OXFORD ECONOMICS

The economic value of Night flights at Heathrow

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OXFORD ECONOMICS

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Executive Summary

Heathrow Night Quota Period (NQP) flights and Night period flights make a significant contribution to the economy...

- Our research shows that the operation of Night Quota Period[1] (NQP) flights at Heathrow directly contributed some £158 million in "value added" (GDP) in 2011, directly supported 3,200 jobs and generated £37 million in tax revenue (from income tax, national insurance contributions and air passenger duty) for the UK Exchequer, calculated on a conservative basis.
- In addition, the operation of NQP flights means that goods and services are purchased from other sectors of the economy through the supply chain to airlines and the airport. And workers employed as a result of NQP flight operations spend their earnings, which helps support other economic activity and jobs.
- When these "indirect" and "induced" impacts are taken into account, we estimate, conservatively, that the total economic impact of NQP flights across the UK (i.e. direct, indirect and induced) was some £342 million in value added in 2011, supporting 6,600 jobs and contributing £64 million in UK tax revenue.
- The same impacts can be calculated for flights during the Night period as a whole (2300 – 0700). The direct economic contribution of Night period flights in 2011 was over £543 million in value added (GDP), 6,800 jobs and £102 million in UK taxation. The total economic contribution across the UK as a whole was about £1.2 billion in value added, 18,700 jobs and £197 million in taxation – again calculated on a conservative basis.

…and contribute to the UK's long term economic prosperity

- Aviation services are a key part of the UK transport infrastructure, helping to facilitate long-term growth by providing access to international markets, supporting tourism, encouraging investment and helping to enhance UK productivity.
- Flights during the NQP/Night period contribute to all of these effects. 1.3% of annual UK business usage by air (business

[1] NQP is the Night Quota Period and applies to flights operating between 2330 and 0600. The "Night" period describes flights operating between 2300 and 0700.

passengers and air cargo) to, from and within the UK occurs during the NQP with 5.7% occurring during the Night period.

- Night flights are particularly important to the UK's ties with the fast growing markets of South East Asia, a fact which is further reinforced by the larger proportion of NQP flights which originate from the region.
- At present passengers in South East Asia can board flights in the late evening at their place of origin, arriving into Heathrow in the early morning UK-time. Conversely the banning of Night flights would result in a loss in "connectivity" between the UK and South East Asia which is likely to hurt UK business.
- Although only one Night express service operates from Heathrow, the airport handles over 60% of air cargo at all UK airports, mainly by carrying bellyhold freight on passenger services. Passenger services are mostly scheduled and by definition a significant proportion of air-freighted goods are time-sensitive. Thus it is reasonable to assume that many companies and individuals rely on overnight bellyhold freight in a similar way to dedicated express services.
- In addition, Heathrow is an important port for connecting bellyhold freight which uses the UK as a transit point. Such freight is reliant on the operation of NQP flights in order to ensure timely deliveries to destination nations.
- Past work by Eurocontrol for Europe as a whole indicates that if air transport usage increased by 10% then business investment will increase by 1.6% in the long run. This modelling found that air transport contributed just over one-third of the growth in European business investment over the decade to 2003.

A ban on NQP flights would reduce UK GDP by £178 million per annum, and jobs by 2,800

- A ban on flights during the NQP in 2011 would result in the direct loss of some £82.3 million per annum in value added, 1,000 jobs and 27 million in tax for the UK Exchequer.
- Taking into account indirect and induced effects, we estimate that a NQP ban would reduce UK value added (GDP) overall by about £178 million in 2011, with a net loss of 2,800 jobs across the entire economy and a reduction in UK tax revenue of £41 million. While these are effectively short term effects, due to factors such as displacement effects, longer term "catalytic" impacts would follow on from such a ban due to lost business connectivity and associated productivity losses. We estimate that such long term catalytic impacts would equate to an annual figure of £1.1 billion in lost GDP in 2021.

A ban on all Night flights would reduce UK GDP by £813 million per annum, and jobs by 11,900

- A ban on Night period flights in 2011 would directly reduce UK GDP by £372 million, cost 3,700 jobs and reduce UK taxation by £158 million. Total impacts amount to £813 million in lost GDP, 11,900 jobs forgone and £222 million in lost tax revenue. The economy would also suffer from lower productivity in the long-term due to reduced connectivity and infrastructure impacting on innovation, efficiency, investment and competition in UK firms. These "catalytic" effects would lead to an estimated annual loss of £6.2 billion in UK GDP by 2021.
- Note that these figures cannot be directly compared with the Cost Benefit Analysis (CBA) figures cited in Chapter 4 below. This due to the use of differing frameworks. The figures above use an impact analysis framework, with GDP and employment as measures. CBA uses the sum of producer and consumer surplus (Or economic welfare) as a measure.

Introducing a ban on Night flights would have additional wide-ranging negative economic impacts on the UK.

- A Government-imposed ban would mean that airlines who currently have rights to LHR slots would be dispossessed of them and their value. This would clearly be open to legal challenge, and/or claims for significant compensation
- In addition there could well be retaliation by foreign Governments in support of their national carriers against UK aviation or other interests if their carriers lose expensive slots in the type of slot confiscation that would be required in a Night ban.

Recent research by CE Delft examining the impact of a ban on Night quota period (NQP) flights at Heathrow cannot be relied on as a basis for policy analysis

- HACAN recently commissioned CE Delft to undertaken a cost-benefit analysis (CBA) of the impact of a ban on flights during Heathrow's Night Quota Period (NQP) from 2330 to 0600.
- The CE Delft report suggests that banning flights during the NQP would reduce noise costs by some £822 million over 10 years. While there would be some losses in profitability and inconvenience to passengers, the CE Delft report suggests that economic benefits would outweigh economic costs under a number of scenarios.
- However a review of the CE Delft report indicates that it has significant deficiencies.
- CE Delft's analysis of noise costs appears to have substantially overestimated their impacts. A simple correction, consistent with

CE Delft's own framework, produces a (generous maximum) noise cost figure of around **£500 million** in Net Present Value (NPV) terms rather than the £822 million claimed by CE Delft. (Note that this is not a formal Oxford Economics view on a noise cost figure. It is simply a correction for an apparent mistake in the CE Delft report.)

- **In addition** to this, the CE Delft report appears to have conflated Night Quota Period (NQP) noise with that of the entire Night period, potentially resulting in a much higher estimate of NQP noise than is warranted. Correcting for this would reduce noise costs **still further** (i.e. well below the adjusted figure of £500 million).
- The CE Delft report's assessment of producer surplus (profits before deduction of fixed costs) substantially underestimates the extent of losses in profitability in the event of a NQP ban. Based on a detailed analysis of the implications of a ban on Night flights for airline schedules these are in the order of £24.6 million per annum or £204 million on an NPV basis (as opposed to £0 to £67 million on an NPV basis, estimated by the CE Delft report).
- CE Delft's analysis has also underestimated losses to passengers (consumer surplus) due to its lack of a substantive analysis of changes in travel time and disproven assumptions about passenger arrival time preferences
- CE Delft's Scenario "R1" suggests that NQP flights to Heathrow can be rescheduled to arrive later in the day. CE Delft suggest that this imposes costs of £250 million in NPV terms, due to sub-optimal arrival times. However this appears to be an underestimate. A recalculation of lost passenger benefits, due to later scheduling of flights, using CE Delft's framework, implies costs in the order of **£758 million** in NPV terms**.**
- A re-assessment of CE Delft's Scenario R1 (for indicative purposes only) using only revised values for noise and arrival time preference suggests that the benefits of removing NQP flights will be smaller than the costs of doing so. Specifically, the ratio of the benefits divided by the costs (the **Benefit-Cost Ratio** or BCR) is **0.66 -** i.e. the benefits of a NQP ban are clearly outweighed by its costs. This is not a formal Oxford Economics view of what the appropriate BCR for the NQP ban should be. It is simply intended to illustrate the impact of correcting for two measures used by the CE Delft report.
- As a consequence of these (and other) significant methodological issues the CE Delft report cannot be used as a guide to practical policy analysis

1 Introduction

British Airways (BA) and BAA Limited have requested that Oxford Economics and MPD Consulting undertake an economic analysis of flights during Heathrow's Night Quota Period (NQP) and of flights during the Night period at Heathrow more generally. The NQP relates to the hours between 2330 and 0600 while the "Night period" relates to the hours 2300 to 0700.

The impacts of flights during the NQP, and the Night period more generally, have been the subject of public discussion and debate for several years. Recently the Heathrow Association for the Control of Aircraft Noise (HACAN) commissioned CE Delft, a consultancy, to undertake a cost-benefit analysis (CBA) into a potential ban on flights during the NQP. CE Delft produced a report on this issue: *Ban on Night flights at Heathrow Airport: A quick scan Social Cost Benefit Analysis* ("the CE Delft report") in January 2011. The CE Delft report examined a number of potential scenarios (named R1, R2 and R3) involving a ban on flights during the NQP at Heathrow. In particular, it suggested that banning such flights could reduce noise costs (principally sleep disturbance) by some £822 million, spread over a ten year period.

This report details some of the UK economy-wide economic benefits of flights during the NQP as well as the economic benefits of flights during the Night period in general. It also examines some of the economic impacts of a ban on flights during the NQP and of Night flights. It then goes on to undertake a close analysis of the CE Delft report CBA.

This report is structured as follows:

- Chapter 2 details the direct, indirect, induced and catalytic impacts that flights in the NQP and Night flights in general have on the UK economy.
- Chapter 3 models the impacts of a ban on flights during the NQP and during the Night period. This modelling includes allowance for direct, indirect, induced and catalytic impacts.
- Chapter 4 provides a close examination of the CE Delft report Cost Benefit Analysis (CBA), supplemented by a further technical analysis in Appendix 7.
- Appendix 1 reviews the operational nature of NQP and Night flights at Heathrow
- Appendix 2 provides more details on the estimation of direct employment effects.
- Appendix 3 discusses the estimation of the direct value added impacts of NQP/Night flights as they currently operate
- Appendix 4 examines the direct economic impacts in the event of a ban.
- Appendix 5 provides a graphical illustration of Night slots at Gatwick
- Appendix 6 provides graphical illustration of capacity restrictions at Heathrow

- Appendix 7 provides a more detailed review of the CE Delft report's cost-benefit methodology.
- Appendix 8 examines the viability of the CE Delft modelled scenarios

2 Current economic value of Night flights at Heathrow

Box 2.1: Key points

- Some 14 to 19 flights per day (depending on the season) operate at Heathrow during the NQP These are mainly long haul flights with up to two thirds connecting the UK with South East Asia and the remainder connecting the UK with points such as the Middle East, Africa and the United States.
- Our research shows that the operation of NQP flights at Heathrow directly contributed some £158 million in "value added" (GDP) in 2011, directly supported 3,200 jobs and generated £37 million in tax revenue (from income tax, National Insurance Contributions and Air Passenger Duty) for the UK Exchequer– taking a conservative approach.
- In addition, the operation of NQP flights means that goods and services are purchased from other sectors of the economy through the supply chain to airlines and the airport. And workers employed as a result of NQP flight operations spend their earnings, which helps support other economic activity and jobs.
- When these "indirect" and "induced" impacts are taken into account, we estimate that on a conservative basis the total economic impact of NQP flights across the UK (i.e. direct, indirect and induced) were some £342 million in value added in 2011, supporting 6,600 jobs and generating £64 million in UK tax revenue.
- The same impacts can be calculated for flights during the Night period as a whole (2300 – 0700). The direct economic contribution of Night period flights in 2011 was over £543 million in value added (GDP), 6,800 jobs and £102 million in UK tax revenue. The total economic contribution across the UK as a whole was about £1.2 billion in value added, 18,700 jobs and £197 million in taxation - again on a conservative basis.
- Aviation services are a key part of the UK transport infrastructure, helping to facilitate long-term growth by providing access to international markets, supporting tourism, encouraging investment and helping to enhance UK productivity. Flights during the NQP/Night period contribute to all of these effects.
- Night flights are particularly important to the UK's ties with the fast growing markets of South East Asia a fact which is further reinforced by the larger proportion of NQP flights which originate from the region. At present passengers in South East Asia can board flights in the late evening at their place of origin, arriving into Heathrow in the early morning UK-time. Conversely the banning of Night flights would result in a loss in "connectivity" between the UK and South East Asia which is likely to hurt UK business.
- Flights during the NQP/Night period contribute to all of these effects. 1.3% of annual business usage by air (business passengers and air cargo) to, from and within the UK occurs during the NQP with 5.7% occurring during the Night period.
- Although Night express services do not operate from Heathrow, the airport handles over 60% of air cargo at all UK airports, mainly by carrying bellyhold freight on passenger services. Passenger services are mostly scheduled and by definition a

significant proportion of air-freighted goods are time-sensitive, so that many companies and individuals rely on overnight bellyhold freight in a similar way to dedicated express services.

- In addition, Heathrow is an important port for connecting bellyhold freight which uses the UK as a transit point. Such freight is reliant on the operation of NQP flights in order to ensure timely deliveries to destination nations.
- Heathrow is also an important tourism hub. As the world's largest international hub it handled 8.5 million overseas visits in 2010. Around 5% of these arrived during the NQP with 15% arriving during the entire Night period.

This section of the report details the direct, indirect, induced and catalytic impacts of the operation of NQP flights (and Night flights in general). This provides a broad indication of some of the value of NQP/Night flights to the UK economy.

2.1 Direct benefits of Night flights

2.1.1 Approach

We have employed a 'bottom up' approach to the modelling and evaluation involved in calculating the direct benefit of Night flights (and the impact of banning such flights).

BAA provided us with a flight-by-flight listing of all flights which actually landed or took off during the Night period (23:00 to 07:00) or which were scheduled to arrive or depart between 22:00 and 08:00, for the 52-week period 1st July 2010 to 30th June 2011. The listing included data on the carrier, actual time of runway landing/take off, scheduled time of arrival/departure from stand, airport of origin/destination of the flight, and passenger and cargo loads. A detailed analysis of the BAA traffic data will be found in Appendix 1 but we note here that the information revealed that some 14 to 19 flights per day (depending on the season) operate at Heathrow during the NQP.

We married up this database with CAA IPS survey data on passengers at Heathrow, by airport origin/destination, showing proportions of passengers terminating or transferring, stratified by UK/non UK residents, and business/leisure journey purpose.

Our employment metrics were sourced from BAA employer survey data (methodology is described in Appendix 2), while value added metrics were based partly on CAA financial statistics for the airline element, and partly on Office of National Statistics data for the other airport inputs (methodology is fully described in Appendix 3). In the absence of fully comprehensive data for 2010/11, the datum for calculation has had to be based on activity in an earlier year but uprated to 2011 prices and activity. The earlier year of 2007 has been chosen as the basis for the economic contribution, as it represents the most 'normal' period in air transport in the recent past, before the global economic downturn and other events temporarily affected activity at Heathrow[2].

We have calculated the employment and value added impacts of each flight dependent on type of carrier, origin/destination of the flight, and the characteristics of passengers carried on the flight.

The result is that each flight in BAA's comprehensive database of Night flights is tagged with measures of economic value, which are grossed up to construct estimates of total economic value generated by flights in the NQP and whole Night period.

This comprehensive source of data was also used to explore the impact of any further changes in the restrictions as envisaged under Scenarios 1 and 2.

The direct tax contribution of Night flights to the UK Exchequer has also been estimated. Taxation has been divided into two categories: Air Passenger Duty (APD) and non-APD taxation. Night flights' contribution to APD has been derived from the estimated number of passenger departures liable in each APD band (taking into consideration the rules and exemptions for connecting passengers[3]). Non-APD taxation captures income tax and National Insurance Contributions (NIC) from the direct employment and corporation tax paid by airlines, the airport operator and other companies present at Heathrow attributable to Night flight activity[4].

2.1.2 Results

Table 2.1 reports direct employment and value added at Heathrow attributable to NQP and Night period flights in 2010/2011. The direct benefits include the activity flowing from the preceding/subsequent leg of transfer passengers who depart/arrive during the relevant Night period. For example it includes activity

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[2] Activity at Heathrow in 2008 and 2009 was significantly affected by the financial crisis and the ensuing global economic downturn, while activity in 2010 was severely disrupted by the unprecedented airspace closures due to volcanic ash in April.

[3] A description of the methodology used will be found in Appendix 3.

[4] Income and NIC estimates are based on average tax rates for non-retired households from the ONS' "Effects of taxes and benefits on household income 2009/10". Applying average household income tax rates may be considered a conservative assumption as earnings in the aviation industry is likely to be higher than the economy average (According to provisional 2011 ONS estimates from the Annual Survey of Hours and Earnings employees in air transport services (i.e. airlines) and air transport support activities (i.e. terminal, air traffic control employees) earned just over 20% more than the average UK worker.) Hence this study may underestimate the tax contribution of Night flights. Corporation tax estimates are derived by estimating Gross Operating Surplus (i.e. profits) from value added, allowing for capital depreciation write-offs, and then applying the appropriate corporation tax rate.

from the day leg of transfer passengers who arrive during the Night, as a flight on this day leg is dependent on the arriving Night flight.

Direct employment at Heathrow attributable to NQP flights amounts to 3,200 employees, with an associated direct value added of £158 million. Tax revenues accruing from income tax and NIC payments by direct employees and corporation tax paid by firms at Heathrow are estimated £26 million. Finally, APD revenue from Heathrow NQP flights equalled an estimated £11 million, meaning the total contribution to the UK Exchequer of NQP is around £37 million.

Considering the entire Night period, employment totalled just under 6,800 employees with activity generating £543 million in direct value added. Income tax, NIC and corporation tax payments attributable to Night period activity were an estimated £64 million. In terms of APD, Night period flights generated an estimated £38 million for the UK Exchequer[5]. Thus total direct tax revenues dependent on Night period flights is an estimated £102 million.

However, in calculating the positive contribution of existing Night flights we have not included any additional benefit other than for the traffic actually carried on these Night flights, including its onward travel on connecting flights. Thus we have been conservative in strictly defining the dependency of the benefit upon the traffic actually arriving at or departing from Heathrow at Night.

It could be argued that some passengers, particularly overseas residents arriving at Heathrow on Night flights in order to transfer onto connecting flights, only choose to fly via LHR and the UK because of the timing of the Night flight with its subsequent convenient connection. Otherwise they might choose to fly via another hub airport in Europe. The benefit they bring is not only the value on the inbound flight, but also their return segment, since most passengers buy return tickets with the same routing. Theoretically, if that were true of all arriving transfer passengers, the direct economic benefit might be up to 30% greater than we have calculated above. However, strict definition of Night flight dependency requires that the transfer (or terminating) passenger boarding a daytime departing flight would be doing so only because its arriving reciprocal flight arrived at night, for the benefit of that departure to be taken into account. As we have no detailed or firm evidence of the exact extent of consumer preference or motivation in this regard, we have not made any allowance for such benefits.

