NEW ECONOMICS FOUNDATION

BAGGAGE CLAIM

THE REGIONAL IMPACT OF HEATHROW'S THIRD RUNWAY

CONTENTS

EXECUTIVE SUMMARY

The decision taken by the UK parliament to approve plans to build an additional runway at Heathrow airport is of international and historic significance. The expected additional carbon emissions of at least three million tonnes per year are equivalent to the footprint of a small country, and threaten to throw fuel on the fires of the climate emergency. At the same time, the UK faces a crisis of social and economic inequality, characterised by the stark differences in life opportunities between the UK's regions.

In *Flying Low*, NEF's last report focussing on the proposed expansion of Heathrow, NEF dissected the economic modelling conducted by various statutory bodies in the lead-up to the decision. We showed that, even using the government's own criteria for infrastructure appraisal, the proposed investment in Heathrow represents a poor deal for the UK as a whole. Our calculations suggested that – applying the usual HM Treasury scores to the proposed North West Runway (NWR) – it would be judged 'low' or even 'poor' value for money and would not be recommended for approval.

In this report we go further, focussing on the distribution of the expected impacts of the scheme to answer the question who pays?

HEATHROW IS LIKELY TO BE HEAVILY PUBLICLY SUBSIDISED

Throughout the process of gaining consent, Heathrow Airport Holdings Ltd (HAL), formerly BAA, has promised that it will finance the majority of the costs of construction privately. However, the public will subsidise Heathrow expansion in three key ways.

The first is through providing 'surface access' to enable more passengers to get to and from the airport. Transport for London has estimated this will cost around £10bn, but has also said that it has not conducted a detailed assessment. If added to the project cost-benefit analysis, this would push the whole scheme deep into negative territory. By comparison, essential transport projects could represent much better value for money –for example diverting the Great Western Railway around its threatened coastline route in Devon at around £500mn or the electrification of east-west rail links in the north of England at around £2bn.

The second is through a complex subsidy regime called the Regulatory Asset Base (RAB) provided by the government to help mitigate the risks of large infrastructure projects. This could see ticket prices rise to compensate for the expansion of the infrastructure at the airport, even though Heathrow is already the world's most expensive airport for airlines to use and its owners have told policymakers that charges would not increase.

The third is in terms of the cost of the additional carbon an expanded Heathrow will emit – there is already a cost associated with emitting CO2 and with the UK's new 'net zero' targets the capacity for sectors of the economy to emit is growing ever smaller and therefore the costs of emitting higher. Allowing more aviation emissions into this environment represents a 'carbon subsidy' which, using conservative government data for the future price of carbon, is estimated to be worth around £19bn in net present value.

Perhaps the most concerning aspect of our analysis on the net public subsidy was how difficult it proved to calculate. Very little work appears to have been done by the relevant public agencies to understand and aggregate the different costs the UK public will incur. Spending on transport infrastructure in London outstrips that in any other regions of England by a factor of 4:1 and the supply of government capital for infrastructure is finite. It is reasonable, therefore, to assume that there will be an opportunity cost to the public subsidisation of Heathrow expansion that is likely to be felt outside of London and the south east.

THE REGIONAL ECONOMIC AND CARBON COSTS OF HEATHROW

The public subsidy and its probable opportunity costs to the UK's regions and nations is only the tip of the iceberg. This report also shows how the scheme's effects will be felt over and above the explicit costs to the public purse.

Using a combination of our own analysis of official Department for Transport (DfT) modelling, and new data accessed via three Freedom of Information (FOI) requests, we have examined the impact of expanding London's largest airport through a NWR on the UK's other regions and nations.

Our results should provide policymakers – especially those located outside London and the south east of England – with cause to re-examine their thinking if they have supported or voted in favour of Heathrow expansion, and reason to redouble their efforts to question Parliament's decision if they have not.

Mobilising the DfT's data and the additional insights we have been able to gain through FOIs, we find evidence of a significant 'Heathrow effect', which has the potential to inflict serious damage on economies outside of London and the south east. Our analysis is presented in two layers.

1. THE ECONOMIC IMPACTS ON THE UK'S NATIONS AND REGIONS

First using DfT's aviation forecasts, our analysis finds that if Heathrow is expanded, then by 2050, 17 million fewer passengers will be departing from non-London airports compared to the forecasts without Heathrow expansion.

In this case, using DfT data accessed via one of our FOIs and analysed by NEF, we find that this could result in up to 27,000 jobs relocating from the UK's wider regions to London and the south east. We estimate that around half of these are jobs not directly associated with the aviation sector.

The forecast movement of jobs will also impact on the national distribution of GDP. Our further analysis suggests that, over the appraised lifetime of a Heathrow third runway, around £43bn in net present value (NPV) would move out of the wider regions and into London and the south east when compared to the aviation sector scenario without Heathrow expansion.[i]

The worst-hit region is likely to be north west England, which according to our analysis would lose 5 million passengers and as many as 15,000 jobs by 2050. In the context of the stark regional imbalances in the UK economy – some of the most pronounced spatial inequalities in the industrialised world – this negative 'Heathrow expansion effect' should be cause for significant concern.

2. THE IMPACT OF CARBON CONSTRAINT ON THE UK'S REGIONS AND NATIONS

In our second layer of analysis we look at the effects that managing aviation demand to curb its carbon emissions could have on the sector as a whole and how this might play out between regions and nations.

Aviation is not currently capped in terms of its carbon emissions, but as the UK economy as a whole is covered by a legally binding cap, future profligacy in the aviation sector will further constrain the possibility of emissions in other sectors. Using the data we have extracted from the DfT through FOI requests, we have attempted to analyse how this may play out.

The DfT's own forecasts show aviation is already likely to overshoot the levels of growth the Committee on Climate Change (CCC), the government's official carbon watchdog, suggest is viable within the wider economy. With Heathrow expansion, UK aviation would be on course to overshoot the maximum level of growth in demand that the CCC suggests is possible by 2050 by more than 50% (i.e. from 60% compared to 2005 levels to 93%). Under the UK's cap, from where would these emissions come?

Even without any more measures to further curb aviation emissions, we find that expansion at Heathrow would effectively transfer £3.3bn worth of emissions out of other regions and nations of the UK and into London between 2030 and 2050. This 'carbon subsidy', paid by some of the poorest regions of the UK to its richest, would penalise non-London aviation or other sectors of the economy.

Aviation is not the only sector that represents a significant decarbonisation challenge. Expanding Heathrow would introduce an additional three to four million tonnes of carbon dioxide equivalent (MtCO2e) into the economy, which would be enough to sustain up to 100,000 jobs in manufacturing, or 50,000 jobs in transport and storage (using 2017 levels of carbon intensity per job in those sectors).

i Calculated over the DfT's assessment period up to 2084/85

If a carbon or aviation fuel tax were introduced to manage the growth in demand for flights, NEF analysis of DfT data gained through a further FOI suggests that this reduces passenger numbers over the DfT baseline far more steeply outside London than at London's four main airports. Linking this fall in passenger numbers to job losses shows that this fall in passenger numbers leads to eight times more jobs being lost outside of London and the south east than within.

A more progressive approach to curbing aviation demand, such as that proposed in the NEF-designed `Frequent Flyer Levy', would see emissions at airports in London and the south east targeted in order to allow more passengers to use regional airports for longer. This would redress the negative carbon subsidy that otherwise flows from the regions to London, but since the strategic case for Heathrow is based on growth in passenger numbers, it would therefore render expansion pointless; why build a new runway to carry more passengers only to curb their number?

INTRODUCTION

This report, commissioned by the No 3rd Runway Coalition, is the latest in a series of independent analyses by the New Economics Foundation (NEF) examining the business cases for major UK infrastructure proposals. It is our second look at Heathrow airport expansion.

In our first report *Flying Low: The True Cost of Heathrow's Third Runway* we demonstrated that the overall business case for expansion of Heathrow is a poor one. At the point of parliamentary approval the project had a benefit-to-cost ratio that would, in any normal circumstances, be considered inadequate. With only a minor disturbance to the model assumptions, the project quickly slips into negative returns. This was recognised by the government's Transport Committee when they stated:

"Once costs are considered, the net economic benefits for the NWR [Heathrow North West Runway] scheme are relatively small at a maximum of £3.3bn over 60 years and in fact, may be negative if future demand falls."[1]

The spectre of a potentially significant loss to the public looms. The UK is in the midst of a crisis of income and wealth inequality. Nowhere is this more evident than in the disparities between the UK's regions. A baby born in the south east has a healthy life expectancy almost six years longer than a baby born in the north east[2] and the median household in the south east owns more than double the wealth of their north east counterpart.[3] Transport infrastructure can play a key role in structuring the UK's economy and enabling development. However, poorly planned transport infrastructure investment can also hold back and unbalance the economy. For example, our analysis of the proposals for high speed rail (HS2) highlighted the highly unequal regional distribution of its benefits. In light of this, in this report we apply a forensic lens to the questions of 'who pays?' and 'who benefits?' from expansion of Heathrow airport.

In the build up to parliamentary affirmation HAL were successful in garnering support for their scheme from political, business, and community stakeholders around the UK. In the process, claims and counter claims were made about the cost of the scheme to the public, and its benefit to the UK's regions. Yet little scrutiny or analysis underpinned those claims.

WHERE THE UK WANTS TO BE: NET-ZERO BY 2050

Since construction of a NWR at Heathrow airport received parliamentary approval on 25 June 2018 the national social and political context for action on climate change has been evolving rapidly. On 27 June 2019 the UK committed to a legally-binding target of net-zero greenhouse gas emissions by the year 2050. This commitment effectively accepted the headline recommendation of the CCC report *Net Zero – The UK's Contribution to Stopping Global Warming (hereafter Net Zero) and has potentially profound implications for the aviation sector.*[4]

What needs to happen in the aviation sector to achieve net-zero by 2050?

In order to achieve net-zero emissions by 2050 the rate of emissions reduction must accelerate considerably across all sectors of the UK economy.

The aviation industry enjoys a privileged position; it is one of very few sectors of the economy that the CCC and government have agreed can maintain emissions above zero. Achieving net-zero will rely on offsetting these emissions in other areas of the economy, i.e. 'negative emissions'.

Nonetheless the aviation sector must dramatically alter its current course. Without action the sector is on track to emit around 38.6 MtCO2e by 2030, around 52% of which will come from Heathrow. With expansion of Heathrow this rises to around 43.5 MtCO2e, and Heathrow's share rises to nearer 63% of the sector's emissions.[ii] The CCC's analysis suggests that achieving net-zero depends on the sector reducing its footprint to around 30 MtCO2e by 2050. On DfT forecasts up to 2050, which include Heathrow expansion and efficiency savings in the sector, a reduction of almost 10 MtCO2e would still be needed. The process by which the sector achieves this reduction has been hotly debated.[5]

ii Author's calculations based on DfT 2017 Aviation Forecasts

Mitigating greenhouse gas emissions from aviation will require a combination of actions, these are grouped by the CCC into:

1. roll-out of new aircraft technologies
2. airspace management and improvements to airline operations
3. roll-out of alternative, lower carbon, fuels
4. use of sustainable biofuels
5. use of synthetic fuels
6. managing passenger demand.

