Covid-19 recovery scenarios: Opportunities for a more prosperous and sustainable South East

Final draft report
January 2021

Covid-19 recovery scenarios: Opportunities for a more prosperous and sustainable South East

Final draft report
January 2021

Prepared by:

Steer
28-32 Upper Ground
London SE1 9PD

+44 20 7910 5000
www.steergroup.com

Prepared for:

Transport for the South East
County Hall
St. Anne's Crescent
Lewes
East Sussex
BN7 1UE

Our ref: 23433708

Contents

Appendices – Technical modelling

Figures

Tables

Executive summary

Covid-19 has had a profound impact on every facet of our lives. It has reshaped the way we live, work and travel and has transformed the world in ways that would have been unimaginable just 12 months ago. Even now, with large-scale vaccination of the UK population well underway, the future looks uncertain. The interaction of the virus, the economy and public policy are all likely to shape it in ways that are as yet unknown, and dependent on variables such as the effective roll out of a vaccine or the discovery of an effective treatment.

But, despite this uncertainty and the hardship which will continue to be inflicted by the impacts of Covid-19, we find ourselves in a moment of real opportunity; to reimagine how we construct our societies and reshape them in ways that are more sustainable and more resilient economically, socially and environmentally.

It is against this background that this report has been written. Its aim is to help inform and support decision makers as they balance options and trade-offs for a more prosperous, and sustainable, South East. The report comes in two sections:

(i) The main report provides an overview of the impact that Covid-19 has had on the South East, and an exploration of how the area might react and adapt in the future.

(ii) A series of appendices providing a technical description of modelling undertaken of the South East, which gives some indications as to how the area's economy and transport systems might recover in the coming years. This work has been used to inform some of the conclusions in the main report, and there are explicit connections/overlaps between the two sections.

This report was developed during a period of rapid change and development and some content in this report may become outdated quickly. However, at the time of writing this represents our assessment of how Covid-19 will impact upon travel in the region; recommendations for how to address challenges and seize opportunities to make decisions; and how to plan and build a more resilient South East in this time of great uncertainty.

For the purposes of the area studies it must be recognised and accepted that there remains significant uncertainty about how the transport network is going to develop post Covid-19. Although the modelling work that has been undertaken provides some indicative possibilities for what this future may look like, more than anything, it highlights the many 'known unknowns' about Covid-19 and its potential impacts. The area studies should therefore aim to develop strategies which provide some measure of flexibility and resilience; strategies which aim to help areas identified as more vulnerable to the impacts of Covid-19, while retaining the flexibility to adapt as its impacts are realised over the long-term.

There are a number of particular insights about how the area studies might interpret and make use of the findings of this work:

Speed of recovery

The economic recovery from Covid-19 is likely to take place over years, rather than months. It may entail major economic restructuring of the South East's economy. However, the short-term economic damage caused by the pandemic should not be used as an indicator of what these long-term changes will be. Many of the sectors which have been hit the hardest – Hospitality, Tourism, Entertainment and The Arts – are fundamental to the functioning of a healthy society and are anticipated to return in the South East once the economy has recovered.

Many of these factors are beyond the control of TfSE and the area studies, which should aim to understand how patterns of working and commuting may change in the future, looking to plan for these changes, rather than changes in what these jobs actually are. Ultimately the long-term nature of the planning which TfSE undertakes means that it needs to envision a society which has returned to a 'new normal', while accepting that this may be several years away.

A new relationship with London

Due to its geographical proximity, the South East has traditionally had a strong relationship with London. This is particularly true of 'commuter towns' with good rail connections to the capital. Covid-19 has changed the nature of this relationship, with many people who formerly worked in London now working from home in the South East. In the future there may be an increase in the number of individuals relocating permanently to the area from London. This is likely to bring benefits to the South East by boosting its 'native' economy but will also place more pressures on an already overstrained housing market.

The area studies must consider carefully how this new relationship with London is going to influence travel patterns across the South East (for example, the demand for rail travel and the case for enhancing the rail network), and encourage housing development in areas which are likely to accommodate this increased population. Radial journeys, which formerly made up a significant proportion of the journeys in the South East, may now become less important, with consequentially greater need for investment in 'Orbital' components of the transport network.

The importance of polycentricity

The relatively large number of medium-sized towns and cities across the South East has thus far helped the region's resilience as compared to other UK regions with larger urban hubs. Individuals are more likely to be able to move safely and efficiently around these smaller urban areas using active travel modes, rather than public transit, to get around. This tallies well with TfSE's desire to 'create great places to live' and 'put people first' as outlined in the recent transport strategy. TfSE must continue to pursue this strategic direction, newly supported by the evidence that it aids regional economic and social resilience.

To help these regions thrive into the future, investment in 'intermediate length' transport journeys will be important, for example, reallocating rail capacity to focus on local services, encouraging express bus services (possibly through the segregation of traffic lanes into explicit 'expressway' lanes) and the provision of more road space for active modes like walking and cycling. With more dispersed patterns of travel

temporally and spatially, it is harder to accommodate these travel patterns by frequent, fixed-route public transport. Existing fixed route transport may also be made less viable with fewer peak trips. In the longer term, if the population of these towns and cities is to increase beyond current plans, there will need to be investment in Transit-Orientated Development, providing the housing needed for population expansion without increasing usage of private cars.

Rising inequality

Covid-19 has affected those at the lower end of the income scale the hardest. More deprived, lower-income sections of the economy have borne the brunt of the economic shock and will take the longest time to recover. The South East already has high levels of inequality, which are likely to worsen as a result of the pandemic. Transport is an 'economic enabler' – it allows people better access to opportunities, helping to encourage economic prosperity. While passenger demand for public transport is suppressed due to capacity constraints and economic and behavioural responses, sustaining and increasing public transport (including shared mobility and on-demand service) capacity, accessibility, and connectivity is necessary as a direct response to ensure that people who are reliant on public transport and need to travel can. In addition, it is important for managing congestion in our towns, cities and along major corridors.

Investment will have direct and wider benefits for the economy, society and the environment. Support for public transport (e.g. additional funding for subsidies or direct payments to operators, promotional campaigns) are required for maintaining levels of service and growing demand as rapidly as possible. Further measures could include the use of new technologies such as integrated ticketing to encourage wider use of services across the area; bus priority measures; and mass rapid transit. Overall, area studies must make use of their influence to provide good connections for individuals living in areas of high deprivation to good job opportunities, carefully assessing how provision of transportation can help communities which have been hardest hit by Covid-19 to recover more rapidly.

Technological and behavioural 'acceleration'

Covid-19 has accelerated many technological developments which were already reshaping our society, such as greater working from home and greater demand for remote access to goods, services and amenities (and corresponding increase in deliveries). Some of these changes have been and will be positive for society. Investment in digital technology has the potential to facilitate economic resilience and recovery as partially evidenced from increased levels of home working and remote access to services and amenities – "Digital as a Mode". Increased homeworking may reduce commuting trips, and longer distance trips, which cause particularly high levels of pollution.

For example, in the short-term greater working from home has lowered the region's carbon emissions. However, many of these developments will pose problems. For example, greater use of online retailers and online forms of 'social' interaction may 'hollow out' the public spaces (such as high-streets) around which society is built, and/or longer but less frequent commutes may lead to a net increase in travel (and therefore carbon emissions).Increased homeworking may also reduce trip-chaining

(e.g. combining a commute trip with a school drop-off or grocery shop). However, these and other trips still need to be made and there could be an increase in trips made outside of the AM and PM peaks. Also, with a car more likely to be available at home most of the day, household members may make more trips by car (because they can now). Ultimately, though, increased homeworking is likely to be environmentally beneficial, and therefore, it is advocated that digital (to ultra-fast broadband) and mobile (to 5G) connectivity are improved to ensure the potential for this is maximised.

Although an increase in car mode share has been forecast, this has been offset by a reduction in total numbers of trips resulting from decreased work trips (i.e. higher levels of working from home and a lower number of jobs). This overall reduction in the total number of car trips is forecast to last at least three years, as per the modelling. It is unclear how this will change beyond this period, but we could well be planning in the medium to long term for lower levels of car traffic than previously envisaged. It is also possible that through changing travel patterns as a result of where people live and work and how they work, that demand for car travel spreads to outside the peaks and moves away from some of the most congested radial routes in the region.

TfSE, through its area studies, must therefore think carefully about how they can best make use of the benefits brought by this technological acceleration and behavioural shifts, whilst ameliorating their negative side-effects. In particular, it will be important to ensure that towns and cities remain sites where people want to come and interact, even as economic opportunities become less geographically concentrated.

2 Context

Purpose

2.1 Transport for the South East's (TfSE's) transport strategy was developed in 2019, before the outbreak of the Covid-19 pandemic in early 2020. The "lockdown" instigated by the UK Government in March 2020 and measures that have been taken since have had short term impacts on the economy, the way people travel, and how far and how often they travel. At this juncture, it is unclear how long-lasting these impacts will be. There is an expectation that transport policy, including investment plans and programmes, will be one way in which public policy can be used to mitigate the economic impacts of the pandemic and aid recovery. At the same time there is a continuing desire to progress pre-pandemic agendas of supporting equitable economic growth, decarbonising the transport sector, and addressing local socio-environmental impacts such as air quality. Changes in travel patterns resulting from the pandemic have the potential to both positively and negatively impact upon the realisation of TfSE's transport strategy and vision (reduction in peak hour travel demand resulting from home working, and reduction in public transport patronage being two of the most notable trends). Overall, at this juncture, what Covid-19 means for TfSE's transport strategy and subsequent area studies is unclear.

2.2 The purpose of this paper is to start to set out issues that may influence the future programme of work. It is limited, however, in several key ways: first, the pandemic and its impacts are changing rapidly, and as such, data presented here will date rapidly; second, there remain many things we do not know about the pandemic and its socioeconomic impacts; third, the Government has, and will likely continue to, implement major policy initiatives in order to combat the virus and the associated economic impacts – in the short term responses such as 'local lockdowns' can cause step changes in forecast trajectories. In the longer term, there are likely to be fiscal and policy initiatives to drive recovery. There will be a need to periodically review and refresh the analysis presented here and any conclusions that are made.

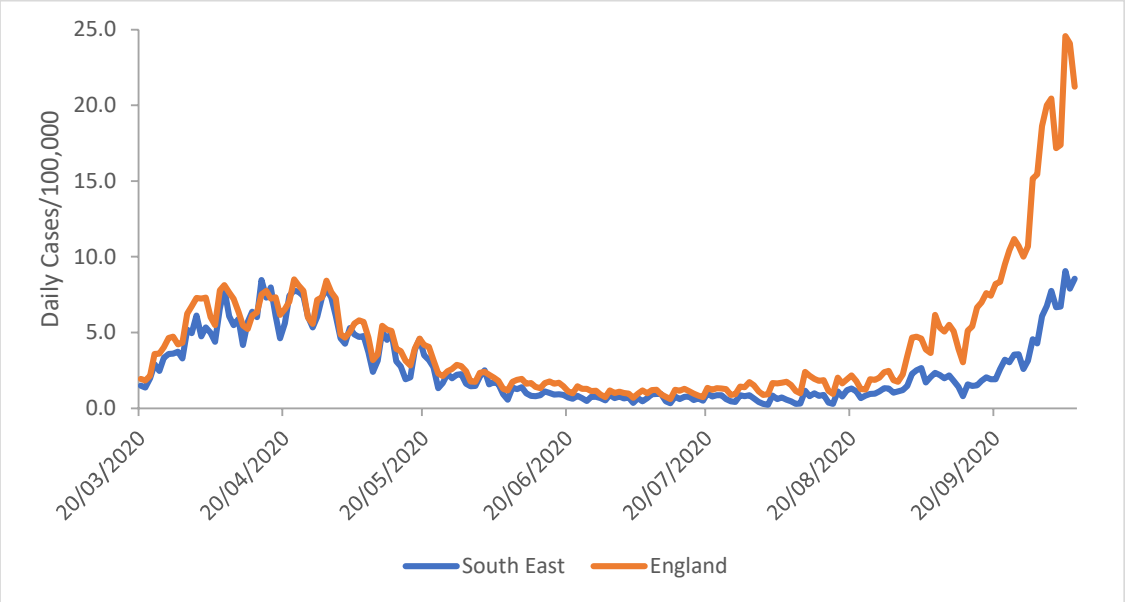
Background

2.3 Covid-19 is a respiratory illness, first identified in China in December 2019. The first cases were detected in the United Kingdom on the 31 January 2020.

2.4 From the beginning of March 2020, the disease spread rapidly across the UK and in most countries globally. The national lockdown reduced the incidence of the disease until the beginning of September 2020, when, after a relaxation of restrictions, case numbers began to rise again. At the time of writing (mid October 2020) we are now well into a 'second wave' of infections with large part of northern England, and parts of the Midlands, Scotland and Wales experiencing different degrees of 'local lockdowns'.

2.5 These patterns are illustrated by Figure 1.1. What is clear in this figure, is that infection rates in the South East closely followed England-wide trends in the 'first wave' but since August (when cases/100,000 began to rise again in a 'second wave') the South East's case rates have increased more slowly than the England-wide average. It is too early to say why this is – it may be because the South East has greater resilience to the virus (due to its socioeconomic characteristics) than other parts of England, or may be because the arrival of this 'second wave' is has been delayed in this part of the country – and as such is too early to say what its implications are.

Figure 1.1: Cases Per 100,000 over time, South East and England (Source: ONS)



Government response and policy context

2.6 To combat the virus, the UK Government made use of several policy intervention areas, two categories of which are particularly relevant for this paper. The first was 'lockdown' – closure of all but essential businesses and the curtailment of freedom of movement for non-essential journeys and interaction of the national population, which occurred on the 24 March 2020 (with a pre-lockdown advisory that everyone in the UK should avoid "non-essential" travel and contact with others delivered on 16 March 2020). Since then, the country has remained in some form of limited lockdown with restrictions varying depending upon geographical location, and moment in time.

2.7 The second major policy intervention was the provision of major economic support packages. These packages have been targeted at individuals and sectors of the economy whose jobs have been detrimentally affected by Covid-19. The most significant policy (in terms of financial cost and impact) has been the Coronavirus Job Retention Scheme (CJRS), which involved the government paying up to 80% of salaries for individuals who were unable to work because of Covid-19. There is also a Self-Employment Income Support Scheme. In addition, the Government has supported businesses directly through schemes such as deferring VAT payments and business rates, as well as the provision of loan facilities, amongst other actions.

2.8 The policy responses to Covid-19 is subject to regular updates and changes, and, as this document is not a policy review, we do not provide extensive exploration of them here. Instead we aim to provide some exploration of the impact these policies have had, in aggregate, on the South East.

3 Impacts

3.1 The measures taken to combat Covid-19 have had a number of impacts upon society, the economy, and the environment. It will continue to do so over the coming months and years, and may drive the world in a new, previously unexpected, direction. This section examines some of the already realised impacts in more detail, bringing them into perspective for the South East.

Health impacts

National

3.2 At the time of writing, cumulatively, over 430,000 people have tested positive for Covid-19 – a rate of approximately 6,500 cases per million population, although overall infection rates are likely to be much higher. The ONS estimates that nationally by the beginning of September between 1 in 14 and 1 in 18 adults had had Covid-19.[1] Over 42,000 have died within 28 days of providing a positive test[2] and 140,000 have been hospitalised with the virus.[3]

South East

3.3 At the time of writing, the average cumulative case rate (since the discovery of the virus) in the South East is 440 per 100,000 of the population, lower than the UK average of 660 per 100,000 of the population.[4] The death rate in the South East due to Covid-19 is 50 per 100,000, lower than the UK average of 63 per 100,000.[5]

Economic impacts

National

3.4 A direct result of the actions taken by governments domestically and internationally to tackle the pandemic is that the UK economy experienced a recession. UK Gross Domestic Product (GDP) is estimated by the Office of National Statistics to have fallen by 19.8% in Quarter 2 2020.

---

[1] Source: Office for National Statistics, **Coronavirus (Covid-19) infections in the community in England**, September 2020 Edition

[2] It is worth noting that this figure likely underestimates the number of deaths caused by Covid19, as there will have been a significant increase in the national death rate due to factors such as reduced hospital capacity.

[3] Source: UK Government, **Coronavirus (Covid-19) in the UK**, accessed 15 October 2020

[4] Ibid.

[5] Ibid.

3.5 The future performance of the economy will be a key driver of future transport demand. The most contemporary forecasts for the UK economy were produced in August 2020 by the Bank of England's Monetary Policy Committee. The Committee recognises that there is significant uncertainty about future economic performance, commenting "the outlook for the UK and global economies remains unusually uncertain. It will depend critically on the evolution of the pandemic, measures taken to protect public health, and how governments, households and businesses respond to these factors. The MPC's projections assume that the direct impact of Covid-19 on the economy dissipates gradually over the forecast period."

3.6 As a consequence, the Committee presents its projections as a range. The Committee anticipates a gradual but steady recovery of the economy from the beginning of 2021, but that health concerns will continue to provide a medium-term dampener on economic growth. The Committee's central case forecast is that in real terms it will be Quarter 4 2021 before the economy exceeds its Quarter 4 2019 size. Their central case unemployment projection peaks at around 7.5% in Quarter 4 2020 and only returns to Quarter 2 2020 levels after three years (in Quarter2 2023). The Committee notes that while the Coronavirus Job Retention Scheme (CJRS) ('furlough') has mitigated short term unemployment impacts, the accommodation and food, and recreation and leisure sectors have experienced the greatest short-term impacts.

3.7 In July 2020 the Office of Budget Responsibility set out a similar but more pessimistic forecast. Its central case has output recovers more slowly, regaining its pre-virus peak by the end of 2022. Its unemployment projections are also more pessimistic.

3.8 In time both the Bank of England and the Office for Budgetary Responsibility will produce new forecasts, but what is clear is that the current central case view is that it will be two to three years before the UK economy returns to its pre-pandemic size and longer still before employment levels recover.

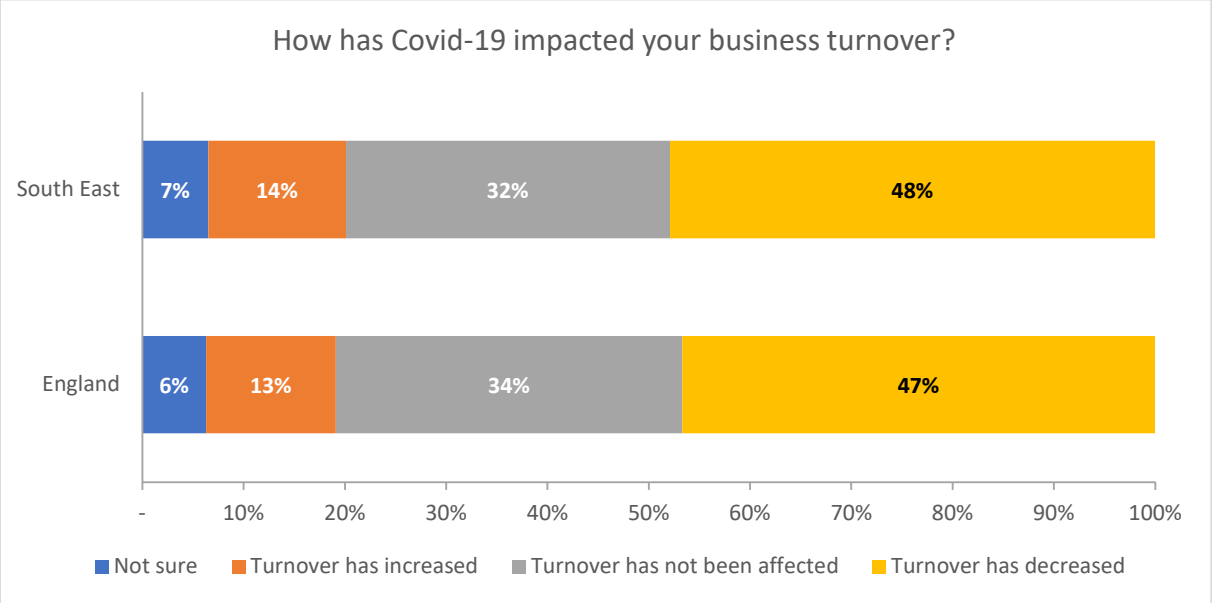
South East

3.9 It is challenging to make an accurate assessment of the impact that Covid-19 induced recession has had on the South East's economy, due to the recent nature of the economic shock and the time delay before there will be a sub-national breakdown of the recent fall in GDP. However, while a complete economic picture remains unavailable, 'furloughing' data can provide a useful proxy. In the South East, furloughing rates currently stand at 15% for women and 13% for men for the economically active population. This is lower than the national average for men (currently 14%) but higher than the national average for women (also currently 14%), and the region currently has the highest female furloughing rate of any region outside London.

3.10 The Office for National Statistics has also been conducting 'Business Impact of Coronavirus' surveys to gain a more complete understanding of how Covid-19 is affecting local businesses. This survey is conducted by sending out approximately 40,000 surveys to businesses of a fortnightly basis, asking their opinions on a range of Covid-19 related issues. Some of the results from this survey are presented in Figure 2.1. This shows that businesses in the South East are currently being affected in a similar fashion to the rest of the country (with just under half seeing turnover

decreasing). The limited data that is available suggests that on the whole the South East is doing no better and no worse than the English average.

Figure 2.1: Business Impact of Coronavirus (Source: ONS)



Transport impacts

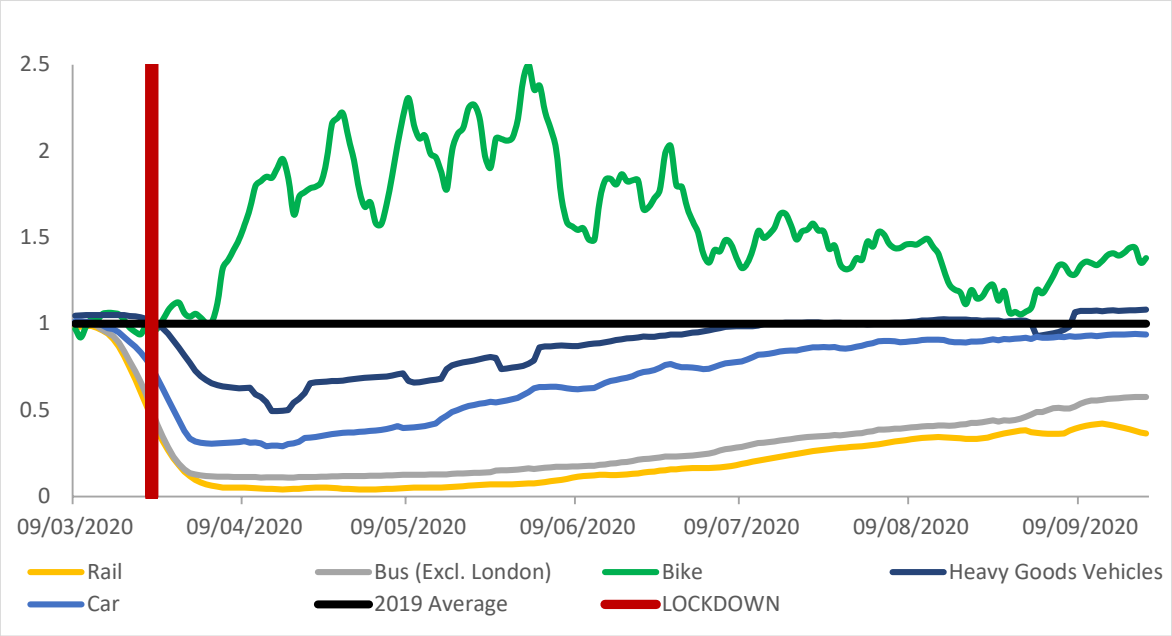
National

3.11 Transport both follows and is a generator of economic activity. During the national lockdown transport demand fell rapidly, but since lockdown relaxation transport usage has not fully recovered, due to the subdued economy and on-going restrictions, including social distancing which has reduced public transport capacity. The shift to home working has probably been the most significant driver of this drop. However, social distancing has also had a significant impact as it influences both capacity (because passengers must remain a greater distance from each other when using public transit, therefore reducing usable seats/space) and demand (because, due to social distancing, fewer spaces are available at entertainment/recreational venues which individuals may have previously chosen to attend). In addition, individuals remain afraid/unwilling to use public transport due to fear, and due to the impact of initial government messaging which told individuals not to use public transport.

