Transportation
https://doi.org/10.1007/s11116-025-10601-0

Economic and financial impacts of working from home and Covid-19 on the British public transport system

Peter White[1]

Accepted: 24 February 2025

Abstract
The Covid pandemic from 2020 has affected transport systems worldwide. The British case is examined, drawing on extensive publicly-available data to describe not only impacts on ridership, but also changes in service output, public expenditure, and some indicators of productivity, with particular emphasis on the rail system, and local buses within England outside London. Expectations that the peak would'flatten out'—resulting from the pandemic and working from home—are not supported in the bus case and only partially in the case of rail. Following very large increases in public expenditure to enable continuation of services, that in the bus industry has returned to a broadly pre-pandemic level, while that for rail remains substantially higher. Whilst the pre-Covid cost structures result in a higher degree of short-run escapability for bus, it is also the case that bus has proven to be more flexible in the medium-term, notably in returning to the level of bus-kilometres per member of staff found pre-Covid. Implications for future policy are discussed.

Keywords Covid pandemic · Buses · Railways · Britain · Cost escapability

Introduction

This paper examines experience in Britain arising from the Covid-19 pandemic, from March 2020 to the 2023–2024 financial year, taking 2018–2019 (the last full financial year prior to its impact) as the baseline. Some of the changes which occurred can be seen as a rapid acceleration of those already in progress (notably working from home), whilst others were wholly new (notably nationwide lockdowns). Detailed analysis is focussed on bus services within England outside London and the passenger rail network in mainland Britain, determined in part by data quality and availability. Findings may also be broadly applicable to other countries, or at least enable some useful contrasts to be drawn.

✉ Peter White
whitep1@westminster.ac.uk

[1] University of Westminster, London, UK

Published online: 28 March 2025

In economic terms, the sharp reduction in demand resulted in some reductions in service but a far greater drop in ridership and revenue, services being sustained by very high levels of state support for local bus and national rail services. Subsequently, a large (but not total) recovery in demand and service volumes has occurred. This raises the question of 'resilience' in networks during a period of enforced severe change, which can be defined in two ways: (i) The ability to restore services to the *status quo ante*, or (ii) The ability to make long-run changes in the pattern of services offered in response to external changes (for example, more working from home). Both raise the question of the extent to which costs are escapable or avoidable in the short run where the longer-run intention may be to retain resources to enable a substantial resumption of service provision. A striking contrast may also be drawn with the express coach network, for which substantial state support was not provided: the network was almost wholly suspended during two lockdown periods, but has largely revived, albeit in changed form. Throughout this paper the constraints imposed such as lockdowns are taken as a 'given' external factor.

In terms of unit costs and productivity, very sharp changes occurred in ridership-based indicators, largely outside the control of operators. However, it would be fair to look at service output indicators, i.e. bus-kilometres and train-kilometres, where operators had some ability to influence performance. Overall, the changes are not as dramatic as some commentators predicted in the earlier stages of the pandemic, but may have parallels with other industries, such as rising real unit costs, and staff recruitment difficulties.

Some broad regional differences are discussed (for example between London, England outside London, Wales and Scotland). It is not the aim to discuss changes in ridership at a local level (for example, specific conurbations or local areas within England) given the limitations of detail that can be covered in single paper. Furthermore, given the emphasis on changes in costs and productivity in response to changes in service output and ridership, limitations are imposed by the degree and quality of data available.

The structure of the public transport industry in Britain prior to Covid

In comparison to systems in many comparable countries, the British one was based to a greater degree on 'commercial' operation, with a lower degree of public expenditure support, especially in the bus industry. Outside London, the bus network operated as a 'deregulated' system, in which operators determined the services they wished to operate and fares to be charged. About 80% of the network operated on this 'commercial' basis, the balance being provided on contract to local authorities, typically lower-density services, for example in rural areas. Note that 'commercial' services also received money from public funding as compensation for the revenue losses associated with free travel for concessionary pass holders—primarily older people—and as 'Bus Service Operators Grant' (BSOG) paid primarily in relation to bus-km operated. Following deregulation in 1986, sharp reductions had occurred in operating cost per bus-km, but these began to rise again from around 2000. In London, the bus system had not been deregulated but became subject to competitive tendering, producing a similar drop in cost per bus-km.

Passenger rail operations were transferred from the British Rail monopoly to a system based on competitive bidding for franchises in the 1990s, based on the net revenue support (or premium generated). In the period shortly before Covid, a net premium payment was

made to the state. Infrastructure was placed under a monopoly provider, initially Railtrack, which aimed to cover its costs through access charges to operators. Following collapse of that company, a state-controlled body, Network Rail, took over this function, but received large annual payments direct from central government. Hence the rail industry as a whole still received substantial public funding support. A general description of the structure of the public transport industry in Britain may be found in chapter 1 of the author's textbook (White 2017) and of demand patterns in chapter 2 thereof.

The impact of Covid made these forms of operation unviable, hence large amounts of public spending support became necessary.

Cost structures in public transport

Given that the principal aim of this paper is to examine the 'economic and financial' impacts of Covid on the public transport system, the potential impacts of reducing and/or spreading the peak is an important aspect. For this purpose, a clear understanding of cost structures is required.

Several decades ago, a crude measure of average unit costs was often used as a guide to efficiency and profitability. For example, the bus industry in Britain often took an average cost per vehicle-mile (total costs divided by miles run) as the base. This remains useful as an indicator of year-by-year changes in the industry as a whole (as shown in this paper) but is a very poor guide to costs of specific service types, since it will vary by factors such as vehicle size, average speed and peak vehicle requirement (PVR). In the 1970s, a more rational system was adopted by the National Bus Company (NBC), subsequently adopted in the industry as a whole. This divided costs into three broad categories:

- Distance-based, primarily fuel
- Time-based, primarily staff costs such drivers
- PVR-based, primarily depreciation and leasing charges for vehicles, and overheads such as depot premises.

For rail, similar considerations apply to operation of trains themselves, with the added complication of allocating infrastructure costs, on which an extensive literature exists. This relates not only to tracks, but also stations, signalling and power supply. This will vary with volume of traffic, axle loading and other physical characteristics of stock, and the time periods of day and week over which a route is in operation (determining station staffing, and signalling costs—especially for older manual systems). Passenger services are provided by train operating companies (TOCs) who lease, rather than own, their rolling stock.

The cost structures for local bus services and TOCs immediately prior to Covid may be summarised as follows (Table 1):

The rail data are derived from a report by the National Audit Office (2021), covering the 2018–2019 financial year. Costs are in 'gross' terms, covering both train operating companies (TOCs) and infrastructure provision. Network Rail (NR). Bus data are from a survey of its member operators by the Confederation of Passenger Transport UK (CPT-UK) (2019).

There are clearly difficulties in comparing the two cost structures, notably due to the role of Network Rail. Bus operators do not incur track costs as such, but contribute to the

Table 1 A comparison of the operating cost structures for passenger rail and local bus services in 2018–2019

Component	%		% of total
Rail		Bus	
Diesel fuel	1.6	Fuel	12.9
Traction electricity	3.7		
Rolling stock leasing	21.8	Depreciation and leasing	7.0
Staff	28.4	Staff	60.5
		Maintenance materials	4.3
Network rail charges and other operating		Insurance and claims	2.5
Costs	44.5	Other	12.8

highways network through fuel duty, and annual duty per vehicle, effectively making these variable with distance run and PVR respectively.

For passenger rail operators, it can be seen that the element directly variable with train-km run (energy) was only about 5% of net costs, although some elements of rolling stock maintenance (within 'other operating costs') might also be variable. Staff, at about 28% of costs, could also be variable, subject to changes in service volumes, working practices and/or staff numbers. Variability in rolling stock leasing and NR charges might be limited if the intention is to resume the previous scale of services after Covid.

For buses, about 17% (fuel and maintenance materials) are likely to vary directly with distance run, the majority varying with time period of operation, notably staff costs at 60% (of which driver costs alone comprised 47%). PVR will determine depreciation and leasing costs together with overheads such as depot premises, subsumed under 'other' above. In both bus and rail cases, substantial variation may occur between operators and areas—for example, due to higher wages in the London region.

The much lower element of costs varying with energy use for rail is clear, along with a very much greater element attributable to rolling stock leasing (22%), having risen at 2022–2023 prices from £1767 m in 2015–2016 to £2878 m in 2018–2019,[1] compared with only 7% for depreciation and leasing of buses. Quality criteria for evaluating franchise bids from 2013 had included a strong weighting for rolling stock, thus incentivising fleet renewal, but with the effect of substantially increasing leasing charges.

Cost of peak capacity

A further issue in cost allocation is treatment of the peak, traditionally associated with work and education commuting on weekdays. There is no 'right' or 'wrong' way of doing so, but alternative assumptions are:

(i) Allocate most costs by time and/or distance run over the day as a whole (including vehicle leasing and depreciation), but assign wholly to the peak those journeys operated only at those times, including PVR and staff costs. Typically, these will have higher unit costs than services run over the day as a whole, not only due to poor utilisation of vehicles etc., but also less efficient crew scheduling.

[1] Office of Rail and Road [ORR] Table 7226 'Franchised passenger train operator finances since April 2015 by franchise (April 2022–March 2023 prices), Great Britain, annual data, April 2015–March 2023'.

