



Trends in Scottish bus patronage

Report to the Confederation
of Passenger Transport (Scotland)

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Important notice

Our work commenced on 27 June 2017 and was completed on 13 October 2017. 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 Transport Scotland, Scottish Government and 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

Making sense of trends in Scottish bus patronage

Bus use in Scotland has fallen, similar to the general trend in England. But the reasons for this are complex and go well beyond the bus sector. It reflects 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.

2011/12

2015/16

2016/17

*provisional estimate



436m
trips

409m
trips

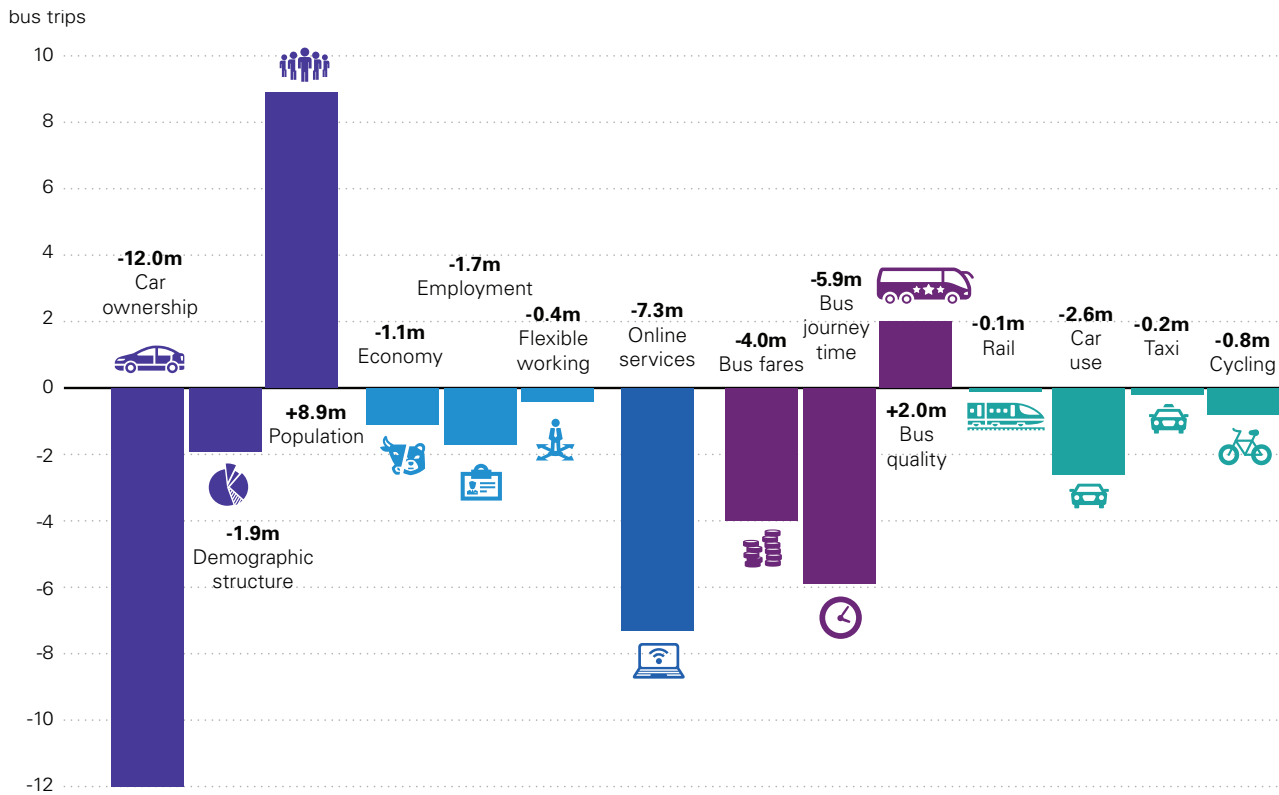
393m*
trips

Overview (continued)

Making sense of trends in Scottish bus patronage

The figure below provides a summary of the impact of different demand drivers on bus patronage levels between 2011/12 and 2015/16. Taken together the net impact is a reduction of 27 million bus journeys.

Drivers of change



By theme

Socio-demographics	Economic & labour market impacts	Alts to travel	Price & Quality of bus service	Price & quality of transport modes
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- 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

- 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

- Growth in online services and home delivery

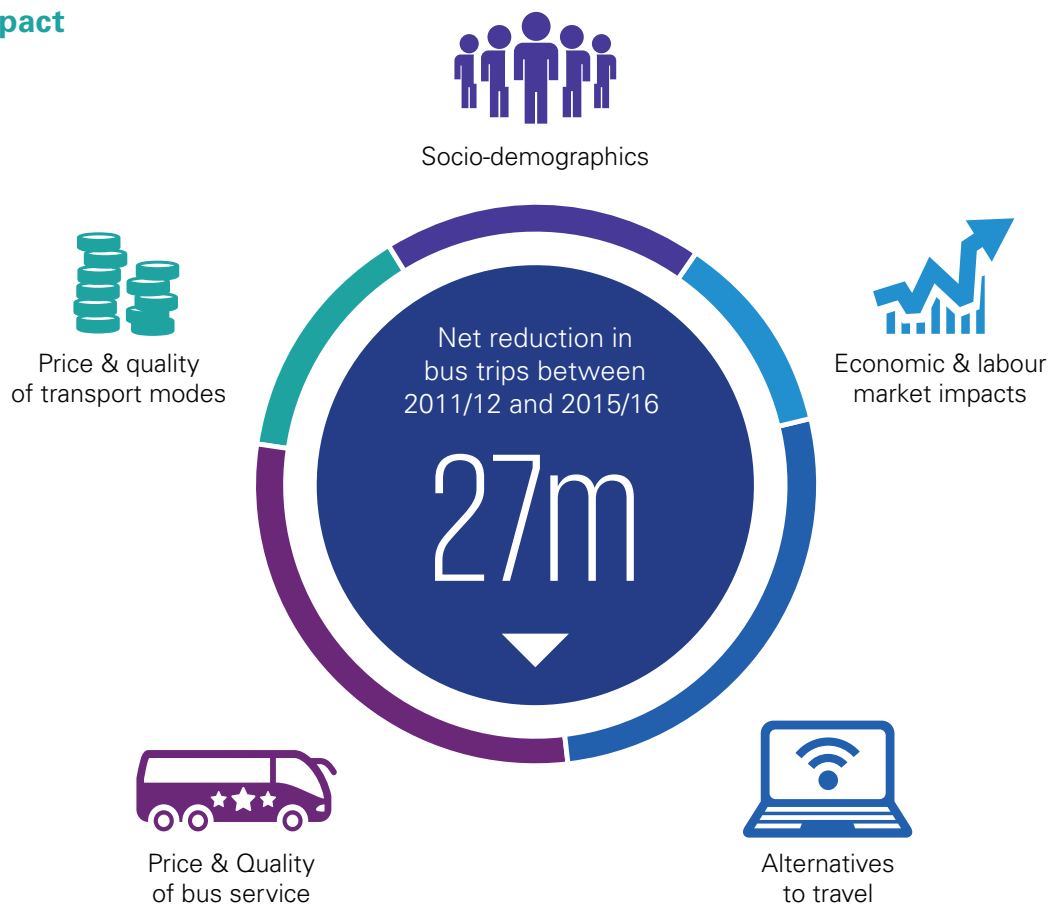
- Bus fares have risen at a faster rate than inflation, driven by increased costs and reduced government expenditure
- Service miles have fallen, especially supported miles
- Vehicle and service quality have improved

- Improved rail service quality and reduction in off-peak fares
- Reduction in vehicle use costs from increased vehicle fuel efficiency and falling fuel prices
- Significant increase in the number of taxi licences. Uber launched in Edinburgh and Glasgow in 2015
- Material increase in the number of trips made by cycle

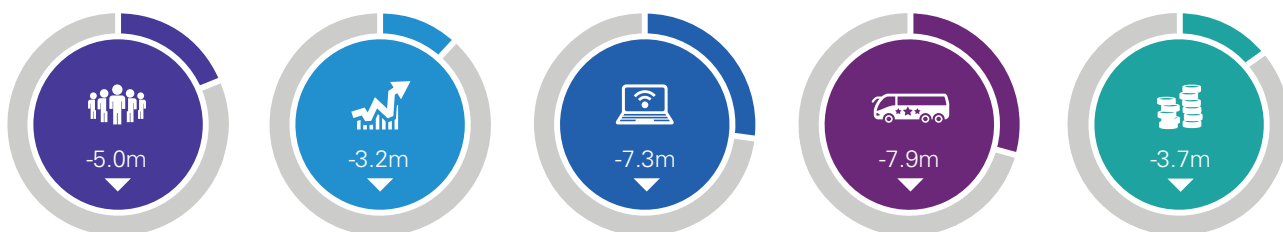
Overview (continued)

Making sense of trends in Scottish bus patronage

Overall impact



Impact by theme



Overview (continued)

Market outlook

Broader demographic, economic and societal trends are influencing transport needs and transport choices, creating a drag on bus patronage. These trends are likely to continue in the near and longer term.

	Demand driver	Near term outlook (under business as usual)	Longer term outlook
Transport Needs	Socio-demographic	Bigger and older population with increased car ownership	Greater sharing of assets leading to reduced car ownership
	Economic & labour market	Increased levels of self-employment, flexible contracts and multi-site working	Potentially large disruption to labour markets with continued increased flexibility in work and work location
	Alternatives to travel	Increased use of online services and e-commerce	Increased use of online services and e-commerce
Transport Choices	Price & quality of transport modes	Modest improvements to the attractiveness of rail, cycling and ride-hailing services	Transformation of the vehicle market and reform of vehicle charging mechanisms reflecting marginal costs
	Integration between modes	Increased use of technology to integrate modes, increased flexibility in demand responsive services	Increased use of technology to integrate modes, increased flexibility in demand responsive services
	Government policy & expenditure	Continued pressure on resources for revenue and capital expenditure	Uncertainty surrounding longer term policy

● Negative ● Positive ● Uncertain

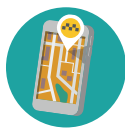
Policy discussion

Whilst the focus of this work is on understanding the historical drivers of change as a foundation for policy discussions on the future of the sector, it is clear the sector as a whole will need to work hard to meet on-going market challenges. The magnitude of the changes needed to 'move the dial' from 'patronage decline' to 'patronage growth' should not be understated.

In the near term, the changes will likely involve:



Stronger alliances between transport authorities, operators and technology firms.



Continued focus on improving end-to-end journey **experience** and affordability for customers.



Investment in infrastructure and traffic management measures to support the reduction of highway congestion.

Looking further ahead, changes may involve:



More **efficient use of resources** through shared use of assets and more cost-reflective user charges incentivising the use of the 'right mode for the journey'.



Greater use of **technology**, micro-transit and demand responsive services to 'aggregate' demand on key routes and play to the strengths of bus services in their efficient use of road capacity.

If buses are to retain their **vital** role in supporting Scotland's economic, social and environmental **wellbeing**, the policy debate needs to reach beyond ownership and regulation towards service and product innovation, improved infrastructure performance and supportive longer term policies on land-use to cater for Scotland's changing economic and social needs.

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1.

Executive summary



1. Executive summary

1.1 Introduction

This report presents the findings of a study that identifies and quantifies the drivers of demand for local bus services in Scotland. The work was commissioned by the Confederation of Passenger Transport (Scotland) and was independently undertaken by KPMG LLP.

Bus patronage in Scotland has fallen from 436 million trips in 2011/12 to 409 million trips in 2015/16 with provisional patronage estimates for 2016/17 falling to 393 million. The decline in patronage has been more pronounced in the non-concessionary segment and in the South West and Strathclyde region. Outside the South West and Strathclyde patronage levels have been more stable and in some regions, such as the Highlands, patronage levels are growing.

The patronage trends in Scotland are similar to those experienced in England, especially in metropolitan areas outside of London, and they reflect wider changes to travel and transport markets across Great Britain. Data from the National Travel Survey reports that overall trip rates per person have fallen by 14% over the last 10 years suggesting a change in the underlying need to travel. The analysis reported here aims to identify the drivers of change and the strength of their impact on local bus patronage in Scotland.

1.2 Drivers of change

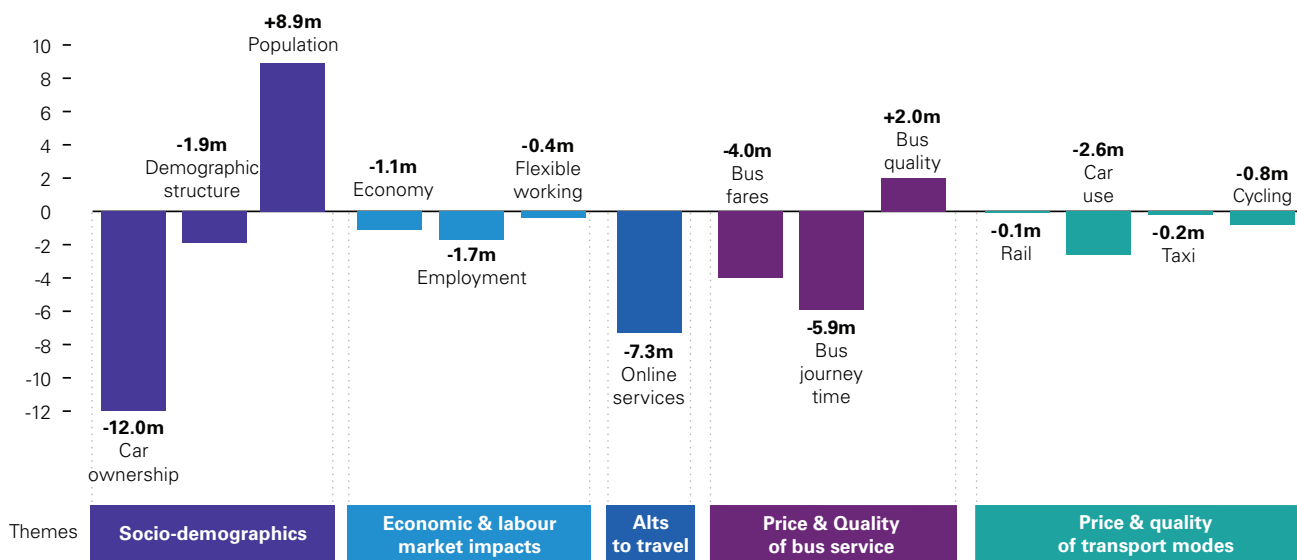
Our analysis shows that a little over a half of the reduction in bus patronage can be explained by changing transport needs - changes to socio-demographics including changes in household car ownership, changes to economic and labour market structures, and changes to the availability and

acceptability of alternatives to travel including online services. The remainder of the change in bus patronage can be explained by changes to the price, quality and availability of alternative transport modes. It is important to note that there is significant variation in patronage and patronage trends between areas driven by differences in these factors as well as wider differences in operator performance and local transport policy.

