NEW ECONOMICS FOUNDATION

FLYING LOW

THE TRUE COST OF HEATHROW'S THIRD RUNWAY

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SUMMARY

A fresh examination of the economic case for a third, north west runway at London's Heathrow airport finds it eroded to the point where it is no longer viable. Now, using the government's own formula for assessing the value for money of transport schemes, Heathrow expansion along proposed lines would be rated as either 'poor' or 'low' value.

MPs debating the building of a third runway at the airport, during an expected process in Parliament this spring, must now ask significant questions of the Government, the Department for Transport (DfT), and the airport before giving the scheme their support. On the basis of this review's economic assessments of London airports expansion, we question whether the vote should even go ahead.

At best, in net present value terms, building the North West Runway (NWR) at Heathrow will yield an economic benefit of £3.3 billion. At worst, in net terms there would not only be no economic benefit whatsoever, but a significant financial cost of up to £2.2 billion, to be borne either by the airport, its investors, airlines, passengers or perhaps even government.

Given the high proportion of new passengers – three-quarters by 2040 – that will use Heathrow as a hub, starting and finishing their journeys outside the UK, it is also unlikely that nations and regions of the UK will see significant benefit, with promised new domestic connections perhaps only viable with government support. In fact according to the latest projections, building the NWR will lead to lower passenger numbers at regional airports than if there were no South East expansion.

WORSENING ECONOMIC COST-BENEFIT

In July 2015, the independent Airports Commission launched its final report, recommending Heathrow's NWR as its preferred means of expanding capacity in the south east of England. In terms of net present value (NPV) – the cost-benefit metric the Government usually uses to assess the

economics of infrastructure projects – the Commission's central economic assessment was that building the runway would yield £11.8 billion of benefit.

But updated modelling by the DfT, published in October last year to support the government's National Policy Statement (NPS) on aviation, significantly revises this down due to changes in a variety of modelling assumptions and now finds that in NPV terms the scheme is expected to deliver between minus £2.2 billion and plus £3.3 billion in economic benefits.

While complex (explored in detail in Appendix 1), the reasons for such a large difference between the Airports Commission's cost-benefit conclusions in 2015 and the DfT's in 2017 are mostly accounted for by two changes in modelling. First, the Commission's modelling of wider economic benefits, especially those of trade and clustering, has been dramatically re-appraised by the DfT due to concerns about double counting and the risk of excluding negative effects. Second, there has been a narrowing of the gap between the benefits that are expected to be enjoyed by passengers versus those captured by airlines, due to changes in modelling assumptions.

Earlier, the DfT also dispensed with whole sections of economic modelling upon which one section of the Airports Commission's report relied and which yielded some of the more eye-catching economic projections published upon its launch in 2015.

According to the Government's updated assessment for the NPS, not only has the economic case for Heathrow NWR been significantly eroded but, at its median and lower bounds, is now worse than the Gatwick second runway (2R) (£1 billion to £2.4 billion). While the case for Gatwick is hardly compelling, and Heathrow's upper bound still better, with a wider range of cost-benefits, and higher environmental disbenefits, Heathrow is arguably also the riskier of the two.

Significantly, according to the DfT's own value for money criteria for transport infrastructure projects, Heathrow NWR would now be rated as either poor or low value.

BUT IT COULD BE WORSE STILL

The New Economics Foundation (NEF) has reviewed all of the past and present modelling – using the publicly available data from sources such as the Airports Commission, DfT and underlying modelling by other firms and organisations – and finds that, taking other significant factors into account, the economic case for Heathrow's NWR could be even worse; perhaps wholly negative.

Most significantly, as Heathrow is a hub airport, the benefits that accrue to passengers that begin and complete their journey in another country (known as international to international passengers or I-to-I) and use the airport only as a hub, should not be included as a benefit in the economic assessment of the NWR. This is because the money these passengers save on cheaper tickets – the NWR's main purported economic benefit to consumers (or consumer surplus) – does not accrue as welfare in the UK economy.

In 2040, three-quarters of the new passengers able to use an expanded Heathrow airport are forecast to be I-to-I and using Heathrow as a hub. Excluding these passengers from the DfT's most recent assessment – something the DfT itself recommends – reduces the NWR's NPV by a further

£5.5 billion, resulting in an NPV ranging from minus £2.2 billion to a worst case of minus £7.7 billion.

But the economic case for Heathrow could be eroded further still. For instance, a critical factor is the amount the airport charges airlines for its use and how much of this is passed on to passengers by the airlines. Heathrow is already one of the world's most expensive airports for airlines – based on average per passenger aeronautical charges – and has not ruled out increases to reflect the costs of constructing its NWR. Even before subtracting I-to-I consumer benefits, a demand response from passengers to the resulting higher fares would result in NWR's NPV falling to minus £3.9 billion to plus £1.6 billion.

If the project faces construction or legal delays or other delays due to local protest, or if the price of emitting carbon is higher than forecast, then Heathrow NWR faces further loss of benefit.

None of these factors are, in and of themselves, unlikely. A perfect storm in which they interact could see Heathrow NWR's economic cost-benefits pushed further and further into negative bounds.

WHO WINS AND WHO LOSES

UK nations and regions have supported the Airports Commission's recommendation in favour of Heathrow on the basis that it delivers benefits across all areas of the UK. But are they right to do so?

The theory goes that Heathrow will open up more routes for regional airports, with passengers hubbing through an expanded Heathrow, and reduce ticket prices both on these connecting routes and in general.

But as the economic case for Heathrow erodes, and with the high number of additional passengers travelling I-to-I, the benefits distributable across the UK economy necessarily narrow. People located closer to Heathrow, though bearing most of the environmental impact costs of Heathrow, are arguably better positioned to capture the benefits of airport expansion, than those outside of London and the South East.

According to the NPS, the government expects to see six new routes from UK airports to Heathrow or Gatwick as a result of expansion, bringing their total domestic connections to 14 and 12 respectively. But Heathrow has said it will not provide guarantees for even a minimum number of UK connections; instead it has suggested it will make it economic for airlines to fly domestic routes and has urged the Government to change the way it mandates 'Public Service Obligation' routes from their current 'city-to-city' status to 'airport-to-airport'.

This may be of benefit to Heathrow and to some passengers, but could have a deleterious effect on other airports and could also mean government ultimately subsidising operators to use the expanded airport.

Significantly, while the NPS has forecast 5.9 million extra international passenger trips from regions outside London and the South East using Heathrow NWR by 2040, this statistic ignores the drop in international traffic using regional airports. Overall by 2040, it is predicted that the scheme will lead to a reduction in 14 million passenger numbers at non-London airports.

Expanding airports in the South East is, at its core, all about changing the status quo in which the constraint on slots provides opportunities for airlines that

already fly into and out of Heathrow to capture many of the existing benefits. Freeing up slots through expansion should therefore create more benefit for consumers in terms of cheaper fares (because of greater supply of take-off and landing slots and more competition) as well as savings in travel times and more scheduled flights.