(ii) Allow for the fact that some 'peak only' working can be integrated efficiently with all-day services, as drivers can cover meal breaks of 'straight shift' staff and some vehicle preventative maintenance undertaken between peaks
(iii) Assume that the *raison d'être* of the operation is to serve the peak, with costs at other times of day treated as marginal. Hence all overheads, vehicle costs and one shift of crew are allocated to the peak.

The first and second assumptions might be most appropriate for a bus service in which most vehicles run for 8–10 h per day or more, the third for service primarily provided to meet peak demand, such as an urban rail commuter network or buses in rural areas primarily serving school travel. Under all scenarios, especially (iii), it is clearly helpful if peak demand can be spread, so that the same revenue can be retained whilst costs are reduced by cutting fleet size, overheads and peak-only staff working.

These cost allocation assumptions also have implications for profitability, especially where average trip length is short. The traditional use of a simple average cost per bus mile may have given a misleading impression of peak profitability. On more realistic allocation, peak-only working may incur losses, despite high loadings in the peak flow direction. Conversely, the inter-peak may attain an operating surplus, dependent on which of the cost allocation assumptions listed above is adopted (University of Leeds and National Bus Company 1984; Savage 1988, 1989). Evening and Sunday services are less likely to cover costs, due to additional shifts of staff needed (possibly at premium rates for weekend work) and low load factors. Even an outright loss of some peak-only traffic may improve profitability. A recent example of peak costing is the recent guidance on compensation for free concessionary bus travel, advising a cost per additional PVR of £23,908 at 2022/2023 prices (Department for Transport 2023).

Working from home (WFH), or 'teleworking'

This phenomenon has been evident for many years, but has gained greatly increased importance during Covid. It has traditionally applied to some occupations (such as farming or shopkeeping)—hence not all WFH can be attributed solely to new technology—but has been greatly assisted by development of home computing and other IT innovations. These enable both 'off-line' work (such as writing a report) together with 'on-line' (real time) contact such as answering consumer queries or participating in a meeting. It has clear implications for all modes of transport by eliminating the journey to work commute.

For example, an early study (White et al. 2007) identified two main forms:

1. WFH on all working days, eliminating the traditional commuting trip
2. A 'hybrid' pattern, in which some days are worked from home, others at the traditional workplace. The seven-day travel diaries compiled by respondents to the National Travel Survey (NTS) in England are particularly helpful in distinguishing WFH on all working days from the hybrid pattern.

A further variant is use of telecommunications by 'nomadic' workers (such as some maintenance staff) who do not regularly have a fixed workplace, but are able to improve their productivity by much more efficient communications with colleagues and management.

The hybrid form of working emerges as potentially attractive both to workers and employers by enabling a degree of face-to-face contact to be maintained, with benefits both to productivity and social life. This may be particularly important for new or younger staff members, for example. Its attractiveness was confirmed in a survey of about 800 staff employed by the Department for Transport in which preferences as well as current working patterns were identified (White et al. 2011). Some 'rebound' effect may also be observed when WFH results in some additional local travel being undertaken on days worked at home, typically by car or non-motorised rather than public transport.

The early study indicated that WFH was generally associated with higher income levels and work by senior professionals, whose work was more readily suited to this form, and whose seniority was likely to result in a higher level of trust by management. Technology was not a general constraint, managerial attitudes being more important.

Employers may also be able to make savings through being able to reduce total office space for a given number of staff, for example by 'hot desking'. The elimination of a commuting journey may also increase productivity by reducing tiredness resulting from travel, and if workers are willing to use some of the travel time savings to undertake further productive work, total output can be increased without reducing discretionary personal time at home. A number of studies following the earlier examples mentioned above pointed to similar conclusions prior to the pandemic, for example in the Dublin area (O'Keefe et al. 2016).

The tendency for higher-income workers to be more likely to engage in WFH has different implications for each mode. Insofar as rail commuters are generally of higher income than bus users, that mode is more likely to be affected (Davenport and Levell 2020), although this will vary by area within the bus sector, dependent on employment mix. A further effect is that rail commuting into centres of larger cities may experience greater impacts, due to seniority of staff employed in central area locations and the longer commuting trip which may encourage more WFH days per week within hybrid patterns.

A further possible impact of WFH is a mixed pattern within the same day—for example, handling e-mails from home at the start of the day, then travelling to the traditional workplace. From the operator's viewpoint this would spread the peak whilst retaining revenue. However, evidence for this seems to be limited, a study in the Paris region by Munch (2019) indicating that even when staff do have flexible working hours, they still tend to commute to work at customary times—this may be associated with interactions within the household, such as getting children to school.

WFH also raises issues of social equity, since those less able to do so are often in lower-income occupations, such as hospitality, health care, shops, manufacturing, entertainment, etc. Whilst in principle WFH may spread or reduce peaks in demand, there is also a danger that the hybrid form may result in a concentration of commuting on certain days of the week, if not evenly spread. Prior to the pandemic, a shift had already occurred from fixed-price weekly or monthly tickets to 'pay as you go' smartcard use, with daily or weekly 'capping' of the total payable, making it easier for users to adjust to this pattern.

Trends in the public transport sector prior to Covid

A strong growth trend can be seen in rail travel from the mid-1990s until shortly before the pandemic, in part coincident with (but not necessarily caused by) privatisation of services. Between 2011–2012 and 2018–2019 total passenger-km rose from 57.13 to 67.67 bn, or by 18.4%.[2] In the case of journey to work commuting, this was associated with an increase in economic activity and a restructuring of employment toward the service sector. This in turn resulted in an increase in employment within city centres, well-suited to rail use (Williams and Jahanshahi 2018). Operators also increased service frequencies outside peak times, stimulating ridership for other trip purposes, thus improving utilisation of assets and getting better use of driver time within 'straight shift' working patterns. The cost structure may have also encouraged such behaviour, given the low proportion of variable cost within track access charges, high rolling stock leasing charges, and the low proportion of energy costs (Table 1 above). However, a trend away from the traditional five-day working pattern was already becoming evident (Williams and Jahanshahi 2018), resulting in a revised assumption prior to Covid for weekly trips per rail season ticket, from 10.3 to 8.5.[3] A change in patterns on Fridays was noted.

The increased revenue enabled TOCs to improve their financial performance, resulting in a net contribution from franchised operators to the state (although this did not mean that the industry as a whole was profitable, given large payments from the state to NR).

Within the local bus sector strong ridership growth in the early 2000s in London was associated with strongly supportive local policies, reaching a peak around 2011. Elsewhere, an aggregate decline occurred (with marked variations by area), associated with rising car ownership. Total bus trips in Great Britain fell from 5614 m in 2010–2011 to 4786 m in 2018–2019,[4] or by 14.7%. A major stimulus to use came from free concessionary travel in England for all older people from 2006 (and earlier in Wales and Scotland) applicable from 0930 on weekdays, all-day weekends, which encouraged inter-peak ridership. The effect was that by 2013 most bus services offered a very similar frequency of service through the daytime working and shopping hours, encouraging good vehicle utilisation. In terms of ridership, the period between 0900 and 1559 represented about 45% of weekday bus usage (some of which would represent school travel in the afternoon), and 60% of weekend bus usage, prior to 2019. Shopping became the trip purpose with greatest share within the local bus market. However the percentage of pensioners regularly using buses declined from around 2012–2014, in part due to increased car ownership and driver licence holding within successive age cohorts becoming eligible (Le Vine and White 2020).

[2] From ORR Table 1233 'Passenger-kilometres by operator, Great Britain, April 2011–June 2024'.

[3] Based on a study for the DfT by Steer and WSP consultancies prior to Covid, results subsequently incorporated in TAG (Transport Analysis and Guidance).

[4] From DfT table Bus01a 'Passenger Journeys on Local Bus Services by metropolitan area and urban-rural status, region and country: Great Britain, annual from year ending March 2005'.

Aggregate impacts of Covid on the public transport system

It is not the intention in this paper to provide a detailed account of changes in demand and research thereon during the pandemic, which are well-documented elsewhere—for example Lu (2024), Bartle (2024), Mulley and Nelson (2024), Lizana et al. (2024), Marshall et al. (2023)—but to look at medium to longer-term changes, the associated changes in service supplied, and efficiency in producing this. Bus and rail are considered separately due to markedly different characteristics and outcomes.

All modes were affected by a sharp drop in demand from imposition of the first lockdown—in Britain from late March 2020. Some recovery then took place in summer 2020, but was then followed by subsequent lockdowns as the pandemic recurred. Most restrictions were lifted in 2022, and broadly 'normal' conditions can be seen to apply to today, with the possible exception of some continued reluctance by older people to travel and act socially as before.

In addition to routine periodic reporting of passenger volumes by operators, the Department for Transport (DfT) responded quickly by setting up an index of daily transport mode use from March 2020 which continues to be published. This covers road traffic (cars, goods vehicles), and public transport trips (local buses, national rail). Some caution is needed in comparing indices for different modes. In some cases, comparable data were available for earlier years (London, and national rail) enabling a comparison with an equivalent day in 2019 to be made, thus removing seasonality. However, in cases where such data were not available (such as cars, bicycles, or buses outside London), seasonality effects arise. For example, a very sharp initial rise in bicycle use may have been largely a seasonal effect, reversed the following winter. In the case of local bus use, the role of school travel during term time results in marked drop in demand during school holidays, affecting comparisons with an absolute base line. The index for car travel is, strictly speaking, an index of vehicular movement, not person movement as such, which is affected by average occupancy rates.