Figure 1 provides a summary of the impact of different demand drivers on bus patronage levels between 2011/12 and 2015/16. Of the net reduction of 27 million trips, increasing car ownership explains a reduction of 12 million trips, the increase in online services and home delivery explains a reduction of 7.3 million trips, reduced bus service miles and increased bus journey times (arising from congestion) account for 5.9 million trips and increases in bus fares account for a reduction of 4 million trips. Other material drivers, such as changes to the structure of the population and labour markets, as well as competition from rail, taxis and cycling, explain a reduction of 8.7 million trips. In addition, the negative demand drivers are offset by increases in population levels and improvements to bus service quality which together are expected to have increased patronage by 10.9 million.

The individual demand drivers are grouped under six themes covering changing transport needs and changing transport choices and are discussed below. The first three themes cover changing transport needs and the fourth theme covers changes to the price, quality and availability of alternative transport modes, Theme 5 is forward looking, considering the potential use of technology to integrate services and provide better information to customers. Finally, Theme 6 reviews government policy and expenditure influencing the price, quality and availability of alternative modes.

Figure 1: Changes in Scottish bus journeys by demand driver (2011/12 to 2015/16)



Source: KPMG analysis

Theme 1: Socio-demographic impacts

Transport 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 Scotland as a result of immigration and increased life expectancy, mitigated 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 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 own a vehicle¹.

Car ownership levels continue to rise with new car sales buoyed by the strength of the economy and an increase in consumer credit². 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 different modes of transport for different purposes. Analysis of National Travel Survey (NTS) data³ shows how big the differences in behaviour are:

- Individuals without a driving licence and without access to a vehicle make on average 181 bus trips per year.
- Individuals with a driving licence but without access to vehicle in a household with one or more cars make on average 164 bus trips per year.
- Individuals with a driving licence with part access to vehicle make on average 55 bus trips per year.
- Individuals with a driving licence and full access a vehicle make on average 14 bus trips per year.
- Individuals with a driving licence and full access to a company vehicle make on average 4 bus trips per year.

All else equal, we estimate that changes to car ownership levels across Scotland between 2011/12 and 2015/16 has resulted in a 2.7% reduction in overall bus patronage with relatively large differences between geographical areas reflecting relatively large variations in changes to car ownership.

Theme 2: Socio-economic impacts

Demand for travel depends in large part 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 Scottish labour market is changing, not just in terms of changes to employment levels but also in 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 available⁴. 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.

Data from the Scottish Household Survey⁵ shows that the proportion of people who mainly work from home has increased from 10.6% in 2011 to 14.1% in 2015, 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 changes to the structure of the economy and labour market has led to a reduction of 3.2 million bus trips. 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 manufacturing⁶. 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.

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

We know from analysis of National Travel Survey data that the number of shopping related trips has declined dramatically across all modes of transport. 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 trips per year and those who frequently buy goods online make on average 25% fewer bus trips per year. When reflected across the whole of Scotland, the impact of online services and home delivery is estimated to have led to a reduction in local bus trips by 7.3 million trips per year between 2011/12 and 2015/16. Online services and home delivery are expected to continue to increase at a fast pace, driving further reductions in bus patronage.

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

2. SMMT <https://www.smmt.co.uk/2017/01/uk-new-car-market-achieves-record-2-69-million-registrations-in-2016-with-fifth-year-of-growth/> [Accessed 10 September 2017].

3. Office for National Statistics, National Travel Survey, <https://www.gov.uk/government/collections/national-travel-survey-statistics>, [Accessed 10 September 2017].

4. ONS, Regional labour market statistics in the UK.

5. Scottish Household Survey, <http://www.gov.scot/Topics/Statistics/16002>.

6. Andy Haldane, Labour's share, Bank of England, November 2015.

Theme 4: Price quality and availability of transport modes

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 by 4.7% in real terms between 2011/12 and 2015/16. This trend is similar to that experienced in England outside London. It has been driven 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, falling from a high of £69.9 million in 2009/10 to £53 million in 2015/16. There has also been a reduction in the rate at which operators are reimbursed for carrying concessionary passengers from 73.6% of the adult single fare in 2006/7 to 56.9% of the adult single fare in 2017/18. All three changes have acted to squeeze operator margins and increase pressure on fares.

Bus journey time includes the time spent on the vehicle and the time spent accessing the vehicle. Scottish cities are some of the most congested in the UK with drivers spending up to 12% of the average journey in congested conditions, substantially increasing travel times. Whilst there has been a brief respite from further increases in traffic congestion following the Recession, traffic levels are once again increasing. Bus service miles, reflecting network coverage, operating hours and service frequency, fell by 3% between 2011/12 and 2015/16, with commercial vehicle miles falling by 1% and supported vehicle miles by 10%. The North East, Tayside and Central and the South East regions have seen modest increases in service miles, service miles in the Highlands, Islands and Shetland have remained relatively constant, and service miles in the South West and Strathclyde region have reduced by 9%⁷.

Data from the Scottish Household Survey shows that customer satisfaction with bus travel is generally good and has generally improved between 2007 and 2014. More recent evidence on customer satisfaction produced by Transport Focus support these findings. They note that between 86% and 93% of respondents to their survey across Scotland were either very or fairly satisfied with bus services. Overall customer satisfaction is highest in the South East and South West and lowest in the North East and Strathclyde. Customer satisfaction in Strathclyde has fallen from 90% in 2014 to 86% in 2016⁸. 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 13% over the same period but the quality of vehicles has improved.

Rail services provide an alternative to bus services in urban areas, especially in and around Glasgow which has a dense rail network and where significant investment in park and ride stations have been made. Rail patronage has increased by more than 12.1 million trips between 2011/12 and 2015/16⁹. Whilst rail fares and service levels have not changed materially over that time, bus fares have increased and bus service miles have reduced. This shift in the competitive position of rail and bus is estimated to have incentivised in the region of 5 million trips to switch from bus to rail.

Edinburgh Trams began operations in 2014/15 attracting 4.1 million journeys. Since then, demand has risen to 5.6 million journeys in 2016/17. The introduction of the service is likely to have had a significant impact on travel within the city centre, although it is not clear how much demand has been abstracted from bus and how much the integration between bus and tram has helped to improve the attractiveness of public transport over private transport.

Use of cars is influenced by the macro-economic cycle, with demand falling during the Great Recession 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. The reduction in fuel costs is estimated to have contributed to a reduction of 2.6 million bus trips as car use becomes more affordable. Looking to the future, vehicle fuel efficiency is increasing and improved battery technology is making electric vehicles a much more viable option. As a result the proportion of total tax revenue from fuel duty is falling, prompting discussion on alternative ways to tax ownership and use of vehicles¹⁰.

Regional variation in parking policy is likely to play an important role in bus use. Edinburgh, for example, has implemented a Controlled Parking Zone across a large area of inner Edinburgh, generally discouraging commuter parking, whereas Glasgow has seen a significant increase in parking. Glasgow City now has approximately 10,000 spaces available in over 25 dedicated carparks across the city centre. In particular, inexpensive temporary carparks have sprung up across the city on vacant land as building work slowed in response to the recession¹¹. On-street parking is also available throughout the city centre.

In addition to the substantial increase in taxi and private hire vehicle licences, especially in Glasgow and Edinburgh over the last ten years, Uber was introduced into Glasgow and Edinburgh in late 2015 providing additional choice to transport customers. The increase in competition from taxi and private hire services is estimated to have led to a decline of 0.2 million bus trips, excluding the impact from Uber.

The total volume of cycle trips in Scotland has increased from around 151 million miles in 2005 to around 213 million miles in 2015¹². Over the same period the proportion of people using cycle as their main mode has risen from 0.9% to 1.2%. The majority of the increase in cycling has occurred in the

7. Scottish Transport Statistics No 35, 2016 Edition, February 2017.

8. Transport Focus (2016) Bus Passenger Survey, March 2017.

9. Scottish Transport Statistics No 35, 2016 Edition, February 2017.

10. Wolfson Economics Prize 2017, <https://policyexchange.org.uk/wolfsonprize/>

11. Glasgow City Council (2015) Glasgow City Transport Strategy 2014-2024.

12. Cycling Scotland, Annual Cycling Monitoring Report 2017

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major cities. Edinburgh and Glasgow have experienced large increases in the proportion of people cycling to work with rates in Glasgow increasing from 1% to 1.6% and rates in Edinburgh increasing from 3% to 4.3% over this period, abstracting 0.8 million trips from local bus services across Scotland.

Theme 5: Integration between modes (forward looking)

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 and to purchase and fulfil e-tickets is clearly 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.

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

In 2015/16 total government expenditure on transport in Scotland was £2,708 million. Two thirds of this total was expenditure by central government and a third by local government. In terms of the breakdown of expenditure, 44% was spent from capital accounts and 56% from revenue accounts. Expenditure on roads totalled £1,095 million, expenditure on rail £621 million, expenditure on buses £112 million, with the remainder spent on concessionary travel for older and disabled people, other local public transport, airports and aviation, ferry services and canals.

Between 2011/12 and 2015/16, government revenue expenditure on bus services in Scotland fell by 11% in real terms. Of the total reduction in expenditure, £10.5 million was down to the reduction in BSOG and £2.2 million down to the reduction in expenditure on supported services¹³. In addition, gross capital expenditure on local transport increased by 8% for highways and reduced by more than 50% for public transport. The reduction in revenue and capital expenditure on local bus services and the commercial reaction to these changes are part of the reason for the increase in fares and reduction in bus vehicle miles in Scotland.

Air quality is an increasing problem across Scotland, in large part due to road traffic and in particular to cars - modern diesel cars produce ten times more toxic air pollution per litre of fuel consumed than heavy trucks and buses. This is particularly relevant in the context that Scotland has some of the most congested cities in the UK. The pollutants emitted as a result of road traffic are estimated to contribute to significant numbers of early deaths every year. The Scottish Government aims to address this with policies aimed at reducing the need to travel and increase the uptake of sustainable travel options where travel is unavoidable. The Government has a commitment to introduce Low Emission Zones into Scotland's four biggest cities by 2020¹⁴.

1.3 Immediate policy implications

It is clear that the bus sector in Scotland 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 revenue risk 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 total net reduction in patronage, less than a third is due to changes within the bus sector and only a part of that is within the direct control of bus operators. In responding to the external forces that are driving reductions in patronage, operators have 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 Scotland, 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 expenditure¹⁵.

13. Scottish Transport Statistics No 35, 2016 Edition, February 2017.

14. Scottish Government (2017) A Nation With Ambition: The Government's Programme for Scotland 2017-18, September 2017.

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>.

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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 Scotland'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 Scottish towns and cities

1.4 Looking further ahead

History tells us that we have had relatively limited universal 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 Scotland's changing economic and social needs.

2.

Introduction



2. Introduction

2.1 Study objectives

The objective of this Project is to produce a detailed market study of the drivers of local bus patronage in Scotland, drawing a distinction between demand drivers that are external to the market, those that are within the control of operators and those that are within the control of local and national government. In developing a better understanding of the relative importance of historical demand drivers and by taking a look at how these drivers could change in the future, the analysis provides insights to inform policy-making and commercial decision-making.

2.2 Scope of work

The scope of work includes:

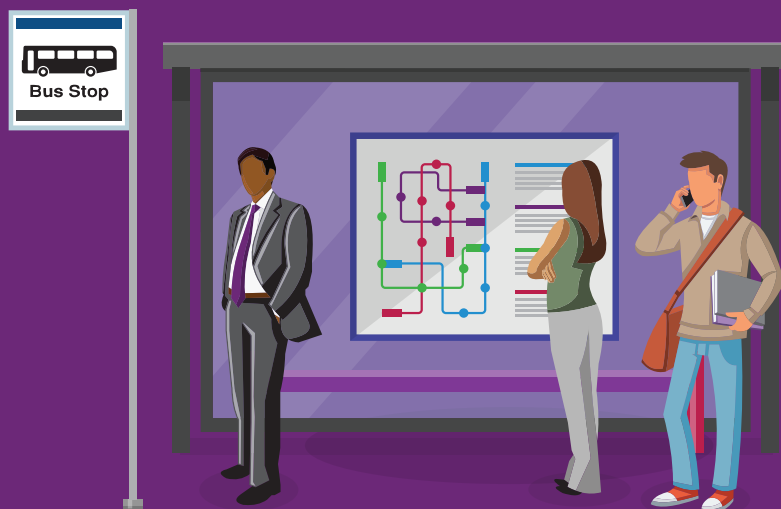
- Identification of a long list of potential demand drivers.
- Review the relationships between potential demand drivers and transport needs and choices.
- Specify an analytical framework to quantify the strength of the relationship between potential demand drivers and bus patronage.
- Undertake a statistical analysis of customer choices and aggregate market trends to quantify the impact of potential demand drivers and bus patronage.
- Review the policy implications of the analysis for the near and longer term.