In the government's *Updated Appraisal Report on Airport Capacity in the south east 2.6 MtCO2e* of potential savings were identified, primarily through new aircraft technologies (ii) and fuels (iv). The CCC, in conjunction with the DfT, then applied further analysis for its *Net Zero report*.[6] But, after considering maximum utilisation of all realistic technological options, (i) through (v), concluded that management (i.e. reduction) of future passenger demand (vi) will be essential to achieve the necessary emissions reductions.

The CCC's calculations suggest that the necessary level of passenger demand in 2050 is an increase no more than 60% over 2005 levels. Table 1 shows the projected passenger numbers in 2050 under different scenarios. Notably, even without Heathrow expansion, there are still expected to be at least 41 million surplus passengers against the CCC target. Expansion of Heathrow adds a further 25 million passengers into the system, and inclusion of expansion plans announced by all other UK airports adds a further 10 million passengers.

The aviation industry has argued that further technological carbon mitigation measures will be implemented and that these remove the need to curb demand using regulatory measures. However, the CCC regard these possibilities as 'speculative options', stating:

"Speculative options currently have very low levels of technology readiness, very high costs, or significant barriers in gaining public acceptability. It is very unlikely they would all become available" – (Technical Report, pg. 199)

When considering the likelihood that these speculative technological solutions will be implemented in the global aviation sector within the next 30 years, other key characteristics of the sector must be analysed. Principally, the fleet replacement rate, which depends both on the commercial viability of replacement, and the capacity of the manufacturing companies (Airbus, Boeing etc.) to build and sell stock. In this regard, Lord Deben, Chair of the CCC, stated in evidence to the House of Commons Transport Committee that *'a huge proportion of the aeroplanes that have ever been in the air are still in the air. It is remarkable how long-lasting they are'*.[7] Given these uncertainties, and the extremely high human and ecological cost of carbon emissions, the precautionary principle would suggest some curbing of passenger demand is essential. At this stage, one of the easiest, and most publicly acceptable, ways of doing this would be to cancel the expansion of Heathrow.

TABLE 1
Projected increases in passenger demand under different scenarios

Scenario	Demand increase over 2005 levels[8]	Equivalent annual passenger numbers in 2050	Difference from CCC net-zero target
Baseline without Heathrow expansion[9]	78%	410 million	41+ million
Baseline with Heathrow expansion[9]	89%	435 million	66+ million
All planned airport[5] **expansion**	93%	445 million	76+ million
CCC net-zero[4]	<60%	<369 million	

Source: Author's calculations based on cited references

1. HEATHROW EXPANSION IS A PUBLIC INVESTMENT

The proposed scheme to expand Heathrow has an upfront cost of £14.3–£18.4bn (as reported in the Updated Appraisal Report). In the public discourse and decision-making process this has largely been treated as a matter for the private sector to be concerned with. Indeed, these cost figures were relegated to a footnote on page 27 of the National Policy Statement.

In theory, HAL will bear the capital costs of the scheme. In reality, as we outline below, expansion of Heathrow represents a colossal public investment, as well as a significant underwriting by the UK public of HAL's private financing risk. Three primary direct costs are discussed here: the direct cost associated with providing surface access, the regulatory subsidy, and the carbon subsidy. Air and noise pollution represent major additional costs to the community local to Heathrow but are not addressed here.

1.1 THE DIRECT COST TO THE PUBLIC

Direct costs to the public principally arise in the provision of surface access to Heathrow and/or in dealing with the congestion the increased passenger load will induce elsewhere in the transport system.

How much will providing surface access cost?
Delivering enhanced surface access to the expanded airport is costed at £1.4 –£3.4bn in the government's appraisal documents.[10] However, the government recognises that these 'remain uncertain'.[11] In contrast in 2015, around the time of the Airports Commission's Final Report, a leak of documents from Transport for London (TfL) reported by Greenpeace's investigative journalism arm put surface access costs in the region of £15–20bn.[12] Later, in its responses to the proposals in June 2018, TfL publicly offered a new assessment, suggesting the costs could exceed £10bn.[13] However, in response to a FOI request submitted in early 2019 (ref: FOI-2910-1819) TfL stated that they had not conducted any detailed modelling to support this estimate.[14] Costs of the magnitude estimated by TfL would be sufficient to send the overall benefit-to-cost ratio of the Heathrow scheme deeply negative (see NEF's *Flying Low report).*

To put the cited cost estimates in context, the cost of re-routing the south west rail line around the coastal flooding hotspot at Dawlish is estimated at £500-£600 million;[15] the cost of fully reinstating the Oxford to Cambridge rail link (east–west rail) was recently placed at £2bn–£3.4bn;[16] and electrification of east-west rail links in the north of England at around £2bn.[17] As the government's capital infrastructure pipeline and borrowing is limited, these comparisons simply illustrate the relative opportunity cost which could be associated with significant state investment around Heathrow in the UK's wider regions.

The cost of providing surface access remains uncertain, but the price paid by the public is likely to be high. Costs will be incurred both in capital investment by regional and central government for new infrastructure, but also either through congestion pains faced by the public, and/or through new congestion charging.

The state will pick up the majority of the bill, or the wider public will pay the price
In regard to who pays for new infrastructure, the National Policy Statement states that HAL would*:*

"Make a contribution towards the cost of the proposed Western Rail Access and Southern Rail Access schemes [but] The majority of the surface access costs where a split of beneficiaries is expected (for example, where multiple businesses and the public at large benefit from a new road junction or rail scheme) are likely to be borne by government, where the schemes provide greater benefits for non-airport users. The airport contribution would be subject to a negotiation, and review by regulators." (p.26)

Modelling by TfL suggests that even with the transport infrastructure improvements assumed by the National Policy Statement, the additional 90,000 daily vehicle trips induced are likely to increase journey times across west London by an average of 3–5%. They also suggest that the

100,000 daily public transport trips triggered by Heathrow expansion are likely to lead to *'significant levels of over crowding on the Elizabeth line [Crossrail], Piccadilly line, and Windsor lines'*.[18] Given this context it is highly likely that new investments which *'provide greater benefits for non-airport users'* will be necessary, and the government will need to invest significantly. While part of the bill for this work may be picked up by the people of London via TfL and the Greater London Authority (GLA), it is likely that most funding would ultimately come from Central government. For comparison, of the £18bn cost of Crossrail, around half was directly funded by Central government. A government investment of only £2bn in surface access costs at Heathrow would be equivalent to the entire transport infrastructure investment pipeline currently committed to the north east.[19]

1.2 THE REGULATORY SUBSIDY

Page 27 of the National Policy Statement states:

"Independent financial advisers have undertaken further work for the government, and agree that all three schemes are financeable without government support."

It may be true that the government will not need to provide capital for the £14.3– £18.4bn direct cost for construction of the new runway; but it is also true that the government provides 'support' in several other ways. The aviation sector enjoys a number of very accommodating regulatory mechanisms provided by the government, without which it is unlikely the scheme would be financeable. For instance, direct subsidies include the exemption of plane fuel from fuel tax, which keeps ticket prices low and passenger demand high. Perhaps the most significant mechanism and de facto subsidy is the Regulatory Asset Base (RAB) mechanism.

Airport owners effectively own a local monopoly on the aviation industry in their area. For this reason the amount of money they can charge their service users (primarily airlines) is regulated to prevent overcharging. The value of the regulatory asset base (RAB), i.e. the size and quality of its infrastructure holdings, determines the amount of money the airport is allowed to recoup through charges. This figure is calculated using a rate set by the Civil Aviation Authority (CAA) every five years. Crucially, whatever figure is set, will ultimately transfer through to the air passengers, as airlines pass on their costs through ticket prices.

The RAB system creates a notoriously generous business environment for the airport. Mechanisms which inflate the value of the asset base upon which returns are calculated, such as capital overspend and overpaying suppliers, can be incentivised and have been documented on multiple occasions. In the CAA's own words:

"The form of regulation adopted for HAL [Heathrow Airport Holdings Ltd] provides an unusually benign climate for investment compared to companies in competitive markets. For instance, the RAB gives a high degree of confidence that investments can be remunerated, subject to efficient operations; and, under the CAA's approach, investments are remunerated from when they are made, rather from when they begin to operate."[20]

The RAB is intrinsically set up to ensure that the plane-using public pays the price for the airport's investments. Past examples, such as the failed attempt to expand Stansted airport (see **Annex A**) set a precedent that any overspend is likely to be recharged through the RAB. Through this process the public effectively pay for, and underwrite a large chunk of the risk of the investment in expansion. Without this underwriting it is highly doubtful that HAL would have the access to capital to undertake this significant investment therefore, it is untrue that the scheme is *'financeable without government support'*. In return for its regulatory support, the UK public should demand that the benefits of the scheme it is underwriting are evidenced and fairly distributed. For a fuller discussion of the RAB, and examples of its past enforcement, see **Annex A.**

1.3 THE CARBON SUBSIDY

After subsidising the upfront costs of construction, under current legislation, the public would continue to subsidise the scheme through the social cost of carbon.

What is a carbon subsidy?
The UK has made a legal commitment to achieve net-zero greenhouse gas emissions by 2050. Given the scale of the ecological crisis and our historic contribution to climate change, many would argue we have a moral duty to decarbonise far sooner.[21] In this context, emissions which are additional to our target decarbonisation trajectory must be

drawn back down, and hence are associated with a significant cost. In a world without an effective carbon tax (see later discussion of this issue) which recoups carbon costs on behalf of the public, each additional tonne emitted represents a subsidy supplied by the public to the person or business emitting.

The government maintains a –largely theoretical – price list for each tonne of carbon emitted in the 21st century. As of 25 June 2019 the price of a tonne of CO2 equivalents was £13.15 (central estimate).[22] This carbon price list was designed on the basis of the UK's previous target of an 80% reduction in emissions by 2050. However, with a legal commitment made to accelerate UK decarbonisation to achieve net-zero by 2050, the cost of emitting carbon can only increase.

Grantham Research Institute suggest the average cost of a tonne of CO2 equivalents should immediately treble to more than £50 in 2019 (central estimate), potentially growing to more than £150 by 2050 in order to be target-compatible.[23] However, as these values have not yet been adopted by the government our subsequent calculations are based on the current BEIS prices.