3.12 As illustrated by Figure 3.2, the national lockdown had an immediate, and significant impact, upon transport demand. The number of people using public transport fell almost precipitously and has recovered only slowly. Car use fell by more than 50% but has recovered more quickly. Bicycle use increased over the summer months, peaking at nearly 2.5 times previous average levels.

3.13 With regards to freight, Figure 3.2 only shows data for road-based Heavy Goods Vehicles. Demand is comparable to pre-Covid levels. Data for Light Goods Vehicles/delivery vehicles operating will likely have seen an increase in trips and trip miles due to more internet shopping and home working.

Figure 3.2: Volume of Use relative to 2019, 7 day rolling average (Source: Covid Statistics)



NB: Highway data is for the SRN and therefore may not be representative of the MRN and local roads.

South East

3.14 The impacts upon the transport networks, and usage of public space, have not been evenly spread across geographies. For example, using data provided by Google, Figure 2.3 shows the change in usage of public parks for four different areas in the South East. It is apparent that in Brighton and Hove, park usage has seen a greater increase in use than either Reading or West Berkshire. Similar differences are evident in Figure 2.4, which shows the change in usage of 'Public Transit Stations' (transport hubs), which have nearly recovered to 2019 levels in West Berkshire, but remain significantly subdued in Reading. Overall, this suggests that the areas with the highest volume stations are the furthest behind the curve – the more a given area relies on public transport, the slower its recovery to pre-Covid levels of usage.

Figure 2.3: Change in usage of Public Parks, 7 day rolling average (Source: Steer Analysis of Google data)

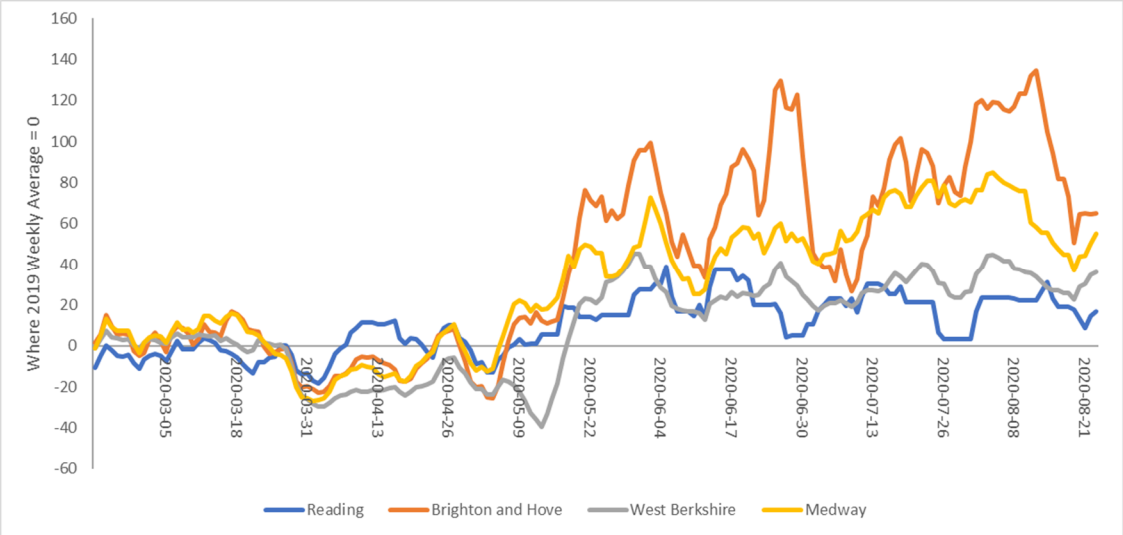
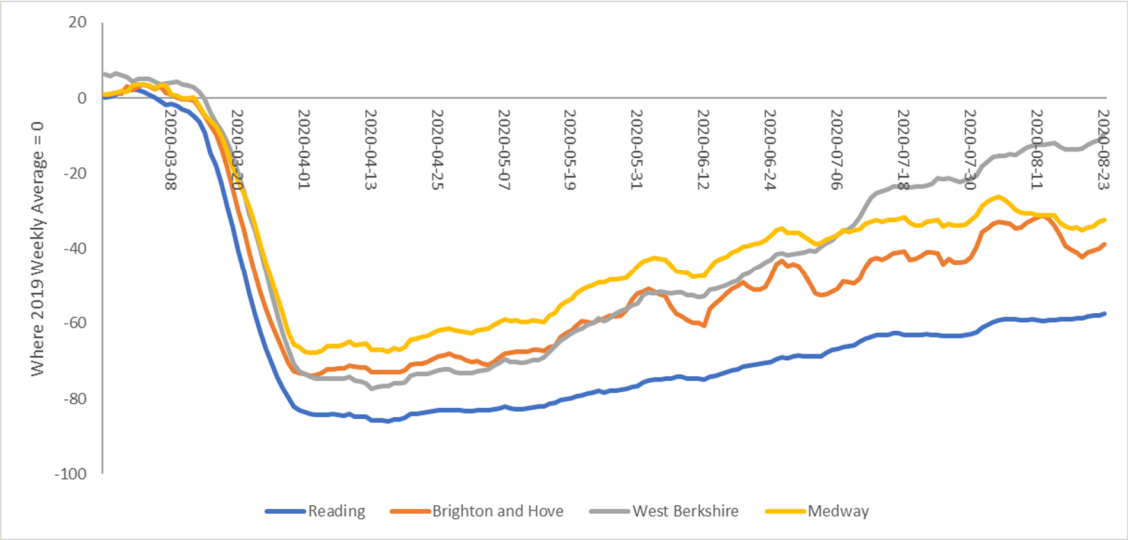


Figure 2.4: Change in usage of Public Transit Stations, 7 day rolling average (Source: Steer Analysis of Google Data)



4 Significant factors

4.1 The impacts of Covid-19 do not occur in a geographically neutral fashion; they are shaped by social, economic, and demographic factors. Similarly, while all areas of the country have experienced an economic downturn, its economic impacts will be more pronounced in some areas than others. Here an overview of these factors, and their relative incidence in the South East, is provided. We are not epidemiologists, and therefore do not aim to interrogate why these factors influence the spread and severity of the disease. Instead we aim to use this information to try and ascertain the relative strengths and weaknesses of the South East to the societal impacts of the virus, at a region-wide, population level.

4.2 In many cases these factors overlap/intersect – for example, individuals of a given income level are more likely to have certain occupations, as are individuals living in cities (high density areas). As such, although delineating each factor into a separate section provides useful clarity, they must be considered as a 'basket' of indicators, both at an individual and region-wide level, to understand the potential impact of the pandemic. An overview of the factors assessed, and their potential impact, is provided in Table 4.1: Key factors and Impact

4.3 .

Table 4.1: Key factors and Impact

Impact	Factor				
	Age and sex	Density	Deprivation	Ethnicity	Occupation
Does this influence the chances of contracting Covid-19? ***(Health impact)***	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Does this influence economic vulnerability to Covid-19? ***(Economic impact)***		**Yes**	**Yes**		**Yes**
Does this influence how transportation networks have changed due to Covid-19?		**Yes**			

(Transport impact)					

Age and sex

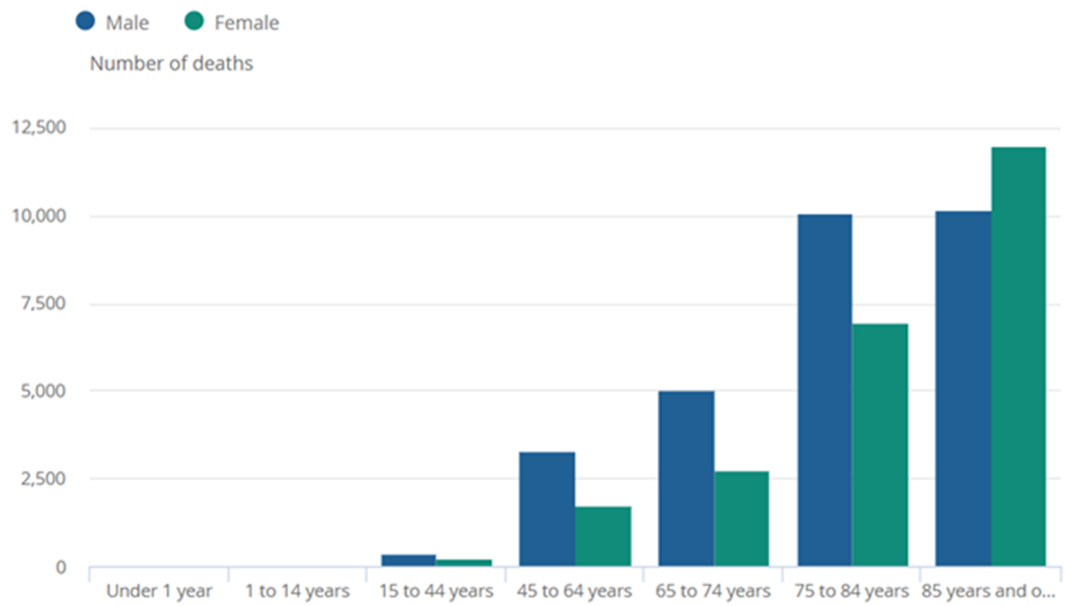
Health impacts

4.4 Age is the single most significant factor for determining the likelihood of serious illness and death by Covid-19, as illustrated in Figure 4.1: Number of deaths involving Covid-19 by sex and age group, England and Wales, registered between 28 December 2019 and 11 September 2020 (Source: ONS)

4.5 . While data is readily available on the number of people who have died from the disease, the number of people who have been ill or continue to experience symptoms of so-called “long Covid” is less clear. For those younger than 45, the risk of death from the disease is low when compared with the other risks faced. On average men are slightly more likely to die from the disease than women.

4.6 This does not mean that the propensity to contract, or likelihood of spreading the disease, are determined by age. In the UK, this has tended to vary through time, for example, in the month of September 2020 as lockdown restrictions eased, younger individuals had a greater propensity to contract the disease.

Figure 4.1: Number of deaths involving Covid-19 by sex and age group, England and Wales, registered between 28 December 2019 and 11 September 2020 (Source: ONS)



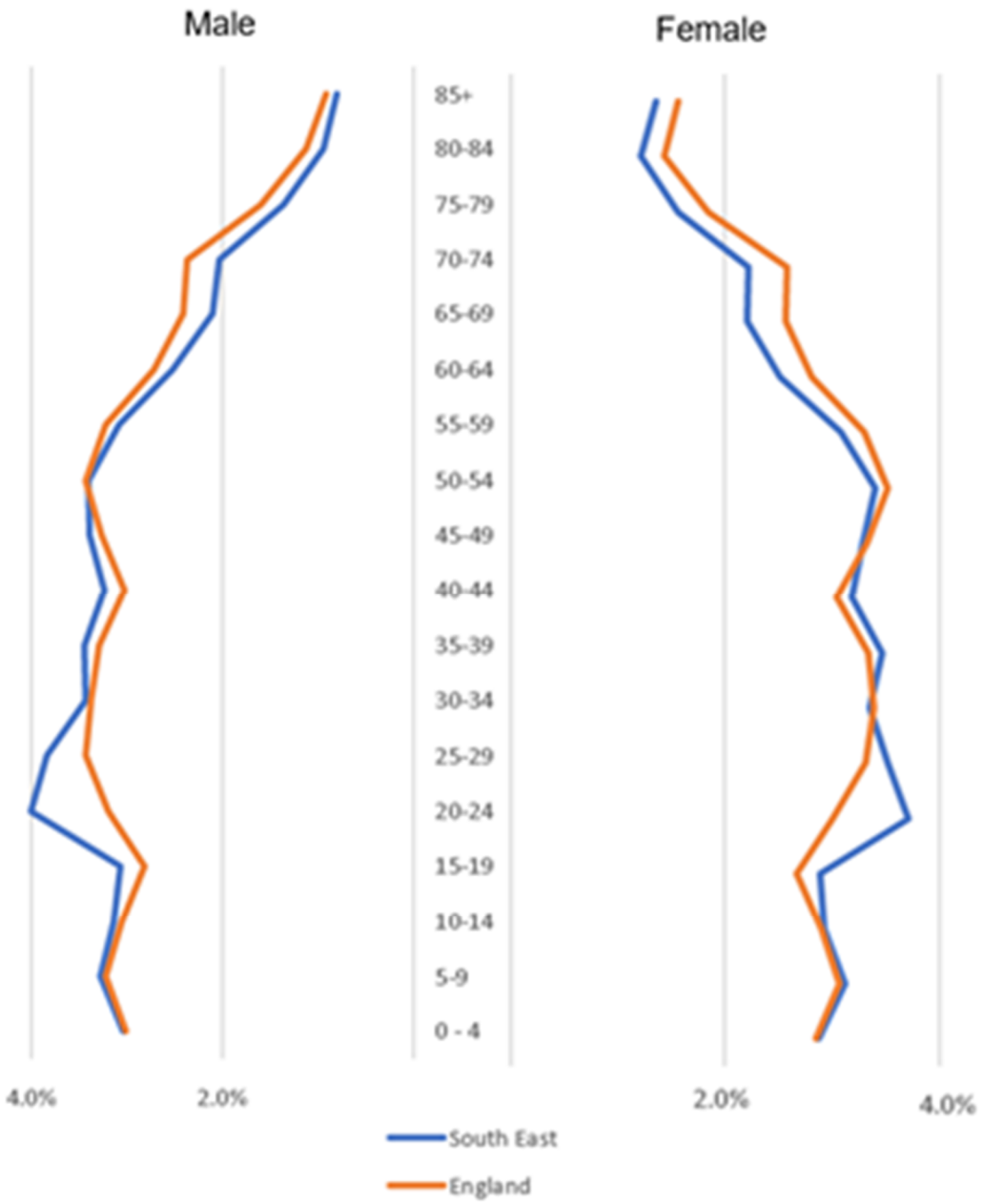
Relevance for the South East

4.7 As illustrated by Figure 4.2: Pre-Covid Population Pyramid, South East vs. England (Source: ONS)

, the South East’s population has an age profile which is broadly comparable to that of England as a whole. A slightly larger proportion of its population is made up by individuals between 19 and 30 years old. The region also has a slightly lower proportion of its population aged 65+ than England as a whole. Overall, this age profile suggests that as a whole the South East should be slightly more resilient to Covid-19 than the rest of the country. However, within the South East there are localities that have a population with a greater share of people over 65 than either the national or South East average, for example, on the Isle of Wight 26% of the population is older than 65 (compared to the South East average of 16%).

4.8 Areas with a higher than average number of older people could well have a more subdued recovery than those with younger people, because elderly people will likely be more cautious about returning to pre-Covid-19 activities. This may mean that areas within the South East with particularly high proportions of elderly people may see a more subdued, slower return to 'transport as normal' than in more 'youthful' areas, and particularly subdued public transport ridership (where the risk of catching Covid-19 is higher, and perceived to be higher, than in private cars).

Figure 4.2: Pre-Covid Population Pyramid, South East vs. England (Source: ONS)



Density

Health impacts

4.9 The higher rates of social mixing and interaction associated with dense urban areas mean that Covid-19 is more likely to spread quickly and widely in urban areas than their rural counterparts.[6] In an recent review of available evidence, Public Health England noted that 'Authorities, which are mostly urban, in London, the North West, the West Midlands and the North East had the highest rates [of infection]. A similar geographic pattern is seen for death rates'.[7]

Economic impacts

4.10 The economic impact of Covid-19 has varied markedly between urban and rural areas. Centre for Cities note that 'the scale and pace of the response [to lockdown] was biggest in the largest cities.'[8] While the largest cities have large numbers of office-based jobs which can be undertaken from home, they also have large retail and food and beverage and visitor sectors, which have been adversely affected by the drop in city centre footfall. Available evidence suggests smaller cities are recovering more quickly than larger cities. By the end of July 2020, instore offline sales in Southampton had reached over 95% of their pre-lockdown average, while in London the figure remained at 50%. In Brighton and Hove, figures were actually higher than the pre-lockdown average at more than 105%. Average footfall in Southampton had also recovered to between 80%-90% of pre-lockdown levels while in London it remained under 40%.[9]

Transport impacts

4.11 Although, initially, all forms of transport saw large drops in usage after the lockdown, others have been affected more severely, or been slower to recover. In larger cities, urban transit networks have seen large drops in ridership (London Underground ridership dropped by approximately 90% immediately after lockdown[10] and at the end of September 2020 had recovered to just 30% of its pre-Covid-19 levels)[11], most of which have failed to recover, and are not expected to for a significant period of time. The long-term prognosis for London is difficult to predict accurately, but a recent

---

[6] Source: **De Lusignan et. al., 2020**, Risk factors for SARS-CoV-2 among patients in the Oxford Royal College of General Practitioners Research and Surveillance Centre primary care network: a cross-sectional study.

[7] Source: Public Health England 2020, **Disparities in the risk and outcomes of Covid-19**

[8] Source: Centre for Cities, **How quickly did people respond to the coronavirus?** Accessed October 2020

[9] Source: Centre for Cities, **High streets recovery tracker**, accessed October 2020

[10] Source: Greater London Authority, **Coronavirus (Covid-19) Mobility Report**, accessed October 2020

[11] Source: Transport for London, **TfL Network Demand**, accessed October 2020

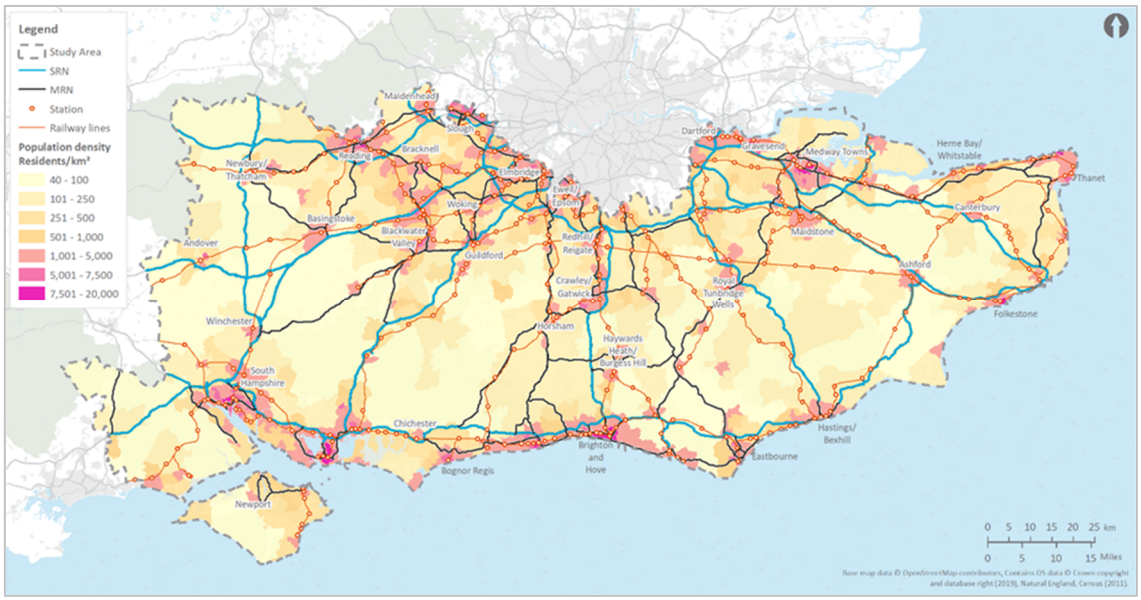
survey found that 14% of Londoners want to relocate from the capital as a result of the Covid-19 pandemic.[12]

Relevance for the South East

4.12 Overall, the South East has one of the highest population densities in Europe for a non-city area. However, as illustrated in Figure 4.3: Resident population density and major transport connections (Census 2011)

4.13 , this density is highly variable. Importantly, none of these denser urban areas are very large (in a review of 'Major Economic Hubs' across the area, Steer found that the majority were under 500,000 people). The polycentric nature of the South East likely assists its resilience to Covid-19 – the majority of towns across the area are small/medium, where economic damage from the pandemic has been more limited than larger cities. Furthermore, the South East's proximity to London means that individuals who formerly commuted to the capital are now working from home in the South East (and therefore potentially making a more significant contribution to the South East's economy as a result of spending locally). There may also be a wider more long-term de-urbanisation movement of individuals looking to move home from London into the South East.

Figure 4.3: Resident population density and major transport connections (Census 2011)



[12] Source: London Assembly, **Half of Londoners wanting to move home want out of London**, accessed October 2020

Deprivation

Health impacts

4.14 Those living in more deprived areas are more likely to catch Covid-19 and more likely to die from it. As Public Health England notes in data until August 2020, 'the mortality rates from Covid-19 in the most deprived areas were more than double the least deprived areas.'[13] At the time of writing (when the country is well into a second wave of infection) rates of infection are accelerating most rapidly in the most deprived areas.[14]

Economic impacts

4.15 The economic impact of Covid-19 has also been more acutely felt in deprived communities and the recovery from it is likely to be slower. This is partly because more deprived individuals are less likely to have access to assets and savings that can assist in times of economic difficulty, and because of the nature of low-earning employment which is often impossible to do from home. For example, Figure 4.4: Key Lockdown Sectors by Income Decile (Source: Blundell et. al., 2020)

4.16 shows that low-income workers are more likely to work in sectors which are subjected to specific 'lockdown rules' (e.g. the hospitality sector) and are less likely to be employed in jobs where working from home is possible. In addition, for low income earners, consumer spending remains high, while it has decreased for high income earners. Some of this is explained by Figure 4.5: Consumer Spending by Income (Source: Institute of Fiscal Studies)

4.17 . Low income earners spend a greater proportion of their income on necessities, costs which are difficult/impossible to cut, even if the individual is placed under additional financial pressure by being furloughed or laid off. By contrast, high-income workers spend a higher proportion of their wages on discretionary spend, which can be reduced, or has been forcibly reduced by the shutdown of some sectors of the economy. As such, high-income earners are more likely to have been saving during the lockdown, and there may be some 'pent up' demand in high-income sectors, while low-income earners are less likely to have been saving, and may be in a worse financial position than at the beginning of the pandemic.