2.3 Structure of this report

The remainder of the report is structured as follows:

- Section 3 provides the context for the work highlighting trends in the use of local bus services in Scotland and across local authority areas in Scotland, together with an analysis of wider travel trends in Scotland and the rest of Great Britain.
- Section 4 provides a description of the analytical methodology used to quantify the relative importance of alternative drivers of demand. Further details of new econometric models are included in the appendix.
- Section 5 provides a description of each of the drivers of demand, grouped under a number of themes to represent changing transport needs and changing transport choices. The analysis of each driver considers its impact on demand, the outlook for further change and the broad policy implications.
- Section 6 brings the analysis in Section 5 together to develop a complete picture of the relative importance of individual drivers of demand and considers the policy implications of the analysis in the short and longer term, considering the range of policy levers available to local and central government to influence market demand and supply.

3. Context



3. Context

3.1 Local bus patronage in Scotland

3.1.1 Overall market trends

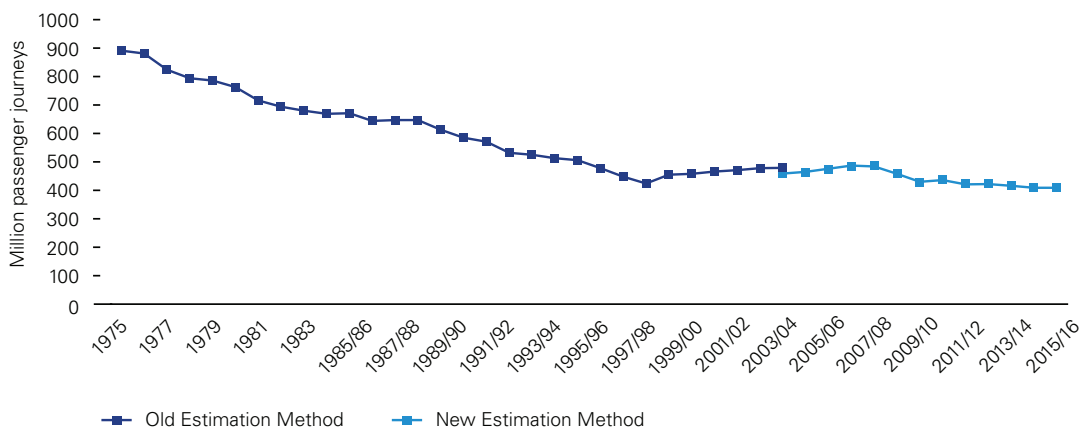
The total number of bus passenger journeys in Scotland was in steady decline until the turn of the century when the number of journeys stabilised for the best part of a decade until the Great Recession in 2007/08 when numbers began to fall again.

Patronage levels have fallen from 436 million in 2011/12 to 409 million in 2015/16 with provisional patronage estimates for 2016/17 falling to 393 million. Bus trips per head per year have fallen from 82 to 76 over this period. The decline in patronage has been more pronounced in the non-concessionary segment of the market than the concessionary market which has remained relatively stable.

3.1.2 A mixed picture nationwide

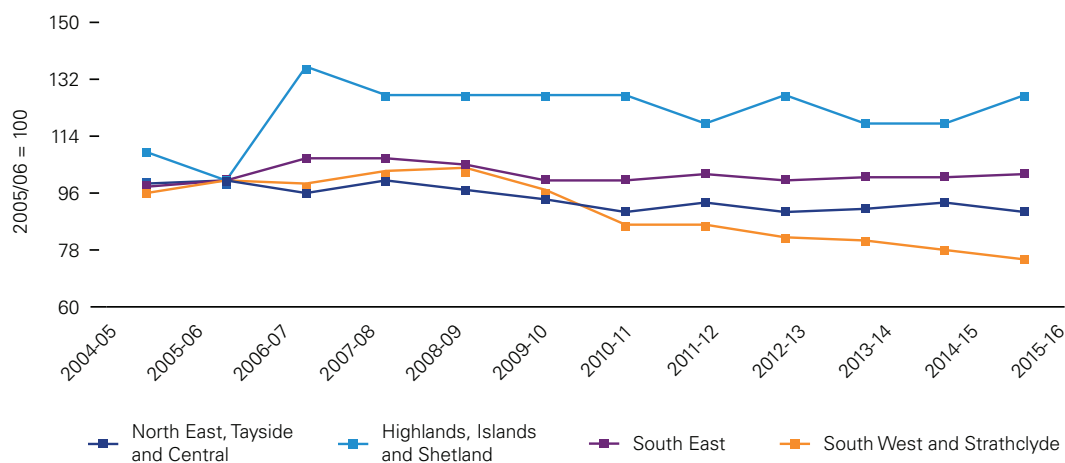
Despite the overall decline in bus trips nationally there is some variation in the change in bus patronage across different local authority areas in Scotland. The highest rates of bus use are in the major cities of Edinburgh, Glasgow, Dundee and Aberdeen, and their surrounding areas. Bus use in Edinburgh is around three times as high as the national average with more than 25% of the population using a bus every day.

Figure 2: Passenger journeys on local bus services in Scotland



Source: Transport Statistics Great Britain 2016

Figure 3: Passenger journeys on local bus services Scottish regions index



Source: Scottish Transport Statistics 2016

3 Context

There has been considerable variation in performance across local authority areas, with a stable growing market in Edinburgh but falling demand in Glasgow, Dundee and Aberdeen. Almost all of the decline in national bus patronage has occurred in the South West and Strathclyde area.

3.1.3 Comparison with England

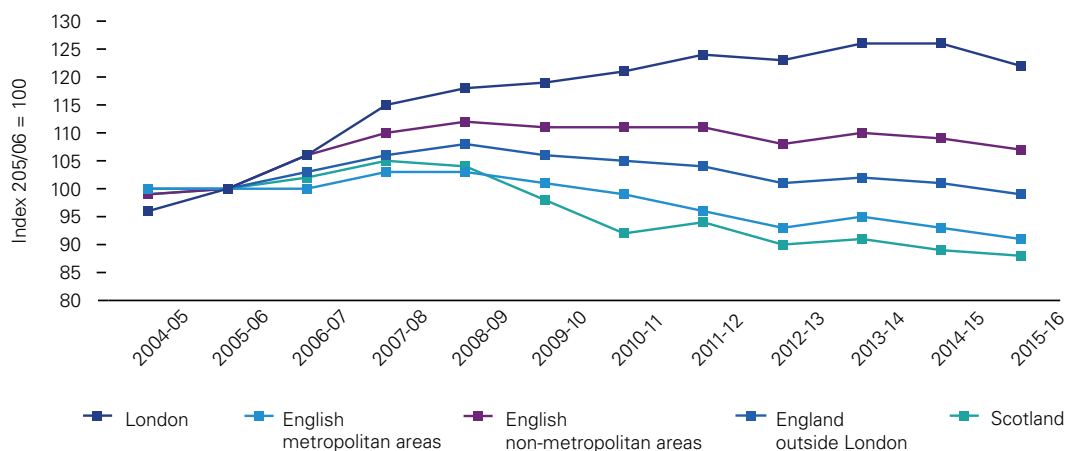
Outside of London, the bus market in England has experienced a similar reduction in patronage to Scotland, especially in metropolitan areas.

Table 1: Percentage of population using a bus every day by Local Authority area

Local Authority	2008	2015	Change
Edinburgh, City of	25.6	27.4	1.8
Glasgow City	21.7	17.7	-4.0
Dundee City	18.6	15.3	-3.3
West Dunbartonshire	18.0	14.8	-3.2
Aberdeen City	14.8	14.2	-0.6
East Lothian	9.8	13.4	3.6
East Ayrshire	10.4	13.3	2.9
Inverclyde	12.7	13.2	0.5
Midlothian	18.2	12.8	-5.4
South Lanarkshire	12.5	12.2	-0.3
Renfrewshire	12.2	11.9	-0.3
North Lanarkshire	11.5	11.7	0.2
Perth & Kinross	7.2	10.2	3.0
Clackmannanshire	7.2	9.7	2.5
North Ayrshire	15.3	9.2	-6.1
West Lothian	7.5	9.1	1.6
East Dunbartonshire	9.5	8.7	-0.8
East Renfrewshire	10.6	8.6	-2.0
Fife	7.7	8.5	0.8
Stirling	9.7	8.0	-1.7
South Ayrshire	10.9	7.7	-3.2
Dumfries & Galloway	7.0	5.8	-1.2
Eilean Siar	4.7	5.4	0.7
Falkirk	7.6	5.2	-2.4
Angus	6.9	4.2	-2.7
Aberdeenshire	3.0	4.2	1.2
Highland	4.6	3.8	-0.8
Argyll & Bute	4.5	2.3	-2.2
Orkney Islands	0.4	1.8	1.4
Shetland Islands	2.2	1.6	-0.6
Scottish Borders	3.4	1.4	-2.0
Moray	3.1	1.3	-1.8
Average	10.0	9.2	-0.8

Source: Transport and Travel in Scotland 2016

Figure 4: Passenger journeys on local bus service index



Source: Transport Statistics Great Britain 2016

3.2 Wider travel trends

Overall trip rates across all modes have fallen by around 14% over the last ten years, with the most significant falls in personal business, business and leisure trips. Falls in trips for shopping and visiting friends and relatives account for around half of the total fall in trip rates on local bus services. There have also been significant falls in car use and walking, but increases in rail and cycling¹⁶.

3.3 Implications for the market analysis

There are material differences in the level of bus use and the rate of change in the level of bus use across local authority areas in Scotland. Explaining the drivers of these differences is central to developing our understanding of local bus patronage and to exploring policy implications in the near and longer term.

These differences are likely to reflect differences in inherent demand drivers, the policy choices of the local authorities, as well as the performance of local bus operators.

A variety of hypotheses have been made to explain the underlying reasons for these trends including increased road congestion, relative falls in the cost of owning and driving a car and reductions in funding for bus services and supporting infrastructure. These factors may have reduced the attractiveness of bus transport whilst also increasing operating

costs for bus operators leading to increases in fares or reduced levels of service, further reducing the attractiveness of bus services and pushing bus users onto other modes.

There may also be a variety of wider factors which may have contributed to falling demand including: changes in land use patterns and the growth of developments based on car access, and more recent social phenomena such as the growth of online shopping and home delivery, increasing levels of flexible and home working and new modes such as Uber leading to increased competition with bus services.

As evidenced by the highly diverse trends in different local authority areas, differences in transport policy are also likely to be critical to the success of the local market. Bus prioritisation, ticketing, integration and wider transport policy factors are likely to have an important impact on the efficiency and quality of bus services and impact on the performance of the local bus market.

These factors can be summarised as impacting on either the need to travel, or the competition and choice across different modes. In the remainder of this report we analyse and assess the impact of different drivers of demand on local bus patronage between 2011/12 and 2015/16 before reflecting on the policy implications of the work.

16. Transport Statistics Great Britain 2016

4.

Methodology



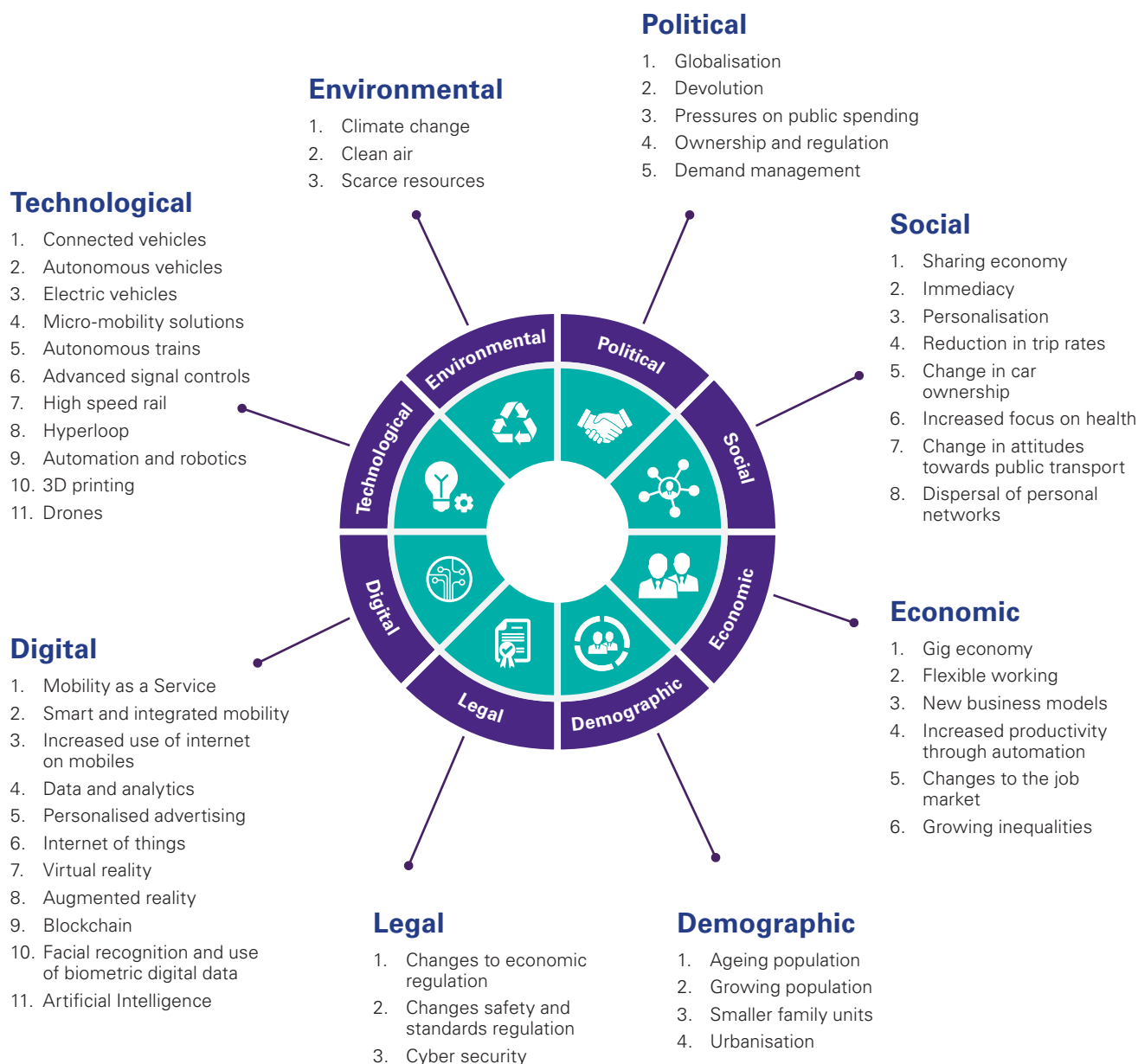
4. Methodology

4.1 Market trends and disruptions

We have considered the potential impact of more than 50 market trends and disruptors on transport needs and choices. 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.