It may also be argued that the reciprocal return journeys of other terminating passengers from Night arrivals should also be regarded as Night flight dependant (e.g. where the Night flight is the only arrival of the day on that route, or the carrier is based overseas and must use a Night-arriving aeroplane to operate outbound). Clearly this would be a particularly difficult argument to sustain, for instance, in the case of passengers (especially UK residents) travelling to and from Heathrow by surface, leaving on a convenient daytime long haul flight of which the reciprocal happened to arrive there at Night – Night

[5] A description of the methodology used will be found in Appendix 3

flight dependency is not proven and indeed might well be unlikely. Again, without objective evidence, we have taken the conservative view not to make any further allowance for reciprocals in calculating the positive economic benefits of Night flights.

This conservative view of Night flight dependency operates just as strictly in the negative scenario, when flights can not operate at Night, but to the opposite effect - if Night flight traffic is lost, be it transfer, or terminating, it is by definition also lost not only from connecting flights but also from the reciprocal flight.

Further details on the calculation of direct employment and value added estimates are provided in Appendices 2 and 3 respectively.

Table 2.1: Direct benefits of Heathrow Night flights, 2011

	Employment (000s)	Value added (£ millions, 2011 prices)	Tax revenue, non- APD (£ millions, 2011 prices)	Air Passenger Duty (£ millions, 2011 prices)
Night quota period	3.2	158	26	11
Night period	6.8	543	64	38

Source: Oxford Economics and MPD calculations

2.2 Indirect and induced benefits of Night flights

The previous section detailed the economic impacts to the UK of NQP flights (and, more broadly, Night flights) at Heathrow by looking at activity within the airport itself. These are the direct benefits of Heathrow NQP/Night flights measured in terms of employment, and GDP[6] and taxation. In addition, NQP/Night flights also support activity in the wider UK economy through indirect (supply chain) and induced (consumer spending) effects.

Indirect benefits consist of employment and GDP generated in the supply-chain by Heathrow NQP flights and Night flights. Airlines, airport operators and other companies who make up direct employment and GDP at Heathrow purchase goods and services from suppliers in the wider UK economy. This supports activity in these suppliers. Further knock-on effects occur as these suppliers themselves purchase goods and services required in their production process. Examples of supply-chain purchases dependent on Heathrow activity include IT/financial services by the airport operator, aircraft parts/equipment by airlines and raw materials by maintenance contractors located at the airport. The key point is that as NQP/Night flights support direct employment and GDP at Heathrow (in airlines, the airport operator, retail outlets and other companies

[6] This report refers to "GDP" and "Gross Value Added" (GVA) interchangeably. Technically, the values reported relate to GVA. GDP per se is (modestly) different to GVA. Technically, GDP at market prices = GVA at basic prices plus taxes on products less subsidies on products

located at the airport), they must also support the supply-chain purchases of activity at Heathrow.

Induced benefits are activity supported by the spending of those directly or indirectly employed by NQP/Night flights at Heathrow. This household spending helps to support jobs and activity in the industries that provide these goods and services, and includes jobs in companies producing consumer goods and a range of service sector industries.

The analysis of indirect effects in this report updates previous work done by Oxford Economics on Heathrow[7], making use of the recently published UK input-output tables for 2005 by the Office of National Statistics (ONS). The results in this study are similar to the multipliers estimated in the previous Oxford Economics report.

Input-output tables report estimates of purchases made by each industry from every other industry in the economy, and the value of household (consumer) spending on each industry. Given our estimates of the direct impact of Heathrow NQP/Night flights by company type (i.e. airlines, airport operators, retail etc) it is possible to trace the impact of purchases through the UK supply chain[8]. The scale of induced impacts are based on simulations of such effects using Oxford Economics' macroeconomic model of the UK economy. The results showed that induced effects are typically equal to 25% of the combined direct and indirect impact.

2.2.1 Indirect and induced benefits of Night quota flights

Chart 2.1 reports the direct, indirect and induced benefits of Night quota flights at Heathrow in terms of employment and value added. 2,000 indirect jobs are dependent on Heathrow NQP flights, with a further 1,400 jobs supported through induced effects. Including direct NQP flights employment at Heathrow of 3,200 employees, a total of 6,600 jobs in the UK economy are dependent on NQP flights. This means each direct job due to Heathrow NQP flights generates an additional 0.65 jobs in the UK economy through the supply-chain i.e. an indirect employment multiplier of 1.65. Accounting for induced impacts, the employment multiplier increases to 2.09.

Activity directly related to NQP flights at Heathrow supported GVA of £116 million in the wider UK economy through indirect effects and a further £68 million in induced benefits in 2011. Combined with direct GVA of £158 million this gives a total economic benefit of £342 million in GVA for the UK economy. Thus, the indirect GVA multiplier is 1.73 - every £1 million of direct GVA generates a

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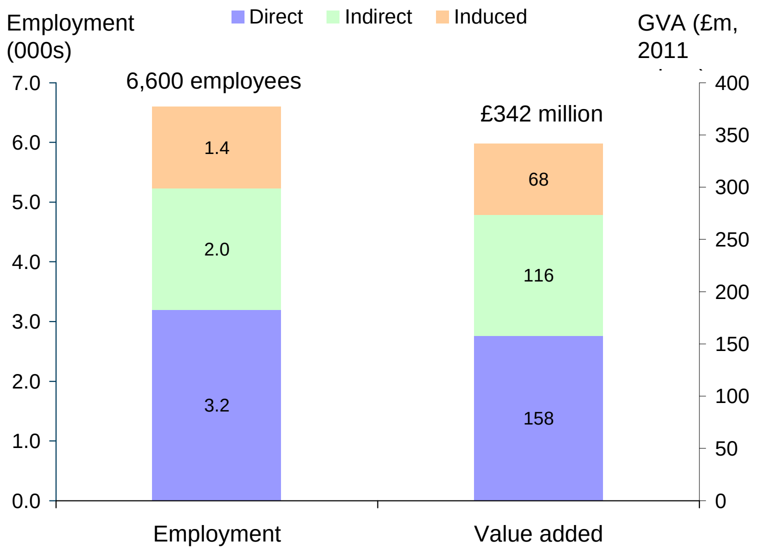
[7] *The Economic Contribution of the Aviation in the UK*, Oxford Economics (2006).

[8] In the input-output analysis we have made adjustments to ensure there is no double-counting of supply-chain effects from airport activity. For example, payments to the airport operator (BAA) form part of airlines' supply-chain. So if one were to estimate indirect impacts for airlines and then separately for the airport operator, aggregating the two results would double-count the contribution of the airport operator.

further £0.73 million of indirect GVA in the wider UK economy. The GVA multiplier goes up to 2.16 once induced effects are taken into consideration.

Chart 2.1: Direct, indirect and induced benefits of Heathrow NQP flights, 2011



Source: Oxford Economics and MPD

Table 2.2 reports the total tax contribution of NQP flights accounting for direct and multiplier impacts. Indirect and induced non-APD revenues are the income tax, NIC and corporation tax payments dependent on indirect/induced employment and value-added. Including these elements raises non-APD tax revenues to £54 million. There are no further benefits from APD as the direct figure already captures all departures in the NQP. Thus, the total contribution of NQP flights to the UK Exchequer is an estimated £64 million.

Table 2.2: Direct, indirect and induced tax revenues from Heathrow NQP flights, 2011

	Tax revenue (non-APD, £ millions, 2011 prices)	Air Passenger Duty (£ millions, 2011 prices)	All tax revenue (£ millions, 2011 prices)
Direct	26	11	36
Indirect	18	NA	18
Induced	10	NA	10
Total	**54**	**11**	**64**

Source: Oxford Economics and MPD calculations

2.2.2 Indirect and induced benefits of Night flights

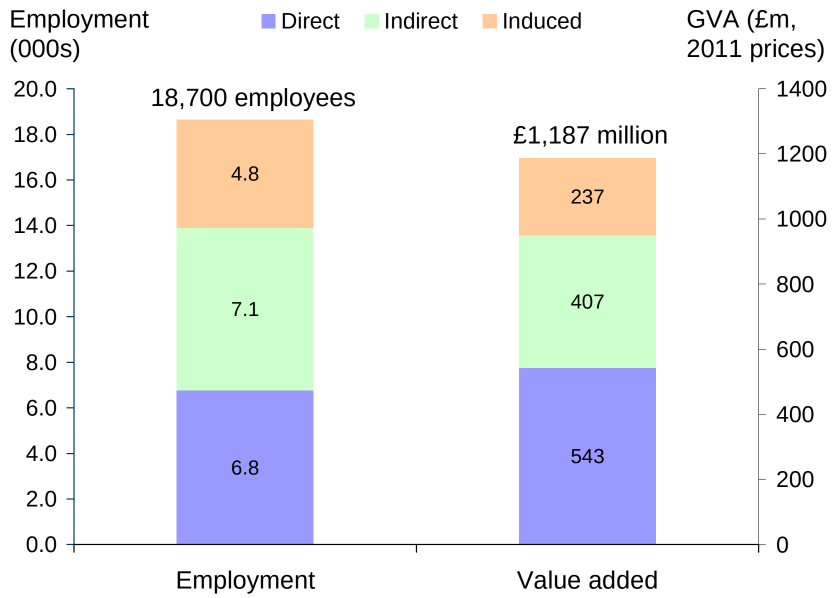
The direct, indirect and induced benefits of Night flights (i.e. the entire period 2300-0700 encompassing NQP flights and “shoulder” period flights) at Heathrow are summarised in Chart 2.2 and Table 2.3 Heathrow Night flights support an estimated 7,100 indirect jobs in the UK supply-chain and a further 4,800 jobs through induced effects. With direct employment of 6,800 this means a total of 18,700 UK jobs are dependent on Night flights. Each direct job due to Heathrow

Night period flights leads to an additional 1.08 indirect jobs in the UK economy, equivalent to an indirect employment multiplier of 2.08. Together with consumer spending (induced effects) the employment multiplier increases to 2.79.

Indirect and induced benefits of Night flights are an estimated £407 million and £237 million respectively. With direct GVA at £543 million the total economic impact is equal to £1,187 million in GVA for the UK economy. This implies an indirect GVA multiplier of 1.75 - every £1 million of direct GVA generates a further £0.75 million of indirect GVA in the UK economy – and a multiplier of 2.19 once induced effects are included.

From Table 2.3 it can be seen that contributions of income tax, NIC and corporation tax resulting from indirect and induced activity are £61 million and £34 million respectively. The gives a total non-APD contribution to the UK Exchequer of £158 million. Including the £38 million of APD revenue dependent on Night flight departures means a total of £197 million in tax revenue comes from activity during the Night period.

Chart 2.2: Direct, indirect and induced benefits of Heathrow Night period flights, 2011



Source: Oxford Economics and MPD

Table 2.3: Direct, indirect and induced tax revenues from Heathrow Night period flights, 2011

	Tax revenue (non-APD, £ millions, 2011 prices)	Air Passenger Duty (£ millions, 2011 prices)	All tax revenue (£ millions, 2011 prices)
Direct	64	38	102
Indirect	61	-	
Induced	34	-	
Total	**158**	**38**	**197**

Source: Oxford Economics calculations

It should be noted that the assessment of direct, indirect, and induced impacts is based on an economic impact framework. This uses value added (GDP) as a metric. Likewise the assessment of catalytic impacts below also uses GDP as a metric.

An alternative way of measuring economic effects is through economic welfare measures. An economic welfare approach is typically used in connection with methods such as cost-benefit analysis (CBA). As discussed in Chapter 4 and Appendix 7, CBA explores changes in producer surplus and consumer surplus connected with a project or initiative. Consumer surplus, in particular, is a measure that does not enter into calculations of GDP. Consequently the figures in the table above (and the discussion of catalytic benefits below) cannot be directly compared to those discussed in relation to the CE Delft report's CBA in Chapter 4.

2.3 Catalytic benefits

The previous sections discussed the direct, indirect and induced contribution of NQP/Night flights. However, by far the most important contribution of aviation to the UK economy is through the way it facilitates activity in other sectors of the economy. The air transport network forms a fundamental part of the infrastructure of the country, connecting UK regions together and the UK with the rest of the world in a way not possible with any other mode of transportation. As such aviation boosts the UK economy by enabling and acting as a spur to trade, business investment, tourism and productive capacity. These "catalytic" impacts provide long-run benefits for the UK economy as detailed in the following sections.

Catalytic benefits can be categorised into four inter-related areas which can benefit the UK economy:

1. Opening up markets and fostering **international trade**;
2. Encouraging **investment** in the UK by domestic and foreign investors;
3. Improving business **efficiency** and raising **productivity**.
4. Spurring growth in the **tourism** economy;

There are particular unique features or advantages of Night flights which cannot be obtained from daytime flights. For example, Heathrow Night flights are particularly valuable for business travellers travelling to the UK from South East Asia. This means that Night flights' catalytic impact are likely to be larger than just their share of total aviation activity - this is discussed below in the sections detailing the four areas of catalytic benefits.

2.3.1 International trade

2.3.1.1 Trade growth mechanisms

International trade allows countries to specialise in producing the goods and services in which they have a comparative advantage. Trade of each others' goods and services then means the value and level of goods and services available to every country can be increased.

Aviation plays a significant role in the processes by which trade raises growth and living standards. Cargo is the most obvious aspect of this role, but aviation's influence on competition, learning, adoption of new techniques and interaction, all contribute to the process.

Air transport stimulates and enables trade through the following mechanisms:

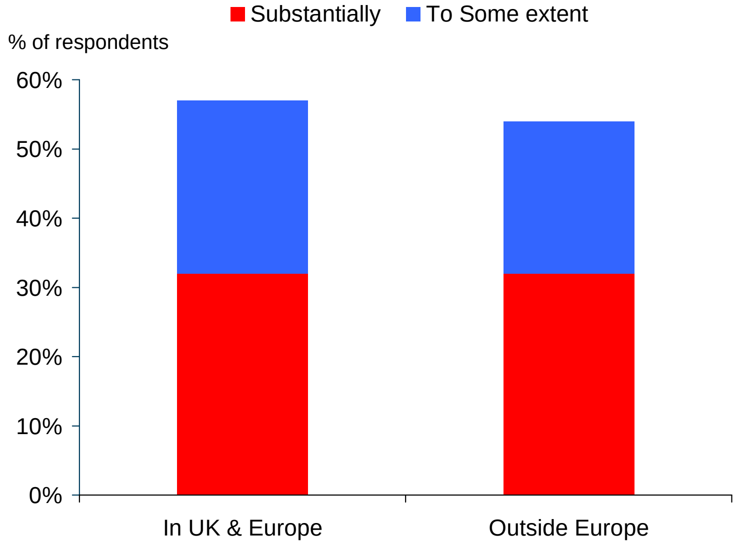
1. **Aviation plays a key role in underpinning activity in the UK export and import markets** by opening international markets to suppliers for whom alternative means of transport are not a viable option. Overall, air transport accounts for 30% of UK exports outside the EU by value, and 23% of imports[9]. Aviation is more cost-effective than other forms of transport for the movement of high-value, low-weight products such as electronic components. In addition perishable commodities (such as fresh food and cut flowers) would not survive long shipping times. A variety of industries are now characterised by elaborate global production networks and a need for timely deliveries, with key export sectors relying heavily on a foreign supply chain.

2. Access to wider markets offers companies the opportunity to benefit from **economies of scale** and thereby lower the price of their goods and services. Moreover, by opening up markets to international competition, air transport encourages **innovation** and firms within countries to **specialise** in the production of goods and services in which they have an advantage, either through labour or capital costs or the availability of natural resources. Increased specialisation is one of the factors that have driven long-term growth across the world.

   Nearly two-thirds of companies (65%) in a survey conducted by Oxford Economics reported that passenger services are either vital or very important for sales and marketing and a very similar proportion (64%) report that passenger services are either vital or very important for servicing or meeting customers. Looking at it another way, more than half of companies confirm that the availability of frequent air services to/from the UK means that they serve a bigger market (Chart 2.3).

[9] Figures are for 2010 from Eurostat.

Chart 2.3: Availability of frequent air services to/from UK on ability to serve a bigger market



Source: Oxford Economics survey of UK companies (2006)

3. Aviation in particular facilitates trade by enabling the **express industry** to provide fast, frequent and highly reliable delivery services worldwide. The express industry is able to offer delivery from UK to countries representing 90% of the world's GDP in 24-48 hours. Express delivery is also critical to 'just-in-time' production requiring rapid and reliable delivery of parts at the various stages and locations of the production process. With its elimination of excess storage and transport costs, it has enabled many sectors to achieve considerable efficiency gains, and trade in more time-sensitive goods has grown more rapidly than trade in other goods.

   While there is only one dedicated express flight at Heathrow, the airport does play an important role in supporting time-sensitive bellyhold freight and it is reasonable to assume that many companies and individuals rely on overnight bellyhold freight in a manner analogous to dedicated express services.

4. Air transport **encourages international business ties** by linking firms to potential customers and suppliers. For instance, a survey[10] of City of London companies found that almost three quarters of companies reported air services were "critical" or "very important" for meeting clients and service providers (Table 2.4). The fostering of business ties boosts both trade in physical goods and services such as those provided by the financial and telecommunications sectors.

[10] York Aviation, Aviation Services and the City, 2008.

Table 2.4: Importance of air transport to business

Importance of air transport to business					
	How important would you say air services are to your organisation?				
	Critical	Very important	Quite important	Not important	Don't know
…for staff business travel for internal company purposes?	30%	34%	18%	18%	-
… for staff business travel for meeting clients/service providers?	43%	30%	18%	7%	2%
… for staff business travel for other purposes?	9%	25%	34%	30%	2%
… for delivery of air freight?	7%	18%	9%	59%	5%
…for sending/receiving express delivery packages/documents?	23%	30%	23%	23%	2%

Source: "Aviation Services and the City", York Aviation 2008

2.3.1.2 Importance of Heathrow Night flights to business

Night slots are important to long-haul flights arriving at Heathrow, particularly from South East Asia. Flights from South East Asia make up one-third to two-thirds of flights during the NQP. At present passengers in South East Asia can board flights in the late evening at their place of origin, arriving into Heathrow in the early morning UK-time. This allows passengers whose final destination is somewhere in the UK to make their onward journey and arrive at their final destination the same morning. NQP flights in particular allow business passengers to travel to many regional centres within the UK or Northern Europe. If flights were to be re-scheduled to arrive at Heathrow outside the NQP this could mean either a departure time in the late afternoon or the few hours after midnight in the originating country. This may not be feasible for airlines without significant knock-on effects.

For example existing day-time flights at Heathrow would have to be cancelled as there are a limited number of slots, or alternatively flights may have to be re-directed to another airport (e.g. Gatwick). As a result it is likely that some flights will be cancelled as it is simply not feasible, from a business perspective, to re-direct or reschedule them. These issues are discussed in more detail in Chapter 3, which examines the responses of airlines to a NQP ban.