How much is the Heathrow carbon subsidy?
In total, over a 60 year appraisal period, the Airports Commission estimated that the carbon cost of Heathrow airport expansion would be £19bn in Net Present Value.[24] However, many scholars have argued that the discount rate (the process that devalues the price of impacts experienced in future years) applied when calculating the Net Present Value of carbon impacts should be reduced.[25] Were the discount rate removed, the Airports Commission's total would increase to £30–£40bn. We estimate that in the absence of some form of regulation which recoups public costs the annual public subsidy to Heathrow would be as shown in Table 2. By 2040 the projected cost to society of emissions resulting from Heathrow airport expansion is in the order of £660mn (central estimate).

TABLE 2
Carbon cost of Heathrow airport expansion in the years 2030, 2040 and 2050

Year	Additional carbon cost		
	Low	Central	High
2030	£186,438,354	£390,655,104	£493,239,073
2040	£276,334,909	£660,345,131	£876,264,227
2050	£362,672,989	£679,520,052	£689,832,942

Source: Based on the DfT aviation sector model and government carbon prices as of June 2019. No discounting has been applied

2. EXPANSION IS A RAW DEAL FOR THE UK'S REGIONS

London already dominates the UK economy and the aviation sector. Successive governments have claimed to want to rebalance the UK's economy across our nations and regions. So far, this has remained more aspiration than reality, and in present-day aviation we see an often repeated pattern, with London and the south east dominating the UK market. In 2018 the London airport system (Heathrow, City, Stansted, Luton and Gatwick) accounted for 59% of the UK's air passenger movements, and 78% of freight handled.[26]

Expansion of Heathrow depends on support from the UK's regions

On the 25 June 2018 the proposed expansion of Heathrow airport passed through parliament with 415 votes for and 119 votes against. Notably, its passage through the commons relied significantly on support from MPs representing constituencies outside of London. Had the vote only been held among London MPs, Heathrow expansion would have been defeated with 27 votes for, and 36 votes against (nine abstentions). The overwhelming support from non-London MPs might seem strange for a scheme so heavily focused on development in and around London. However, MPs made their judgement against the backdrop of a number of claims regarding the economic benefits of the proposed scheme to the wider UK economy and to regions outside of London. In this section of the report we review and analyse the evidence base surrounding the economic impact of Heathrow expansion on the UK's regions.

TABLE 3

Sources of economic benefit (2014 prices) presented as evidence to decision makers in the Updated Appraisal Report following multiple rounds of analysis.
Benefits shown relate to UK residents and do not include benefits to international passengers

Impact area	Stakeholder	Benefit/Cost	Value to UK (NPV of impacts to 2084/85)
Direct economic impacts	Passenger benefits	Increased flight frequency	£2bn[27]
		Lower fares	£39bn[25]
		Fewer delays	Negligible
	Airline and government Impacts	Airline profits	-£55bn
		Reduced delays to airlines	Negligible
		Government revenue	£3.5bn
Wider economic impacts	Businesses and wider economy	Increased business output	£1.2bn
	Exchequer	Changes in tax revenue due to redistribution of jobs	£0.5–1.9bn
Job numbers were also calculated but these do not represent the net national change, only the increase seen in the vicinity of Heathrow airport.			
Local economy impacts	Local communities	Additional local employment	2030: 57,000–114,000 jobs 2050: 39,000–78,000 jobs

Source: Updated Appraisal Report, DfT

TABLE 4
Regional economic benefits of the proposed expansion of Heathrow, as claimed on the website of HAL on 16 July 2019.[28]
Benefits per capita are NEF calculations based on 2017 ONS population estimates

Region	Economic benefits	Benefits per capita
South west	Up to £13bn	Up to £2,339
East of England	Up to £15bn	Up to £2,432
West Midlands	Up to £13bn	Up to £4,487
East Midlands	Up to £7.8bn	Up to £1,635
Yorkshire and the Humber	Up to £12bn	Up to £2,202
North West	Up to £16bn	Up to £2,204
North east	Up to £5bn	Up to £1,890
Sum of non-London/south east benefits	**Up to £81.8bn**	**Up to £2,354**
South east	Up to £30bn	Up to £3,304
London	Up to £44bn	Up to £5,017
Sum of London/south east benefits	**Up to £74bn**	**Up to £4,145**

Source: HAL, ONS

The focus of our analysis is on the claimed economic benefits presented to decision makers in the final suite of evidence approved by the DfT. This evidence base represented the product of a long process of modelling, analysis, review and filtration. Ultimately, many studies into the economic impact of expanding Heathrow were thrown out by the DfT due to concerns about their credibility. The benefits left standing in the Updated Appraisal Report, and which underpinned the National Policy Statement, are shown in Table 3. If this list represents the final say on the credible costs and benefits of Heathrow expansion, how are they distributed? Who benefits, and who pays? And crucially, were decision makers equipped with the necessary information to analyse the impacts of expansion on their local areas, and its implicit social justice?

2.1 REGIONAL BENEFITS PRESENTED BY HEATHROW AIRPORT

HAL have made some eye catching estimates
As of the 16 July 2019, a series of statements could be found on HAL's website regarding the claimed economic benefits of the scheme to the England's regions. These are summarised in Table 4.

The claimed values are listed on the company's website simply as 'economic benefits', the precise nature of these benefits is not clearly explained, nor is their source clearly identified.

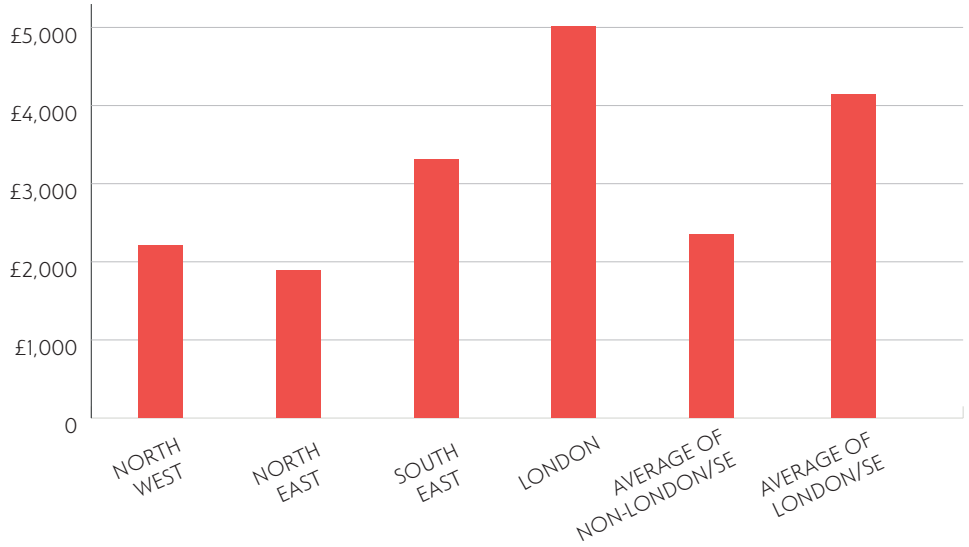
The benefits publicised by HAL nonetheless represent a highly unequal distribution. As shown in Figure 1, on a per-capita basis benefits accrue to London and the south east at almost double the rate they accrue to the rest of England.

HAL appear to be overstating potential benefits
In order to understand and verify HAL claims we conducted a review of the full business case development process undertaken between 2013–2018, seeking to identify all references to non-London benefits. **Annex B** shows a chronological list of the key business case documents, and their primary function.

Throughout the majority of the assessment period, three airport expansion schemes were under consideration, two options at Heathrow, and one at Gatwick. The need to understand the regional impacts of the proposed schemes in greater detail was identified during the initial consultation period. It is suggested in the Airports Commission's final report that many consultation responses raised questions about the role that airport expansion would play (or not) in the rebalancing of the UK's regional economies, stating:

"Responses to consultation raised a number of issues related to these assessments, highlighting in particular the need to consider the potential of each option to support growth outside London and the south east and thereby contribute to the rebalancing of the economy." (p.112)

FIGURE 1
Economic benefits publicised by HAL presented on a per-capita basis for different regions of the UK



Source: HAL, ONS

In response to this, regional impacts were first addressed in a subsequent report by PwC for the Airports Commission on the GDP/GVA impacts of the three proposals. This report calculated the net present value of the additional GDP created in London and the south east (£35.8–£70.7bn), the rest of England (£42.4–£78.1bn), and the combined GDP created in Scotland, Northern Ireland, and Wales (£16.7–£36.5bn).

The equivalent value for London and the south east advertised on HAL's website is up to £74bn, and the equivalent value for the rest of England is up to £81.8bn. Both of these values appear to exceed the upper bounds of the Airports Commission's results.

HAL are propagating figures the government say are unreliable

The Airports Commission Final Report included PwC's early modelling, stating:

"In total, the analysis indicates that around 60% of the overall boost to GDP would be focused on areas of the UK outside the south east of England. This would deliver an increase in GDP in these regions of approximately £70–80bn (present value over 60 years) from expansion at Heathrow."

However the DfT's review of the Final Report states:

"The Department has also identified a number of concerns, which cast further doubt on these estimates. On this basis the Department does not recommend using these figures to inform a decision on preferred location."

The regional GDP/GVA modelling was not carried forward into the Updated Appraisal Report and National Policy Statement.

The consequence of the DfT's decision to remove, and not replace, the Airport Commission's work, was that the evidence base available to decision makers was entirely lacking in any detail on the regional impact of the proposed scheme. Indeed, of the multiple costs and benefits assessed (see Table 3), none were broken down by region, nor in such a way as to allow readers to understand how different groups (e.g. rich and poor) would be affected by the scheme.

2.2 THE REGIONAL IMPACTS OF HEATHROW EXPANSION

In the following chapter we analyse the regional impacts of expanding Heathrow. To do so we have accessed and analysed previously unpublished government model data using three FOI requests. Unless otherwise stated, impacts are assessed by comparing the DfT baseline scenario of aviation sector growth with their forecast scenario including an expanded Heathrow. It is important to note that even in the baseline scenario the sector is expected to grow and as such, all impacts reported under Heathrow expansion are against a backdrop of sector growth.