Figure 5: Market trends and disruptors



Source: KPMG analysis

4.2 Transport needs and choices

Given the complexity and interaction between trends and disruptors it is difficult to consider each in isolation and 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 as follows. These themes can be considered as impacting on transport needs and transport choices, where transport needs reflect the underlying reasons to travel, i.e. to participate in various economic and social activities, and transport choices reflect the relative attractiveness of alternative modes of travel. In some ways car ownership falls under both transport needs and transport choices but as household car ownership is closely related to other socio-demographic factors we have included it in that theme.

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 217,551 individuals between 2002 and 2016. That data used during model estimation includes survey respondents from households across Great Britain, including data for Scotland but excluding data for London. 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

Table 2: Transport needs and choices

Transport needs	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 and substitutes for 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.
Transport choices	Theme 4 Changes in price, quality and availability of transport modes	The price, quality and availability of alternative modes including bus, rail, light rail, car, taxi/ Uber and active modes (e.g. walking and cycling). 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 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, 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 Methodology

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 2015/16 using a methodology referred to as Prototypical Sample Enumeration¹⁷. In brief, the models are applied to a sample of travel diary data from 15,200 individuals from 2011. 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 2015/16. 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 authority area in Scotland. 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:

- Theme 4: Changes in price, quality and availability of transport modes.
- Theme 5: Integration between modes.
- Theme 6: Government policy and expenditure.

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 2015/16 in Section 6.

17. Daly, A (1998) Prototypical sample enumeration as a basis for forecasting with disaggregate models, European Transport Conference.

5. Drivers of change



5. Drivers of change

5.1 Introduction

In this section we describe the findings of our analysis of demand drivers covering:

- Theme 1: Socio-demographic impacts.
- Theme 2: Economic and labour market impacts.
- Theme 3: Availability and quality of alternatives to travel.
- Theme 4: Price, quality and availability of alternative transport modes.
- Theme 5: Integration between modes, including better customer information.
- Theme 6: Government policy and expenditure.

Within each theme there are a number of individual drivers of demand, some negative and some positive, that work in combination to influence overall levels of bus patronage.

It is important to note that Theme 5 is forward looking, concerning the potential impact of digitalisation and new business models on patronage and Theme 6 considers the impact of government policy and expenditure on the price, quality and availability of alternative transport modes.

It is not until Section 6 where we consider overlaps and synergies between individual drivers to present an overall view of the relative importance of each.

5.2 Theme 1: Socio-demographic 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 growth and urbanisation.
- Demographic structure, including health and mobility.
- Car ownership, car availability and licence holding.

Population has been growing in Scotland as a result of immigration, 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 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 own a vehicle. Some of these trends may simply be driven by economics – e.g. the relatively high cost of vehicle insurance for young people – other trends may be driven by broader attitudinal changes to education, health, employment and asset ownership, for example.

18. National Records of Scotland.

5.2.1 Population growth and urbanisation

Between 2011/12 and 2015/16 Scotland's population increased by around 2% with much of this increase centred on growth in major urban areas¹⁸. Population in the Edinburgh City Region, including East Lothian, Midlothian and West Lothian, increased by 5.2% between 2011/12 and 2015/16. The Glasgow City Region which including East Renfrewshire, Renfrewshire, West and East Dunbartonshire, and North and South Lanarkshire has experienced 2.7% population growth over the same period. Almost all other areas of Scotland have seen some population growth with the exception of Argyll and Bute (-2%), Inverclyde (-2.5%), and North Ayrshire (-1.6%).

All else equal, we would expect the increase in the population to lead to a proportionate increase in travel demand. However, all else is not equal. We know that the propensity to use local bus services increases with settlement size and population density. Those living in urban conurbations typically make 71% more trips per year by bus than those in urban towns and cities, whilst those in rural towns and villages make 27% fewer, and those in more remote areas make still fewer bus trips.

Part of these differences can be explained by differences in income, employment and car ownership and part can be explained by differences in the supply of bus services. There are significant economies of scale in the supply of bus services, both in terms of operating efficiencies 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.

Based on typical trip rates by area type, we would expect the increase in the population of Scotland from 5.3 million to 5.4 million between 2011/12 and 2015/16 to have led to an increase in the number of bus patronage from 436 million to 445 million trips, with proportionally stronger growth in demand in urban areas.

Looking ahead, the National Records of Scotland expects Scotland's population to rise by 7% over the next 25 years, with the City of Edinburgh and Aberdeen City projected to see relatively large population increases of 21% and 17% respectively, with Glasgow City and Dundee City projected to see much lower growth of 7 and 5% respectively. Population in some areas is projected to fall.

On one hand the expected growth in population in the large urban areas is good news for public transport, especially if new residential and commercial developments are planned and delivered to be accessible by public transport, cycling and walking. On the other hand, expenditure on transport infrastructure, traffic management and public transport operations will be required to provide additional network capacity and mitigate against the negative impacts of congestion and overcrowding.

5.2.2 Demographic structure

In addition to changes to the size and location of the population of Scotland, there have also been changes to the structure of the population between 2011/12 and 2015/16, including an increase in the proportion of the population who are retired, 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 household size.

Historically, both older and younger people have tended to make greater use of bus services than other groups in the population. In part, this is due to discounted fares and concessionary travel entitlements 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 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 a slight reduction in the number of bus trips from 436 million in 2011/12 to 434 million in 2015/16.

These demographic trends are expected to continue with the majority of council areas seeing a reduction in the number of children and a reduction in the population of working age, with all areas expecting to see an increase in the population of pensionable age. The continued provision of discounted and concessionary travel, as well as changes to the propensity to hold driving licences and own vehicles amongst the young and amongst seniors will continue to influence levels of bus patronage.

Transport Scotland recognise the wider economic and social benefits arising from concessionary travel for older and disabled residents¹⁹. They are currently consulting on options for safeguarding the long term sustainability of the existing scheme and on providing concessions for young modern apprentices. Recent analysis shows that concessionary travel for older and disabled people and concessionary travel for apprentices can provide excellent value for money with returns valued at £3.80 and £2.70 for each £1 of expenditure respectively²⁰.

With an increase in the number of people eligible for concessionary travel expected to increase as the proportion of the population aged over 60 increases, Transport Scotland need to make sure that the scheme is properly funded and that operators are reimbursed on a 'no better no worse off' basis. In 2006/7 the reimbursement rate was set at 73.6% of the adult single fare for each concessionary journey and has since gradually reduced to 56.9% of the adult single fare today. There are clearly challenges associated with squeezing reimbursement rate further while maintaining the 'no better no worse off' principle.

5.2.3 Car ownership

Between 2011/12 and 2015/16 household car ownership changed, increasing from 68% of households having access to a car to 70% of households having access to a car. Over the same period, there has been a 2% increase in the proportion of households with access to one car and a 3% increase in the proportion of households with access to two or more cars²¹. These aggregate changes however mask more substantial differences between areas. According to the 2011 Census, Aberdeenshire has some of the highest car ownership levels in Scotland with 85% of households having access to at least one car and Glasgow City some of the lowest levels of car ownership with only 49% of households having access to a car. Since then, car ownership levels have continued to change at varying rates across different areas reflecting absolute levels of ownership and factors such as changing income, employment, population density and other demographic features of local areas.

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:

- Individuals without a driving licence and without access to a vehicle make on average 181 bus trips per year.
- Individuals with a driving licence but without access to vehicle in a household with one or more cars make on average 164 bus trips per year.
- Individuals with a driving licence with part access to vehicle make on average 55 bus trips per year.
- Individuals with a driving licence and full access a vehicle make on average 14 bus trips per year.
- Individuals with a driving licence and full access to a company vehicle make on average 4 bus trips per year.

All else equal, we estimate that changes to car ownership levels across Scotland between 2011/12 and 2015/16 has resulted in a 2.7% reduction in overall bus patronage with relatively large differences between geographical areas reflecting relatively large variations in changes to car ownership.

Following five years of relatively strong growth in new car sales buoyed by the strength of the economy and an increase in consumer credit, the growth in demand for new cars has started to reduce although sales are still strong²². Concerns over vehicle emission, improved propulsion technologies and the prospect of greater levels of automation mean that there is considerable uncertainty surrounding the size and structure of the vehicle market in the longer term.

We know that the young are learning to drive and buying cars much later in life than their parents and this is having knock-on impacts on their travel behaviour in later life²³. The young

19. Transport Scotland (2017) Consultation on Free Bus Travel for Older and Disabled People and Modern Apprentices.

20. 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>.

21. Scottish Transport Statistics No 35, 2016 Edition, February 2017.

22. SMMT <https://www.smmt.co.uk/2017/01/uk-new-car-market-achieves-record-2-69-million-registrations-in-2016-with-fifth-year-of-growth/> [Accessed 10 September 2017].

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

also 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 reduce the pressures to be locked into a single mode and encourage people to make more varied transport choices based on the needs of the specific journey they are making. In the short term however, future trends in car ownership are expected to follow recent trends, abstracting demand from public transport markets and increasing demand for road space.

Public policy needs to continue to focus on managing transport network capacity, investing to renew and enhance transport infrastructure. It also needs continue to integrate land-use and transport planning to support more sustainable travel choices. Innovative and potentially disruptive business models based on shared ownership and use of assets, including cycle hire, car clubs, and demand responsive services, can work with high volume fixed route public transport networks within and between urban areas to deliver Mobility as a Service. It is not yet clear what role the government should have in shaping this market in the near term and how it should support the development of autonomous transport systems in the longer term. There are potentially huge benefits to be gained for those who can embrace the expected changes ahead.

5.3 Theme 2: Economy and labour market impacts

Demand for travel depends in large part 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 Scottish labour market is changing, not just in terms of changes to employment levels but also 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 contracts²⁴. There have also been changes to the balance of employment across industrial sectors and the type of jobs that are available.

Looking further ahead, 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. 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.

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.
- Occupation type.
- Flexible working.

It is important to note that there are aspects of economic structure that 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 Scotland needs to be considered alongside the socio-demographic structure and vice-versa.

5.3.1 Economic growth

Between 2011/12 and 2015/16 real GVA per head across the whole of Scotland increased by around 6% with significant variation in growth between areas²⁵. For example, Aberdeenshire (19%), Clackmannanshire (15%) and East Dunbartonshire (13%) all experienced significant increases in real GVA per head whereas Moray (-7%), West Lothian (-4%) and Aberdeen City (4%) experienced relatively smaller changes to real GVA per head.

The relationship between economic growth - as measured by GVA per head - household income and the propensity to travel by bus is complex. Real wages in Scotland fell by 5% between 2008 and 2012 and have increased only moderately since then, failing to keep pace with GVA per capita. The type of work we do and how productive we are influences the income we earn. On one hand, households with greater disposable income can afford to make more trips but on the other they may substitute some trips for other activities that are less reliant on public transport.

Analysis of NTS travel diary data shows households with lower income make 62% more bus trips than those on middle income and those with higher income make 37% fewer bus trips than those on middle income. These raw statistics however are confounded by other closely related factors such as employment status, occupation type, car ownership and residential location. After these factors have been taken into account the impact of changing income on the propensity to use local bus services is much lower – our econometric analysis suggests that, holding all else equal, a 10% change in household income leads to a 0.3% reduction in bus patronage. Holding all else equal, the increase in real GVA per household across Scotland between 2011/12 and 2015/16 is estimated to have led to a small reduction in bus patronage estimated at a little over a million trips.

5.3.2 Employment status

The total number of people in employment in Scotland has been increasing and the employment rate is currently at 75.2%. Unemployment is low at 3.9% and economic inactivity at 21.8%. The most recent data from the Labour Force Survey indicates inactivity rates in Scotland have been increasing since the start of 2016, having previously been on a slow downward trend since 2013. Part-time employment is up by 10.8% in Scotland since 2008 and full-time employment up 2.1%. The

24. ONS, Regional labour market statistics in the UK.

25. Office for National Statistics.

5 Drivers of change

number of self-employed people in Scotland has also gradually increased over the last decade. Youth unemployment in Scotland is favourable to other parts of the UK and is amongst the lowest in the European Union.

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

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

Holding all else equal and allowing the structure of the labour market to change with regard to changes in employment status in Scotland between 2011/12 and 2015/16 leads to a reduction of 1.7 million bus trips.

In the short term it likely that trends in employment will be similar to today, however, in the medium and longer term greater uncertainty exists around the impact of the United Kingdom leaving the European Union and the impact of technology on the structure of the labour market.

5.3.3 Occupation type

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.

Average bus trip rates per person per year vary considerably by occupation type although it is difficult to see a clear rationale for differences in the propensity to use bus services between occupations that go beyond income, car ownership and employment location.

Some commentators are expecting to see huge changes to the structure of labour markets in the longer term, with jobs and industries being reshaped by globalisation, technology and new business models. It is too early to make anything other than speculative predictions but changes to the location of production and consumption, the distribution of resources, and the nature of work are all likely to change, potentially changing the role of urban areas and transport networks.

5.3.4 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 for at least some of the time. There are also more people whose work involves them attending more than one work site. Data from the Scottish Household Survey shows that the proportion of people who mainly work from home has increased from 10.6% in 2011 to 14.1% in 2015, 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 (albeit based on a data from a relatively small sample of around 2,000 respondents). They estimate that homeworking has increased by 25% over the last five years.