Moreover the later/earlier arrival time at Heathrow may not be as convenient, particularly for business travellers. This loss in "connectivity" between the UK and South East Asia is likely to hurt UK business (Table 2.4). The potential loss to UK growth will be particularly significant as emerging markets in South East Asia will play an increasingly important role in global economy in the future.

2.3.1.3 Importance of Heathrow Night flights to goods trade

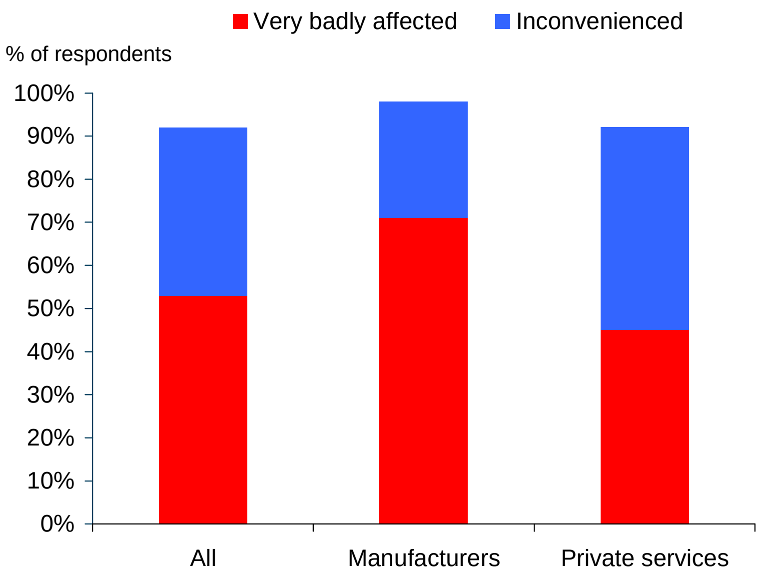
With respect to trade in goods, some 1.58 million tonnes of freight passed through Heathrow in 2010, equivalent to 67% of all air freight handled at UK airports[11]. This is despite the virtual absence of dedicated freight flights at Heathrow – almost all the freight that passes through Heathrow is carried in the holds of passenger flights. The use of bellyhold for carrying freight is vital for the efficiency of air freight operations, underlining the dependence of freight on

[11] Source: CAA

passenger services. Overall, Night period flights account for around 14.1% of total freight at Heathrow by volume, with NQP flights accounting for 3.2%.

Night flights are crucial to operations in the express industry. In many cases the only way to achieve the next-day delivery schedule that companies require to meet their production and delivery commitments is by the operation of aircraft at Night. A survey of companies by Oxford Economics found that over half would be "very badly affected" by the loss of next-day international express deliveries, which are dependent on air services (Chart 2.4). Although express services do not operate from Heathrow, the airport handles over 60% of air cargo at all UK airports, mainly by carrying bellyhold freight on passenger services. Passenger services are mostly scheduled and by definition a significant proportion of air-freighted goods are time-sensitive. Thus it is reasonable to assume that many companies and individuals rely on overnight bellyhold freight in a similar way to dedicated express services.

Chart 2.4: Impact of loss of next-day international express services



Source: Oxford Economics survey of UK companies (2006)

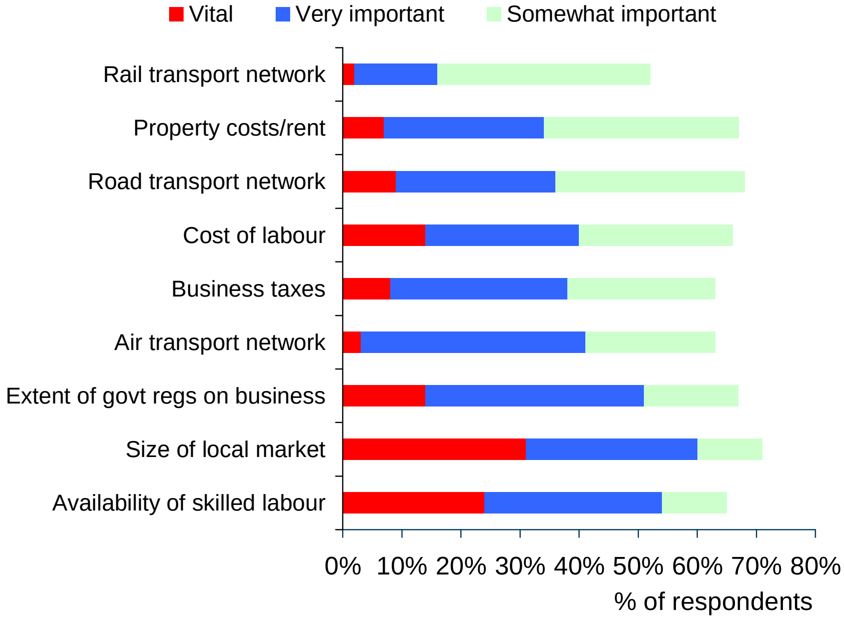
2.3.2 Investment in the UK

2.3.2.1 General issues

Air transport fosters investment by both domestic firms and foreign direct investors, by providing accessibility to national and international customer and supplier markets for firms. As a result the availability of air services is a key determinant of business location on the one hand, and investment decisions of firms already located in a particular area on the other. Moreover, by increasing the potential customer-base of existing firms and encouraging innovation and competition across/within countries, air transport can raise productivity and efficiency, which in turn stimulates greater investment in the region.

The European Cities Monitor survey of companies across Europe consistently shows that transport links with other cities and internationally are one of the most important factors firms consider when deciding where to locate their business. The latest 2010 survey[12] found that 51% of companies considered transport links to be absolutely essential in business location decisions. Similarly, an Oxford Economics' survey of UK companies showed that the air transport network is rated as vital or very important by more than 40% of companies in determining the country in which to invest (Chart 2.5).

Chart 2.5: Importance of factors in determining the country in which organisation chooses to invest



Source: Oxford Economics survey of UK companies (2006)

A survey of over 600 companies in five countries[13] (IATA, 2006) found that 63% of firms stated air transport networks are 'vital' or 'very important' to investment decisions, while 30% of firms stated they would be highly likely to invest less in a region if air networks were constrained. Investment by the high-tech sector was found to be particularly sensitive to the quality of air transport networks, consistent with the importance of air freight for this sector.

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[12] "European Cities Monitor 2010" conducted by Cushman & Wakefield.

[13] IATA Economics Briefing No.3, 2006. The five countries comprised Chile, China, the Czech Republic, France and the US.

A EUROCONTROL[14] study covering 24 European countries for 10 years up to 2003 looked for correlations between air transport usage and business investment, controlling for the effects of other key drivers. As in most models of business investment, the results showed that business investment is driven in large part by the relationship between the cost of capital and the return on capital. But the research also included air transport usage among the long-run drivers of business investment. The results implied that if air transport usage increases by 10% then business investment will tend to increase by 1.6% in the long run. For Europe as a whole, air transport usage increased by 5.1% a year over the decade to 2003, compared with an increase of around 2% a year in GDP over the same period. Translating the relatively fast growth of air transport usage, it was found that air transport usage contributed just under one-third of the growth in European business investment over the last decade. Average annual growth in business investment was 0.6% points higher over the last decade than it would have been had air transport usage grown no faster than GDP.

2.3.2.2 Importance of Heathrow Night flights for investment benefits

As explained above Heathrow Night flights contribute to boosting business ties with South East Asia, as it provides optimal arrival times for those travelling on business from that region. Given evidence of the importance of face-to-face meetings for international business ties (Table 2.4), the loss in "connectivity" as a result of a Night flights ban would have a potentially negative impact on future investment opportunities for UK business. Given that emerging markets in South East Asia will be a key source of global economic growth in the medium to long-term, and the number of NQP flights from South East Asia, the loss to the UK would be even more significant.

2.3.3 Raising productivity and efficiency

2.3.3.1 General effects

The benefits of aviation to efficiency and economic productivity are linked with the impact on international trade and investment (detailed in previous sections). The role of aviation in facilitating international trade, for example, allows companies to increase sales and to attain economies of scale through improved efficiency of production and supplier relationships. A survey of over 600 companies[15] found that 70% thought aviation had allowed them to benefit from economies of scale. Similarly, the role of aviation in supporting investment enhances productivity - inward investment has particular benefits as it can introduce new technologies or management techniques into the economy.

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[14] 'The Economic Catalytic Effects of Air Transport in Europe', Eurocontrol (the European Organisation for the Safety of Air Navigation) 2005

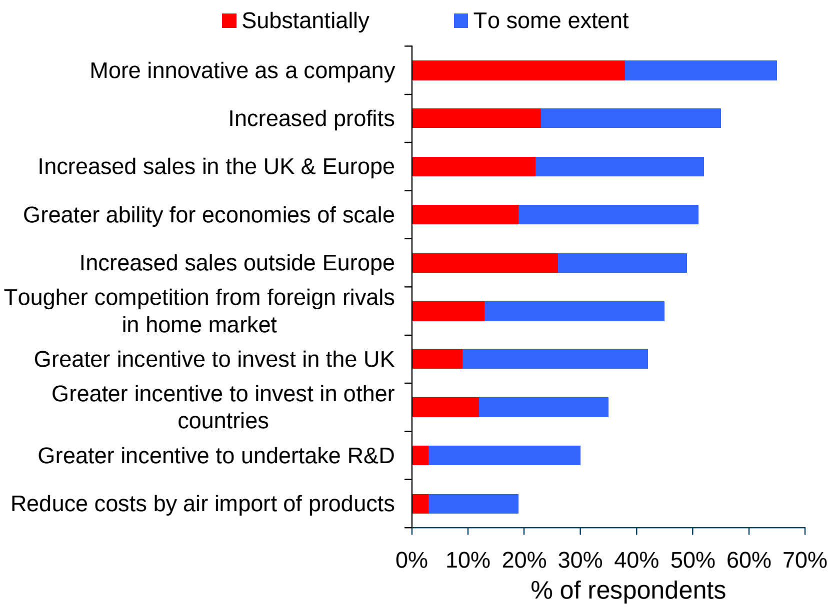
[15] Airline Network Benefits, IATA Economics Briefing No. 3, 2006.

The opening of markets to international competition also drives innovation which typically leads to efficiency improvements. Surveys have found that over a quarter of companies believe that innovation and investment in research and development would probably be badly affected if air transport services were constrained[16].

A survey of UK companies conducted by Oxford Economics found further evidence of the benefits associated with being able to serve a larger market due to aviation (Chart 2.6).

The biggest effect according to the survey is as a spur to innovation, presumably because the costs of innovation can be spread across a greater number of potential sales. 40% of businesses report that air transport services had a substantial impact on incentives to be innovative, with 70% reporting that innovation is affected at least to some extent. UK companies also report that the access air services gives them to a bigger market leads to increased sales and profits, more scope to exploit economies of scale and increased competition.

Chart 2.6: Benefits of being able to serve a bigger market



Source: Oxford Economics survey of UK companies (2006)

In addition, air travel enables organisations to be managed more effectively - for example, by making it easier for senior executives to visit subsidiaries or parent companies in another country. Around 50% of UK companies in the Oxford Economics survey reported that passenger services are vital or very important for the management of their organisation in terms of being able to oversee foreign subsidiaries (Chart 2.7), and this role in itself is likely to reinforce the impact of aviation on inward investment.

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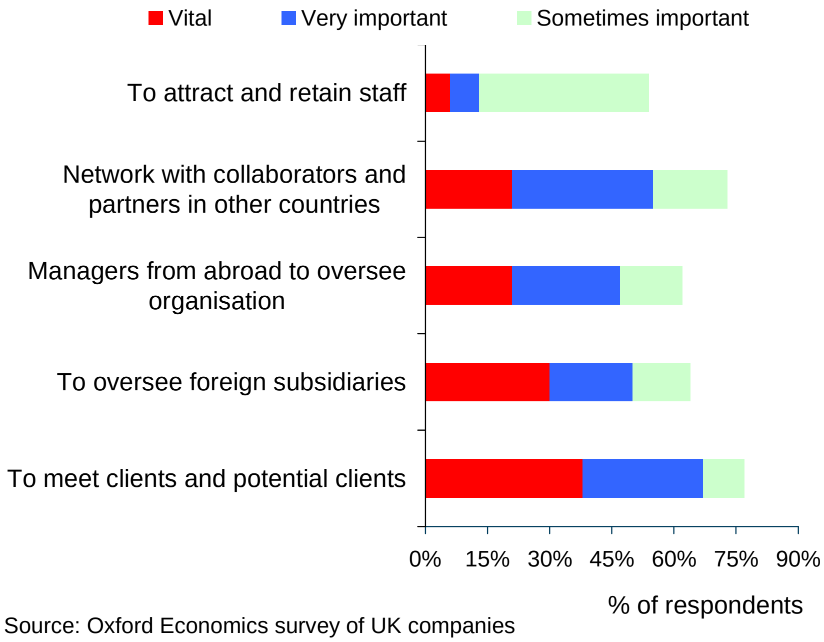
[16] *The Economic and Social Benefits of Air Transport* 2008, ATAG.

Chart 2.7: Importance of factors in determining the country in which organisation chooses to invest



Source: Oxford Economics survey of UK companies

2.3.3.2 Econometric evidence of productivity benefits

Oxford Economics have undertaken quantitative research looking at the impact of aviation on Total Factor Productivity[17] (TFP). TFP is the key ingredient of economic performance over-and-above the input of labour and capital and is critical to achieving high and sustainable growth rates for the economy, and hence more wealth and higher living standards. The research used data on a 'panel' of 31 UK industries for 27 years.

The results implied that, other things equal, a 10% increase in business air usage (business passengers and air cargo combined) would raise GDP by 0.6% in the long run, equivalent to £11.5 billion in annual GDP by 2021 (2011 prices).

Other studies have also found evidence of a link between aviation connectivity and productivity. For example a study by InterVISTAS covering 48 countries found that a 10% increase in national connectivity (reflecting destinations available, frequency of service and number of onward connections) leads to a 0.07% increase in national productivity[18].

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[17] TFP measures the contribution to GDP of intangible factors such as technology, R&D, management and efficiency to output, and is calculated by looking at how much output has increased after taking account of any increases in capital and labour used in production.

[18] Measuring the Economic Rate of Return on Investment in Aviation, InterVISTAS, 2006.

2.3.3.3 Importance of Heathrow Night flights for productivity benefits

Estimates by Oxford Economics[19] find that approximately 1.3% of business usage by air (business passengers and air cargo) to, from and within the UK in a year occurs at Heathrow during the NQP, with a corresponding figure of 5.7% for Heathrow Night period flights. Night flights therefore contribute to productivity benefits for the UK economy from aviation as detailed in previous sections.

2.3.4 Tourism

2.3.4.1 Air travel and UK tourism

Tourism is a major industry in the UK economy. With over 40%[20] of international tourists travelling by air globally, air transport provides essential support to tourism. Air transport thus contributes to raising or maintaining activity in the tourism sector directly.

During 2010, there were an estimated 29.8 million visits to the UK by overseas residents, spending £25.1 billion (foreign visitor spending, including spending on transportation). To put this in context, during 2009 (the latest year for which figures are available) there were 126 million trips/visits by UK residents within the UK, with a total spend of £21.9 billion (Visit Britain UK Tourist Report 2009). Although the number of trips made by UK residents is over four times greater than their overseas counterparts, the longer duration and higher spending by overseas visitors means that these travellers account for over half of all spending.

An estimated 74% of overseas visitors arrived by air in 2009, and aviation has played a major role in boosting the UK's tourist sector in recent years, bringing in more passengers than ever. The growth of air travel in terms of routes, and its relatively low cost, allows people to travel large distances to visit the UK. Significantly, those travelling the furthest tend to be those who spend most; the bigger spenders from just three places – namely the US, Japan and Australia - provided 23% of all UK visitor spending in 2005, travelling into the UK almost exclusively by air, with the exception of a few travellers that visited other places in Europe first.

2.3.4.2 Importance of Heathrow Night flights to UK inbound tourism

By definition, as the world's largest international hub, Heathrow handles more overseas visitor arrivals than any other UK airport. Of the 21.4 million overseas visitor[21] arrivals to the UK by air in 2010 around 8.5 million were at Heathrow[22].

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[19] Based on data from CAA, International Passenger Survey and Department for Transport, and MPD passenger/cargo estimates.

[20] In line with standard definitions, 'tourists' here include leisure and business visitors as well as people travelling to visit friends and relatives.

[21] Overseas visitors include those on leisure and business trips.

[22] Source: UK Travel Trends 2010, ONS

Around 5% of overseas visitors at Heathrow arrived during the Night quota period (2330-0600), with an estimated 15% arriving during the whole Night period (2300-0700). Spending of visitors arriving on Heathrow night flights is likely to be much higher than the average air traveller. Average spend by Hong Kong and Australia residents per visit to the UK equalled £985 and £964 in 2010[23] respectively, with both locations being key departure points of NQP flights. This compares with the average spend of £563 for all overseas visitors.

[23] Source: UK Travel Trends 2010, ONS

3 Impact of banning Night flights at Heathrow

Box 3.1: Key points

- A ban on flights during the NQP in 2011 would result in the direct loss of some £82.3 million in value added, 1,000 jobs and £27 million in UK tax revenue (consisting of income tax, National Insurance Contributions and Air Passenger Duty).
- These direct losses stem from our assessment of traffic loss in this negative scenario – not only from the flights banned, but from their reciprocals. If a passenger can not arrive, by definition he cannot depart, and *vice versa*,
- Taking into account indirect and induced effects, we estimate that a NQP ban would reduce UK value added (GDP) overall by about £178 million in 2011, with a net loss of 2,800 jobs across the entire economy and a reduction in UK tax revenue of £41 million.
- While these are effectively short term effects due to factors such as displacement effects, longer term "catalytic" impacts would follow on from such a ban due to lost business connectivity and associated productivity losses. We estimate that such long term catalytic impacts would equate to an annual figure of £1.1 billion in lost GDP in 2021.
- A ban on Night period flights in 2011 would directly reduce UK GDP by £372 million, UK jobs by 3,700 and UK taxation by £158 million. Total impacts amount to £813 million in value added, 11,900 jobs and £222 million in tax revenue.
- Note that these figures cannot be directly compared with the CBA figures cited in Chapter 4 due to the use of differing frameworks.
- Introducing a ban on Night flights could invite reprisals by foreign Governments on behalf of their affected airlines, leading to additional wide-ranging negative economic impacts on the UK beyond those which have been measured in this Report.

This section of the report details the direct, indirect, induced and catalytic impacts of a ban on NQP flights (and Night flights in general). This provides a broad indication of how a loss of NQP flights/Night period flights would affect the UK economy.

3.1 Night ban implications

Introducing a ban on Night flights – either for the whole Night period (2300 to 0700), or for the NQP (2330 to 0600) – would have wide-ranging implications beyond those which have been measured in terms of direct economic impact.