---

[13] Source: Public Health England 2020, **Disparities in the risk and outcomes of Covid-19**

[14] Source: Office for National Statistics, **Coronavirus (Covid-19) roundup**, accessed October 2020

Figure 4.4: Key Lockdown Sectors by Income Decile (Source: Blundell et. al., 2020)

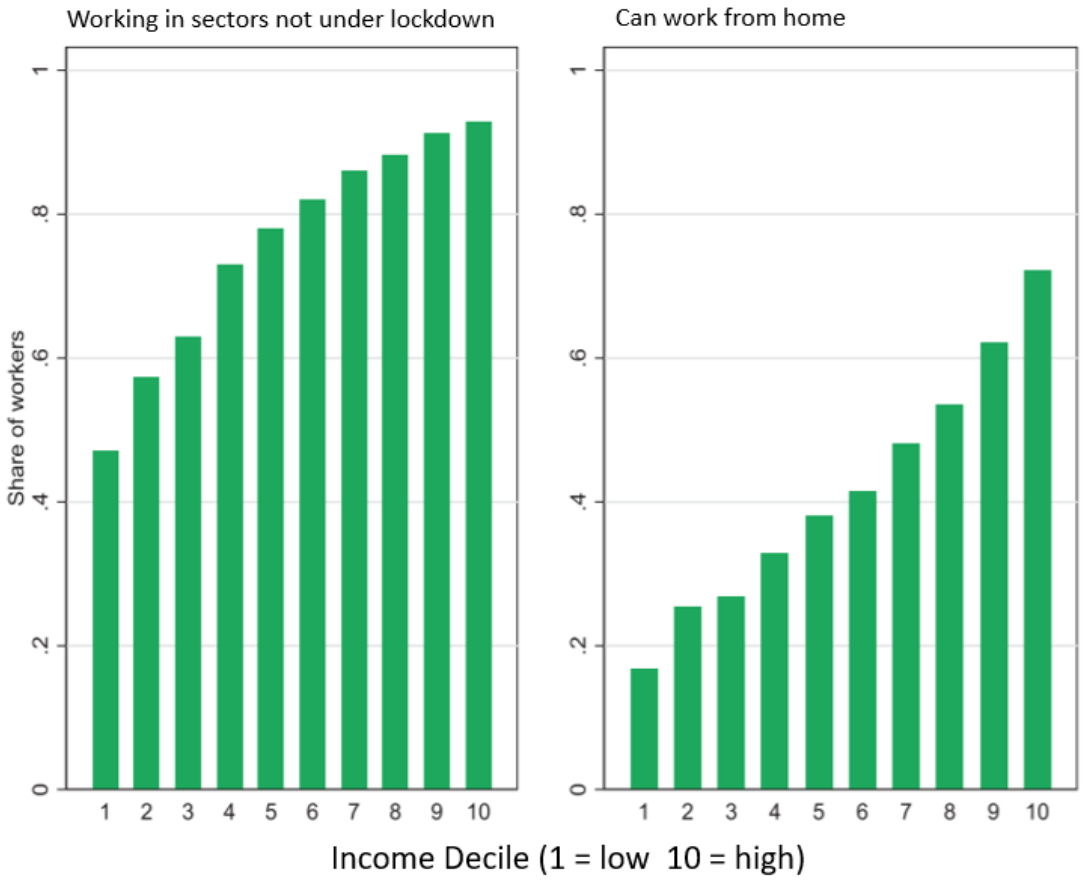
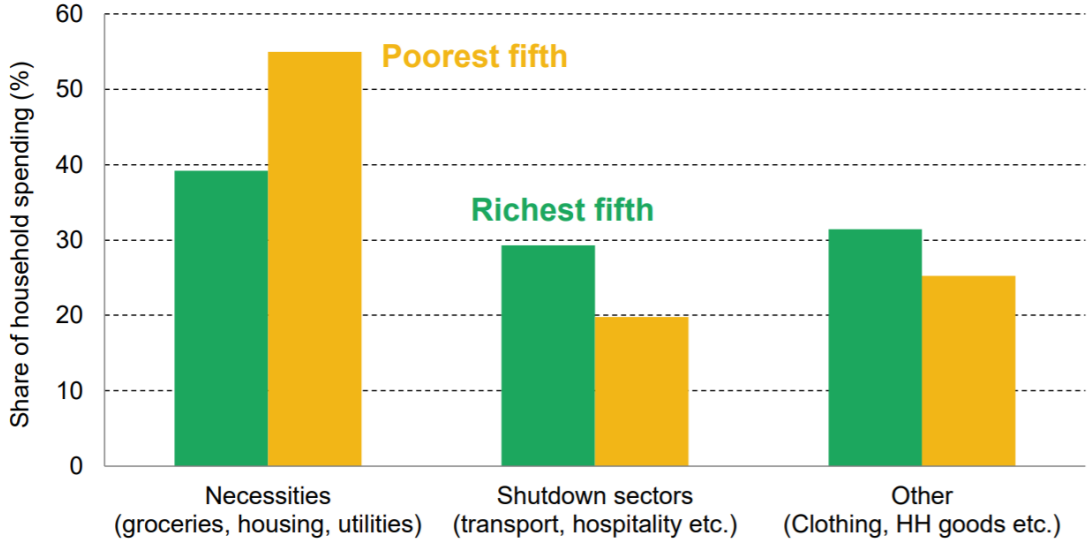


Figure 4.5: Consumer Spending by Income (Source: Institute of Fiscal Studies)



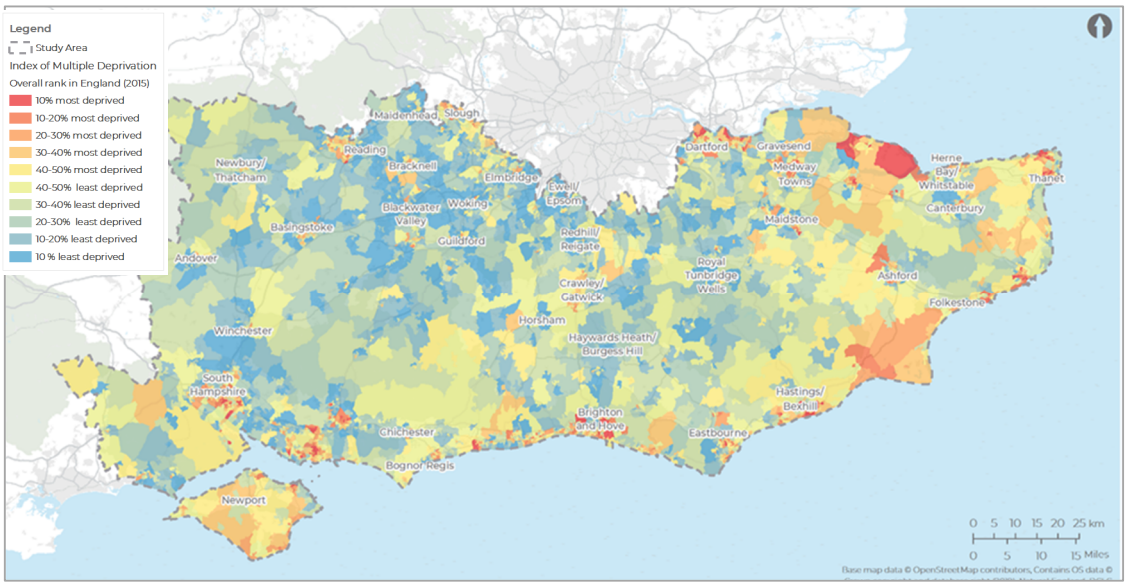
Relevance for the South East

4.18 Although on average relatively prosperous, the South East contains pockets of deprivation as illustrated by Figure 4.6: Index of Multiple Deprivation (TfSE Area)

4.19 . This is particularly true of its eastern and south eastern coastal areas, which are amongst the most deprived in the country. Because Covid-19 is more damaging to poorer communities than their better off counterparts, areas of high deprivation are more likely to be subjected to major short-term economic impacts; and recover more slowly than their less-deprived counterparts.

4.20 Ultimately this means that inequality across the South East could well be worsened by the pandemic, and in this case more deprived regions would need more assistance than their wealthier counterparts to recover effectively. Issues in deprived areas are likely to be amplified, making it more important than ever that they are prioritised in terms of investment (such as in the public transport network) and support.

Figure 4.6: Index of Multiple Deprivation (TfSE Area)

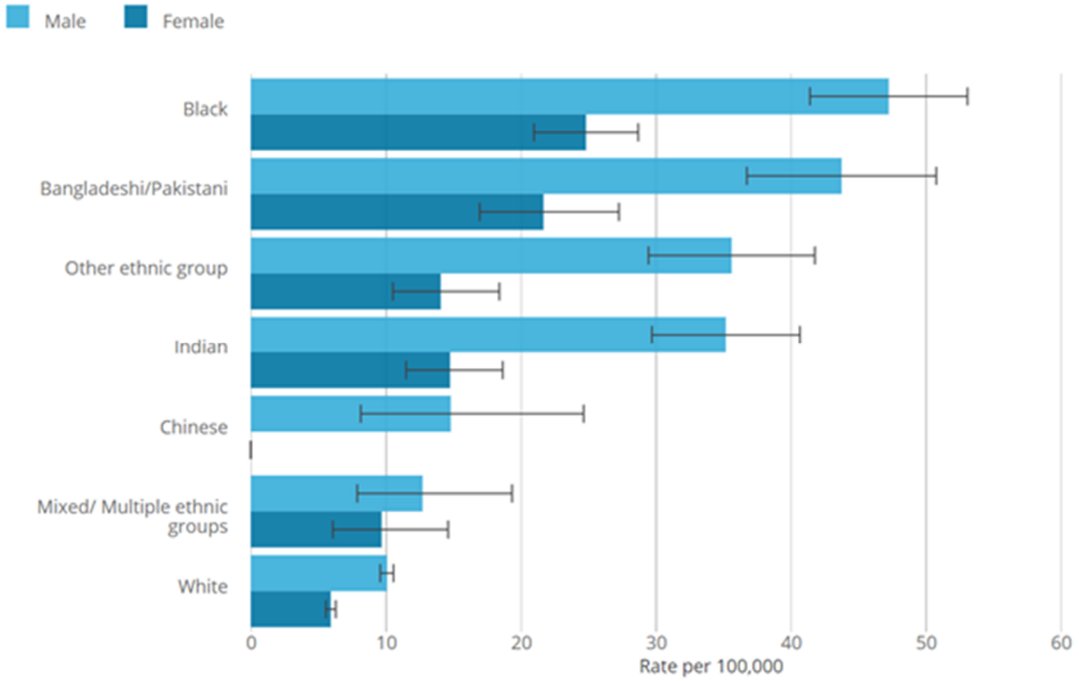


Ethnicity

4.21 As illustrated by Figure 4.7: Deaths involving Covid-19 at ages 9 to 64 years by sex and ethnic group, per 100,000 people: England and Wales, occurring 2 March to 15 May 2020 (Source: ONS)

4.22 , people in the UK from ethnic minorities have significantly higher death rates due to Covid-19 than their white counterparts. The ONS found that Black people are more than four times more likely to die from Covid-19 than white people, with higher death rates in other ethnic minority groups too.[15] As we have already noted, we quote mortality data because that is data that is readily available but high concentrations of mortality will also be correlated with high incidents of debilitating illness. It is important to note that the links between ethnicity, infection rates, and deaths, are poorly understood, and the impact of comorbidities is likely to be particularly important here.

Figure 4.7: Deaths involving Covid-19 at ages 9 to 64 years by sex and ethnic group, per 100,000 people: England and Wales, occurring 2 March to 15 May 2020 (Source: ONS)



Relevance for the South East

4.23 As illustrated by Figure 4.8: Comparison of Ethnic Diversity in South East England and rest of England (Source: Census, 2011)

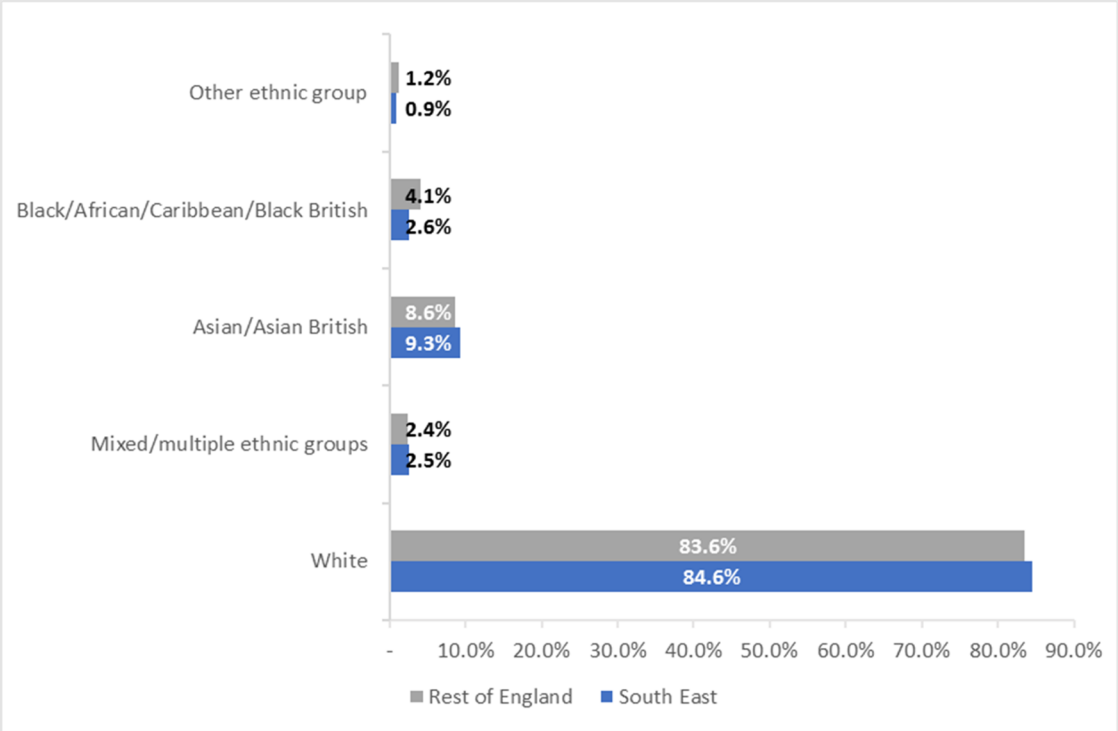
4.24 , the South East is less diverse than the rest of England, but not significantly so. It has 1.5% fewer black residents, and 1% more white residents than the rest of the country. However, in contrast with the London and the metropolitan cities in the Midlands and the North, the South East does not have as many localised high density BAME populations that lead to high Covid-19 impacts in a particular locality.

---

[15] Source: Office for National Statistics, **Coronavirus (Covid-19) in 10 charts**, accessed October 2020

4.25 Overall this suggests that the South East should be slightly more resilient to Covid-19 than the rest of the country.

Figure 4.8: Comparison of Ethnic Diversity in South East England and rest of England (Source: Census, 2011)



Occupation

Health implications

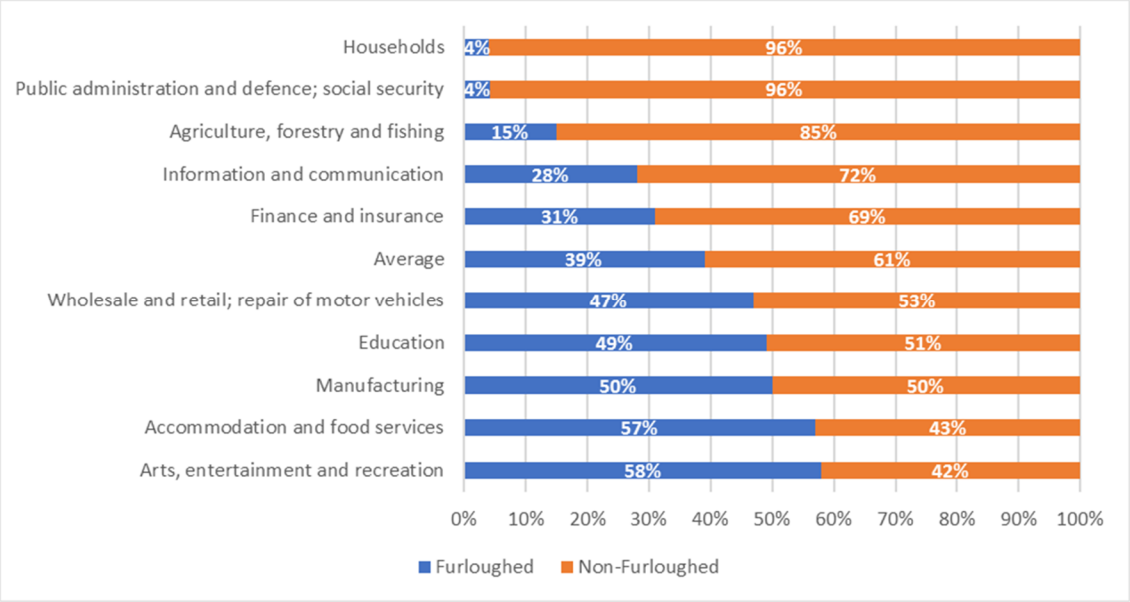
4.26 Jobs which require frequent and/or close contact with other individuals mean that the employee has a higher risk of Covid-19 infection. Health Care Workers are therefore particularly at risk (especially because they are likely to be in contact with high-risk individuals).[16] Individuals working in elementary occupations (e.g. security guards, taxi drivers and chauffeurs, bus and coach drivers, chefs, sales and retail assistants, lower skilled workers in construction and processing plants) have also had higher death rates from Covid-19.[17]

Economic implications

4.27 Those with occupations which can be conducted from home, or while socially distanced, were less likely to be affected by the economic downturn associated by Covid-19. Furloughing rates can provide some insight here. Figure 4.9: Top and Bottom 5 industries by Furlough Rate Nationally, September 2020 (Source: Covid Statistics)

4.28 shows the top and bottom 5 industries by furloughing rate nationally. What becomes immediately apparent is that jobs which are 'essential', or 'professional' in nature have had lower furloughing rates than those associated with entertainment, consumption, or education. Significant economic restructuring post-Covid-19 is very likely; certain industries such as IT will likely see significant gains, while others, such as urban property development, significant losses.

Figure 4.9: Top and Bottom 5 industries by Furlough Rate Nationally, September 2020 (Source: Covid Statistics)



[16] Source: Public Health England 2020, **Disparities in the risk and outcomes of Covid-19**

[17] Source: Office for National Statistics, **Coronavirus (Covid-19) in 10 charts**, accessed October 2020

Relevance for the South East

4.29 In the recently conducted Economic Connectivity Review of the South East, priority sectors, important for the region's economic resilience and growth were identified as being;

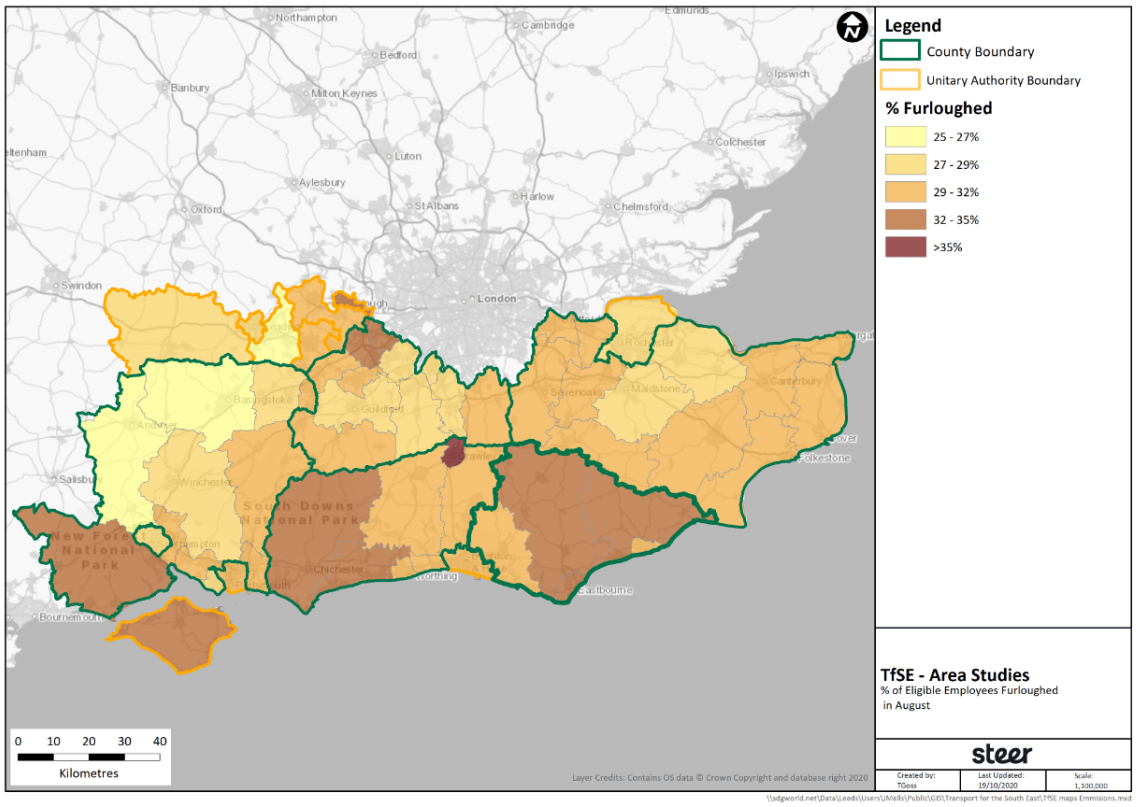
- Advanced Engineering and Manufacturing;
- Creative Industries;
- Financial and Professional Services;
- IT and Data Services;
- Low Carbon Environmental Industries;
- Marine;
- Maritime and Defence;
- Tourism; and,
- Transport and Logistics[18]

4.30 Some of these industries (for example, Tourism) have been particularly susceptible to the economic damage of lockdown. However, the impacts have not been equally felt across the South East's geography. This is illustrated by Figure 4.10: Percentage of Eligible Employees Furloughed

4.31 , which shows the percentage of eligible workers who have been furloughed. This provides some proxy for the economic impact of Covid-19. As illustrated, the rates of furloughing are highly variable. Crawley, for example, has seen very high levels of furloughing due to the area's reliance upon aviation as a source of employment (an industry which has been majorly impacted by Covid-19.

[18] Source: Transport Strategy, **Economic Connectivity Review**, 2019

Figure 4.10: Percentage of Eligible Employees Furloughed



Pre-Covid-19 transport volumes

4.32 Covid-19 has caused a major drop in the use of transport, but this drop has not been spread evenly across modes, as illustrated by Figure 3.2 in Section 2.8. Public transport modes (rail and bus) have seen large drops in usage, and limited recovery. By contrast, use of private modes (bike and car) have either increased (bike) or returned more quickly to pre-Covid-19 levels (car). DfT data suggests car usage has almost returned to pre-Covid-19 averages, although this data is for the Strategic Road Network and may not be representative of local roads. Bike use is higher than pre-Covid-19 levels (and during the early stages of lockdown was significantly higher than average). Every time an individual chooses a certain transport mode, they do so based upon a range of factors, which since the Covid-19 pandemic have included fear of catching the virus, and the 'tightness' of government restrictions. Modes which the government permits the use of, and which people feel 'safe' when using, are therefore those which have shown the most 'pandemic resilience'.

Relevance for the South East

4.33 In a review of the South East's major economic hubs (defined as 'urban centres with the highest population and employment densities in the South East') Steer found that, pre-Covid-19, 53% of journeys to work were less than 5km – distances which could easily be travelled by active transport. However, only 17% of commuting journeys in the South East were made by active modes, 6% by public transport, and 70% by road. This data is further broken down in Figure 4.11: Commuting Distances for Major Economic Hubs

4.34 and Figure 4.12: Mode share of pre-Covid commuting trips for Major Economic Hubs

4.35 .

