



Trends in English bus patronage

Report to the Confederation of
Passenger Transport

September 2018



Important notice

Our work commenced on 31 July 2018 and was completed on 21 September 2018. We have not undertaken to update our presentation for events or circumstances arising after that date.

In preparing our report, our primary source has been data published by the Department for Transport. We do not accept responsibility for such information. Details of our principal sources are referenced throughout the report and we have satisfied ourselves, so far as possible, that the information presented in our report is consistent with other information which was made available to us in the course of our work in accordance with the terms of our Engagement Letter. We have not, however, sought to establish the reliability of those sources by reference to other evidence.

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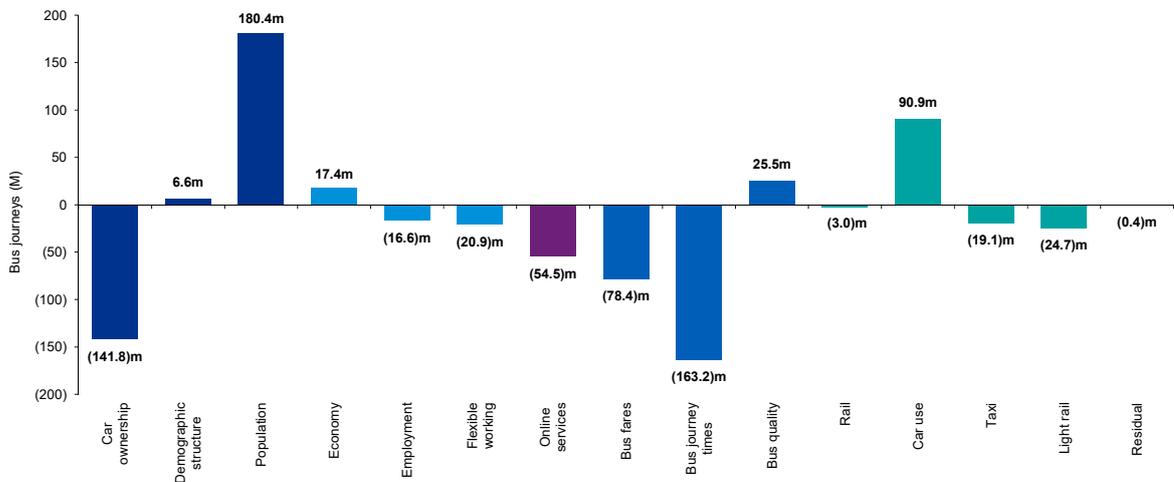
Overview

Between 2011/12 and 2016/17 bus patronage in England fell by 4.4%, falling from 4,640 million to 4,438 million journeys per year.

The reasons for this are complex and go well beyond the bus sector. They reflect a range of significant wider changes across Britain in the economy, to the way people live and work, as well as the impact of government policy and

investment decisions, and competition from other transport modes.

The figure below provides a summary of the impact of different demand drivers on bus patronage levels between 2011/12 and 2016/17. Taken together the net impact is a reduction of 202 million bus journeys.



By theme

Socio-demographics

- Population numbers have increased, especially in major urban areas
- The population is getting older. Household sizes are falling. More young people in education or training
- Increased proportion of people with direct access to a car linked to low motoring costs

Economic and labour market impacts

- The structure of the labour market is changing
- More self-employed workers and more people on flexible contracts
- More working from home or across multiple work-sites

Alts to travel

- Growth in online services and home delivery

Price and quality of bus services

- Bus fares have risen at a faster rate than inflation, driven by increased costs and reduced government expenditure
- Bus journey times have increased due to a combination of highway congestion, reduced service reliability and lower service miles (especially local authority supported service miles)
- Vehicle and service quality have improved

Price and quality of other modes

- Improved rail service quality and reduction in off-peak fares
- Increase in availability of light rail
- Reduction in vehicle use costs from increased vehicle fuel efficiency and falling fuel prices
- Reduction in highway speeds and increase in journey times
- Significant increase in the number of taxi licences.

Source: KPMG analysis

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1 Executive summary

1.1 Introduction

This report presents the findings of a study to quantify the drivers of demand for local bus services in England. The work was commissioned by the Confederation of Passenger Transport and was independently undertaken by KPMG LLP.

Between 2011/12 and 2016/17 bus patronage in England fell by 202 million journeys, falling from 4,640 million to 4,438 million journeys per year.

It is important to note that whilst the market has fallen overall, there has been significant variation in the magnitude of the changes across different geographical areas and different markets:

- The decline in patronage has been more pronounced in metropolitan areas¹ (6.6%), than it has been in non-metropolitan areas (3.9%) and in London (3.6%).
- Within metropolitan areas, West Yorkshire, South Yorkshire and Tyne and Wear have seen the biggest reductions in patronage at around 10% and Greater Manchester and Merseyside the lowest reductions at less than 5%.
- Outside of the metropolitan areas, urban areas as a whole have seen no overall change in demand but rural areas have seen significant decline.
- With much local variation, in each of the nine English regions, at least one local authority area saw a decline in patronage and within five English regions at least one local authority area saw patronage growth.
- There has been a 6% reduction in concessionary travel (6.7% reduction in concessionary travel for older and disabled people) and a 3.5% reduction in non-concessionary travel.

The patronage decline in England (4.4%) is significantly lower than that experienced in Scotland (9.7%) and Wales (13.9%) over the same period.

The analysis reported here builds upon KPMG's 2017 report for the Confederation of Passenger Transport (Scotland): *Trends in Scottish bus patronage*.² It follows a similar reporting structure noting that the statistical analysis here focuses on England and includes data to the financial year 2016/17.

A more detailed description of the analytical approach is provided in the appendix.

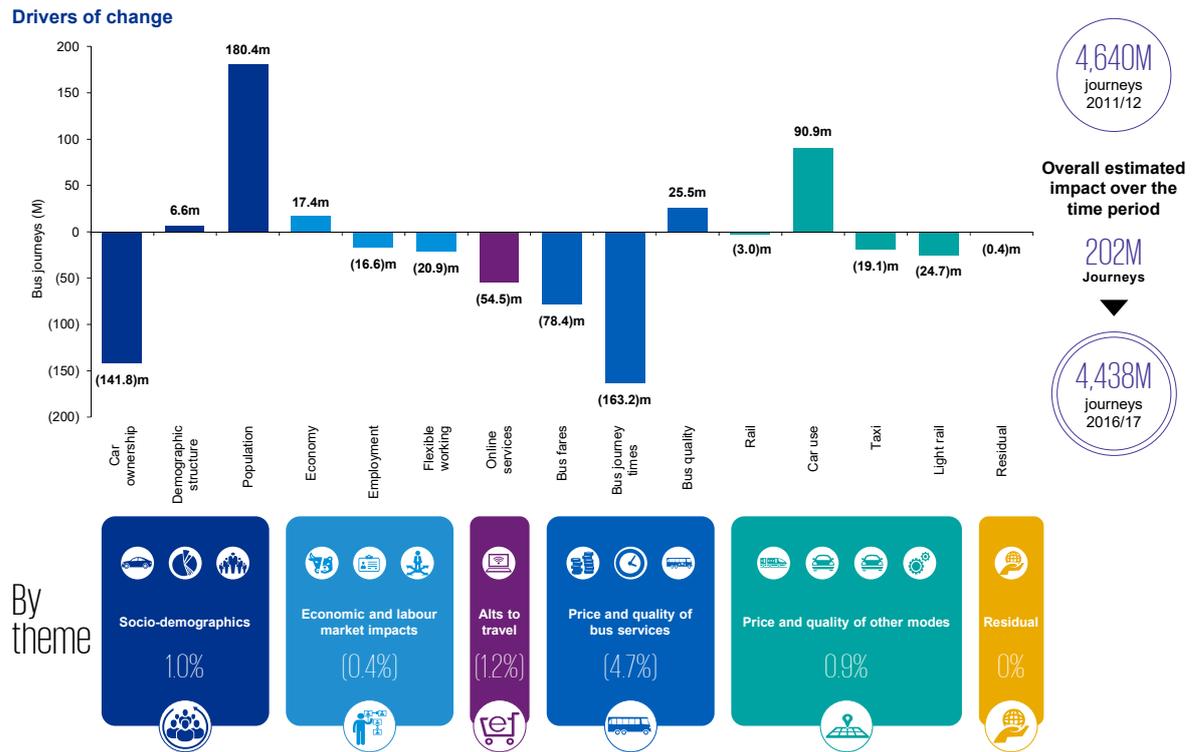
1.2 Drivers of change

Our analysis shows that a little over a half of the reduction in bus patronage can be explained by changing customer needs – changes to socio-demographics including changes in household car ownership, changes to economic and labour market structures, and changes to the availability and acceptability of alternatives to travel including online services. The remainder of the reduction in bus patronage can be explained by increases in bus fares and reduction in service quality (bus speeds and service miles run). There are also factors offsetting the reduction in demand including increased population and increased journey times for car drivers and passengers. The variations in patronage levels and patronage trends between areas are driven by differences in these factors, as well as differences in operator performance and local transport policy.

¹ City regions with Integrated Transport Authorities including: Tyne and Wear, West Yorkshire, South Yorkshire, Greater Manchester, Merseyside and West Midlands.

² KPMG (2017) Trends in Scottish Bus Patronage, Report to CPT Scotland, November 2017, <https://getonboardwithbus.scot/>

Figure 1 Drivers of changes in bus patronage in England 2011/12 to 2016/17



Source: KPMG analysis

Figure 1 shows the impact of different demand drivers on changes in bus patronage between 2011/12 and 2016/17. Of the net reduction of 202 million journeys, increasing car ownership explains a reduction of 142 million journeys, the increase in online services and home delivery explains a reduction of 55 million journeys, reduced bus service miles and increased bus journey times (arising from highway congestion, especially in London and metropolitan areas) account for 163 million journeys³ and increases in bus fares account for a reduction of 78 million journeys. Other material drivers, such as changes to the structure of labour markets and flexible working account for 37 million journeys, and competition from rail, light rail and taxis, explain a reduction of 47 million journeys.

These negative demand drivers are partially offset by positive impacts arising from increased population (180 million journeys), improvements to bus service quality (25 million journeys) and deterioration in motoring speeds and costs which has impacted on car use (91 million journeys).

³ Congestion levels can impact on journey times, frequency of service, network and reliability.

We structure our analysis of historical trends in terms of **five primary themes** and **two secondary themes**.

The first three themes cover changing customer needs associated with changing socio-demographics, changing socio-economics and alternatives to travel. The fourth theme is divided in two, covering the price, quality and availability of bus and other forms of transport. The secondary themes cover the role of technology and government policy in influencing the price, quality and availability of bus and other forms of transport.

Primary (direct) themes

Theme 1: Socio-demographic impacts

Customer needs are influenced by key socio-demographic trends including:

- Population growth and urbanisation.
- Demographic structure, including health and mobility.
- Household car ownership, car availability and licence holding.

Population has been growing in England as a result of immigration and increased life expectancy, offset by lower birth rates. In addition to the population getting bigger, it is also getting older and more concentrated in larger cities where land use patterns and higher population densities generally help to promote higher rates of public transport use. Within these broad socio-demographic trends some quite fundamental changes to individual behaviours are happening. People are staying in education for longer than previously, they are delaying when to start a family, and delaying when to learn how to drive and to own a vehicle.⁴

Car ownership has risen throughout the period buoyed by the strength of the economy and an increase in consumer credit.⁵ The relatively high fixed costs of car ownership and relatively low marginal costs of car use mean that those with access to a car have a much lower propensity to use alternative modes of transport for different purposes. Analysis of National Travel Survey (NTS)⁶ data presented in Table 1 shows how big the differences in behaviour are.

Table 1 Influence of individual access to a household car on bus use

Individual access to the use of a car	Average bus journeys per year
Without a driving licence and without access to a vehicle	181
With a driving licence and without vehicle access	164
With a driving licence with part access to a vehicle	55
With a driving licence and full access to a vehicle	14
With a driving licence and full access to a company vehicle	4

Source: National Travel Survey

All else being equal, we estimate that changes to car ownership levels across England between 2011/12 and 2016/17 resulted in a 3.1% reduction in overall bus patronage with relatively large differences between geographical areas reflecting relatively large variations in changes to car ownership. For example, the number of licenced vehicles grew by 11% in the South East and less than 5% in London.⁷

We estimate that changes to socio-demographics has led to an increase of 45 million bus journeys, driven largely by the increase in population.

Theme 2: Socio-economic impacts

Demand for travel depends closely on the volume, type and location of economic activity. In turn these determine the level and type of employment, the activities workers engage in and the journeys they make.

The labour market is changing, not just in terms of changes to employment levels but also in

⁴ Stokes, G (2013) The Prospects for Future Levels of Car Access and Use, Transport Reviews, Volume 33.

⁵ SMMT <https://www.smmmt.co.uk/2018/09/uk-new-car-market-rises-in-august-as-one-in-12-buyers-goes-electric/> [Accessed 17 September 2018]

terms of changes to the mix of full and part-time work, changes to the number of people in self-employment and increased use of zero-hour employment contracts. There have also been changes to the balance of employment across industrial sectors and the type of jobs that are available.⁸ The increase in the number of people in self-employment in particular is linked with the increase in the number of people who regularly work from home or work in more than one location. These changes increase the likelihood of commuters owning a car and reduce the likelihood of them using the bus.

We estimate that changes to the structure of the economy and labour market has led to a reduction of 20 million bus journeys.

Theme 3: Alternatives to travel

In addition to changing socio-demographic and socio-economic factors influencing the need to travel, there are new behavioural trends that are influencing the overall need to travel. The most important of these include the increase in online services and e-commerce. New online

⁶ Office for National Statistics, National Travel Survey, <https://www.gov.uk/government/collections/national-travel-survey-statistics>, [Accessed 17 September 2018].