The NTS, as a household-based survey, was inevitably disrupted by Covid but subsequently resumed, providing insights into changes in the trip purpose mix, use of taxi and private hire services, and the degree of WFH. Unlike many other household surveys, all age groups are covered, including schoolchildren. However, some fluctuations can occur from year to year due to use of cluster sampling which may affect the purpose mix shown.

Table 2 shows changes in aggregate passenger trips from 2018 to 2019, expressed in per capita terms to allow for population growth during this period, and shown as an index value.

'National Rail' comprises the surface rail network operated by franchised Train Operating Companies (TOCs) and open-access operators on some long-distance routes. 'Urban Rail' comprises self-contained urban rail networks, dominated by the London Underground, but also including light rail systems. 'All public transport' is the sum total for these systems (no data are available for coach services). Published aggregate data reported by operators has been divided by the applicable mid-year population estimate (e.g. the 2023–2024 total by the 2023 mid-year estimate) to derive a per capita rate, from which the indices have been calculated. During the period shown, opening of the cross-London Elizabeth Line in 2022 attracted very high passenger volumes, diverting some trips from the London Underground to National Rail. A 'heavy rail index' is therefore shown—the sum of National Rail and London Underground—to remove this distortion.

Table 2 Indices of changes in per capita use of public transport in Great Britain 2018–2019 to 2023–2024

Year	2018–2019	2019–2020	2020–2021	2021–2022	2022–2023	2023–2024
Mode						
National rail	100	98.6	21.9	56.0	77.6	89.6
Urban rail	100	96.0	22.5	55.0	75.7	83.5
Heavy rail total	100	97.5	21.6	54.9	76.7	86.7
Buses in London	100	94.5	38.8	67.4	80.0	82.9
Buses in the rest of England	100	92.9	34.4	64.3	76.3	84.3
Buses in wales	100	90.8	26.6	52.0	59.4	69.5
Buses in Scotland	100	96.3	33.1	61.9	79.2	89.1
All public transport trips, Great Britain	100	95.2	30.2	60.8	76.7	84.0
National rail passenger-km	100	98.1	18.3	57.1	76.7	86.1

Sources: Office of National Statistics mid-year population estimates

Department for Transport tables Bus 01a, and LRT0101

Office for Rail and Road (ORR) tables 1220 and 1231a

Data are shown for financial years, running from 1 April to 31 March. The year 2018–2019 is taken as the base, since the Covid-19 was already having an impact on ridership in March 2020 even before the first lockdown. A sharp drop can be seen in 2020–2021, especially for rail, followed by a recovery. A broadly similar pattern can be seen in terms of trips, with indices for 2023–2024 within the range 82.9–89.6, apart from a notably lower figure for buses in Wales at 69.5. The stronger recovery in bus use in Scotland may be attributed to free travel for those aged under 22 since January 2023.

In addition, an index for passenger-km for National Rail is shown, broadly similar to that for trips, but giving a slightly lower value for 2023–2024, implying a slight drop in average trip length. A distortion may have arisen through the growth in 'split ticketing' in recent years, in which travellers save money by paying separately for sections of a through journey, which thus exaggerates the number of trips actually made, hence the passenger-km indicator is probably more reliable for rail volumes. In the case of buses, operators do not report distance travelled, but an estimate of average passenger trip length can be made from the NTS,[5] showing some growth in England outside London from 6.6 to 7.2 km over the period shown (i.e. 8%), a probable factor being the greater loss of trips by older passengers on concessionary passes (see below) whose trips may have been shorter than the average. On this indicator, buses would perform more favourably than on trips as such.

Table 3 shows data from the DfT daily index for absolute volumes of travel. These data are not directly equivalent in definition to those in Table 1 (as no adjustment for population growth has been made), but indicate different trends for weekday and weekend travel, taking a period during school term to provide comparable data in measurement of bus use outside London. Data suggest a broadly similar recovery in both periods, apart from a notably higher figure for National Rail, consistent with growth its index value for 2023–2024 in Table 2.

Buses in London and the London Underground have not been reported since early August 2024 and are therefore excluded here. A two-week period outside school half-term has been

[5] DfT Table Bus03a. 'Passenger journeys on local bus services by metropolitan area and urban-rural status, region and country: Great Britain, annual from year ending March 2005'.

Table 3 Use of transport modes in Great Britain October 2023 and 2024

Days	Car	National Rail including Elizabeth line	Bus outside London
Saturday and Sunday October 2023	104	86	102
Monday–Friday October 2023	94	89	91
Saturday and Sunday October 2024	103	99	99
Monday–Friday October 2024	95	98	92

Source: DfT Table 'Daily domestic transport use by mode' (updated monthly)

Percentages on a base of January 2020 or equivalent day in 2019

considered. In the case of car travel and buses outside London a stronger recovery is shown at weekends, but very similar for National Rail. The car data are based on vehicular traffic flow, not person movement as such which is affected by average occupancy rate.[6] This fell from 1.55 in calendar year 2019 to 1.49 in 2020 and 2021, but recovered to 1.55 in 2023, hence the indices above would also apply to person movement by car. Note that population growth implies a small decline in trips per head per year by car, confirmed by NTS data as a drop of 4.5% for car driver trips between 2019 and 2023.[7] Greater recovery at weekends is also confirmed from NTS data. We can thus see some parallels between trends in car use and for public transport, with drops in per capita trip rates, and greater recovery at weekends.

An indication of a longer-term shift in demand by day of week can be seen in NTS data for this variable,[8] which shows that 'rail' (a combined total for surface rail and London Underground) displayed a trip rate in calendar year 2023 equivalent to 87% of the 2015–2019 average for weekdays, but 111% at weekends. However, no clear equivalent difference emerged within other modes. It can also be shown (for all modes combined) that the ratio of the work trips per day on Tuesdays, Wednesdays and Thursdays to those on Mondays and Fridays rose from 1.08 to 1.17 over this period, with Friday the lowest of the weekdays.

The overall recovery trends in Britain are broadly similar to those found for major urban areas in Germany, Canada, USA and Australia, with only Germany showing a slightly higher figure, of 91%, possibly attributable to a greater proportion of the workforce being employed in manufacturing with less opportunity for working from home. The USA and Australia were noticeably lower, at 72% and 76% respectively. A greater recovery at weekends than weekdays was also generally observed.[9]

Flattening the peak

A flattening of the peak demand would encourage better utilisation of infrastructure and rolling stock, and potentially more efficient crew scheduling.

This expression can be seen in three ways:

[6] NTS Table 0905a 'Average car or van occupancy by trip purpose: England, 2002 onwards'.

[7] 'NTS Table NTS0303a 'Average number of trips by main mode (trips per person per year): England, 2002 onwards'.

[8] NTS Table 0504 'Average number of trips by day of the week or month and purpose or main mode: England, 2002 onwards'.

[9] From data assembled by Graham Currie (Monash University), Ralph Buehler (Virginia Tech, USA) and John Pucher (Rutgers University, USA).

1. Obtaining a better spread within the typical work or education day
2. Obtaining a better spread between days of the week (e.g. working days and weekends, but note the risk of a hybrid working week producing more variation *within* the working week).
3. Over the year as a whole, for example between school terms and school holidays.

The local bus case

The initial expectation might have been a flattening out of the weekday peak, due to a loss of some journey to work travel. In practice, a very similar time-of-day profile can be seen in Fig. 1. This is taken from data published by DfT drawn from a large sample of bus journeys throughout England reported by a major supplier of electronic ticket machines which also record smartcard validations. All cases relate to school term-time. During lockdowns a very flat profile was observed, as might be expected, given absence of most commuting and school travel. However, at other times, the time-of-day profile reverted to the pre-Covid pattern, if anything with a slightly greater difference between the morning peak and inter-peak periods. In addition to resumption of peak school traffic, this is explained by a marked drop in free travel by older and disabled people on concessionary passes (generally valid from 0930). This represented 28.1% of all local bus trips in England outside London in 2018–

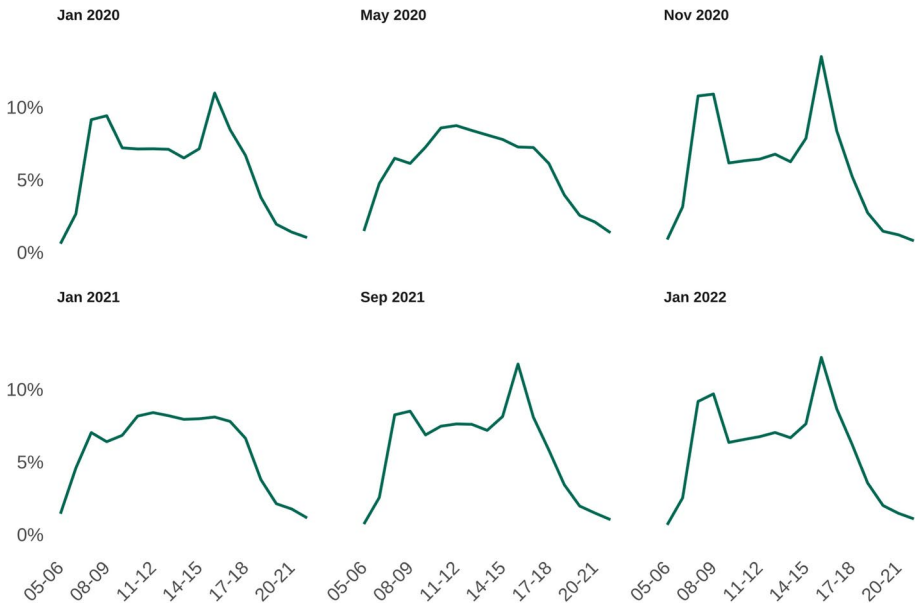

Fig. 1 Local bus trip distribution by time of day January 2020–January 2022. Data for a sample from Ticketer for areas outside London, second Tuesday of the month (i.e. during school term). May 2020 and Jan 2021 fall within 'lockdown' periods. NB Graphs show percentage distribution, not absolute totals. Source: DfT Release on National Bus Annual Statistics for year ended 31 March 2023, published 30 November 2023, Chart 2