But the case for Heathrow is no longer as it was originally presented by the Airports Commission:

- Economic modelling for the Airport Commission's 'strategic case', which produced some of the big GDP benefits cited in press reports at launch, is now discredited and should not be used.
- Subsequent changes in economic assumptions made in between July 2015 and the publication of the DfT's updated appraisal report in October 2017 have reduced Heathrow's projected NPV from £11.8 billion to between minus £2.2 billion and plus £3.3 billion.
- Stripping out the benefits that accrue to I-to-I passengers – which mostly do not accrue in the UK – erodes Heathrow NWR's cost-benefits by up to a further £5.5 billion.
- A range of other factors, such as if Heathrow's aeronautical charges increase and are passed through to passengers, could reduce the lower bound of Heathrow's cost-benefit to an even more significant minus number.
- The stated benefits to UK connectivity may be significantly overstated, with regions outside of London actually experiencing an overall reduction in aviation traffic.

On the basis of these findings, we question whether a planned Parliamentary vote on the scheme this spring should even go ahead. It seems clear to us that Heathrow's proposed NWR is no longer economically viable in net terms and indeed the DfT's own method for scoring such projects would seem to rule it out.

If the NPS does proceed into Parliament, then in considering whether to approve it or not, MPs should take all these factors into account.

NEF was commissioned by the No Third Runway Coalition to undertake independent analysis of the economic case underpinning the Government and Airports Commission's proposal to allow a third, Northwest runway to be built at Heathrow airport. We undertook to examine and explain the difference between the results of cost-benefit analysis undertaken by the Commission and published in 2015, and updated analysis published in 2017 by the Department for Transport, and to set out what this might mean in the upcoming debate about the Airports National Policy Statement. We used only publicly available data and did not undertake any additional modelling ourselves.

1. THE ECONOMIC CASE FOR HEATHROW NWR NOW DISPLAYS A NEGATIVE NET PRESENT VALUE

In 2015, the Airport Commission's (AC) Final Report recommended the building of a third Northwest runway (NWR) at Heathrow with analysis that showed that this would deliver the highest **Net Present Value (NPV) of £11.8bn** versus other considered alternatives. But since then, the evidence has changed.

Updating this same framework for improved DfT methodology, and using the latest 2017 UK aviation data, the project is now expected to deliver an NPV range of just **£-2.2bn to £3.3bn. Heathrow NWR is no longer the project that delivers the highest NPV and it may, in fact, be negative**[1]:

A full analysis of why these numbers have changed so significantly is set out in Appendix 1. It is important to note that all metrics other than NPV (such as 'Total benefits', 'Net public value', 'Direct economic benefit', 'Net social benefit') fail to include the Scheme and Surface Costs (i.e. the costs of building Heathrow NWR and the services around it), and therefore represent highly incomplete contributions to a cost-benefit analysis. These should not have been placed forefront in the Airports Commission's final report launch.

As Heathrow NWR's NPV has fallen towards zero, so has its expected **value for money**. Using the DfT's value for money criteria, the Heathrow NWR project would now be classified as either a **'poor'** or a **'low'** value for money project (i.e. its Benefit Cost Ratio (BCR) is just 0.89x - 1.22x – using the same formula, Gatwick 2R's BCR is 1.15x - 1.35x[2]).

Alongside this NPV analysis, a very different modelling of GDP impacts was originally conducted by PwC. Even at the time, expert panelists on the Airport Commission raised concerns about the results, agreeing "caution should be taken when interpreting the GDP numbers due to the innovative application of the model". More recently, in its Further Review and Sensitivities report, the DfT stated that "it is the view of both the expert panelists and the department that given this lack of consensus, it is highly challenging to produce a single central estimate of the GDP impact of airport expansion using the S-CGE approach with the evidence currently available".[3] An explanation of this alternative, but discredited, methodology is set out in Appendix 3.

TABLE 1: NET PRESENT VALUE OF GATWICK 2R AND HEATHROW NWR

	The AC's economic analysis presented in 2015		The DfT's updated analysis of the AC's economic case in 2017	
	Gatwick 2R	**Heathrow NWR**	**Gatwick 2R**	**Heathrow NWR**
Consumer Surplus	*47.1*	*54.8*	*69.4*	*67.6*
Producer Surplus	*-41.8*	*-38.4*	*-65.1*	*-55*
Delays	*2.4*	*1*		
Net Passenger benefits - Producer costs	**7.7**	**17.4**	**4.3**	**12.6**
Government Revenue	2.5	1.8	4.6	3.5
Wider Economic Benefits	8.1	11.5	0.1 to 1.3	1.8 to 3.1
Environmental Disbenefits	-1.6	-2.7	-0.9	-1.6
Net Social Benefits	**16.8**	**28**	**8.1 - 9 .3**	**16.2 - 17.5**
Scheme Cost	-6	16.1	-7.0 to -6.9	-18.3 to 14.3
Net Present Value	**10.8**	**11.8**	**1.0 to 2.4**	**-2.2 to 3.3**
		↑ The calculated NPV of Heathrow NWR THEN		↑ The calculated NPV of Heathrow NWR NOW

2. THE ISSUE OF AERONAUTICAL CHARGES REMAINS UNRESOLVED

The DfT's updated NPV analysis still has areas of uncertainty, such as how much construction and surface access will cost (hence the range in its latest appraisal) and the extent to which these costs are passed through to airlines and passengers via the 'aeronautical charges' that the airport makes for take-off and landing slots. The model's default assumption is that such charges will be passed on to the airlines, who absorb them in full.

Heathrow has recently launched an informal public consultation on the basis of quoted scheme costs that, at £14 billion, are £2.5 billion less than the sum originally used in the Airports Commission's report. This is a shade below the lowest end of the DfT's range of costs (-£18.3 billion to -£14.3 billion) in the updated appraisal, but would not significantly affect the -£2.2 billion to £3.3 billion range of NPV cost-benefits (though would suggest an outcome at the higher end of the range).

According to 2015 analysis, these costs may cause the charge levied by Heathrow on airlines taking off from and landing at the airport, currently ~£21 per passenger (though set to fall slightly in real terms due to a 2014 Civil Aviation Authority ruling[4]), to rise in real terms to ~£29 when the new runway first opens and to ~£31 when the full scheme is complete in the early 2030s.[5]

This has emerged as a significant issue in the evidence that Parliament's Transport Committee has been hearing as part of its inquiry into the airport's National Policy Statement (NPS) ahead of a vote expected in the late Spring. While Heathrow's chief executive has

recently given verbal guarantees that they will "deliver expansion at close to current charges"[6], it is fair to assume that some increase in aero charges is inevitable. Either airlines operating out of the airport must absorb these charges in full (causing their producer surplus to fall further from what is modelled above) or passengers will face higher ticket prices (causing their consumer surplus gain to fall from what is modelled above).

Giving evidence to the committee inquiry, Willie Walsh, the CEO of IAG, the parent company of British Airways, when pressed on these charges, said: "What I am saying very clearly is that, if the charges increase, you are not going to get the expansion at Heathrow that has been talked about. Therefore, the third runway will become a white elephant."