Far fewer flights will depart from the UK's regions

At the core of the socioeconomic and environmental modelling that underpins the business case for expanding Heathrow is the DfT's aviation sector model. This model simulated the future of the sector with regard to flights and passenger numbers up to 2050 with and without a NWR at Heathrow. The outputs depend to a large extent on assumptions about supply and demand across the UK. Overall, the DfT's model suggests that expansion of Heathrow has three key impacts:

1. The number of passengers departing Heathrow increases significantly. As shown in Table 5, passenger departures rise by 46 million in 2030 and 43 million in 2050.
2. The number of international passengers who use Heathrow as a hub on their way to another country increases significantly. As shown in Table 5, the number of hubbing passengers increases by 19 million per year in 2030 and 16 million in 2050.
3. A large number of passenger departures from non-Heathrow airports which flew in the baseline scenario no longer happen. The DfT's model estimates that expansion will reduce annual passenger movements through non-London airports by 5 million in 2030 and 17 million in 2050 (Table 6).[29]

TABLE 5

Changes in passenger numbers at Heathrow under expansion

	Baseline	New runway	Change	Change in hubbing passengers
2030	86,236,995	132,399,577	46,162,582	18,937,881
2050	93,441,653	136,482,662	43,041,009	15,797,126

Source: UK aviation forecasts 2017, DfT

TABLE 6

Projected changes in annual passenger departures from UK regions in 2030 and 2050 as a result of Heathrow airport NWR derived from DfT 2017 aviation sector model.
London airports include: Heathrow, London City, Stansted, Gatwick, and Luton

	Change in passenger numbers 2030	Change against baseline 2030 (%)	Change in passenger numbers 2050	Change against baseline 2050 (%)
East Midlands	287,000	4.55%	-110,157	-1.10%
East of England	-115,952	-9.47%	-4,951,942	-70.35%
North east	362,091	7.74%	-18,860	-0.29%
North West	-1,091,782	-3.12%	-5,240,732	-8.93%
Northern Ireland	7,231	0.08%	13,357	0.10%
Scotland	-144,944	-0.51%	221,318	0.58%
South east	-1,155,039	-38.72%	-1,818,782	-25.50%
South west	-1,089,403	-10.00%	-2,489,497	-13.67%
Wales	-23,975	-2.93%	-888,341	-29.77%
West Midlands	-2,807,516	-15.42%	-1,778,064	-5.41%
Yorkshire and the Humber	371,013	4.64%	-251,407	-2.81%
Sum of non-London changes	**-5,401,276**	**-4.28%**	**-17,313,107**	**-8.48%**
London	**34,535,182**	**18.46%**	**43,072,874**	**20.97%**

Source: UK aviation forecasts 2017, DfT

Expanding Heathrow airport curtails the number of people who fly from the UK's regions

The government's Updated Appraisal Report was reasonably clear that expansion of Heathrow would reduce passenger departures from non-London airports. However, the report was also very clear in stating that the UK's regions would still receive benefits:

"Expansion is not just for the south east of England, as the whole of the UK will benefit from the enhanced connectivity on offer. […] Table 3.6 shows that substantial numbers of passengers from outside of London and the south east will benefit from the improved international connectivity provided by expansion. It therefore remains the case that an expanded Heathrow will allow more passengers from across the UK to benefit from access to important international markets from the airport." (p.19)

The wording here has been chosen carefully because, in fact, what Table 3.6 of the report shows is that there will be an increase in regional passenger traffic through Heathrow. What it does not show is that there will be a net increase in connectivity (i.e. internationally flights) for regional travellers nationally. In order for there to be a net increase nationally in 2050, there must be sufficient regional travellers using Heathrow to comfortably offset the 17 million passenger reduction in departures from regional airports.

We sought to explore whether there would be a sufficient increase in surface access journeys to Heathrow, and domestic flights to Heathrow, to offset the lost regional departures. The alternative hypothesis might be that regional passengers are effectively *replaced* by passengers from London and the south east in the national aviation network. We gained access to the DfT's own modelling of surface access to Heathrow up to 2050 through a FOI request (ref: F0017657). We combined the increase in the number of passengers accessing Heathrow via surface transport under the expansion scenario with the numbers of passengers accessing Heathrow via domestic flights. We then balanced this against the decline in the number of passengers departing directly from regional airports. The results are shown in Table 7.

Our analysis of the DfT's modelling suggests that, in the short-term (2030) there is a significant increase in the number of passengers flying who originate from regions other than London and south east. However, over time the picture reverses. By 2050, Heathrow expansion appears to significantly reduce the number of passengers originating from regions outside London and the south east who fly. Notably there is a major impact on the number of flyers from the north west, reducing by almost five million per year.

Without full access to the DfT's aviation sector model we cannot definitively explain the trends seen in Table 7 but they would appear to represent an organic process of structural realignment in the aviation sector. Some regional residents are expected to change their behaviour and will prefer to fly from the expanded Heathrow instead of their local airport. We posit that as a result, routes originating from regional airports will either increase in price or be shut down as they are no longer profitable. The net result might be that another group of travellers are priced out as they cannot afford to go to Heathrow instead.

The trends in Table 7 raise concern that Heathrow expansion has a significant cost to the economies of the north west, the east of England, the south west, the West Midlands, and Wales. Business passengers and holiday makers who would have flown under the baseline scenario no longer do so. At the same time, London and the south east benefit from a very significant growth in travellers.

TABLE 7
Net changes in the number of people flying as a result of Heathrow airport expansion, broken down by their region of origin.

REGION OF PASSENGER ORIGIN	2030	2050
East Midlands	966,302	724,947
East of England	1,363,817	-2,830,201
London	8,955,782	14,030,672
North east	1,391,510	378,814
North West	1,405,438	-4,797,779
Scotland	843,336	1,240,101
South east	2,355,725	3,575,874
South west	-40,374	-1,112,111
Wales	414,518	-302,709
West Midlands	-1,849,402	-615,808
Yorkshire and the Humber	1,991,276	1,762
Sum of non-London/SE changes	**6,486,421**	**-7,312,983**
Sum of London and south east	**11,311,506**	**17,606,546**

Source: UK aviation forecasts 2017, DfT; FOI ref: F0017657

TABLE 8
Distribution of aviation jobs across the UK in 2017

Region	Total aviation jobs	Proportion of UK aviation jobs	Aviation jobs per head working age population
North east	2,670	2%	0.002
North West	14,700	11%	0.003
Yorkshire and The Humber	3,950	3%	0.001
East Midlands	1,430	1%	0.000
West Midlands	3,255	3%	0.001
East of England	13,010	10%	0.004
London	52,670	40%	0.009
South east	23,000	18%	0.004
South west	4,125	3%	0.001
Wales	875	1%	0.000
Scotland	10,385	8%	0.003

Source: BRES, ONS

In addition to the trends suggested by this modelling, recent developments in infrastructure development planning in the transport sector may be further bad news for regional use of Heathrow. The government placed HS2 at the centre of its plans for access to Heathrow from the UK's regions,[30] but the completion date for the new line to Birmingham has been pushed back to 2028–2031, and the second phase further north to Manchester and Leeds is now not expected until 2035–2040. Completion of HS2 therefore, would not occur until between nine and 14 years after the planned opening of Heathrow's NWR. There are significant doubts as to whether the scheme will ever be delivered.[31]

The government expect up to 27,000 jobs to relocate to London and the south east

The proposed expansion of Heathrow will have impacts both on the jobs available in the aviation sector itself, and right across the economy in sectors that utilise aviation for transport and business. Present-day aviation sector jobs are already

concentrated in London and the south east. As shown in Table 8 together these regions claimed 59% of jobs in 2017, while Wales and the East Midlands each claimed only 1% of jobs. When accounting for the size of London's population (the largest of the UK's regions) it still receives a disproportionate share of aviation jobs – with 2.25 times more jobs/head than the next regions (the East and south east), and leaving the other UK nations and regions yet further behind.

The DfT's most recent analysis estimates that the NWR scheme will create 57–114,000 additional local jobs in 2030, and 39–78,000 in 2050.[32] However, their analysis is also careful to note that *'These jobs are not additional at the national level, as some jobs may have been displaced from other airports or other sectors'*[33], a point similarly acknowledged by the Airports Commission.[34]

If the government is serious about tackling regional inequalities it is essential to understand the number of jobs which will be displaced from other regions. While figures were not presented in the Updated Appraisal Report, we note that the DfT did calculate these values as a necessary part of their analysis on the tax impact of the scheme, stating:

"Tax impacts are driven by the job redistribution induced by the change in passengers using each airport in the UK as a result of expansion." (p.27)

We gained access to the data inputs that informed this part of the appraisal using a FOI request (ref: P0017641). The data accessed addresses only the jobs relocated from one region to another, and not the jobs newly created or destroyed entirely. The results shown in Table 9 show the difference between regional jobs in the baseline aviation sector growth scenario, and the Heathrow expansion scenario. As shown in Table 9 the DfT estimate that 2,300–22,500 jobs will relocate to London and the south east in 2031, increasing to 9,000–27,200 in 2051. The biggest losers are the West Midlands, the south west, and the north west. As we do not have access to the model underpinning the DfT's jobs calculations we cannot explain the unusual swing in fortunes experienced in the north west between 2031 and 2051.

As would be expected, job losses are concentrated in the local authorities in the vicinity of airports that are likely to lose passengers as a result of Heathrow expansion. Table 10 shows some of the most affected authorities. There are particular concentrations of losses around Greater Manchester and the wider area around Birmingham.

TABLE 9
Jobs relocated to/from the UK's regions as a result of a Heathrow NWR

	2031 (Low)	2031 (High)	2051 (Low)	2051 (High)
East Midlands	-37	238	-125	-92
East of England	-221	-2,246	-2,780	-1,100
North east	52	301	-305	-16
North west	102	822	-2,026	-15,093
Scotland	-114	-1,314	-31	-675
South west	-959	-6,555	-2,084	-3,350
Wales	-20	-20	-739	-739
West Midlands	-1,612	-13,716	-584	-5,025
Yorkshire and the Humber	517	-28	-292	-1,055
Sum of non-London/South east	**-2,293**	**-22,517**	**-8,966**	**-27,145**
South east	318	5,394	1,305	6,244
London	1,975	17,124	7,661	20,901

Source: DfT jobs modelling outputs accessed via FOI Ref: P0017641

TABLE 10
Top ten local authorities facing job losses as a result of Heathrow expansion in the years 2031 and 2051

	2031			2051		
Rank	Region	Authority	Jobs change	Region	Authority	Jobs change
1	South west	Bristol	-2,360	East of England	Rochford	-3,208
2	East of England	Cambridge	-2,230	North West	Manchester	-3,196
3	West Midlands	Coventry	-1,753	Scotland	Glasgow City	-2,707
4	London	Newham	-1,701	South west	Christchurch	-1,808
5	West Midlands	Solihull	-1,624	North West	Trafford	-1,625
6	South west	South Gloucestershire	-1,521	South east	Eastleigh	-1,514
7	West Midlands	Sandwell	-1,443	North West	Warrington	-1,378
8	Scotland	Glasgow City	-1,399	North West	Salford	-1,149
9	East of England	Harlow	-1,350	North West	Stockport	-1,127
10	North West	Manchester	-1,315	East of England	Norwich	-914

Source: DfT jobs modelling outputs accessed via FOI Ref: P0017641

The government expect up to £43bn in GDP to relocate to London and the south east

As jobs moved towards London and the south east so will economic productivity. Using data and modelling supplied by the DfT in their calculation of the tax wedge we can a calculate the regional shifts in GDP. The DfT provided us with a figure for GDP per worker, and the index of productivity per worker broken down by local authority.[35] Multiplying these figures together with the job numbers and the appropriate discount rate produces the net present value (NPV) figures in Table 11.