2019, but fell to 23.9% in 2022 and further to 21.9% in 2023.[10] A study by the Chartered Institute of Transport and Plymouth University (2023) from a sample of local authorities involved in the scheme shows a drop of 36% in the absolute number of trips between 2019 and 2022 (and somewhat greater for over 80s within this average). This appears to be related to a general drop in travel and social activity by this age group, accentuated by concerns over infection when travelling on public transport. A shift to home shopping delivery hit the principal trip purpose of shopping. The drop in concessionary travel by older people would also explain substantial part of the overall decline in bus use—indeed, some operators now report paid-for trips at or above pre-Covid levels, the net decline being wholly attributable to loss of concessionary trips. Further contributions to the absolute drop in concessionary travel by older people arise from successive increases in the age of eligibility (especially for women) and greater car ownership and driving licence holding among successive cohorts, together with the lower birth rate following the 'baby boom' of the late 1940s.

A change in the trip purpose mix for local bus use over the whole year is shown in Table 4, indicating that education travel (which may be assumed to comprise mostly school travel) became the most frequent trip purpose over the year in England outside London in 2022 (within London this effect was even more marked). Given that the education year (approx 190 days) is shorter than the traditional full-time working year (approx 220 days) this implies that education will represent an even higher share during term time. Note that the absolute total volume in 2022–2023 was substantially lower than in 2019–2020. This contrasts with rail, in which the peak demand share substantially reduced.

It can be seen that the rail purpose mix has changed substantially, with marked drop in the share of travel attributable to commuting from 47.0 to 37.1%, but partly offset by growth in education from 7.6 to 12.8%, affecting the proxy indicator for the peak. In case of bus,

Table 4 Composition of surface rail and local bus journey purposes 2019, 2022 and 2023 (percentages)

Year	Surface rail			Bus in England outside London		
	2019	2022	2023	2019	2022	2023
Purpose						
Commuting	47.0	37.8	37.1	20.3	21.8	21.3
Education*	7.6	8.7	12.8	22.8	24.8	20.5
Shopping	13.6	6.4	4.9	23.5	20.9	23.2
Leisure	26.3	35.2	35.0	20.3	22.0	22.1
Other**	14.8	11.8	10.2	13.2	13.2	12.9
Commuting and education as proxy for peak	53.9	46.5	49.9	43.0	46.6	41.8

Source: NTS Table 0409a 'Average number of trips by purpose and main mode: England, 2002 onwards'

*Includes education escort trips

**Comprising business, other escort and personal business

Data shown are calculations by the author from the NTS table, shown to one decimal place (may not sum to 100 due to rounding)

'Surface rail' is equivalent to 'national rail' as elsewhere in this paper

Some data variations from year to year may be affected by the smaller sample size of trips attained in 2022 (e.g. for bus in rest of England: from 3,260 in 2022, to 5,917 in 2023; for surface rail from 2,178 to 4,492 respectively)

[10] DfT table Bus01d 'Concessionary passenger journeys (including youth schemes) as a percentage of total passenger journeys on local bus services by metropolitan status, region and country: Great Britain, annual from year ending March 2008'.

there was initially a shift toward a *higher* share for commuting and education in 2022, thus contradicting the expectation of peak flattening in the Davenport and Levell (2020) and the recent review by Kendall et al (2024). However, in the 2023 there is a return to the 2019 pattern, notably for shopping, a possible factor being the £2 maximum fare introduced in January 2023, discussed below.

Other factors affecting ridership

In addition to the direct impacts of Covid, public transport ridership has for many years been affected by factors such as changes in real fare levels, service frequency and coverage, service reliability, and car ownership. Note that total ridership and the per capita figure will differ due to change in total population. Specific policy measures to encourage public transport ridership since Covid restrictions were lifted will also have an effect.

For example, in the case of bus ridership, one might expect a short-run demand elasticity of approximately +0.4 with respect to service level (expressed as bus-km run) and −0.4 with respect to changes in average real fare. As shown in Table 4, bus-km run in England outside London fell by 17% between 2018–2019 and 2023–2024, which might be expected to cause a decline of about 6.8% in ridership (from the pre-Covid total volume) in its own right. Furthermore, services were subject to very frequent timetable changes during Covid restrictions, creating passenger uncertainty. More recently, driver shortages in 2022–2023 caused disrupted schedules and were a partial cause of an overall reduction in output. The real fare index (measured at March each year, as base of March 2005 = 100) in England outside London changed from an index of 127.7 in 2018–2019 to 105.1 in 2023–2024, a drop of 17.6%[11], which might be expected to give an increase in trips by fare-paying passengers over a full year of about 7.0%. This is attributable to a government initiative introduced in January 2023 to cap all single bus fares in England outside London at £2.00 until December 2024, and is likely to be a major factor in the more favourable outcome for bus use in England outside London shown in Table 2 (even if the £2 cap had applied there, the flat fare in London is in any case below it). Within urban areas the £2 cap may have had limited impact, but a much greater one the on use of rural and inter-urban services, especially for discretionary journeys. A review of the fare cap and possible alternative future options has been provided by KPMG (2024). The net effect of real fare and service level changes (plus an increase in average passenger trip length) between 2018–2019 and 2023–2024 has restored average loading per bus to a higher figure than pre-Covid due to fewer bus-km but at a lower real fare, the value for England outside London rising from 9.9 in 2018–2019 to 11.0 in 2023–2024.[12]

Car ownership in England rose from 27.13 m at June 2019 to 27.65 m at June 2023.[13] Adjusting by the same ONS population estimates used in Table 1, car ownership per capita was 0.483 and 0.479 respectively, a marginal drop of −0.67%. However, the failure of suc-

[11] From DfT Table Bus04dii 'Local bus fares index (in constant prices) by metropolitan area status and country: Great Britain, annual from 1995'.

[12] DfT Table 03b 'Average bus occupancy on local bus services by metropolitan area status and country: Great Britain, annual from year ending March 2005'.

[13] DfT Table VEH0101a 'Licensed vehicles at the end of quarter by body type, Great Britain, from 1994 Q1'.

cessive governments to raise fuel duty per litre in line with inflation for over ten years has reduced the relative cost of car travel.

In the case of rail, total train-km fell by 8.3% between 2018–2019 and 2023–2024 (see Table 9). Furthermore, extensive disruption due to strikes was noteworthy in 2022–2023, days of 'severe disruption' rising from 22 in 2018–2019 to 54 in 2022–2023.[14] The money fares index rose for all tickets by 23.9% between 2018 and 2024, whilst the Retail Price Index (RPI) rose by 37.9%, implying a real fares drop of about 11% over this period.[15] This was associated with the regulated fares annual increase being capped at RPI to 2020 and in 2022, and RPI + 1% in 2021. Subsequently, in 2023 it was capped in England and Wales at average earnings in that year[16] (i.e. 5.9%, but well below RPI of 9.0%: this could be seen as a measure to stimulate rail use akin to the £2 bus fare cap).

Trip distribution by time for rail

Many operators have reported a stronger recovery in weekend traffic, in some cases now above pre-Covid, presumably largely comprising leisure, shopping and social activity. On weekdays, journey to work commuting has been affected more than local bus, due to the mix of occupations and consequent greater scope for WFH. However, this has not been evenly distributed during the working week, due to the widespread use of hybrid working, and a tendency to focus on Tuesdays/Wednesdays/Thursdays as the typical 'in office' days, and much lower volumes on Mondays and Fridays. Hence, peak resources mid-week may be somewhat lower than before, but some rolling stock used at height of the peak may only be needed on three days per week rather than five. Time-of-day profiles show a modest 'flattening out', but within this peaks still occurring at the same times of day, consistent with the evidence from Munch (2019) (Table 5).

Some flattening out can be observed in 2020, notably in the morning peak, but with a gradual return toward pre-Covid patterns, especially in the afternoon peak. In terms of absolute volumes, the period 0800–0859 fell from 342,000 in 2019 to 279,000 in 2023 (a drop of 13.8%). Total passenger movements per day rose from 2.203 to 2.268 m, a rise of 2.4% (due to growth after 1800). Note that these data show the Tuesday-Thursday pattern, which pre-Covid could be seen as typical, but now represents the busier part of the week. TfL data

Table 5 Percentage distribution of rail Passenger Arrivals and Departures by Hour, Central London: Autumn 2019–2023

Year	Start to 0759	0800–0859	0900–1559	1600–1759	1800 to end
2019	12.73	14.71	27.48	18.59	26.50
2020	17.27	9.09	31.99	18.72	22.94
2021	12.44	11.51	30.14	17.60	28.31
2022	11.63	12.33	30.15	17.74	28.16
2023	11.57	12.32	29.88	18.19	28.04

Source: DfT Table RAI0102 'City centre [Corresponding to Travelcard zone 1] arrivals and departures by rail on a typical autumn weekday, by city and time band, annual from 2011'

[14] Office of Rail and Road (ORR) Table 3157 'Days of severe disruption by sub-operator (periodic)'.