4.36 In locations where there is a high proportion of commuting journeys less than 5km, it is expected that during the pandemic public transit ridership (which remains low across the area) has been split between road and active travel, or that these trips are no longer being made. Where average journey lengths are longer than 5km, it is anticipated that the majority of public transit trips will have shifted to car usage, or are no longer being made (for example, people 'working from home'). Although, as highlighted above in Figure 4.4: Key Lockdown Sectors by Income Decile (Source: Blundell et. al., 2020)

4.37 , only between 40% and 50% of the workforce in the South East individuals are able to work from home (less than 20% for people in the most deprived areas), meaning that the shift to home working may be more limited for certain sectors/occupations.

4.38 Planning for the future, what is clear from these two figures is that there are already lots of relatively short car commuting trips being made in the South East. The more of these trips that can be transferred to active transport (walking and cycling) or public transport, the easier it will be to make the transport network in the South East carbon neutral, and the quicker concurrent public realm/environmental improvements can be delivered. As transport usage recovers to normal, it is important that we try to move a proportion of individuals from private cars to these alternative modes, despite the emerging trend of car use being the transport mode returning to pre Covid-19 levels the most rapidly.

Figure 4.11: Commuting Distances for Major Economic Hubs

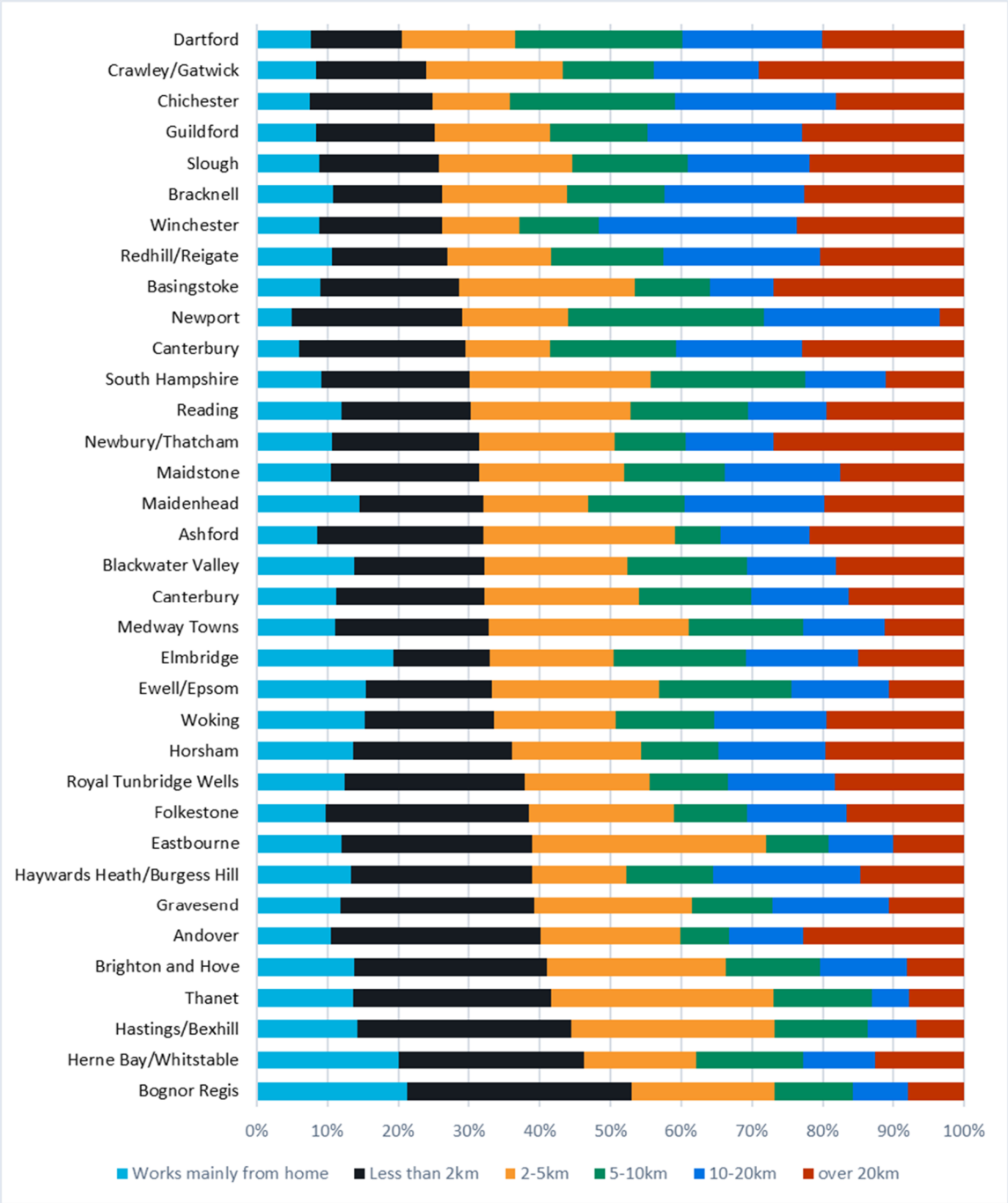
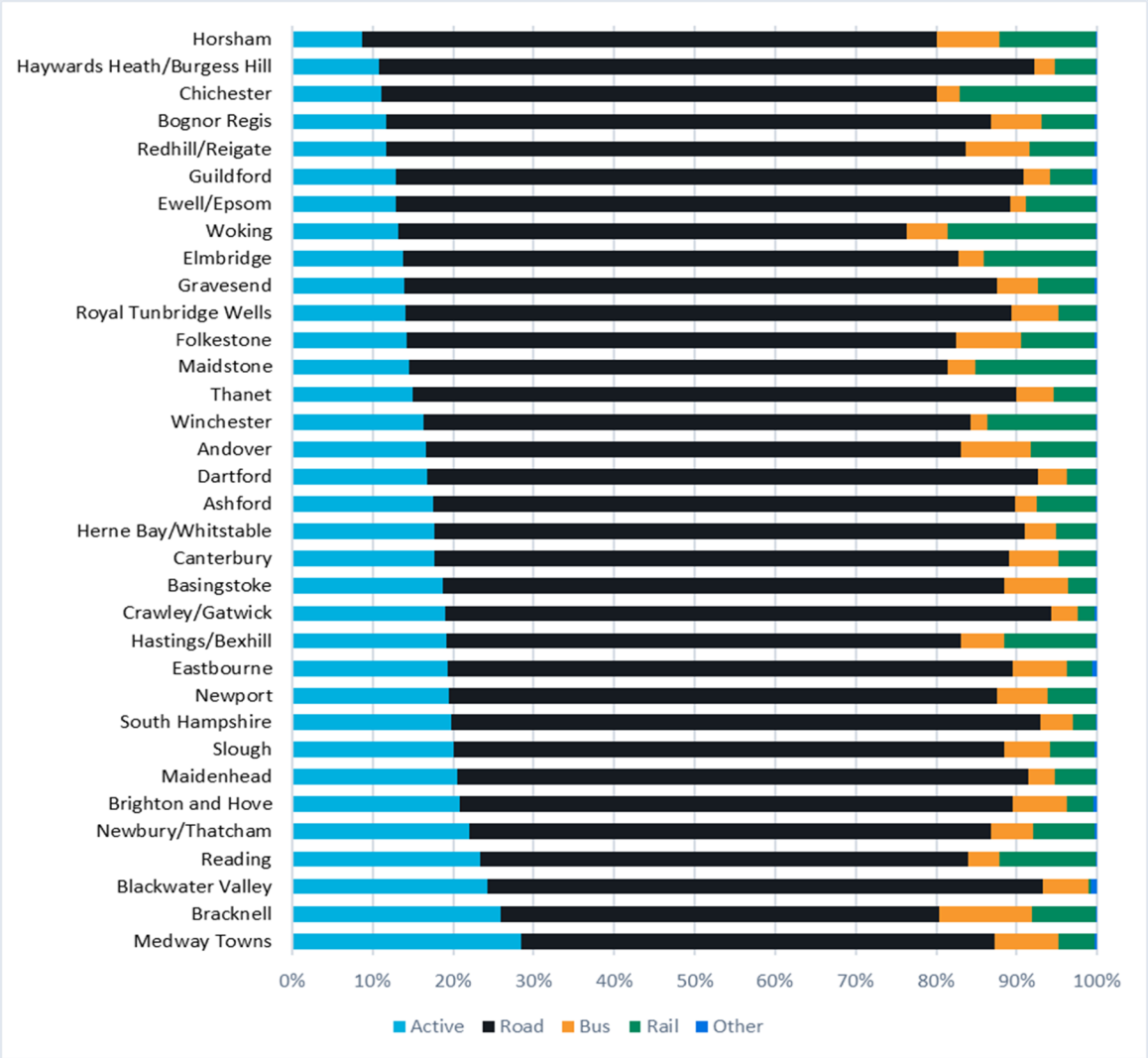


Figure 4.12: Mode share of pre-Covid commuting trips for Major Economic Hubs



Implications for the area studies

The geographical variability of Covid-19 and the complexity of the factors which cause this variability, make it challenging to draw overarching conclusions about the South East as a whole. As illustrated by Figure 1.1, the South East is currently experiencing lower rates of Covid-19 infection than the England average, but whether this is due to underlying factors which make the area resilient to infection, or because the “second wave” is upon us, is impossible to state at this stage. The evidence presented above shows a variety of factors determine individual and community resilience to Covid-19. Many of these factors overlap and intersect to affect economic and health resilience, both of which, in turn, will impact current and future transportation demand.

The Area Studies, being more geographically specific than the transport strategy, will be able to present a more geographically precise view of the underlying socio-demographics for each area. This should mean that specific areas which are likely to be hit particularly hard by Covid-19, and struggle to recover, can be identified, and prioritised for future investment programmes. Ultimately, each Area Study should conduct an assessment of Covid-19 resilience and recovery potential, allowing clearer understanding of how the region’s human geography might shift in the coming years as a result of the pandemic.

5 Modelling and future impacts

5.1 As part of the project to develop TfSE's Transport Strategy, Steer was commissioned to develop a model that would determine the impact of economic growth scenarios on employment, population and travel in the South East. This model was the South East Economy and Land Use Model (SEELUM). The complete technical report produced alongside this modelling exercise can be found in the appendices. Here a brief overview is provided.

5.2 In our previous work, we tested several growth and transport strategy options. The preferred option was the 'Sustainable Route to Growth' (SRtG). To further develop the model and help better understand how the South East will recover from Covid19, we tested a range of scenarios against this scenario (in other words, the tests show how the SRtG case is altered, in its early years, by each of four Covid-19 response scenarios):

- **Scenario 1:** Cycles of lockdown: Social distancing and 'track-and-trace' fail to stop a second wave of Covid-19. No effective treatment of vaccine is available and further lockdowns are necessary over the next 2-3 years with the consequent negative effects on society. Abbreviated to CoL in charts.
- **Scenario 2:** Adaptation: No second wave materialises, and society adapts, finding a new equilibrium of behaviours and activities that keep Covid-19 under control. Abbreviated to Adap in charts.
- **Scenario 3:** Therapeutics: By 2021 an effective clinical pathway is found that significantly reduces the health impacts and the mortality rate of the virus. There is no vaccine, but society returns mostly to normal. Abbreviated to Thera in charts.
- **Scenario 4:** Vaccine: An effective vaccine is widely deployed in 2022. Society rapidly returns to pre-Covid-19 norms. Abbreviated to Vacc in charts.

Results

Unemployment

5.3 The four lockdown scenarios follow a similar pattern across the three-year model period. This similar pattern is primarily a result of the same assumptions being used regarding the furloughing period and number of expected job losses (post furlough) for all four scenarios. The jobs lost, post furlough, lead to an increase in unemployment in all four lockdown scenarios.

5.4 Over time, as capacity restrictions begin to ease, the availability of workforces helps the recovery progress. Employers, reacting to a plentiful supply of labour and seeing as recruitment is one of the key factors affecting location attractiveness, are attracted to the area. This increased level of attractiveness and workforce availability leads to relatively rapid recovery in unemployment for all four lockdown scenarios. (This

information is displayed more completely in Figure D.4: Lockdown Scenarios - Workforce Unemployment rate

5.5 in the annex).

Travel to work trips

5.6 The initial drop in travel to work trips, which persists for almost six months, is a result of the various lockdown measures (i.e. capacity constraints, working from home, and furlough) being implemented. The subsequent rise in trips nearly half a year into the simulation is caused by the removal of the furlough scheme, which encourages those who are not able to work from home to travel to their place of work. This rise in trips is followed by a reduction in travel to work trips due to the loss of jobs which kicks in after the furlough period.

Following this, scenarios 1, 2 and 3 (Cycles of Lockdown, Adaptation and Therapeutics) follow similar paths, due to multiple capacity constraints still being applied to the scenarios. Scenario 4 sees a significant uplift in travel to work trips due to the removal of capacity constraints, allowing the transportation networks to return to pre-Covid capacity levels. The total level of trips still remains lower than in the SRtG scenario, as a result of the lower employment levels and increased, long-lasting, WFH among the workforce. (This information is displayed more fully in Figure D.5: Lockdown Scenarios - Total Travel to Work trips

5.7 in the annex).

Work from home

5.8 Scenario 3 (Therapeutics) displays indications of rapid economic improvement, similar to what is experienced in Scenario 4 (Vaccine), despite the persistent capacity constraints on workplaces and transport. The ability for employees to work from home takes up the strain, filling the gap left by the capacity loss. (This information is displayed more completely in Figure D.6: Lockdown Scenarios - Work From Home Volumes

5.9 in the annex).

5.10 The initial rise in working from home volumes is a result of the introduction of this mechanism as well as the various lockdown measures (i.e. capacity constraints and furlough) being implemented. As in when investing travel to work trips, the subsequent rise in working from home volumes nearly half a year into the simulation is caused by the removal of the furlough scheme, which encourages those who had previously not been economically active to now working from home if they are in a position to do so. The peak is followed by a reduction in volumes due to loss of jobs following the furlough period.

5.11 From this point, the various Scenarios begin to diverge. Scenario 1 and 2 (Cycles of Lockdown and Adaptation) follow similar patterns throughout the model period due to capacity constraints still being applied and therefore these volumes illustrate the maximum working from home levels applicable under each Scenario. The slight difference between Scenario 1 and 2 (Cycles of Lockdown and Adaptation) is due to the overall levels of employment achieved in these scenarios which affects the maximum amount of working from home as a result of business type.

5.12 Following the easing of capacity restrictions, Scenario 4 (Vaccine) volumes drop to levels of working from home where they stabilise to a new level, which is higher than the starting point because we assume employers will continue using working from home for its staff to some degree. Investigating Scenario 3's (Therapeutics) working from home volumes shows that after easing of capacity constraints working from home volumes are no longer at maximum level (which is illustrated by Scenario 2) (Adaptation). As mentioned above, in Scenario 3 (Therapeutics), working from home is no longer a constraint and is now able to provide the remaining 'virtual' capacity. This explains the higher levels of economic outputs experienced under Scenario 3 (Therapeutics) without the increased level of travel to work trips seen in Scenario 4 (Vaccine).

Travel to work mode shares

5.13 The changing transport conditions throughout the scenarios lead to a change in travel patterns. As these conditions impact travel to work volumes, they also impact mode shares. To investigate changes in mode shares, we have tabulated the respective start and end points of each respective mode in each of the scenarios. These start and end mode shares for travel to work trips can be viewed in Table 4.1. The table shows how, under SRtG conditions, the public transport mode shares are expected to increase, and the car mode share to fall.

Table 5.1: Lockdown Scenarios - Start and End Mode Shares

Mode Shares	Starting mode shares				Ending mode shares			
	Car	Rail	Bus	Walk/cycle	Car	Rail	Bus	Walk/cycle
Scenario 1	77.2%	4.1%	6.0%	12.7%	81.2%	1.2%	3.4%	14.2%
Scenario 2	77.2%	4.1%	6.0%	12.7%	79.5%	2.0%	4.6%	13.9%
Scenario 3	77.2%	4.1%	6.0%	12.7%	76.7%	4.1%	6.0%	13.2%
Scenario 4	77.2%	4.1%	6.0%	12.7%	74.7%	5.3%	7.4%	12.6%
SRtG	77.2%	4.1%	6.0%	12.7%	67.3%	9.4%	10.9%	12.5%
BAU	77.2%	4.1%	6.0%	12.7%	74.3%	4.7%	6.9%	14.1%

5.14 Table 4.2 shows how the mode shares change in each case between the start and end points, and also how they change compared to the SRtG case. It illustrates the SRtG scenario's interventions reduced car travel within the TfSE area by encouraging use of public transport. The lockdown scenarios have all negatively impacted public transport mode shares (rail and bus) and increased shares for walk/cycle. Even when the transport capacity restrictions have been lifted (in Scenario 4 (Vaccine)), the mode share for car remains higher than in SRtG. This happens because there are fewer travel to work trips overall (fewer jobs, more working from home) and road congestion is reduced at a region-wide level. This makes car more attractive, relative to public transport, resulting in a higher car mode share, even after the public transport capacity restrictions have been lifted. The table also shows how the mode shift effect becomes more pronounced as the capacity on public modes becomes more constraining (shifting from Scenario 4 (Vaccine) to Scenario 1 (Cycles of Lockdown)).

Table 5.2: Lockdown Scenarios - Mode share comparison

Mode Shares	Change from start				Change from SRtG			
	Car	Rail	Bus	Walk/cycle	Car	Rail	Bus	Walk/cycle
Scenario 1	4.1%	-2.9%	-2.7%	1.5%	14.0%	-8.2%	-7.5%	1.7%
Scenario 2	2.3%	-2.1%	-1.4%	1.2%	12.2%	-7.4%	-6.3%	1.4%
Scenario 3	-0.4%	-0.1%	0.0%	0.5%	9.5%	-5.4%	-4.8%	0.7%
Scenario 4	-2.5%	1.2%	1.4%	0.0%	7.4%	-4.1%	-3.4%	0.1%
SRtG	-9.9%	5.3%	4.8%	-0.2%	-	-	-	-
BAU	-2.9%	0.6%	0.8%	1.5%	7.0%	-4.7%	-4.0%	1.7%

Implications for the area studies

These results underline the fact that recovery from the pandemic will likely take years, rather than months, and when the recovery does occur, the volume of users using different transport modes (and therefore, the form of the transport network) will likely differ markedly from that which currently runs across the region.

For the purposes of the area studies it must be recognised and accepted that there remains significant uncertainty about how the transport network is going to develop post Covid-19. Although the modelling above provides some indicative possibilities for what this future may look like, more than anything, it highlights the many ‘known unknowns’ about Covid-19 and its potential impacts. The area studies should therefore aim to develop strategies which provide some measure of flexibility and resilience; strategies which aim to help areas identified as more vulnerable to the impacts of Covid-19, while retaining the flexibility to adapt as its impacts are realised over the long-term.

6 Summary and recommendations

6.1 The aim of this paper has, ultimately, been to answer the question: what does Covid-19 mean for TfSE and the area studies?

6.2 The answer is not straightforward – as this paper has outlined, the impacts of Covid-19 are complicated, still poorly understood, and still being realised. The picture is further complicated by the fact that many of the factors which influence its impact overlap and intersect.

6.3 However, what is very clear is that Covid-19 has stimulated unprecedented changes in our society of a scale and speed unseen for generations. As such, it represents an opportunity to think imaginatively and ambitiously about how the South East wants to develop over the coming decades and shape this development in a decisive way. This window of opportunity will not last long and therefore decisions and investments made now will have a decisive impact upon the future of the region.

6.4 Below, more specific insights are presented about how the area studies might interpret and make use of the information in this paper.

Speed of recovery

6.5 The economic recovery from Covid-19 is likely to take place over years, rather than months. It may entail major economic restructuring of the South East's economy. However, the short-term economic damage caused by the pandemic should not be used as an indicator of what these long-term changes will be. Many of the sectors which have been hit the hardest – Hospitality, Tourism, Entertainment and The Arts – are fundamental to the functioning of a healthy society and are anticipated to return in the South East once the economy has recovered. For many who have continued in full employment through the pandemic, there will be a degree of pent up demand for leisure activities which could help drive recovery of these sectors. Portsmouth, Southampton and Brighton and Hove all show signs of making a strong recovery, with consumer spending and footfall in the city centres rebounding to near pre-Covid-19 levels.

6.6 Many of these factors are beyond the control of TfSE and the area studies, which should aim to understand how patterns of working and commuting may change in the future, looking to plan for these changes, rather than changes in what these jobs actually are. Ultimately the long-term nature of the planning which TfSE undertakes means that it needs to envision a society which has returned to a 'new normal', while accepting that this may be several years away.

Certainty	Outcome
Very certain	Covid-19 has had the most significant economic impact on the South East for a generation.
Relatively sure *(can forecast)*	The economy will rebound over the course of years, rather than months.
Realistic possibility	The economy will rebound relatively well (vigorously) due to pent-up demand.
Very unsure	What structural changes will occur to the economic makeup of the South East.

A new relationship with London

6.17 Due to its geographical proximity, the South East has traditionally had a strong relationship with London. This is particularly true of 'commuter towns' with good rail connections to the capital. Covid-19 has changed the nature of this relationship, with many people who formerly worked in London now working from home in the South East. In the future there may be an increase in the number of individuals relocating permanently to the area from London. This is likely to bring benefits to the South East by boosting its 'native' economy but will also place more pressures on an already overstrained housing market. The Area studies must consider carefully how this new relationship with London is going to influence travel patterns across the South East (for example, the demand for rail travel and the case for enhancing the rail network), and encourage housing development in areas which are likely to accommodate this increased population. Radial journeys, which formerly made up a significant proportion of the journeys in the South East, may now become less important, with consequentially greater need for investment in 'Orbital' components of the transport network.

Certainty	Outcome
Very certain	In the short term, commuting trips to London from the South East have dropped precipitously.
Relatively sure *(can forecast)*	The increased time spent in the South East has provided a relative boost to the 'native' economy.
Realistic possibility	This will be a permanent shift, which restructures the relationship that the South East has with London.
Very unsure	London's day time population will not recover to pre COVD-19 levels, and there will be a permanent shift in the UKs economic geography.

The importance of polycentricity

6.18 The relatively large number of medium-sized towns and cities across the South East has thus far helped the region's resilience as compared to other UK regions with larger urban hubs. Individuals are more likely to be able to move safely and efficiently around these smaller urban areas using active travel modes, rather than public transit, to get around. This tallies well with TfSE's desire to 'create great places to live' and 'put people first' as outlined in the recent transport strategy.[19] TfSE must continue to pursue this strategic direction, newly supported by the evidence that it aids regional economic and social resilience. To help these regions thrive into the future, investment in 'intermediate length' transport journeys will be important, for example, reallocating rail capacity to focus on local services, encouraging express bus services (possibly through the segregation of traffic lanes into explicit 'expressway' lanes) and the provision of more road space for active modes like walking and cycling. With more dispersed patterns of travel temporally and spatially, it is harder to accommodate these travel patterns by frequent, fixed-route public transport. Existing fixed route transport may also be made less viable with fewer peak trips. In the longer term, if the population of these towns and cities is to increase beyond current plans, there will need to be investment in Transit-Orientated Development, providing the housing needed for population expansion without increasing usage of private cars.