We calculate NPV up to 2084/85 as the government have done in their Updated Appraisal Report. As we will evidence in the following sections, we do not regard the 'low' figures shown in Table 11 to be credible as these rest on DfT estimates of job displacement which seem implausibly small. Overall the regions outside London and the south east lose GDP with an NPV of up to £43bn. Losses are concentrated strongly in the West Midlands and north west, where losses of up to £18bn and up to £14bn respectively are forecast.

TABLE 11
The Net Present Value (2019–2084/85) of GDP relocated due to shifts in the location of employment resulting from Heathrow Expansion

Region	Net Present Value of GDP displaced (low)	Net Present Value of GDP displaced (high)
East Midlands	-£173,579,001	-£173,579,001
East of England	-£2,149,484,033	-£1,050,117,062
North east	£147,284,150	£147,284,150
North West	-£1,861,908,754	-£13,841,595,082
Scotland	-£123,954,610	-£1,662,357,417
South west	-£2,348,943,072	-£5,672,521,226
Wales	-£887,000,993	-£887,000,993
West Midlands	-£2,460,275,809	-£18,247,908,282
Yorkshire and The Humber	-£400,197,151	-£1,284,289,401
Sum of non-London/south east	**-£10,258,059,272**	**-£42,672,084,314**
South east	£1,059,381,259	£10,526,995,610
London	£11,430,707,133	£38,310,170,168

Source: Calculations based on DfT modelling and guidance and FOI ref: P0017641

Box 1: What do we mean by 'London'?

Aviation statistics often refer to the 'London Airport System' – Heathrow, City, Gatwick, Stansted and Luton. This is what we have done so far in this report. However, to make use of jobs data collected in the *Business Register and Employment Survey* (BRES), we need to reflect its geographies. In this section, we refer only to Heathrow and City when discussing 'London'. Stansted and Luton are part of the east of England, and Gatwick is in the south east. There is some blurring as, for example, a large number of workers at Heathrow live in the south east region. As such where presenting model outputs we present London and the south east as a separate grouping.

TABLE 12
London's (Heathrow and London City) proportion of UK passengers under the DfT's base scenario and the NWR scenario

	2030	2040	2050
Without NWR	30%	27%	24%
With NWR	40%	36%	33%

Source: DfT Aviation Forecasts 2017

Job losses occur both due to changes in passenger volume and flight type

In order to better understand the meaning and credibility of the DfT numbers shown in Table 9 we have conducted our own jobs modelling. We focus specifically on the aviation sector, aiming to isolate these from the wider job losses forecast by the DfT. With the information presented above pointing to a fundamental restructuring of the aviation sector we might also expect broader restructuring in other sectors which utilise aviation.

In the aviation sector the relocation of jobs to Heathrow will reflect both changing passenger *volume*, and changing passenger *type* (for example premium versus low cost carriers).

The DfT's modelling indicates that centralisation of passenger departures will become more extreme with the NWR expansion, as shown in Table 12 which compares the proportion of the UK's total passengers at London airports (according to the definition of London described in **Box 1**) in the years 2030, 2040, and 2050 with and without the proposed expansion. It shows that with expansion, London airports (and it should be noted that London City accounts for a very small proportion of this) will claim an additional 10% of the UK's passengers in 2030, and an additional 9% in 2040 and 2050.

With this change in where passengers fly from and to, we would expect a redistribution of aviation jobs since jobs are tied to passengers. With fewer passengers, airports are likely to sustain fewer jobs.[iii]

Thousands of regional aviation sector jobs will be lost due to passenger volume changes

By linking 2017 passenger numbers across the regions with Business Register and Employment Survey (BRES) data, we calculated a current rate of aviation jobs per million passengers. We then applied this rate to the DfT passenger number projections. This allows us to estimate how changes in passenger distribution across the UK from Heathrow's expansion could change the distribution of jobs when compared with the baseline scenario (Table 13). We forecast a huge growth in jobs in London, and job losses in almost every other region.[iv] While some of these losses are fairly minimal, in the low hundreds, many are far more significant. The north west aviation sector, for example, could lose 2,358 jobs under the NWR scenario in 2050, a gap which is almost the same size as the region's current aviation employment (without Heathrow expansion the north west's aviation sector would be much larger than at present).

iii There are some exceptions, for instance the Highlands and Islands airports which are subsidised by the Scottish government to provide transport connections.

iv Northern Ireland has not been included in any of this analysis, on the basis that Heathrow could not 'substitute' for any Northern Irish airports, and therefore will not displace passengers.

TABLE 13
Estimate of the changes in the regional distribution of aviation jobs, NWR scenario compared to the DfT's base model.

	2030	2050
East Midlands	84	-32
East of England	-2,679	-1,504
North east	178	-9
North West	-491	-2,358
Scotland	-52	80
South west	-437	-998
Wales	-14	-531
West Midlands	-705	-446
Yorkshire and the Humber	262	-177
Sum of non-London/south east changes	**-3,854**	**-5,975**
South east	-914	-922
London	28,146	27,587

Source: NEF calculations based on UK aviation forecasts 2017and BRES data

Thousands of regional airline jobs will be lost due to carrier type changes

It is not only changes in passenger volume that could affect aviation jobs across the UK. One further effect of Heathrow's expansion that is revealed in the Department's modelling is the redistribution across the UK of different *types* of flights and subsequent employment densities.

An airport's employment density (how many direct jobs it creates) depends both on the *volume* of passengers, but also on the *type* of passengers. '*Typically, airports which predominantly offer long-haul services and hub capabilities have higher employment densities*'.[36] Typically this feature occurs because hub airports have a higher proportion of carriers providing more complex services, covering both freight and passengers. Conversely, airports dominated by low-cost airlines have a lower employment density, as their airlines cut costs through fewer staff and 'frills' (i.e. services), while their reliance on short-haul flights means lower levels of freight movement.

The effects of the different airlines types and functions on jobs are already visible in the UK. Again, by linking BRES data on the regional distribution of aviation jobs with DfT passenger data, we can see how different regions create different job densities. London, again, comes out very well – every million passengers is linked to 638 aviation jobs, compared to as few as 250 jobs in the West Midlands (Table 14).[v]

One of the effects of runway expansion at Heathrow will be to further centralise the airline activity that generates the most jobs, as scheduled (or 'premium') carriers, airlines like British Airways and Lufthansa, which have a lower staff:passenger ratio, relocate to Heathrow from other UK airports. Heathrow is projected to fly **only** scheduled carriers by 2030, and it will do this by creating new routes, pushing low-cost carriers out to surrounding airports, and absorbing scheduled routes from other airports.

To understand the potential impact that these changes could have on regional distribution of jobs, we have used the DfT's forecasts of changes in the distribution of low-cost and scheduled carriers to model three scenarios (Figure 2).

v It is likely that Leeds Bradford airport, as the home of Jet2, contributes to the particularly high job density by hosting centralised office functions in a relatively small airport.

FIGURE 2: THREE SCENARIOS OF FUTURE JOB INTENSITY IN THE AVIATION SECTOR

Scenario 1: staffing models change creating more airline jobs

- This scenario assumes that the Norwegian model (a lower passenger:staff ratio than many low-cost airlines) grows, at the expense of the Ryanair model (highest passenger:staff ratio of low-cost airlines) (6555:1).
- Conventional carriers do not change their staffing model in this scenario (1008:1).

Scenario 2: staffing models change little

- This scenario assumes that the staffing models of both low-cost (7196:1) and conventional carriers (1008:1) stay broadly as they are.

Scenario 3: staffing models change creating fewer airline jobs

- This scenario assumes that other low-cost carriers follow the Ryanair model (higher passenger:staff ratios) (7385:1).
- Conventional carriers also increase their passenger:staff ratio, assuming that they will be able to make staff reductions by consolidating their routes at Heathrow (1109:1).

Source: NEF

Table 15 shows the range in the outputs these scenarios produce in our model. The headline finding is that concentration of conventional carriers at Heathrow will redistribute airline jobs across the UK, with an enormous consolidation in London and substantial losses elsewhere. Note, without further processing (applied below) this modelling cannot be aggregated with the outputs shown in Table 13.

TABLE 14
Aviation jobs per passenger million across the UK

	Passengers 2017[vi]	Aviation jobs 2017[vii]	Aviation jobs per passenger million
North east	5,425,752	2,670	492
North west	32,684,255	14,700	450
Yorkshire and the Humber	5,600,337	3,950	705
East Midlands	4,873,490	1,430	293
West Midlands	12,978,350	3,255	251
East of England	43,511,477	13,010	299
London[viii]	82,519,281	52,670	638
South east	47,622,210	23,000	483
South west	10,294,574	4,125	401
Wales	1,464,180	825	563
Scotland	28,832,976	10,375	360

Source: DfT, BRES

vi Source: DfT aviation statistics, Table TSGB0202b (AVI0102b).

vii Source: BRES data, 2017. Accessed via NomisWeb

viii Heathrow and London City airport.

TABLE 15
Airline jobs gap across UK regions between the DfT's base and NWR aviation forecasts based on the change in passenger numbers and the change in distribution of airline types. ,

	2030		2050	
	Scenario 1	Scenario 3	Scenario 1	Scenario 3
East Midlands	73	119	75	124
East of England	-3,533	-3,799	-3,683	-3,969
North east	136	163	6	7
North west	-449	-674	-1,267	-1,901
Scotland	-68	-85	114	142
South west	-284	-357	-1,040	-1,311
Wales	-2	-6	-81	-207
West Midlands	-845	-1,374	-392	-636
Yorkshire and the Humber	341	474	-103	-143
Sum of non-London/ south east changes	**-4,704**	**-5,658**	**-6,446**	**-8,018**
South east	-2,324	-2,632	-2,168	-2,455
London	14,513	23,878	14,225	23,404

Source: DfT aviation forecasts 2017, Civil Aviation Authority (CAA), and the Centre for Aviation

Thousands of regional jobs linked to the aviation sector will be lost

In addition to the jobs created within the aviation sector, further changes in employment are likely in other sectors that link to changes in the aviation sector. 'Indirect' job changes will occur in industries which supply the airports and airlines, and 'induced' job changes will occur due to shifts in the money flowing through aviation sector salaries and where they are spent. To account for these jobs we have followed a standard approach of increasing our initial job loss estimates using an ONS employment multiplier to estimate the total job redistribution across the UK. In total, as shown in Table 16, London gains almost 43,000 jobs in 2030 and just under 42,000 in 2050 with the NWR scheme (figures which fit within the ranges estimated by the DfT). The rest of the UK, on the other hand, stands to lose more than 10,000 in 2030 and nearly 15,000 in 2050.