The DfT's updated analysis of Heathrow's proposal, published in October 2017 and that underpins the draft NPS, does not contain updated estimates of these charges. It merely states that the government expects Heathrow "to continue working closely with airlines and its regulator (Civil Aviation Authority, CAA) to refine the scheme design to target landing charges … as close to today's level as possible."

3. REMOVING THE WELFARE BENEFIT OF PASSENGERS STARTING AND FINISHING THEIR JOURNEY OUTSIDE THE UK

Applying HM Treasury's guidelines, the NPV figure for NWR may be judged overstated. Any transport project appraisal"should take account of all benefits to the UK"[7]. The current calculated NPV for Heathrow NWR of -£2.2bn to 3.3bn includes benefits accruing to non-UK travellers who are transferring via a UK airport with their origin and destination outside the UK (international to international passengers, or I-to-I).

The DfT has explicitly stated that "benefits accruing to UK and foreign passengers should be included, and that I-to-I should be excluded".[8] Under the AC and DfT's modelling, these passengers will contribute nothing towards the cost of the project (unless aero charges are passed through), have no positive impact on the UK economy, and are not subject to Air Passenger Duty[9]. Their passenger benefits therefore do not belong in a net present value calculation for a UK project.

As the majority (~75 per cent in 2040) of marginal passengers (the additional air traffic generated by Heathrow NWR) are expected to be filled by such I-to-I passengers, **removing the £5.5bn effect of I-to-I passenger benefits reduces the NPV of Heathrow NWR to -£7.7bn to -£2.2bn**. According to HM Treasury policy"generally, proposals should not proceed if, despite a net benefit overall, there is a net cost to the UK"[10]:

Even if we assume that aero-charges are fully passed on to passengers, so I-to-I passengers shoulder some of the scheme costs, it is impossible for these contributions to offset this £5.5bn reduction. Because I-to-I traffic represents just 30% of total

post-expansion Heathrow traffic, and assuming the proposed 25% discount on I-to-I aero-charges[11], passing through the maximum scheme cost would generate a I-to-I passenger contribution to the project costs of just £4.1 billion (i.e 30% *75% *£18.3bn = £4.1bn). This is less than the £5.5 billion reduction in I-to-I consumer benefit. Therefore, the non-I-to-I economic case NPV for Heathrow NWR is necessarily negative. As Gatwick is less of a hub airport, removing this I-to-I share of consumer surplus has less of an impact, but still pushes 2R into the margins of viability.

TABLE 2: THE DFT'S ECONOMIC ANALYSIS 2017 AND I-TO-I PASSENGER BENEFITS

	Including "I to I" passenger benefits		Excluding "I-to-I" passenger benefits		
	Gatwick 2R	Heathrow NWR	Gatwick 2R	Heathrow NWR	
Net Present Value	1.0 to 2.4	-2.2 to 3.3	-1.3 to 0.1	-7.7 to -2.2	◄ *Average NPV:* -£4.4bn

4. ADJUSTING FOR OTHER POTENTIAL SENSITIVITIES IN THE ANALYSIS

Adjusting out the I-to-I passenger benefits ensures the economic case made for Heathrow NWR is negative, but it may be worse still. In 2016, the DfT also published **sensitivity analyses**[12] to identify what may happen to the benefits of each project for a **set of possible scenarios**. For example, the 'aero-charge pass-through' scenario assumes that instead of absorbing the extra aero-charges that fund these projects, airlines passed them on to customers, causing demand responses (as suggested by Willie Walsh in his evidence to the Transport Committee). When we translate these sensitivity analyses directly into each project's NPVs, even leaving I-to-I passenger benefits in the model, Heathrow NWR displays a negative average value for each of the following scenarios:

Recognising that more than one of these scenarios could occur simultaneously, Heathrow NWR's NPV might end up being extremely negative indeed. On the basis of this evidence, and applying the DfT's own project appraisal rationale, unless better arguments can be put forward, Heathrow NWR does not deserve a government mandate.[13]

TABLE 3: DFT'S SENSITIVITY ANALYSIS TO FOLLOWING SCENARIOS

	Gatwick 2R	Heathrow NWR	Gatwick 2R	Heathrow NWR	
			Aero-charge Pass-Through		
Direct Economic Benefits	7.2	15.6	5.0	13.9	
↓	↓	↓	↓	↓	
Net Present Value	1.0 to 2.4	-2.2 to 3.3	-1.2 to 0.2	-3.9 to 1.6	◀ *Average NPV:* -£1.1bn
			Two Year Project Delay		
Direct Economic Benefits	7.2	15.6	6.7	14.3	
↓	↓	↓	↓	↓	
Net Present Value	1.0 to 2.4	-2.2 to 3.3	0.5 to 1.9	-3.5 to 2.0	◀ *Average NPV:* -£0.7bn
			Noise Respite Measures		
Direct Economic Benefits	7.2	15.6	7.2	13.8	
↓	↓	↓	↓	↓	
Net Present Value	1.0 to 2.4	-2.2 to 3.3	1.0 to 2.4	-4.0 to 1.5	◀ *Average NPV:* -£1.2bn
			International Hub Capacity Unconstrianed		
Direct Economic Benefits	7.2	15.6	7.1	14.9	
↓	↓	↓	↓	↓	
Net Present Value	1.0 to 2.4	-2.2 to 3.3	0.9 to 2.3	-2.9 to 2.6	◀ *Average NPV:* -£0.1bn
			High Carbon Price		
Direct Economic Benefits	7.2	15.6	4.6	12.3	
↓	↓	↓	↓	↓	
Net Present Value	1.0 to 2.4	-2.2 to 3.3	-1.6 to -0.2	-5.5 to 0.0	◀ *Average NPV:* -£2.7bn
			Including a Carbon Cap Abatement Cost		
Direct Economic Benefits	7.2	15.6	-0.6	-1.0	
↓	↓	↓	↓	↓	
Net Present Value	1.0 to 2.4	-2.2 to 3.3	0.5 to1.9	-3.1 to 2.3	◀ *Average NPV:* -£0.4bn

5. GATWICK 2R NOW PERFORMS BETTER THAN HEATHROW NWR

In the DfT's core scenario, the economic case for Gatwick 2R, though by no means compelling in its own right, now beats Heathrow NWR **on almost every single economic metric**[14]:

- **Higher total benefit to passengers and the wider economy** (average Gatwick 2R £74.7bn vs Heathrow NWR £73.5bn)
- **Higher net public value** (average 2R £73.5bn vs NWR £70.2bn)
- **Higher NPV** (average 2R £1.7bn vs NWR £0.5bn)
- **Higher NPV ex Wider Economic Impacts** (average 2R £0.9bn vs NWR -£1.9bn)
- **Higher value for money according to the Benefit Cost Ratio** (2R 1.15x – 1.35x vs NWR 0.89-1.22x[15])

As part of these higher scores, Gatwick 2R is expected to deliver lower environmental disbenefits (-£0.9bn vs -£1.6bn) and higher government revenue (£4.6bn vs £3.5bn).