Certainty	Outcome
Very certain	Thus far the medium-sized towns and cities found in the South East have been more resilient to Covid-19 than larger comparators.
Relatively sure *(can forecast)*	Short-term investment in active transport and public transportation will make them healthier, more attractive places to live.
Realistic possibility	There will be higher long-term population growth in these smaller urban centres, relative to larger comparators.
Very unsure	All individuals living in cities in the South East will live in '15-minute cities.'

[19] **https://transportforthesoutheast.org.uk/wp-content/uploads/2020/07/TfSE-transport-strategy-Summary-Document.pdf**

Rising inequality

6.19 Covid-19 has affected those at the lower end of the income scale the hardest. More deprived, lower-income sections of the economy have borne the brunt of the economic shock and will take the longest time to recover. The South East already has high levels of inequality, which are likely to worsen as a result of the pandemic. Transport is an 'economic enabler' – it allows people better access to opportunities, helping to encourage economic prosperity. While passenger demand for public transport is suppressed due to capacity constraints and economic and behavioural responses, sustaining and increasing public transport (including shared mobility and on-demand service) capacity, accessibility, and connectivity is necessary as a direct response to ensure that people who are reliant on public transport and need to travel can, but also for managing congestion in our towns, cities and along major corridors. Investment will have direct and wider benefits for the economy, society and the environment. Support for public transport (e.g. additional funding for subsidies or direct payments to operators, promotional campaigns) are required for maintaining levels of service and growing demand as rapidly as possible. Further measures could include the use of new technologies such as integrated ticketing to encourage wider use of services across the area; bus priority measures; and mass rapid transit. Overall, area studies must make use of their influence to provide good connections for individuals living in areas of high deprivation to good job opportunities, carefully assessing how provision of transportation can help communities which have been hardest hit by Covid-19 to recover more rapidly.

Certainty	Outcome
Very certain	Covid-19 is hitting those at the bottom of the income scale the hardest and has exacerbated inequality.
Relatively sure *(can forecast)*	Those at the bottom of the income scale will find it hardest to get back 'on their feet' after the pandemic.
Realistic possibility	The gap between the most deprived places in the South East and the rest of the region will increase. Drop in mean income/ economic activity amongst the least well-off in the South East will lead to a drop in public transport ridership.
Very unsure	Long-term inequality will have a significant impact upon the 'liveability' of urban spaces.

Technological and behavioural ‘acceleration’

6.20 Covid-19 has accelerated many technological developments which were already reshaping our society, such as greater working from home and greater demand for remote access to goods, services and amenities (and corresponding increase in deliveries). Some of these changes have been and will be positive for society. Investment in digital technology has the potential to facilitate economic resilience and recovery as partially evidenced by increased levels of home working and remote access to services and amenities – “Digital as a Mode”. Increased homeworking may reduce commuting trips, and longer distance trips, which cause particularly high levels of pollution.

6.21 For example, in the short-term greater working from home has lowered the region’s carbon emissions. However, many of these developments will pose problems. For example, greater use of online retailers and online forms of ‘social’ interaction may ‘hollow out’ the public spaces (such as high-streets) around which society is built, and/or longer but less frequent commutes may lead to a net increase in travel (and therefore carbon emissions).Increased homeworking may also reduce trip-chaining (e.g. combining a commute trip with a school drop-off or grocery shop). However, these and other trips still need to be made and there could be an increase in trips made outside of the AM and PM peaks. Also, with a car more likely to be available at home most of the day, household members may make more trips by car (because they can now). Ultimately, though, increased homeworking is likely to be environmentally beneficial, and therefore, it is advocated that digital (to ultra-fast broadband) and mobile (to 5G) connectivity are improved to ensure the potential for this is maximised.

6.22 Although an increase in car mode share has been forecast, this has been offset by a reduction in total numbers of trips resulting from decreased work trips (i.e. higher levels of working from home and a lower number of jobs). This overall reduction in the total number of car trips is forecast to last at least three years, as per the modelling. It is unclear how this will change beyond this period, but we could well be planning in the medium to long term for lower levels of car traffic than previously envisaged. It is also possible that through changing travel patterns as a result of where people live and work and how they work, that demand for car travel spreads to outside the peaks and moves away from some of the most congested radial routes in the region.

6.23 TfSE and the area studies must therefore think carefully about how they can best make use of the benefits brought by this technological acceleration and behavioural shifts, whilst ameliorating their negative side-effects. In particular, it will be important to ensure that towns and cities remain sites where people want to come and interact, even as economic opportunities become less geographically concentrated.

Certainty	Outcome
Very certain	The numbers of individuals who are working from home has increased dramatically, along with delivery vehicle movements associated with online retail.
Relatively sure *(can forecast)*	The numbers of people working from home will decrease compared with the height of the pandemic but remain higher than pre-Covid-19 levels.
Realistic possibility	Urban centre office spaces are no longer required in the scale and style that they currently exist.
Very unsure	New technologies will be used to ensure that city-centre spaces are car-free, people-friendly spaces used for recreation and entertainment.

Scenario Modelling Appendices

A Introduction

Background to this project

A.1 There are big questions for towns, cities and regions about lifting lockdown. What happens to transport and employers if only some categories of people are allowed to travel, for limited purposes? If extended social distancing reduces public transport capacity, how will the system cope? How long will public transport operators require subsidy? Will home working affect transport operators' ability to provide peak capacity? How much will car travel increase if people are afraid of public transport? What happens if lockdowns are re-imposed?

A.2 In giving approval for the final version of the Transport Strategy for the South East (TfSE), TfSE's Shadow Partnership Board was concerned about the potential impacts of Covid-19 and consequential impacts on the development of the transport strategy and in particular the forthcoming Area Studies. It was recognised that there is further need to assess potential impacts on travel demand, patterns and supply; and their interaction with population, housing, employment and GVA in the TfSE area. Additional technical work would be needed to ensure that the forthcoming area studies can take account of these potential impacts.

A.3 While forecasting is of limited use in these circumstances, we believe there is a strong case for envisaging future scenarios and rehearsing responses to them to find how to achieve the best possible outcomes, especially for economic recovery.

A.4 The SEELUM transport and land use model, that was developed to inform the development of the transport strategy, offers an excellent platform to test a range of recovery trajectories, rehearsing how they might unfold and how to best manage them. While it has required some modification, the core model and the principal outputs it delivers remain as before: employment, business activity and travel patterns. To this we have added to ability to simulate lockdown and the effects of capacity restraints in public transport and workplaces.

The SEELUM Model

A.5 As part of the project to develop its Transport Strategy, Steer was commissioned to develop a model that would determine the impact of economic growth scenarios on employment, population and travel in the South East. This model was the South East Economy and Land Use Model (SEELUM).

A.6 SEELUM is a transport and land use model that simulates the interaction of transport, people, employers and land-use over periods of time. SEELUM is a simulation, which means that it attempts to replicate events in the real world using simplified representations of how people perceive their circumstances and decide how to react. It is also dynamic, which means it is concerned with how events unfold through time: as its internal clock rolls forward it calculates, step by step, how conditions change and

how people respond. It does this for everything encompassed by the model, at every time step, simultaneously.

SEELUM's primary use is to test how investment in transport, sometimes coupled with changes to land-use policy, affect the economic performance of a region, city or urban area. It does this principally by simulating how changes in patterns of connectivity and access affect how attractive different locations are for employers and/or households to locate in, how they respond, and what the consequences are. For example, if travel costs rise in a particular area (say, due to an exogenous input), depending on the other options available, people may change their mode of travel, change where they live or change where they work. In the extreme, if there are no other viable options to access work, people can become unemployed. Similarly, businesses can relocate to an area if transport costs reduce, increasing their accessibility to the potential workforce. Figure A.1: High level overview of the linkages in the model

shows a high-level view of the linkages in the model.

Figure A.2: High level overview of scenario testing inputs and outputs

A.7 shows a high-level view of the key inputs and outputs when testing scenarios.

Figure A.1: High level overview of the linkages in the model

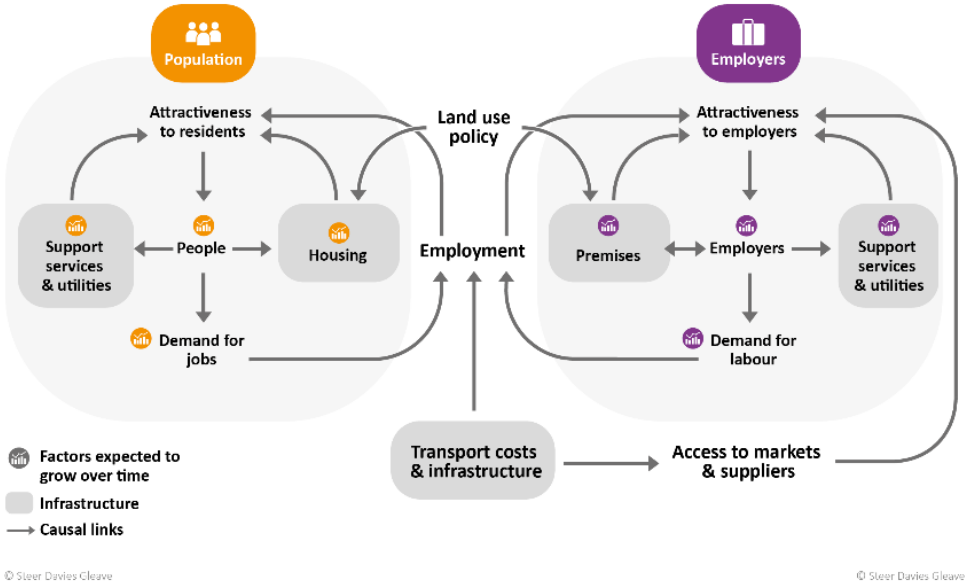
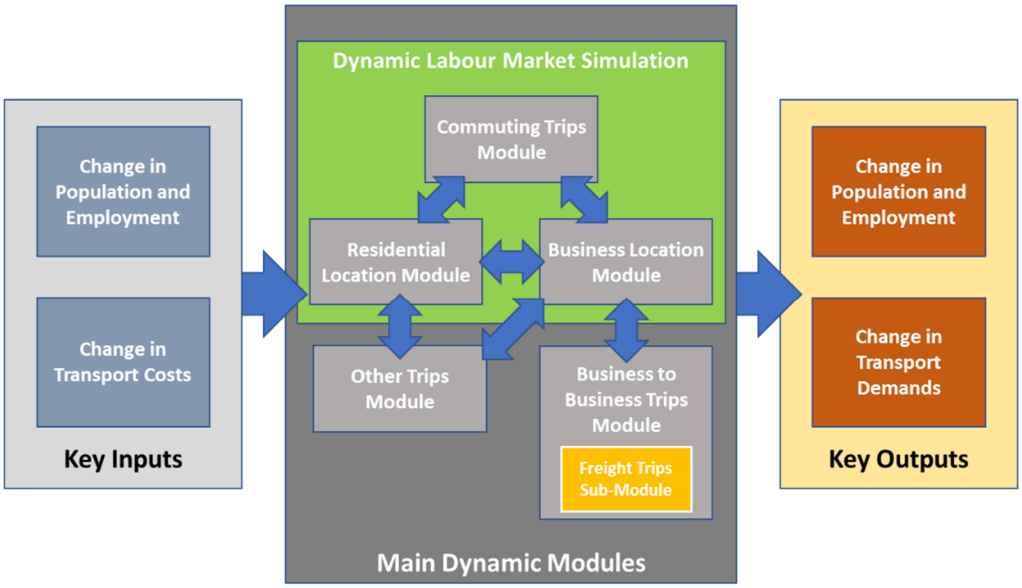


Figure A.2: High level overview of scenario testing inputs and outputs



Project scope

A.8 This project was divided into the main tasks outlined below:

i. Develop lockdown related scenarios: With the use of Steer's previously developed Covid-19 scenarios as well as input derived from a stakeholder scenario workshop, scenarios based on different possible futures regarding the relaxation of lockdown were developed.
ii. The creation of a test model: in order to develop and test the mechanisms needed to rehearse lockdown (such as working from home and furloughing of staff), the mechanisms were first built in a small test model to ensure the model would respond as anticipated.
iii. Implement new mechanisms in SEELUM: Once the mechanisms had been understood and developed, they were implemented in SEELUM and the model was initialised in "lockdown".
iv. Intervention testing: In addition to the lockdown scenarios developed, intervention testing runs were carried out to explore how recovery might best be managed, by adjusting fares, capacity and employment policies.
v. Identification of the potential implication of these findings for the development of the forthcoming area studies

A.9 We should stress that the modified model does *not* simulate transmission of the Covid-19 virus. It is *not* an epidemiological model. Rather, it takes the restrictions on daily life that are a consequence of government guidance and simulates the impact on travel and employment. It can then be used to test how effective transport related remedial measures might be in reducing the negative impacts of lockdown and/or of speeding up recovery.

Following sections

- **Appendix B:** Describes the Lockdown Scenario development and how they operate within SEELUM;

- **Appendix C:** Explains the adaptations in SEELUM required to allow for the rehearsal of lockdown scenarios;
- **Appendix D:** Discusses the lockdown scenario results;
- **Appendix E:** Discusses the impacts of intervention testing; and
- **Appendix F:** Provides an overview of the findings and concluding remarks.

B Lockdown Scenario Development

Introduction

B.1 Across the world, Covid-19 has led to unprecedented impacts on the way we live, work and travel. As governments start to ease lockdowns and the focus turns from immediate crisis to recovery, natural questions arise as:

- What will the future look like in a post Covid-19 world?
- What interventions can be implemented to ease the path of economic and societal recovery?

B.2 To assist in the development of Lockdown Scenarios, Steer used a combined approach of internal research development coupled with a local stakeholder workshop to allow Steer to internally develop Covid-19 Scenarios.

Steer internally developed Covid-19 scenarios

B.3 To answer these questions arising from the uncertainty surrounding the easing of Covid-19 lockdown, scenario development of potential futures was required. To help frame possible ways forward, Steer experts from across the world have come together to consider the impacts and paths forward relating to Covid-19. With perspectives from the Americas, Europe and Asia, and expertise in roads, transit and rail, aviation, and freight and logistics, looking ahead over the next few years we have developed four future scenarios.

B.4 In our view, the form and timing of any medical resolution of the Covid-19 crisis is the key question. This will drive the direction of behavioural and policy responses and what this means to the economy, people's activity and transport demand. Based on this, we have identified three key uncertainty areas:

- Whether or not there is a second wave;
- Whether or not effective treatment pathways are found; and
- Whether or not a successful vaccine is successfully deployed.

B.5 Based on these ideas, Steer has developed four broad scenarios describing possible and plausible ways in which the future could develop. These scenarios have been developed to look at 'what is' and 'what could plausibly be' to define potential paths forward. They are not target-seeking/normative scenarios, and they do not represent Steer *forecasts* of what will occur; they have been created to help further analysis and development of policy and strategy.

B.6 These scenarios and accompanying high-level assumptions are outlined overleaf.

Scenario 1: Cycles of lockdown

B.7 Social distancing and ‘track-and-trace’ fail to stop a second wave of Covid-19. No effective treatment of vaccine is available and further lockdowns are necessary over the next two to three years with the consequent negative effects on society, the economy and transport demand.

Scenario 2: Adaptation

B.8 No second wave materialises, and society adapts, finding a new equilibrium of behaviours and activities that keep Covid-19 under control.

Scenario 3: Therapeutics

B.9 By 2021 an effective clinical pathway is found that significantly reduces the health impacts and the mortality rate of the virus. There is no vaccine, but society returns mostly to normal.

Scenario 4: Vaccine

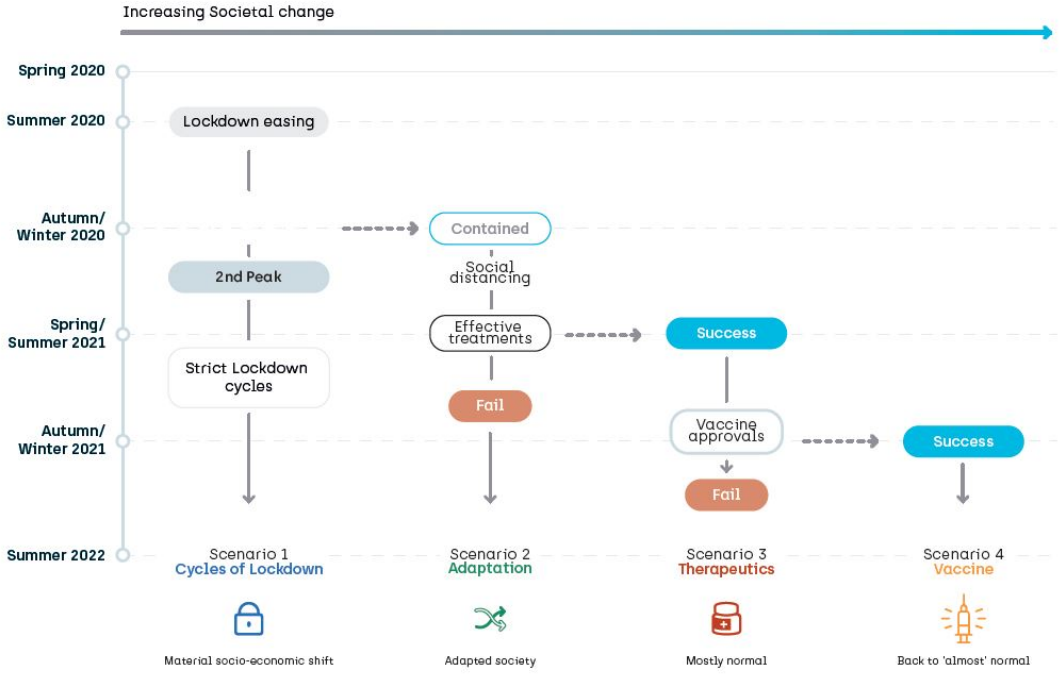
B.10 An effective vaccine is widely deployed in 2022. Society rapidly returns to pre-Covid-19 norms.

B.11 Across these scenarios, there are likely to be some changes or new “norms” that could derive positive impacts. For example, increased levels of home working could reduce traffic levels and associated impacts as well as foster greater work-life balance/ quality of life impacts and increased spend in local economies.

Other variants are possible. For instance, a world on the Cycles of Lockdown pathway could find a vaccine. However, we believe “Vaccine” (least impact) and “Cycles of Lockdown” (biggest impact) represent the upper and lower bounds of what we believe to be the plausible post-Covid-19 outcomes for economy, activity and transport demand. A timeline illustrating the pathways to our scenarios can be seen in Figure B.1: Covid-19 Scenario Timelines

below.

Figure B.1: Covid-19 Scenario Timelines



Stakeholder workshop

B.12 In order to provide a range of potential future outcomes regarding the Covid-19 pandemic and the response to lifting lockdown restrictions, it was important that in addition to the internally developed Steer scenarios we also received inputs from local stakeholder within the South East region. To achieve this, we hosted an online workshop session. Those invited to the workshop included officers from the constituent authorities as well as a number of representatives from key stakeholders who are members of the TfSE Transport Forum.

B.13 Participating stakeholders in the workshop were given a brief introduction to the project and its context and were informed of the modelling approach and the approach to scenario planning being used in this project.

B.14 Following this, the stakeholders were separated into four 'break-out' groups, with each group being assigned to a particular Steer Covid-19 scenario. The purpose of these 'break-out' groups was to allow each group to focus on a single scenario and provide their insights and inputs on realistic/plausible conditions and regarding:

- "unlock" policies and government guidance;
- capacity constraints on transport and workplaces;
- modal preference and behaviour adaptation; and
- transport interventions.

B.15 By combining the inputs received during the stakeholder workshop and applying them to our Covid-19 scenarios we were able to infer quantifiable values relating to various mechanisms which needed to be developed and implemented into the SEELUM model. The description of these mechanisms and their accompanying assumptions have been detailed in Chapter C below.

C Adapting the SEELUM model

C.1 This section describes the new mechanisms we built into SEELUM in order to simulate the effects of lockdown, so far as it affects travel and employment.

Mechanisms

Furlough

C.2 During furlough, this mechanism removes a specified proportion of all travel to work trips. Furloughed staff are assumed to be still employed, but do not travel to work, and do not contribute to GVA.

Safe carrying capacity on public transport

C.3 Social distancing rules mean the safe carrying capacity on public transport is significantly reduced to 25%, or even less, of its pre-Covid level. When social distancing is introduced, the model calculates the new ratio of demand to (reduced) capacity and uses this to generate a sharp increase in the perceived travel times to deter use. This has two immediate effects: mode switching, mainly to car and walk/cycle; and increased desire to work from home. The model adjusts people's behaviour until demand is more loosely aligned with capacity (There is a third, longer term effect, in that the higher perceived generalised times on public transport will deter recruitment, and shift employment patterns; however, this is largely beyond the timescales we have simulated to date).

Safe capacity at workplaces

C.4 Social distancing also reduces the safe working capacities in workplaces. In the model, when social distancing is activated, this creates a requirement for staff to work from home. The model calculates this number, and these staff are then assumed to work from home, subject to constraints on the maximum proportion of people who can work from home; these constraints are inputs and vary by employment sector. Staff who work from home do not travel to work but do contribute to GVA.

Hard lockdown

C.5 Under hard lockdown, as occurred back in March 2020, people are assumed to be compelled to reduce travel and work from home. The model imposes the maximum work from hoe rates permissible (see above) for as long as hard lockdown is in place. After it is lifted the model assumes responses are all voluntary responses to conditions, such as social distancing on public transport and at the workplace.

Public confidence

C.6 Public confidence is rated on a scale from 1 to 3, with 3 as the highest level, equivalent to pre-Covid levels. This number is supplied as an input and changes throughout the simulation depending on the scenario being tested.

C.7 The public confidence variable increases or decreases the speed at which people react to conditions. Low confidence makes people quicker to reduce travel and increase working from home, and slower to adjust back to pre-Covid behaviour; their behaviour becomes asymmetric. At the highest level of confidence, decisions are made as in the pre-Covid model. Public confidence affects decisions about mode shares, working from home, non-commuting trip rates and business travel.

Retail

C.8 In previous version of the model, retail expenditure was distributed among retail locations within accessible reach of the home. In the new model a proportion of this expenditure, assumed to be 15%, takes place close to the workplace. When people stop travelling to work because of furlough or working from home, this expenditure shifts back to the home location. The total amount of expenditure does not change, only the distribution of where it takes place.

Switching peak travel to off-peak

C.9 Travel occurs in either the peak or off-peak period. The proportional split of travel between peak and off-peak can be varied as a policy input, allowing peak journeys to take place in the off-peak, reducing crowding.

Forced business closure

C.10 It is expected that when furlough ends, businesses that relied on the scheme to remain trading will be forced to lay off staff or close completely. The model will force a specified proportion of businesses to close, with a consequent loss of jobs, when furlough ends. The expected loss of jobs, differentiated by employment sector, is an input to the model, based on the views expressed at the stakeholder workshop.

Business to business trip rates

C.11 As the travel into work is reduced the amount of travel between workplace also decreases. The model assumes that the proportional reduction in business to business trip rates is the same as the proportional reduction in travel to work trips. The speed at which these trip rates vary depends on public confidence; with low confidence the rates fall quickly but rise slowly.

Non-commuting trip rates

C.12 We assume home-based non commuting trip rates also fall under lockdown. Trip rates are assumed to fall by the same fraction as bus capacities fall under social distancing constraints. The speed at which theses rates fall and rise are affected by the level of public confidence: with low confidence the rates fall quickly but rise slowly.