A Government-imposed ban would mean that airlines who currently have rights to LHR slots during the Night period would no longer be able to exercise those rights – in effect being dispossessed of them and their value. This would clearly be open to legal challenge, and/or claims for significant compensation. It would not be possible for Government to award alternative slots in the daytime to the carriers affected because there are no other slots available at LHR. This has been confirmed by Airport Coordination Limited (ACL) – the organisation responsible for slot allocation at LHR – and illustrated in Appendix 6

In addition there could well be retaliation by foreign Governments in support of their national carriers against UK aviation or other interests if their carriers lose expensive slots in the type of slot confiscation that would be required in a Night ban. Many nations still have very close ties with their airlines and some are part state owned - so the relevant Government would feel the pain of any restrictions and would have the means to show their displeasure.

The most common form of reprisal would be to make life more difficult in general for UK carriers. Measures could range from impacts on slot change/increase requests to new code-share agreements and alliance activity. Many countries do not follow the open and transparent IATA slot allocation process, making retaliation possible and difficult to prove. Cargo would be particularly affected by the retaliation aspect because of their significant Night flying schedule. In the case of certain nations there could even be a reciprocal confiscation of slots or forced reduction in services of UK carriers.

Because of the unpredictability of these potential consequences of a Night ban, no attempt is made in this report to measure their potential negative economic impact on the UK, which would be in addition to the impacts calculated in the following sections.

3.2 Potential mitigation activity

In general, carriers would seek to mitigate their losses from a ban on Night activity. There are a number of actions they might take, depending on the severity of the impact of the ban on their activity. However, none of these actions would be straightforward or simple to implement.

1. **Transfer of Night flights to Gatwick airport (LGW).**

   Airlines carrying only limited traffic connecting at LHR might consider moving their Night flights to LGW in order to retain optimum timing for their terminating traffic. This would be the case particularly if they already had services and investment at LGW, and such a move would not weaken their overall commercial and economic viability by splitting operations between LHR and LGW. In any case, only a limited transfer to LGW would be possible, because slot availability even at Night is limited by a Night movement ceiling (especially during peak summer months see Appendix 5), and these carriers would still have to obtain difficult-to-acquire daytime slots for the departures of their Night-arriving aircraft either by purchase or by arrangement with alliance partner airlines. From a noise point of view, there would be no reduction in the noise produced at Night, just that there are fewer people in the LGW environs exposed to Night noise compared with those living in the LHR vicinity.

2. **Rescheduling at LHR into the daytime.**

   This is not a straightforward option, because there are no runway slots currently available in the daytime at Heathrow – which to all intents and purposes is now full. This is well illustrated in Appendix 6, based on ACL data for Summer 2011, showing that there is no spare capacity for simply rescheduling Night arrivals (or departures) into the daytime.

   However, carriers with a portfolio of slots at LHR (and this would particularly be true of British Airways) would be able to 'cannibalise' their slot holding, and reschedule their Night flights to daytime slots – where necessary as close as possible to the Night period to retain optimum timing for terminating and transfer traffic. The daytime flights currently using the slots which are freed up to allow for the rescheduling would have to be cancelled - these would tend to be less profitable shorthaul services - as would the reciprocal outbound or return flight.

   The advice given to us by ACL is that airlines would find it impossible to swap early morning arrivals just after the Night ban ends for later times, since no other airline would be interested in swapping morning arrivals into later times. So alternatively airlines would have to go down the secondary trading route and find a willing seller in order to reschedule their Night flights, or perhaps make an arrangement with an alliance partner to cannibalise a joint holding of slots. In any case there would be a loss of current daytime flights (and their reciprocals) to accommodate the rescheduling, as well as creating an imbalance in arrivals and departures in terms of slot holdings at LHR.

   It is worth noting that the daytime rescheduling required to mitigate the effects of a Night movement ban would not be a straightforward or simple process, There would almost certainly be knock-on effects for airlines in terms of sub-optimal aircraft and crew utilisation. However, measurement of the consequent economic disbenefits of lower utilisations is beyond the scope of this study without detailed discussion with the airlines involved

3. **Further rescheduling to avoid Night cancellations**

   A Night ban – even one where some limited dispensation could be given for emergencies or other unusual reasons for a flight to be allowed to operate at Night – would have the additional effect of further reducing the number of flights at LHR over and above curtailment of Night flights. Airlines would be loath to schedule departures too close to the start of the curfew time, because late departures would not be allowed, with heavy costs of holding the aircraft and its traffic on the ground overnight, and the knock-on effect on the incoming service. Similarly, carriers would be careful to schedule late evening arrivals earlier than before to avoid similar problems at the outstation. The same would be true of early morning arrivals – airlines would wish to avoid situations where a significant number of early-running flights would be forced into an expensive holding pattern in the sky, or be required to land at an intermediate airport to avoid breaching the curfew.

3.3 Direct economic impacts

In our calculations of the direct economic impacts of various scenarios of Night bans at LHR, we have had to make a number of assumptions as to what carriers might do to mitigate loss, and what the effect would be on traffic – both terminating and transfer passengers as well as on freight/mail. We have consulted with British Airways and with ACL, but the judgements we have made in the end are our own, based on our industry experience, and in our view give a conservative view of the loss of employment and of value added consequent upon a Night ban.

Table 3.1 summarises the estimated losses to employment and value added from banning Heathrow NQP and Night period flights. For details on the calculations behind the estimates please see Appendices 4 and 5.

A total NQP ban without allowing dispensation flights would result in a loss of 1,000 jobs and £82 million in value added for the UK economy. Allowing dispensation flights within this time period does not significantly lessen the impact.

A total Night period ban meanwhile would lower UK employment by 3,700 employees and UK value added by £372 million. The significant increase in losses compared with the NQP is due to the large proportion of flights which occur during the “shoulder period” ((2300-2330 and 0630-0700). As with NQP flights, allowing dispensation flights would not significantly affect losses under a Night period ban.

Table 3.1: Direct impacts of NQP ban, 2011

	Employment (000s)	Value added (£ millions, 2011 prices)
NQP total ban	1.0	82
NQP ban with dispensation	0.9	76
Night period total ban	3.7	372
Night period ban with dispensation	3.5	360

Source: MPD calculations

3.4 Indirect and induced economic impacts

3.4.1 Indirect and induced losses from a ban on NQP flights

Table 3.2 summarises the total impact from a ban on NQP flights (without dispensation), taking into consideration indirect and induced effects. The estimates show how much lower employment, value added and taxation would be in 2011 if a ban was in effect.

The ban would lead to a loss of 1,100 jobs in the wider economy through supply chain effects and a further 700 jobs through induced effects. Including the direct impact of 1,000 jobs, the loss to the UK economy would be a total 2,800 jobs. This means each direct job lost would lead to a further knock-on effect of 1.05 jobs from indirect effects – a multiplier of 2.05. Induced losses are 0.7 jobs per direct job, giving a total employment loss multiplier effect (indirect plus induced) of 2.75.

Value added would be £178 million lower in the UK economy in the event of a total ban on NQP flights, accounting for direct and multiplier effects. Each £1 million of direct value added lost would result in a further impact of £0.73 million in the wider UK economy through the supply-chain, while a further £0.43 million in value added would be lost through consumer spending (induced) effects. The full value added multiplier is therefore 2.16.

Non-APD revenue (income tax, NIC and corporation tax) falls by £24 million, which consists of a direct effect of £10 million, an indirect loss of £9 million and an induced loss of £5 million. The NQP period ban would lead to a reduction in UK departures liable for APD (accounting for knock-on impacts from rescheduling and the diversion of some flights to Gatwick), resulting in a loss of £17 million in APD revenue. The total loss of taxation to the UK would therefore be an estimated £41 million (£27 million of which comes from direct effects).

Table 3.2: Total impacts of NQP ban, 2011

	Employment (000s)	Value added (£ millions, 2011 prices)	Tax revenue (non-APD, £ millions, 2011 prices)	Air Passenger Duty (£ millions, 2011 prices)
Direct	1.0	82	10	17
Indirect	1.1	60	9	-
Induced	0.7	36	5	-
Total	**2.8**	**178**	**24**	**17**

Source: MPD and Oxford Economics calculations based on CAA and BAA data

The scenario allowing dispensation for off-schedule flights does not lessen the direct impact of a ban significantly. The total losses including indirect and induced effects are therefore only marginally lower than under a total ban.

Arguably, these losses would ultimately be mitigated by displacement effects over the long term. That is the employees directly affected would find new jobs in new industries which would generate activity in those industries supply chains and so on. However, this is easier said than done. Labour is not perfectly mobile: it can take a considerable amount of time and retaining to shift into new jobs and it may be too late for employees in the later stages of their careers.

Moreover, the issue of displacement ignores the longer term catalytic effects due to a loss of business traffic, as described below. These would persist over the longer term and represent a loss to the UK economy.

3.4.2 Indirect and induced losses from a ban on Night period flights

The estimated total impacts of a ban on Night period (11pm-7am) flights are reported in Table 3.3. The scenario modelled is one without dispensation for off-schedule flights. The figures refer to the loss of annual 2011 employment and value added that would occur if Night period flights were banned.

The direct loss of 3,700 jobs would lead to further losses of 4,900 and 3,300 jobs from indirect and induced effects respectively. UK employment would therefore be 11,900 lower under the ban. This implies an indirect employment multiplier of 2.31 – each direct job lost would mean a further reduction of 1.31 jobs through the supply chain. Induced impacts mean an additional 0.87 jobs are lost, giving a total employment loss multiplier of 3.18.

Annual value added is £813 million lower under a Night period ban, which consists of £372 million from direct effects, £279 million from indirect and £163 from induced effects. Thus, each £1 million of direct value added lost leads to further reductions of £0.75 million and £0.44 million through indirect and induced impacts respectively – a total multiplier of 2.19.

Loss of direct, indirect and induced employment and value added would lead to reduced income tax, NICs and corporation tax revenues. These effects would lower government tax revenue by a total of £103 million. Meanwhile the loss of UK departures liable for APD (accounting for knock-on effects due to some flights being rescheduled and diverted to Gatwick) would lead to a £119 million reduction in APD revenue. Thus, the total loss to the UK Exchequer from a Night period ban would be an estimated £222 million (£158 million of which comes from direct effects).

Table 3.3: Loss of employment and value added due to a total ban on Night period flights, 2011

	Employment (000s)	Value added (£ millions, 2011 prices)	Tax revenue (non-APD, £ millions, 2011 prices)	Air Passenger Duty (£ millions, 2011 prices)
Direct	3.7	372	39	119
Indirect	4.9	279	42	-
Induced	3.3	163	23	-
Total	**11.9**	**813**	**103**	**119**

Source: MPD and Oxford Economics calculations based on CAA and BAA data

As is the case for the NQP ban above, while some of this labour and economic activity may ultimately move into other industries, this is far from certain and there are longer term catalytic costs to the economy, as indicated below.

Note that, as indicated in Chapter 2, the assessment of direct, indirect, and induced impacts employs a different framework to a CBA. Consequently the value added figures in the tables above (and the discussion of catalytic benefits below) cannot be directly compared to those discussed in relation to the CE Delft report's CBA in Chapter 4.

3.5 Catalytic economic impacts

As discussed above, a banning of Heathrow Night flights would have a real and immediate impact on employment and value added in the UK. The ban would also affect the significant long-term catalytic benefits the UK derives from aviation and Night flights in particular, which were detailed above. International trade, investment and productivity in the country would likely be affected as the ban reduces aviation's capacity to provide an economic environment conducive to innovation, competition and trade.

The impact of a Night flights ban can be quantified from the relationship between business-related aviation and UK productivity (one of the channels of catalytic benefits). Research by Oxford Economics has found that a 10% increase in business usage of aviation (business passengers and cargo) leads to an approximate 0.6% in UK productivity in the long-run. Modelling work done for this study suggests that a total Heathrow NQP ban will result in a 1% reduction in UK cargo and terminating business passengers in 2011. If this scale of impact were to persist in the long-run then this suggests UK GDP (in 2011 prices) would be about £1.1 billion lower in 2021 than under a scenario where NQP flights continued to operate. Following the same methodology, a Night period ban (11pm-7am) would lower business usage by about 5.5%, leading to a £6.2 billion reduction of UK GDP in 2021.

4 Review of CE Delft report

Box 4.1: Key points

- An appropriately specified cost-benefit analysis should consider producer and consumer surplus and externalities. While the CE Delft report does consider all these factors its analysis is flawed,
- The analysis of noise externalities appears to have substantially overestimated their impacts. A simple correction, consistent with CE Delft's own framework, produces a (generous maximum) noise cost figure of around **£500 million** in Net Present Value (NPV) terms rather than the £822 million claimed by CE Delft. (Note that this is not a formal Oxford Economics view on a noise cost figure. It is simply a correction for an apparent mistake in the CE Delft report.)
- Further, the CE Delft report appears to have conflated Night Quota Period (NQP) noise with that of the entire Night period, potentially resulting in a much higher estimate of NQP noise than is warranted. Allowing for this would reduce noise costs **still further** (i.e. well below the re-estimated figure of £503 million).
- The CE Delft report's assessment of producer surplus (profits before deduction of fixed costs) underestimates the extent of losses in the event of a NQP ban. A re-estimation of such losses suggests they are in the order of £24.6 million per annum or £204 million on an NPV basis.
- Consumer surplus losses are likely to have been underestimated due to the lack of a substantive analysis of changes in travel time and unreliable assumptions about passenger arrival time preferences.
- CE Delft's Scenario "R1" suggests that NQP flights to Heathrow can be rescheduled to arrive later in the day. CE Delft suggest that this imposes costs of £250 million in NPV terms, due to sub-optimal arrival times. However this appears to be an underestimate. A simple allowance for lost passenger utility, due to later scheduling of flights, using CE Delft's framework, implies losses in the order of **£758 million** in NPV terms for Scenario R1.
- A re-assessment of CE Delft's Scenario R1 (for indicative purposes only) using only revised values for noise and arrival time preference suggests that the benefits of removing NQP flights will be smaller than the costs of doing so. Specifically, the ratio of the benefits divided by the costs (the **Benefit-Cost Ratio** or BCR) is **0.66** - i.e. the benefits of a NQP ban are clearly outweighed by its costs. This is not a formal Oxford Economics view of what the appropriate BCR for the NQP ban should be. It is simply intended to illustrate the impact of correcting for two measures used by the CE Delft report.
- A large number of other technical issues concerning the estimates in the report have also been identified and are further discussed in Appendix 7. The reliability of the CE Delft estimates is also questionable given the implausible operational assumptions modeled in the report, as discussed in Appendix 8.

- As a consequence of these issues the CE Delft report cannot be used as a guide to practical policy analysis.

This chapter reports the key findings of a review of the methodology adopted by the CE Delft report. The report utilised an economic approach called cost-benefit analysis (CBA) which is a widely accepted method for evaluating the costs and benefits of a project/intervention, and thus determining whether a project/intervention is on balance a benefit or cost to society.

The findings of the review are (as with other sections of this report) a result of a collaborative exercise making use of Oxford Economics expertise in economic analysis (including that of CBA) and MPD Group's knowledge of the aviation industry. Specific information on the calculation of alternative noise impacts was also provided by an industry expert in this field (Bernard Berry).

A more detailed analysis of these and other issues relating to the CE Delft report is provided in Appendix 7.

Note that the intention of this review is not to provide an alternative CBA to the CE Delft report. However, an indicative re-estimation is provided to illustrate the material effects of some of the issues described.

4.1 Externalities (noise impacts)

This section reviews the valuation of noise impacts from flights performed during the Night Quota period (NQP) at Heathrow in the CE Delft report.

Aircraft noise is an "externality" of Night flights as it affects the population living in the vicinity of Heathrow who are not participants in the market[24]. The externality is considered to be negative in that it is considered to be undesirable (i.e. a cost) for those affected by the noise.

The CE Delft study derived three estimates of the value of noise impacts during the NQP using three different approaches and chose one as the preferred estimate. The three approaches were:

1. Valuation of the DALY[25] impact of those highly sleep disturbed by Night flights.
2. Estimation of the value of Night flight annoyance from an overall (all-day) measure of annoyance.

[24] Direct participants are those who make decisions which determine the market outcome, such as airlines, airport operators and air passengers.

[25] Disability Adjusted Life Years (DALY) - the sum of years of life lost due to early death and the years of "healthy" life lost due to suffering from poor health or disability.

3. Valuation of the DALY impact of hypertension due to Night flights.

The chosen approach was valuation via sleep disturbance effects[26].

The basic framework of CE Delft's chosen approach (valuing high sleep disturbance) is based on an accepted methodology utilised by the World Health Organisation (WHO) and Department of Transport (DfT). There are, however, a number of issues surrounding the application of this methodology by CE Delft. These issues centre around the estimate of the number of people "highly sleep disturbed" by Night flights. This figure appears to have been significantly overestimated in the CE Delft study.

The number of highly sleep disturbed was derived in two steps:

1. First the number of people exposed to (affected by) noise from Night-time aircraft between 11:30pm and 6am was estimated, split according to the level of noise suffered (in decibels)
2. Then the estimated relationship between exposure to aircraft noise and high sleep disturbance (i.e. the so-called exposure-effect relationship) was applied to derive the numbers of highly sleep disturbed

There are significant issues in each of these two steps in the CE Delft study. These are explored in more detail in Appendix 7.

However, notwithstanding the issues relating to the number of people exposed to Night flight noise, there are some question marks around the CE Delft report's translation of the exposed population into the highly sleep disturbed. Appendix 7 explores these issues in detail.

The analysis in that Appendix indicates that instead of £99 million per year as claimed in the CE Delft report) the cost of noise impacts should be in the range of £56 million – £65 million per annum. Taking the centre point of this range (£60.5 million per annum) substantially reduces the estimated net present value of noise costs from the £821.7 million estimated by CE Delft to £503.2 million.

Note that this is not a formal Oxford Economics view on a noise cost figure. It is simply a correction for an apparent mistake in the CE Delft report.

The figure of £503.2 million should, in fact, be considered a **generous maximum**. Other issues affecting the calculation of noise externalities in the CE Delft report include:

- A material overestimate of the population exposed to noise during the NQP due to an apparent confusion between figures relating to the NQP and the

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[26] Note that despite statements in the CE Delft report that the preferred approach is to measure annoyance or the cost of "highly annoyed" people, the report's methodology (based on cited research and calculations) in fact values sleep disturbance.

Night period. This suggests that even the revised NPV estimate of £503.2 million is too high and that noise costs are considerably smaller than this.

- The CE Delft report relies on self reported sleep disturbance as a measure of externalities. However there are substantial uncertainties associated with this measure.
- The lack of any allowance for daytime noise impacts, despite the fact that such impacts would also appear to have an implicit cost. This means rescheduling flights to daytime operations might offset the benefits of a ban on NQP flights. In addition if, in fact, flights are diverted to Gatwick, as more realistic scenario analysis suggests, they would add to noise there – i.e. it would merely be a shift of the noise costs rather than a reduction in such costs.