Analysis of NTS data shows those who mainly work from home have a much lower propensity to travel by bus than other groups in the population, with those who work at multiple sites also making fewer trips by bus. We estimate that the impact of increase flexibility on work location is likely to have reduced bus patronage by 0.4 million trips per year in Scotland since 2011/12.

From a customer perspective it is important that public transport operators are able to offer tickets that cater for flexible working and from a public policy perspective, increased flexibility in work hours and location may help to reduce peak loads on transport infrastructure.

5.4 Theme 3: Alternatives to travel

In addition to changing socio-demographic and socio-economic structures influencing the need to travel, there are existing and new technological trends that are influencing the need to travel. The most important of these include online services such as education, banking or shopping delivered by road. The new business and retail opportunities can be attractive for customers as they are able to access products and services more quickly or/ and 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.

5.4.1 Online services and home delivery

Market share and growth in online services and e-commerce are particularly strong in the UK. On average, we each spend £4,600 a year online, more than £1,000 more than Americans do. By 2025, we are expected to reach 2.7 billion parcels a year, more than double the 1.3 billion being delivered this year, according to the online-retailers industry body IMRG. This trend is not only impact on high street retailing and the volume of shopping related trips made by bus. The latest ONS retail statistics show that December's High Street retail figures slumped to their biggest fall for over four years, while online sales rose by 21.3%.

Our econometric analysis of National Travel Survey Data shows that those who buy goods online tend to make fewer trips by bus on average. Relative to those who never buy online, those who occasionally buy goods online make on average 3% fewer bus trips per year and those who frequently buy goods online make on average 25% fewer bus trips per year.

The growth in online services and home delivery appears to have had a relatively strong impact on bus trips. Between 2011/12 and 2015/15 the impact of online services and home delivery is estimated to have led to a reduction in local bus trips by 7.1 million trips per year. A doubling of online delivery could see a further reduction in local bus trips by 17 million trips, excluding the impact of increased traffic congestion as a result of increased use of delivery vehicles.

5.5 Theme 4: Price, quality & availability of alternative transport modes

In this section we consider the price, quality and availability of alternative transport modes. For each mode there are a number of drivers of demand, some negative and some positive, 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.

Customer experience is part of the story and there is a need to develop our understanding of consumer behaviour and choice, starting with how customers recognise that they have a need to travel, their search for information on the choices available to satisfy those needs, the purchase decision itself and the post purchase/post consumption evaluation of those choices. This is important for all journeys but it is arguably more important when looking at behaviours relating to discretionary travel. Within this structure, a better understanding of the factors that influence choice include those factors that are in some sense 'internal' to the customer including their motivations, perceptions and experiences, and those that can be considered as 'external' including attitudes and behaviours of reference groups and society more generally.

Under Theme 4 we consider the impact of changes to the price, quality and availability of:

- Bus services
- Rail services
- Glasgow subway and the Edinburgh tram
- Cars
- Taxis
- Walking and cycling.

5.5.1 Changes within the bus market

Every year, local bus services carry around 400 million trips in Scotland, around 9.5% of all trips made. 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 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.

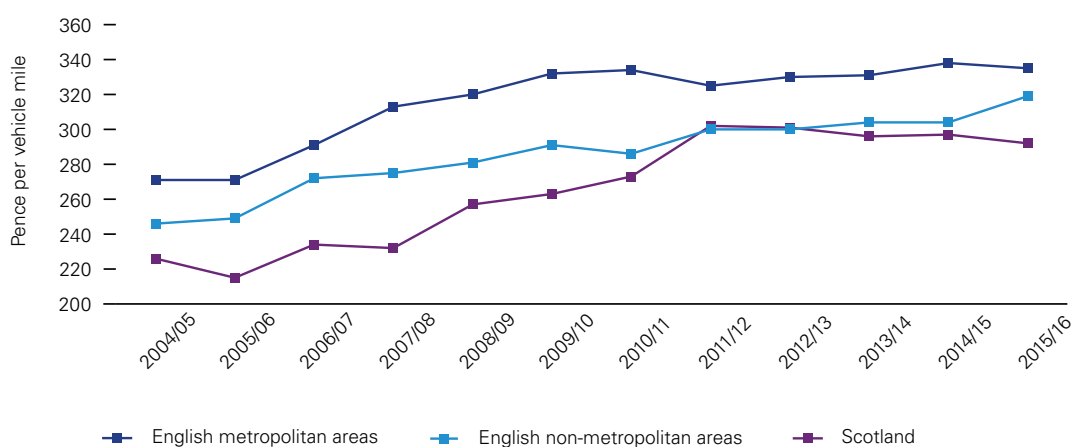
5.5.1.1 Impact of bus fares on bus patronage

Bus fares have risen faster than inflation, increasing by 4.7% in real terms between 2011/12 and 2015/16. This trend is similar to that experienced in England outside London. It has been driven 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 (Figure 6). There has been a material reduction in BSOG payments, falling from a high of £69.9 million in 2009/10 to £53 million in 2015/16. There has also been a reduction in the rate at which operators are reimbursed for carrying concessionary passengers from 73.6% of the adult single fare in 2006/7 to 56.9% of the adult single fare in 2017/18. All three changes have acted to squeeze operator margins and increase pressure on fares.

Part of the reason for the cost increases over the longer term may be linked to rapid increases in drivers' pay throughout the bus industry. Staff costs typically account for between 50 and 70% of total operating costs and the gross weekly earnings of full time bus drivers has risen by 13% in real terms since 2004 relative to 2% across all occupations.

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 1,622 million in 2004/05 to 1,521 million in 2015/16, whilst the total number of employees in the industry has remained almost constant at 123,000. This implies a 5% 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.

Figure 6: Operating costs per vehicle mile (2016 prices)



Source: DfT Bus Statistics 2016

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Increases in real fares are likely to be a leading contributor to reductions in bus demand across Scotland. Depending on the source, evidence on bus fare elasticities of demand are in the region of -0.4 in the short term increasing to -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 436 million local bus trips in 2011/12 in Scotland, and a 4.7% increase in real fares across Scotland observed between 2011/12 and 2015/16, as well as a concessionary rate of 35% (this is the proportion of bus users unaffected by the fare rise), we obtain a reduction in patronage of 1.2% - equivalent to approximately 5 million trips.

As noted above, the provision of local bus services is characterised by strong economies of scale in production. The best way to reduce the cost of providing and using bus services is therefore to increase demand. This has important policy implications that support the provision of concessionary travel to certain 'price-sensitive' groups in the population, the Bus Service Operators' Grant to help keep fares lower and service levels higher than they otherwise might be, and traffic management measures to improve the efficiency of bus operations. All three interventions provide excellent value for money, with each £1 of expenditure generating up to £3.80, £3.70 and £4.90 of benefits for concessionary travel, BSOG and bus priority measures respectively²⁶.

5.5.1.2 Impact of bus 'timetable-related' service quality on bus patronage

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 Scotland are highly congested. INRIX traffic data suggests that Aberdeen and Edinburgh are amongst the most congested cities in the UK with drivers spending an average of 12.3% and 9.8% of the average journey in congested conditions. TomTom traffic index data also provides estimates of

congestion levels and suggests that congestion increases travel times by 40% in Edinburgh and 28% in Glasgow.

Whilst the congestion levels are undoubtedly high, evidence on the rate of increase in congestion over recent years is mixed. Total vehicle miles on all roads has increased by around 6% between 2005 and 2015, but has not changed significantly on urban roads

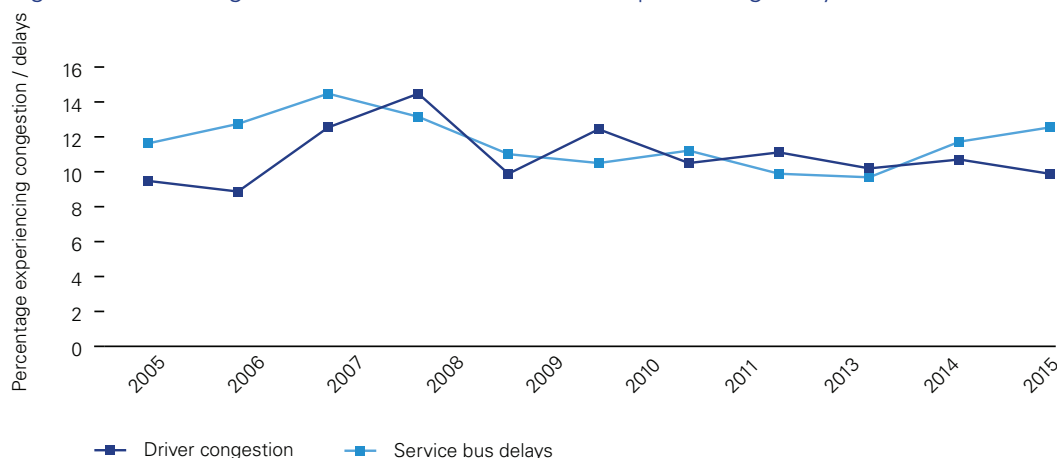
This suggests that congestion may have increased slightly – although the impact of greater traffic could well have been offset by investments in capacity. There is some variation across local authorities with total vehicle miles actually decreasing by 1% in Edinburgh and Aberdeen and 4% in Glasgow over this period.

Based on a survey of around 10,000 drivers, the percentage reporting delays by congestion declined from a high point of 14.4% in 2007 to 9.7% in 2013 but has recently increased to 12.5%. A similar survey of 2,000 bus users shows more variable trends between 2006 and 2015, but have remained relatively stable between 2011 and 2015.

A report by Audit Scotland found that the condition of council maintained roads has deteriorated over the last five years, with the proportion in an acceptable condition falling from 70% in 2005 to 66% in 2011, remaining the same in 2016. Both Edinburgh and Glasgow have experienced a 4% fall in the proportion of acceptably maintained roads within their areas between 2011/12 and 2014/15. This has coincided with a 14 percent reduction in road maintenance funding. Glasgow has cut funding by around 50% over this period, Edinburgh by around 10%. This may have reduced the efficiency of the road network and worsened bus journey times.

Whilst longer and more unreliable journey times clearly have a substantial negative impact on bus patronage levels, we have not included impacts of changes to traffic congestion on bus patronage in this analysis as the changes to traffic levels and congestion have been relatively small at an aggregate level. That is not to say that traffic congestion has not suppressed bus patronage levels (and increased bus operating costs) just that conditions have generally not deteriorated between 2011/12 and 2015/16.

Figure 7: Percentage of car drivers and bus users experiencing delay



26. 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-Source: Scottish Transport Statistics 2016>

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Traffic congestion is a huge challenge across the UK with INRIX estimating that traffic congestion cost the economy more than £30 billion in 2016. By improving the efficiency of transport networks we can reduce the costs associated with delays and poor travel time reliability and go some way towards improving economic productivity, the environment and quality of life. The solution to this problem lies at least in part in making better use of existing road capacity through targeted investment in local bus infrastructure and selective priority measures that encourage people to switch to more efficient mode of transport and improve the performance of the transport network as a whole.

Bus service miles

Total bus service miles in Scotland fell by 3% between 2011/12 and 2015/16, with commercial vehicle miles falling by 1% and supported vehicle miles by 10%. With the North East, Tayside and Central and the South East regions seeing modest increases in service miles and service miles in the Highlands, Islands and Shetland remaining constant, the South West and Strathclyde region has seen a 9% reduction in service miles.

The reduction in service miles is estimated to lead to reductions to bus patronage and service headways are increased, operating hours shortened and network sizes reduced. The impact of changes to vehicle service miles is greater for supported services than for commercial services and largely concentrated in the South West and Strathclyde region.

5.5.1.3 Impact of changes in non-timetable related service quality on bus patronage

Based on the Scottish Household Survey, passenger satisfaction with bus travel is generally good and has generally improved since 2007. Between 2007 and 2014 survey responses show improvements to services running to time, improvements to service stability, improvements to the availability of information about services and fares, and improvements in integration between modes of transport. Respondents are generally less in agreement that buses are environmentally friendly, that they feel safe/secure on a bus during the evening and are satisfied with value for money.

Table 3: Vehicle miles by type of service (millions)

Area/Type	2005 /06	2006 /07	2007 /08	2008 /09	2009 /10	2010 /11	2011 /12	2012 /13	2013 /14	2014 /15	2015/ 16
Scotland	232	239	247	240	234	215	210	203	206	205	204
Commercial	191	191	196	193	188	173	173	163	166	165	170
Supported	41	48	51	47	46	42	37	40	40	40	34
Vehicle miles by Region											
North East, Tayside & Central	35	35	32	34	36	34	34	34	35	35	35
Highlands, Islands & Shetland	24	24	20	17	24	23	21	21	20	20	21
South East	68	69	73	73	66	64	63	63	64	63	64
South West & Strathclyde	106	111	117	116	109	94	92	86	88	87	84

Source: Scottish Transport Statistics 2016

Table 4: Bus passenger satisfaction

Percent agreeing with each statement	2007	2014	Change
Buses run to timetable	71	78	6.9
Buses are frequent	77	N/A	N/A
Service runs when I need it	71	N/A	N/A
Bus service is stable and not regularly changing	80	83	3.4
Buses are clean	72	78	6.1
Buses are comfortable	73	N/A	N/A
Buses are environmentally friendly	N/A	66	N/A
I feel personally safe and secure	80	N/A	N/A
Feel safe/secure on bus during day	N/A	94	N/A
Feel safe/secure on bus during the evening	N/A	69	N/A
Simple deciding what ticket I need	87	89	2.4
Finding out about routes and times is easy	77	86	8.5
Easy to change from buses to other forms of transport	69	75	6.1
Bus fares are good value	63	60	-2.6
Sample Size	2,697	4,070	

Source: Scottish Household Survey

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The findings of the Scottish Household Survey are supported by independent research and analysis by Transport Focus who report that between 86 and 93% of respondents to their large scale survey across Scotland were either very or fairly satisfied with bus services. Transport Focus found some significant variation in performance in different areas and different operators. Overall satisfaction is highest in the South East and South West and lowest in the North East and Strathclyde.