Employers using smaller premises

C.13 There is much speculation about how employers' use of premises might change after Covid. We have assumed after Covid, employers decide to retain / experience at least some increased level of working from home and will, therefore, require proportionally smaller premises if social distancing is no longer required. The model will then put new businesses and employers into proportionally smaller workplace units[20].

C.14 As the turnover in businesses continues, more and more of them occupy smaller premises, but since the stock of buildings remains the same, the number of vacant premises rises. The post-Covid levels of working from home vary by business sector and are inputs to the model.

Time controls

C.15 The revised model was set up to simulate three years, and the smallest simulated time unit was reduced to one week.

Scenarios

C.16 The model reads in timeseries data from an Excel workbook telling it how conditions vary over time for each of the four scenarios.

The transport and workplace capacities change in line with the scenario timelines in Chapter 2. Below are charts that show how the capacities change throughout each scenario. These are based on results from the stakeholder workshops. It should be noted that the workplace capacity figures shown in the following charts do not equate to levels of occupancy. Due to assumed work from home rates remaining post-Covid, provided at the end of this section, the capacity rates should rather be viewed as the "maximum" levels achievable. In scenario 1 the capacities cycle through different levels of lockdown as the model comes out of lockdown and returns to lockdown repeatedly shown Figure C.1: Capacity in Scenario 1: Cycles of Lockdown

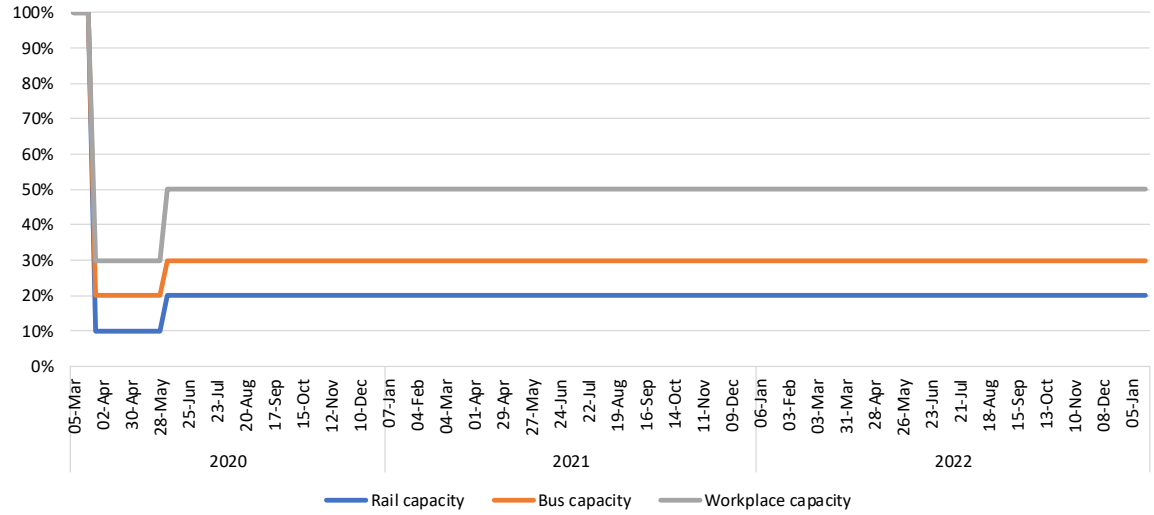
C.17 .

Figure C.1: Capacity in Scenario 1: Cycles of Lockdown

[20] This only happens in the model after social distancing restrictions end. In practice the change might happen sooner, but we have assumed that while social distancing is in place employers will need to retain larger premises in order to accommodate satisfactory numbers of staff safely.

C.18 Figure C.2 shows adaptation, where there is an increase in capacity as lockdown is relaxed. As no other mitigation becomes available this capacity restriction remains until the end of the three-year period.

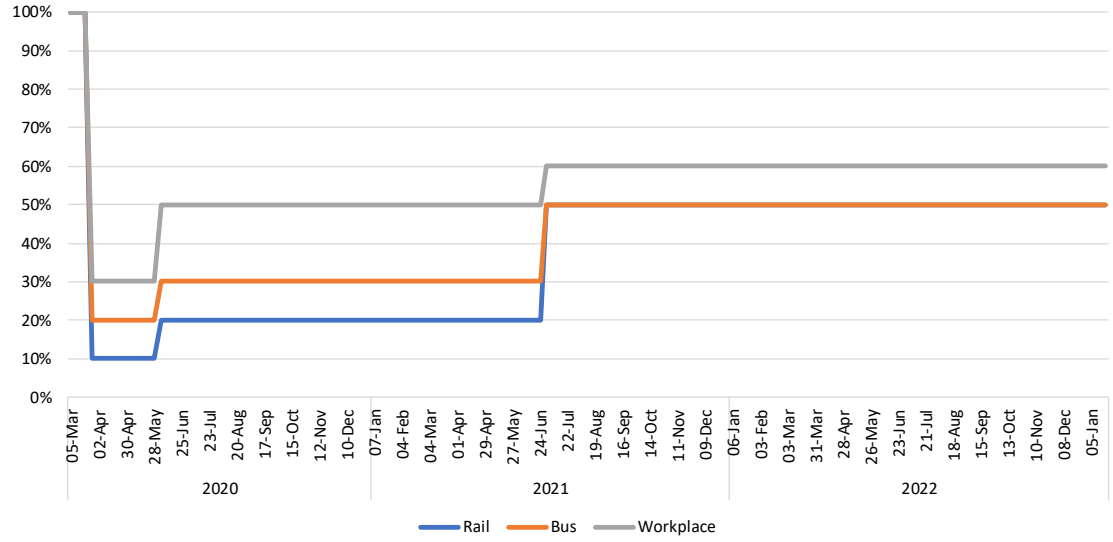
Figure C.2: Capacity in Scenario 2: Adaptation



C.19 Scenario 3 has the relaxing of lockdown and the discovery of effective treatment, allowing the capacity to increase again shown in Figure C.3: Capacity in Scenario 3: Therapeutics

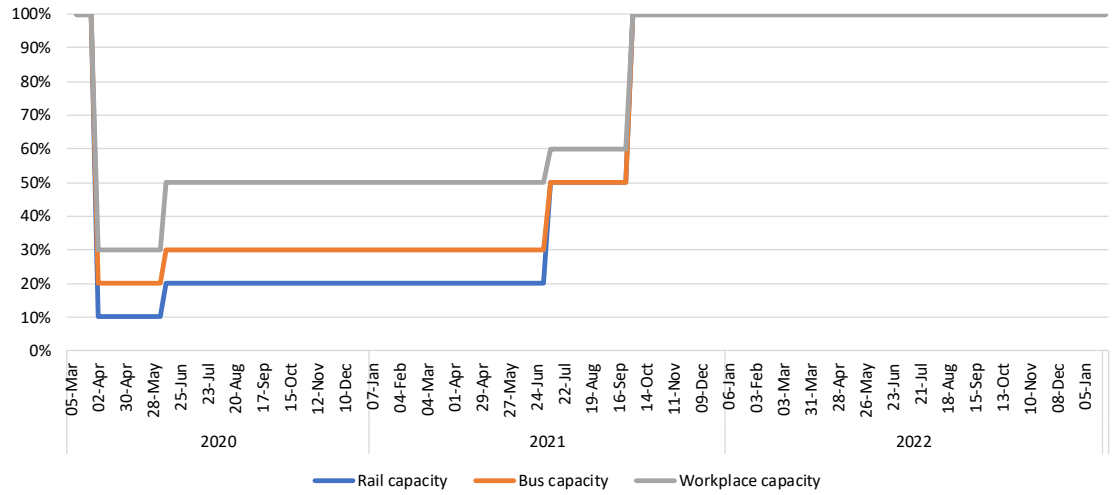
C.20 .

Figure C.3: Capacity in Scenario 3: Therapeutics



C.21 In Scenario 4 the relaxing and treatment allow for two increases in capacity as before. There is an additional increase back to pre-Covid capacity as a vaccine is discovered and there is no longer a need to reduce capacity for safety (shown in Figure C.4). Even though workplace capacity has returned to 100% in this scenario there will still be some working from home post Covid. The impact of this is discussed below.

Figure C.4: Capacity in Scenario 4: Vaccine



C.22 Public Confidence starts off on a medium level (level 2) in all four scenarios. In scenario 1, this level of confidence is reduced in September of 2020 as the public would be anticipating the reintroduction of constrained capacities, from where it cycles between capacity levels. In scenario 4, public confidence is increased to a high level once a promising vaccine is assumed to be in its final stages of development (July 2021). For scenarios 2 and 3, the initial medium level of public confidence is maintained throughout the timeline.

Scenario independent assumptions

C.23 As mentioned above, some of the mechanism inputs change depending on the scenario being tested. However, some assumptions remain consistent between scenarios; these have been outlined in Table C.1 below and are concerned with the proportion of employees able to work from home, furloughed and the loss of jobs once furlough ends. These inputs have been inferred from the workshops held in addition to the collection of available data where possible.

Table C.1: Business category related assumptions

Sector / type of worker	Max % who can work from home	Jobs remaining (post furlough)	Percentage of staff furloughed
Advanced manufacturing	23%	90%	27%
Knowledge service sectors	77%	87%	24%
Primary sectors (e.g. agriculture)	10%	97%	38%
Finance and business	83%	83%	26%
Education	20%	97%	11%
Retail and catering	10%	77%	49%
Other Industry and manufacturing	10%	87%	27%
Other services (e.g. health, public administration)	43%	93%	20%
Sea ports	10%	90%	20%
Airports	10%	70%	20%

C.24 The assumed post-Covid rates for working from home are supplied to the model differentiated by type of building. The assumed values are:

- Offices: 50%
- Shops, hotels and restaurants: 10%
- Research and manufacturing premises: 10%
- Other: 50%

C.25 Hard lockdown occurs in all four scenarios from 26 March 2020 through to the end of May 2020. Similarly, the furlough period input used in all four scenarios has also been assumed to remain the same and lasts for 6 months following the introduction of the hard lockdown.

D Lockdown Scenario Results

Introduction

D.1 This section presents the results of the simulation tests.

D.2 In our previous work, we tested several growth and transport strategy options. The preferred option was the 'Sustainable Route to Growth', or SRtG, so we tested each of the four Covid scenarios against this background growth scenario. In other words, the tests show how the SRtG case is altered, in its early years, by each of the four Covid scenarios.

D.3 In the following sections we compare the results for each Covid scenario against the original SRtG results. For information, we also show the 'Business as usual' (BAU) case, taken from the original work.

D.4 A brief description of the growth strategy options and their naming conventions can be found below:

- **Business as Usual (BAU)**: This scenario assumes NTEM growth and only do minimum transport interventions.
- **Sustainable Route to Growth (SRtG)**: A "do something" scenario aimed to increased mode shift to public transportation while encouraging economic growth within the study area. This scenario is supported by increased road pricing, public transport fare subsidisation, no policy constraints on CAV/MAAS, road space reallocation, improved bus/high quality urban transit and pedestrianised urban centres. This scenario is also the "preferred scenario" informing TfSE's Transport Strategy.

D.5 Further details regarding the scenarios and naming conversions above, and description regarding output metrics can be found within our full report for the Transport Strategy[21].

D.6 Seeing as SRtG has been identified as the "preferred scenario" in TfSE's Transport Strategy, the four lockdown scenarios outlined below have been based off the underlying interventions assumed to take place under SRtG conditions. As such, SRtG should be viewed as the reference case when comparing outputs regarding the lockdown scenarios. The following naming conventions are used for the lockdown scenarios:

- **CoL:** Reflects conditions assumed to take place in "Cycles of Lockdown";
- **Adap**: Reflects conditions assumed to take place in "Adaptation";

[21] Report Title: Transport Strategy for the South East – Scenario Forecasting Technical Report

- **Thera**: Reflects conditions assumed to take place in “Therapeutics”; and
- **Vacc**: Reflects conditions assumed to take place in “Vaccine”.

SEELUM lockdown scenario results

Introduction

D.7 This section provides the results relating to lockdown scenario testing and compare the outputs of the four tested lockdown scenarios to the BAU and SRtG scenario baselines.

D.8 Due to uncertainties surrounding Covid recovery and data availability, the scenarios have been modelled for a three-year period and outputs provided as such. When reviewing the various Lockdown scenario results and comparing the metrics to those of SRtG and BAU, it is noticeable that the trajectories of some metrics have shifted, where in some cases growth seems to have been accelerated. With current outputs, we can’t precisely determine whether the trajectories will lead to increased levels in the future. However, crucially the main economic growth assumptions are subject to the same land use constraints in SRtG as in the Lockdown scenarios. We would therefore assume that the results for the Lockdown scenario’s (once capacity constraints have been lifted) would broadly be similar to SRtG in the long term.

D.9 It should be mentioned that the baseline BAU and SRtG scenarios and four Lockdown Scenarios presented do not include the same exact assumptions on how life is expected to change post-Covid (i.e. increased working from home). We therefore suggest that future work expand upon the comparison of scenarios by developing more comparable baselines as well as investigate longer modelling periods. This will allow for an improved understanding of how these differences in trajectories are expected change in the long run.

Gross Value Added (GVA)

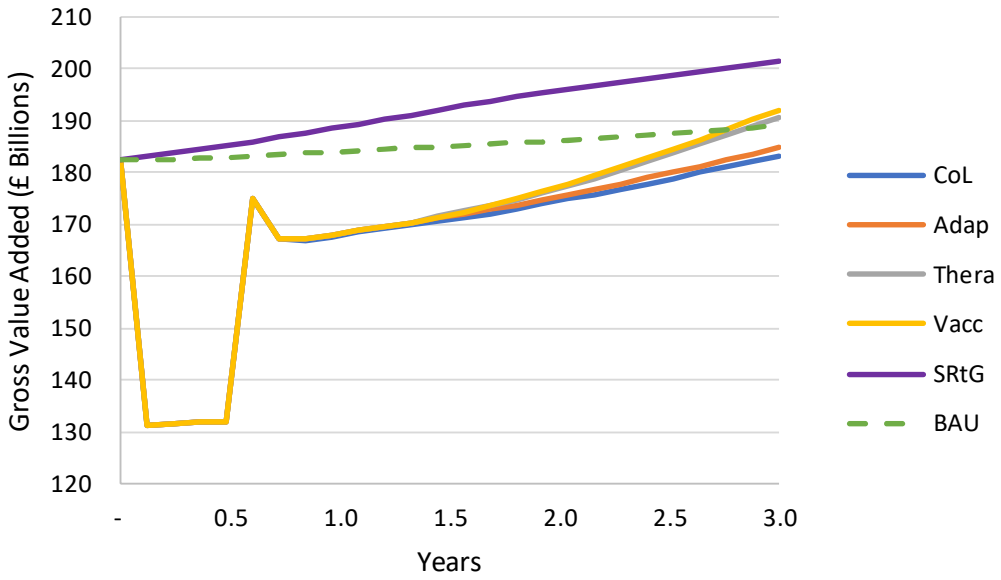
D.10 Figure D.1: Lockdown Scenarios - Gross Value Added

D.11 below illustrates the expected Gross Value Added (GVA) in each scenario when compared to the BAU scenario and the SRtG scenario. The expected GVA across all lockdown scenarios is lower than in SRtG. In the early stages of Lockdown, the effective GVA across all scenarios drops significantly due to the introduction of furloughing which stop employees from contributing to GVA. As the furlough scheme is concluded, GVA spikes back up and then drops once again as the job losses attributed to the end of furlough take effect.

D.12 In the early stages of the modelled period, GVA is largely the same for all lockdown scenarios. This is due to the same assumptions being used regarding the furloughing period and number of expected job losses (post furlough). However, GVA fails to reach the levels experienced in SRtG due to the capacity constraints and number of jobs assumed to be lost post furlough.

D.13 In time, GVA begins to diverge between the scenarios post furlough, with 'Vaccine' performing the best and 'Cycles of lockdown' performing the worst, as a result of the capacity constraints relating to safe workspace, and public transport.

Figure D.1: Lockdown Scenarios - Gross Value Added



Jobs filled

D.14 Figure D.2: Lockdown Scenarios – Total Number of Jobs filled

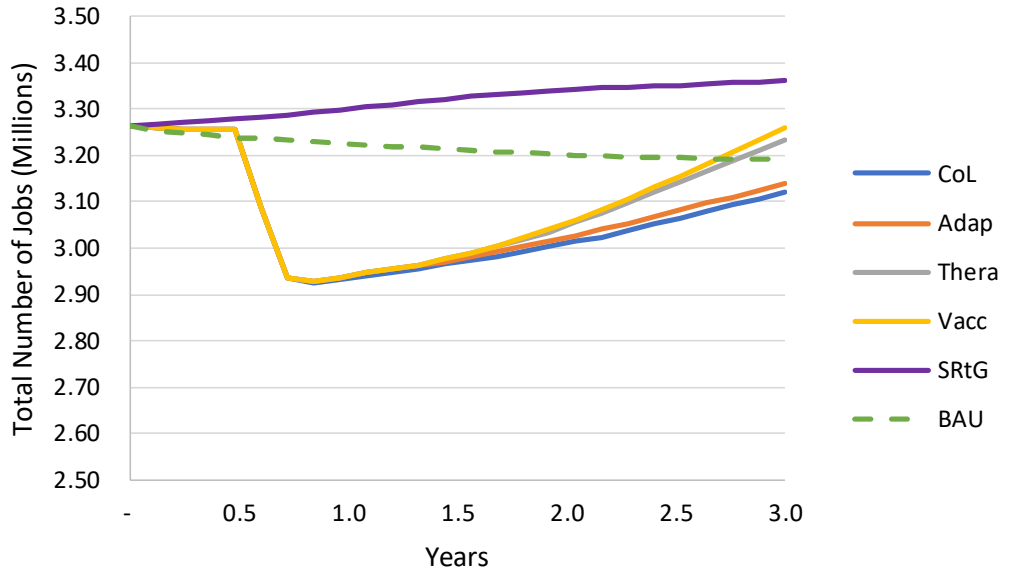
D.15 below illustrates the total number of employed (jobs filled) across the various scenarios. GVA in the model is generated by employment and a real value multiplier, so the patterns are very similar to those seen above. For the BAU the decrease in jobs filled does not directly result in a decrease in GVA due to the change in mix of jobs coupled with the multiplier effect.

D.16 From Figure D.2: Lockdown Scenarios – Total Number of Jobs filled

D.17 , it can be seen that during the initial stages of lockdown, while furlough is still active, employment levels remain stable for all four lockdown scenarios, however at a lower level than when compared to SRtG. Once the furlough period concludes, the total number of jobs filled is reduced because of the forced job losses. From this point onward, the scenarios begin to diverge, with 'Vaccine' regaining the highest amount of jobs and 'Cycles of lockdown' regaining the fewest number of jobs by the end of the three-year modelling period. The difference across the lockdown scenarios are a result of the capacity constraints relating to safe workspace, and public transport which all influence the number of accessible jobs available to individuals.

D.18 Interestingly 'Therapeutics' follows a pattern closer to 'Vaccine' than 'Adaptation'. The differences between these two scenarios are in the assumed safe levels of capacity on rail and bus transport and at workplaces, pointing to the value of efforts to increase these capacities. Despite the persistent capacity constraints on workplaces and transport in 'Therapeutics', the jobs recovery is almost as high as in 'Vaccine'. This is because working from home fills the gap, allowing jobs to remain in place despite the capacity limits.

Figure D.2: Lockdown Scenarios – Total Number of Jobs filled



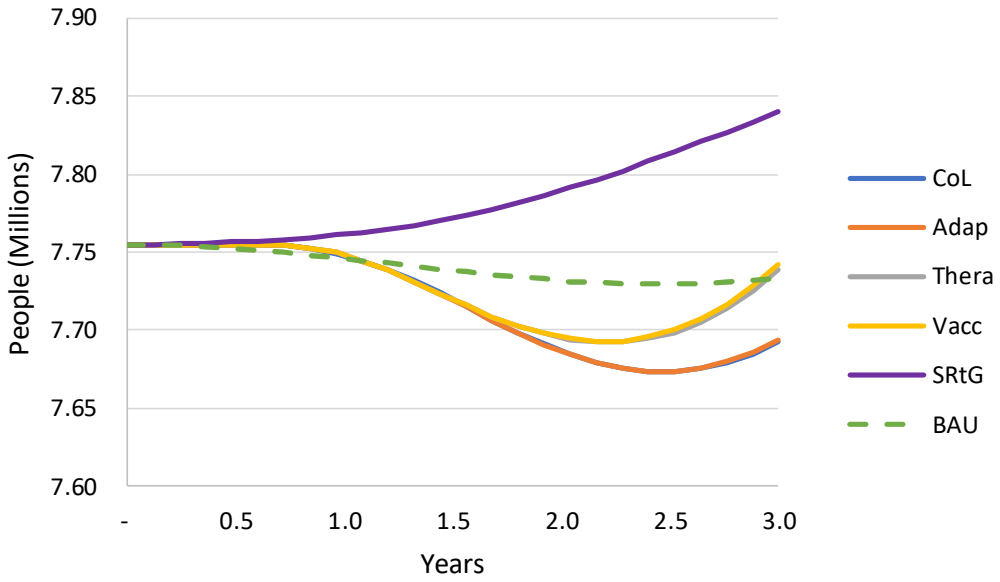
Population

D.19 As lockdown conditions impact the capacities and conditions within the TfSE area, making conditions more restrictive and less favourable, the attractiveness of the area decreases. This lower level of attractiveness leads to inward migration being reduced compared to what would be expected under normal conditions. This leads to lower levels of population growth, against background growth, across all four lockdown scenarios when compared to the SRtG scenario.

D.20 As conditions begin to improve in each scenario, the attractiveness of the region rises again, and inward migration leads to growth in population. Figure D.3: Lockdown Scenarios - Population

D.21 below illustrates the effect of lockdown scenarios on population. Once again, a pattern of similarity emerges when comparing ‘Therapeutics’’ population outputs to those of ‘Adaptation’ and ‘Vaccine’ respectively. This is illustrating that the ability to increase capacity levels from ‘Adaptation’ to ‘Therapeutics’ (coupled with increased levels of working from home) can be beneficial when attempting to mitigate the negative impacts of lockdown in situations where the total removal of capacity constraints is not possible.

Figure D.3: Lockdown Scenarios - Population

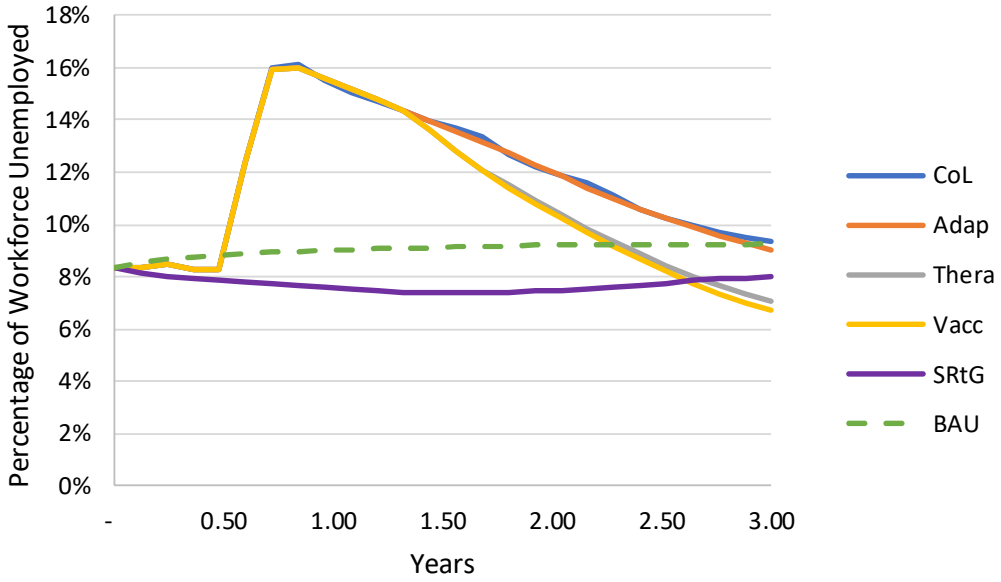


Unemployment rate

D.22 The unemployment rate follows an inverse pattern when compared with jobs filled (i.e. when jobs filled increases, the unemployment rate is reduced). In the early stages of modelling, the four lockdown scenarios follow a similar pattern. This similar pattern is primarily a result of the same assumptions being used during the furloughing period in the early part of the period and number of expected job losses (post furlough) for all four scenarios. The jobs lost, post furlough, lead to an increase in unemployment rate in all four lockdown scenarios.