Also, using the latest aviation data, Gatwick 2R also now appears to offer more benefits than Heathrow NWR on almost every UK aggregate connectivity metric (note that connectivity must be analysed across the UK system as a whole, as individual airports might generate additional ATMs solely by displacing traffic elsewhere in the UK). Compared to building Heathrow NWR, the building of Gatwick 2R is now expected to generate:

- More UK total direct **flight terminal passengers** (361.9mppa across UK given Gatwick 2R vs 359.9mppa across UK given Heathrow NWR)

- More UK total **domestic interliner terminal passengers** (4.6m vs 2.5m)
- More UK total **international interliner terminal passengers** (2.7m vs 2.4m)
- More UK total **domestic to domestic terminal passengers** (50.2m vs 49.8m)[16]

In fact, the only reason that the total headline additional terminal passengers at Heathrow is higher than Gatwick 2R (435 mppa vs 432 mppa for Gatwick 2R) is due to its much larger share of I-to-I passengers (20.7mppa I-to-I vs 12.8m Gatwick 2R I-to-I). **The majority of the additional trips enabled by Heathrow NWR into 2040 are expected to be non-UK passengers flying I-to-I (using Heathrow as a hub), not more people travelling to or from the UK via Heathrow or other airports)[17]:**

There was an assumption made in the Airport Commission's terms of reference that I-to-I traffic through a UK hub should be seen as intrinsically good, however as we outline in Appendix 3 below, much of the modelling that underpinned this assumption – on trade and clustering benefits, for instance – has been discredited[18]. And once we consider that only a minority of the marginal traffic enabled by Heathrow NWR will actually be those travelling to, or from, the UK, any route benefits are necessarily limited.

TABLE 4: ADDITIONAL PASSENGER FORECASTS

	Direct	Domestic Interliners	International Interliners	Domestic to Domestic	International to International (I-to-I)	Total
Gatwick 2R: Additional Terminal passengers (mppa) at UK Airports (vs no expansion)						
2030	0	2	0	0	2	3
2040	2	2	0	0	5	10
2050	11	3	-1	1	8	23
Gatwick 2R: Terminal passengers at UK Airports (mppa)						
2030	249	5	5	38	20	317
2040	303	4	3	43	16	370
2050	362	5	3	50	13	432
Gatwick 2R: Trips through UK Airports (mppa)						
2030	249	2	5	19	10	284
2040	303	1	3	21	8	338
2050	362	2	3	25	6	398
		Divide Terminal passengers by 3		*Divide Terminal passengers by 2*	*Divide Terminal passengers by 1*	

Gatwick 2R: How much extra capacity I-to-I		
	% Additional terminal passengers I-to-I	% Additional trips I-to-I
2030	50%	60%
2040	50%	41%
2050	35%	24%

	Direct	Domestic Interliners	International Interliners	Domestic to Domestic	International to International (I-to-I)	Total
Heathrow 2R: Additional Terminal passengers (mppa) at UK Airports (vs no expansion)						
2030	-3	14	-1	0	19	29
2040	2	4	0	0	21	28
2050	9	1	-1	1	16	26
Heathrow 2R: Terminal passengers at UK Airports (mppa)						
2030	246	18	4	38	37	342
2040	303	6	3	43	33	388
2050	360	3	2	50	21	435
Heathrow 2R: Trips through UK Airports (mppa)						
2030	246	6	4	19	19	293
2040	303	2	3	21	16	346
2050	360	1	2	25	10	398
		Divide Terminal passengers by 3		*Divide Terminal passengers by 2*	*Divide Terminal passengers by 1*	

Heathrow 2R: How much extra capacity I-to-I		
	% Additional terminal passengers I-to-I	% Additional trips I-to-I
2030	64%	89%
2040	76%	75%
2050	61%	46%

6. HEATHROW NWR MAY NOT LEAD TO BETTER UK NATIONAL AND REGIONAL CONNECTIVITY

Increased traffic through the hub airport of Heathrow can occur at the expense of passengers using other airports. Thus NWR risks concentrating UK aviation at Heathrow forever.

Into 2050, Heathrow NWR is modelled to expand UK aviation traffic from 409 million terminal passengers per annum to 435 million. But concealed within this aggregate, terminal passengers at London airports will rise from 205 million to 248 million. Meanwhile, Heathrow NWR is expected to cause terminal passengers at non-regional airports to grow more slowly than would be the case without NWR expansion (i.e. regional terminal passengers rise to 187m instead of 204m).

In conclusion, it may be argued that expanding Heathrow – or, to a lesser extent, London airports in general – means airports outside of London and the South East will struggle to achieve the density to develop their own routes, locking the UK into a model that revolves around Heathrow over the longer term.

It has been argued that Heathrow NWR may be particularly good for generating long-haul traffic. But this effect should not be overstated. By 2050, Heathrow NWR is predicted to generate just two additional long-haul routes compared to no expansion; Gatwick 2R leads to one fewer long-haul route compared to no expansion (124 routes vs 121 routes).[19] By the same date Heathrow NWR is predicted to offer 118.7 million long-haul seats versus 111.6 with Gatwick 2R[20]. Once we adjust down for the greater share of I-to-I passengers expected at Heathrow, the differential on long-haul seats to or from the UK may become very small indeed. Moreover, recent announcements such as Norwegian Airlines to develop Gatwick as its

TABLE 5: TERMINAL PASSENGERS AT UK AIRPORTS (LONDON AND REST OF UK), DFT FORECASTS 2017 (MMPA)

		2016	2030	2040	2050
No expansion	London airports	162	187	199	205
	Rest of UK	104	126	160	204
LGW Second Runway	London airports	162	192	220	249
	Rest of UK	104	124	150	183
LHR Extended Northern Runway	London airports	162	216	235	239
	Rest of UK	104	122	147	190
LHR Northwest Runway	London airports	162	222	241	248
	Rest of UK	104	121	146	187

17m extra terminal passengers at regional airports without Heathrow NWR.

2016 outputs are modelled, and therefore differ from the CAA's data, but within a small margin

major global long-haul base (including flights to South America and Asia) would suggest the DfT might need to update its long-haul assumptions.

The NPS forecast there will be 5.9 million more international passenger trips from or to regions outside of London *using* Heathrow as a result of NWR. However, through 2040, the number of passengers using non London airports is set to fall by 14 million[21] (see table above). Only a fraction of this lower regional airport traffic would have to be going or coming from abroad for regional international connectivity to be lower overall with NWR, than without.

The National Policy Statement points out that Heathrow NWR is expected to cater to 14 domestic (i.e. UK to UK routes) in 2030, versus 12 for Gatwick 2R. As part of its analysis, we wonder if the DfT analysis incorporated the effect of a step-up in the aero-charge rising to £31 per passenger at Heathrow (versus £16 per passenger at Gatwick). Because it seems likely that a significant increase in average aero charges may disadvantage domestic airline services and their passengers.