The findings of the passenger surveys reflect changes in bus service quality. Passengers have seen reductions to service delays and the quality of the bus fleet in Scotland has improved significantly over recent years. In 2006 the average age of the bus fleet was 8.5 years, 35% of buses were fitted with CCTV, 22% were fitted with Automatic Vehicle Locators (AVL) and only 29% of buses had an accessibility certificate. In 2015/16 all of these factors have improved. The average age of the bus fleet is 8.0 years. 78% of the fleet is fitted with CCTV, 86% are fitted with AVL. There has also been extensive take up of ITSO smart card readers, with 84% of vehicles so equipped and 92% of buses now have an accessibility certificate.

There is relatively good empirical evidence that positive changes in public transport service quality can have a positive impact on patronage, with the Department for Transport providing guidance on customer willingness-to-pay values for a range of service quality improvements including ticketing, customer information, personal safety and security and vehicle accessibility. When applied to the Scottish Bus market, reflecting difference in perceived service quality by local authority area we estimate that enhancements to non-timetable related service quality are likely to have led to between a 0.5% and a 1.5% increase in demand depending on the local change in service quality.

5.5.2 Changes within the rail market

Every year, 93 million trips are made by rail in Scotland – around 1.7% of the total number of passenger trips made²⁷. The number of rail trips has grown steadily over recent years with the volume of demand increasing by 15% over between 2011/12 and 2015/16. The increase in demand has been accompanied by an increase in supply (scheduled train miles) and increase in network coverage (route miles operated).

Although rail serves a diverse set of geographical markets across Scotland, almost half of total demand is concentrated on short distance flows to and from Glasgow and Edinburgh. Outside of the Central Belt, rail demand is much less concentrated.

Based on data published by the Office of Rail and Road, Glasgow Local Authority area - with 61 rail stations - accounts for around 40% of all station entries and exits in Scotland. Despite having roughly similar population sizes, Edinburgh Local Authority area - with 11 rail stations - accounts for around 15% of all station entries and exits.

Over this period almost three quarters of the change in rail demand in Scotland has occurred at only seven locations:

- Glasgow City (33%)
- City of Edinburgh (9%)
- West Lothian (9%)
- South Lanarkshire (8%)
- North Lanarkshire (6%)
- Renfrewshire (6%)
- Aberdeen City (6%)

Some of the change can be explained by changing demographic and labour market structures and some of the change can be explained by changes to the relative attractiveness of rail relative to other transport modes. Glasgow for example has seen the development of a number of rail-based park and ride sites throughout the area. Since 2008, SPT has invested over £12 million in developing and expanding park and ride projects at Croy, Kilwinning, Carluke, Bellshill, Irvine and Johnstone rail station. These projects include more than 4,000 car parking spaces. SPT is planning to continue to invest in park and ride sites as part of its Regional Transport Strategy.

It is likely that growth in rail use has had an impact on demand for bus travel, especially in urban areas with relatively dense rail networks. Based on published diversion factors for urban areas, we might expect up to 5 million of the 12 million new rail trips to have been diverted from bus as a result of changes in the relative attractiveness of rail and bus.

5.5.2.1 Impact of changes to rail fares on bus patronage

Rail fares in Scotland are relatively low with revenue per passenger mile for Scotrail services ranked 16th lowest from a total of 19 rail franchises in Britain. The core Anytime, Off-Peak and Season fares make up the majority (c80%) of fare types used and all three are regulated under Transport Scotland's Fares Policy. A further 5% of rail passenger revenue is associated with multi-modal, concessionary and discount schemes which are protected under the Franchise Agreement.

Table 5: Scottish passenger rail demand and supply

	2011/12	2012/13	2013/14	2014/15	2015/16
Passenger journeys (million)	81.10	83.25	86.34	92.68	93.21
Passenger miles (million)	1,667	1,686	1,757	1,877	1,786
Scheduled train miles (million)	27.22	27.59	27.56	28.20	27.55
Route miles operated	1,905	1,905	1,905	1,905	1,939

Source: Transport Statistics Great Britain, 2016

27. Transport and Travel in Scotland 2015.

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Table 6: Revenue per rail journey in Scotland

Local Authority	2011/12	2012/13	2013/14	2014/15	2015/16
Revenue per journey (£ 2016/17 prices)	4.36	4.42	4.62	4.57	4.51
Revenue per passenger mile (£ 2016/17 prices)	0.06	0.06	0.06	0.06	0.06

Source: Office of Rail and Road

As a consequence of regulation, rail fares have remained relatively stable between 2011/12 and 2015/16, moving in line with general price inflation.

Transport Scotland's current rail fares policy is set at RPI plus 0% for peak fares and RPI minus 1% for off-peak fares. Off-peak regulated fares make up around a third of all regulated fares. Given these constraints, it is unlikely that changes to rail fares themselves has had a significant impact on bus patronage, although it is important to note that bus fares have become comparatively more expensive over the period largely due to rising bus operating costs. That said, since the start of the most recent Scotrail franchise off-peak regulated fares are getting cheaper.

5.5.2.2 Impact of changes to timetable-related rail service quality on bus patronage

The supply of scheduled train miles in Scotland has generally increased in recent years with total train miles increasing by 1.2% between 2011/12 and 2015/16. This is likely to have had a positive impact on rail demand, driven in part by abstraction from local bus services. The increase in rail service miles is however relatively small and therefore likely to have had only a modest detrimental impact on bus patronage.

5.5.2.3 Impact of changes to non-timetable-related rail service quality on bus patronage

Satisfaction with rail services has generally improved over time in Scotland. Customers report increased levels of satisfaction with how operators deal with delays, how station staff deal with requests, the station environment, ticket buying facilities and overall value for money. They have also noted relatively little change or a deterioration in satisfaction with timetable related service quality including service frequency, journey times and punctuality and reliability.

The changes in satisfaction ratings reflect what we have observed on fares and train service miles remaining relatively constant over the period. Changes to non-timetable related service quality will undoubtedly play a part in retaining existing rail customers and attracting new ones but given the size of the changes these are only likely to have had a small impact on rail demand and an even smaller impact on bus patronage arising from customer switching modes.

5.5.3 Edinburgh Tram and Glasgow Subway

Edinburgh Tram began operations in 2014/15 attracting 4.1 million journeys. Since then demand has risen to 5.6 million journeys in 2016/17. The introduction of the service is likely to

Table 7: Customer satisfaction with rail services in Scotland

Passenger satisfaction with Scotrail services	Percentage who were satisfied or said good				
	2011	2012	2013	2014	2015
Overall opinion of journey	88	89	88	89	89
How deals with delays	34	39	42	47	50
Value for money	57	52	50	58	60
How station staff handle requests	89	90	87	90	93
Overall station environment	76	76	74	80	81
Ticket buying facilities	80	82	81	79	85
Information on departure times and platforms	85	88	85	87	87
Punctuality / reliability	84	87	83	84	85
Length of journey time	90	91	90	89	89
Ease of getting on/off	87	88	87	88	87
Amount of seats / standing space	73	78	78	77	75
Frequency	83	82	83	83	83
Train Cleanliness	80	83	82	83	78
Comfort of seats	80	81	80	81	82

Scottish Transport Statistics 2016

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have had a significant impact on travel within the city centre – although it is not clear how much demand has been abstracted from bus and how much the integration between bus and tram has helped to improve the attractiveness of public transport over private transport. Around 16% of tram users arrive at the tram stop from a bus – against 63% arriving on foot, and 13% use bus for their onward destination.

Data for Glasgow Subway shows that between 2011/12 and 2015/16 train miles increased by 2% and average revenue per passenger increased by around 15% in real terms reflecting changes to the fare tariff and fare levels. Demand for services has fallen over the period moving from 12.9 million trips in 2011/12 and 12.7 million trips in 2015/16.

5.5.4 Changes in car use

In this section we review the impact of car use on bus patronage - car ownership and driving licence holding is considered under socio-demographic trends (Theme 2).

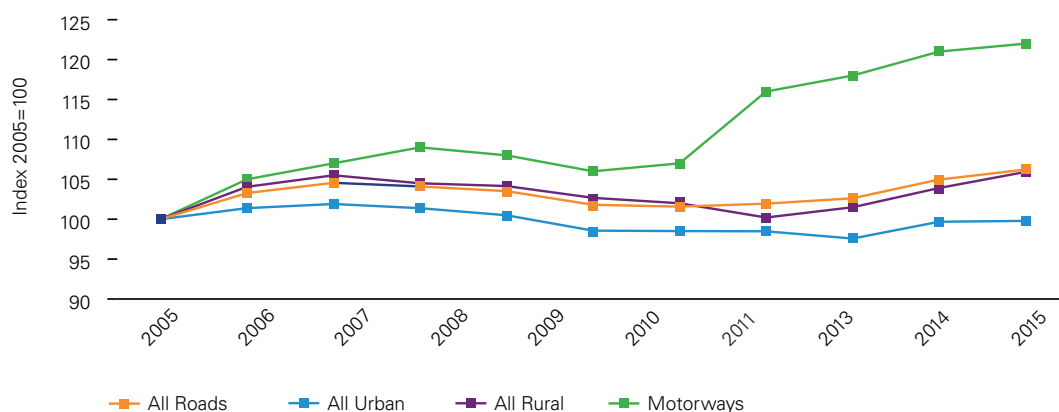
Car has an average mode share of 63% for journeys in Scotland. More than 28 billion vehicle miles were driven in 2015/16 increasing by 5% from 26.6 billion vehicle miles in 2011/12²⁸. There has been significant variation in growth across different road types and areas of the country. Motorway vehicle

the case therefore that declining rates of personal shopping trips (either by car or other modes) are effectively being replaced with home deliveries.

These reductions in car use are supported by trip rate data which indicates that car mode share as a percentage of all journeys has actually declined from 70% to 63% between 2005 and 2015.

Use of cars is influenced by the macro-economic cycle, with demand falling during the Great Recession 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). Regional variation in parking policy is likely to play an important role in bus use. Edinburgh, for example, has implemented a Controlled Parking Zone across a large area of inner Edinburgh, generally discouraging commuter parking, whereas Glasgow has seen a significant increase in parking. Glasgow City now has approximately 10,000 spaces available in over 25 dedicated car parks across the city centre. In particular, inexpensive temporary car parks have sprung up across the city on vacant land as building work slowed in response to the recession²⁹. On-street parking is also available throughout the city centre.

Figure 8: Change in vehicle miles by road type



Source: Scottish Transport Statistics 2016

miles have increased the most – by around 14% over this period with a particularly large increase in 2012. In contrast, urban and rural road miles have been relatively stable. Total vehicle miles show significant variation by council area.

The increase in overall traffic has been driven in part by an increase in usage of light goods vehicles. Total vehicle miles for this class of vehicle has increased by 14% across all roads types, with HGV vehicle miles remaining relatively stable. This is a significant change in patterns of vehicle usage and may be indicative of broader economic trends such as the growth of the parcel delivery business linked with internet shopping and associated online activities. Ofcom data shows strong growth in parcel volumes with year-on-year growth at 12%. It may be

The total cost of motoring, including the purchase price, maintenance costs, fuel costs, tax and insurance, has fallen by 13% in real terms between 2011 and 2015.

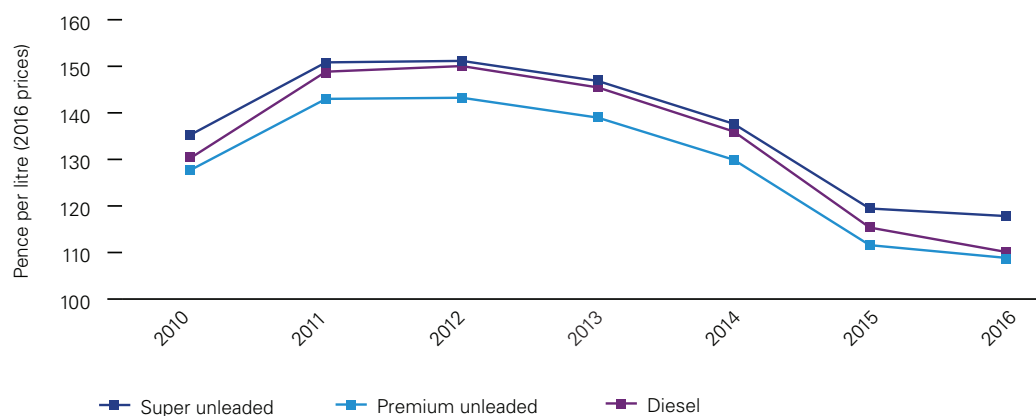
5.5.4.1 Impact of fuel costs on bus patronage

Fuel prices are an important part of vehicle use costs and are an important determinate of vehicle use. Empirical evidence suggests that a 10% reduction in fuel cost leads to a 1 to 2% increase in vehicle use in the long run. Around a third of this increase comes from a change in vehicle ownership with the remainder coming from a change in the intensity of vehicle use³⁰. Part of the trips that are generated by lower fuel prices are likely to transfer from other modes including local bus services.

28. Scottish Transport Statistics No 35, 2016 Edition, February 2017.

29. Glasgow City Council (2015) Glasgow City Transport Strategy 2014-2024.

Figure 9: Typical retail prices of petroleum products (2016 prices)



Source: Transport Statistics Great Britain 2016

Over recent years average fuel prices for a litre of premium unleaded first increased from £1.28 in 2010 to £1.43 in 2012 and then fell to £1.09 in 2016.

Vehicle fuel efficiency is increasing, reducing the cost of use still further. There are also signs that battery technology is dramatically improving making electric vehicles a much more viable option. These trends have an important policy implication for the way the government taxes the ownership and use of vehicles. The proportion of total tax revenue from fuel duty is falling and is expected to continue to fall if fuel efficiency of new vehicles keeps increasing. The Office for Budget Responsibility forecasts that revenues from Fuel Duty will reduce from 1.4% of GDP in 2016/17 to 1.28% by 2020/21.