D.23 After the peak in unemployment, all four scenarios see the rate falling in the longer term. The Therapeutics and Vaccine scenarios actually see slightly lower rates at the end of the three years than in the SRtG scenario, but it has to be remembered that this is in a much reduced economy. Even under the Vaccine scenario, the workforce is 50,000 people fewer than under SRtG, and the number of employed is 100,000 fewer.

Figure D.4: Lockdown Scenarios - Workforce Unemployment rate



Travel to work trips

D.24 Figure D.5: Lockdown Scenarios - Total Travel to Work trips

D.25 below illustrates the total number of travel to work trips for journeys which originate and stay within the TfSE area.

D.26 The initial drop in travel to work trips, which persists for almost half a year, is a result of the various lockdown measures (i.e. capacity constraints, working from home and furlough) being implemented. The subsequent rise in trips nearly half a year into the simulation is caused by the removal of the furlough scheme, which encourages those who have returned to work and who are not able to work from home to travel to their

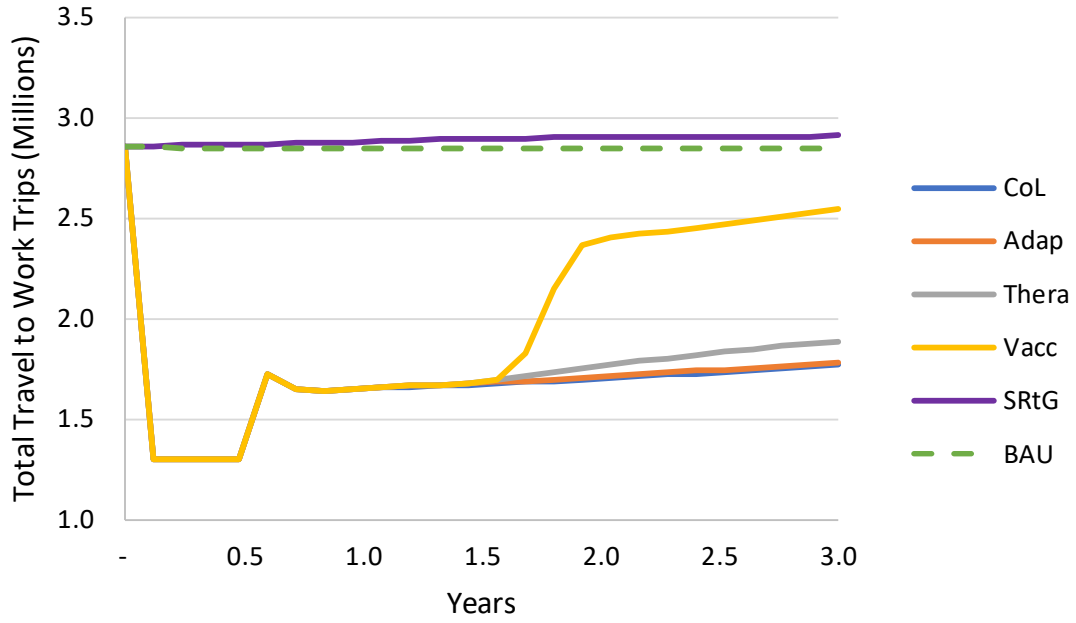
place of work. This rise in trips is followed by a reduction in travel to work trips due to the loss of jobs which kicks in after the furlough period[22].

D.27 Following this, 'Cycles of Lockdown', 'Adaptation' and 'Therapeutics' follow similar paths due to multiple capacity constraints still being applied to the scenarios. 'Vaccine' on the other hand, sees a significant uplift in travel to work trips due to the removal of capacity constraints, allowing the transportation networks to return to pre-Covid capacity levels. The delay in uplift experienced under the 'Vaccine' scenario is due to the assumed timings of capacity restrictions being relaxed. These assumed timescales have been outlined in Chapter C. The total level of trips still remains lower than in the SRtG scenario, as a result of the lower employment levels and increased, long-lasting, working from home among the workforce.

D.28 It is worth noting that whereas 'Therapeutics' more closely resembled 'Vaccine' in the earlier metrics, for travel to work trips it remains significantly lower and lays closer to 'Cycles of Lockdown' and 'Adaptation'. This is due to the transport capacity constraints still applicable under 'Therapeutics', limiting the travel to work volumes, while working from home provides the remaining 'virtual' capacity.

D.29 This also explains why employed numbers and GVA eventually rise but travel to work trips do not, at least not to the same extent. Levels of working from home remain higher than in the starting position even in 'Vaccine'[23], and this means that travel to work trips do not rise as much as the numbers of employed people.

Figure D.5: Lockdown Scenarios - Total Travel to Work trips



[22] The model puts the furloughed staff back in their posts and then makes them redundant. This causes the spike. In reality many of those jobs are being lost before furlough ends.

[23] Because we assume employers will continue have a higher level of their workforce working from home to some degree, allowing them to use smaller premises and cut costs.

Work from home

D.30 As mentioned above, the ‘Therapeutics’ displays indications of rapid economic improvement, similar to what is experienced in ‘Vaccine’, despite the persistent capacity constraints on workplaces and transport. Presumably this is because the ability for employees to “Work from Home” takes up the strain, filling the gap left by the capacity loss. In Figure D.6: Lockdown Scenarios - Work From Home Volumes

D.31 we illustrate the work from home volumes between scenarios to show the impacts of adding this capability.

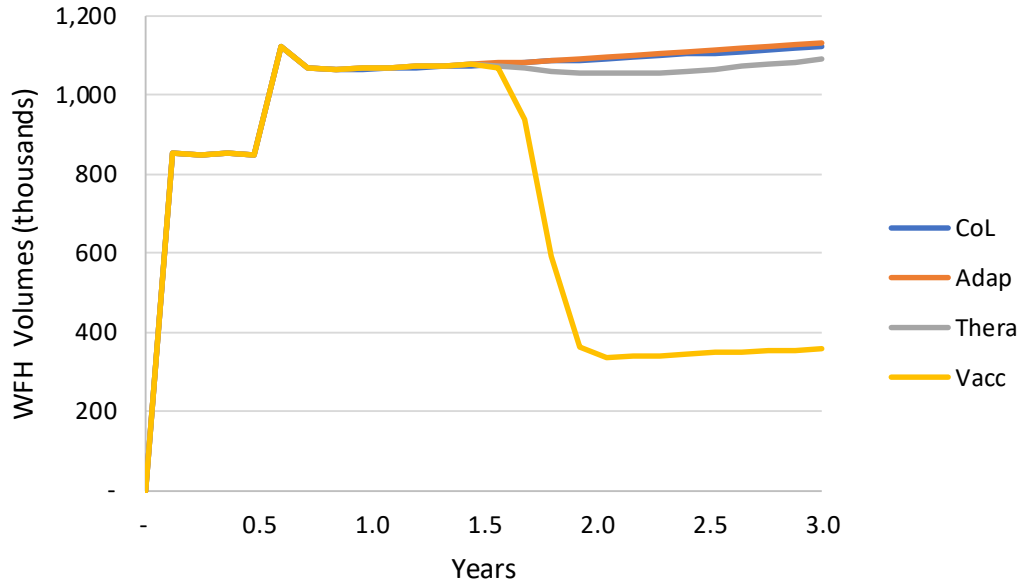
D.32 In the figure below, the initial rise in working from home volumes is a result of the introduction of this mechanism as well as the various lockdown measures (i.e. capacity constraints and furlough) being implemented. As in when investing travel to work trips, the subsequent rise in working from home volumes nearly half a year into the simulation is caused by the removal of the furlough scheme, which encourages those who had previously not been economically active to now work from home if they are in a position to do so. The peak is followed by a reduction in volumes due to loss of jobs following the furlough period.

D.33 From this point, the various Scenarios begin to diverge. ‘Cycles of Lockdown’ and ‘Adaptation’ follow similar patterns throughout the model period due to transport and workplace capacity constraints constantly being applied and therefore these volumes illustrate the maximum number of home working levels applicable under each Scenario. The slight difference between ‘Cycles of Lockdown’ and ‘Adaptation’ is due to the overall levels of employment achieved in these scenarios which affects the maximum amount of work from home as a result of business type.

D.34 Following the easing of capacity restrictions, ‘Vaccine’ volumes drop to levels of working from home where they stabilise to a new level, which is higher than the starting point because we assume employers will continue using home working to some degree. Investigating ‘Therapuetics’’ work from home volumes shows that after easing of capacity constraints home working volumes are no longer at maximum level (which is illustrated by ‘CoL’ and ‘Adap’). As mentioned above, in ‘Therapeutics’, working from home is no longer a constraint and is now able to provide the remaining ‘virtual’ capacity. This explains the higher levels of economic outputs experienced under ‘Therapeutics’ without the increased level of travel to work trips seen in ‘Vaccine’.

D.35 It should be noted that the work from home volumes presented for the four scenarios below are incremental to the original SRtG scenario home working assumption. Although under all scenarios levels of working from home increase, and it is assumed that these patterns do, to some extent, endure, it has not been possible to model any potential increase in trip rates during the day for other journey purposes and as a result of car availability increasing for, say, other household members also at home.

Figure D.6: Lockdown Scenarios - Work From Home Volumes



Travel to work mode shares

D.36 As can be seen above, the changing transport conditions throughout the scenarios lead to a change in travel patterns. As these conditions impact travel to work volumes, they also impact mode shares. To investigate changes in mode shares, we have tabulated the respective start and end points of each respective mode in each of the scenarios. The travel to work mode shares at the start and end point of the period that has been modelled are shown in Table D.1: Lockdown Scenarios - Start and End Mode Shares below.

Table D.1: Lockdown Scenarios - Start and End Mode Shares

Mode Shares	Starting mode shares				Ending mode shares			
	Car	Rail	Bus	Walk/cycle	Car	Rail	Bus	Walk/cycle
CoL	77.2%	4.1%	6.0%	12.7%	81.2%	1.2%	3.4%	14.2%
Adap	77.2%	4.1%	6.0%	12.7%	79.5%	2.0%	4.6%	13.9%
Thera	77.2%	4.1%	6.0%	12.7%	76.7%	4.1%	6.0%	13.2%
Vacc	77.2%	4.1%	6.0%	12.7%	74.7%	5.3%	7.4%	12.6%
SRtG	77.2%	4.1%	6.0%	12.7%	67.3%	9.4%	10.9%	12.5%
BAU	77.2%	4.1%	6.0%	12.7%	74.3%	4.7%	6.9%	14.1%

D.37 The table shows how, under SRtG conditions, the public transport mode shares are expected to increase, and the car mode share to fall. Table D.2: Lockdown Scenarios - Mode share comparison shows how the mode shares change in each case between the start and end points, and also how they change compared to the SRtG case.

Table D.2: Lockdown Scenarios - Mode share comparison

Mode Shares	Change from start				Change from SRtG			
	Car	Rail	Bus	Walk/cycle	Car	Rail	Bus	Walk/cycle
CoL	4.1%	-2.9%	-2.7%	1.5%	14.0%	-8.2%	-7.5%	1.7%

Adap	2.3%	-2.1%	-1.4%	1.2%	12.2%	-7.4%	-6.3%	1.4%
Thera	-0.4%	-0.1%	0.0%	0.5%	9.5%	-5.4%	-4.8%	0.7%
Vacc	-2.5%	1.2%	1.4%	0.0%	7.4%	-4.1%	-3.4%	0.1%
SRtG	-9.9%	5.3%	4.8%	-0.2%	-	-	-	-
BAU	-2.9%	0.6%	0.8%	1.5%	7.0%	-4.7%	-4.0%	1.7%

D.38 Table D.2: Lockdown Scenarios - Mode share comparison illustrates the SRtG scenario's interventions reduced car travel within the TfSE area by encouraging use of public transport. The lockdown scenarios have all negatively impacted public transport mode shares (rail and bus) and increased shares for walk/cycle. Even when the transport capacity restrictions have been lifted (in 'Vaccine'), the mode share for car remains higher than the levels experienced under the SRtG scenario. This happens because there are fewer travel to work trips overall (fewer jobs, more working from home) and road congestion is reduced. This makes car more attractive, relative to PT, resulting in a higher car mode share, even after the PT capacity restrictions have been lifted. The table also indicates how the mode shift effect becomes more pronounced as the capacity on public transport modes becomes more constrained (shifting from 'Vaccine' to 'Cycles of Lockdown').

Summary table

D.39 A summary table of the various scenarios relating to the main metrics: GVA, Jobs Filled, Unemployment and Total number of Travel to Work (TTW) trips at the end of the three-year modelled period is show in Table D.3 below. To assist in summarising the impacts, the Total number of Travel to Work (TTW) trips by different modes has also been provided in Table D.4 below.

Table D.3: Lockdown scenarios - Summary table

Scenario	GVA (£ Billion)	Jobs Filled (Million)	Population (Million)	Unemployed (%)	TTW trips (Million)
CoL	183.2	3.119	7.692	9.4%	1.767
Adap	184.9	3.140	7.694	9.0%	1.780
Thera	190.7	3.235	7.738	7.0%	1.886
Vacc	192.1	3.258	7.742	6.7%	2.541
SRtG	201.5	3.362	7.840	8.0%	2.908
BAU	189.1	3.192	7.733	9.3%	2.846

Table D.4: Lockdown scenarios - TTW trips by mode summary table (thousands)

Scenario	Car trips (Thousands)	Rail trips (Thousands)	Bus trips (Thousands)	Walk trips (Thousands)	TTW trips (Thousands)
CoL	1,435	21	60	250	1,767
Adap	1,415	36	82	247	1,780
Thera	1,448	77	114	249	1,886
Vacc	1,897	135	189	320	2,541
SRtG	1,955	274	316	362	2,908
BAU	2,113	134	196	402	2,846

D.40 As expected, the results of our lockdown scenario tests illustrate that the more restrictive the lockdown measures the larger the impact on economic variables such as GVA, jobs filled and total number of travel to work trips at the end of the three-year model period. Due to the deterrence of inward migration, the total workforce unemployment figures suggest ‘Therapeutics’ and ‘Vaccine’ perform better than SRtG. This can be explained by the change in composition of and overall level of population. As we can see from the Table D.3, total jobs filled do not reach SRtG levels. Unemployment is a result of number of job seekers, divided by total workforce. Therefore, in ‘Therapeutics’ and ‘Vaccine’, even when a lower numbers of jobs are filled, they are proportionally filled by a higher percentage of the available workforce, leading to lower unemployment figures. It is also important to highlight that even under constrained conditions where mode shift to car from public transport is occurring, overall we are still observing a lower volume of car trips by the end of the three-year model period compared to both the SRtG scenario as can be seen in Table D.4.

E Intervention Results

Introduction

E.1 Analysis in the previous section showed how, as expected, each of the Covid-19 recovery scenarios has a negative impact on the region's economy, typically, compared to the SRtG scenario. In this section we look at the effect of various mitigating measures that could be employed.

E.2 The intervention tests were developed to of test the impacts of changing in transport and workplace conditions under Covid-19 Scenarios. Beyond reducing the negative effects of lockdown, the aim of these tests is to assist in and further develop an understanding of potential interventions which could be implemented in Covid-19 lockdown. For interventions outlined below which adjust transport and workplace capacities, we do not outline how this can be achieved in detail, the purpose of these interventions are to test their impact on the key variables explored in Section D.

Intervention development and assumptions

E.3 The primary restriction relating to Covid-19 lockdown scenarios is driven by the limited capacity of transport or places of work. Various intervention tests have been developed to assess the impacts of improvements relating to transport and workplace conditions.

E.4 All interventions have been assumed to take place after the furlough period has ended and resulting intervention impacts are compared at the end of the three-year modelling period. The interventions tested consist of the following:

- Intervention 1: Rail capacity halfway back to 100% from current levels (*see para E.8)
- Intervention 2: Bus capacity halfway back to 100% from current levels (*see para E.11)
- Intervention 3: Rail fares reduced by 20%
- Intervention 4: Bus fares reduced by 20%
- Intervention 5: Active mode (walking/cycling) Generalised Journey Times[24] reduced by 10%
- Intervention 6: Active mode (walking/cycling) Generalised Journey Times reduced by 20%
- Intervention 7: 20% uplift in Working from Home levels (based on business type and from current levels)
- Intervention 8: 50% uplift in Workplace capacity (from current levels)
- Intervention Bundle 1: Combination of Interventions 1, 2 and 8

[24] Tests reducing Generalised Journey Time (GJT) have been selected with the understanding that under Covid-19 conditions, enhancements to transport networks (e.g. widening of footpaths or cycle lanes) could lead to these modes becoming more attractive/accessible, thereby increasing the likelihood of use.

- Intervention Bundle 2: Combination of Interventions 3, 4 and 6

E.5 Seeing as the four Covid-19 Lockdown scenarios all share the same underlying assumptions and differ in terms of how and when capacity conditions would be expected to adjust across the model period, the intervention tests and their impacts have been tested on two of the four Covid-19 Lockdown scenarios to identify the impacts of the interventions.

E.6 'Adaptation' and 'Vaccine' have been selected for testing intervention impacts. 'Adaptation', due to being an appropriate "middle ground" scenario. As this scenario applies capacity constraints which are not the most extreme when compared to the other scenarios which apply constraints throughout the model period. 'Vaccine' has also been selected to investigate the impacts of interventions when applied to a scenario which alleviates all capacity constraints at the end of its modelled period.

E.7 As some of the intervention tests outlined above aim to test the results associated with changes to specific modes, a summary table of mode share impacts has been provided at the end of this section in Table E.12: Intervention impacts on modal split in 'Adaptation' scenario12.

Intervention results

Intervention Test 1: Increasing rail capacity

E.8 This intervention tests the resulting impact of increasing rail capacity post furlough. In this test, rail capacity is increased to a level precisely between the scenarios assumed capacity at each respective point in the timeline (refer to Chapter 3), and 100% capacity, or as is the case for Scenario 4 ("Vaccine") until it reaches 100% capacity.

Table E.1: Intervention 1: Increasing rail capacity results

Intervention 1		GVA (Billions)	Jobs Filled (Millions)	Population (Millions)	TTW Trips (Millions)	Unemployed (* pp change)
Adap	No Intervention	185	3.3	7.7	1.8	9.0%
	Intervention 1	197	3.6	7.8	1.9	6.0%
	Percentage change	**6.3%**	**9.0%**	**1.4%**	**5.3%**	**-3.0%***
Vacc	No Intervention	192	3.5	7.7	2.5	6.7%
	Intervention 1	198	3.7	7.8	2.6	5.8%
	Percentage change	**3.1%**	**3.9%**	**0.8%**	**2.1%**	**-0.9%***

E.9 As would be expected, this intervention results in a positive impact across all metrics at the end of the three-year modelling period. Here the main economic metrics (GVA, Jobs filled, Population and Travel to Work Trips) receive a significant increase and due to this unemployment is also reduced on a percentage points level (see Table E.1 above).

E.10 'Vaccine' experiences less benefit when compared to 'Adaptation' due to 'Vaccine' already having relaxed its capacity constraints during the modelling period. This leads to a relatively short period where the benefits of the intervention can be realised. Thus, benefits experienced by Intervention 1 are driven by improving accessibility via increasing rail capacity, this increased accessibility makes economic conditions more

favourable and results in more GVA, Jobs Filled, Population and Travel to Work Trips while also reducing Unemployment.

Intervention Test 2: Increasing bus capacity

E.11 This intervention tests the resulting impact of increasing bus capacity post furlough. In this test we increase bus capacity to a mid-point value between the capacity assumed available in the scenario at each respective point in the timeline (refer to Chapter 3), and 100% capacity, or until it reaches 100% capacity.

Table E.2: Intervention 2: Increasing bus capacity results

Intervention 2		GVA (Billions)	Jobs Filled (Millions)	Population (Millions)	TTW Trips (Millions)	Unemployed (* pp change)
Adap	No Intervention	185	3.3	7.7	1.8	9.0%
	Intervention 2	186	3.4	7.7	1.8	8.7%
	Percentage change	**0.7%**	**0.8%**	**0.1%**	**1.0%**	**-0.3%***
Vacc	No Intervention	192	3.5	7.7	2.5	6.7%
	Intervention 2	193	3.5	7.7	2.5	6.6%
	Percentage change	**0.2%**	**0.3%**	**0.0%**	**0.3%**	**-0.1%***

E.12 As in Intervention 1, Intervention 2 also increases the capacity on a constrained public transport mode network, however this time for buses instead of rail. This results in a positive impact across all metrics. Notably, the increase applied to bus capacity under Intervention 2 is lower than that the capacity increase of rail in Intervention 1 as a higher level of bus capacity was assumed in each scenario (The levels of bus and rail capacity assumed in the four scenarios can be seen in Chapter 3). This in turn reduces the impact of the Intervention (see Table E.2 above).

E.13 'Vaccine' again experiences lower levels of this interventions benefits when compared to 'Adaptation', due to completely relaxing its capacity constraints during the modelling period.

Intervention 3: Reducing rail fares

E.14 This intervention tests the resulting impact of reducing rail fares post furlough. In this test following the furlough period rail fares have been reduced by 20%.

Table E.3: Intervention 3: Reducing rail fares results

Intervention 3		GVA (Billions)	Jobs Filled (Millions)	Population (Millions)	TTW Trips (Millions)	Unemployed (* pp change)
Adap	No Intervention	185	3.3	7.7	1.8	9.0%
	Intervention 3	185	3.3	7.7	1.8	9.0%
	Percentage change	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%***
Va	No Intervention	192	3.5	7.7	2.5	6.7%

	Intervention 3	192	3.5	7.7	2.5	6.7%
	Percentage change	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%***

E.15 The impact experienced when reducing rail fares is relatively insignificant for both scenarios. This is due to the constraints experienced under our scenarios relating to the capacity levels of the transport networks and not price (see Table E.3 above).

Intervention 4: Reducing bus fares

E.16 This intervention tests the resulting impact of reducing bus fares post furlough. In this test following the furlough period bus fares have been reduced by 20%.