Also, if we believe the aim of airport expansion is to enhance the 'quality of connectivity' (both domestic and long-haul), then there are better more targeted ways we can achieve these goals. The UK's imminent departure from the EU opens up possibilities to alter the way in which the UK enforces its Public Service Obligation routes (PSOs) or to alter the regulatory framework on airport slots[22] to achieve the type of connectivity we want, without the need for a new runway. Indeed, guaranteeing certain domestic routes via PSOs is being 'considered as part of the Aviation Strategy' according to the Secretary of State for Transport's recent letter to the chair of the Transport Select Committee.[23]

Overall there seems very little to choose between Gatwick 2R and Heathrow NWR in enabling UK wide connectivity, and on many metrics, Gatwick comes out ahead. On this basis, any proposed non-monetised benefits (such as higher FDI, productivity, tourism or exports) are likely to be similar. Remember too, a Wider Economic Impact metric is already included in the cost-benefit analysis of net present value.

7. WHAT ABOUT ENVIRONMENTAL IMPACTS AND DISBENEFITS?

The environmental impacts (disbenefits) of Heathrow's NWR have in fact been reduced under the DfT's reappraisal. Whereas the Airports Commission NPV analysis produced £2.7 billion of environmental costs in total – noise, air pollution and carbon emissions – the updated analysis for the NPS produces £1.7 billion. This is principally because the DfT has restricted monetised impacts of air pollution to a range of two miles around the airport to improve the accuracy of the forecasting whereas the Airports Commission used a less detailed valuation approach that incorporated the surface access costs over a wider area.

Air pollution has proven an issue of some controversy in the Transport Committee's evidence sessions on the NPS. John Holland-Kaye, Heathrow's Chief Executive, has said that the airport complies with all air quality standards and pointed to vehicle pollution (surface transport close to the airport) as the main source of the problems.[24] Others have pointed to the wider efforts that are currently underway to improve air quality in London and how Heathrow may be a beneficiary of these rather than generating benefits themselves.

With regard to climate change-related emissions of carbon dioxide, the DfT identifies a scenario where carbon cannot be traded across the economy. Instead, net emissions from aviation do not rise above the Committee on Climate Change's advised 37.5 megatonnes of carbon dioxide in 2050 (a return to 2005 levels). In this scenario, this cap is achieved using the most efficient forms of abatement, set to cost Heathrow NWR an extra -£1.0 billion (represented as one of the scenarios in the sensitivity analysis earlier).

8. WHAT ABOUT UK AIR FREIGHT?

In the draft National Policy Statement, it states 'Heathrow Airport is the UK's biggest freight port by value' citing Heathrow's own website. It is true that UK high-value add sectors such as advanced manufacturing and pharmaceuticals rely on exporting their output via a strong UK airfreight network. But what should be questioned is whether any constraint on this network is likely if additional airport capacity is not built in the South East.

Despite an increasing *value* of airfreight, the actual *volume* of UK airfreight cargo has been static at approximately 2.3 million tons since the year 2000.[25]

A capacity constraint on airfreight at Heathrow would be expected to be showing up in rising prices for such cargoes. But a global trend of 'miniaturisation' in high-value products (e.g. smartphones and tablets versus TVs) coupled with the increased belly-space of new generation wide-body passenger aircraft, has acted to significantly lower the cost of airfreight every decade since the 1950s[26].

We can examine the annual reports of IAG (the parent company of British Airways), for which Heathrow serves as its main international hub for BA World Cargo (and IAG occupies half its slots). The company's yields on cargo have been declining in recent years (in 2016 alone, they fell by 9.3% in constant currency)[27]. **The DfT could be pressed on their view as to whether this evidence undermines the airfreight case for Heathrow NWR.**

Even if we imagine a Heathrow air freight capacity constraint might occur in future, a report prepared for the Freight Transport Association found that the specific financial impact of higher costs of moving freight (involving additional trucking to alternative airports) would be just an extra £17m without Heathrow NWR[28]. Note that there are alternative airports such as East Midlands or Stansted which specialise in dedicated freighters (rather than passenger belly-hold) with ample room for expansion. It is not unreasonable to ask, given the disbenefits of Heathrow NWR already discussed, whether there is not a better, more targeted way the UK can assist UK airfreight connectivity, than with a multi-billion-pound new runway at Heathrow.

9. WHAT ABOUT LOCAL JOB CREATION?

The AC's Final Report suggested the Heathrow NWR could generate 78,000 jobs by 2050, versus Gatwick 2R generating 32,000 over the same period[29]. The DfT has subsequently cast these figures into doubt.[30]

Employing an alternative approach which uses data on current employment at Gatwick and Heathrow, the DfT established a new range of 39k-78k additional local jobs for Heathrow NWR, and 25k-60k for Gatwick 2R[31]. The DfT points out: "These jobs are not additional at the national level, as some jobs may have been displaced from other airports or other sectors."There may be areas other than the South East of the England where the benefit of additional jobs from infrastructure investment can have a much more powerful impact.

However, if as discussed above, South East airport expansion reduces growth in passenger numbers at national and regional airports (NWR to a greater extent that 2R – compared with no expansion), then the DfT's point may be borne out and the aggregate jobs benefit may be more muted with job creation in London and the South East coming at the expense of the UK's nations and regions.

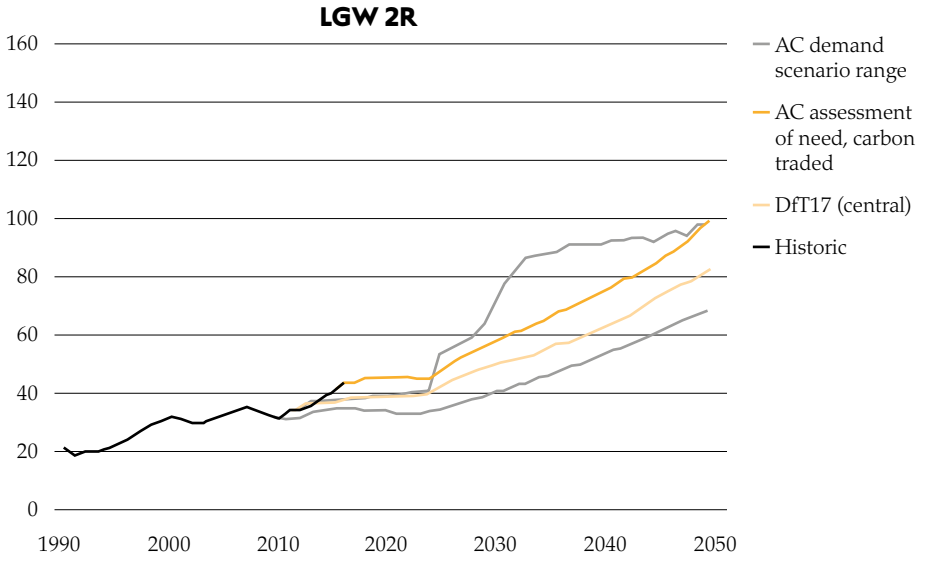
APPENDIX 1: HOW ARE THESE NUMBERS CALCULATED, AND WHERE HAVE THE BIG MOVES BEEN?