⁷ Department for Transport statistics, [Accessed 17 September 2018]

⁸ ONS, Regional labour market statistics in the UK.

businesses and retail opportunities are attractive for customers as they are often able to access a wider range of products and services more quickly and/ or at a lower cost.

We know from analysis of National Travel Survey data that the number of shopping related journeys has declined considerably across all modes of transport. Data from the NTS shows that there were 13 shopping trips per person per year on local bus in England in 2016, down from 17 per person per year in 2011. New econometric analysis undertaken as part of this work shows that relative to those people who never buy online, those who occasionally buy goods online make on average 3% fewer bus journeys per year and those who frequently buy goods online make on average 25% fewer bus journeys per year.

When reflected across the whole of England, the impact of online services and home delivery is estimated to have led to a reduction in local bus journeys by 54 million journeys (1.2%) per year between 2011/12 and 2016/17. Online services and home delivery are expected to continue to increase at a fast pace, driving further reductions in bus patronage.

Theme 4a: Price quality and availability of Local bus services

The attractiveness of bus services relative to other modes of transport is influenced by fares and ticketing, timetable-related service quality (e.g. journey times, service frequency, network coverage, interchange requirements and service reliability) and non-timetable-related service quality (e.g. vehicle quality, driver quality, quality of the waiting environment and the provision of customer information).

Bus fares have risen faster than inflation, increasing in real terms between 2011/12 and 2016/17 by 3% in London, 5% in metropolitan areas and 9% in other areas. It has been driven in part by unit cost changes and bus operators' response to changes in government policy. Operating costs per vehicle mile have increased by almost 30% in real terms since 2004/5. There has been a material reduction in the Bus Service Operators' Grant (BSOG) payments, with payments outside of London having fallen by 27% in real terms with all of BSOG devolved to TfL within London. This

⁹ Greener Journeys, 2017, Costs and Benefits of the Bus Service Operators Grant

¹⁰ TfL, 2017, Understanding and Managing Congestion

policy change has the potential to impact on service quality and fare levels.⁹

The Department for Transport notes that it is likely that congestion in urban areas and city centres has affected bus performance leading to a fall in bus patronage. Transport for London attribute the fall in bus patronage seen in London in the last three consecutive years to increased congestion and road works which has affected bus performance by reducing average bus speeds.¹⁰ Transport Focus data shows that congestion and road works are among the top factors which passengers think impact on the length of bus passenger journeys.

Bus service miles, reflecting network coverage, operating hours and service frequency, fell by 5% between 2011/12 and 2016/17, with commercial vehicle miles in England outside of London increasing by 2.8% and supported vehicle miles in England outside of London falling by 43%.

Data from Transport Focus shows that overall satisfaction with bus journeys ranged between 78% and 94% across local authority areas in England in 2017, a general increase from between 79% and 91% in 2011.¹¹ Importantly, customer satisfaction is driven to a large extent by convenience, dependability and value which in turn are influenced by network coverage, journey times, service reliability and affordability – factors jointly influenced by operators, local and central government. The total number of public service vehicles has fallen 2.3% over the period. The average age of vehicles has remained relatively stable at 7.6 years.

Theme 4b: Price quality and availability of other transport modes

Rail services

The demand for rail travel increased by 18.4% between 2011/12 and 2016/17,¹² accompanied by an increase in supply (scheduled train miles) and control of regulated fares at close to the rate of general inflation. In many instances rail and bus services are complements rather than substitutes although there are instances in cities with relatively dense rail networks where rail and bus compete for traffic. In those instances, the improved rail service and

¹¹ Transport Focus, Bus Passenger Survey

¹² ORR, 2018, Passenger rail usage

deteriorating bus service may have led to 3 million journeys transferring from bus to rail.

Light rail

Light rail services in England attracted 268 million journeys in 2016/17 up from 205 million journeys in 2011/12. The Docklands Light Railway and London Tramlink comprised 57% of all light rail journeys. The growth of these services is likely to have a significant impact on bus demand where they are operating in urban centres in direct competition with bus services. Evidence from the evaluation of the expansion of Greater Manchester's Metrolink network estimated that over 50% of new customers would use the bus if the network was unavailable.¹³ Across the eight light rail systems operating in England, we estimate almost 40% of new light rail journeys have been abstracted from local bus services.

Private cars

Use of cars is influenced by the macro-economic cycle, with demand falling during the Financial Crash and then rising through the recovery. It is also influenced by the costs of use (fuel prices, fuel efficiency and parking charges) and well as the ease of use (journey times, travel time reliability and parking availability). Average fuel prices have fluctuated over recent years, peaking in 2013 before falling quite dramatically in 2015 and 2016. The increase in highway congestion over the period has slowed growth in car use. Taken together, the reduction in fuel price and increase in highway congestion have slowed the continued abstraction of journeys from local bus services to car by almost 91 million journeys.

Taxi, private hire and ride hail services

There has been a rapid increase in the number of taxi and private hire vehicles and drivers licenced in England between 2011 and 2017, increasing by 48% in London and 15% outside of London. In the West Midlands the number of licenced vehicles has increased by 32%, in West Yorkshire the increase is 16% and in Greater Manchester the increase is 13%. The growth has been concentrated on private hire and is stacked towards the end of the time period, aligned with the increase in popularity of ride hailing services and applications. Data on the volume of journeys by taxi is limited to data

¹³ TfGM, 2016, Monitoring and Evaluation Early Findings Report

¹⁴ Marsden, G. et al. (2018) All Change? The future of travel demand and the implications for policy and planning, First

from surveys but relatively conservative assumptions on the size of the impact of the expansion of taxi and private hire services suggest that in the region of 19 million journeys per year have switched from bus to taxi and private hire.

Cycling

Department for Transport statistics, show that between 2011/12 and 2016/17, the number of cycling journeys declined by 8.4% although the average distance travelled by bicycle increased.

However these statistics note this may reflect sampling variation rather than a real decrease in cycling journeys. Whilst there is likely to be some substitutability between cycling and public transport, given the relative uncertainty in the number of cycle trips, we estimate that the impact of cycling on the number bus journeys is likely to be small.

Secondary (indirect) themes

Theme 5: Integration between modes

Digital information is increasingly playing a role in how we plan, pay-for and use public transport, allowing us to make more informed and more efficient decisions before, during and after travelling. The use of smartphones to check passenger information as well as purchase and fulfil e-tickets is beneficial to passengers. The improvement in convenience and customer relationship management is expected to continue as Mobility as a Service (MaaS) provides even greater flexibility, catering for customer's personal travel needs by mixing and matching public and private means of transport.

Digitalisation, along with increased acceptance of the 'sharing economy', will likely encourage new business models to evolve, reducing the need for people to own assets (e.g. cars and bikes) and allowing them to adopt a more flexible behaviour based on their immediate needs. At the same time, an increase in online services, which provide an increasing range of personalised products and services to customers, will also contribute to changes in consumer behaviour.¹⁴

Report of the Commission on Travel Demand, ISBN: 978-1-899650-83-5

The use of technology to provide greater integration of modes, drawing on the forces of the 'sharing economy', has created a new commercial lever to influence customer behaviour stimulating demand for local bus services. The market potential of this innovation is to a great extent untested but trials around the world are underway.

Theme 6: Government policy and expenditure influencing price, quality and availability of alternative transport mode

Government provides support to the industry via the Bus Service Operators Grant (BSOG). It also intervenes in the market for wider policy reasons to allow for older and disabled people to travel for free via the English National Concessionary Travel Scheme and to subsidise additional services that are deemed socially necessary but are not commercially viable.

Outside of London, expenditure on BSOG has fallen by 27% in real terms, expenditure on supported services has fallen by 26% and expenditure on concessionary travel has fallen by 6%. Within London, total expenditure has fallen by 2% in real terms, with BSOG now paid to Transport for London (TfL) rather than operators.

1.3 Market segmentation

We have segmented the analysis in terms of three markets: London, other metropolitan areas, and non-metropolitan areas. Below we highlight some of the key differences between these markets.

London relative to the other market segments

- Significant negative demand impacts caused by increasing bus journey times, leading to a reduction of 118 million journeys.
- Negative demand effects have further been exacerbated due to proportionately increased competitiveness of other modes, notably taxis and light rail, which combine to reduce demand by 25 million journeys.
- Socio-demographics of London have been more positive than the rest of the country for bus use, with population increasing demand by 79 million journeys.
- Bus fares have risen by a smaller level than in other areas of the country and hence the

negative effects of this has been smaller, leading to 26 million fewer journeys.

Metropolitan areas relative to the other market segments

- Increased car ownership had the greatest impact on demand, reducing bus use by 46 million journeys.
- Increasing bus journey times have reduced bus use by 31 million journeys.
- Increased competitiveness of taxi and light rail has reduced demand by 12 million.
- Population increases created an additional 36 million bus journeys.

Non-metropolitan areas relative to the other market segments

- Increased car ownership has significantly reduced bus use by 91 million journeys.
- Higher bus fares rises have had a strong impact, with a reduction of 34 million journeys.
- Online services in this market have played a more significant role in reducing levels of demand, with a reduction of 21 million journeys.
- Limited impacts on the bus market from changing competitiveness of rail, taxis and light rail.

1.4 Immediate implications

It is clear that the bus sector in England (as well as Scotland and Wales), is facing some very strong challenges as a result of changing transport needs and continued competitive pressure from private transport. These trends are likely to continue to create a drag on bus patronage, increasing the financial pressures borne by bus operators. The magnitude of the changes needed to 'move the dial' from 'patronage decline' to 'patronage growth' should therefore not be understated but there are measures that can be implemented in both the near and longer term to significantly strengthen the customer proposition.

Of the factors driving patronage change, only a relatively small part is within the direct control of bus operators. In responding to the external forces that are driving reductions in patronage, operators have in places improved service quality, made relatively modest reductions to commercial vehicle mileage and have increased fares to reflect changing unit

operating costs and reduction in government expenditure. More however might be done to increase demand. There are examples of local bus markets in England, the UK and further afield which have experienced sustained growth in bus patronage. In general, those areas have adopted a more proactive policy approach to supporting the bus market with engagement between local authorities and operators to play to the mode's strengths which lie in the wider economic, social and environmental benefits that good local bus services deliver – both capital and revenue expenditure generate excellent value for money from wider economic, social and environmental benefits estimated at between £2.00 and £3.80 for each £1 of revenue expenditure and £4.20 and £8.10 for each £1 of capital expenditure.¹⁵

We know that customers value improved levels of convenience, dependability and value. In the short term, traditional policy measures such as investment in infrastructure and services, parking and traffic management, and greater integration of bus services into commercial and residential land-use planning continue to be a priority. This may require a greater degree of co-ordination across the industry and the adoption of joint measures such as shared ticketing, co-ordinated timetables and fair access regimes for high quality infrastructure. These policies are particularly important in large urban areas where bus services can be more convenient, cost effective and provide the most economic benefits.

The wider economic and social impacts of local bus services mean that there is a strong rationale to promote local bus services and may even strengthen with increasing urbanisation and growth in England's major cities. The wider impacts include promoting business and retail agglomeration, improving access to essential services such as health and education, and reducing environmental degradation from transport networks and services. Despite the challenges facing the industry there are reasons for optimism.

1.5 Looking further ahead

History tells us that we have had relatively limited success in attracting people from cars on to public transport. The economics of car ownership are such that once an individual has

invested in a vehicle there are strong incentives to use it. As noted above, the high fixed costs of car ownership and relatively low marginal costs of car use, mean that those with access to a car show a much lower propensity to use other modes of transport.

Times however are changing. The young are learning to drive and buying cars much later in life than their parents. They appear to be less concerned with asset ownership and are more accepting of the 'sharing economy'. In urban areas in particular, new business models are emerging which are based on a more intensive and shared use of vehicles, made more customer friendly through the use of technology. Over the longer term this may encourage people to make more varied transport choices based on the needs of specific journey they are making. The rise of connected and autonomous vehicles and electric cars will require new models for vehicle taxation (both fuel duty and vehicle tax) which could also be used to achieve transport policy objectives such as bringing the marginal costs of vehicle use closer to the social optimum.

Leaving aside the prospect for some form of demand management for cars, it is unlikely that any single measure will positively transform bus patronage levels in the near term. Instead, a more concerted effort is needed to implement a package of hard measures to reduce bus journey times, increase service reliability and improve service affordability, working in concert with the technology to improve customer information and engagement. New technologies and new business models could disrupt the market, providing new way to 'aggregate' demand, allowing economies of scale to reduce average costs and drive up service quality.

The policy debate needs to reach beyond ownership and regulation of the bus market to consider alternative ways in which operators, technology firms and local authorities can form alliances to meet the challenges ahead by creating an environment that encourages service and product innovation, together with improved infrastructure asset management and supportive longer term policies on land-use and transport planning to cater for England's changing economic and social needs. These challenges need to be met regardless of the delivery model.

¹⁵ KPMG (2017) The True Value of Local Bus Services. A report to Greener Journeys. <http://www.greenerjourneys.com/wp->

<content/uploads/2017/07/Greener-Journeys-Value-for-Money-Update-FINAL.pdf>.

2 Introduction

2.1 Study objectives

This study explores the drivers of local bus patronage in the different geographical markets across England between 2011/12 and 2016/17, including London, metropolitan and non-metropolitan areas, where metropolitan areas include Tyne and Wear, West Yorkshire, Greater Manchester, Merseyside, South Yorkshire and the West Midlands.

Through this analysis we provide insights with regards to historical trends in demand for bus travel.

This work builds upon KPMG's 2017 report for the Confederation of Passenger Transport (Scotland) '*Trends in Scottish bus patronage*', and as such follows a similar reporting structure noting that the analysis here focuses on England and our analytical approach reflects our latest thinking and latest available data.

2.2 Scope of work

The scope of our work includes the following activities:

- Review of observable trends in bus use across geographical markets between 2011/12 and 2016/17 covering London, metropolitan and non-Metropolitan areas.
- Identify and outline a list of potential demand drivers.
- Appraise the relationships between potential demand drivers and customer needs and choices.