[15] ORR Table 7180 'Average change in fares by regulated and unregulated tickets, Great Britain, annual data, 1995 to 2024'.

[16] ORR Rail Fares Index 2023, published 27 July 2023.

for the Underground show a much greater decline in peak demand on Mondays and Fridays than Tuesdays/Wednesdays/Thursdays between 2019 and 2023, consistent with the shift to hybrid working (Transport for London 2023, Figs. 6, 7 and 8).

Changes in use by income category

Given fears over the risk of infection when using public transport, higher car availability, and reduced traffic during early stages of the pandemic, it is likely that public transport users with cars available would divert to that mode. One sign of this could be sharp drop in use of bus-based park and ride facilities, some services and sites being suspended entirely. Higher income users might also have greater scope for WFH, also reducing their public transport use to greater degree. For example, a longitudinal study by Anable et al. (2022) showed greater drops in public transport use by summer 2021 among higher social grades, and those by cars available, along with rail users being more likely to shift to WFH. One would therefore expect aggregate public transport use to shift toward lower income categories.

Table 6 shows calculations for the shares of overall public transport use. In terms of trips, the lowest quintile's share rose from 22 to 27%, and in miles from 13 to 17%. However, the trend by quintile is not a systematic one, the highest quintile showing the second highest share of trips in 2023, and still the highest in terms of absolute miles travelled per respondent, associated with high use of surface rail. Note that these data apply to household, not personal, income and include travel by all age groups. Hence school journeys on public transport by younger members of high-income households are included, for example.

A sign of recovery in public transport use by those with cars available can be seen in the reopening and ridership recovery in the larger bus-based 'park & ride' schemes (such as Oxford), although some smaller services and sites have closed.

Changes in capacity provided, service output and resources used: local bus

In 2020 a sharp reduction occurred in service levels offered, in part due to a lower need for capacity, but also concerns re exposing operating staff to infection. A deliberate attempt to discourage social interaction during this period was made. Vehicle capacity was also reduced in order to ensure 'safe spacing', notably on buses where this was easier to enforce on entry to the vehicle than on rail. Regulations varied by nation within Britain, but on

Table 6 Estimated percentage shares of total public transport use in England by income quintile 2019–2023

	Trips 2019	Trips 2021	Trips 2023	Miles 2019	Miles 2021	Miles 2023
Lowest quintile	22	24	27	13	11	17
Second quintile	20	19	19	13	14	14
Third quintile	15	19	17	14	19	18
Fourth quintile	20	20	15	24	31	20
Highest quintile	23	19	22	37	25	31

Source: Author's calculations, based on NTS 2023 Table 0705 'Average Number of Trips and Miles by household income quintile and main mode: England 2002 onwards'. Public transport use is the sum of bus in London, other local bus, surface rail and London Underground

buses typically took the form of banning standing passengers, and restricting the proportion of seats available for use—initially one in four, later one in two. In some cases capacity may have been inadequate to meet demand as it recovered during the summer of 2020, for example. A particular measure from September 2020 was the introduction of separate peak bus journeys for schoolchildren, which were operated at full seating capacity. An explicit data series on capacity provided, as distinct from vehicle-km run, is not available.

It was possible to reduce some operating costs as service levels were reduced, but not *pro rata* to lower km operated. Short-run variable costs such as fuel and energy could be avoided, but not those such as vehicle leasing and depreciation, given that the intention was to resume services as demand recovered. The largest proportion for bus operation is staff, notably drivers. The government introduced the facility of 'furloughing' in many industries, under which staff not required received an income from the state rather than their usual employer (subject to not undertaking work during the period concerned). Substantial use was made of this facility by bus operators, but it may not have been possible to reduce staff *pro rata* to reduced output for all categories of staff (for example, some specialist engineering or management roles). Note that although wage costs to the usual employer were reduced, partially offsetting increases in public spending elsewhere occurred.

Given the lower loads carried, one might have expected smaller vehicles to be substituted, but due to seating occupancy reductions the opposite occurred in some cases—e.g. double-deckers replacing single-deckers to handle peak loads. Discussion with a major operator group in the UK indicates substantial use of furloughing for driving and some engineering staff, and in some cases temporary closure of depots to reduce overhead costs. However, additional workloads were placed on administrative staff (for example, in frequent rescheduling of services and staff duties). The service reductions were much greater during the first lockdown period than the second (over England as a whole, about 50%—but higher in some cases—versus about 15%).

The greatly reduced demand for public transport resulted in a drop in revenue, and hence the need for additional public financial support, reflected in greatly increased public spending for both rail and local bus services, funded through a number of different grant systems, which varied considerably within the UK. Average revenue yields from those still travelling may also have changed—for example, rail has encountered a greater loss in business travel (which generally produces the highest yield) than other forms, and a strong recovery in leisure travel, which generally gives lower yields. For commuting the picture is more mixed. A reduction in days travelled per week results in a loss of season and travelcard sales, but probably a higher revenue yield per journey or km on days still travelled. On buses, school trips make up a higher share of peak demand, but may produce lower revenue per trip due the traditional practice of charging half the adult fare for such trips. A drop in concessionary travel may have produced a lower reduction in unit revenue, due to compensation being at a level much less than the full adult fare. The £2 maximum single fare may have produced a shift from period tickets.

A broad indication of changes in revenue and support is given by DfT data on 'operating revenue per vehicle kilometre' to 2023/2024,[17] which includes BSOG (defined below) and other support payments as well as user revenue per se. These indicate a broadly stable level in real terms in the period 2018/2019 to 2022/2023, within each region (London, rest of

[17] DfT Table Bus 04cii_km 'Operating revenue per vehicle kilometre (in constant prices) on local bus services by metropolitan area status and country: Great Britain, annual from year ending March 2005'.

England, Wales and Scotland) and thus by implication large increases in public funding to offset drops in user revenue. However, a peak in 2020/2021 was observed (discussed further below), except in Scotland. Ignoring profit margins (modest during this period) these could also be seen as an indication of differences in cost. Lower values were observed in Wales and Scotland, reflecting the higher proportion of rural operations and possibly wage levels, but much higher in London as might be expected due to high wages and low operating speeds.

From this point, performance is examined for local buses outside London in England only as case study, due to much better availability of data (Table 7).

Costs are expressed in real terms, using the GDP deflator at June 2024.

Data are derived from DfT Tables Bus01 (passenger trips), Bus02a (km), Bus 04eii (total cost), Bus04fii (cost per passenger trip) and 04gii (cost per bus-km). Note that published data for cost per bus-km and per passenger trip were shown to the nearest whole number, and differ very marginally from the same data derived directly from totals shown above. Data shown in italics in tables 7 to 11 are indices based on 2018-19 as a value of 100, to distinguish them from absolute totals shown.

Revenue received directly from passengers (excluding concessionary fares compensation) was £2102 m in 2018–2019 and £1841 m in 2023–2024 (also in real terms[18]), implying cost recovery ratios of 55.6% and 57.5% respectively. If the compensation were counted as operator revenue from passengers (since it is intended to substitute for the lost revenue resulting) these ratios rise to 66.5% in 2018–2019 and 66.2% in 2022–2023.

Passenger trips dipped to 34% of the pre-Covid total in 2021–2022, recovering to 84% in 2023–2024, bus-km to 78% and 83% respectively. Cost per bus-km rose by 15% between 2018–2019 and 2020–2021, but then dropped to 11% above the base in 2021–2022, suggesting some ability to adjust costs with output. Had total costs remained the same in 2020–2021 and 2018–2019, a cost per km of about 339p would have been expected in 2020–2021 rather than the observed 304p, but bus-km fell about 22%. This is explained by savings in

Table 7 Local bus services in England outside London: cost and outputs 2018–2019 to 2023–2024

Year	Passenger trips (m)	Bus-km (m)	Cost per bus-km (p)	Cost per passenger trip (p)	Total cost (£m)
2018–2019	2113	1415	265	179	3754
Index	*100*	*100*	*100*	*100*	*100*
2019–2020	1962	1371	273	189	3744
Index	*92.9*	*96.9*	*103.0*	*105.6*	*99.7*
2020–2021	727	1107	304	470	3393
Index	*34.4*	*78.2*	*114.7*	*262.6*	*90.4*
2021–2022	1359	1242	295	272	3680
Index	*64.3*	*87.8*	*111.3*	*152.0*	*98.0*
2022–2023	1613	1163	298	220	3518
Index	*76.3*	*82.2*	*112.5*	*122.9*	*93.7*
2023–2024	1781	1170	301	203	3542
Index	*84.3*	*82.7*	*113.6*	*113.4*	*94.4*

[18] DfT Table Bus05ai 'Estimated operating revenue (at constant prices) for local bus services by revenue type and metropolitan area status: England, annual from year ending March 2005'. Revenue from local authority payments in 2023–2024 is not yet available.

distance-related costs from the CPT data (Table 1). However, operators were also able to contain costs by use of furloughing of staff (especially drivers), and an ability to reschedule services to run at higher speeds during a period of lower vehicular traffic levels.

Note that the drop in bus-km between 2021–2022 and 2022–2023 was partly associated with cuts in service resulting from low ridership and public spending constraints, but may have also been involuntary rather planned, due to difficulties in staff recruitment. It may also reflect a restructuring of services in light of changed demand patterns.

The sharp fall in passenger volume and revenue resulted in a rapid increase in public expenditure required to support local bus services (Table 8).