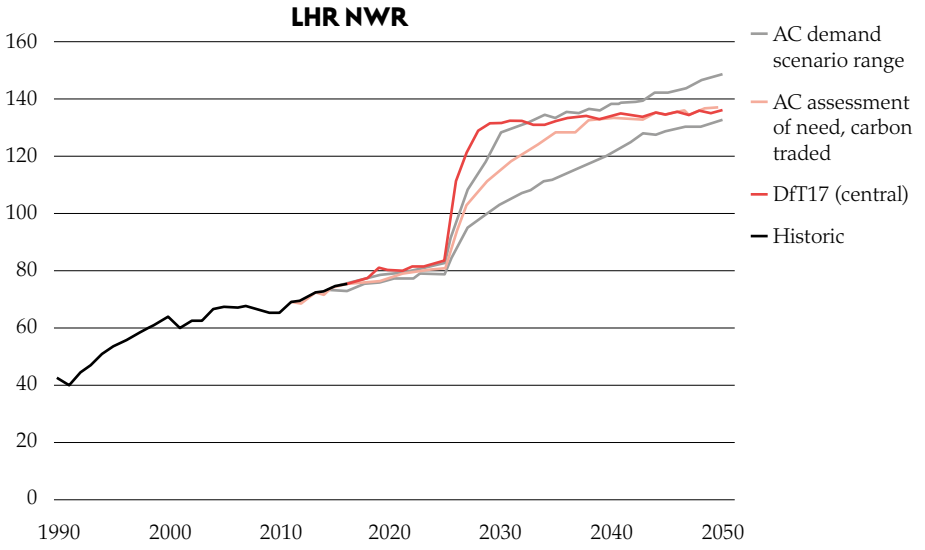
	The AC's economic analysis presented in 2015		The Dft's updated analysis of the AC's economic case in 2017	
	Gatwick 2R	Heathrow NWR	Gatwick 2R	Heathrow NWR
Consumer Surplus	*47.1*	*54.8*	*69.4*	*67.6*
Producer Surplus	*-41.8*	*-38.4*	*-65.1*	*-55*
Delays	*2.4*	*1*		
Net Passenger benefits - Producer costs	**7.7**	**17.4**	**4.3**	**12.6**

1.1 NET PASSENGER BENEFITS – PRODUCER SURPLUS

Description Background: The **passenger benefits** from an additional runway are expected to result from lower fares, frequency benefits (i.e. more regular flights to where people want to go) and reduced delays. But as the majority of these benefits result from lower fares, this gain for the customer will be offset by a loss in **producer surplus** (i.e. the airlines' benefit from charging higher fares). However, because both passengers and airlines can benefit from a marginal expansion in capacity, as well as reduced delays, these figures sum to a positive net figure. Note that improvements in delay benefits are now bundled into the consumer and producer surplus figures rather than split out separately.

Changes to the Numbers: The DfT has updated the appraisal value of time and used as an input to the valuation of frequency benefits. But more importantly, passenger benefits have been updated with the latest data and forecasts from the UK aviation model[32].





Because of the higher demand forecasts for a potentially expanded Gatwick, and its extra capacity from operating in mixed mode (99 million passengers are forecast to use the airport by 2050, compared to 82 million under the AC's forecast), **the passenger benefit is now expected to be higher for Gatwick 2R than Heathrow NWR.** While the losses of producer surpluses (including both UK and non-UK airlines) are accordingly expected to be higher for both schemes, the **net benefit anticipated for each has been revised down by £3.4bn for Gatwick 2R and £4.8bn for Heathrow NWR**.

1.2 GOVERNMENT REVENUE

	The AC's economic analysis presented in 2015		The AC's economic analysis updated in 2017	
	Gatwick 2R	Heathrow NWR	Gatwick 2R	Heathrow NWR
Government Revenue	2.5	1.8	4.6	3.5

Description Background: The source of this government revenue relates to Air Passenger Duty (APD). An adjustment is made that subtracts a change in Value Added Tax (VAT) revenue "because additional passengers may be transferring their expenditure from goods and services which are subject to VAT to air fares".

Changes to the Numbers: The latest updated aviation data registers higher traffic at both Heathrow and Gatwick compared to what had originally been anticipated. Gatwick, in particular, is expected to cater for higher demand – and therefore higher APD – hence a £2.1bn increase in Government revenue expected for Gatwick 2R, versus a £1.7bn increase in Government revenue expected for Heathrow NWR.

1.3 WIDER ECONOMY IMPACT

	The AC's economic analysis presented in 2015		The AC's economic analysis updated in 2017	
	Gatwick 2R	Heathrow NWR	Gatwick 2R	Heathrow NWR
Wider Economic Benefits	8.1	11.5	0.1 to 1.3	1.8 to 3.1

Description Background: The AC adapted the DfT's WebTag calculation of 'Wider Economic Impacts' to include four elements in relation to additional airport capacity: **Agglomeration** (i.e. an increase in connectivity and lower generalised costs benefit businesses connected to the airport. More jobs will be created in these higher value areas close to the airport), including jobs explicitly created to service the airport capacity; **Increase in tax from productive labour** (i.e. as firms become more productive, higher wages generate government revenue from the increased income tax); **Increase in output in imperfectly competitive markets** (i.e. As some firms operate in an imperfectly competitive market, extra airport capacity may boost output. This effect is proxied by adding an additional 10% to the extra passenger surplus experienced by business passengers); **The increase in international trade** (i.e. Higher imports and exports is argued to cause a boost to productivity. The AC modelled business passenger flows vs international trade, and then modified up sector GVAs according to these relationships)[33]:

Assessment of Need (£millions)	Imports	Exports	Net agglomeration	Tax Wedge	Business Output Benefits	Total
GAL	1,108	5,193	580	148	1,108	8,136
HAL	1,269	6,070	1,666	1,102	1,360	11,466

Changes to the Numbers: A benefit of trade is not included in the DfT's WebTag analysis and the department chose to no longer include these numbers in its NPV calculation 'due to the risks of double-counting'[34]. This removes £7.3bn of benefit from Heathrow NWR NPV and £6.3bn of Gatwick 2R NPV. The DfT also chose to exclude the AC's estimates for net agglomeration – pointing to the possibility of a negative impact arising from congestion impact around the expanded airport. This removes a further £1.7bn from the NPV of Heathrow NWR and £0.6bn from Gatwick 2R.