- Specify an analytical framework to quantify the strength of the relationship between potential demand drivers and bus patronage.
- Undertake statistical analysis of customer choices and aggregation of market trends to quantify the impact of potential demand drivers and bus patronage.

2.3 Structure of this report

This report is structured as follows:

- Section 2 provides the context for the work highlighting trends in the use of local bus services in England and across different markets, linking this to wider observed travel trends.
- Section 3 provides an overview of market trends and disruptors as well as a framework to consider the relative importance of alternative drivers of demand.
- Section 4 provides a discussion of each of the drivers of demand, grouped under a number of themes to represent changing transport needs and changing transport choices.
- Section 5 sets out the results of our analysis that seeks to quantify the impacts on bus demand in correspondence to the drivers of demand.

Within the appendix we provide a more detailed description of the analytical approach employed and key assumptions.

3 Context

3.1 Bus use in England

3.1.1 Overall market trends

The local bus market in England plays a significant role in connecting people to economic and social activities. In 2016/17 there were 4,438 million journeys made by bus, representing 6% of all journeys undertaken across the country and around 60% of all public transport journeys. Since 2011/12, the annual number of bus journeys across England has declined by 202 million or 4.4%, with the greatest drop of 70 million occurring last year.

3.1.2 A mixed picture nationwide

This overall decline across England has been experienced differently between local areas creating a mixed picture nationally. Some areas have observed reductions in bus use, whilst others have seen growth. This can make drawing broad conclusions challenging and

there is a need to recognise that different factors are at play within markets, some of which are historical in nature.

The delivery of local bus services in England has two core approaches. A regulated tendered system in London and a deregulated commercial system in the rest of the country.

Within the deregulated model for local areas, there exists variability in terms of competitiveness, partnership structures and amount of support provided by the local authority. We disaggregate our review the deregulated market outside of London in terms of metropolitan areas and non-metropolitan areas, with these distinguished based on the size of market and existence of an Integrated Transport Authority (ITA).

Table 2 provides a perspective on each of these different markets.

Table 2 Bus markets in England – number of journeys

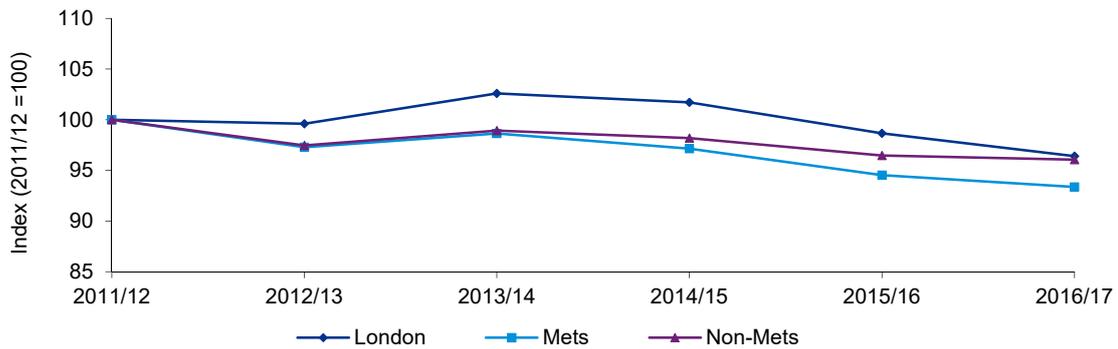
Market	Description	Total demand in 2016/17	Share of market in 2016/17	Change in demand between 2011/12 and 2016/17
London	Inner and outer London	2,240 million	50%	Decline of 84 million (3.6%)
Metropolitan	Major city regions with Integrated Transport Authorities (ITAs)	938 million	21%	Decline of 67 million (6.6%)
Non-metropolitan	Other cities and rural counties	1,260 million	28%	Decline of 52 million (3.9%)

Source: Department for Transport

The trends in demand within these markets between 2011/12 and 2016/17 are set out in Figure 2. Demand in metropolitan areas has declined the most as a proportion and London

has the least reduction as a proportion – Albeit a greater absolute decline. Non-metropolitan areas have seen a similar proportional decline to that seen in London.

Figure 2 Passengers journeys by market



Source: Department for Transport

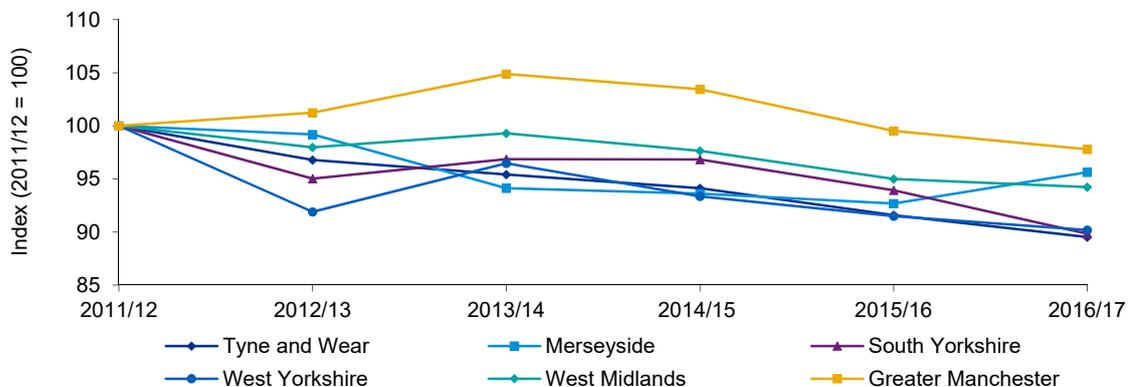
The following sections provide a more detailed breakdown of these trends.

3.1.3 Metropolitan areas

Metropolitan areas have seen the largest proportionate decline in patronage. Figure 3 provides a breakdown of this. West Yorkshire, South Yorkshire and Tyne and Wear have seen

the most significant declines in demand of around 10%. Greater Manchester and Merseyside have seen the smallest declines, which have been less than 5%. At the start of the period, major operators in some of the metropolitan areas introduced significant reform of fares which stimulated patronage growth, and operators on Merseyside introduced a £2 flat fare for young people in 2014 which also generated patronage growth.

Figure 3 Passenger journeys in metropolitan areas



Source: Department for Transport

3.1.4 Non-metropolitan areas

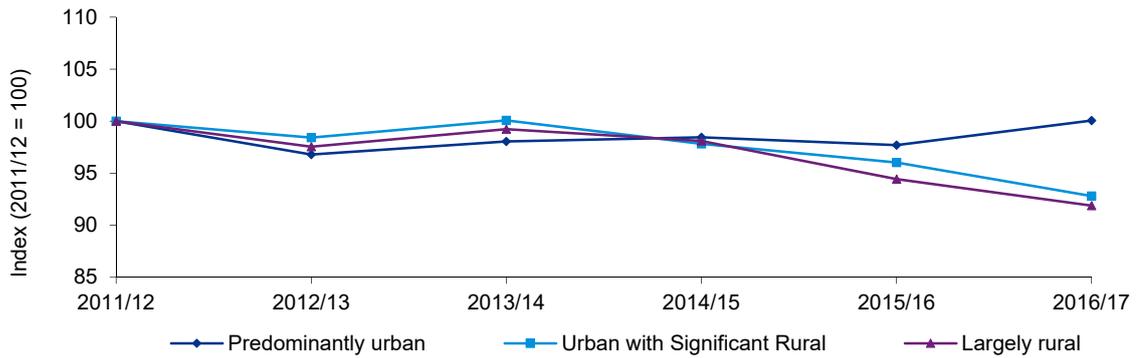
We categorise non-metropolitan areas into three sub-groups: those that are predominately urban (accounting for 50% of journeys), those that are urban with significant rural areas

(accounting for 29% of journeys) and largely rural (accounting for 21% of journeys).¹⁶

Figure 4 provides a breakdown of the trends between these.

¹⁶ Based on DEFRA 2011 Rural-Urban Classification of Local Authority Districts.

Figure 4 Passenger journeys in non-metropolitan areas



Source: Department for Transport

3.1.5 Patronage across the regions

Those areas that are predominately urban have seen no overall change in demand. Those that are largely rural or containing significant rural areas have seen declines of 8% and 7% over the period.

There is substantial variation in the change in local bus use across the English regions (Figure 5) with the North East seeing the biggest decline and the South West and South East seeing patronage growth.

Figure 5 Patronage change across regions



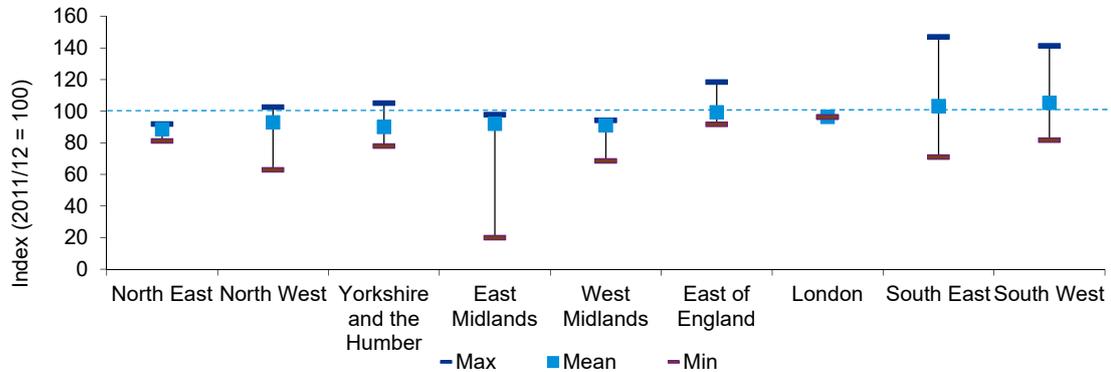
Source: Department for Transport

3.1.6 Patronage at a local level

Within regions there are variances in the trends observable at the local area level, with these

set out in Figure 6. This shows the minimum and maximum indexed performance of an individual area within a region as well as the overall regional trend.

Figure 6 Regional variation in bus market trends between 2011/12 and 2016/17



Source: Department for Transport

In every region at least one market saw a decline in patronage. However within five regions at least one market saw growth, including the North West, Yorkshire and the Humber, East of England, South East and South West.

The local areas with the highest growth in patronage were West Berkshire (South East), South Gloucestershire (South West) and Bristol (South West). These demonstrate that where effective investment, fares strategies and coordination between operators and local authorities are delivered the bus proposition has supported growth in patronage and made this an achievable objective.

The analysis we have undertaken occurs at this local level and aggregates the results to the key bus market segments. It is important to recognise though that unique outcomes are observable at the local area level and unique factors within these areas have likely had an impact on patronage.

3.2 Wider travel trends

3.2.1 Overall transport demand

The reduction in bus use is part of broader changes to travel demand. The recent UK Research Council funded initiative¹⁷ to establish a better understanding of how travel demand is changing and may change in the future, noted that:

- People are travelling less. We make 16% fewer trips per year than we did in 1996, we spend 22 hours less time travelling per year than we did a decade ago and we travel 10% fewer miles than we did in 2002.
- People under 60 are travelling less than before. This is particularly true for under 30s who are learning to drive later and are making fewer trips by car.
- There are more people in employment, the population has grown but there are fewer commuter trips overall due to a 20% reduction in commuter trips per person per week since the 1990s
- Online shopping is growing at a rate of 10-12% per year and is now almost 17% of total retail sales. The rise in online sales has coincided with a 30% reduction in shopping trips over the last decade and a 16% decline in distance travelled.

¹⁷ Marsden, G. et al. (2018) All Change? The future of travel demand and the implications for policy and planning, First

Report of the Commission on Travel Demand, ISBN: 978-1-899650-83-5

3.2.2 International bus markets

An initial inspection of trends in bus patronage in a selection of cities around the globe also shows a mixed picture. Some cities have witnessed a reduction in patronage, others an increase and in other patronage levels have remained stable.

In New York, average weekday patronage in Manhattan, the borough with the slowest travel times, fell by 6% in 2014 and another 5% in 2015. Whereas patronage in the outer boroughs declined by 1% in 2014 and nearly 1.5% in 2015. At the same time, the use of ride services, including taxis and app-based ride services, rose dramatically.

In Paris, bus patronage has remained relatively stable despite economic growth, an upturn in the jobs market, public policies impacting car traffic in Paris, the return of tourists after the drop in 2016 following the terrorist attacks, and by the long-term effects of the introduction of all the zones flat-fare on modes of transport serving the outer zones of Ile-de-France.

In Sydney, bus patronage has increased significantly, rising from 203 million trips in 2011/12 to 264 million trips in 2017/18. Much of this change has been attributed to reform of fares and ticketing.

This report has not sought to undertake specific analysis of the these international trends, however it is important to recognise that where the market has grown this has likely been due to investment, customer-led propositions and coordination between operators and local policy-makers.

3.3 Implications for analysis

Overall there has been a decline in bus use between 2011/12 and 2016/17 across market types. At a more local level the trend varies greatly between areas with some significant declines whilst other areas have seen growth or at least constant levels of demand. This means that whilst undertaking the analysis at a market segment level provides insights, it must be accompanied by a narrative to explain the more nuanced trends that have been seen at the more local level.

These differences likely reflect variations in the inherent demand drivers, the policy choices of the local authorities, as well as the performance of local bus operators. Each of these is explored in the following sections. A description of the analytical approach is also provided in the appendix.

4 Methodology

4.1 Market trends and disruptions

Transport markets are impacted by both historical trends as well as new and innovative changes that are impacting on the economy and society. In this work we set out more than 50 market trends and disruptors on transport needs and choices that are likely to be influencing bus demand.

Some of these trends and disruptors impact on the need to travel, either positively or

negatively, and some influence the price, quality and availability of alternative transport modes. The long list of impacts includes demand drivers that have historically impacted on local bus services together with those that have the potential to impact services in the near and longer term future.