'Net support' is the net cost incurred by local authorities, primarily on tendered (i.e. non-commercial) services—which is paid to operators—but also includes a small element of administrative cost incurred by authorities themselves. 'Concessionary Travel Compensation' is the compensation paid to operators via local authorities for carrying certain categories of passenger free of charge—primarily those over retirement age (currently 66) but also those who are disabled. The former is largely confined to off-peak periods after 0930, but the latter applies all day. Compensation is not paid at the full equivalent adult fare, but takes into account the trip generation resulting from zero price. The total sum also varied with the volume of such trips up to 2019–2020, but during the pandemic local authorities were encouraged not to reduce compensation wholly *pro rata* to the drop in ridership.

'BSOG' is the 'Bus Service Operators Grant', which is paid direct to operators of commercial services but via local authorities for tendered services. It is broadly related to fuel consumed (effectively offsetting part of fuel duty) but also includes incentive payments for zero-emission vehicles and on-vehicle technology. 'Additional support to bus operators'

Table 8 Public Expenditure support to local bus services in England outside London 2018–2019 to 2023–2024, £m at constant prices

Year	Net support (£m)	Concessionary travel compensation (£m)	BSOG (£m)	Additional funding to operators (£m)	Fare cap (£m)	Total (£m)	Support per passenger trip (p)
2018–2019	320	925	301	n/a	n/a	1546	73.2
Index	*100*	*100*	*100*			*100*	*100*
2019–2020	311	905	301	n/a	n/a	1509	76.9
Index	*97.2*	*97.8*	*97.0*	*n/a*	*n/a*	*97.6*	*105.1*
2020–2021	389	840	255	1258	n/a	2742	377.3
Index	*121.6*	*90.8*	*84.7*			*177.4*	*515.4*
2021–2022	324	724	278	514	n/a	1839	135.3
Index	*101.3*	*78.3*	*92.4*			*119.0*	*184.8*
2022–2023	334	618	213	162	64	1391	86.3
Index	*104.4*	*66.8*	*70.8*			*90.0*	*117.9*
2023–2024	Not available	Not available	210	206	279	Not available	Not available
Index			*69.8*				

Converted to constant prices using GDP Deflator as at June 2024

Sources: DfT Tables Bus05bii 'Government support for the bus industry and concessionary fares at constant prices (England), and Bus05cii 'Net government support per passenger journey for local bus travel (at constant prices): England, annual from year ending March 2005'

'n/a' Not applicable;'not available' indicates data not available to the DfT when the tables in question were published in Autumn 2024

includes the 'COVID-19 bus service support grant' (CBSSG), which was set up to support commercial bus operators in England in recognition of the impacts of Covid on their revenue due to reduced patronage. The payments aimed to ensure operators could provide service levels of up to 100% of pre-Covid-19 levels without the operator making a profit or a loss. It also includes the 'Bus Recovery Grant' which was set up to support commercial bus operators in England after CBSSG ended, due to the ongoing impacts of Covid on their revenue from reduced patronage. A further component is 'BSOG+' (additional to BSOG).

At 2022–2023, total support was about 10% lower than at the start, but support per passenger trip up by 18%, reflecting lower passenger volumes.

It should be borne in mind that the use of annual cost data may obscure some variations in the short run. For example, severe cuts were made in the early part of 2020–2021 financial year, but some recovery in service levels then took place from summer 2020 onwards, only to be reversed during further lockdowns.

Note that these data do not include funding from central government for Bus Service Improvement Plans (BSIPs) introduced in England outside London under the National Bus Strategy of 2021. Substantial payments did not begin until 2022/2023, covering initiatives such as improved service frequencies and coverage, lower fares and bus priorities. The strategy can be seen as a long-term measure rather than a response to Covid per se, but clearly could affect ridership in the longer term.

Changes in capacity provided, service output and resources used: rail

Table 9 shows the principal changes in TOCs' output and costs.

The year 2018–2019 was the last without any impacts of Covid, the following year being affected in the last few weeks. 2022–2023 represents a year in which restrictions had been

Table 9 Train operating companies (TOCs) output and cost changes, 2018–2019 to 2023–2024

Year	Total passenger-km ('000 m)	Total train-km (m)	Implied average passenger load	TOC total costs (£m)	Implied cost per train-km (£)	Implied cost per pax-km (pence)
2018–2019	67.70	534.19	126.74	12,144	22.73	17.94
Index	*100*	*100*	*100*	*100*	*100*	*100*
2019–2020	66.80	553.82	120.62	12,878	22.25	19.28
Index	*98.7*	*103.7*	*95.2*	*106.0*	*102.3*	*107.5*
2020–2021	12.50	422.38	29.59	12,427	29.42	99.41
Index	*18.6*	*79.1*	*23.4*	*102.3*	*129.4*	*554.2*
2021–2022	38.46	468.15	82.15	12,670	26.97	32.83
Index	*57.5*	*87.6*	*64.8*	*104.0*	*118.6*	*183.0*
2022–2023	51.67	454.85	113.60	12,352	27.16	23.91
Index	*76.3*	*85.2*	*89.6*	*101.7*	*119.5*	*133.3*
2023–2024	58.65	489.77	119.75	12,504	25.53	21.32
Index	*86.6*	*91.7*	*94.5*	*103.0*	*112.3*	*118.9*

All cost data at 2023–2024 prices

Sources: Office of Rail and Road (ORR) Tables 1233 (Passenger-kilometres by operator), 1243 (Passenger train-kilometres by operator); and 7210a (Rail Industry Finances by country and Network Rail Region). Open Access operations and services to Heathrow Airport are excluded

lifted, but some effects on rail demand—such as reduced commuting—were ongoing. Train-km continued to rise during 2019–2020, reflecting a trend of expanded services over many years. The greatest impact was in 2020–2021, with passenger-km reduced by over 80% but train-km by only about 20%, hence average load fell by about 76%. Total costs changed little over the period as a whole, but this clearly implies large unit cost increases, with cost per train-km up about 20% to 2022–2023 (compared with about 13% for bus in Table 7), and per passenger-km by over 30% (compared with 23% per bus passenger trip in Table 8). Apart from a drop in total cost of about 4% between 2019–2020 and 2020–2021, there seems to be little flexibility in responding to reduced output. This may be attributable to two main factors:

1. Directly variable distance-based costs form a very small proportion of the total as shown in Table 1, due to dominance of leasing. Even if fleets were reduced, it is likely that the oldest stock would be retired, whilst the newest stock (with higher leasing charges) would remain. For example, if train-km fell by 20% year-on-year, savings in energy costs (assumed *pro rata*) would only reduce total costs by about 1%.
2. Limited scope to reduce staff *pro rata* to train-km. For example, where a TOC employs station staff it may not have been possible to cut these even where frequency was reduced, unless services were suspended. There may also have been a reluctance to use furloughing for train operating staff. Total staff (FTE) employed by passenger train operating companies at 31 March rose from 61,230 in 2019 to 62,155 in 2022.[19] It must be stressed that the TOC costs shown above substantially understate total rail industry costs, due to the fact that less than half of Network Rail's income is produced from charges to operators. A fuller picture is presented in Table 10. However, in 2023–2024 rail performance improved substantially, with marked growth in passenger volume and train service output, reducing indicators such as cost per train-km and passenger-km.

Table 10 Rail industry total expenditure and support for passenger operations 2018–2019 to 2023–2024

Year	Total rail industry expenditure (£m)	Industry expenditure per passenger train-km (£)	Industry expenditure per passenger-km (p)	Government support to passenger operations (£m)	Government support per passenger-km (p)	Total government support to the rail industry (£m)
2018–2019	20,760.60	38.86	31.06	639.5	0.96	5417.6
Index	*100*	*100*	*100*	*100*	*100*	*100*
2019–2020	21,707.10	39.20	32.89	639.5	2.20	7848.8
Index	*104.56*	*100.85*	*105.92*	*226.57*	*229.52*	*144.88*
2020–2021	22,692.20	53.72	182.41	12,367.8	99.42	20,442
Index	*109.31*	*138.24*	*587.38*	*1933.98*	*10,392.81*	*377.33*
2021–2022	23,699.70	50.62	61.62	7826.7	20.35	15,454.2
Index	*114.16*	*130.26*	*198.42*	*1223.88*	*2127.31*	*285.26*
2022–2023	23,966.60	52.69	46.38	4608.5	8.92	15,429
Index	*115.45*	*135.58*	*149.36*	*720.64*	*932.36*	*284.79*
2023–2024	22,195.90	45.32	37.84	4060.6	6.92	12,433.9
Index	*106.92*	*116.61*	*121.86*	*634.96*	*723.74*	*229.51*

All data at April 2023 to March 2024 prices

[19] ORR Table 2233 'Full-time equivalent employees by operator, Great Britain, as of 31 March, 2011–2023'.

Total industry expenditure is derived from ORR Table 7210 (as above) and government support from ORR Table 7270 'Government support to the rail industry (April 2023–March 2024 prices), Great Britain, annual data, April 1985–March 2024'. The expenditure data are taken from in Table 7210, and exclude expenditure on High Speed Line 2, rail freight, non-franchised passenger operators, Northern Ireland, East–West Rail, and Crossrail (now known as the Elizabeth Line). However it is not wholly possible to separate some elements of freight costs within Network Rail, hence a small overstatement of infrastructure cost attributable to passenger operations may arise. Passenger-km indicators are based on the same totals as shown in Table 9.