The potential solutions to this 'problem', including road user charging, can be complex and controversial but the options need to be developed relatively quickly if we are to avoid creating a gap in funding for transport and other expenditures. This is largely the responsibility of central government but can also be considered by local bodies.

5.5.4.2 Impact of changes to highway congestion on bus patronage

Transport Scotland have observed varying trends in journey delays experienced by car drivers and bus users. The Great Recession that followed the financial crisis of 2007/8 provided some respite from the growth in traffic levels and traffic congestion. Since 2013 however traffic levels have risen quite dramatically, leading to heightened levels of congestion adversely impacting all road users. It is difficult to say what will happen in the medium to longer term, given uncertainties on the structure of the labour market and the rise of automated vehicles, but in the short term growth in traffic levels will likely continue placing increased pressure on our roads.

5.5.5 Changes in the number of taxis and private hire vehicles

There are 23,000 taxis licensed in Scotland, including 12,000 private hire vehicles. Glasgow and Edinburgh account for a large proportion of these, with 4,600 and 2,800 licensed vehicles in each respectively³¹. The latest statistics show an increase of 1,441 private hire vehicles in 2015. The mode share for taxi and private hire vehicles has fluctuated over time and is currently at 1.3%. Private hire licences increased by 25% in Glasgow and 14% in Edinburgh between 2005 and 2016. Increases in private licence vehicles is less apparent across other areas although there have been big proportional increases in Aberdeen and Dundee.

This data however does not pick-up demand for services like Uber, which launched in some Scottish cities in 2015. According to local news reports, in the first year of operation, 80,000 people in Glasgow had made use of Uber services with 15% of the Glasgow population having used the service at least once.

5.5.6 Changes in walking and cycling

Active modes – walking and cycling – are popular in Scotland, showing a combined mode share of 22.8% for all journeys. In general, these are chosen for short distance travel as the average journey time for walking and cycling is 14 and 22 minutes respectively.

It is difficult to get a true picture of trends in walking as data collection methodologies are not always accurate and respondents to travel surveys often fail to record short trips. Data imperfections aside, walking trip rates appear to be falling quite dramatically along with walking mode share which fell from 26% to 21.6% between 2012 and 2015 according to the latest Scottish Household Statistics (2015).

The total traffic volume of cycle trips in Scotland has increased by around 151 million miles in 2005 to around 213 million miles in 2015. Over the same period the proportion of people using cycle as their main mode has risen from 0.8% to 1.2%³². Based on the Census between 2001 and 2011 the proportion

30. Hössingera, R., Linka, C., Sonntagb, A. and Starke, J. (2017) Estimating the price elasticity of fuel demand with stated preferences derived from a situational approach, Transportation Research Part A – Policy and Practice.

31. Scottish Transport Statistics No 35, 2016 Edition, February 2017.

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of people cycling to work across Scotland increased from 1.3% to 1.5%.

The majority of the increase in cycling has occurred in the major cities. Edinburgh and Glasgow have experienced large increases in the proportion of people cycling to work and overall traffic has risen year-on-year. Rates in Glasgow increased from 1% to 1.6%. Rates of cycling are considerably higher in Edinburgh, and have also increased from 3% to 4.3% over this period. Glasgow City Council has commissioned an annual count of cyclists entering cordon sites across the city. This has shown continuous growth in trips both to and from the city with a total increase of 85% between 2009 and 2016 with 9,689 trips recorded entering the city over a two day period.

There has been extensive policy intervention and investment to encourage cycling and this may have resulted in some direct abstraction from bus services. Some policy measures such as the introduction of 20mph speed limits in city centres may also have impacts on bus services.

Between 2006 and 2015 Glasgow's cycle network has more than doubled from 72 miles to 195 miles of dedicated cycle routes with further routes in development. In 2014 the city launched a new Mass Automated Cycle Hire (MACH) scheme providing 400 bikes for public hire at 31 locations across the city, including temporary sites at six of the Commonwealth Games venues. The MACH scheme has been expanded and now has 485 bikes across 43 stations. The scheme achieved 118,000 rentals in its first 18 months of operation and the council has plans to expand the scheme.

The Glasgow City Centre Transport strategy includes objectives to introduce a series of segregated cycle routes through the city centre, restrict traffic and alter parking and provision and promote the introduction of bus gates and wider infrastructure improvements in part of the city. The strategy notes that there are challenges with bus stop congestion in parts of the city.

The Edinburgh transport strategy has similar initiatives and intends to increase the proportion of the Roads and Transport budget dedicated to cycling to 8%. The city has 191 miles of cycle routes (122 of which are traffic free) and 33% of streets have a 20mph speed limit to encourage cycling. There are plans for a bike hire scheme and new segregated cycle lanes.

5.5.6.1 Impact of increases in cycling on bus patronage

The key factors driving demand by active modes include journey times, the quality of public realm and infrastructure, safety and, for cycling, availability of cycle parking and cycle hire. In terms of commuting, other factors such as the availability of showers at employer's locations play a role in people's decisions to run or cycle to their office.

Demand for cycling across Scotland has increased significantly over the last decade, partly as a result of policy changes and investments encouraging active modes of travel. This is important for bus demand as the diversion from bus to walk and cycle is relatively high at 42% - meaning that for a decrease in bus demand of 10 trips, 4 trips would switch to either walk or cycle. We have estimated the decrease in bus trips that an increase in cycling may have led to during recent years. Taking an average cycling trip length of 2.9 miles (Cycling Scotland 2017), and assuming a change in 22.4 million cycling miles

from 2011/12 to 2015/16, we have estimated a change in bus trips of 0.8 million bus trips.

From a policy perspective, the Scottish Government is encouraging the use of active and sustainable modes. This includes for example projects such as the 'Smarter Choices' programme, which provides funding for local authorities to encourage less car use and more journeys by foot, bicycle, public transport and car share. This programme, which allocated funding for the first time in 2015/16, has led to an increase in walking and cycling according to the programme evaluation.

5.6 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.

5.7 Theme 6: Government policy and regulation

There are good reasons why governments intervene in local bus markets, not least because of the wider economic, social and environmental benefits that good local bus services can deliver.

Table 8 shows that central and local government have the ability to influence transport markets through different policy instruments including: tax and spending, land-use planning, environmental policies, licencing and regulation.

Total expenditure

In 2015/16 total government expenditure on transport in Scotland was £2,708 million. Two thirds of this total was expenditure by central government and a third by local government. In terms of the breakdown of expenditure, 44% was spent from capital accounts and 56% from revenue accounts. Expenditure on roads totalled £1,095 million, expenditure on rail £621 million, expenditure on buses £112 million, with the remainder spent on concessionary travel for older and disabled people, other local public transport, airports and aviation, ferry services and canals.

32. Cycling Scotland, Annual Cycling Monitoring Report 2017.

5 Drivers of change

Table 8: Policy levers at national and local levels

Policy levers applied nationally	Policy levers applied locally
– Bus Service Operators’ Grant	– Supported services
– Concessionary travel	– Partnerships and contracts
– Licensing and quality regulation (UK wide)	– Traffic and demand management
– Environmental standards (UK wide)	– Land use planning
– Competition Law (UK wide)	– Infrastructure investment

Source: KPMG analysis

Revenue expenditure

Figure 10 show that between 2011/12 and 2015/16, government revenue expenditure on bus services in Scotland fell by 11% in real terms. Of the total reduction in expenditure, £10.5 million was down to the reduction in BSOG and £2.2 million down to the reduction in expenditure on supported services.

Infrastructure expenditure

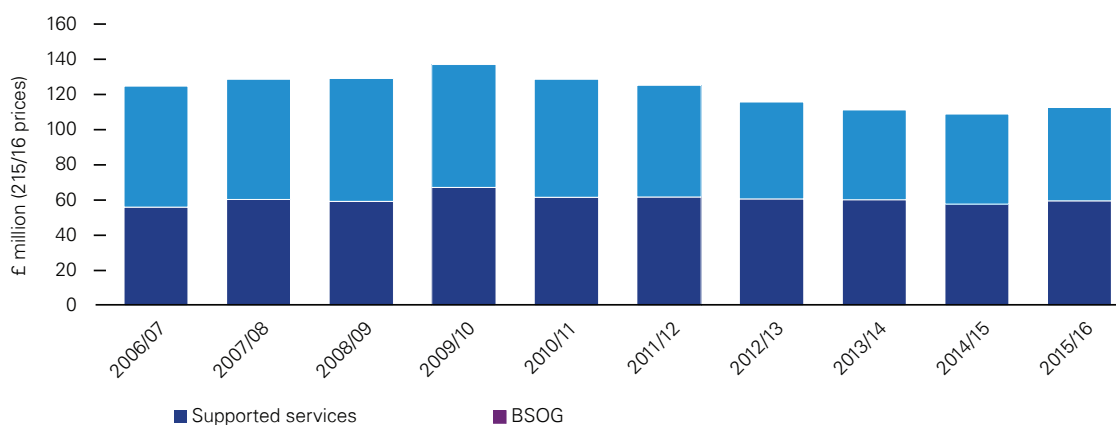
Central government expenditure on capital and current support to transport industries in Scotland has increased by 22% from £1,652 million in 2011/12 to £2,015 million in 2015/16, including £217 million on the Forth Replacement Crossing. Gross capital expenditure on local transport increased by 8% in nominal terms for new roads construction and improvements, and reduced by more than 50% for public transport investment.

Devolution has played an important role in Scotland in funding transport infrastructure investment. In August 2014, Glasgow and the Clyde Valley became the first area in Scotland to agree a City Deal. In 2016 deals were agreed for Aberdeen and Inverness. Edinburgh and South East Scotland agreed the latest deal in July 2017, and deals for Ayrshire, Stirling and Tayside are in negotiation.

Environmental standards

Air quality is an increasing problem across Scotland, in large part due road traffic and in particular to cars - modern diesel cars produce ten times more toxic air pollution per litre of fuel consumed than heavy trucks and buses. This is particularly relevant in the context the Scotland has some of the most congested cities in the UK. The pollutants emitted as a result of road traffic are estimated to contribute to significant numbers of early deaths every year. The Scottish Government aims to address this with policies aimed at reducing the need to travel and increase the uptake of sustainable travel options where travel is unavoidable. The Government has a commitment to introduce Low Emission Zones into Scotland’s four biggest cities by 2020³⁴.

Figure 10: Government revenue expenditure (2015/16 prices)



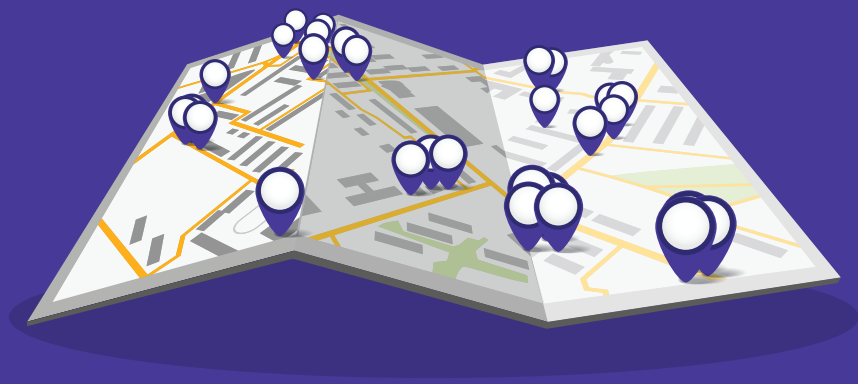
Source: Scottish Transport Statistics 2016

33. Scottish Transport Statistics No 35, 2016 Edition, February 2017.

34. Scottish Government (2017) A Nation With Ambition: The Government’s Programme for Scotland 2017-18, September 2017.

6.

Market analysis



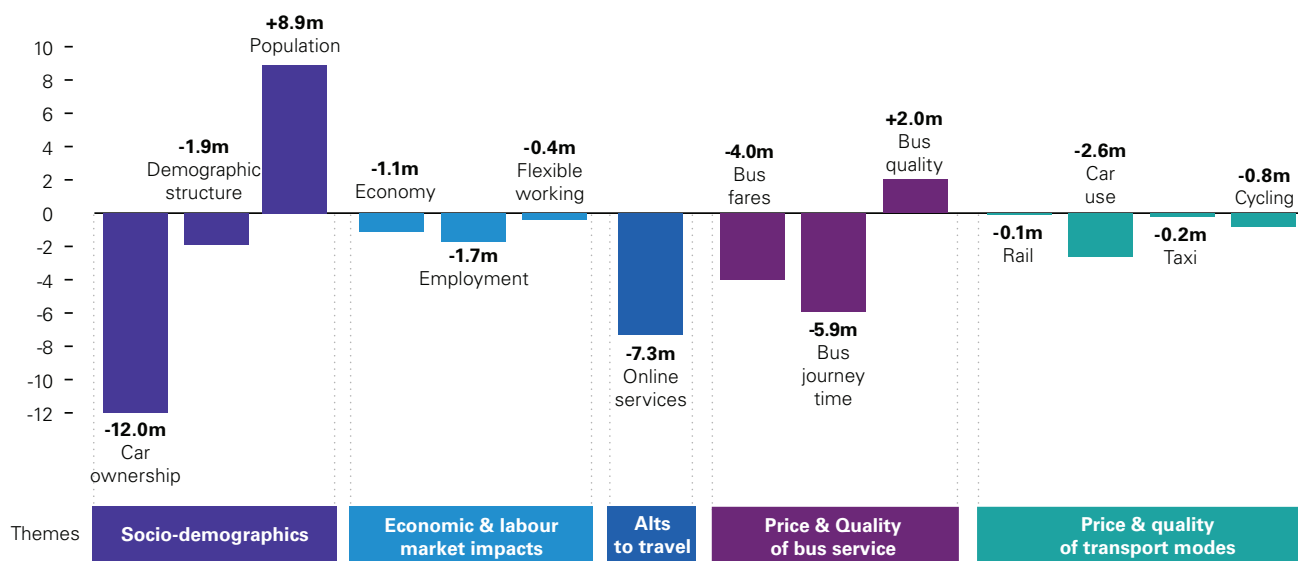
6. Market analysis

6.1 Introduction

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 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.