The list is structured under political, social, economic, demographic, legal, digital, technological and environmental categories and set out in Figure 7.

Figure 7 Market trends and disruptors



4.2 Customer needs and choices

Given the complexity and interaction between these trends and disruptors it is difficult to consider each in isolation. Therefore we think it is more appropriate to consider and group trends and disruptors in terms of their impact on

market outcomes and in particular the potential impact on the demand for travel and customer choice between modes.

We have identified six key themes to reflect possible outcomes. These themes can be considered as impacting on customer needs and customer choices, where customer needs reflect the underlying reasons to travel, i.e. to

participate in various economic and social activities, and customer choices reflect the relative attractiveness of alternative modes of travel. In some ways car ownership falls under both customer needs and customer choices. However, as household car ownership is

closely related to other socio-demographic factors we have included it in customer needs.

Table 3 provides a description of each of these themes.

Table 3 Customer needs and choices

Customer needs	Primary (direct) themes	Theme 1 Changes in socio-demographic factors	Changes to demographic profiles including household structure, car ownership, urbanisation and household location, as well as changes in social trends, changes to income distribution, participation in higher and further education, changing societal attitudes and expectations.
		Theme 2 Changes to the structure of the economy	Changes to the structure of the economy and labour markets including rates of employment, flexible working, productivity and new business models. The outlook for the economy and the role of transport is fundamental to understanding transport demand.
		Theme 3 Alternatives to transport	Innovation and new technology may lead to a variety of new technologies which may create alternatives and substitutes to travel. These include improved communications and virtualisation, which might enable people to work remotely, the proliferation of online services such as education, banking or shopping service, and other more uncertain technology such as 3D printing which could revolutionise manufacturing.
Customer choices	Primary (direct) themes	Theme 4a Changes in price, quality and availability of local bus services	The price, quality and availability of local bus services. Quality includes timetable-related service quality such as journey times and service frequencies, and non-timetable-related service quality including: reliability, punctuality, vehicle quality, and travel environment.
		Theme 4b Changes in price, quality and availability of other transport modes	The price, quality and availability of other transport modes including rail, light rail, car, taxi / ride sharing and active modes (e.g. walking and cycling).
	Secondary (indirect) themes	Theme 5 Integration between modes	New technology, data and the proliferation of mobile phones and smart devices is leading to much greater integration between modes of transport. This includes trends towards smart ticketing and Mobility as a Service (MaaS), as well as the potential for greater real-time planning and coordination across modes of transport. This could have an impact on the attractiveness of public transport modes for example by reducing uncertainty about travel times and delays.
		Theme 6 Government policy and expenditure	Government policy, regulation, licensing and demand management, including how policies influence the price, quality and availability of alternative modes. Key policy dimensions include: concessionary travel, supported services, BSOG, traffic management and infrastructure investment within the bus sector but it also includes policies aimed at other modes and alternatives to travel.

Source: KPMG analysis

4.3 Analytical framework

We have developed an analytical framework to bring together analysis of transport needs and transport choices in a consistent way so that we can form a view of the relative importance of individual demand drivers and their relevance to policy making.

The analysis is empirically robust and based on data and assumptions with good provenance. The general structure of the analytical framework considers the impact of changing transport needs and changing transport choices on patronage levels.

Further details of the model specification, estimation and application are reported in the appendix.

4.3.1 Transport needs

We examined changing transport needs by estimating and applying a series of 'trip rate' models using a specialist econometric methodology that takes account of an individual's propensity to use the bus and the number of bus trips they make in a year. The trip rate models were estimated to data from the National Travel Survey containing travel diary data from a sample of 220,442 individuals between 2002 and 2016. The data used during model estimation includes survey respondents from households across England.

Different models are estimated by journey purpose including: commuting, shopping, education, business and other trips. The models explain the number of bus trips recorded in individual travel diaries as a function of the characteristics of the individual, the characteristics of their household, the characteristics of the area where they live, and behavioural trends over time. The new models include close to 50 explanatory variables for

each journey purpose, reflecting individual demand drivers relating to:

- Theme 1: Changes in socio-demographic factors.
- Theme 2: Changes to the structure of the economy.
- Theme 3: Alternatives and substitutes for transport.

The trip rate models were then applied to estimate levels of bus patronage by local authority area for 2011/12 and 2016/17.

The sample is then reweighted to reflect changes to the socio-demographic characteristics of each local authority at different points in time. Based on the reweighted sample of individuals, forecasts of local bus demand are made for each local authority in 2011/12 and in 2016/17. The forecasts are made in stages allowing for the incremental impact of each individual demand driver to be assessed for each local authority area.

4.3.2 Transport choices

We specify a series of direct demand models for each journey purpose and each local areas. The models explain the changes in demand based on changes in the price, timetable-related service quality and non-timetable-related service quality of each mode available. The models are calibrated to best evidence on the relationship between bus patronage and the price and quality of transport networks, their integration and the influence of public policy, expenditure and investment decisions on demand.

In Section 5 we consider the supporting evidence relating to key demand drivers within each of the six themes before estimating the relative importance of each in explaining overall changes in demand at a local level between 2011/12 and 2016/17 in Section 6.

5 Drivers of change

5.1 Introduction

In this section we describe the findings of our analysis of demand drivers in relation to the six themes identified in Section 4. Each of these themes has a number of individual drivers of demand, which can have positive and negative effects on the overall level of demand. The strengths of these effects can be greater and/or lesser, and also vary due to the market characteristics of a local area.

5.2 Theme 1: Socio-demographics impacts

Analysis of changing socio-demographics is the starting point to understanding the overall demand for travel. We know that travel choices are influenced by key socio-demographic trends including:

- Population and urbanisation.
- Demographic structure.
- Car ownership, car availability and licence holding.

5.2.1 Population and urbanisation

Between 2011/12 and 2016/17 the population of England increased by 4.0%. Of the regions, London saw the sharpest increase of 6.7% followed by the East of England with 4.5%. The slowest growth in population was in the North East where growth was 1.6% and the North West where population growth was 2.4%.¹⁸

Metropolitan areas have experienced a growth rate of 3.4%. The largest increases were in the West Midlands and Greater Manchester whilst Tyne and Wear and Merseyside experienced the slowest growth. Overall non-metropolitan areas have seen an increase in population of 3.6%.

When the population increases it would be expected to increase the overall demand for travel. However there are other factors that can influence the propensity of people to use local bus services including settlement size and population density. There are significant economies of scale in the supply of bus services, both in terms of operating efficiencies

¹⁸ ONS, 2018, Population Estimates

and in terms of network coverage and service frequency. These economies can reduce the costs of use, improving the competitive position of bus services relative to other modes in a local area. Therefore where population increases occur are important. When population increases in dense urban centres we would expect it to have a greater than proportionate impact on bus demand compared to population increases in rural and sparsely populated areas.

Given the overall increase in population of 4.0% and the location of this we would have expected to see a rise in the number of bus journeys in England by close to 4.0% (180 million).

5.2.2 Demographic structure

In addition to changes in the size and location of the population of England, there have also been changes to the structure of the population, including an increase in the proportion of the population who are over 65, a reduction in the proportion of the population who are under 17, an increase in the proportion of students in further or higher education and a reduction in average household size.

Historically, both older and younger people have tended to make greater use of bus services than other groups within the population. This is partly due to the discounted fares and concessionary travel entitlements available, but it is also due to lower levels of car ownership amongst those groups. Whilst licence holding and vehicle ownership amongst the young, especially young men, is falling, licence holding and vehicle ownership is increasing amongst seniors, especially older women.

The overall impact of changes to demographic structure on bus patronage is therefore mixed. Our analysis suggests that all else being equal, changes to the structure of the population reflecting changes to the age distribution, changes to household size and changes to participation in further and higher education has contributed to an additional 6.6 million journeys.

5.2.3 Car ownership, car availability and licence holding

Between 2011/12 and 2016/17 the number of cars registered in England increased by 8.9%, faster than the increase in population. This was reflected in household car ownership levels, increasing from 75.2% of households having access to a car to 76.4% of households having access to a car.

Overall there has been a 1.9% decline in the proportion of households with access to one car and a 6.8% increase in the proportion of households with access to two or more cars. The number of individuals with a driving license has also increased by 5.4% over the same period. These aggregate changes however mask more substantial differences that persist between areas.

In 2016/17, the highest car ownership levels in England were in the South East and South West with 84% and 83% of households having access to at least one car whilst London and the North East have some of the lowest levels of car ownership with only 59% and 71% of households having access to a car. Car ownership rates in the North West have increased the most, up to 76% from 72%.

With high fixed costs of car ownership and relatively low marginal costs of car use, those with access to a car show a much lower propensity to use other modes of transport. Based on estimates from the National Travel Survey an individual without a driving licence and without access to a vehicle will make on average 181 bus journeys per year. A similar individual, with a driving licence and full access to a company vehicle will make on average 4 bus journeys per year (see Table 1 in the Executive Summary).

All else equal, we estimate that changes to car ownership levels across England between 2011/12 and 2016/17 has resulted in a reduction of 142 million (3.1%) in overall bus patronage with relatively large differences between geographical areas reflecting the different patterns of changes in car ownership.

¹⁹ ONS, 2017, Regional gross value added (balanced), UK: 1998 to 2016

5.3 Theme 2: Economic and labour market impacts

Demand for travel depends in large part on the volume, type and location of economic activity. With this determining the level and type of employment, the activities workers engage in and the journeys they choose to make.

In this section of the report we consider the impact of the following trends on the need to travel and the demand for local bus services:

- Economic growth.
- Employment status.
- Flexible working.

It is important to note that there are aspects of economic structure that historically are closely linked to aspects of socio-demographic structure such as household location and car ownership, and therefore the true impact of changes to the economic structure of England needs to be considered alongside the socio-demographic structure and vice-versa.

5.3.1 Economic growth

Between 2010 and 2016 real Gross Value Added (GVA) across England increased by around 2.1% annually although with significant variation in growth between areas.¹⁹ London and the West Midlands saw the fastest growth, whilst the North East and Yorkshire and the Humber saw the slowest growth. In general the rate of economic growth across the country has been lower since the Financial Crash of 2008/09 than in the period preceding this.

The relationship between economic growth – as measured by GVA – household income and the propensity to travel by bus is complex. Whilst the economy has grown, real total pay in England has only increased by 1.5% between 2011/12 and 2016/17.²⁰

The type of work and how productive people are influences the income they earn. On one hand, households with greater disposable income can afford to make more journeys but on the other they may substitute some journeys for other activities that are less reliant on public transport. Data from the NTS shows that lower

²⁰ ONS, 2018, EARN01 Real Average Weekly Earnings (seasonally adjusted)

income households make more bus trips than middle or higher income households.

We have estimated that the impact of economic growth and a rise in real wages has led to 17.4 million new bus journeys.

5.3.2 Employment status

The total number of working age people in employment in England has been increasing and the employment rate is currently at 75%. Unemployment is historically low at 4% and economic inactivity is at 21%. The most recent data from the Labour Force Survey indicates inactivity rates in England have been decreasing over recent years with more people entering the workforce. Part time work is increasing, as is the number of people who are self-employed.

Relative to average bus trip rates per person per year, employment status is shown to have a material impact on bus use. On average:

- Full-time workers make 24% fewer bus journeys per year.
- Part-time workers make 15% more bus journeys per year.
- People who are unemployed make 64% more bus journeys per year.
- People who are retired make 11% more bus journeys per year.
- Students make 148% more bus journeys per year.
- Those who are self-employed make 76% fewer bus journeys per year.

In addition to changes in the number of people employed, there have been changes in the sectoral mix with employment in manufacturing and construction declining and employment in service sector jobs increasing. The mix of occupations is also changing, with employment in managerial and professional occupations increasing and employment in administrative and secretarial occupations and machine operatives reducing. The occupation that people are employed in has the potential to influence how often they use public transport.

Holding all else equal and allowing the structure of the labour market to change with regard to changes in employment status in England

between 2011/12 and 2016/17 leads to a reduction of 16.6 million bus journeys.

5.3.3 Flexible working

The structure of the labour market is changing with more people in part-time employment, more people working for themselves and more people working from home at least some of the time. There are also more people whose work involves them attending more than one work site. All of these changes to the labour market have the potential to impact on the propensity of people to use bus transport.

Data from the Labour Force Survey⁵ shows that the proportion of people who mainly work from home has increased from 12.8% in 2011 to 13.8% in 2016, with Virgin Media reporting that there could be as many as 15.6 million homeworkers in the UK by 2022, up from 8.2 million people working from home at least one day a week today.

We estimate that the impact of this increased flexibility on working is likely to have reduced bus patronage by 21 million journeys per year in England since 2011/12.

In the short term it is likely that these trends will continue to negatively impact on bus patronage. Looking further ahead the landscape is much more uncertain. Some commentators predict large scale changes to the labour market as a result of advancements in technology including: automation, robotics, artificial intelligence and additive manufacturing.²¹ These changes could disrupt the labour market, reducing employment opportunities in some sectors and increasing employment opportunities in others. The changes are also likely to influence the location of production and consumption. One of the key uncertainties for the future is the role of urban areas in generating business and retail agglomeration economies – the driving force that pulls workers into employment clusters.

5.4 Theme 3: Availability and quality of alternatives to travel

There are existing and new technological trends that are influencing the need to travel. The most relevant of these include online services such as education, banking or shopping delivered by road. Internet sales as a percentage of retail

²¹ Andy Haldane, 2015, Labour's share, Bank of England

sales are up from 9.6% in 2011/12 to 15.1% in 2016/17.²²

These new business and retail opportunities can be attractive for customers as they are able to access products and services more quickly and/ or at a lower cost. This slowly shapes consumer behaviour and expectations, as customers increasingly demand immediacy and personalisation, which these services are able to offer.

As noted above, online shopping is growing at a rate of 10-12% per year. The rise in online activity has coincided with a 30% reduction in shopping trips over the last decade and a 10% decline in distance travelled. The potential benefits for customers vary between urban and rural populations based on the ability and costs associated with accessing location based services, although further work is needed exploring this relationship.