Further detail on these issues is provided in Appendix 7. In combination these facts suggest that the actual net noise externalities relevant to the NQP are likely to be even lower than the (revised) estimate of £503.2 million cited above. In general, these issues cast further doubt over the accuracy of the measures used in the CE Delft report to assess noise externalities.

4.2 Producer surplus

As indicated, the CE Delft report sets up three scenarios for the analysis of noise impacts and analysis of profits is rightly considered as a factor in assessing costs and benefits in all three scenarios.

However, it is not clear that the scenarios suggested by the CE Delft report are feasible. In particular, Scenario R1 suggests that all NQP flights can be re-directed to daytime landings at Heathrow. However consultations with BA, BAA and ACL for this report suggest that this is not a feasible option. The main reason for this is a lack of available daytime slots - Heathrow is effectively “full”. This issue is further discussed in Appendix 7 and Appendix 8.

The same objections relate to Scenario R2 which likewise assumes that such rescheduling occurs at Heathrow and (apparently) that transfer flights still operate (albeit with reduced passenger loads).

Scenario R3 assumes that there are no longer any Night flight operations at Heathrow, though, as discussed below, it would not appear to fully account for the economic magnitude of such a change.

As detailed in Section 3,2, Section 3.3 and Appendices 4 and 8, consultations with BA and subsequent modelling of a plausible scenario by MPD indicate that the effects of the banning of flights during the NQP (by both BA and other airlines) would be quite different to that assumed by the CE Delft report.

MPD modelling, based on these impacts, included estimates of the lost airline “value added” (i.e. GDP) due to the disruptions caused by the removal of NQP flights.

The MPD lost value added figure, in turn, can be used to derive a figure for lost producer surplus. **Under such an approach the annual value of lost producer surplus is estimated to be £24.6 million per annum or £204 million on an NPV basis over 10 years using a 3.5% discount rate recommended by HM Treasury's *Green Book*.**

Further details of these calculations is provided in Appendix 7.

These estimates of lost profits are much larger than those estimated by the CE Delft report which does not allow for any loss in profits for Scenario R1 and a maximum loss of £67 million (on an NPV basis) for Scenario R3.

Other material issues in the assessment of the impact of a NQP ban include:

- The CE Delft report excludes lost freight revenues. While this is understandable due to a lack of data, a review of such information suggests that lost connecting underbelly freight revenues would be material.
- Reduced UK carrier profits derived from UK consumers appear to be incorrectly excluded from the analysis by treating them as a transfer to those consumers. This suggests the estimate of costs in Scenario R2 and R3 is too low as producer surplus losses are underestimated.
- "Saved travel expenses" are incorrectly treated as a benefit, suggesting that the estimate of benefits in Scenarios R2 and R3 is too high.
- Foreign tourism losses in Scenario R3 appear to be overstated. However, revision of this factor should be reconsidered in conjunction with a wholesale revision of other costs and benefits.

. These issues are further detailed in Appendix 7.

4.3 Consumer surplus

The assessment of consumer surplus forms one of the central parts of a transport CBA. Further, the value of travel time forms an important part of the consumer surplus. It is often the most material component of most transport CBAs and should be carefully examined.

Key issues (explored in detail in Appendix 7) include:

- *Travel time* - No allowance for changes in travel times is made in the CE Delft report. This is surprising given the magnitude of the changes involved.
- *Flight time preferences* – The CE Delft report's assumptions about Heathrow-bound passengers preferring afternoon arrivals is dubious. Variation of this assumption makes a material difference to the results.

In terms of the second of these issues in particular, Appendix 7 suggests that there is little basis for the CE Delft inferences that leisure passengers prefer to arrive in the afternoon in the context of NQP flights. The significance of this issue to the analysis can be easily demonstrated using figures for UK resident utility reported in CE Delft's Scenario R1. Table 18 in the CE Delft report indicates that under this scenario UK resident business passengers would suffer an annual loss in utility of £82.87 million, while transferring leisure passengers would suffer a loss of £8.23 million.

Assuming that business and leisure transfer passengers do indeed suffer a loss of utility as described by CE Delft and that leisure travellers are merely *indifferent* to the new arrangements (meaning they experience no utility loss or gain) suggests a loss in consumer utility of £91.1 million per annum (i.e. 82.87+8.23) or £757.6 million over 10 years, on an NPV basis using a 3.5% discount rate.

This is likely to be a conservative estimate of costs to passengers given that they are likely to prefer to arrive at the times of their current choosing – without the imposition of regulatory barriers such as a NQP ban.

Similar considerations apply to the CE Delft report's scenarios R2 and R3 (indeed the suggestion that changes to arrival times produce a benefit in the former is counterintuitive while no losses are estimated in the latter).

Other important issues in the estimation of consumer surplus impacts include:

- The value of frequency (or alternatively waiting time) is not adequately accounted for by the analysis
- The unit value of travel time appears to be significantly underestimated

These issues are discussed in more detail in Appendix 7. Taken together they indicate that consumer surplus losses due to a NQP ban are significantly underestimated by the CE Delft report.

4.4 Summary

As indicated, while making some attempt to capture some elements of producer and consumer surplus, as well as relevant externalities, the CE Delft report suffers from a number of shortcomings. Key issues include:

- *Overestimation of noise costs* – Noise impacts appear to be greatly overestimated. Even a modest re-estimation implies impacts with an NPV of some £503 million rather than £822 million as suggested in the CE Delft report. It is likely that noise costs are substantially smaller than this if factors such as the apparent confusion of noise impacts from the NQP and Night flights are allowed for.
- *Underestimation of producer surplus losses* – Impacts on profitability are likely to be much more severe than estimated by the CE Delft report. If an alternative modelling approach (using non-CE Delft scenarios) is adopted, lost profitability totals some £24.6 million per year or £204 million over 10 years. Lost connecting underbelly freight losses would be in addition to this
- *Underestimation of consumer surplus gains* – Consumer surplus is likely to have been underestimated due to the lack of a substantive analysis of changes in travel time and unreliable assumptions about passenger arrival

time preferences, A simple allowance for lost passenger utility due to later flights implies losses of £91.1 million per year or £757.6 million over 10 years.

In addition, a number of other substantial issues are detailed in Appendix 7.

These shortcomings make the CE Delft report unreliable for policy evaluation purposes. In particular, the questionable assessment of benefits and the exclusion of key costs make it likely that the benefits of a NQP ban are significantly exaggerated while the costs are greatly underestimated.

The above assessment has attempted to lay out a more appropriate scenario for the consequences of a ban on NQP flights, as well as some of the attendant consumer and producer surplus issues. A more rigorous CBA would take these issues into account and form a basis for appropriate policy decisions.

A practical illustration of the material impact of only some of the effects discussed above can be undertaken by re-considering CE Delft's Scenario R1. This compares the revised travel time and noise calculations described above. Considering the revisions to these two elements alone, produces a benefit cost ratio (BCR) well below 1.0 (i.e. 0.66) suggesting that the initiative is not worth undertaking as benefits of a ban are smaller than its costs.

Note that this is not a formal Oxford Economics view of what the appropriate BCR for the NQP ban should be, nor is it intended to be definitive. It is intended only as an illustration of one potential starting point for re-examining the CE Delft assessment, indicating the impact of correcting for two measures used by the CE Delft report. However the BCR would be even smaller if some of the other issues identified above were included in a revised calculation.

Table 4.1: Sample revised R1 CBA

Costs	£ (million)	Benefits	£ million
Travel time preferences	757.6	Noise reduction	503.2
Total	*757.6*	*Total*	*503.2*
		Benefit/cost ratio	**0.66**

Appendix 1 Night Flights at LHR

This Appendix deals with the nature of NQP and Night flight operations at Heathrow

A1.1 Aircraft Movements

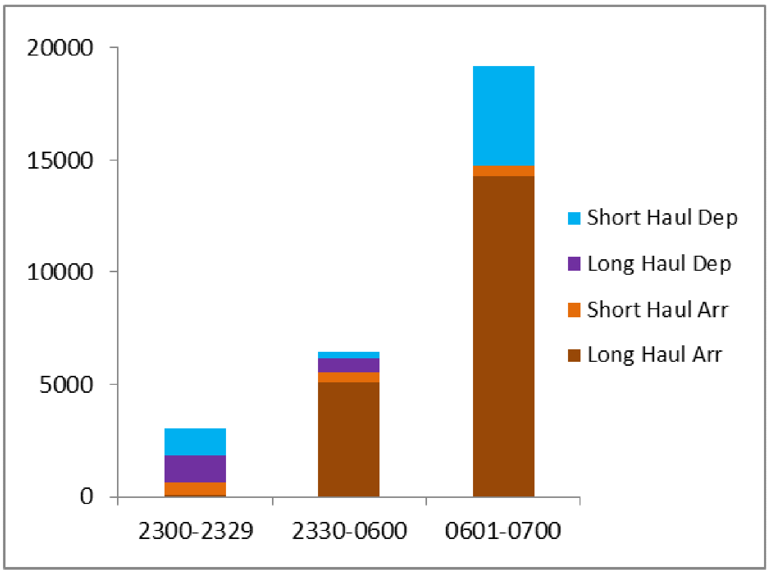
- Of 469,563 movements at LHR in the 12 month period 01 July 2010 to 30 June 2011, 28,702 (6.1%) took place at Night (2300-0700). Within those total internationally defined Night hours:
- 3,010 (10.5%) occurred between 2300 and 2329, the late evening "shoulder", 80% of those being departures;
- 6,483 (22.6%) took place during the "core" Night quota period (NQP) 2330-0600, 86% of them arrivals. This was rather more than the 5,800 annual limit permitted under the current regime of Night flight restrictions, partly due to the snow disruption of December 2010. Further details of the number of NQP flights are at Table A1-2 19,209 (67%) were in the 0601-0700 early morning "shoulder" period, arrivals (overwhelmingly long haul) accounted for most (77%) of them, but short haul similarly dominated the lesser number of departures.

Table A1-1 Night Movements at LHR 2010-2011

Evening Shoulder 2300-2329			Core Night (NQP) 2330-0600			Morning Shoulder 0601-0700			Total Night 2300-0700		
Long haul passenger Deps	1,225	40.7%	Long haul passenger Arrivals	5,042	77.8%	Long haul passenger Arrivals	14,146	73.6%	Long haul passenger Arrivals	19,259	67.1%
Short haul passenger Deps	847	28.1%	Long haul passenger Deps	578	8.9%	Short haul passenger Deps	4,421	23.0%	Short haul passenger Deps	5,505	19.2%
Short haul passenger Arrivals	501	16.6%	Short haul passenger Arrivals	352	5.4%	Short haul passenger Arrivals	405	2.1%	Long haul passenger Deps	1,804	6.3%
Short haul cargo Departures	275	9.1%	Short haul passenger Deps	237	3.7%	Long haul cargo Arrivals	107	0.6%	Short haul passenger Arrivals	1,258	4.4%
Long haul passenger Arrivals	71	2.4%	Miscellaneous Arrivals	159	2.5%	Miscellaneous Departures	70	0.4%	Short haul cargo Departures	291	1.0%
Miscellaneous Departures	45	1.5%	Miscellaneous Departures	95	1.5%	Miscellaneous Arrivals	52	0.3%	Miscellaneous Arrivals	247	0.9%
Miscellaneous Arrivals	36	1.2%	Short haul cargo Departures	13	0.2%	Short haul cargo Arrivals	3	0.0%	Miscellaneous Departures	210	0.7%
Short haul cargo Arrivals	6	0.2%	Long haul cargo Departures	5	0.1%	Short haul cargo Departures	3	0.0%	Long haul cargo Arrivals	109	0.4%
Long haul cargo Departures	4	0.1%	Long haul cargo Arrivals	2	0.0%	Long haul passenger Deps	1	0.0%	Long haul cargo Departures	10	0.0%
Long haul cargo Arrivals	0	0.0%	Short haul cargo Arrivals	0	0.0%	Long haul cargo Departures	1	0.0%	Short haul cargo Arrivals	9	0.0%
Total Evening Shoulder	**3,010**	100.0%	**Total Core Night NQP**	**6,483**	100.0%	**Total Morning Shoulder**	**19,209**	100.0%	**Total Night**	28,702	100.0%
Of Total Night =	10.5%		Of Total Night =	22.6%		Of Total Night =	66.9%		Total Night	100.0%	

Source: Consultants' analysis of BAA data

Chart A1-1 Aircraft Night movements at LHR 2010-2011



Source : Consultants' analysis of BAA data

Movements during the late evening shoulder period 2300-2329 comprised:

- 1,300 (44%) long haul, almost all departures; and
- 1,700 (56%) short haul, two thirds of which were departures.

In the core Night period 2330-0600:

- 5,700 (88%) movements were long haul, of which arrivals (89%) predominated; and less than 800 (12%) were short haul.

The early morning shoulder period 0601-0700 was characterised by

- 14,300 (74%) long haul movements, an average of just under 40 per day, virtually all arrivals; 4,900 (26%) short haul, 91% of them departures.

Table A1-2 NQP Movements at LHR 01 July 2010 to 30 June 2011

	Summer	Winter	Total
Movements Limit	3250	2550	5800
Scheduled to fly in NQP	3177	2583	5760
Scheduled to and actually flew in NQP	**2746**	**2357**	**5103**
-Scheduled to but did not fly in NQP:	431	226	657
-Late arrivals of morning flights	410	216	626
-Early departures of evening flights	2	0	2
-Positioning, general aviation, etc.	19	10	29
Scheduled outside NQP but flew in NQP:	**696**	**684**	**1380**
-Early arrivals/Late departures (Sched pax flts)	584	325	909
-Special dispensations	79	342	421
-Positioning, general aviation, etc.	33	17	50
Total flights flown in NQP	**3442**	**3041**	**6483**

Source: BAA

BAA has provided records of 455 Dispensation flights. Almost all (95%) were scheduled passenger flights. Reasons for the dispensations were:

- Exemptions granted by Government 161
- Delays liable to lead to serious airport congestion 141
- Delays resulting from widespread prolonged ATC disruption 113
- Emergency (risk to life or health) 39
- Delay likely to lead to serious hardship to animals 1

Table A1-3 Main destinations served in the NQP 01 July 2010 to 30 June 2011

Origin/Destination	Arr	Dep	Total Flights
Hong Kong	616	33	649
Sydney	401	33	434
Singapore Changi	372	12	384
Lagos	217	45	262
Melbourne	182	10	192
Kuala Lumpur	178	5	183
Chicago O'Hare	123		123
Boston	117	1	118
Johannesburg	92	4	96
Nairobi	87	1	88
Jeddah	64	3	67
Dammam	67		67
Philadelphia International	49	1	50

Source: BAA

A1.2 Passengers

In the 12 month period 01 July 2010 to 30 June 2011, LHR handled some 68.5 million terminal passengers, of whom 5.7 million (8.4%) landed or took off (runway time) during the 2300-0700 Night. Of that total of 68.5 million passengers, 5.1 million were long haul passengers using LHR at Night, and 0.6 million were on short haul Night flights. According to CAA survey data, some 23 million passengers (nearly 12 million people[27]) were transfer or connecting passengers in the year, about 36% of the total at LHR. We have calculated the transfer traffic on Night flights by applying specific CAA percentages to the numbers of passengers on the 18 busiest Night routes, and used average CAA percentages for the "unspecified" remainder, where the number of passengers implies a less reliable sample size. The resultant estimate of 2.1 million transfer passengers using LHR at Night (2300 to 0700) is thus conservative, but it does indicate a slightly higher proportion (38%) of transfer traffic at Night than the overall 36% average. The breakdown is shown at Table A1-4.

[27] Transfer passengers are counted on both the flight they leave and the flight they join the same day, thus counting as two (airport) terminal passengers. Terminating passengers arrive or depart on one flight, so are counted once that day. The Grand Totals in Table A1-4 differ slightly from those quoted elsewhere in this report (5% lower for Total, 1% lower for Night), largely due to slightly different annual definitions, and Miscellaneous flights being excluded from CAA surveys.

Table A1-4 Transfer passengers at LHR, 2010-2011 (Thousands of passenger movements)

Connecting Between	Thousands		Percentages	
	Total	Night	Total	Night
Domestic/Domestic	7	0	0.1%	0.0%
Domestic/Rest of Europe & vv	1,286	301	5.5%	14.0%
Domestic/Long Haul & vv	4,016	286	17.3%	13.3%
Rest of Europe/Rest of Europe	548	13	2.4%	0.6%
Rest of Europe/Long Haul & vv	12,071	753	51.9%	35.1%
Long Haul/Long Haul	4,864	793	20.9%	36.9%
Unspecified	443	0	1.9%	0.0%
Total Transfer	**23,237 (36%)**	**2,146 (38%)**	**100.0%**	**100.0%**
Terminating	42,008 (64%)	3,546 (62%)		
Grand Total	**65,245 (100%)**	**5,692 (100%)**		

Source: Consultants' analysis of CAA Survey and BAA Night flight data

It must always be kept in mind that one transfer passenger (person) is two passenger movements at the airport in each direction of a return trip. When dealing with the Night alone there tends to be a directional imbalance, of inbound longhaul passengers, but this is recognised by applying the CAA-derived percentages to the actual traffic on Night flights, irrespective of direction.

Transfer traffic is thus an important component of Night traffic – with average profit among major UK airlines in relatively good years (2006/2007) being of the order of 6% of turnover, a transfer element of the order of 35% of total traffic would be a vital component of a flight's payload. Without it (and only passenger variable costs saved) a modest profit would be expected to become a substantial loss.

A1.3 Cargo (Freight and Mail)

About one and a half million tonnes of flown cargo passed through LHR in the 2010-2011 year (we exclude consideration of air freight by road in this context), of which 228,500 tonnes (15%) moved at Night. Some 93 percent of all flown cargo moving at Night at LHR is belly cargo on passenger aircraft, amounting to 212,000 tonnes per annum, 98% of it long haul, including significant transfer traffic.

Two thirds of Night cargo (151,000 tonnes) is on long haul arrivals in the morning shoulder period; while 50,000 tonnes (22%), also long haul, arrives in the NQP.

Regularly scheduled dedicated freighter operations at Night are represented by a quasi-daily express departure in the late evening shoulder period, and a twice weekly long haul freighter arrival in the early morning shoulder period.