The DfT's lower end estimates do not seem credible

In Table 17 we compare our estimates with the estimates we have accessed via FOI from the DfT. It is important to note that we are not comparing like-for-like, and as such the message is complex. Our first key finding is that the lower estimate used by the DfT does not seem credible. Losses outside London and the south east of 2,200 in 2030 and 8,700 in 2050 are well below the range suggested by current employment densities in the aviation sector, as established in national statistics. This discrepancy may relate to the DfT's use of a different methodology to calculate their low estimate of the tax wedge. We conclude that the DfT's higher estimate of job relocation is the most credible.

Thousands of job losses will occur in sectors not directly linked to the aviation sector

Of the 22,500 jobs the DfT forecast will relocate in 2031, and the 27,100 jobs relocating in 2051, a portion will relate to non-aviation sectors not included in NEF's modelling. These are jobs that simply *use* the aviation sector as a means of personnel or goods transport. Expansion of Heathrow creates an added incentive for businesses to relocate to the vicinity of Heathrow where their business functions may be cheaper and/or easier. Our modelling suggests that 49–57% of job losses outside the London/south east region are in the aviation sector, while the remainder of the number identified by the DfT could relate to other sectors which rely on aviation to conduct their business.

TABLE 16
Estimates of total redistribution of jobs across the UK as a result of NWR expansion.

	Jobs linked to passenger volume		Jobs linked to airline type[ix]		Combined[x]		Total including indirect and induced jobs[xi]	
	2030	2050	2030	2050	2030	2050	2030	2050
East Midlands	84	-32	72	77	100	66	180	119
East of England	-2,679	-1,504	-3,517	-3,697	-4,401	-4,193	-7,921	-7,547
North east	178	-9	136	6	195	3	350	6
North west	-491	-2,358	-450	-1,261	-612	-2,039	-1,102	-3,671
Scotland	-52	80	-69	115	-86	141	-154	254
South west	-437	-998	-281	-1,040	-425	-1,370	-766	-2,465
Wales	-14	-531	-2	-79	-7	-255	-13	-459
West Midlands	-705	-446	-844	-388	-1,076	-535	-1937	-964
Yorkshire and the Humber	262	-177	344	-103	430	-162	774	-291
Sum of non-London/ south east changes	**-3,854**	**-5,975**	**-4,611**	**-6,370**	**-5,882**	**-8,344**	**-10,589**	**-15,018**
South east	-914	-922	-2,346	-2,187	-2,647	-2,491	-4,765	-4,483
London	28,146	27,587	14,513	14,225	23,801	23,329	42,842	41,992

TABLE 17
Comparisons between different model estimates of the number of jobs leaving non-London/south east regions

Region	NEF estimate of jobs relocated in the regional aviation sector	DfT lower estimate of relocated jobs in all sectors	DfT upper estimate of relocated jobs in all sectors
2031	-10,589	-2,293	-22,517
2051	-15,018	-8,966	-27,145

Source: NEF – synthesis of above analyses

ix Wage growth is included in an index proposed by Scotland Living Rent and Common Weal in their report A Living Rent for Scotland's Private Tenants, available online: https://commonweal.scot/New%20Common%20Weal/cache/file/9C1569C1-D554-69DC-9EA150DF-5D14ACD1.pdf

x Airline jobs are included in the 'aviation jobs' accounted for in the BRES data we have used. To combine these two figures, we need to remove the proportion of 'aviation jobs' that we estimate to be airline jobs. We have based this figure on the Optimal Economics study of Heathrow, which also underlies the DfT job estimates. Their research found that 62% of Heathrow direct on-site employees were employed by airlines, a figure which we adjusted to remove 'catering and retail' from overall employment since this would not be covered by our BRES categories. After re-weighting, the proportion of aviation jobs at Heathrow accounted for by airlines was 67%.

xi We have used a multiplier listed in ONS UK Input-Output tables (2015 being the latest release). Accessed here: https://www.ons.gov.uk/economy/nationalaccounts/supplyandusetables/datasets/ukinputoutputanalyticaltablesdetailed

2.3 HEATHROW EXPANSION IS EXTRA DAMAGING IN THE CONTEXT OF RAPID DECARBONISATION

As shown above, the expansion of Heathrow exerts a direct downward pressure on passenger demand at airports in the UK's regions. At the same time, the NWR increases the UK's net passenger load by 25 million in 2050 and increases the excess over the CCC's target for *Net Zero* to 66 million (Table 1). In order to deal with the carbon oversupply the UK will have, broadly, four options:

1. Offset the excess emissions using an international trading mechanism.

2. Apply a regulatory mechanism which specifically aims to slow growth in passengers at Heathrow.

3. Apply a regulatory mechanism to the UK aviation sector as a whole.

4. Demand faster decarbonisation (and latterly carbon capture/negative emissions) in non-aviation sectors.

In the following section we discuss, and model, the implications of options two, three and four for the UK and its regions. We have disregarded option one as the CCC have strongly recommended against this approach. Responding to a question from the House of Commons Transport Committee, Lord Deben, Chair of the Committee on Climate Change stated:

"As we move on, nations will be doing more and more, and they will find it more and more difficult. The idea that there will be a whole lot of spare and quite cheap [carbon] trading to be done seems unlikely"[37]

i.e. if we are to avert dangerous global warming, we must hope that spare and cheap international carbon trading is not available. In his letter to the secretary of state in February 2019, Lord Deben asked the government to clarify that the aviation sector emissions target would be achieved by reducing actual emissions *'rather than by relying on international offset credits'*.[38] WWF have assembled an extensive list of additional reasons why international offset credits should not be used to substitute for demand management.[39]

Targeting a regulatory mechanism at London and the south east would waste the public subsidy
The New Economics Foundation have long advocated for a carbon tax on flying that is progressive, designed to curtail demand from the wealthiest and most frequent fliers first. As of 2016, around 80% of the richest 5% of households had taken a flight, while only 30% of the poorest 5% had flown. Among the highest earners frequent flyers are common, around 30% of people who earn over £230,000 fly between 12 and 47 times a year.[40] A disproportionate number of those who might be classed as frequent flyers live in London and the south east. Indeed, residents of London and the south east are around twice as likely to take three or more flights per year.[41] A tax such as the 'frequent flyer levy' proposed by NEF and A Free Ride, could constrain demand most strongly in London and the south east.

However, despite almost half of all growth in passenger demand taking place at Heathrow, pursuing this option as a way of mitigating the carbon impact of Heathrow expansion does not make sense. Given that the strategic imperative for a new runway in the south east is driven by growth in London and the south east, it seems illogical to proceed with construction and then constrain that demand. Critically, targeting Heathrow's growth would waste the significant public subsidy (highlighted above) which would be provided to the scheme.

A regressive carbon tax would have major negative impacts on the UK's regions
The most likely format of option three is a sector-wide flat rate of carbon tax. A carbon tax that distributes the demand management across the aviation sector seems a likely course of action from a government seeking to achieve net zero emissions by 2050. This approach reduces flying by 'pricing-out' travellers with less demand or less ability to pay. This option is regressive to the extent that it penalises poorer flyers proportionately more strongly than wealthier flyers, but it does not penalise non-flyers. To an extent this model of taxation has already been accepted in the form of the Airline Passenger Duty. There were early signs that a regressive carbon tax may soon be implemented, with the government reportedly considering a charge, applied to all flight tickets, which would *'drive consumer choices towards less polluting journey options'*, although the design currently proposed includes an *'opt-out'*.[42]

In anticipation of such a development, already built into the DfT's 2017 aviation forecasts was a carbon price that the model transferred onto the price of

tickets. The effect was to simulate a carbon tax on emissions. The rate rises over time, growing from £25 per tonne of carbon dioxide equivalents in 2025, to £221 per tonne in 2050. Recognising the potential for the precise price applied to tickets to vary with future policy decisions the DfT tested different levels of carbon price in its sensitivity simulations. The headline finding was that a 50% increase in the carbon price could reduce total national passenger numbers by 4% in 2050, equivalent to 18 million passengers.[8] The impact of another form of regulation, a fuel tax, was also tested. A 50% increase in fuel prices led to a 7% fall in passenger numbers in 2050, equivalent to 31 million passengers. The greater the carbon tax, the greater the ticket price, the slower the growth in sector-wide passenger numbers.

It follows that the application of a higher carbon tax, designed to bring aviation sector emissions down to levels compatible with *Net Zero* by 2050, has the potential to reduce passenger numbers at the UK's regional airports. The extent of this impact however, was previously unknown as the DfT did not release the full model outputs of its sensitivity runs. Using a FOI request submitted to the DfT (ref: P0017549) we have gained access to these model outputs.

As shown in Table 18, the impacts of either form of carbon tax (fuel price or carbon price) are felt disproportionately by the UK's non-London airports. As a proportion of total passenger numbers the declines are particularly significant in Wales (Cardiff airport), the East of England (Norwich and Southend airports), the north east (Newcastle and Teeside airports), and the north west (Liverpool and Manchester airports). The rate of decline in London and the south east is typically at least four times lower.

TABLE 18
Projected changes in annual passenger numbers in 2050 under two sensitivity scenarios tested in the DfT's 2017 aviation sector model. London airports include: Heathrow, London City, Stansted, Gatwick, and Luton

	Carbon price sensitivity run		Fuel price sensitivity run	
	Change in passenger numbers 2050	Change against baseline (%)	Change in passenger numbers 2050	Change against baseline (%)
East Midlands	38,841	0.39%	87,843	0.88%
East of England	-3,649,064	-51.84%	-4,893,698	-69.52%
North east	-721,552	-11.10%	-965,162	-14.85%
North West	-5,946,320	-10.14%	-10,173,486	-17.34%
Northern Ireland	-733,461	-5.31%	-1,235,815	-8.95%
Scotland	-1,896,203	-5.00%	-3,409,482	-8.98%
South west	-172,284	-0.95%	-2,683,509	-14.73%
Wales	-729,539	-24.45%	-1,558,515	-52.23%
West Midlands	-1,009,489	-3.07%	-2,349,683	-7.14%
Yorkshire and the Humber	-446,307	-4.98%	-247,781	-2.77%
Sum of non-London/south east changes	**-15,265,378**	**-7.75%**	**-27,429,288**	**-13.92%**
South east	-153,572	-2.15%	-13,119	-0.18%
London	-1,897,793	-0.92%	-3,176,840	-1.55%

Source: FOI Ref: P0017549

The sensitivity tests shown above were conducted on the DfT's baseline aviation sector model, i.e. they do not factor in expansion of Heathrow airport. This caveat means that the figures for passenger number decline in Table 18 cannot be summed with those in Table 6. The addition of an expanded Heathrow to the DfT's model sensitivity runs could potentially reduce the regional disparities in the carbon price impacts – or it could exacerbate them. Nonetheless, the regional imbalance of the costs and benefits of Heathrow expansion is almost certainly compounded by the implementation of a regressive carbon tax.