Based on new econometric analysis of National Travel Survey data, we estimate that online services have had a negative impact on overall demand for bus use in England by 54 million journeys or 1.2% of total demand.

5.5 Theme 4a: Price and quality of local bus services

This section considers the price, quality and availability of alternative transport modes. For each mode there are a number of drivers of demand that work in combination to influence bus patronage. As with the analysis of transport needs, the challenge is to consider the wide range of influences on transport choices in a consistent way, taking account of overlaps and synergies between individual drivers.

We consider the impact of changes to the price, quality and availability of bus, rail, light rail, private cars, taxis and private hire vehicles and cycling.

5.5.1 Changes within the Bus market

In 2016/17 local bus services carried 4,439 million passengers in England. The attractiveness of bus services relative to other modes of transport is influenced by bus fares and ticketing, timetable-related service quality (e.g. journey times, service frequency, network coverage, interchange requirement and service reliability) and non – timetable-related service quality (e.g. vehicle quality, driver quality, quality of the waiting environment and the provision of customer information).

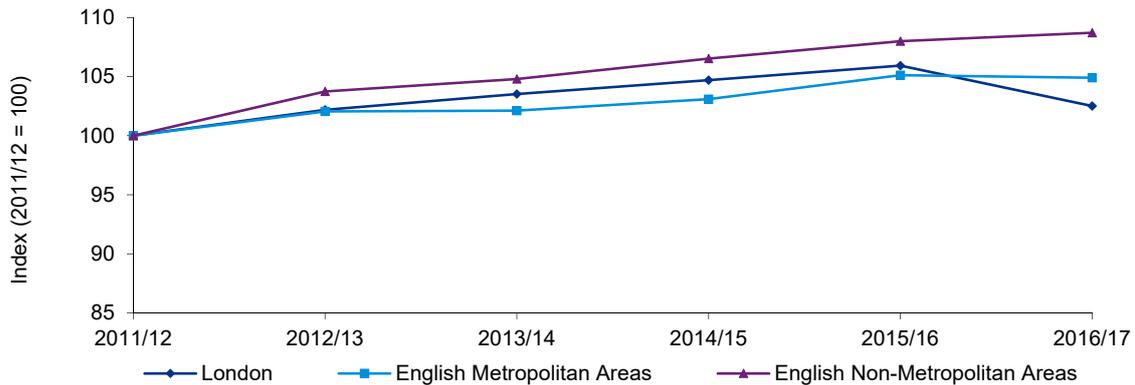
Some of this is within the direct control of bus operators and some is within the direct control of local authorities and some lies outside of the control of both. For example, bus fares reflect bus operating costs, the market position of bus services, government policy and expenditure in terms of the Bus Service Operators' Grant (BSOG) and concessionary travel. In turn, operating costs are by and large influenced by fuel prices and labour costs as well as the efficiency of bus operations.

5.5.1.1 Bus fares

Bus fares have risen between 2011/12 and 2016/17. In non-metropolitan areas this increase was 8.7%, in metropolitan areas it was 4.9% whilst in London it was 2.5%, with the trend shown in Figure 8. This has likely been driven by a combination of unit cost changes and bus operators' response to changes in government policy.

²² ONS, 2018, Retail Sales Index time series

Figure 8 Bus fares (in 2016/17 prices)



Source: Department for Transport

Operating costs per vehicle mile outside of London have increased by 3.7% in real terms between 2011/12 and 2016/17. The increase has been greater in non-metropolitans with an increase of 4.6%. At the same time there has also been a material reduction in BSOG payments. These changes have acted to squeeze operator margins and increase pressure upwards on fares.

Part of the reason for the cost increases may be linked to increases in drivers' pay throughout the bus industry. Staff costs typically account for between 50 and 70% of total operating costs and the gross median weekly earnings of full time bus drivers has risen by 2.8% in real terms between 2011 and 2016.

There is also some evidence to suggest that the productivity of bus operators has fallen over recent years. Across Great Britain total bus vehicle miles have fallen from 1,589 million in 2011/12 to 1,503 million in 2016/17, a fall of 5% whilst the total number of employees in the industry has only fallen 2% from 123,800 to 121,000. This implies a 3% reduction in vehicle miles per employee over the period. At least part of this reduction in productivity can be explained by increasing congestion on local road networks, compounded by reductions in road space and infrastructure for bus services, and worsening road conditions as a result of reduced maintenance budgets.

Increases in bus fares are likely to be a leading contributor to reductions in bus demand across England. Depending on the source, evidence on bus fare elasticities of demand are in the region of - 0.4 in the short term increasing to -

²³ INRIX, 2016, London Congestion Trends

0.6 or above in the longer term. These elasticity values however need to be reduced when concessionary travel is taken into account.

Taking a starting demand of 4,460 million local bus journeys in 2011/12 in England, and a 2.5% to 8.7% increase in real fares between 2011/12 and 2016/17, together with a change in the eligibility criteria for concessionary travel, we estimate a reduction in patronage of 1.7% – equivalent to approximately 78.4 million journeys.

5.5.1.2 Bus journey times

In this part of the analysis we consider the impact of changes to bus timetable-related service quality (journey times, service frequency, reliability and network coverage) with reference to changes in traffic congestion and service vehicle miles.

Traffic congestion

Many urban areas in England are highly congested. Traffic data from INRIX suggests that London is the most congested city in Europe, whilst Birmingham, Manchester, Bristol and Leeds are all identified as having high levels of congestion.

Congestion in London has specifically risen between the years of 2012 and 2015 with INRIX analysis suggesting that journey times in Central London increased by 12% annually.²³ Much of this being linked to changing mix of traffic with increasing levels of light goods vehicles (LGVs), private hire vehicles (PHVs) and bicycles, in addition London has seen

increasing level of roadworks. TfL data for London shows the impact of this additional congestion is reducing average bus speeds, which have declined from 9.6 mph to 9.2 mph between 2013/14 and 2016/17.²⁴ In London the percentage of on-time for low frequency bus services declined from around 84% to 80% between 2011/12 and 2016/17.²⁵

Outside of London, there also exists the challenge of increased congestion causing higher journey times and less reliable services. Where data on average excess waiting times for frequent services exists this has increased from 1.0 minute to 1.2 minutes.

Traffic congestion can be caused by a combination of excess levels of demand and also the limitation of road space either where these are in poor condition or are undergoing repairs. The quality of Local Authority managed 'A', 'B' and 'C' road conditions have gradually improved over the last 5 years, while unclassified roads have remained broadly stable.²⁶

Bus service miles

Total bus service miles in England fell by 5.3% between 2011/12 and 2016/17. In metropolitan areas this decline was 11.7%, in non-metropolitan areas the decline was 4.7% and in London the number of bus service miles increased by 0.9%.

Outside of London, 87% of services were commercially provided in 2016/17 up from 78% of services in 2011/12. The majority of this change in split and indeed the cause of the overall reduction was the change in the number of local authority supported service miles. These being services which are supported by the local authority that would not be provided commercially. Local authority supported service miles have fallen from 219 million miles in 2011/12 to 125 million miles in 2016/17, with declines in both metropolitan and non-metropolitan areas. At the same time commercial service miles in non-metropolitans have increased by 9.2%, and fallen in metropolitan areas by 7.8%.

Overall our analysis suggests the impact of bus 'timetable-related' service quality on bus patronage, specifically the impact of increased congestion, reduced demand by 163 million journeys.

5.5.1.3 Bus service quality

In addition to fares and timetable service quality impacts there is also non-timetable related service quality impacts.

Transport Focus undertake a range of surveys annually to monitor the views of customers in relation to their interaction with bus services. These surveys occur at a local level, the below table provides a summary of how customer satisfaction with bus services has evolved over the study period.

Table 4 Passenger satisfaction scores

Metric	Area	Range in results (2011)	Range in results (2017)	Change in midpoint
Overall Satisfaction with the journey	All Areas	79% – 91%	78% – 94%	Up 1%
	PTEs	81% – 91%	83% – 93%	Up 2%
Satisfaction with value for money	All Areas	39% – 68%	51% – 73%	Up 8.5%
	PTEs	51% – 65%	62% – 72%	Up 9%
Satisfaction with punctuality	All Areas	64% – 81%	63% – 83%	Up 0.5%
	PTEs	64% – 77%	69% – 76%	Up 2%

Source: Transport Focus

Whilst some of these changes are captured via fare changes or timetable impacts, customers do appear to be more satisfied overall with their

journeys and especially with the value for money they are getting. This suggests the

²⁴ Transport for London, 2018, Bus speeds reports

²⁵ Transport for London, 2018, Long Terms Trends to 2017/18

²⁶ Department for Transport, 2018, Road Conditions in England

quality of services, at least in some areas, has improved and customers recognise this.

There are a number of specific service quality factors measured by the Department for Transport, including CCTV, age of fleet, use of automatic vehicle location (AVL), use of smart card readers and WiFi availability. These support the Transport Focus findings, that there have been improvements in the bus fleet.

CCTV on bus across England is up 23%, the majority of this increase coming in non-metropolitan areas which had much lower levels of CCTV in 2011/12. Across England the age of fleet has remained constant at around 7.6 years. Meanwhile the average age of the fleet in London has increased from 5.4 to 6.3 years and the average age in non-metropolitan areas decreased from 8.7 to 8.2 years.

Use of AVL technology has increased in England from 74% to 97%, with the biggest increase occurring in non-metropolitan areas with an increase from 59% to 95%, meanwhile in London the figure remained constant at 98% across the study period.

The use of smart card readers outside of London has increased significantly between 2011/12 to 2017/17 from 53% to 91%. With metropolitan areas see the largest increase from 52% to 97% of vehicles.

Newly collected Department for Transport data on WiFi availability of buses shows in 2016/17 this was available on 36% of bus in metropolitan areas, 33% in non-metropolitan areas and 3% in London. It is likely that the majority of this was rolled out between 2011/12 and 2016/17.

Overall our analysis suggests the impact of improvements in non-timetable related service quality on bus patronage was to increase patronage by 26 million.

5.6 Theme 4b: Price and quality of other modes

5.6.1 Changes to rail

In 2016/17 1,729 million journeys were made by rail in Great Britain – Which accounted for around 2% of the total number journeys made

²⁷ ORR, 2018, Passenger rail usage

²⁸ ORR, 2018, Rail fares index

in England. The number of rail journeys has grown over recent years with the volume of demand increasing by 18.4% between 2011/12 and 2016/17.²⁷

The increase in demand has been accompanied by an increase in supply (scheduled train miles) and increase in network coverage (route miles operated). Passenger train kilometres are up from 509.9 million in 2011/12 to 520.9 million in 2016/17.

Fares in rail are a combination of those that are regulated and those that are unregulated, with customer protection both within commuter and some leisure markets. Between 2011/12 and 2016/17 overall fares increased by 2.1% over and above inflation.²⁸ Within this fares have varied between routes and market segments.

At the same time overall customer satisfaction with relation to their overall journey has remained fairly constant over the period at around 83% satisfied. This customer satisfaction varies greatly by Train Operating Company (TOC), with this currently ranging from 69% to 95% satisfaction.²⁹

Whilst the amount that rail competes directly with bus is dependent on the nature and length of the journey in question. It is likely that this growth in use of rail has impacted on bus demand, especially in urban areas with denser networks.

Based on published diversion factors for urban areas, we might expect up to 3 million new rail journeys to have been diverted from bus as a result of changes in the relative attractiveness of rail and bus.

5.6.2 Changes to light rail

Light rail and tram services in England attracted 268 million journeys in 2016/17 up from 205 million journeys in 2011/12, which equate to 3% of public transport journeys. The Docklands Light Railway and London Tramlink comprised 57% of all light rail journeys in 2016/17. The growth of light rail and tram services can impact on bus demand where they are operating in urban centres in direct competition with bus services.

Data from the Department for Transport shows that trends in demand for light rail services vary

²⁹ Transport Focus, 2018, National Rail passenger Survey

greatly between the eight different light rail operations in England. This includes the following trends between 2011/12 and 2016/17:

- Dockland light railway journeys up 42%
- London Tramlink journeys up 3%
- Nottingham Express Transit journeys up 82%
- Midland Metro journeys up 27%
- Sheffield Supertram journeys down 16%
- Tyne and Wear Metro journeys down 1%
- Manchester Metrolink journeys up 70%
- Blackpool Tramway journeys up 364%

In 2016 customer satisfaction was, 91% of passengers being satisfied with their overall journey, 68% of fare paying passengers were satisfied with value for money of their journey and 88% were satisfied with the punctuality.³⁰

Due to the increasing attractiveness of light rail journeys, we might expect around 25 million journeys have been diverted from bus to light rail.

5.6.3 Changes in car use

Use of cars is influenced by the macro-economic cycle, with demand falling during the

Financial Crash and then rising through the recovery. It is also influenced by the costs of use (fuel prices, fuel efficiency and parking charges) and well as the ease of use (journey times, travel time reliability and parking availability).