A1.4 Passenger Flights

A1.4.1 Short Haul

There were 6,763 short haul passenger flights at Night (2300-0700) at LHR in the twelve months to the end of June 2011, virtually all of them scheduled service operations:

- Only 589 of them took place during the core Night period 2330-0600, accounting for 9% of the total movements in the NQP.
- However, they make up 45% of total late evening movements at LHR between 2300 and 2329 local.
- Almost all early morning shoulder period departures 0600-0659 are short haul passenger flights, but since the arrivals are similarly dominated by a larger number of long haul flights, short haul passenger flights are only 25% of total movements in the morning shoulder period.
- Over the whole Night period 2300-0700, 24% of total movements are by short haul passenger aircraft; within that they make up 70% of departures but only 6% of the much larger number of arrivals.
- About a third of the short haul traffic at LHR comprises transfer passengers connecting to and from other, mostly longhaul routes. The main competitive threat from foreign short haul carriers for the long haul traffic is that they feed UK origin/destination traffic to their home hubs.

For local traffic, scarcity of slots at LHR and other hub airports, as well as the need to offer attractive departure and arrival local timings at both ends of routes, while maximising aircraft utilisation, accounts for the need to schedule early morning short haul departures, and late evening short haul arrivals at LHR.

Short haul passengers (on flights of one, two or three hours) do not normally want to lose sleep by flying during the Night, but airline load factors and demand-responsive revenue rates display no apparent preference for westbound late afternoon arrivals in the UK from the continent, or in Ireland from the UK. On the contrary, terminating passengers tend to want as full a day as possible at the start and end of their business or leisure trip, while passengers connecting to and from long haul flights tend to prioritise a prompt and reliable transfer[28].

The contribution of short haul passenger jets to the Night noise climate can thus be seen to be largely a matter of operations at the margins of the Night period in order to maximise the operating day while responding to market demand. Thus at LHR in 2010/2011 these flights accounted for:

- 2300-2329 local: 81% of arrivals, and 35% of departures;

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[28] Due to the UK's geographical position, there is little short haul to short haul international connecting traffic. .

- 2330-0600 local: 6% of arrivals, and 26% of departures;
- 0601-0700 local: less than 3% of arrivals, but 98% of departures.

A1.4.2 Long Haul

Long haul passenger flights, virtually all scheduled services, make up nearly three quarters of all aircraft movements at LHR at Night (2300-0700). About nine out of ten of them are arrivals, and almost three quarters of those arrivals take place after 06:00 local. They tend to be large aircraft, and long haul routes are generally more profitable than short haul. Transfer traffic to domestic, short haul and other long haul departing flights is an important component of their passenger loads, and they also carry considerable quantities of freight and mail as belly cargo.

Within the constraints of the relationships between time zones and the speed of aircraft, there is some flexibility according to the commercial competitiveness of timings and the degree of availability of slots. There is perhaps a further competitive constraint related to the layout and operation of the airport served; expressed in its published “minimum connecting times” (MCT). For a long haul arrival connecting at LHR or a competing continental airport to another international flight, these minima vary from a flat 45 minutes at FRA, to between 60 and 120 minutes (depending on terminal) at CDG and LHR. Thus to offer onward connections to flights departing about 07:00 local, a long haul flight would have to be scheduled to arrive at CDG or LHR by 06:00, and at FRA by 06:15, at best.

In practice a spread of arrivals/departures has to be catered for, and hubbing airlines can be expected to be selective in scheduling to make on-line rather than interline connections;

The actual arrivals pattern is due to a combination of factors, including:

- commercial and airport constraints upon departure time at the flights' originating points;
- the interaction of local time differences around the world with the cruising speed and range of a jet (very roughly 1 hour gained/lost per 1.5 hours of flight west/east), with non-stop sectors over 9,500 km common;
- optimising crew and aircraft utilisation, taking account of duty and rest limitations;
- arrival airport restrictions (QC, movement caps), and slot availability constraints;
- commercial constraints upon arrival time
- not too early for terminating traffic; and
- not too late for the first wave of (particularly short-haul) connections.

Clearly a 13-hour flight to Europe leaving (say) Hong Kong (HKG) or Singapore (SIN) between about 23:00 and midnight local time (as most of them do) is going to arrive (in Summer, with 6 or 7 hours local time gained on the way) between

05:00 and 07:00. If it leaves an hour or two earlier, it will arrive correspondingly earlier – unwelcome for terminating passengers and extending transit times for onward connecting passengers. An hour or two later departure from Asia offers a commercially unattractive post-midnight take-off, and may miss the first wave of onward connections from the European gateway.

In order to illustrate and demonstrate, primarily for the reader outside the industry, some of the constraints on the scheduling of these flights to LHR (and major competing European airports), we have analysed, as case studies, the Summer arrivals pattern on the four LHR routes with over 1,000 Night movements in the 2010-2011 year. :

Table A1-5: Major long haul LHR Night arrivals

Origin	ATM Arrivals	%
Sydney (SYD)	1,551	7.4%
Hong Kong (HKG)	1,489[29]	7.2%
New York (JFK)[30]	1,527	7.3%
Johannesburg (JNB)	1,401	6.7%
Sub Total	5,968	28.6%
Other Long Haul	13,484	64.6%
Short Haul	1,430	6.8%
Grand Total	20,882	100%

Source: Consultants' analysis of BAA data.

Note that, since our source is the representative May 2011 Official Airline Guide, all times are scheduled (stand) times; not runway times, which would be expected to be up to 15 minutes earlier for arrivals. However, en route winds and operational issues including air traffic management can lead to early or late arrivals.

[29] Includes 104 freighters.

[30] Flights departing from New York Newark have been excluded from the analysis (as have those arriving at London City and Paris Orly), but they demonstrate the same pattern as is analysed for JFK.

Table A1-6: European passenger flight arrivals from Sydney (SYD, UTC-10) June 2011

To (UTC)	Via	Operator[31]	Aircraft	Dep (Local)	Arr (Local)	Elapsed
LHR (+1)	HKG	VS	346	1425	0525	24:00
CDG(+2)	RUN	UU	77W	1145	0530	25:45
LHR(+1)	SIN	BA	777	1530	0535	23:05
FRA(+2)	SIN	QF	744	1550	0600	22:10
LHR(+1)	SIN	QF	388	1610	0635	23:25
LHR(+1)	BKK	BA	744	1640	0635	22:55
LHR(+1)	BKK	QF	744	1655	0700	23:05

Source: Consultants' analysis of OAG published schedules, May 2011.

The characteristics of this route enable it also to demonstrate the scheduling constraints and opportunities of intermediate points such as Bangkok (UTC +7) and Singapore (UTC +8), which are significant markets in their own right as well as offering transit stops on other routes to LHR and its continental competitors. There are five daily direct flights from Sydney to London, and one to Frankfurt. There are no direct flights to Amsterdam, but a twice weekly flight from Noumea transits Sydney on the way to Paris via Rêunion. All these flights arrive at their European termini between 0525 and 0700 local, after transit stops which allows a little scheduling flexibility with Sydney-Europe elapsed times of 23 to 24 hours.

The Sydney Airport Curfew Act of 1995 which broadly bans large aircraft movements 23:00 to 06:00 local time, does allow international landings by Chapter 3 aircraft between 05:00 and 06:00. The transit airports of HKG, SIN and BKK have no curfews. The scheduling of Europe-bound flights is thus not directly affected by restrictions other than on arrival in LHR and FRA, which, given the flight times and time zone changes involved, do not conflict with departure restrictions. Reciprocal flights by UK-based airlines can however be "squeezed" between the late evening scheduling shadow at LHR on departure and the early morning curfew on arrival at Sydney.

The schedules are also constrained by commercial pressures and time zone changes, particularly with substantial transit point markets (between SYD and BKK, SIN and HKG; and more relevantly in this context, between those transit points and LHR). The requirements include a SYD departure allowing arrival at (e.g. SIN) in time to depart at a local customer- acceptable late evening hour, flying the long leg to LHR during a long and arriving in time for the first wave of connections.

[31] All flights except VS are code-shares.

Starting from the SYD afternoon departure which that pattern demands[32] , a UK based airline will be turning round the same aeroplane that operated outbound from LHR. To maximise utilisation that turnaround should be as short as is compatible with technical and crew requirements, and with commercially attractive timings from LHR and at the transit point. Those pressures all seem to push the LHR departure toward late evening. However, NQP Night restrictions at LHR (QC and cumulative seasonal movement limits) make this a potentially risky choice, commercially. If a late evening shoulder departure is delayed, it may be given dispensation to fly or it may be stuck overnight, at considerable cash cost to the airline and in terms of passenger time. This will also "knock on" to the next day's arrival in Sydney and its subsequent reciprocal departure, as well as disrupting transit point plans. Thus there is also the constraint that the "scheduling shadow" or buffer may suggest a prudently earlier departure from LHR – but not so early as to arrive during the prohibited landing period at SYD. Even without the direct pressure of the shadow, the presence of later flights and limited slots can have an indirect effect. In the following example, a pre-shadow departure from LHR is compensated by a relatively long transit time en route (possibly also for technical reasons) permitting a timely post-international-curfew arrival in SYD.

These operational, commercial, geographic and "legislative" pressures combine and interact to explain why airlines fly, land and take off at Night in these circumstances and over these longitudinal distances. The BA 015/016 flights between SYD and LHR may serve as an example. Local time at LHR in Summer is UTC+1, SIN is UTC+8, SYD is UTC+10.

Table A1-7: Representative LHR/SYD daily schedule, May 2011 (all times block, not runway)

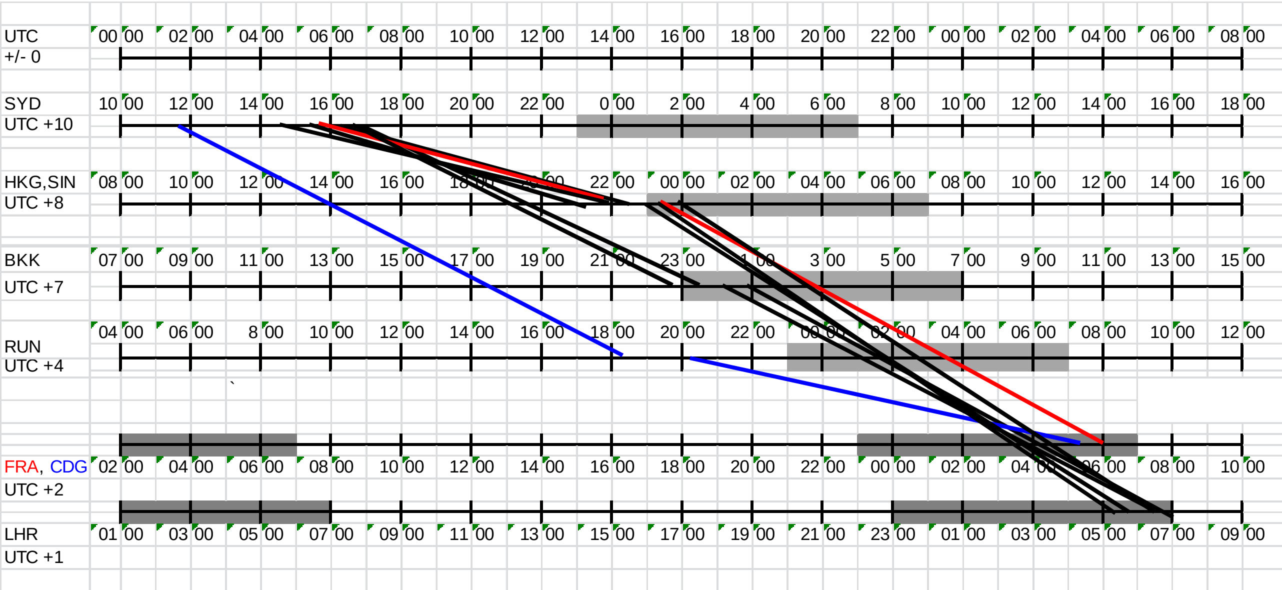
Flight	Dep (UTC)	Dep (Local)	From	To	Arr (Local)	Arr (UTC)	Real Elapsed Time	Apparent Elapsed Time	Local Time Gained/Lost
BA 015	2015	2115	LHR	SIN	1710	0910	12:55	19:55	Loss 7:00
			Transit				2:35		
BA 015	1145	1945	SIN	SYD	0515	1915 prev. day	7:30	9:30	Loss 2:00
			Turnround				10:15		
BA 016	0530	1530	SYD	SIN	2145	1345	8:15	6:15	Gain 2:00
			Transit				1:25		
BA 016	1510	2310	SIN	LHR	0535	0435	13:25	6:25	Gain 7:00

Source: Consultants' analysis of OAG, May 2011.

[32] Not necessarily the order in which the airline scheduler would approach the situation, but convenient for description here.

It should be noted that in the example above, it is the operational and commercial need to transit points with a 7 or 8 hour positive time difference from UTC, that enables a long westbound Night to be combined with locally acceptable timings. Chart A1-2 shows the inbound implications of these scheduling constraints at LHR and its near Continental competitors. Each line, colour coded to match the tabulated presentation, represents a (generally) daily scheduled flight operating across time zones.

Chart A1-2: Westbound flights from Sydney to Europe, with transits, May 2011



Source : Consultants' analysis of OAG 2011 published timetables.

Table A1-8 Daily European passenger flight arrivals from Hong Kong (HKG, UTC +8) 2011

Origin	To (UTC)	Operator	Aircraft	Depart (Local)	Arrive (Local)	Elapsed	Notes
	LHR (+1)	BA	744	2315	0455	12:40	
	AMS (+2)	KL	74M	2300	0515	12:15	
SYD	LHR (+1)	VS	346	2325	0525	13:00	
	LHR (+1)	BA	744	2345	0525	12:40	
	LHR (+1)	CX	744	2355	0540	12:45	
	CDG (+2)	AF	777	2305	0545	12:40	
	FRA (+2)	CX	744	2355	0600	12:05	
	LHR (+1)	CX	744	0035	0620	12:45	
	CDG (+2)	CX	744	2345	0630	12:45	
	AMS (+2)	CX	744	0015	0635	12:20	
MEL	LHR (+1)	QF	744	0735	1330	12:55	
AKL	LHR (+1)	NZ	772	0830	1445	13:15	5 weekly
	LHR (+1)	CX	343	0940	1600	13:20	
	CDG (+2)	AF	777	1025	1715	12:50	
	FRA (+2)	LH	744	1245	1855	12:10	
	LHR (+1)	CX	744	1440	2030	12:50	
	CDG (+2)	CX	343	1405	2135	13:10	

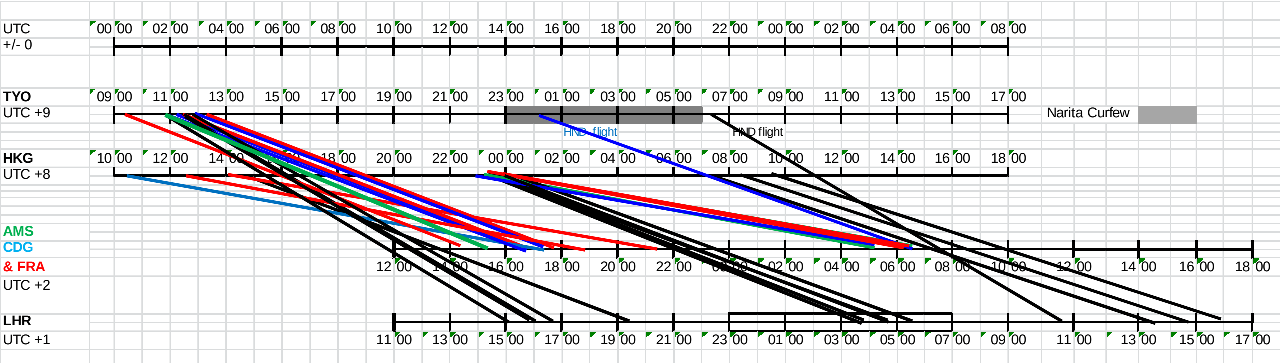
Source: Consultants' analysis of May 2011 OAG

Hong Kong is a transit point for longer haul flights, but it is important as a market in its own right. Analysis shows that at a UTC +8-hour time difference, with a sector block time approaching 13 hours for flights to western Europe, any evening departure scheduled up to midnight is going to be timetables to arrive well before 0700 local time, and most will land on the runway before 0600 local.

Nevertheless, in the airport and airline competitive situation outlined above, that is the most popular departure and arrival pattern, since it allows a long Night flight timed for connections at both ends of the route as well as acceptable times for terminating traffic. As noted elsewhere, most of the day flights have been introduced in recent years in response to demand growth, but apparently timed according to slot availability rather than market preference.

As can be seen from the lines representing flights across time zones in Chart A1-3, just one further time zone eastward is Tokyo (UTC+9), still within 12½ hour nonstop range from Europe. It is virtually impossible to schedule an overnight westbound flight providing attractive terminating arrival times and prompt onward connections (allowing for 1 to 2 hour minimum connecting times, MCT) at LHR without coming up against Narita's 2300-0600 local time curfew. The latest practicable scheduled departures from stand, taking account of scheduling shadow, would be between 2200 and 2230 local, arriving in Europe between 0300 and 0400. This is not only commercially unattractive, there are no spare slots or QC at LHR.

Chart A1-3: Nonstop Passenger flights from Hong Kong and Tokyo (Narita & Haneda) to Europe, June 2011



Source: Consultants' analysis of June 2011 published timetables in May 2011 OAG.

Air France has used France's 2 hour positive time difference from UTC to schedule an 0620 local time arrival at CDG, by departing from Haneda at 0035 local. BA also uses Haneda for one flight five days per week, but has opted for a 0625 local departure arriving LHR 1040 local, while all Narita-originating flights arrive after lunch.

The **New York** route market is so large that frequencies have to spread throughout the morning, but the early morning arrivals are clearly commercially attractive and thus competitive. Afternoon arrivals in Europe would give uncompetitive departure times from New York, although there is flexibility in reciprocal departure and arrival timings on this route. To get the maximum benefit of the most daytime hours in New York and at destination, the five or six hour local time difference with an a 7 to 8 hour sector time means that an evening departure gives a local time morning arrival in London about 12½ "apparent" hours later, but 13½ hours or so for continental airports.