It can be seen that total industry expenditure rose fairly steadily in real terms (by about 15% to 2022–2023), but more substantially in terms of cost per train-km (36%) and per passenger-km (49%) with an obvious peak in 2021–2022 when passenger volumes were very low. Total expenditure fell to 107% of the base year figure 2023–2024: a major factor in this may be a sharp drop in Network Rail's financing costs from £4,400 m in 2022–2023 to £2,600 m in 2023–2024, i.e. by 40.9%, mostly due to a reduction in cost of historic index-linked debt (Office of Rail and Road 2024a). The net support to passenger operations fluctuates much more widely, since this reflects the difference between revenue received by operators and their expenditure, comprising grants paid to TOCs by central government and payments from Passenger Transport Executives in the metropolitan areas outside London. In some cases, the former were very small prior to Covid, or even negative (i.e. premia paid back by some TOCs exceeded the sum total of support to others). Overall, support in 2022–2023 was over seven times that paid in the first year. However, this category could be seen as broadly comparable in definition to the net support to local bus services support in Table 8, which rose very little to 2022–2023.

It shoud be noted that 'support to passenger operations' in Table 10 above relates only to payments involving TOCs, which shows very large fluctuation during the Covid period. In addition, a large payment has been made for many years by central government directly to Network Rail. Given that the vast majority of infrastructure costs relate to passenger services, this can also be seen as form of assistance to passenger operations. In 2022–2023 this comprised £7515 m of NR's total income of £10,024 m.[20] It is also reflected in the total industry costs per passenger-km in Table 10. A further feature of NR's costs is that very high debts have been accumulated, resulting in financing costs as mentioned above, absorbing over half of the government payment to NR in 2022–2023.

An alternative view of support to rail passenger services which gives a less volatile outcome is to examine total industry support for the rail industry (including direct government funding for NR), shown in the right hand column of Table 10. The absolute total support thus calculated is much greater than that to TOCs directly, but less extreme fluctuation is observed, with an index value of about 230 in 2023–2024, compared with 635 for passenger operators as such.

A further factor in the public expenditure required to support rail is the fact that train operating company contracts have been placed on a gross cost basis, with the state effectively taking all revenue risk. Hence, the drop in revenue yield associated with loss of business travel will have directly impacted public spending. There is also the question of whether incentives for management to contain costs have been reduced.

[20] Network Rail Annual Report and Accounts 2022–2023, p196.

Table 11 Output per member of staff

Year	Rail—TOC staff only	Rail—including NR staff	Local buses England outside London
2010–2011	10,026	5934	20,247
2018–2019	8814	5283	20,390
2019–2020	8968	5345	20,392
2020–2021	6773	3983	17,003
2021–2022	7643	4548	20,753
2022–2023	7415	4501	19,970
Index (1)	*84.1*	*85.2*	*96.1*
Index (2)	*74.1*	*75.9*	*97.4*

Rail: passenger train-km per member of staff

Bus: bus-km per member of staff, bus-km from Table 6 (above)

Index (1) shows the 2022–2023 value as a percentage of 2018–2019; Index (2) shows the 2022–2023 value as a percentage of 2010–2011

There is little sign of short-term flexibility in costs incurred by Network Rail. Although the access charges paid by operators do include an element of 'Variable User Charge' (VUC) associated with total train-km run and rolling stock characteristics (such as axleload) it should be borne in mind that it may not be possible to vary input costs in the short run given the existing maintenance and renewal schedules. However, in some cases the opportunity was taken to undertake substantial renewal work during periods of lower traffic. In terms of signalling staff and other costs, these may vary little with train-km run if the routes are kept open for the same periods of time.

A comparison of staff productivity

For rail, Train Operating Companies (TOC) staff cover all rail passenger operations in Britain,[21] as do the train-km.[22] Network Rail (NR) staff are taken from annual reports for the years in question. Note that furloughed bus staff are included (note 17 to DfT Table 07b), hence a different outcome to trends in reported operating costs may result, and the 2020–2021 bus output indicator is depressed. As staff numbers are shown only to the nearest thousand, small differences should be treated with caution. A very similar trend for bus-km per member of staff is evident for buses in Britain as a whole. Likewise, the bus-km per member of platform staff (largely drivers) in GB as a whole remained around 25,000 over the whole period[23] (Table 11).

It is noteworthy that the drop in output per rail staff member is not confined to Covid, but (from the same data sources) is more marked when compared with a base year of 2010–2011. A study by the ORR (2024b) indicates a very similar trend, from a base year of 2013–2024. Note that for both rail and bus operators all staff are included, i.e. engineering and management functions as well as direct operating staff. It is possible that return of some contracted activities back to 'in house' provision by directly-employed staff may have affected some indicators, notably for Network Rail.

[21] ORR Table 2233 'Full-time equivalent (FTE) employees by operator, Great Britain'.

[22] ORR Table 1243 'Passenger train kilometres by operator, Great Britain'.

[23] From DfT tables Bus 07a (staff composition) and Bus 02b (km run).

ORR data also provide total passenger-vehicle km (in addition to train-km) over this period, indicating an average train length of about 6 vehicles (including 'locomotives') during this period.[24] On this basis, staff productivity for rail staff woud be much higher, indeed greater than for bus, but the trend would be very similar. Furthermore, only one driver is needed for a bus or a full-length train, so the comparisons between output in terms of train-km and bus-km perhaps remain more valid.

The coach industry case

The national rail and local bus cases described above represent examples in which it was deemed a public priority to ensure that at least a certain minimum service of service was provided during a period of very low demand under lockdowns, so that those passengers needing to make vital journeys (such as food shopping, or in essential employment categories) could do so. The maintenance of services may also have reflected a desire to see the industry remain in action in order to resume a broadly similar level of service after the pandemic. Hence, as well as enabling furloughing of staff, revenue support was provided on a large scale.

In contrast the coach sector, whilst able to use furloughing of staff, did not receive revenue support as such (the same applies to air travel). The sector is composed of two main elements:

1. The scheduled express coach network, providing a service similar to rail, on fixed routes and timetables, primarily operated by large companies such as National Express (NE), run on a commercial basis. Prior to the pandemic, NE had carried about 20 million passenger trips per year, with a further 4 million on Megabus (Reynolds and White 2022). Within Scotland, a separate network is operated mainly by Citylink.
2. Private hire, excursion and tour work, operated according to demand, mainly by smaller companies. A further major element is operation of contracted school services (additional to education travel by scheduled local bus services described earlier), often by older vehicles.

These lockdown periods saw the almost complete suspension of scheduled coach services, and likewise elimination of hire and tour activity (with corresponding loss of revenue), with a slow recovery afterward. A number of companies in the hire and tour sector did not survive, with the notable collapse of the largest tour operator (Shearings) during this period, and capacity in the market was substantially lower after the pandemic ceased.

In most cases, the facilities provided by this sector could be seen as serving an 'optional' demand, essential local services being sustained by local buses. However, some express coach services do provide very useful long-distance through links from rural regions to major centres such as London. Those areas which retained their rail services for such purposes continued to benefit from very high levels of financial support, whilst no such funding was provided for express coach services and their users.

Scotland was a partial exception to the cessation of coach services during lockdowns, a basic network (albeit at low frequency) being continued by Citylink, which rapidly recov-

[24] ORR Table 1253: Passenger vehicle kilometres by operator, Great Britain, April 2010–March 2024.

ered to full strength afterward. A significant factor may be that many Citylink services have registered 'local' sections on hence making them eligible for BSOG. In addition, free concessionary travel applies to coaches as well as local buses in Scotland, and hence operators receive concessionary travel compensation.

Following the end of the pandemic, the NE network has largely resumed, although some lower-density services in rural areas have not done so, whilst a greater concentration on trunk routes can be seen. Airport-related traffic is an important component in NE's demand, which was thus dependent on revival in that sector. Perhaps surprisingly, Flixbus entered the UK market during the pandemic and has subsequently expanded. However, almost all its services parallel existing coach corridors, thus further emphasising the greater focus on this component. London commuter services have largely disappeared. Megabus resumed operation. However, it withdrew all services operating wholly within England in December 2024, but continued to operate within and to/from Scotland. Almost all of these had paralleled existing NE and Flixbus services.

National Express reported a passenger volume on its 'core coach' network of 19.212 m in 2023, versus 20.779 m in 2019, i.e. only 7.5% below pre-Covid (Mobico 2024). Coach travel may have been stimulated by numerous rail strikes during this period.

Possible operational and policy responses

Although absolute passenger volumes have largely recovered, some longer-term changes remain evident:

1. A loss of off-peak bus travel by older people.
2. A continued peak on weekdays in local bus travel, associated with educational journeys.
3. Substantial rail commuting mid-week, with lower utilisation on Mondays and Fridays (and on bus in some areas).
4. A high level of fixed costs associated with vehicle leasing and depreciation. Already evident in rail, this is also beginning to apply to bus, following the shift from diesel to battery electric buses. The latter have lower variable costs for maintenance and (dependent on electricity pricing) energy, but about twice the initial capital cost.
5. Greater ridership retention (or even a net increase on pre-Covid) at weekends.

To some degree, resources can be redeployed. For example, improved weekend services can be covered by staff whose weekday load is reduced. This involves some negotiation to change working patterns which in the rail case may be required in any case (Sunday work has often been covered by voluntary overtime, resulting in poor reliability).