The DfT estimation of the tax impact relies on its assertion that "changes in tax revenue occur from the redistribution of jobs across areas of the country that display different levels of productivity"[35]. It estimated a tax impact of -£1.1bn to £0.1bn for Gatwick 2R and £0.5 to £1.9bn for Heathrow NWR[36]. No change was made by the DfT to the methodology for calculating Business Output benefits, but the latest aviation data means that both Gatwick 2R and Heathrow NWR are now assumed to enjoy a £1.2bn Business Output Benefit. Combining these two figures (Tax Wedge range and Business Output numbers) generates a **total reduction in Wider Economic Benefit NPV for Gatwick 2R of £6.8 to £8.0bn and for Heathrow NWR of £8.4 to £9.7bn.**

1.4 ENVIRONMENTAL DISBENEFITS

Description background: The AC considered environmental disbenefits to include the negative effects of noise, air quality, carbon emissions, and biodiversity (assumed negligible).

Changes to the Numbers: The DfT has updated these numbers according to the latest aviation data and forecasts and its new methodologies (e.g. on air quality to include Defra's published new guidance allowing the direct effect of exposure to nitrogen dioxide to be quantified and monetised). The net effect of these changes **is to increase the NPV of the Gatwick 2R by £0.7bn and the Heathrow NWR by £1.1bn.**

	The AC's economic analysis presented in 2015		The AC's economic analysis updated in 2017	
	Gatwick 2R	Heathrow NWR	Gatwick 2R	Heathrow NWR
Noise	-0.4	-1.0	-0.2	-0.6
Air Quality	-0.2	-0.8	-0.1	-0.2
Carbon Emissions	-1	-0.9	-0.6	-0.8
Environmental Disbenefits	**-1.6**	**-2.7**	**-0.9**	**-1.6**

1.5 SCHEME COSTS AND SURFACE ACCESS COSTS

	The AC's economic analysis presented in 2015		The AC's economic analysis updated in 2017	
	Gatwick 2R	Heathrow NWR	Gatwick 2R	Heathrow NWR
Scheme Cost	Undiscounted -6.9	Undiscounted -15.3	-6.3 to 6.4	-12.9 to -14.9
Surface Access Cost	Undiscounted -0.8	Undiscounted -5.0	-0.6	-1.4 to -3.4
Scheme Cost + Surface Access	**-6.0**	**16.1**	**-6.9 to 7.0**	**-14.3 to -18.3**

Description Background: There are two main areas of capital costs associated with airport expansion: the capital expenditure required for completion of the new runways and terminals (referred to as"scheme costs"); and the capital expenditure required to ensure surface access capacity can meet the extra demand of passengers travelling to and from the expanded airport (referred to as "surface access costs"). It is expected that at least some of the latter will be paid for by the government, while the former will be paid for by the airport operators (recompensed through an increase in the aero-charges per passenger).

Changes to the Numbers: The DfT made'changes to the central case to better reflect the uncertainty around the scope of the schemes and surface access designs'[37] and'given that there is still considerable uncertainty around the precise designs that may be pursued in practice, at this stage it is appropriate to generate a range using the AC's two cost estimates for each scheme'[38].

APPENDIX 2: THE RANGE OF VALUE DESCRIPTORS BEING USED BY AC AND DFT TO EXPLAIN THE PROJECTS

		The AC's economic analysis presented in 2015		The DfT's updated analysis of the AC's economic case in 2017	
		Gatwick 2R	Heathrow NWR	Gatwick 2R	Heathrow NWR
Total benefits - environmental disbenefits high case surface access costs (or zero) →	Total Benefits	60.1	69.1	74.1 to 75.3	72.8 to 74.2
	Net Public Value	55.6	62.1	72.6 to 74.4	67.8 - 72.6
Consumer Surplus - Producer Surplus + Gov Rev - Delay →	Direct Economic Benefit	5.4	17.2	7.2	15.4
Total benefits (including wider economic benefit) - costs (ex project costs) →	Net Social Benefit	16.7	28.0	8.1 - 9.3	16.2 - 17.5
	Net Social Benefits	10.8	11.8	1.0 to 2.4	-2.2 to 3.3

Originally Heathrow NWR scored higher than Gatwick on every metric. ▶ Now Gatwick 2R scores higher for **Total Benefits** and **Net Public Value**.

Although Heathrow NWR **Direct Economic Benefit** and **Net Social Benefit** still score higher, Heathrow's higher project costs mean its **Net Present Value** is lower.

APPENDIX 3: THE DISCREDITED 'STRATEGIC CASE' £147BN HEATHROW NWR

The AC originally commissioned PwC to attempt an S-CGE benefit analysis for UK GDP from airport expansion. Even though in its final report the AC described these estimates as 'highly innovative' and under the advice of two of their expert panelists, they instead relied on a 'bottom-up' welfare approach (consistent with guidance outlined in DfT's WebTAG and the HM Treasury Green Book)[39], upon launch the first economic number in the press release was "up to £147 billion in GDP impacts over 60 years".[40]

The numbers generated by this S-CGE analysis did not even merit a single mention in the government's National Policy Statement.

Table 71: LHR NWR Present Value of real GDP impacts, by scenario (£bn, 2014 prices)

	Assessment of Need	Global Growth	Relative Decline of Europe	Low Cost is King	Global Fragmentation
Total	147.2	211.4	111.7	209.6	118.3

Source: PwC analysis

Table 95: LHR NWR Present Value of real GDP impacts by carbon emissions policy, Assessment of Need scenario (£bn, 2014 prices)

	Carbon traded emissions policy	Carbon capped emissions policy
Passenger Flows	36.4	34.8
Productivity	78.5	70.3
Frequency Benefits	7.7	6.9
TEE	24.6	16.8
Total	**147.2**	**128.9**

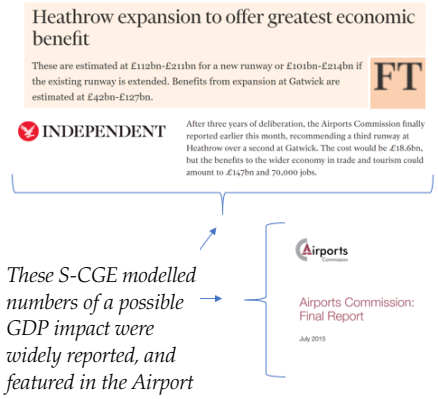
Table 11: LGW 2R Present Value of real GDP impacts, by scenario (£bn, 2014 prices)

	Assessment of Need	Global Growth	Relative Decline of Europe	Low Cost is King	Global Fragmentation
Total	89.0	114.7	62.8	127.4	41.7

Source: PwC analysis

Table 35: LGW 2R Present Value of real GDP impacts by carbon emissions policy, Assessment of Need scenario (£bn, 2014 prices)

	Carbon traded emissions policy	Carbon capped emissions policy
Passenger Flows	-2.1	-8.9
Productivity	61.4	34.3
Frequency Benefits	4.6	1.6
TEE	25.2	16.6
Total	**89.0**	**43.6**



These S-CGE modelled numbers of a possible GDP impact were widely reported, and featured in the Airport Commission's Final Report recommending Heathrow NWR. The Governments NPS

Of the four elements in the S-CGE analysis, **Frequency Benefits** and **Transport Economic Efficiency** metrics are already directly involved in the DfT's 'economic case', and there is little difference between Heathrow NWR and Gatwick 2R. The most important contributor to PwC's model – a Productivity Benefit – is also included within the 'Wider Economic Impacts' according to the latest methodology. Back in 2014, PwC appear to have used an econometric regression to causally link passenger number to economic activity such as exports.