We used NEF's method for calculating job changes from passenger volume changes, as presented above. This allowed us to look at the jobs impact of a regressive carbon tax across the UK's aviation sector. The findings, shown in Table 19, highlight that either form of carbon tax will hit jobs linked to the aviation sector far harder in UK regions outside London/south east. Losses are widely distributed around the regions, with particular concentrations in the north west and East of England. On average, there are around eight times as many job losses in the regions compared to London and the south east.

In a carbon constrained world regulation is needed to determine fair allocation between sectors

As the UK moves into a more carbon constrained world, aiming for a carbon budget of net zero in 2050, we can expect to see increased competition from carbon-intensive sectors for the right to emit. As shown in Table 20, the UK's most carbon-intensive sectors are strongly concentrated outside of London and the south east, a pattern that is further enhanced when the aviation sector is excluded. Notably, there are particular concentrations of carbon-intensive jobs in the East and West Midlands. The north west, which stands to lose out most from Heathrow expansion, also has a reasonably high concentration of carbon-intensive jobs.

Any carbon emissions released above each sector's target-compatible allowance will need to be paid for and offset elsewhere. At the same time the pool of offsets available will shrink, and grow in cost, as demand rises.

TABLE 19

Modelled changes in job numbers in the aviation sector under two scenarios from the DfT's sensitivity analysis of future passenger numbers accessed via FOI. Numbers may not sum due to rounding

	2030	2030	2050	2050
	Carbon price	Fuel price	Carbon price	Fuel price
East Midlands	-36	-32	20	46
East of England	-981	-2,757	-2,496	-3,246
North east	-64	-191	-639	-855
North West	-445	-1,251	-4,817	-8,241
Scotland	-258	-767	-1,229	-2,209
South west	-300	-745	-124	-1,937
Wales	16	-40	-785	-1,678
West Midlands	-71	-740	-456	-1,062
Yorkshire and the Humber	-367	-629	-566	-314
Sum of non-London/south east change	**-2,505**	**-7,150**	**-11,092**	**-19,495**
South east	**-118**	**-318**	**-512**	**123**
London	**-483**	**-303**	**-544**	**-2,520**

Source: NEF analysis of FOI ref: P0017549 using BRES employment data

TABLE 20
The percentage of total employment which is in carbon-intensive sectors (manufacturing, transportation and storage, electricity and gas, and mining and quarrying), including and excluding the aviation sector, by region

Region	Aviation excluded	Aviation included
East Midlands	18.25%	18.31%
East of England	11.79%	12.21%
North east	14.14%	14.36%
North West	14.65%	15.08%
Scotland	12.33%	12.73%
South west	11.25%	11.40%
Wales	13.08%	13.14%
West Midlands	16.69%	16.81%
Yorkshire and the Humber	16.19%	16.35%
Non-London/south east	**14.23%**	**14.47%**
South east	9.93%	10.43%
London	6.06%	7.10%

Source: Nomis – Labour Market Profile – Employee jobs

As it stands, the majority of the aviation sector is not subject to any form of carbon tax. Two systems are in operation, the European Union Emission Trading System (EU ETS), and the International Civil Aviation Organisation's Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA). EU ETS, however, applies only to internal European flights and between 2013–2020, 82% of the sector's emissions allowances were granted 'for free' to aircraft operators.[43] CORSIA is currently a voluntary scheme, does not apply to domestic flights, and the quality assurance process for the carbon offsets it intends to purchase is the subject of concern.

In the absence of a carbon tax and in the presence of a net zero target, the growth in the aviation sector's emissions effectively represents a subsidy from the public and from other sectors of the economy to the aviation sector. If our emissions target is to be met, and unless aviation emissions are capped, other sectors will have to deliver faster, more costly decarbonisation in order to compensate. When the regional makeup of the UK economy is considered, it becomes apparent that any carbon 'over-spend' by the aviation sector, which, as we have already shown, is predominantly based in London and the south east, will incur a cost to other carbon-intensive sectors, which are largely based elsewhere. For example, expanding Heathrow might increase the pressure to close a petroleum refinery on the Humber, or an automobile factory in Solihull. These areas will need support to achieve a fair transition regardless of action in the aviation sector, but adding considerable additional pressure on our limited carbon budget reduces the room to phase-in changes and ease the pace of the transition.

In the absence of a carbon tax the right to emit represents a public subsidy

As the cost of each tonne of carbon emissions is set by the government[44] (albeit not actually enforced) we can estimate the value of different 'carbon subsidies' given out when businesses are given a licence to pollute (or in this case to fly). While in essence, every uncompensated tonne of carbon emitted represents a subsidy from the public to the polluter, a fairer way to measure the value of the subsidy provided is to benchmark each sector against its carbon reduction targets as recommended by the CCC and ultimately set by the government. As the aviation sector is already 'over budget' in relation to the reduction target set by the CCC, the entirety of any additional carbon added to the sector's total might be considered a subsidy. The total 'subsidy' is shown in Table 21, in discounted and undiscounted values.

TABLE 21
Additional tonnes of CO2 equivalents forecast as a result of Heathrow airport expansion, and their price according to BEIS carbon prices as of June 2019, broken down by Low, Central, and High carbon price and aviation forecast scenarios

	2030			2040			2050		
Carbon price and forecast scenario	**Low**	**Central**	**High**	**Low**	**Central**	**High**	**Low**	**Central**	**High**
Tonnes of CO2 equivalents ('000)	4,614	4,833	4,068	3,543	4,233	3,745	3,154	2,942	1,994
Undiscounted value (£'000)	£186,438	£390,655	£493,239	£276,335	£660,345	£876,264	£362,673	£679,520	£689,833
Discounted value (£'000)	£123,385	£258,536	£326,426	£129,656	£309,834	£411,143	£121,786	£228,183	£231,646

Source: NEF analysis of DfT aviation forecasts 2017 using BEIS carbon pricing

TABLE 22
Job numbers corresponding with the carbon emissions shown in Table 21 based on the 2017 carbon per job intensity of the corresponding sectors

	2030			2040			2050		
Carbon price and forecast scenario	**Low**	**Central**	**High**	**Low**	**Central**	**High**	**Low**	**Central**	**High**
Manufacturing jobs	146,967	153,955	129,594	112,853	134,840	119,287	100,459	93,705	63,510
Transportation and Storage jobs	75,920	79,530	66,945	58,298	69,656	61,621	51,895	48,406	32,808
Electricity and Gas jobs	12,050	12,623	10,626	9,253	11,056	9,781	8,237	7,683	5,207
Mining and Quarrying jobs	10,662	11,169	9,402	8,187	9,782	8,654	7,288	6,798	4,607

Source: NEF analysis of DfT aviation forecasts 2017, Nomis – Labour Market Profile, and Eurostat data on emissions by NACE revision 2 economic activities

The carbon subsidy given to Heathrow could sustain thousands of jobs in other sectors

Aviation is not the only sector that is hard to decarbonise. The CCC identifies others that are expected to have residual emissions in 2050. These include industry, surface transport, waste, agriculture and shipping. In some cases technical solutions may not become available to allow business operations in these sectors to continue without a significant carbon footprint. In these circumstances communities and decision makers may wish to use a portion of our national carbon budget to sustain these jobs until a suitable alternative becomes available, or at least to ease the decline. Doing so might protect communities from the type of social upheaval seen when over 20,000 jobs were abruptly stripped from the coal mining sector in the 1980s. Carbon overspend in the aviation sector will reduce the overall carbon budget available, making this type of decision considerably more difficult, and putting important jobs further at risk.

Heathrow expansion represents a major carbon overspend. The quantity of additional carbon emitted through expansion could be sufficient to sustain a very large number of jobs in other carbon intensive sectors for an extended period of time. For example, at 2017 carbon to job ratios, 3-4 MTCO2e would be sufficient to sustain more than 100,000 jobs in the manufacturing sector, and over 50,000 jobs in the wider transportation and storage sector (Table 22). Expanding Heathrow removes any carbon buffer to protect these jobs. The location of

these sectors has a strong regional component to it as the jobs at risk are disproportionately located outside of London and the south east (see Table 20).

The carbon subsidy given to Heathrow represents a bad deal for the UK regions

Here we convert the carbon subsidy given to HAL into a financial subsidy given by the regions to Heathrow. To do so we have taken the changes in flight-linked emissions resulting from Heathrow expansion (based on DfT Aviation forecasts) in the UK regions and monetised them. We have then scaled these values to reflect that a small proportion of aviation sector emissions are paid for under the EU's ETS allowance scheme i.e. we have assumed that some of the additional emissions will be paid for, but the majority (82%) will not. As shown in Table 23 expansion of Heathrow leads to a very significant transfer in 'carbon spend' away from the UK's regions and towards London. This might be regarded as a 'carbon subsidy' from the regions to London. Our estimates here are only crude, based on the current mix of legislation and the DfT's 2017 aviation forecasts.

In 2030 around 16%, or £200mn, of the total sector's carbon subsidy is transferred to London under Heathrow airport expansion. In 2040 this falls to around 15%, and in 2050 around 11%. The net result, is that in 2030 around 62% of the aviation sector's emissions come from Heathrow. As such, we can say that without application of some form of carbon tax which funds offsets elsewhere, or a change in planned policy regarding the distribution of emissions allowances, a carbon subsidy of around £3.3bn (NPV) will be transferred from the regions to airlines using Heathrow between 2030 and 2050. It is important to note that our estimate accounts only for the flights taking off from Heathrow, and not for those which land.

TABLE 23

The monetised value of the emissions allowance giveaway (subsidy) to the aviation sector. Values are discounted and are based on DfT aviation forecasts

	2030	
	Total 'subsidy'	Change in 'subsidy'
Heathrow	£640,547,900	£236,391,109
London	£846,984,063	£196,965,113
All non-London	£300,200,604	-£43,661,967
Total UK	£1,240,036,591	£155,121,329
London/non-London swing		£198,783,296
	2040	
	Total 'subsidy'	Change in 'subsidy'
Heathrow	£506,069,958	£168,954,063
London	£672,665,426	£152,325,396
All non-London	£307,957,127	-£36,008,717
Total UK	£1,059,299,858	£117,736,895
London/non-London swing		£153,745,612
	2050	
	Total 'subsidy'	Change in 'subsidy'
Heathrow	£197,597,581	£54,175,589
London	£265,888,762	£51,167,161
All non-London	£158,826,981	-£15,266,018
Total UK	£459,259,012	£36,509,253
London/non-London swing		£51,775,271

Source: NEF analysis of DfT aviation forecasts 2017 scaled based on European Commission data on the UK ETS aviation sector carbon allowances and priced using BEIS carbon prices.