Table A1-9: Daily European passenger flight arrivals from New York (JFK, UTC +4), June 2011

To (UTC)	Operator[33]	Aircraft	Dep (Local)	Arr (Local)	Elapsed
FRA(+2)	LH	388	1540	0515	7:35
AMS(+2)	DL	767	1615	0600	7:45
CDG(+2)	AF	777	1640	0600	7:20
LHR(+1)	AA	777	1820	0620	7:00
LHR(+1)	VS	346	1815	0635	7:20
LHR(+1)	BA	744	1840	0635	6:55
CDG(+2)	AA	763	1725	0645	7:20
LHR(+1)	BA	744	1910	0655	6:45
LHR(+1)	BA	744	1910	0700	6:50
LHR(+1)	DL	764	1825	0705	7:40
AMS(+2)	KL	747	1800	0730	7:30
CDG(+2)	AF	777	1815	0730	7:15
LHR(+1)	VS	744	1930	0750	7:20
CDG(+2)	AF	380	1915	0835	7:20
LHR(+1)	BA	744	2040	0835	6:55
CDG(+2)	DL	767	1900	0855	7:55
LHR(+1)	AA	777	2105	0900	6:55
LHR (+1	DL	764	2050	0925	7:35
FRA(+2)	DL	757	1915	0935	8:20
LHR(+1)	BA	744	2155	0935	6:40
LHR(+1)	BA	777	2235	1030	6:55
CDG(+2)	AA	757	2115	1035	7:20
LHR(+1)	VS	346	2230	1040	7:10
LHR(+1)	AA	777	2305	1100	6:55
CDG(+2)	AF	777	2150	1105	7:15
LHR(+1)	DL	764	2300	1105	7:05
FRA(+2)	SQ	744	2125	1115	7:50
FRA(+2)	LH	744	2140	1120	7:40
AMS(+2)	KL	74M	2250	1210	7:20
CDG(+2)	AF	777	2320	1230	7:10
LHR (+1)	BA	744	0800	1940	6:40
LHR(+1)	AA	777	0930	2130	7:00

Source: Consultants' analysis of OAG, May 2011.

A third of the flights to the four European hubs are scheduled to arrive at or earlier than 0605 local, in a two hour scheduling "window", so they would all expect to land before 0600"morning shoulder". Almost all the remaining two thirds of arrivals spread over the following five hour local time arrival window, tending to cluster in its earlier hours, and there are a couple of day flights. Since

[33] All flights except VS are code-shares

airlines schedule to maximise traffic this seems to indicate a market preference for early morning arrivals with which LHR services are to an extent competing. Lufthansa for example applies the largest aircraft in its fleet to the earliest departure (and arrival) of the day.

Thus LHR carriers seem to have some commercial advantage in scheduling eastbound from the US east coast, but would lose it were the early morning shoulder period not available on the runway (some 15 minutes earlier than the off/on stand times scheduled).

Table A1-10 Daily European passenger flight arrivals ex Johannesburg (JNB, UTC+2) June 2011

To (UTC)	Operator	Aircraft	Dep (Local)	Arr (Local)	Elapsed
LHR(+1)	BA	744	1915	0515	11:00
FRA(+2)	LH	388	1845	0520	10:35
CDG(+2)	AF	380	1925	0605	10:40
FRA(+2)	SA	346	1925	0610	10:45
LHR(+1)	SA	346	2000	0625	11:25
LHR(+1)	BA	744	2045	0645	11:00
LHR(+1)	VS	346	2030	0650	11:20
LHR(+1)	SA 6 per week	332	2015	0655	11:40
AMS(+2)	KL	777	2320	1030	11:10

Source: Consultants' analysis of OAG May 2011.

This is a latitudinally rather than longitudinally long haul route, with only an hour of local time difference from LHR and in the same time zone as LHR's continental competitors for transfer traffic. The CDG and FRA operations have faster sector times sector times than LHR, but all the flights except the much later departure to AMS are scheduled to arrive on stand before 0700, and half of them would expect to be landing on the runway before 0600. They are clearly timed to compete with each other and to match what the market demands, overnight flights with connection possibilities at both ends of the route, combined with attractive departure timings for originating traffic.

Of the "top four" routes for Night arriving traffic at LHR, this one carries the most belly cargo, again a significantly profitable element as the marginal costs of its carriage are relatively low.

A1.5 Cargo flights (and belly cargo)

Only two regularly scheduled freighters use LHR at Night, almost entirely accounting for the 419 such aircraft movements in the year. These are a twice weekly scheduled freighter arrival from Hong Kong in the early morning shoulder period, and a near-Nightly short haul scheduled express departure in the late evening shoulder. Only 20 cargo flights stray into the NQP over the course of the year.

The inbound long haul freighter uses valuable early morning slots (albeit not on a daily basis), indicating that the cargo yield, transfer opportunities, and perhaps integration of the aircraft's utilisation with overnight flights into other airports, justify the requirement to the operator. Since they are uniquely identifiable, commercial confidentiality considerations have precluded further investigation.

The outbound late evening short haul express flight is also identifiable, but there is a well publicised generic commercial requirement for such operations to take off as late as is compatible with the turnaround window at their European hub. The return flight, determined by the interaction of sorting time at the hub, distance, and slot availability, arrives at LHR outside the Night period.

As noted elsewhere, almost all flown Night cargo at LHR arrives on long haul passenger aircraft, thus the opportunity to compete in the relevant cargo markets arises because that is when the aircraft flies. Thus although the cargo is not the *raison d'être* of the flights and their scheduling, the considerable value (given the low marginal cost of carriage) it adds to the Night flights is largely a function of the time of their operation. Transfer traffic can account for up to 80% of the load on some flights, including express and mail, while supermarkets' ability to offer year round fresh produce from overseas depends upon early morning arrivals by air. Further details are excluded to respect confidentiality.

A1.6 Other flights

Air ambulance, diplomatic, air taxi, general aviation, military, and occasional positioning flights made up the remaining 457 Night aircraft movements at LHR in the year. Mostly short haul, with departures roughly matching arrivals, they averaged only a handful of passengers per movement. Including exempt operations, they had a variety of specialised reasons for flying at Night, but make a relatively insignificant impact on the noise climate over the year as a whole.

Appendix 2: Estimation of direct employment impacts

This Appendix deals with the estimation of direct employment impacts for flights during the NQP and the more widely-defined Night period.

A2.1 Data Source

Our main data source for employment is the 2007 Heathrow Airport Staff Census – figures supplied by BAA. BAA carry out annual staff censuses of employment at Heathrow via employing companies based at the airport. Although similar censuses have been carried out in later years, we are using the year 2007 as our datum for calculation of costs and benefits, because that year represents a more ‘normal’ period in air transport before the economic downturn temporarily affected activity at Heathrow.

The results of the 2007 census are shown below.

Table A2-1: Heathrow Airport Staff Returns 2007 – Summary by company type

Companies	Total
Airlines	43,238
Airline Handling Agents	2,412
Government Services	3,032
BAA	4,476
Airline Caterers	2,243
Catering Concessionaires	1,433
Retail Concessionaires	3,253
Other Public Pax Services e.g. BT, banks etc.	1,809
Cleaning Services, Waste Disposal, Pest Control	2,215
Fuel Companies - Aviation related only	252
*Hotels **	*592*
Bus & Taxi Operators	346
Car Park Operators	293
Cargo/Freight/Courier Services/Mail	2,445
Building, Maintenance & Electrical Contractors, Fire Protection	1,840
Other Airport Related Companies e.g.Security, Flying Clubs, AOC	1,835
*Non-Airport Related Companies e.g. Hotel Shops, Hotel Catering **	*417*
Sub-total	**72,131**
Total direct employment	**71,122**

Source: BAA (Heathrow Airport Ltd data).

* Activities excluded from 'Direct' employment total

Direct employment is defined as jobs which only exist because the airport is there. For example

- *Government Services* - include Immigration, Customs & Excise, NATS and Police staff.

- *Catering & Retail* - include outsourced airline caterers as well as catering outlets for travellers etc, and staff in shops both landside and airside.
- *Other Public Passenger Services* - include currency exchange agencies, car hire concessionaires, car parking, etc.
- *Other Companies* - include outsourced cleaning services of aircraft and premises, fuel companies, security companies, etc.

The two starred categories of employer, i.e. hotels and non-airport related companies, need to be excluded. The direct employment figure for LHR as a whole for 2007 is therefore 71,122.

A2.2 Employment Relating to Night Activity

A more detailed employer survey and census was carried out on behalf of BAA by Sinclair Knight Merz (SKM) in 2008/9. As part of the SKM survey a large sample of LHR workers were interviewed to determine the employment characteristics of Heathrow Airport's working population, such as job classification, home location and mode of transport to work. One of the issues related to employee's reporting (i.e. starting) and finishing times. The responses are shown in the table below.

Table A2-2: LHR Employees Reporting and Finish Times

Local Time	Reporting %	Finishing %
00:00-00:59	0.2	1.2
01:00-01:59	0.1	0.8
02:00-02:59	0.2	1.4
03:00-03:59	0.2	0.7
04:00-04:59	4.5	0.4
05:00-05:59	13.1	0.3
06:00-06:59	20.2	0.6
07:00-07:59	12.9	0.7
08:00-08:59	9.7	0.9
09:00-09:59	5.4	0.9
10:00-10:59	3.8	0.9
11:00-11:59	5.0	1.0
12:00-12:59	6.0	3.7
13:00-13:59	6.4	9.3
14:00-14:59	7.0	18.0
15:00-15:59	2.2	8.4
16:00-16:59	1.1	6.2
17:00-17:59	0.5	5.5
18:00-18:59	0.9	7.6
19:00-19:59	0.3	6.1
20:00-20:59	0.2	5.8
21:00-21:59	0.0	6.8
22:00-22:59	0.2	8.7
23:00-23:59	0.0	4.4

Source: SKM LHR Employment Survey 2008/9

The table shows the percentages of all LHR workers reporting for work and finishing work on an hour by hour basis.

As a general rule, the average LHR employee works an 8-hour shift at the airport, taking into account part-time work, overtime, etc. So a worker reporting for duty at 18:00 would work roughly for 3 hours during the Night Period, i.e. after 23:00, and 2.5 hours during the Night Quota period, i.e. after 23:30. Similarly someone finishing their shift at 04:00 would have worked for 5 hours during the Night Period, and 4.5 hours during the Night Quota period.

On this basis it is therefore possible to estimate the percentage of total LHR manpower hours which are worked during the Night periods, either based on reporting times, or on finishing times.

Table A2-3 Manpower equivalent worked during night period

Percentage of all LHR employment

NQP night		Total night period	
Reporting	*Finishing*	*Reporting*	*Finishing*
3.2%	5.2%	8.0%	8.2%
Source: Consultants calculations based on SKM/BAA data			

The result for the full Night period 2300 – 0700 based on reporting times is very close to that based on finishing times, averaging 8.1% of all employment. For the NQP period there is a wider divergence, averaging 4.1% of all employment.

The method of calculation above for determining employee Night activity is an acceptable and maybe conservative proxy for determining employees directly related to Night flight activity. Certainly not all work carried out at Night is dependent on Night flight activity. For example, premises maintenance employees work at Night because activity is low at that time, and employment levels would be unaffected by a reduction or cessation of Night flights, and in fact there might be an increase in such employment at Night in those circumstances. However, counterbalancing that there is the employment of air crew and cabin crew – nearly one third of all Heathrow-based employees - who report for work and finish work at times directly related to aircraft departures and arrivals (albeit with a pre and post flight buffer), and for whom the 8-hour shift pro-ration in the calculation is not applicable.

In the absence of any more reliable and up-to-date figures we have assumed that the same pattern of employment and productivity has continued into 2010/11. Overall activity at Heathrow measured in Wlu[34] in 2010/2011 is 2.5% greater than in 2007, implying that total direct employees at Heathrow would now number 72,903. Applying these percentages to the computed 2010/2011 total LHR Direct employment figure of 72,903 gives the following result:

Table A2-4: LHR Employees directly related to Night flight activity – 2010/11

Period	Percent	Number
NQP period	4.1%	2,989
Total Night period	8.1%	5,905
Source: Consultants' calculations based on SKM/BAA survey data		

In addition, Night flights support a certain amount of employment outside the Night period. As explained previously, the economics of Night flights at LHR are largely underpinned by connecting traffic. Transfer passengers (and the same

[34] A workload unit combines passenger and cargo traffic into a single measure, where 100 kg of cargo is equivalent to one passenger

applies to transshipment freight) who arrive on a Night flight and then continue their journeys outside the Night period onto a linked departure require additional employment resources relating to the transfer and to the following flight. In the same way as the revenue for the full journey encompasses the two sectors, so too in economic terms do the employment and other resources to achieve the full journey.

The method of calculation for assessing this additional employment has been based on an initial proration of the direct employment according to the workload unit (Wlu) of UK and foreign airlines, separately for longhaul and shorthaul operations. The database provided by BAA contains information on all flights operated in the Night period in the year July 2010 to June 2011 at LHR. Major parameters include actual time of runway landing/take off, scheduled time of arrival/departure from stand, airline, origin/destination, and passenger/cargo load. We have classified flights as to whether they are shorthaul or longhaul. For each Night flight calculation was made of the number of transfer passengers to/from shorthaul or longhaul (depending on the region of origin/destination of the connecting flight) based on CAA survey data. The relevant employment parameter per Wlu for shorthaul or longhaul and the nationality of the operator were applied to this transfer traffic.

The additional UK employment resulting from Night flight transfer traffic is indicated below:-

Table A2-5: Additional UK employment resulting from Night transfer traffic

Period	Employment
NQP flights	210
Total Night flights	870

Source: Consultants' calculations based on CAA and BAA survey data

Thus direct total UK employment at LHR generated by flights arriving or departing during the Night is as follows:

Table A2-6: Total direct UK employment at LHR generated by NQP and Night flights

Period	Employment
NQP	3,199
Total Night period	6,775

Source: Consultants' calculations based on CAA and BAA survey data

Appendix 3: Estimation of direct value of Night flights

This Appendix provides details of the estimation of direct value added of NQP/Night flights.

The added value benefit (i.e. contribution to UK GDP) of Night flights has been calculated based on two main sources – CAA financial results of UK airlines for contribution by airline activity at LHR, and more generalised ONS-based statistics [35] for contribution by non-airline entities at the airport.

Airline added value for relevant reporting UK scheduled airlines, the majority of whose flights are based at LHR, for 2007 (the last 'normal', i.e. pre-recession, year for which data is available) is shown in the following table:[36]

Table A3-1: UK Scheduled airlines: Added value 2007 (£ 000)

	BA	City Flyer	BMI	Virgin
Op Profit	861288	-8785	7202	16982
Depreciation (a)	527732	1332	13297	16768
Depreciation (b)	144439		6160	2134
EBITDA	1533459	-7453	26659	35884
Staff Cost	1599498	18856	131906	244462
Added value	**3132957**	**11403**	**158565**	**280346**
Pax (000)	32388	588	9379	5664
cargo(00kg)	7160	0	258	2142
Wlu (000)	39548	588	9637	7806
Added value / Wlu (£)	**79.22**	**19.39**	**16.45**	**35.91**
Sector distance (km)	*2382*	*676*	*735*	*7274*

Source:Consultants analysis of Airiline data

We have taken a combination of BA and Virgin as a proxy for longhaul operators, and a combination of City Flyer and BMI for shorthaul operators, and computed the added value per Wlu for each type of operation accordingly. However, not all of the airline added value can be attributed to the UK. Based

[35] Office for National Statistics: National Accounts; Workforce Jobs; and the Annual Business Inquiry

[36] UK charter airlines, together with UK budget airlines such as Easyjet, have been excluded from this analysis because their style of operation and business model differ significantly from the airlines operating at LHR.

on the fact that roughly 12.5% of major UK airline staff are employed outside the UK, and assuming a similar proportion of staff of non-UK airlines are employed in the UK, we have reduced the added value per Wlu calculated as above by 12.5% for UK airlines, and by 87.5% for non-UK airlines.

The added value calculation for non-airline entities has been derived by multiplying the number of employees in each entity (e.g. retail, catering etc) by 2007 Greater London productivity (based on ONS data) in the appropriate SIC (Standard Industrial Classification) industry. The total added value was then divided by total Wlu at LHR, and added to the values for the airlines as computed above. The 2007 values were then uprated for inflation to 2011 according to the UK GDP deflator as published by ONS, and then to 2011 levels of Wlu activity.

The resulting added value benefit - contribution to UK GDP - calculation for Night flights at Heathrow is shown on the following table:

Table A3-2: Added value contribution to UK GDP of NQP and Night flights at Heathrow (£ 000)

Total Added Value (£) 2011 prices		
	UK airline	**Foreign airline**
Longhaul per Wlu	88.68	29.49
Shorthaul per Wlu	35.55	21.90

NQP			
Traffic data Wlu	**UK**	**Foreign**	**Total**
Longhaul	1,227,754	792,435	2,020,189
Shorthaul	37,884	36,566	74,450
Added Value £000	**UK**	**Foreign**	**Total**
Longhaul	108,874	23,370	132,244
Shorthaul	1,347	801	2,148
Total	**110,220**	**24,171**	**134,392**

Total Night Period			
Traffic data Wlu	**UK**	**Foreign**	**Total**
Longhaul	3,755,735	3,497,943	7,253,678
Shorthaul	234,332	489,465	723,797
Added Value £000	**UK**	**Foreign**	**Total**
Longhaul	333,048	103,160	436,208
Shorthaul	8,331	10,720	19,051
Total	**341,378**	**113,881**	**455,259**

Source: Consultants' model calculations based on BAA and CAA data

In addition, account has to be taken of the added value contributed by connecting traffic for their full journey, not just for the Night sector. As explained above, in the same way as the revenue for the full journey encompasses the two sectors, so too in economic terms does the added value. The relevant added value parameter per Wlu for shorthaul or longhaul and the nationality of the operator were applied to this transfer traffic on its additional leg in the database.

Total added value from Night flights – i.e. contribution to UK GDP - can therefore be summarised as follows:

Table A3-3: Added value contribution to UK GDP of NQP and Night flights at Heathrow: Summary (£ 000)

£ million	NQP	Total Night
Direct added value	134	455
Added value resulting from transfer pax	24	90
Total added value	**158**	**543**

Source: Consultants' model calculations based on BAA and CAA data

Contribution from APD

The direct benefit of the APD Revenue arising from activities both in the Night Quota Period and the Total Night period were estimated using the rates in force in November 2010 and making the following assumptions:

- that 75% of passengers travelled in standard class; 25% travelled in “other than standard class” and hence were liable to the higher rate of APD;
- that only departing passengers who commenced their journey in the UK generated APD. (i.e. passengers who commenced their journey outside the UK were assumed to transfer onto a flight departing from the UK within 24 hours and therefore were not liable to APD);
- that arriving passengers who transferred onto non-UK flights did so within 24 hours and therefore were not liable to APD.

Appendix 4: Estimation of direct impacts of a Night flights ban

This Appendix provides details of the estimation of the direct impacts of a NQP/Night period ban.

In our calculations of the direct economic impacts of various scenarios of Night bans at LHR, we have had to make a number of assumptions as to what carriers might do to mitigate loss, and what the effect would be on traffic – both terminating and transfer passengers as well as on freight/mail. We have consulted with British Airways and with ACL, but the judgments we have made in the end are our own, based on our industry experience, and in our view give a conservative view of the loss of employment and of value added consequent upon a Night ban.