But the significant original gap between Heathrow NWR and Gatwick 2R according to PwC's S-CGE analysis stemmed from **Passenger Flows** (this looks at the effect of spending in the UK from inbound traffic, versus the loss of spending due to UK resident outbound traffic). But this analysis is based on static numbers and metrics from 2011 (e.g. inbound vs outbound and differentials in traveller spending) as well as weakly evidenced multipliers. Given that the DfT is forecasting very similar levels of inbound-outbound traffic compared between this scheme and Heathrow, it can be expected this Passenger Flow effect for Gatwick 2R versus Heathrow NWR should now also be similar.

In any case, the DfT's review of the AC report was unequivocal on any use of these numbers, stating:"the Department does not recommend using these figures to inform a decision on preferred location"[41]. It appears from the subsequent press and political furore and the some of the evidence given in the current Transport Committee Inquiry that this advice has not always been followed.

ENDNOTES

1. These figures supersede the ones displayed in the Jan 2018 House of Commons Briefing Paper.
2. Note on the same BCR criteria, the HS2 project was classified as medium to high (1.9x - 2.3x). Modernising the Great Western Railway (including electrification) was downgraded by the NAO to a BCR of 1.6x [NAO Modernising the Great Western Railway 2016]. We attempted to contact DfT to see what transport projects had ever been sanctioned with a BCR <1x but they did not respond.
3. DfT 2016 Further Review and Sensitivities Report)ct 2016 [p36]
4. https://www.telegraph.co.uk/finance/newsbysector/transport/10562850/Heathrow-forced-to-cut-charges-by-CAA.html
5. PwC Cost and commercial viability funding and financing update Jul 2015 (page 41) https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/440179/cost-and-commercial-viability-funding-and-financing-update.pdf
6. See Q356: http://data.parliament.uk/writtenevidence/committeeevidence.svc/evidencedocument/transport-committee/airports-national-policy-statement/oral/77959.html
7. HM Treasury, The Green Book: Appraisal and Evaluation in Central Government [page 21] Note 4 *"All impacts (including costs and benefits, both direct and indirect) on non-UK residents and firms should be identified and quantified separately where it is reasonable to do so, and if such impacts might affect the conclusions of the appraisal"*.
8. DfT Review of the Airport Commission's Final Report Dec 2015 [p15]
9. At best, these passengers may be argued to have an indirect impact by creating density on routes that otherwise would not be flown (although given we are discussing surplus, there may only be small changes in behaviour at the margin). Further, any such positive effect may be more than offset by the reduced alternative of passengers *actually* travelling to, or from, the UK.
10. HM Treasury, The Green Book: Appraisal and Evaluation in Central Government [page 21, Note 4]
11. https://www.heathrow.com/file_source/Company/Static/PDF/Partnersandsuppliers/Heathrow-Airport-Limited-Airport-Charges-Decision-2018.pdf
12. DfT Further Review and Sensitivities Report Oct 2016 [p48]. We would urge the DfT to update these figures for 2017 Aviation data, and work each scenario through to NPV.
13. Revised Draft Airports National Policy Statement Oct 2017 [page 7] 'Under section 104 of the Planning Act 2008, the Secretary of State must decide any application in accordance with any relevant NPS unless he or she is satisfied that to do so would: Result in adverse impacts of the development outweighing its benefits'.
14. See **Appendix 2**, from DfT Updated Appraisal Report Airport Capacity in the South East Oct 2017
15. We use the lower bound of social benefit divided by the higher bound of costs for the bottom end of the ratio and the higher bound of social benefit divided by the lower bound of costs for the top.
16. DfT Updated Appraisal Report Airport Capacity in the South East, Oct 2017 [page 19]
17. DfT Updated Appraisal Report Airport Capacity in the South-East, Oct 2017 [page 18 and 19]
18. Membership and terms of reference of the Airports Commission 'The commission will examine the scale and timing of any requirement for additional capacity to maintain the UK's position as Europe's most important aviation hub'.
19. DfT Updated Appraisal Report Airport Capacity in the South East Oct 2017 [page 17]
20. DfT Updated Appraisal Report Airport Capacity in the South East Oct 2017 [page 16]
21. Ibid DfT 2017 (Table 3.7, Page 21)
22. See, for example, House of Commons Briefing Paper June 2017 Airport Slots
23. http://www.parliament.uk/documents/commons-committees/transport/Letter-from-Chris-Grayling-MP-to-Committee-Chair-re-Airports-NPS-revised-draft-23-2-2018.pdf
24. http://data.parliament.uk/writtenevidence/committeeevidence.svc/evidencedocument/transport-committee/airports-national-policy-statement/oral/77959.html see Q407.
25. DfT The air freight end-to-end journey May 2009 (page 8) with updated volume data displayed in York Aviation's 'Implications for the Air Freight Sector of Different Airport Capacity Options' (page 11)

26. DfT The air freight end-to-end journey May 2009 (page 6)
27. IAG 2016 Annual Report [p228] – cargo revenue per CTK
28. York Aviation's 'Implications for the Air Freight Sector of Different Airport Capacity Options' (page 26)
29. Airport Commission Final Report [p261]
30. DfT Review of the Airport Commission's Final Report Dec 2015 [page 15] – 'The methodology chosen by the Airports Commission to use the promoters' job multipliers is inherently subjective (since it relies on the promoters' own assessments); and this has not been applied consistently across the schemes. The estimates should be treated with caution and carry very low analytical assurance'.
31. DfT Updated Appraisal Report Airport Capacity in the South-East [page 29]
32. DfT updated-appraisal-report-airport-capacity-in-the-south-east – page 11
33. Airport Commission: Wider Economic Impact Assessment July 2015 [page 23]
34. DfT *Further-review-and-sensitivities-report-airport-capacity-in-the-south-east* [page 8] - These Trade 'benefits are closely related to business passenger benefits as well as wider economic benefits from increased agglomeration, and further review has suggested that these cannot be deemed as additive to one another'
35. DfT updated-appraisal-report-airport-capacity-in-the-south-east [page 26]
36. DfT updated-appraisal-report-airport-capacity-in-the-south-east [page 27] - 'This is partly because Heathrow's catchment area displays higher average levels of density and productivity compared to Gatwick's catchment area, and partly because there is a more significant relocation of jobs under the Heathrow expansion schemes'
37. further-review-and-sensitivities-report-airport-capacity-in-the-south-east [page 8]
38. further-review-and-sensitivities-report-airport-capacity-in-the-south-east [page 8]
39. Airport Commission Final Report [p114]
40. https://www.gov.uk/government/news/airports-commission-releases-final-report
41. DfT Review of the Airport Commission's Final Report Dec 2015 [p 14]

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