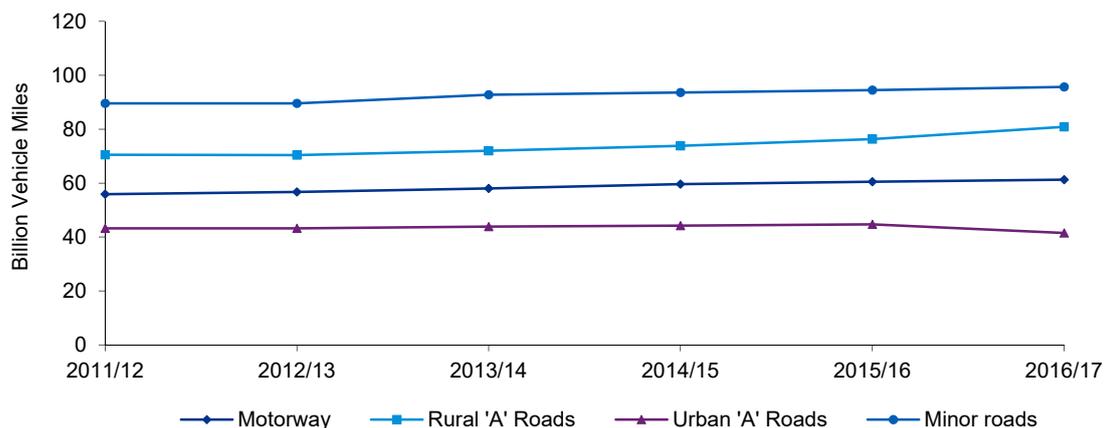
Average fuel prices have fluctuated over recent years, peaking in 2013 before falling quite dramatically in 2015 and 2016. The increase in highway congestion over the period has slowed growth in car use. Cars account for around 62% of journeys and 78% of distance travelled.

5.6.3.1 Changes to highway congestion

In England 279 billion miles were travelled in 2017, up from 260 billion miles in 2011. The most significant rises in road use was on rural 'A' roads which were up 15%, Motorways which were up 10% and minor roads which were up 7%, whilst urban 'A' roads saw a decline in traffic of 4%. The type of traffic miles on the road network has been changing over the same period, with light commercial vehicles growing at the fastest rates.

Figure 9 provides an overview of the trends in vehicle miles over the study period.

Figure 9 Vehicle miles by road type



Source: Department for Transport

³⁰ Transport Focus 2017, Tram Passenger Survey (Note: includes Blackpool Tramway, Manchester Metrolink,

Midland Metro, Nottingham Express Transit and Sheffield Supertram)

Department for Transport statistics show that this increasing use of the road network has been having varying impacts on journey delays experienced by both car drivers and bus users. Growth in traffic has been particularly strong since 2013.

Within built-up areas average speeds have declined from 31 mph in 2011 to 25 mph in 2016. This decline in average speeds reduces the competitiveness of cars, and in certain situations can lead to modal shift to bus.

5.6.3.2 Impact of motor running costs

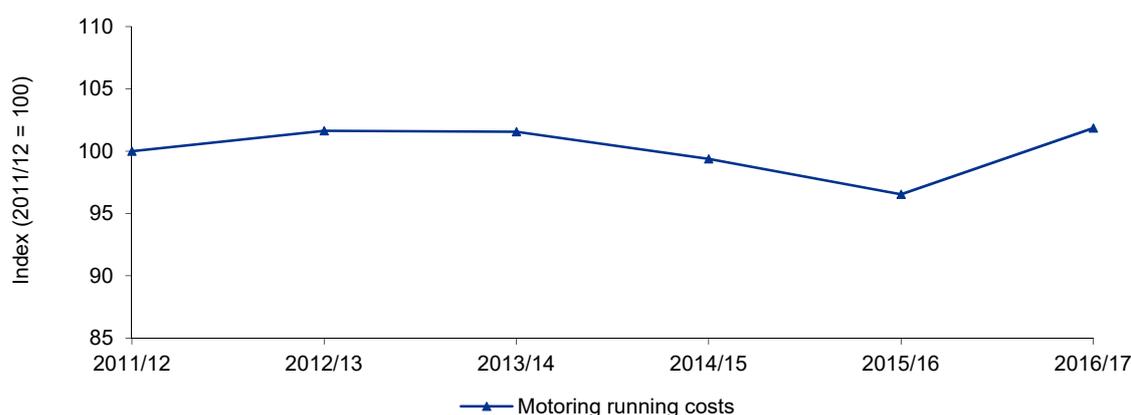
Motoring costs are made up of a range of factors including petrol & oil, tax & insurance and maintenance. These costs influence the propensity of an individual to use a private

vehicle they own as they impact on the marginal cost of use for a given journey.

Fuel prices are the most significant element that make up motoring costs. Between 2009 and 2012, fuel prices rose sharply and peaked at 142 pence per litre for petrol and 148 pence per litre for diesel in 2012. Since 2013, prices have fallen although have recovered more recently in 2016/17. The most significant elements over recent years that have been driving up costs are a combination of tax, insurance and maintenance changes.³¹

Figure 10, outlines an index of motoring running costs showing how these have increased, decreased and then increased again over the study period.

Figure 10 Motoring costs (in real prices)



Source: Department for Transport

Overall we estimate that changes in highway congestion and motor running costs caused an increase in bus patronage by 91 million over the study period.

5.6.4 Taxis and private hire

In 2017 there were 76,000 licensed taxis and 205,000 private hire vehicles (PHVs) in England, with 356,000 driver licenses issued. This represents a 3% increase in licensed taxis, a 37% increase in PHVs and a 19% increase in number of licenses issued to people compared to 2011.

PHVs have grown significantly over this period as app-based companies have entered urban markets and become popular. This is especially true in the largest taxi market London which had 109,000 licensed vehicles in 2017 up from 73,000 in 2011, representing a 49% increase with PHVs.

Other significant taxi markets include the West Midlands with 16,000 licensed vehicles up 32% from 2011, Greater Manchester with 13,000 licensed vehicles up 13% from 2011 and West Yorkshire with 12,000 licensed vehicles up 16% from 2011.

³¹ RAC, 2017, RAC Report on Motoring: Feeling the squeeze

The degree to which traditional taxis compete with bus is limited. However the emergence of app-based technologies and competition with buses needs to be explored further to understand this relationship.

Due to the increased number of taxi and PHVs we estimate this has reduced bus patronage by 19 million journeys.

5.6.5 Change in cycling

Between 2011/12 and 2016/17, the number of bicycle journeys declined by 8.4% although the average distance travelled by bicycle has increased. However this decline in cycling may reflect sampling variation rather than a real decrease in cycling journeys. Whilst there is likely to be some substitutability between cycling and public transport, given the relative uncertainty in the number of cycle trips, we estimate that the impact of cycling on the number bus journeys is likely to be small.

5.7 Theme 5: Integration between modes

Digitisation is already transforming transport provision enabled by smartphones and new digital platforms but we are only on the start of the transformations. Digital information is increasingly playing a role in how we plan, pay-for and use public transport, allowing us to make for informed and more efficient decisions before, during and after travelling. Using smart phones to check passenger information and to purchase and fulfil e-tickets is clearly beneficial to passengers but it is expected that in the near future digital platforms will allow us to book a personalised point-to-point journey using different modes without the need of buying multiple tickets. Mobility as a Service will help reduce travel uncertainty, allowing customers to travel more efficiently.

Digitisation, along with increased acceptance of the 'sharing economy' will encourage new business models to evolve, reducing the need to own assets (e.g. cars and bikes) and allowing them to adopt a more flexible

behaviour based on their immediate needs. At the same time, an increase in online services, which provide an increasing range of personalised products and services to customers, is also contributing to changes in consumer behaviour and how people interact.

5.8 Theme 6: Government policy and expenditure.

The bus market in England has undergone a number of policy changes since 2010 that may have potentially impacted on demand levels over the study period. Government provides support to the industry via the Bus Service Operators Grant (BSOG), in addition government has a number of wider policy objectives that mean that it subsidises the provision of additional services where these are uncommercial and allows elderly people to travel for free.

5.8.1 Bus Service Operators Grant

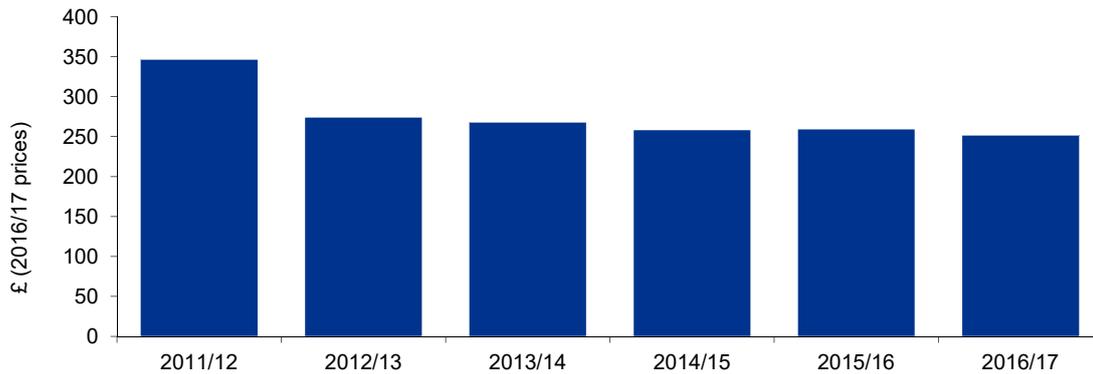
Bus Service Operators' Grant (BSOG) is a subsidy paid by the Department for Transport to operators in England for eligible local bus service, based on annual levels of fuel consumption. The aim of BSOG is to help keep fares lower and service levels higher than otherwise would be possible.

The BSOG Stage 1 reforms in July 2014, changed the method through which BSOG is paid. With the main changes being:

- BSOG payments in London were transferred to Transport for London (TfL) rather than the bus operations.
- Outside of London for those services that were tendered the payment was transferred to the local council.
- Certain types of services were deemed to no longer qualify for BSOG.

Figure 11, based on Department for Transport statistics, shows how BSOG payments to operators outside of London has evolved over the period accounting for these reforms.

Figure 11 BSOG support paid to bus operators outside of London (in 2016/17 prices)



Source: Department for Transport

The change in BSOG payments outside of London from £346 million to £252 million may have impacted the quality and competitiveness of different modes via influencing fare levels and investment in service quality, although this work has not sought to evaluate that link.

5.8.2 Other expenditure

In addition to BSOG, the government makes expenditure in the bus market to achieve a range of social and economic aims.

This includes supporting socially necessary services that are not commercially viable and providing concessionary travel for older and disabled people.

Notable changes since 2010 include the changes to the eligibility criteria for an English

National Concessionary Travel Scheme bus pass, linking eligibility to the female State Pension age regardless of gender. The state pension age for women has been rising since 2010 and the number of people able to access the older person’s bus pass has therefore been curtailed by this change.

Meanwhile total spend by local authorities in England on supported bus services has declined from £323 million in 2011/12 to £223 million in 2016/17 in real terms.³² This includes 64% of local authorities reducing or spending nothing on supported services in 2017/18.

There are other areas of policy that government can use to indirectly influence the bus market such as through wider infrastructure expenditure, competition law, land use planning and environmental standards.

³² Campaign for Better Transport, 2018, Buses in Crisis: A report on bus funding across England and Wales: 2010-2018

6 Market analysis

6.1 Introduction

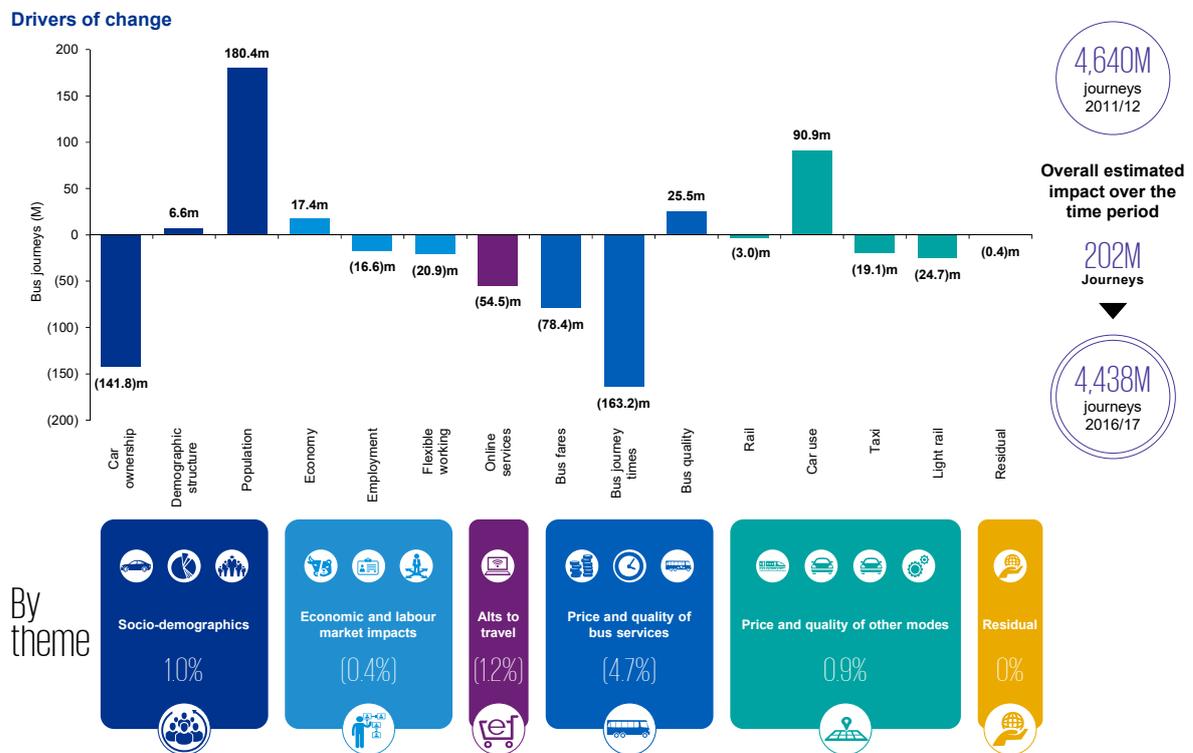
This section sets out the results of our empirical analysis with a breakdown by key market segments, including London, non-metropolitan areas and metropolitan areas. Whilst many of the trends are common across these markets, each possess unique features which mean that the relationships between transport needs and transport choices varies within them. It is important to understand the results at both levels so as to identify the most

significant drivers of demand in each and thereby be able to form conclusion.

6.2 National analysis

The national analysis covers all the local markets including London, metropolitan areas and non-metropolitan areas. Figure 12 shows the impact of different demand drivers on changes in bus patronage between 2011/12 and 2016/17.