ANNEX A

WHAT IS THE REGULATED ASSET BASE (RAB)?

The Regulated Asset Base (RAB) is a concept that regulators use to determine how much return a company can make from the capital stock of a particular utility or piece of infrastructure. The RAB of Heathrow airport is calculated by the CAA based on the value of the airport as an infrastructural asset. Any capital expenditure on the airport is added to the RAB and the RAB is subject to depreciation. The maximum amount that can be collected through airport charges at Heathrow is then set by the CAA to allow the owners to receive a fair return on the amount they have invested. This return is based on the weighted-average cost of capital (WACC) of the RAB.

The CAA has recognised that the scale and complexity of the NWR project are unprecedented when it comes to economic regulation. Given that the public will eventually bear the cost of the NWR's construction through elevated airport charges, there are a number of features of this regulatory model that are worth exploring further, as they call into question whether the NWR can be delivered without excessive costs to the public.

THE RAB INCENTIVISES EXCESSIVE CAPITAL EXPENDITURE

When a privatised utility is regulated based on the capital stock and a fair rate of return on that capital stock (as is the case with Heathrow's RAB-based regulation), there is a well-documented incentive for the owners of the utility to overspend on capital investment . This may come in the form of excessively high prices for new infrastructure, building too much new infrastructure, or reclassifying operational expenditure as capital expenditure. Heathrow's RAB system lessens the incentive for investors in the NWR to keep their costs low, since they know that the more they spend, the more revenue they will be allowed to extract through airport charges.

A recent independent review of the efficiency of capital expenditure by HAL provided evidence of a significant gap between the prices HAL is willing to pay for new infrastructure and the fair market price. This included a project to install smoking shelters at Terminal 2, where HAL had been quoted a price of £1m for infrastructure usually costing £500,000. Similarly, when purchasing self-bag drop machinery, HAL estimated a cost of £150,000, whereas British Airways had paid approximately £40,000 for the same machines. In these cases, the onus was on airlines to challenge HAL's cost estimates with more accurate market unit costs. It is unlikely that airlines will have the resources to provide this check against cost escalation in the construction of the NWR and they have expressed 'significant concern' about the ongoing effectiveness of the current capex efficiency process used by HAL, especially in relation to the NWR.

There has been recognition of these shortcomings in capex governance and structures exist or are under development to encourage greater efficiency in capital expenditure at Heathrow. The current system applies ex-post adjustments whereby at the end of a 5-year control period, the CAA assesses whether HAL's capex was efficient and items that are deemed to have been inefficient expenditure are disallowed from the RAB for the subsequent control period . These ex-post reviews typically focus on the most contentious areas of capital expenditure, meaning that the onus is on airlines or passengers to dispute HAL's estimates, which they may not have the capacity to do when faced with a very large and complex project like the NWR.

The track record of the CAA's regulation of airport capex also suggests that the regulator is likely to side with HAL in any such disputes. In its final proposals for the economic regulation of Heathrow in the current (Q6) control period, the CAA described its approach as providing 'an unusually benign climate for investment compared to companies in competitive markets' and giving 'high degree of confidence that investments can be remunerated, subject to efficient operations' . The CAA also confirmed that it would allow investments to be financed by increases in user charges while they were being built, rather than waiting until the infrastructure began to operate; this practice of pre-funding infrastructure was criticised by airlines as unfair to passengers during the construction of Heathrow Terminal 5, as it forces

them to pay for assets that they may never use in the future.

The treatment of Stansted airport, with regard to large sums of capital expenditure incurred for the construction of a second runway (a project which was subsequently cancelled) also sets a worrying precedent. BAA, then owners of Stansted and the company that later became HAL, spent £313m on planning, blight and project management for the second runway, with airlines disputing whether this spending was necessary and whether it was carried out efficiently . The CAA persistently sided with BAA, allowing them to add the bulk of this expenditure to the RAB. Only £47m of the costs were disallowed from the RAB, after protests from airlines and a review by the Competition Commission. The inclusion of the remainder of the costs meant that the RAB 'was inflated above its true asset value, with airlines forced to pay higher charges to reimburse Stansted for capital investment, which they had protested against and which ultimately provided no-benefit to users'.

The sums of capital expenditure forecast for the construction of the NWR are large enough that HAL may have difficulty carrying any cost overruns to the end of a given control period. This suggests that in the event of significant overruns relative to the NWR's budget, the CAA would have to reassess Heathrow's RAB and add these overruns to the total. If this occurred, it would ultimately be reflected directly in higher passenger charges for the public when using Heathrow.

CAA modelling confirms this possibility, showing that delays and overspending could push passenger charges from their 2016 level of £21.75 per person to almost £30 per person by the late 2020s, and that charges would remain above their 2016 level for more than a decade in such a scenario . The CAA points out that this modelling does not reflect a worst-case scenario: 'longer delays and larger overspends are possible' relative to the overspends that they have modelled. Heathrow's passenger charges are already among the highest in the world , meaning that further increases would pose a heavy burden for passengers.

THE RETURN ON THE RAB IS GENEROUS

The previous section looked at the risks of the size of the RAB becoming too large due to inefficient expenditure and accommodating regulatory practices. Another aspect of the regulation of Heathrow that has the potential to impose higher costs on passengers is the process of determining the rate of return (the WACC) that HAL can earn from the RAB. The WACC is calculated by the CAA, based on forecasts for the coming price control period of the likely cost of equity and cost of debt that HAL will face and HAL's notional gearing (the proportions in which it is likely to employ equity and debt to finance itself). This produces a range in which the true WACC is likely to lie, and the CAA then chooses a point in that range (a single WACC rate) to apply over the subsequent control period. In the case of Heathrow, a higher RAB leads to higher passenger charges for the public, all else being equal.

The standard practice in regulation of airports and other public utilities in the UK has been to select a WACC from the upper end of the range. Regulators acknowledge that the true WACC cannot be known in advance and prefer to err on the higher side, reasoning that the costs of setting a rate that is too high are less than the costs of setting a rate that is too low. This in turn is based on the assumption that a low WACC will discourage the owner of the utility (HAL in the case of Heathrow) from undertaking the necessary level of capital investment, at great cost in terms of service quality. Setting a WACC that is too high, on the other hand, results in actual demand for the service that is less than the optimal level.

The other important implication of setting a WACC that is too high is that creates excess profits for the owner of the utility. This effect is deliberately ignored by standard economic theory, which is interested in maximising the combined benefit for owner and customers; these profits are considered as a wealth transfer from customers to the owner and have no net impact in the standard modelling framework. This is a key shortcoming in a sector such as airports, where the owner could be seen to provide a public service rather than purely operating for profit. The approach of maximising economic welfare for consumers and producers also overlooks the major externality of the environmental impact of the NWR (which is discussed elsewhere in this paper).

There is little empirical evidence behind the assumption that setting a lower rate of allowed return leads to underinvestment. Justification for this rule of thumb in the literature frequently relies

either on stylised microeconomic theory or on the fact that the rule of thumb is widely used, as proof that it is correct.

The bias towards a higher WACC has major implications for the revenue that HAL can extract via passenger charges. Forecasts by the CAA of passenger charges at Heathrow until 2044 show that for every 1 percentage point increase in the WACC that the regulator prescribes for Heathrow, airport charges per passenger increase by £2.65. When compounded across the large number of passengers using the airport in a given 5-year control period, small differences in the WACC can lead to large shifts in profits for HAL.

Analysis by CEPA on behalf of British Airways in advance of the Q6 control period, forecast the effect on HAL revenue of different choices of WACC by the regulator. The CAA estimated that the cost of capital that HAL would face during the Q6 period (2014/15-2018/19) would lie in the range between 4.51% and 5.89%, and proposed (and eventually selected) a WACC at the 80th percentile of the range (5.35%). CEPA estimated that HAL's revenue over the 5-year period would be £294m higher with this WACC than if the WACC at the midpoint of the range (4.92%) had been selected. CEPA recommended that this midpoint be selected and considered the selection of the 80th percentile as 'arbitrary, and not justified based on RAB growth'.

The CAA subsequently stuck with its original proposal of a WACC at the 80th percentile of the range. HAL has gone on to pay its shareholders £3.1bn in dividends between 2014 and 2018, suggesting that the company has had ample opportunity to extract profit from Heathrow's passengers during Q6 so far. With the size of the RAB set to grow sharply as the NWR is constructed, it is more important than ever that regulators have a strong justification for their choice of allowed return. The risk of growth in the RAB arising from inefficient capital expenditure during the construction of the NWR is compounded by the risk of setting an overly high WACC, creating the potential for outsized profits for HAL owners and a substantial cost for passengers via the airport charges embedded in their ticket prices.

ANNEX B

TABLE N
Key appraisal documents and developments in relation to regional impacts

Year	Document	Key function/finding
2013	Airports Commission Interim Report	Identifies need for greater airport capacity in the south east and provides three options for addressing that need
2014	Airports Commission (PwC): Local economy impact analysis	Explores the potential impacts on the economy in the vicinity of Gatwick and Heathrow with regard to employment
2014	Airports Commission: Heathrow airport NWR: Business Case and Sustainability Assessment	Conducts a typical transport business case appraisal, but does not include information on the distributional aspects of the costs and benefits analysed
2015	Airports Commission (PwC): Strategic Fit: GDP/GVA Impacts (post consultation)	Introduces a new approach to modelling GDP/GVA impacts, the S-CGE model, which divides impacts across regions: London & south east, the Rest of England and the Rest of the UK
2015	Airports Commission: Final report	Carries forward the PwC analysis of GDP/GVA by region. This remains the only cost/benefit broken down by region
2015	DfT review of the Airports Commission's final report	The DfT raises issues with the regional GDP/GVA modelling work, and recommends it is not used for decision making.
2016	DfT: Further review and sensitivities report: Airport capacity in the south east	Suggests revisions to a number of the economic modelling approaches which may relate to regional impacts, but does not evidence regional impacts. Revises down the Airports Commission's jobs estimates.
2017	DfT: Updated Appraisal report: Airport capacity in the south east	Develops a new business case for expansion. Does not include PwC's regional impacts model. Presents new analysis on multiple costs and benefits but fails to report any distributional impacts
2018	DfT: Addendum to the updated appraisal report: Airport capacity in the south east	Revises a number of assumptions around the environmental impacts of the scheme, negligible overall impact
2018	DfT: Airports national policy statement	Synthesises and reports evidence, primarily from the Updated Appraisal Report

ENDNOTES

1 House of Commons Transport Committee (2018) *Airports National Policy Statement: Third Report of Session 2017-2019.*

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