Table E.4: Intervention 4: Reducing bus fares results

Intervention 4		GVA (Billions)	Jobs Filled (Millions)	Population (Millions)	TTW Trips (Millions)	Unemployed (* pp change)
Adap	No Intervention	185	3.3	7.7	1.8	9.0%
	Intervention 4	185	3.3	7.7	1.8	9.0%
	Percentage change	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%***
Vacc	No Intervention	192	3.5	7.7	2.5	6.7%
	Intervention 4	192	3.5	7.7	2.5	6.7%
	Percentage change	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%***

E.17 Similar to Intervention 3, the impact experienced when reducing bus fares is insignificant for both scenarios. As highlighted above, the lack of impact is a result of the constraints on mode capacity. An attempt to increase affordability at an already capacity constrained network results in no additional benefit, as this reduced capacity is the main constraint inhibiting the generation of more trips (see Table E.4 above).

Intervention 5: Reducing active mode GJTs (10%)

E.18 This intervention tests the impact of reducing generalised journey times for active modes (walk and cycle) post furlough. In this test following the furlough period the generalised journey times for active modes within the TfSE area have been reduced by 10%.

Table E.5: Intervention 5: Reducing active mode GJTs (10%) results

Intervention 5		GVA (Billions)	Jobs Filled (Millions)	Population (Millions)	TTW Trips (Millions)	Unemployed (* pp change)
Adap	No Intervention	185	3.3	7.7	1.8	9.0%
	Intervention 5	185	3.3	7.7	1.8	9.0%
	Percentage change	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%***
Vacc	No Intervention	192	3.5	7.7	2.5	6.7%
	Intervention 5	192	3.5	7.7	2.5	6.7%
	Percentage change	**0.0%**	**0.0%**	**0.0%**	**0.2%**	**0.0%***

E.19 Reducing the Generalised Journey Times by 10% for active mode trips results in relatively minor impacts across the metrics explored for both scenarios. This is due to, under scenario conditions, active modes already being the preferred mode of choice when available (see Table E.5 above).

E.20 Therefore, the reduction in generalised journey time for active modes does not lead to a significantly greatly number of trips/accessibility. Although there is a low change in number travel to work trips, the mode shares of walk/cycle do increase by a further 0.5% for both Scenarios. It should be highlighted that there is a minor increase in ‘Adaptation’ travel to work trips, but the impact is too small to record in Table 5.5.

Intervention 6: Reducing active mode GJTs (20%)

E.21 This intervention tests the resulting impact of reducing generalised journey times for active modes (walk and cycle) post furlough. In this test following the furlough period the generalised journey times for active modes within the TfSE area have been reduced by 20%.

Table E.6: Intervention 6: Reducing active mode GJTs (20%) results

Intervention 6		GVA (Billions)	Jobs Filled (Millions)	Population (Millions)	TTW Trips (Millions)	Unemployed (* pp change)
Adap	No Intervention	185	3.3	7.7	1.8	9.0%
	Intervention 6	185	3.3	7.7	1.8	9.0%
	Percentage change	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%***
Vacc	No Intervention	192	3.5	7.7	2.5	6.7%
	Intervention 6	192	3.5	7.7	2.6	6.7%
	Percentage change	**0.0%**	**0.0%**	**0.0%**	**0.5%**	**0.0%***

E.22 Once again, reducing the Generalised Journey Times, this time by 20%, for active mode trips results in relatively minor impacts for both scenarios. As in the discussion regarding Intervention 5, the reason to the impact being marginal is due to the highly congested network in the model. The high level of congestion leads individuals that can already access work via active mode already opting to do so. The reduction in Generalised Journey Time for active modes therefore does not lead to a significantly greatly number of trips/accessibility or economic output, it does however lead to an increased walk/cycle mode share of around 1.2% for both Scenarios. It should be highlighted that there is a minor increase in 'Adaptation' travel to work trips, but the impact is almost negligible, due to transport network still being highly constrained, whereas 'Vaccine' does experience some uplift in travel to work trips (see Table E.6 above).

Intervention 7: Increasing ability to Work from Home

E.23 This intervention tests the impact of increasing the ability of employees to work from home post furlough. In this test following the furlough period the work from home capability has been increased by 20% across all business types. The maximum level of working from home capability is capped at 100% for industries were an uplift of 20% working from home capability would exceed the maximum number of employees.

Table E.7: Intervention 7: Increasing work from home level results

Intervention 7		GVA (Billions)	Jobs Filled (Millions)	Population (Millions)	TTW Trips (Millions)	Unemployed (* pp change)
Adap	No Intervention	185	3.3	7.7	1.8	9.0%
	Intervention 7	186	3.4	7.7	1.5	8.6%
	Percentage change	**0.8%**	**1.0%**	**0.2%**	**-18.2%**	**-0.5%***
Vacc	No Intervention	192	3.5	7.7	2.5	6.7%
	Intervention 7	193	3.6	7.7	2.5	6.6%

	Percentage change	**0.4%**	**0.5%**	**0.1%**	**0.3%**	**-0.1%***

E.24 Increased levels of working from home has positive impacts on GVA, Jobs Filled, Population and reduces the unemployment rate due to indirectly increasing the accessibility of the workforce. In 'Adaptation', this intervention reduces the number of trips expected due to the workforce and improves other metrics due to enabling the workforce to contribute economically whether they commute to work or not (see Table E.7 above).

E.25 In 'Vaccine', where capacity constraints are no longer applicable, sees less benefit, only a experiencing modest uplifts in GVA, Jobs Filled, Population and reduction in the unemployment rate. Conversely to 'Adaptation', when testing the intervention on the 'Vaccine' scenario, there is an increase in total travel to work trips experienced. This is due to any jobs created which would not be able to work from home needing to commute to their place of work.

E.26 The reason as to why 'Vaccine' isn't impacted as significantly as 'Adaptation' is due to the way the Work from Home function is applied in the model. The mechanism increases the number of people who can work from home, however the model does not adjust the likelihood of them doing so, as it won't model the behavioural response to home working ability. The modelling approach therefore does not make the trade-off between home working and travel to work dynamically. The assumed amount of working from home is instead an input derived from workshops held with delegates of the Transport Strategy Working Group (TSWG) and Transport Forum. The assumption to not increase home working in the 'Vaccine' scenario is a limitation of the modelling exercise, but should be identified as a sensitivity that could be run as part of further analysis. The uplift experienced in 'Vaccine' is a result of the short period where capacity constraints were applicable to the scenario and therefore benefited from increasing the employee's ability to Work from Home.

Intervention 8: Increasing workplace capacity

E.27 This intervention tests the resulting impact of increasing workplace capacity post furlough. In this test following the furlough period, workplace capacity has been assumed to increase, by a value of 50% greater than the scenarios originally assumed capacity. The workplace capacity has been capped at 100% for industries were an uplift of 50% or lower would exceed the maximum capacity achievable under normal conditions.

Table E.8: Intervention 8: Increasing workplace capacity results

Intervention 8		GVA (Billions)	Jobs Filled (Millions)	Population (Millions)	TTW Trips (Millions)	Unemployed (* pp change)
Adap	No Intervention	185	3.3	7.7	1.8	9.0%
	Intervention 8	184	3.3	7.7	2.4	9.2%
	Percentage change	**-0.3%**	**-0.3%**	**0.0%**	**35.9%**	**0.2%***
Vacc	No Intervention	192	3.5	7.7	2.5	6.7%
	Intervention 8	192	3.5	7.7	2.5	6.8%
	Percentage change	**-0.1%**	**-0.2%**	**0.0%**	**-0.1%**	**0.1%***

E.28 Intervention 8 increases workplace capacity which encourages more travel to work trips. Under constrained public transport network conditions, these additional trips are translated into car trips, the additional car trips lead to higher levels of congestion on the road network. Higher levels of congestion result in decreased accessibility within the TfSE transport network. Lower levels of accessibility, squeezes out those who are more sensitive to changes in costs and therefore reduces the number of total jobs filled, lowering GVA and increases the Unemployment rate. Impacts for 'Vaccine' are dampened slightly due to it only having constrained capacity for a relatively short period of time after furlough (see Table E.8 above).

Intervention Bundle 1: Increasing rail, bus and workplace capacity

E.29 This package of interventions tests the impacts of combining tests 1, 2 and 8 which increase rail bus and workplace capacity. As such, the transport capacities, on public modes, and workplace capacities are less constrained post-furlough period under this Intervention Bundle test.

Table E.9: Intervention Bundle 1 Results

Intervention Bundle 1		GVA (Billions)	Jobs Filled (Millions)	Population (Millions)	TTW Trips (Millions)	Unemployed (* pp change)
Adap	No Intervention	185	3.3	7.7	1.8	9.0%
	Bundle 1	197	3.6	7.8	2.6	5.9%
	Percentage change	**6.4%**	**9.3%**	**1.4%**	**44.5%**	**-3.2%***
Vacc	No Intervention	192	3.5	7.7	2.5	6.7%
	Bundle 1	198	3.7	7.8	2.6	5.8%
	Percentage change	**3.1%**	**3.9%**	**0.8%**	**2.3%**	**-0.9%***

E.30 This Intervention Bundle relaxes capacity constraints associated with the lockdown scenarios. As capacity restriction is the one of the main inhibiting factors found within our lockdown scenarios, when easing the constraints applied to both the workplace capacity with transport capacity all economic variables react positively (see Table E.9 above).

E.31 It should be noted that by relaxing both the transport and workplace capacity constraints, the negative effects experienced in Intervention 8, where only workplace capacity was increased, are no longer experienced and similarly the benefits of improving transport capacity (Interventions 1 & 2), are further enhanced.

Intervention Bundle 2: Reducing cost (rail fares, bus fares and walk/cycle GJT)

E.32 This package of interventions tests the impacts of combining tests 3, 4 and 6. As such, the costs associated with non-car related transport have been decreased to investigate the resulting impacts under this Intervention Bundle test.

Table E.10: Intervention Bundle 2 Results

Intervention Bundle 2	GVA (Billions)	Jobs Filled (Millions)	Population (Millions)	TTW Trips (Millions)	Unemployed (* pp change)

Adap	No Intervention	185	3.3	7.7	1.8	9.0%
	Bundle 2	185	3.3	7.7	1.8	9.0%
	Percentage change	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%***
Vacc	No Intervention	192	3.5	7.7	2.5	6.7%
	Bundle 2	192	3.5	7.7	2.6	6.7%
	Percentage change	**0.0%**	**0.0%**	**0.0%**	**0.5%**	**0.0%***

E.33 In this Intervention Bundle test, it is clearly illustrated that by trying to improve accessibility by reducing the costs associated with transport where capacity constraints are the bottleneck, the benefits of reducing costs are not able to be realised. Seeing as this Intervention Bundle still doesn't resolve the capacity constraints experienced in the lockdown scenarios, the benefits realised arrive at results mirroring those experienced under Intervention 6 where active mode GJTs were reduced. When reviewing the outputs in greater detail, there were found to be slightly more trips when applying Bundle 2 than only Intervention 6, however the impacts were relatively minor (see Table E.10 above).

Summary table of Intervention tests

E.34 To assist with highlighting the results of the intervention tests, a summary table of the implied impacts has been produced. These are shown in Table E.11: Intervention test summary table. In this table, the impacts have been outlined on a percentage base. Green cells identify a positive change to corresponding variable at the end of the three-year model period, whereas red indicate an undesirable change to corresponding variable and no-colour indicates no significant change. Travel to Work trips have been greyed out as the desired outcome regarding this metric is dependent on the intention behind the intervention tested. For example, increasing the total number of travel to work trips could be desirable when these increased trips are due to increased public transport usage (Test 1 and 2), and not desirable when the increased travel to work trips are the result of increase car trips (Test 8).

E.35 Due to some minor difference in the results found when testing interventions on 'Adaptation' and 'Vaccine', which are due to 'Vaccine' not having any capacity restrictions at the end of its model period, the table below indicates the impacts recorded on 'Adaptation'. All impacts have been rounded to the nearest percentage change. In the table the change in unemployment metric is provided as "percentage point change".

E.36 To assist in the review of the summary tables, a short summary description of the Interventions tested has been provided below:

- Intervention 1: Capacity **halfway back** to 100% **rail** capacity from current levels
- Intervention 2: Capacity **halfway back** to 100% **bus** capacity from current levels
- Intervention 3: **Rail** fares reduced by **20%**
- Intervention 4: **Bus** fares reduced by **20%**
- Intervention 5: **Active mode** (walking/cycling) Generalised Journey Times reduced by **10%**
- Intervention 6: **Active mode** (walking/cycling) Generalised Journey Times reduced by **20%**

- Intervention 7: **20%** uplift in **Working from Home** levels (based on business type and from current levels)
- Intervention 8: **50%** uplift in **Workplace Capacity** (from current levels)
- Intervention Bundle 1: Combination of Interventions 1, 2 and 8
- Intervention Bundle 2: Combination of Interventions 3, 4 and 6

Table E.11: Intervention test summary table

	Intervention Test									
Metric	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**B1**	**B2**
GVA	6%	1%	0%	0%	0%	0%	1%	0%	6%	0%
Jobs	9%	1%	0%	0%	0%	0%	1%	0%	9%	0%
Pop	1%	0%	0%	0%	0%	0%	0%	0%	1%	0%
TTW	5%	1%	0%	0%	0%	0%	-18%	36%	45%	0%
Unemp	-3%	0%	0%	0%	0%	0%	0%	0%	-3%	0%

E.37 From Table E.11: Intervention test summary table above we can clearly identify that Intervention Test 1 and Bundle 1 are the only two tests which positively impact all economic metrics compared to the “no intervention” baseline. The remaining tests either don’t impact these metrics significantly to be recorded in the above table or only modestly affect GVA and Jobs Filled by 1% (as is the case in Intervention Test 2 and 7).

E.38 The economic impacts realised in Intervention Test 1 and Bundle 1 are very similar, however one large difference is in the total number of travel to work trips, where Bundle 1 experiences significantly greater trips in its test. The similarity in economic variables stems from the impacts of increasing available rail capacity on the network in Intervention 1, which highlights the significant importance of rail accessibility within the TfSE area.

E.39 Impacts relating to the mode splits as a result of the interventions tested have been summarised in Table E.12: Intervention impacts on modal split in 'Adaptation' scenario, for the ‘Adaptation’ Scenario, below. The values presented in the below table highlight the resulting modal split at the end of the three-year model period.

Table E.12: Intervention impacts on modal split in 'Adaptation' scenario

Intervention Test	Car	Rail	Bus	Walk/Cycle
No Intervention	79.5%	2.0%	4.6%	13.9%
Test 1	77.5%	4.8%	4.3%	13.3%
Test 2	76.9%	2.0%	8.0%	13.0%
Test 3	79.5%	2.0%	4.6%	13.9%
Test 4	79.5%	2.0%	4.6%	13.9%
Test 5	78.9%	2.0%	4.6%	14.5%
Test 6	78.3%	2.0%	4.6%	15.1%
Test 7	78.8%	2.4%	5.2%	13.6%
Test 8	80.5%	1.5%	3.8%	14.2%
Bundle 1	77.0%	3.8%	6.3%	12.9%

Bundle 2	78.3%	2.0%	4.6%	15.1%

E.40 When reviewing the impacts on mode splits, the results are as would be expected. **Tests 1 and 2**, which increase the capacity of rail and bus respectively, lead to an increased level of each respective mode share.

E.41 **Tests 3 and 4**, which reduce the fare of bus and rail respectively have no resulting impact on mode shift, due to the capacity constraints inhibiting any additional travel on these already congested transport modes.

E.42 Reducing the Generalised Journey Times of Walking/Cycling by 10% and 20% respectively in **Tests 5 and 6** increase the shares of active modes but has little direct impact on the economic metrics assessed.

E.43 Intervention **Test 7**, which levels of home working, reduces the total level of travel to work trips and leads to a reduction in car and active modes splits, thereby slightly increasing rail and bus mode shares.

E.44 Increasing the capacity of workplaces in **Test 8** results in more travel to work trips, which on an already capacity constrained public transport network would be dominated by an increase in car and walk/cycle trips, which is reflected in the mode shares presented.

E.45 **Intervention Bundle 1**, which adjusted rail, bus and workplace capacities, leads to an increase in public mode (rail and bus) shares.

E.46 Whereas **Intervention Bundle 2**, which focused on reducing rail and bus fares, while also reducing walk/cycle generalised journey times, had the same impact as test 6, which only improved walk/cycle generalised journey times, due to the reduction in fare having no impact on a capacity constrained public transport network.

F Concluding remarks

General

F.1 The South East Economy and Land Use Model has been successfully modified to enable it to simulate the effects of Lockdown in relation to the economy and travel impacts. This enables the rehearsing of various Lockdown Scenarios to be undertaken. The new mechanisms incorporated allowed for a range of intervention testing to take place with the aim being to assist in the identification of potential measures which could be implemented when attempting to reduce the negative impacts associated with the various Lockdown scenarios.

F.2 There are many uncertainties regarding Covid-19 related impacts on travel behaviour, the assumptions and proxies used in the model, and as part of the various scenario testing performed, could be further refined as part of future studies, were more time and resources made available. These refinements include, but are limited to, the assumptions underpinning each scenario. For example, reflecting observed of forecast changes in working from home patterns, percentage of jobs remaining post-furlough, and the percentage of staff placed on furlough. Another area for potential future improvement relates to the application of hard lockdown and how this mechanism is implemented across the various scenarios.

Conclusions

F.3 The “furlough scheme” has been effective at “cushioning” some of the economic “blows” of the pandemic. The Chancellor of the Exchequer’s recent announcements about the continuation of financial support over the winter are positive and should help to protect the region’s economy. However, these modelling results show that when the “furlough scheme” ends (regardless of when) there will likely be a major economic response – driven by increased rates of unemployment. The region should be ready to adapt to this as necessary.

F.4 Until the end of the “furlough scheme”, there is not a significant divergence in socio-economic outcomes between the scenarios. Beyond the end of the scheme though, there is a marked divergence in outcomes. It appears that they key determinant of the economic impact is the assumed level of capacity restrictions on public transport and in the workplace – which are ultimately determined by the public health requirement for social distancing and consumer behaviour. Lower requirements for social distancing would mean lower capacity restrictions and, consequently, a more rapid economic recovery.

F.5 Determining how to vary public transport capacity will be challenging. Increasing capacity has measurable and significant benefits in most cases, but will likely be expensive as it will require more rolling stock and buses to be provided if social distancing has to be maintained, at a time when farebox revenues are down, which is potentially problematic. However, increasing this capacity has the potential to bring

significant benefits. For example, restricted public transport will encourage higher car usage, which is environmentally damaging. By contrast, increasing the availability of public transport (particularly rail) has significantly positive impacts upon the region's economy. Rail capacity has a particularly strong impact upon the region's recovery.

F.6 Ultimately though, we must remember that there are many 'known unknowns' surrounding the future impacts of Covid-19. As evidenced by this modelling, very small changes in the trajectory of the pandemic, or very small changes in assumptions about how it will impact our society, lead to major differences in socio-economic outcomes. As such, more than anything, these results emphasise the importance of building resilience into future planning for the region. Remaining flexible and adaptable will ensure that the region sees the best possible outcomes for residents in this highly uncertain time.

F.7 The outputs from this report are a 'rehearsal' of scenarios lockdown and subsequent recovery scenarios rather than a 'forecast'. It provides a range of possible outcomes, rather than exact description of what will happen. Many of them show that the region's economy and associate metrics will be negatively impacted at a regional level for an extended period.

F.8 In some scenarios, the long-term prognosis for the area is good. This is particularly the case if a vaccination is found, where the economy will rebound, initially to higher GVA than would have been expected pre-Covid, due to higher availability of labour in the area.

Key findings and recommendations

F.9 We provide the following recommendations based on the result of this modelling:

1. GVA impacts over the next three could be between 5% and 9% lower than the preferred "Sustainable Route to Growth" scenario; population up to 2% less; unemployment up to 18% more; and the number of work trips made per day between 14 and 39% less - economic recovery will, therefore, take years rather than months.
2. The longer it takes for an effective treatment or the successful roll out of a vaccine the more severe the economic impacts, and the longer the pandemic lasts, the less likely recovery will be to previous "norms" and trajectories - the industrial sectors, their scale and location of operation, means of operation, and forecast growth will be different. Correspondingly, labour market catchments will shift, along with corresponding travel behaviours, and over time, further shift as people change jobs and home locations.
3. How, where and when these shifts occur at a regional scale are not fully understood and have consequences for not only transport, but also land use, economic development, and other areas of planning and commerce/business. Planning must be flexible and adaptable due to a) changing number, location and types of jobs and socio-demographics of the people; and b) the unpredictability of the economic outlook - retaining flexibility will help ensure resilience. Future Area Study work should consider not only the likely and forecast impacts of planned development from Local Plans on transport and travel, but also be attuned to how spatial patterns may change or how development could be accommodated more sustainably from a transport perspective. development on
4. Investment in digital technology has the potential to facilitate economic resilience and recovery as partially evidenced from increased levels of home working and remote access to services and amenities – "Digital as a Mode". Increased homeworking may reduce commuting trips, and longer distance trips, which cause particularly high levels of pollution.
5. Increased homeworking may also reduce trip-chaining (e.g. combining a commute trip with a school drop-off or grocery shop). However, these and other

trips still need to be made and there could be an increase in trips made outside of the AM and PM peaks. Also, with a car more likely to be available at home most of the day, household members may make more trips by car (because they can now). Ultimately, though, increased homeworking is likely to be environmentally beneficial, and therefore, it is advocated that digital (to ultra-fast broadband) and mobile (to 5G) connectivity are improved to ensure the potential for this is maximised.

6. Although an increase in car mode share has been forecast, this has been offset by a reduction in total numbers of trips resulting from decreased work trips (i.e. higher levels of working from home and a lower number of jobs) at a region-wide level. This overall reduction in the total number of car trips is forecast to last at least three years, as per the modelling. It is unclear how this will change beyond this period, but we could well be planning in the medium to long term for lower levels of car traffic than previously envisaged. It is also possible that through changing travel patterns as a result of where people live and work and how they work, that demand for car travel spreads to outside the peaks and moves away from some of the most congested radial routes in the region.

7. With more dispersed patterns of travel temporally and spatially, it is harder to accommodate these travel patterns by frequent, fixed-route public transport. Existing fixed route transport may also be made less viable with fewer peak trips.

8. While passenger demand for public transport is suppressed due to capacity constraints and economic and behavioural responses, sustaining and increasing public transport (including shared mobility and on-demand service) capacity, accessibility, and connectivity is necessary as a direct response to ensure that people who are reliant on public transport and need to travel can. It is also important for managing congestion in our towns, cities and along our major corridors.

9. Again, investment will have direct and wider benefits for the economy, society and the environment. Support for public transport (e.g. additional funding for subsidies or direct payments to operators, promotional campaigns) are required for maintaining levels of service and growing demand as rapidly as possible. Further measures could include the use of new technologies such as integrated ticketing to encourage wider use of services across the area; bus priority measures; and mass rapid transit.

10. There could also be opportunities to reimagine how the demand for trips can be made sustainably, and how we make best use our existing networks and capacity. Considerations of how new technologies, and future mobility, are used to deliver these changes, will be paramount for ensuring that they provide improved quality of life for all of the region’s residents, workers and visitors. On the rail network, this could include a range of options, not all concurrent, such as further “metroisation” of rail services to/from our region’s largest Major Eocnomic Hubs and to/from London; to creating paths for more long- distance express services.

11. While in isolation active travel interventions do not directly lead to high positive impacts against the metrics analysed using a **regional model**, at a **local level**, such interventions are import and for public health and road safety, improving public realm, and managing town and city centre congestion in direct response to

mitigating the adverse economic, social, and environmental impacts of Covid-19 and its impacts. In addition, such interventions support wider objectives not directly related to Covid-19.

TRANSPORT FOR THE South East

steer