Figure 12 Drivers of changes in bus patronage in England 2011/12 to 2016/17



Source: KPMG analysis

Of the net reduction of 202 million journeys, increasing car ownership explains a reduction of 142 million journeys, the increase in online services and home delivery explains a reduction of 55 million journeys, reduced bus service miles and increased bus journey times (arising from highway congestion, especially in London and Metropolitan areas) account for 163 million journeys and increases in bus fares account for a reduction of 78 million journeys. Other material drivers, such as changes to the structure of labour markets and flexible

working account for 37 million journeys, and competition from rail, light rail and taxis, explain a reduction of 47 million journeys.

These negative demand drivers are offset by positive impacts arising from increased population (180 million journeys), improvements to bus service quality (25 million journeys), deterioration in motoring speeds (91 million journeys) and improvements in demographic structure (7 million).

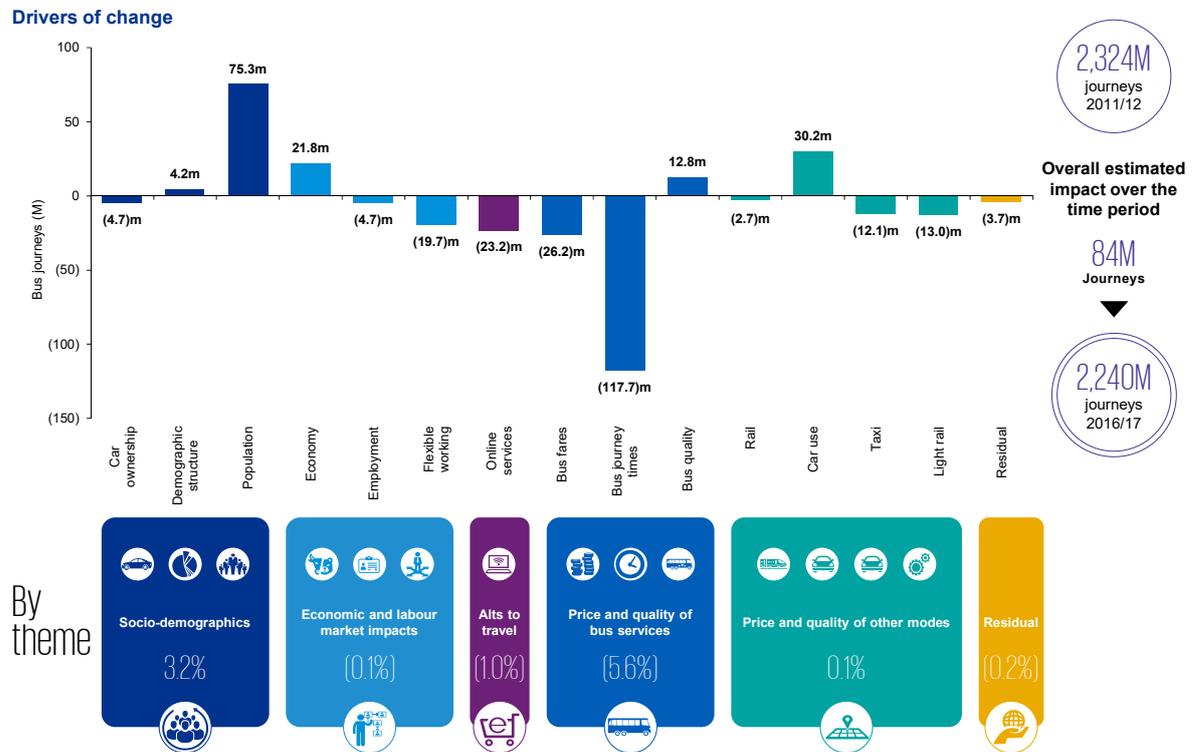
6.3 Market segmentation

6.3.1 London

London accounts for around 50% of total bus demand, and includes both inner and outer

London. Figure 13 shows the impact of different demand drivers on changes in bus patronage in London between 2011/12 and 2016/17.

Figure 13 Changes in bus journeys in London by demand driver (2011/12 to 2016/17)



Source: KPMG analysis

Of the net reduction of 84 million journeys, increasing car ownership explains a reduction of 5 million journeys, the increase in online services and home delivery explains a reduction of 23 million journeys, reduced bus service miles and increased bus journey times (arising from highway congestion) account for 118 million journeys and increases in bus fares account for a reduction of 26 million journeys. Other material drivers, such as changes to the structure of labour markets and flexible working account for 24.4 million journeys, and competition from rail, light rail and taxis, explain a reduction of 28 million journeys.

These negative demand drivers are partially offset by positive impacts arising from increased population of 75 million more journeys, positive demographic structure causing 4 million more journeys, improvements to bus service quality accounting for 13 million

and deterioration in motoring speeds accounting for 30 million journeys.

Key differences of London to the other market segments:

- Significant negative effects on demand has been caused by increasing bus journey times with this impact more pronounced than in the other markets, leading to a reduction of 118 million journeys.
- Negative demand effects have further been exacerbated due to proportionately increased competitiveness of other modes, notably taxis and light rail, which have combined to reduce demand by 25 million journeys.
- Socio-demographics of London have been more positive than the rest of the country for bus use, with population increasing demand by 79 million journeys.

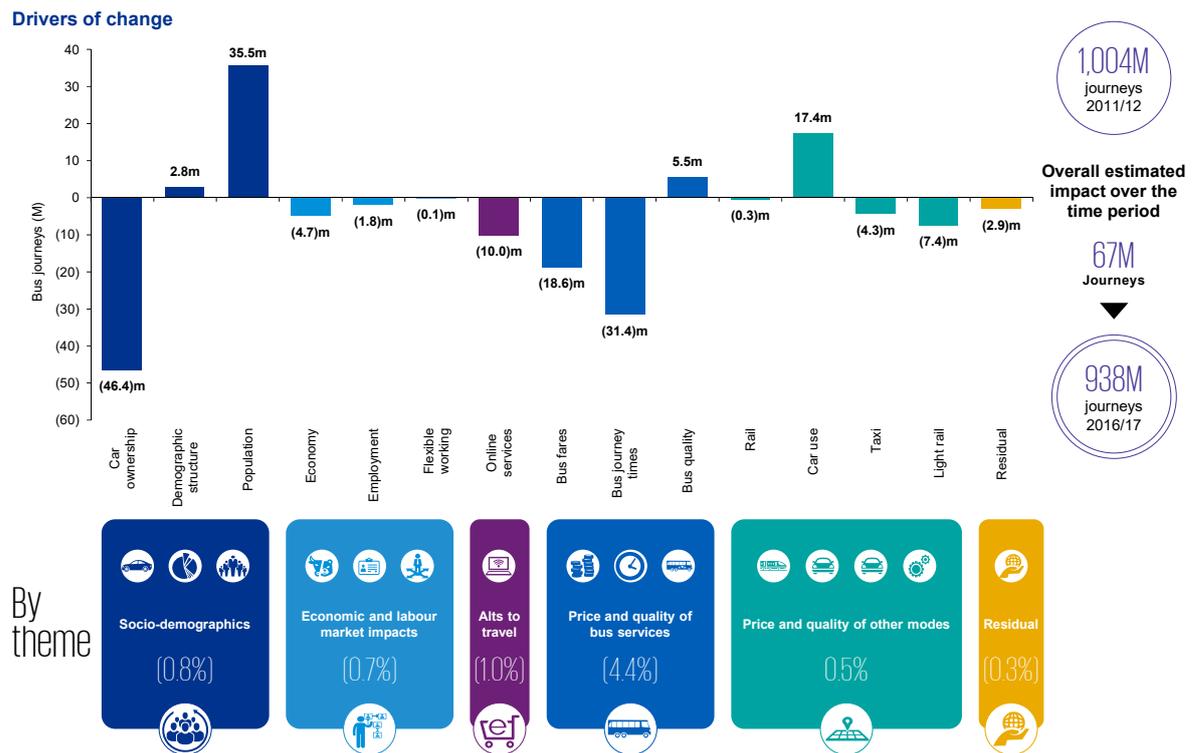
— Bus fares have risen by a smaller level than in other areas of the country and hence the negative effects of this has been smaller, leading to 26 million fewer journeys.

6 areas with integrated transport authorities. This contains Greater Manchester, West Midlands, West Yorkshire, Merseyside, South Yorkshire and Tyne and Wear. Figure 14 shows the impact of different demand drivers on changes in bus patronage in Metropolitan areas between 2011/12 and 2016/17.

6.3.2 Metropolitan areas

Metropolitan markets cover around 21% of total bus demand in England, and includes the

Figure 14 Changes in bus journeys in Metropolitan areas by demand driver (2011/12 to 2016/17)



Source: KPMG analysis

Of the net reduction of 67 million journeys, increasing car ownership explains a reduction of 46 million journeys, the increase in online services and home delivery explains a reduction of 10 million journeys, reduced bus service miles and increased bus journey times (arising from highway congestion) account for 31 million journeys and increases in bus fares account for a reduction of 19 million journeys. Other material drivers, such as changes to the structure of labour markets and flexible working account for a reduction in 7 million journeys, and competition from rail, light rail and taxis, explain a reduction of 12 million journeys.

These negative demand drivers are partially offset by positive impacts arising from

increased population with 36 million journeys, improvements to bus service quality leading to 6 million more journeys and deterioration in motoring speeds with 17 million journeys.

Key differences of non-metropolitan areas to the other market segments:

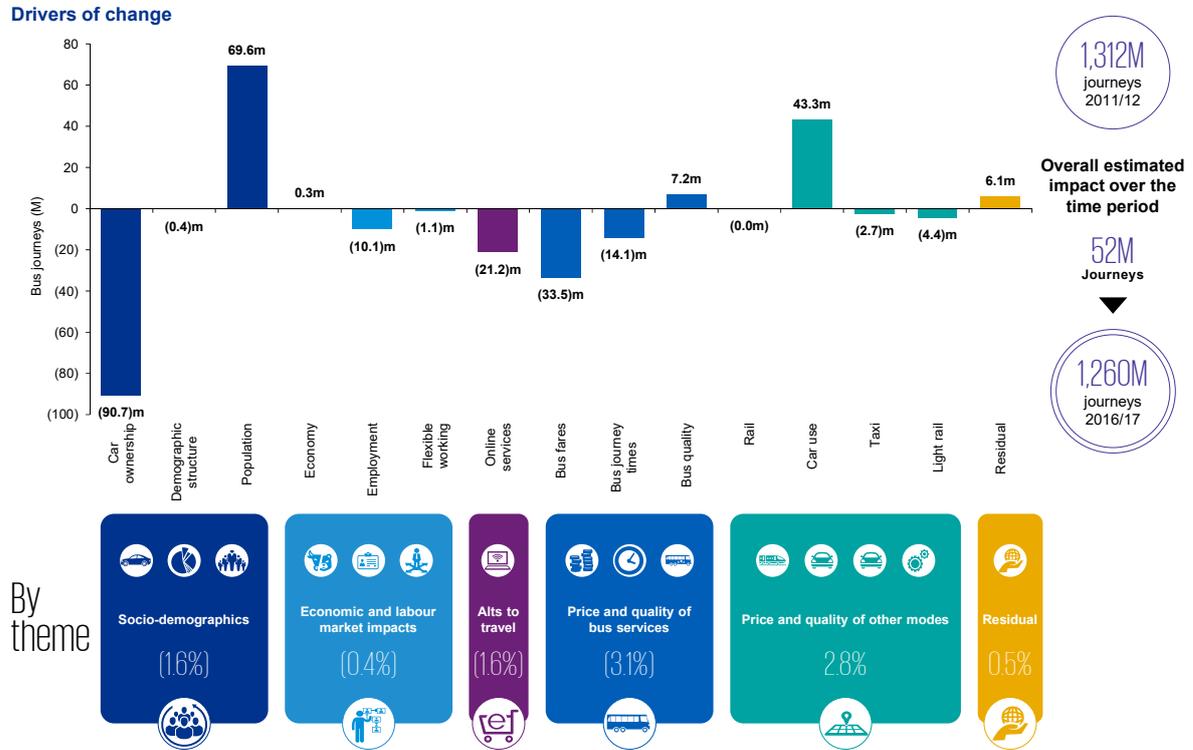
- Car ownership levels and declining bus journey times have had the greatest proportionate negative effects on demand levels.
- Increased competitiveness of taxi and light rail in these markets has also negatively impacted on demand.
- Population increases have created additional transport demand.

6.3.3 Non-metropolitan areas

Non-metropolitan areas cover around 28% of total bus demand in England, and includes a wide array of smaller cities and rural counties.

Figure 15 shows the impact of different demand drivers on changes in bus patronage in non-metropolitan areas between 2011/12 and 2016/17.

Figure 15 Changes in bus journeys in non-metropolitan areas by demand driver (2011/12 to 2016/17)



Source: KPMG analysis

Of the net reduction of 52 million journeys, increasing car ownership explains a reduction of 91 million journeys, the increase in online services and home delivery explains a reduction of 21 million journeys, reduced bus service miles and increased bus journey times (arising from highway congestion) account for 14 million journeys and increases in bus fares account for a reduction of 34 million journeys. Other material drivers, such as changes to the structure of labour markets and flexible working account for 11 million journeys, and competition from rail, light rail and taxis, explain a reduction of 7 million journeys.

These negative demand drivers are offset by positive impacts arising from increased population of 70 million journeys, improvements to bus service quality account for 7 million more journeys and deterioration in motoring speeds for 43 million journeys.

Key differences of non-metropolitan areas to the other market segments:

- Car ownership levels had the greatest impact on demand, reducing this by 91 million journeys.
- Corresponding higher rises in bus fares have also proportionately had a greater impact with a reduction in 34 million journeys.
- Online services in this market have played a more significant role in reducing levels of demand, with a reduction by 21 million journeys.
- The market has been supported by more positive trends in car use levels which has to some degree offset the increase in car ownership, and increasing demand by 43 million journeys.
- Limited impacts on the bus market from changing competitiveness of rail, taxis and light rail.