Our analysis shows that a little over a half of the reduction in bus patronage can be explained by changing transport 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 change in bus patronage can be explained by changes to the price, quality and availability of alternative transport modes. It is important to note that there is significant variation in patronage and patronage trends between areas driven by differences in these factors as well as wider differences in operator performance and local transport policy.

Figure 11: Changes in Scottish bus journeys by demand driver (2011/12 to 2015/16)



Source: KPMG analysis

6.2 The whole story

Figure 11 provides a summary of the impact of different demand drivers on bus patronage levels between 2011/12 and 2015/16. Of the net reduction of 27 million trips, increasing car ownership explains a reduction of 12 million trips, the increase in online services and home deliver explains a reduction of 7.3 million trips, reduced bus service miles and increased journey times account for 5.9 million trips and increases in bus fares account for a reduction of 4.0 million trips. Other drivers, such as competition from rail, taxis and cycling, together explain a reduction of 8.7 million trips. In addition, the negative demand drivers are offset by increases in population levels and improvements to bus service quality both of which would be expected to increase patronage by around 10.9 million in total.

6.3 Immediate policy implications

It is clear that the bus sector in Scotland is facing some very strong challenges as a result of changing transport needs and continued competitive pressure from private transport.

The changing structure of labour markets with more flexible employment contracts and more self-employed workers, the changing location of production and consumption of goods and services, and the availability of technology and new business models all increase the revenue risk borne by bus operators.

These trends are likely to continue to create a powerful drag on bus patronage, increasing the revenue risk borne by bus operators. The magnitude of the change 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.

The challenges facing the market are tough but there are examples of local bus markets in Scotland, 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.³⁵

Customers respond positively to 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. Some of this is under the control of bus operators and some under the control of central and local government. This may also 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 Scotland's major cities. 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 Scottish towns and 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.

6.4 Looking further ahead

History tells us that we have had relatively limited universal 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 each 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 make use of existing policy levers to implement a package of measures to reduce bus journey times, increase service reliability and improve service affordability.

The policy debate needs to reach beyond ownership and regulation of local bus markets to consider alternative ways in which operators and local authorities can form alliances to meet the challenges ahead. This can be achieved 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 Scotland's changing economic and social needs.

35. 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 specification

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 trips in a given local authority area in the after situation (A) is equal to the total volume of trips in the before situation (B) multiplied by an index of the change in bus trips caused by changing needs (I_N) and an index of the change in bus trips 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 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 217,551 individuals between 2002 and 2016. That data used during model estimation includes survey respondents from households across Great Britain, including data for Scotland but excluding data for London. 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:

- 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 trips 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:

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

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 :

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

The estimated models are shown in Table A1.

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 and those who live in Scotland have a higher propensity to use buses than those who live in the rest of Great Britain outside of London. 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 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	-5.90***	-2.30***	-29.41***	-13.26***	-2.78***
Sex (Base=Female)	Male	Dummy	-1.10***	-0.90***	-0.25	-0.39	-0.01
Age (Base = 26-64)	<17	Dummy	-1.28**	0.34**	8.64***	-3.81**	0.27**
	17-25	Dummy	0.05	-0.36***	7.13***	-1.09**	0.55***
	65+	Dummy	-0.8	0.79***	-7.61***	-1.01	0.08
Driving Licence (Base = No)	Yes	Dummy	-1.24***	-0.38***	-1.62**	0.17	-0.51***
Car access (Base = No)	Yes – Full	Dummy	-11.47***	-2.98***	-12.33***	-6.42***	-2.34***
	Yes - Part	Dummy	-2.64***	-1.26***	-2.90***	-2.24***	-0.94***
Company car	Main driver	Dummy	-7.81***	-2.48***	-5.74	-0.93	-1.37***
Self-employment (Base = No)	Self-employed	Dummy	-3.23***	-0.36**	-3.10**	0.52	-0.46***
Employment (Base = Full Time)	Part time	Dummy	-1.03***	1.09***	10.75***	1.00***	1.08***
	Unemployed	Dummy	6.28***	-0.05	0.6	4.28***	0.80***
	Retired	Dummy	-5.27***	0.66***	-2.92**	-4.08***	0.37**
	Student	Dummy	7.58***	-0.61***	9.34***	-0.04	0.31**
	Other	Dummy	-4.95***	-3.33***	0.15	-6.57**	-0.69***
Employment SEG (Base = Professional)	Managerial	Dummy	-1.03**	-0.33**	-0.04	-0.58	-0.34**
	Skilled non-manual	Dummy	0.38	-0.06	0.85	-3.04***	-0.23*
	Skilled manual	Dummy	-2.83***	-0.09	0.28	-3.27***	-0.52***
	Partly skilled	Dummy	-2.45***	0.1	0.3	-2.36***	-0.42***
	Unskilled	Dummy	-2.39***	0	-2.78*	-1.50*	-0.53***
Disability (Base = No)	Yes	Dummy	0.21	-0.41***	-2.09	0.58	-0.35***
Household Income (Base = Low)	Medium	Dummy	0	-0.08	-0.34	-0.65*	-0.17***
	High	Dummy	-0.33	-0.37***	-0.1	-0.55	-0.37***
HH Structure	# Adults	Continuous	0.70***	0.26***	0.70***	0.32*	0.13***
	# Children	Continuous	-0.72***	-0.19***	0.17*	-0.70***	-0.34***

Appendix 1 - Analytical framework specification

Group	Variable	Variable Type	Journey Purpose				
			Commute	Shopping	Education	Business	Other
HH Structure	# Adults	Continuous	0.70***	0.26***	0.70***	0.32*	0.13***
	# Children	Continuous	-0.72***	-0.19***	0.17*	-0.70***	-0.34***
Location (Base = Urban City and Town)	Urban Conurbation	Dummy	2.61***	0.87***	2.32***	1.82***	0.91***
	Rural Town and Fringe	Dummy	-0.68**	-0.54***	1.90***	-1.02	-0.41***
	Rural Village	Dummy	-2.93***	-1.31***	3.39***	-2.53**	-1.13***
	Scotland	Dummy	3.24***	0.74***	2.42***	2.24***	1.22***
Car ownership (Base = No Car)	1 car	Dummy	-1.69***	-2.23***	-2.06***	-0.64	-2.33***
	2+ cars	Dummy	-3.86***	-3.31***	-2.59***	-1.85***	-3.61***
Bus difficulties	Bus diff	Dummy	-10.21***	-7.86***	-13.68***	-7.95*	-7.68***
Bus access	log of walk time to stop	Continuous	-0.99***	-1.07***	-0.96***	-0.36	-0.82***
Rail access	log of walk time to station	Continuous	1.48***	0.51***	1.09***	0.61**	0.43***
Taxi user (Base = No)	Yes	Dummy	0.82***	0.60***	0.12	0.82**	1.33***
Work from home (Base = No)	Yes	Dummy	-11.02***	0.13	1.25	-0.58	0.07
Work diff place (Base = No)	Yes	Dummy	-3.79***	-0.49***	-1.16	0	-0.21
Online activity (Base = No)	Online delivery Infrequent	Dummy	0	-0.16***	-0.21	0.42	0.01
	Online delivery Frequent	Dummy	-0.48*	-0.51***	-0.68*	0.69	-0.23***
Time trend	Year	Continuous	-0.49	0.1	-0.81*	1.29	0.49***
Scale	Scale	Scale	1.48***	0.78***	1.68***	1.15***	0.84***
AIC			75253.5	189376.6	76239.2	11564.2	224117.8
BIC			75819.5	189942.6	76805.2	12119.8	224683.8
Log Likelihood			-37571.7	-94633.3	-38064.6	-5728.1	-112003.9
Deviance			34884.0	94275.3	37231.8	7646.2	111813.3
Total			217551	217551	217551	217551	217551
Left-censored			210528	195608	211205	216800	192377
Uncensored			7023	21943	6346	751	25174
Right-censored			0	0	0	0	0
Wald Test			5861.24	18414.11	3859.28	483.93	16926.1

Source: KPMG Analysis

Note: *** Statistically significant at 1% level
 ** Statistically significant at 5% level
 * Statistically significant at 10% level

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 authority area in Scotland for 2011/12 and 2015/16 as described below.

This approach rests on the assumption that the sample (usually the sample on which the model is estimated) is representative of the population and that the forecast demand (Q) is simply the expected demand for each individual summed across all individuals in the population:

$$Q = \sum_{i=1}^N w_i E(y_i)$$

Where $E(y_i)$ is the expected use of bus for individual i and w_i is a weight or expansion factor attached to individual i in order to make its sum representative of the population. If the sample is representative, the weight for each observation is simply equal to the number of decision-makers in the population divided by the number of decision makers in the sample.

If the sample is not representative of the population, perhaps because the model is being used to forecast in a different geographical area or in a time period some time into the future, then the sample needs to be adjusted so that it can be considered to be representative. A solution proposed by Daly and Gunn³⁶ involves adjusting the weights w_i so that the new weighted base sample has the same aggregate characteristics as those published by planning authorities (e.g. the sex and age distribution of the population). The problem here is that we need to find a balance between generating a new sample that is consistent with the base sample, while also achieving consistency with such aggregate statistics as are available.

Rather than re-weight each individual separately, individuals are grouped into a number of pre-defined categories (c) that cover the main dimensions of the sample e.g. household size, numbers of adults, number of children, and car ownership. The new frequencies of household in each category (ϕ_c) are determined by minimising the following equation with respect to ϕ_c .

$$Y = \sum_t k_t \left(z_t - \sum_c \phi_c x_{tc} \right)^2 - \sum_c (\phi_c - f_c)^2$$

Where:

- t is a vector of target variables shown to represent the aggregate characteristics of a given target area in a given time period
- k_t is the weight attached to the importance of meeting target t
- z_t is target statistic t divided by the total number of individuals in the target area
- x_{tc} is the average amount of target variable t for an individual in category c
hence $\sum_c \phi_c x_{tc}$ is the predicted total value per individual of statistic t
- f_c is the frequency of individual category c in the base sample.

Note that all terms of are on a per-individual basis. The first term in y represents the error in not meeting the target marginal totals for each variable z , while the second term represents the divergence from the current distribution of households over the categories. The weights w are introduced so that differential importance can be given to meeting each of the different targets or that the balance between consistency with targets and consistency with base population can be adjusted. Setting large values of w would cause the optimisation to find a distribution of individuals that matched the target totals very well at the expense of substantial departures from the original distribution.

The advantage of the method described here is that a close fit to the 'targets' is obtained quickly and reliably with minimal departure from the original distribution. A further advantage is the flexibility available to the user to shift the balance between meeting the targets and maintaining the original proportions. It might seem useful, for example, to keep more closely the original proportions in a base year and to give more weight to the targets for a forecast year: this would be achieved by giving higher values to w_t for the forecast year than for the base year. Similarly, more important targets can be given more weight if required.

The models in Table A1 are applied to generate ownership forecasts by individual category for each of the 32 local authority areas using the prototypical sample enumeration technique described above. The five stages to model application are described below.

- Base sample definition. The base sample to be enumerated includes data from the 15,200 individuals responding to NTS travel diary surveys in 2011. This includes data from Great Britain outside London.
- Target area definition. The second stage is to define a set of geographical areas (referred to as target areas) for which the forecasts are required. In this instance, the target areas comprise the 32 local authority areas in Scotland
- Forecasting period definition. Forecasts are required for 2011/12 and 2015/16.

36. Daly, A.J. and Gunn, H.F. (1985) Cost-Effective Methods for National-Level Demand Forecasting, IATBR Conference, Noordwijk.

Appendix 1 - Analytical framework specification

- Target variable definition. The aggregate socio-demographic characteristics of each target area in each time period are described in terms of target variables, are classified according to total population, numbers of households, employment levels, age distribution, employment type, and car ownership.
- Individual category definition. Rather than re-weight each observation in the sample separately, individuals are grouped into 192 pre-defined categories that cover the main dimensions of the sample and weights are calibrated and applied to each category of household.

Based on the reweighted sample of individuals, forecasts of local bus demand were made for each local authority in 2011/12 and in 2015/16. The forecasts were made in stages allowing for the incremental impact of each individual demand driver to be assessed for each local authority area. The forecasts are then used to create indices of changing transport needs (IN).

Index of changing transport choices

We specify a series of direct demand models for each local authority area in Scotland. 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.
- Integration between modes.
- Government policy and expenditure.

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: Direct demand model elasticities

	Bus	Rail	Tram / Subway	Taxi	Car
Fares	-0.6	-0.9	-0.6	-0.6	-0.1
GJT	-1.1	-0.9	-1.1	-0.6	-0.2

Source: KPMG Analysis

The own elasticity estimates shown in Table A2 are transformed to cross elasticity estimates based on the following expression:

$$\epsilon_{ij} = -\epsilon_{jj} \frac{s_j}{s_i} \theta_{ji}$$

The cross-elasticity of demand for mode i with respect to the price/ generalised journey time of mode j can be deduced from the own elasticity of mode j, the relative market share each mode and the diversion factor (this is the share of demand transferred from mode i to mode j if mode i is no longer available). The diversion factors used in this analysis were taken from Balcombe et al (2004)³⁷.

37. Balcombe et al (2004) The Demand for Public Transport: A Practical Guide. Transport Research Laboratory.



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Our work commenced on 27 June 2017 and was completed on 13 October 2017. 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 Transport Scotland, Scottish Government and 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.

This engagement is not an assurance engagement conducted in accordance with any generally accepted assurance standards and consequently no assurance opinion is expressed. Nothing in this report constitutes legal advice or a valuation.

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