However, patterns within the working week remain problematic. In some cases, reduced services are operated (for example, on Fridays; or during university vacations on Oxford P&R services) but this leaves the question of lower vehicle and infrastructure utilisation. The lower demand on Mondays and Fridays also affects utilisation of office space and viability of city centre ancilliary trading such as hospitality, suggesting other organisations have an incentive to spread demand as well as transport operators. One option may be to use pricing, given the widespread adoption of smartcard pricing based on journeys made rather than a fixed period cost. For example the Mayor of London introduced all-day off-

peak pricing on rail on Fridays in March 2024, for the period to May 2024, but this seems to have had very little effect. Following a peak in WFH during Covid, there has been some return to greater levels of attendance at offices, encouraged or enforced by management. However, this is unlikely to wholly revert to the pre-Covid pattern. Indeed, as shown in the earlier study (White et al. 2007) employers also saw benefits from hybrid working patterns, for example by being able to attract a wider range of potential employees.

In the case of the educational travel peak on local buses, it may be necessary to accept a greater differential between peak and inter-peak demand. It may be worth adopting the approach adopted in rural areas to school demand, in which older vehicles are used. These may incur higher variable maintenance cost per bus-km, but much lower capital costs (reflected in written-down values). They still have to meet the same safety standards, and can be interworked if needed with all-day services. Where it is desired to electrify such vehicles, older buses can be retrofitted with batteries designed for a limited range rather than all-day operation.

A particularly worrying outcome of bus cutbacks is the substantial drop in service levels to about 83% of pre-Covid levels in England outside London, although ridership has held up slightly better (Table 7). This substantially reduces accessibility for those dependent on such services. The current programme of Bus Service Improvement Plans (BSIPs) now provides funding for all local authority areas, the previous system of competitive bidding having been replaced by a needs-based allocation system. The BSIP funding was also reformed prior to this, so that it could be used to sustain existing services rather being limited solely to 'innovative' services. It does not necessarily follow that all reductions in services will be restored, either in terms of network size or frequency, since demand patterns have changed and total funding available would not be sufficient. The BSIP funding is dependent upon local transport authorities adopting 'Enhanced Partnerships' with bus operators which encourages a more co-ordinated approach to service provision and marketing than under the previous deregulated framework, albeit the distinction between commercial and tendered services remains. Some areas are adopting the concept of 'franchising' under which all services are specified by the local transport authority and contracted out to operators. This enables a greater degree integration between services and a common fare structure. So far one area (Greater Manchester) has converted its whole network to operate on this basis, with others proposing to do so. However, total funding available may likewise constrain the degree of the ridership recovery that is attainable.

Conclusions

The public transport sector in Britain has recovered substantially in terms of ridership since the end of the pandemic, but only on rail has a substantial change in the trip purpose mix and distribution by time of day occurred. On local bus, a clear weekday peak remains, associated with education travel, whilst inter-peak demand has been affected by a drop in demand from older users. Working from home has affected rail more than bus, and has produced variations within the working week associated with hybrid working patterns. The bus industry has displayed more flexibility in responding to changed conditions, being able to maintain a broadly stable level of bus-km per member of staff, whereas for rail the equivalent indicator

has declined substantially. Policy responses may include measures to get a better spread of rail demand within the working week.

The willingness of government to provide very large amounts of financial support during the pandemic enabled operators to survive this difficult period, and thus be in a position to largely restore services, with supporting staff and vehicle resources to do so. The alternative might have been a permanent loss of capacity with resultant low service levels and ridership. However, it is notable that support levels for rail have remained much higher than in the local bus sector, despite the greater recovery of rail demand in the last reported year.

Acknowledgements Helpful comments were provided on a draft report of the 2007 teleworking study by Prof. Patricia Mokhtarian of University of California Davis indicating broadly comparable findings with those in the USA at that time. The principal findings of this paper were first presented at the International Transportation Economics Association conference held at Leeds University in June 2024. This text has benefitted from comments received from academic colleagues and a bus industry senior manager, and has been updated to incorporate data made available since the earlier version.

Author contributions Entire text written by single named author, who also carried out calculations derived from published data.

Funding This work has not been funded from a specific source, but has clearly benefitted from the substantial data collection carried out by the DfT. The earlier study of teleworking (White et al. 2007) was carried out in partnership with other academic colleagues at the University of Westminster, University College London, and Imperial College London, being funded by Transport for London and British Telecom. All viewpoints expressed, and subsidiary calculations from published data, are those of the author, who has no competing interests in the matters described. He is member of the Editorial Advisory Board of this journal. Data from the Department for Transport is shown in Fig. 1. Government publications are generally issued under Crown copyright, under the Open Government Licence enabling reproduction except where third parties are involved.

Data availability No datasets were generated or analysed during the current study.

Declarations

Competing interests The authors declare no competing interests.

References

Anable, J., Brown, L., Docherty, I., Marsden, G.: 'Less is more: Changing travel in a post-pandemic society' CREDS/DecaboN8. Centre for Research into Energy Demand Solutions, March (2022)

Bartle, C.: Insights from social and behavioural research at DfT during the COVID-19 pandemic. University of the West of England/Department for Transport (2024)

Chartered Institute of Logistics and Transport (CILT) and University of Plymouth: 'The impact of Covid on English national concessionary travel journeys (2023).

Confederation of Passenger Transport UK (CPT-UK): Annual survey of member operators (2019).

Davenport, A., Levell, P.: Changes down the line: flattening the curve of public transport use. Institute for Fiscal Studies Briefing Note 287, May (2020)
Department for Transport: Concessionary travel for older and disabled people: guidance on reimbursing bus operators (England), p. 47 (2023)
Kendall, S., Niblett, M., El Hajj, J.: The longer-term impacts of the Covid-19 pandemic on Transport and Land Use. Independent Transport Commission, London, March (2024)
KPMG: 'Alternatives to the National Fare Cap: How can the next government make bus travel more affordable for more people?' Report for CPT, February (2024)
Le Vine, S., White, P.: The shape of changing bus demand in England. Independent transport commission, London, January (p. 8 and figure 31, p. 52 and figure 44, p 61) (2020)
Lizana, M., Choudhury, C., Watling, D.: Analysing the impacts of individual-level factors on public transport usage during the COVID-19 pandemic: a comprehensive literature review and meta-analysis. Transp. Rev. **44**(2), 434–460 (2024). https://doi.org/10.1080/01441647.2023.2295967
Lu, M.: Long-term Implications of COVID-19 on Travel Behaviour and Traffic Forecasting—An International Literature Review. Department for Transport, London (2024)
Marshall, B., Rigby, C., Heywood, A., Sheerin, C., Behailu, A.: Our changing travel: research into how people's travel choices are changing' IPSOS report to Department for Transport (2023)
Mobico Group PLC [holding company for National Express]: Results for the full year ended 31 December 2023, published 22 April 2024, p 17 (2024)
Mulley, C., Nelson, J.: Public transport responses to COVID-19 in the United Kingdom Chap 27. Shibayama, T., Emberger, G. (eds) International perspectives on public transport responses to Covid-19. World Conference on Transport Research (2024)
Munch, E.: The irresistible peak-hour: Instrumental and axiological rationales of work hours' synchronisation. Transp. Res. Interdiscip. Perspect. **3** (2019). https://doi.org/10.1016/j.trip.2019.100063
National Audit Office (NAO): A financial overview of the rail system in England 22 April, pp. 10–16 (2021)
Office of Rail and Road: Rail Industry Finance (UK) April 2023 to March 2024, published 28 November 2024, p. 8 (2024a)
Office of Rail and Road: Discussion paper on rail industry productivity. April (2024b)
O'Keefe, P., Caulfield, B., Brazil, W., White, P.: Impacts of telecommuting in Dublin. Res. Transp. Econ. **57**, 13–20 (2016)
Reynolds, T., White, P.: Forty years' experience of deregulated express coach services in Britain. Res. Transp. Econ. (2022). https://doi.org/10.1016/j.retrec.2022.101181
Savage, I.: The analysis of bus costs and revenues by time period. Transp. Rev. Part 1 (Lit. Rev.) **8**, 283–299 (1988)
Savage, I.: The analysis of bus costs and revenues by time period. Transp. Rev. Part 2 (Methodol. Rev.) **9**, 1–12 (1989)
Transport for London: Travel in London 2023: trends in public transport demand and operational performance (2023)
University of Leeds, Institute for Transport Studies, and National Bus Company: Cross subsidy in urban bus operations (1984)
White, P.: Public Transport: Its Planning, Management and Operation, 6th edn. Routledge, Abingdon, New York (2017)
White, P., Christodoulou, G., Mackett, R., Titheridge, H., Thoreau, R., Polak, J.: The role of teleworking in Britain: its implications for the Transport System and Economic Evaluation. Paper at European Transport Conference, Netherlands, October (2007)
White, P., Titheridge, H., Moffat, D.: Potential impacts of teleworking on transport systems. Logist. Transp. Focus **13**(11), 26–29 (2011)
Williams I, Jahanshahi K (2018) Wider factors affecting the long-term growth in rail travel. Independent Transport Commission, London, November (pp. 79–80, and 106–107).

Peter White is Emeritus Professor of Public Transport Systems at the University of Westminster. His career began as Lecturer in that subject at the same institution (then known as the Polytechnic of Central London) in 1971. He is author of the textbook'Public Transport: Its Planning, Management and Operation' (sixth edition 2016), co-author of the Independent Transport Commission report 'The changing shape of bus demand in England' (2020), and of numerous other published reports and papers. Current research interests include developments in the bus and coach industry, the impacts of teleworking on public transport, and role of smaller vehicles in public transport.