6.4 Implications of analysis

It is clear that the bus sector in England (as well as Scotland and Wales), is facing some very strong challenges as a result of changing transport needs and continued competitive pressure from private transport. These trends are likely to continue to create a drag on bus patronage, increasing the financial pressures borne by bus operators. The magnitude of the changes needed to 'move the dial' from 'patronage decline' to 'patronage growth' should therefore not be understated but there are measures that can be implemented in both the near and longer term to significantly strengthen the customer proposition.

Of the factors driving patronage change, only a small part is within the direct control of bus operators. In responding to the external forces that are driving reductions in patronage, operators have in places improved service quality, made relatively modest reductions to commercial vehicle mileage and have increased fares to reflect changing unit operating costs and reduction in government expenditure. More however could be done to increase demand. There are examples of local bus markets in England, the UK and further afield which have experienced sustained growth in bus patronage.

Areas such as West Berkshire, South Gloucestershire and Bristol have all demonstrated that where effective investment, fares strategies and coordination between operators and local authorities are delivered the bus proposition has supported growth in patronage and made this an achievable objective.

In general, those areas have adopted a more proactive policy approach to supporting the bus market with engagement between local authorities and operators to play to the mode's strengths which lie in the wider economic,

social and environmental benefits that good local bus services deliver – both capital and revenue expenditure generate excellent value for money from wider economic, social and environmental benefits estimated at between £2.00 and £3.80 for each £1 of revenue expenditure and £4.20 and £8.10 for each £1 of capital expenditure.³³

We know that customers respond positively to improved levels of convenience, dependability and value. In the short term, traditional policy measures such as investment in infrastructure and services, parking and traffic management, and greater integration of bus services into commercial and residential land-use planning continue to be a priority. This may require a greater degree of co-ordination across the industry and the adoption of joint measures such as shared ticketing, co-ordinated timetables and fair access regimes for high quality infrastructure. These policies are particularly important in large urban areas where bus services can be more convenient, cost effective and provide the most economic benefits.

The wider economic and social impacts of local bus services mean that there is a strong public policy rationale to promote local bus services and this rationale will continue and may even strengthen with increasing urbanisation and growth in England's major cities. The wider impacts include promoting business and retail agglomeration, improving access to essential services such as health and education, and reducing environmental degradation from transport networks and services. Despite the challenges currently facing the industry there are reasons for optimism. With the right investment and the right set of coordinated transport and land-use policies, buses can continue to play a strong role in supporting sustainable and inclusive growth in English towns and cities.

³³ KPMG (2017) The True Value of Local Bus Services. A report to Greener Journeys.
<http://www.greenerjourneys.com/wp->

<content/uploads/2017/07/Greener-Journeys-Value-for-Money-Update-FINAL.pdf>.

Appendix 1 Analytical framework

In this appendix we provide a technical description of the analytical framework covering transport needs and transport choices. The overall framework is as follows:

$$V_A = V_B \cdot I_N \cdot I_C \quad (1)$$

Where the total volume (V) of bus journeys in a given local authority area in the after situation (A) is equal to the total volume of journeys in the before situation (B) multiplied by an index of the change in bus journeys caused by changing needs (I_N) and an index of the change in bus journeys caused by changing transport choices (I_C).

Index of changing transport needs

We examined changing transport needs by estimating and applying a series of 'trip rate' models using a specialist econometric methodology that takes account of an individual's propensity to use the bus and the number of bus journeys they make in a year. The trip rate models were estimated to data from the National Travel Survey containing travel diary data from a sample of 220,442 individuals between 2002 and 2016. The data used during model estimation includes survey respondents from households across England.

Different models are estimated by journey purpose including: commuting, shopping, education, business and other journeys. The models explain the number of bus journeys recorded in individual travel diaries as a function of the characteristics of the individual, the characteristics of their household, the characteristics of the area where they live, and behavioural trends over time. The new models include close to 50 explanatory variables for each journey purpose, reflecting individual demand drivers relating to:

- Changes in socio-demographic factors.
- Changes to the structure of the economy.
- Alternatives and substitutes for transport.

The trip rate modes were specified with a Tobit model formulation describing the relationship between a non-negative dependent variable y_i (the number of bus journeys made in a week) and a vector of independent variables x_i used

to explain the variation in the dependent variable.

The model supposes that there is a latent (i.e. unobservable) variable y_i^* . This variable linearly depends on x_i and an associated parameter vector β . There is also a distributed error term μ_i to capture random influences on this relationship. The observable variable y_i is defined to be equal to the latent variable whenever the latent variable is above zero and zero otherwise.

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$$y_i = \begin{cases} y_i^* & \text{if } y_i^* > 0 \\ 0 & \text{if } y_i^* \leq 0 \end{cases}$$

Where y_i^* is a latent variable:

$$y_i^* = \beta x_i + \mu_i$$

In this work μ_i is specified to have a logistic distribution to make the model 'closed form'. With the logistic distribution, the predicted values of the observed variable y_i can be computed based on the mean of y_i^* and a scaling parameter σ :

$$E(y_i) = \sigma \ln(1 + \exp(\beta x_i / \sigma))$$

The estimated models are shown in Table A1 on the following page.

It is difficult to make direct comparisons between the estimated parameters for each journey purpose as they each have an associated scale, nevertheless we can see a number of interesting patterns, some of which are relatively well understood such as the fact that men have a lower propensity to use bus than women and other patterns are new and emerging.

The impact of car ownership and access to cars is particularly striking in its negative influence on bus use across all journey

purposes. It is also striking the extent of the negative relationship between online activity and bus use, and extent of the negative relationship between self-employment and bus use. Furthermore, people who work from home or work in multiple locations use the bus less than other. Those who live in larger places

have a higher propensity to use buses. Understandably, the closer people live to bus stops the higher their propensity to use bus services and the closer they live to a rail station and LRT stop the lower their propensity to use buses.

Table A1 Tobit model parameters

Group	Variable	Variable Type	Journey Purpose				
			Commute	Shopping	Education	Business	Other
Intercept	Intercept	Dummy	(3.06) ^(a)	(2.44) ^(a)	(22.06) ^(a)	(10.14) ^(a)	(2.29) ^(a)
Time trend	Time trend	Continuous	0.02	0.00	(0.04)	0.05	0.03 ^(a)
London	London	Dummy	1.31 ^(a)	0.89 ^(a)	3.27 ^(a)	2.64 ^(a)	1.66 ^(a)
Location (Base =Urban City and Town)	Urban city	Dummy	(2.80) ^(a)	(0.99) ^(a)	(2.44) ^(a)	(2.03) ^(a)	(1.00) ^(a)
	Rural town	Dummy	(3.42) ^(a)	(1.58) ^(a)	(0.27)	(3.35) ^(a)	(1.43) ^(a)
	Rural village	Dummy	(5.92) ^(a)	(2.36) ^(a)	1.32 ^(a)	(3.46) ^(a)	(2.16) ^(a)
Sex (Base=Female)	Male	Dummy	(1.37) ^(a)	(0.85) ^(a)	(0.42) ^(b)	(1.08) ^(a)	0.01
Age (Base = 26-64)	Under 18	Dummy	(1.02)	0.37 ^(a)	7.73 ^(a)	(4.44) ^(a)	0.64 ^(a)
	Age 18-25	Dummy	0.10	(0.36) ^(a)	4.01 ^(a)	(1.33) ^(a)	0.38 ^(a)
	Over 65	Dummy	(0.53)	0.80 ^(a)	(7.85) ^(a)	(1.42) ^(c)	0.13 ^(c)
Driving Licence (Base = No)	Yes	Dummy	(1.87) ^(a)	(0.19) ^(b)	(1.84) ^(a)	(0.61)	(0.37) ^(a)
Disability (Base = No)	Yes	Dummy	(1.29) ^(c)	(1.67) ^(a)	(2.63) ^(c)	(1.44)	(1.54) ^(a)
Taxi user (Base = No)	Yes	Dummy	0.63 ^(a)	0.46 ^(a)	0.06	0.78 ^(b)	1.18 ^(a)
HH Income (Base = Low)	Mid	Dummy	(0.21)	(0.08)	(0.34) ^(c)	(0.37)	(0.17) ^(a)
	High	Dummy	(1.22) ^(a)	(0.45) ^(a)	(0.52) ^(b)	(0.60) ^(c)	(0.39) ^(a)
HH Structure	Number of Adults	Continuous	0.89 ^(a)	0.20 ^(a)	0.48 ^(a)	0.08	0.05 ^(b)
	Number of Children	Continuous	(0.63) ^(a)	(0.19) ^(a)	0.40 ^(a)	(0.62) ^(a)	(0.33) ^(a)
Car access (Base = No)	Full car access	Dummy	(9.96) ^(a)	(2.72) ^(a)	(9.77) ^(a)	(4.95) ^(a)	(2.00) ^(a)
	Part car access	Dummy	(2.08) ^(a)	(0.97) ^(a)	(1.59) ^(b)	(1.62) ^(a)	(0.65) ^(a)
Company car	Company car	Dummy	(7.95) ^(a)	(2.33) ^(a)	(4.60)	(1.04)	(1.34) ^(a)
Car ownership (Base = No Car)	One car	Dummy	(1.20) ^(a)	(2.15) ^(a)	(2.57) ^(a)	(0.84) ^(b)	(2.31) ^(a)
	Two or more cars	Dummy	(3.54) ^(a)	(3.28) ^(a)	(3.36) ^(a)	(2.14) ^(a)	(3.65) ^(a)
Self Emp (Base = No)	Yes	Dummy	(3.91) ^(a)	(0.27) ^(c)	(1.90) ^(c)	0.44	(0.52) ^(a)
Employment (Base = Full Time)	Part time	Dummy	(0.58) ^(a)	1.10 ^(a)	9.02 ^(a)	0.65 ^(b)	1.18 ^(a)
	Unemployed	Dummy	4.72 ^(a)	(0.05)	(0.23)	4.69 ^(a)	0.78 ^(a)
	Retired or disabled	Dummy	(5.33) ^(a)	0.75 ^(a)	(5.58) ^(a)	(3.01) ^(a)	0.08
	Student	Dummy	5.77 ^(a)	(0.65) ^(a)	4.84 ^(a)	1.72	0.15
	Employment DNA	Dummy	(9.10) ^(a)	(3.42) ^(a)	(2.00) ^(a)	(10.43) ^(a)	(1.31) ^(a)
Employment SEG (Base = Professional)	Intermediate	Dummy	1.25	0.33 ^(a)	(1.24) ^(c)	(1.97) ^(a)	(0.01)
	Routine	Dummy	(0.14)	0.55 ^(a)	(1.60) ^(a)	(1.57) ^(a)	(0.22) ^(a)
	Never	Dummy	(0.55)	0.04	0.16	(1.30)	(0.37) ^(a)
	Not Classified	Dummy	(0.01)	0.01	3.30 ^(a)	(0.73)	0.11
Work from home (Base = No)	Yes	Dummy	(9.85) ^(a)	0.29	(0.50)	0.80	0.37 ^(c)
Work diff place (Base = No)	Yes	Dummy	(3.44) ^(a)	(0.40) ^(a)	(1.65) ^(c)	4.19 ^(a)	(0.15) ^(a)
	Work place NA	Dummy	(16.15) ^(a)	1.70 ^(a)	5.95 ^(a)	(6.18) ^(a)	1.51 ^(a)
Online activity (Base = No)	Frequent online	Dummy	(0.72) ^(a)	(0.46) ^(a)	(0.58) ^(b)	0.06	(0.18) ^(a)
	Less frequent online	Dummy	(0.36) ^(b)	(0.11) ^(b)	0.02	0.06	(0.02)
Bus access	Bus available	log(access)	(2.05) ^(a)	(1.22) ^(a)	(1.19) ^(a)	(0.41)	(0.89) ^(a)
Rail access	Rail available	log(access)	0.84 ^(a)	0.41 ^(a)	0.45 ^(a)	0.14	0.28 ^(a)
Tram access	Tram available	log(access)	0.39 ^(a)	0.27 ^(a)	0.14	0.11	0.21 ^(a)
Scale	Log(scale)	Scalar	1.52 ^(a)	0.80 ^(a)	1.66 ^(a)	1.20 ^(a)	0.86 ^(a)

Notes: (a) Significant at 10% level (b) Significant at 5% level (c) Significant at 1% level
Source: KPMG analysis

The Tobit models provide a powerful explanation of bus use against alternative measures of transport needs by journey purpose.

The models are applied to generate estimates of bus use for each local area for 2011/12 and 2016/17 and the forecasts then used to create indices of changing transport needs (I_N).

Index of changing transport choices

We specify a series of direct demand models for each local area. The models explain the changes in demand based on changes in the price, timetable-related service quality and non-timetable-related service quality of each mode available. The models are calibrated to best evidence on the relationship between bus patronage and the price and quality of transport networks, their integration and the influence of public policy, expenditure and investment decisions on demand. This part of

the analytical framework considers changes in price, quality and availability of transport modes.

The index of changing transport choices in equation 1 is specified as follows:

$$I_C = \prod_{m=1}^M I_m$$

Where I_m is an index for each mode (m) including bus, rail, car, taxi and cycle, takes the general form:

$$I_m = \left(\frac{Price_{m,A}}{Price_{m,B}} \right)^{\epsilon_{Price}} \left(\frac{GJT_{m,A}}{GJT_{m,B}} \right)^{\epsilon_{GJT}}$$

This index combines the change in price and generalised journey time of each mode factored by the relevant elasticity of demand (Table A2).

Table A2: Direct demand model elasticities

	Bus	Rail	Light rail	Taxi	Car
Fares	-0.6	-0.9	-0.6	-0.6	-0.1
Generalised Journey Time (GJT)	-1.1	-0.9	-1.1	-0.6	-0.2

Source: KPMG analysis

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