Scenario 1 Total ban on flights during NQP (23:30 to 06:00) – no exceptions

In this scenario we have assumed that:

- six airlines will transfer 2000 annual flights to LGW – losing 90% of their pax transfer traffic, but none of their pax terminating traffic, and 45% of their freight/mail
- a further six airlines will reschedule Night flights into the daytime, occupying 6556 LHR slots currently used for daytime flights, losing 30% of their transfer traffic and 15% of their freight/mail, but none of their pax terminating traffic, and the displaced flights and their reciprocals are cancelled. (In keeping with a conservative approach, no allowances have been made for potential negative impacts on yield.)
- all other Night flights scheduled during the NQP or currently arriving or departing during the NQP are cancelled, as are their reciprocals.
- 50% of the total traffic affected by cancellations would be able to be accommodated on other direct daytime services or carried via non-UK hubs into and out of the UK.

The scenario we have modelled gives the following results:

Table A4-1: Scenario 1 results

Scenario 1 Results	Employment	Value Added (£m)
Lost in UK by moving some flights to LGW	134	8.9
Lost by rescheduling at LHR	303	15.1
Loss from cannibalising 6556 LHR slots	200	40.0
Loss from flight cancellations	374	18.3
Totals lost in UK	**1,011**	**82.3**

Source: Consultants' calculations based upon modelled scenario

Scenario 1a Ban on flights during NQP (23:30 to 06:00) – but 'dispensations' allowed.

This scenario is identical to Scenario 1, but the ban is eased marginally by allowing 'dispensation' flights to arrive or depart during the NQP. The BAA database shows that during the past year some 455 flights were allowed to exceed the NQP movements ceiling by special dispensation for reasons such as delays likely to lead to serious airport congestion, delays resulting from serious ATC disruption, various emergency situations etc.

In Scenario 1 such flights would have had to be cancelled together with their reciprocals, but for Scenario 1a they are assumed reinstated. The resulting impact is as follows

Table A4-2: Scenario 1a results

Scenario 1a Results	Employment	Value Added (£m)
Reinstatement of 455 'dispensation' flights	123	6.6
Totals Lost in UK	**888**	**75.7**

Source: Consultants' calculations based upon modelled scenario

Scenario 2 Total ban on flights during Night (23:00 to 07:00) – no exceptions

In this scenario we have assumed that

- six airlines will transfer 2000 annual flights to LGW – losing 90% of their pax transfer traffic, but none of their pax terminating traffic, and 45% of their freight/mail
- a further ten airlines will reschedule Night flights into the daytime, occupying 16830 LHR slots currently used for daytime flights, losing 30% of their

transfer traffic and 15% of their freight/mail, but none of their pax terminating traffic, and the displaced flights and their reciprocals are cancelled.

- all other Night flights scheduled during the Night or currently arriving or departing during the Night are cancelled, as are their reciprocals.
- 50% of the total traffic affected by cancellations would be able to be accommodated on other direct daytime services or carried via non-UK hubs into and out of the UK.

The scenario we modelled gives the following results:

Table A4-3: Scenario 2 results

Scenario 2 Results	Employment	Value Added (£m)
Lost in UK by moving some flights to LGW	134	8.9
Lost by rescheduling at LHR	683	35.6
Loss from cannibalising 16830 LHR slots	514	102.8
Loss from flight cancellations	2,403	224.7
Totals lost in UK	**3,734**	**371.9**

Source: Consultants' calculations based upon modelled scenario

Scenario 2a Ban on flights during NQP (23:00 to 07:00) – but 'dispensations' allowed.

This scenario is identical to Scenario 2, but the ban is eased marginally by allowing 'dispensation' flights to arrive or depart during the Night period. It is assumed that a similar proportion of flights would be classified as 'dispensation' during the longer and busier Night period as was the case currently during the NQP period.

Table A4-4: Scenario 2a results

Scenario 2a Results	Employment	Value Added (£m)
Reinstatement of 798 'dispensation' flights	215	11.5
Totals Lost in UK	**3,518**	**360.3**

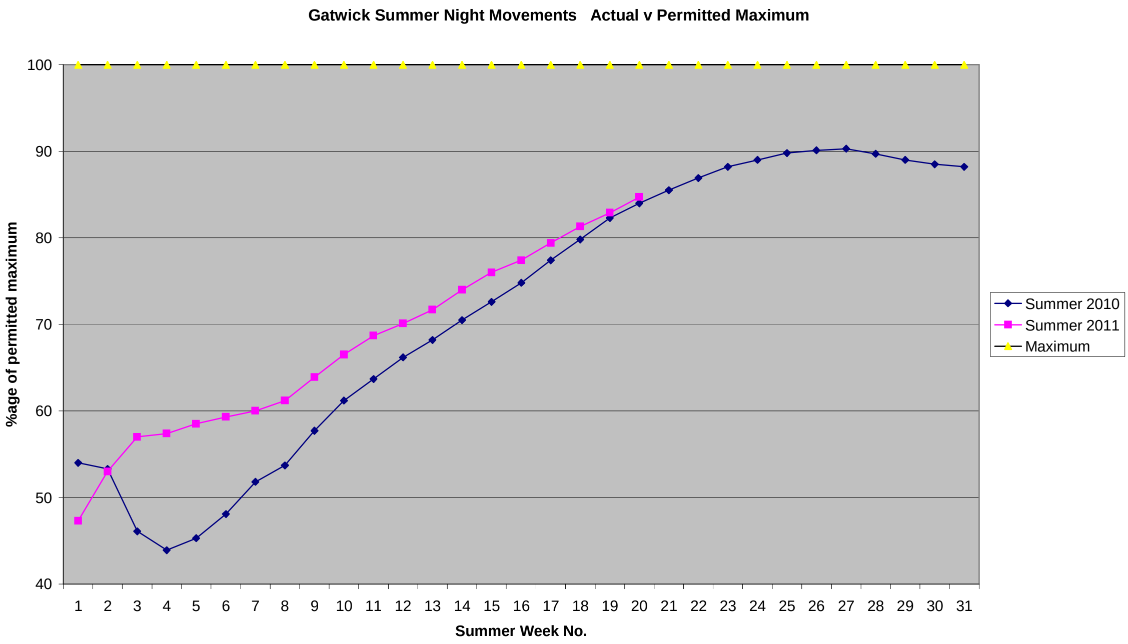
Source: Consultants' calculations based upon modelled scenario

Irrespective of the scenario being considered, losses of employment and of value added are likely to be sustained for some time, both because in the present economic circumstances in the UK job losses will be slow to be reversed, and also because there is an imperfect market for much of the specialised labour that is employed at LHR.

Appendix 5: Availability of Night slots at Gatwick

This chart shows the night situation at Gatwick in Summer 2011.

Chart A5-1: Night slots at Gatwick: Summer 2011

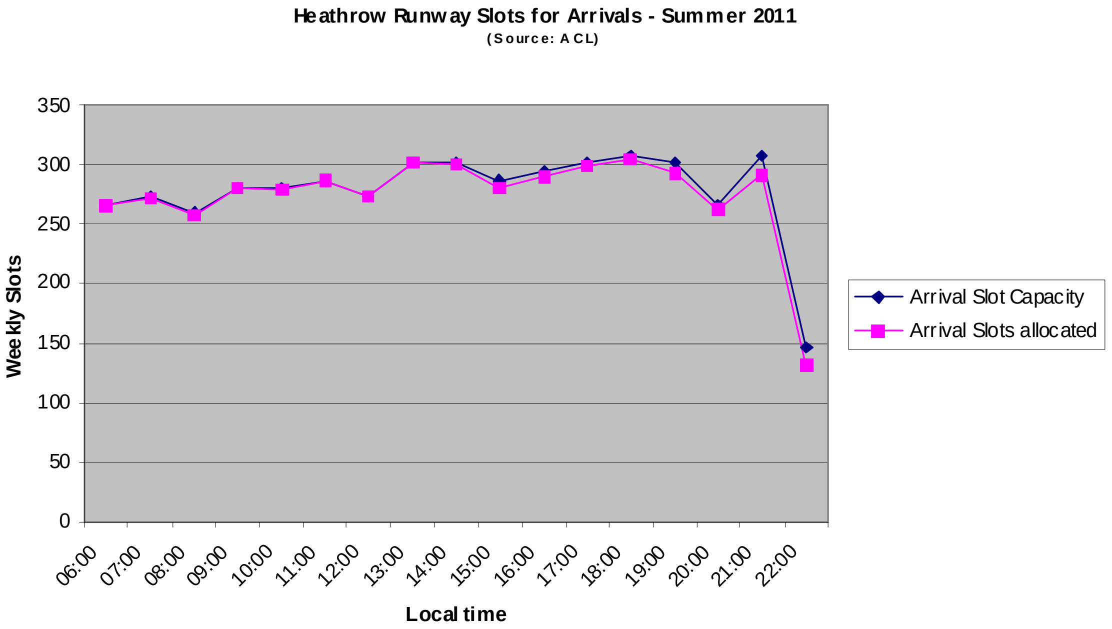


Source: ACL

Appendix 6 Non-availability of daytime slots at Heathrow

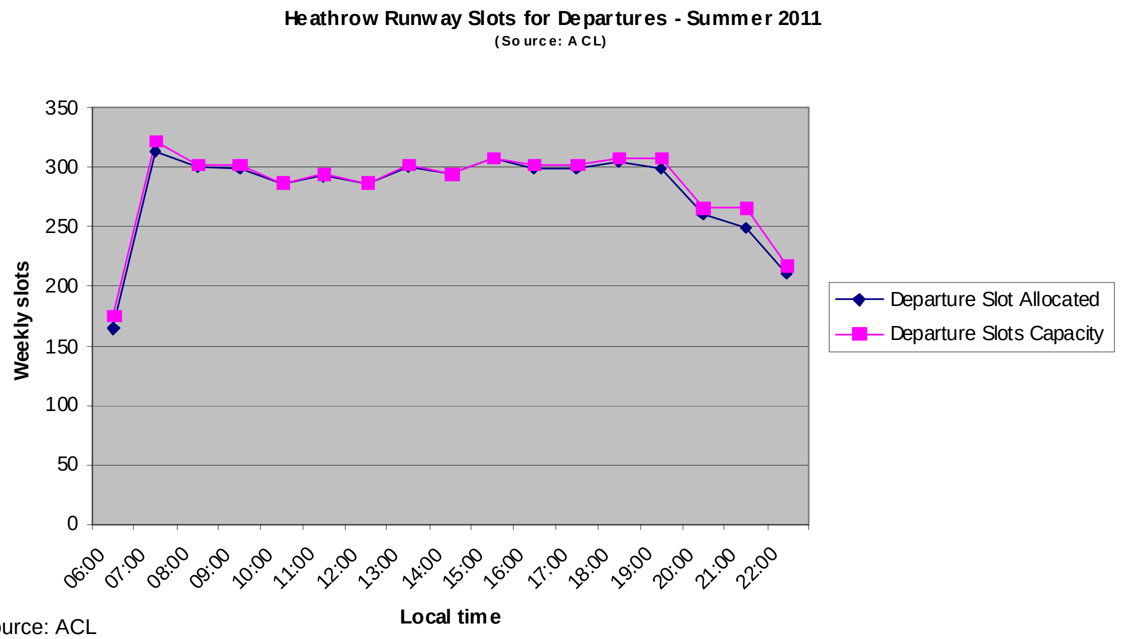
These charts show that without increases in available capacity or removal of existing flights, Heathrow is already virtually full in 2011, with no room for rescheduling of night flights.

Chart A6-1: Daytime slots for Heathrow arrivals: Summer 2011



Source: ACL

Chart A6-2: Daytime slots for Heathrow departures: Summer 2011



Source: ACL

Appendix 7: Review of CE Delft report

This Appendix provides a detailed review of the methodology adopted by the CE Delft report. The findings of the review are (as with other sections of this report) a result of a collaborative exercise making use of Oxford Economics expertise in economic analysis (including that of CBA) and MPD Group's knowledge of the aviation industry.

A7.1 Overview of CE Delft report

The CE Delft report looked at the impact of banning NQP flights by evaluating three scenarios based around assumptions on how airlines and passengers might respond to a ban. The reference case (or baseline) against which each was evaluated was a continuation of the existing NQP policy i.e. NQP flights continue to take place. The three response scenarios to a total NQP ban were defined as:

1. Response scenario 1 (R1): All NQP flights rescheduled and the original passengers opt for other arrival times.
2. Response scenario 2 (R2): All NQP flights are rescheduled; terminating business and leisure passengers accept rescheduled flights (65% of total passengers); the remaining 35% of passengers no longer fly to Heathrow.
3. Response scenario 3 (R3): All flights are cancelled and passengers no longer travel to Heathrow.

The UK was the defined as the boundary of costs and benefits to be evaluated, that is the study considered only the impact of a ban on UK residents and UK economic activity.

Table A7-1 outlines the channels of costs and benefits considered by the CE Delft report and a brief explanation on each is relevant to their CBA approach, though as can be seen some were not evaluated quantitatively.

Table A7-1: Channels of benefits and costs in the CE Delft report

Channel of impact	How potentially impacts on HACAN's CBA calculation	Evaluated quantitatively?
Airline passenger revenues	Impacts on airline profits	Yes
Airline freight revenues	Impacts on airline profits	No
Non-airline revenues (e.g. retail concessions)	Impacts on non-airline profits	No
Noise from aircraft	Health effects (sleep disturbance) of noise valued	Yes
Emissions	Monetary value of NOX emissions from aircraft estimated	Yes
Passengers' travel time (time spent actually travelling)	Monetary value of time spent travelling	Yes
Passengers' arrival time (impact of not arriving during NQP)	Monetary value of different arrival time estimated	Yes
Spending of inbound tourists to the UK	Impacts on value added for UK tourism	Yes
Saved travel expenses not spent on foreign airlines	UK residents no longer travelling on foreign airlines spend saved money in the UK	Yes
Employment effects at airlines/Heathrow	Employment effects considered part of CBA by HACAN	No

Source: HACAN 2011

Table A7-2 summarises the reported Net Present Value (NPV) of banning NQP flights over the period 2013 to 2023 compared with a situation where NQP flights continue, based on the CBA in the CE Delft report. Key points from the results are:

- The NPV value over the ten years 2013 to 2023 of banning NQP flights ranges from a benefit to the UK of £856 million to a cost of £35 million depending on the response scenario.
- Noise impacts constitute by far the most significant benefit in every scenario with an NPV of £821.7 million. As NQP flights are banned in all scenarios the noise (reduction) impact is the same in each. The CE Delft report itself notes that results "are sensitive…to the valuation of noise, and we recommend studying the benefits of noise reduction in more detail".
- The impact on profits is small by comparison. Airlines lose no annual profits in R1; and only £28.5 million in R2 and £66.8 million in R3. There are no estimates of reduced profits from freight and non-airline activities – the reason given in the CE Delft report is unavailability of data.
- There are no travel time effects from the rescheduling of flights in R1, R2 or R3 i.e. the banning of NQP flights does not increase passengers' travel time.
- The impact of changed passenger arrival times is a NPV cost of £250 million under R1 (all flights rescheduled and all passengers travel at the rescheduled times) due to significant disutility from business travellers and transferring leisure passengers having to arrive at earlier/later times.

However the impact from passengers' arrival times is positive, i.e. a benefit, under R2. This is because under R2 transferring passengers no longer travel through Heathrow, and use a different hub with no disutility. In addition, it is assumed that leisure passengers terminating at Heathrow prefer to arrive outside the NQP, thus they benefit from the ban (this assumption also applies in R1). This benefit outweighs the cost for business travellers having to arrive earlier/later and so the net effect is positive.

Table A7-2: Net Present Value estimates in the CE Delft report, 2013-2023

	Benefit/cost (£, 2010 prices, Net Present Value 2013-2023)		
Channel of impact	**R1**	**R2**	**R3**
Airline passenger revenues (profits from)	0	-28.5	-66.8
Airline freight revenues (profits from)	No estimate	No estimate	No estimate
Non-airline revenues (profits from)	No estimate	No estimate	No estimate
Noise affecting local residents	821.7	821.7	821.7
Emissions	0	0	2.4
Passengers' travel time (time spent actually travelling)	0	0	0
Passengers' arrival time (impact of not arriving during NQP)	-250.1	39.9	0
Spending of inbound tourists to the UK	0	0	-831.7
Saved travel expenses not spent on foreign airlines	0	22.9	39.2
Employment effects at airlines/Heathrow	No estimate	No estimate	No estimate
Total	**571.6**	**856**	**-35.2**

Note: A positive number means there is a welfare benefit from the relevant channel from banning night quota period flights for that particular scenario; a negative number means there is a welfare loss.

Source: HACAN 2011

A7.2 Appropriate framework for cost-benefit analysis

Before examining the CE Delft report more closely it is important to recall the conceptual basis for cost-benefit analysis (CBA).

Note that the intention of this review is not to provide an alternative CBA to the CE Delft report. However, an indicative re-estimation is provided to illustrate the material effects of some of the issues described.

Box A7-1 summarises the conceptual basis for cost-benefit analysis (CBA) and how it should be applied to the analysis of banning of NQP flights as widely accepted in the literature.

Box A7-1: Appropriate framework for cost-benefit analysis of NQP flights ban

As its name suggests, a CBA involves comparing the benefits of a given project or initiative to its costs. CBA is commonly applied to transport appraisals and there is a vast literature in this field.

In essence, a CBA requires consideration of the changes to the following as a result of a given initiative:

- Consumer surplus;
- Producer surplus; and
- Relevant externalities

Consumer surplus measures the value of a service or good to consumers over and above the market price or cost actually paid. In transport appraisals "generalised cost" is often used as the relevant measure which accounts for factors such as travel time, frequency of service and arrival time, as well as the monetary cost of travel to consumers.

On the producer side, a CBA should consider impacts on producer surplus (i.e. roughly speaking, firm profits before the deduction of fixed costs).

Externalities are third party or spillover effects, which affect those not taking part in direct market transactions, which may often include environmental impacts such as air, noise or water pollution or issues such as visual amenity.

Adding up the changes to producer and consumer surpluses from an initiative gives the net economic benefits to society as a whole.

In many cases, CBAs are "ring-fenced" around a particular jurisdiction (such as the UK). In such cases only benefits to the people (consumer surplus) and entities (producer surplus) should be considered in the context of assessing costs and benefits. The included people and entities form what is known as "the population of standing".

Note that, given its central role in transport appraisal and the fact that it impacts directly on the users of the transport system itself, it is highly unusual for travel time to be considered an "externality" – as referred to in the CE Delft report.

In this case, the CE Delft report has indicated that its findings are ring-fenced around the UK, and this approach is also followed in this review of their CBA.

A7.3 Externalities (noise impacts)

This section reviews the valuation of noise impacts from flights during the Night Quota period (NQP) at Heathrow performed in the CE Delft study. This section has been informed by advice from an industry expert in this field (Bernard Berry).

Aircraft noise is an "externality" of Night flights as it affects the population living in the vicinity of Heathrow who are not participants in the market[37]. The externality is considered to be negative in that it is considered to be undesirable (i.e. a cost) for those affected by the noise.

The CE Delft study derived three estimates of the value of noise impacts during the NQP using three different approaches and chose one as the preferred estimate. The three approaches were:

1. Valuation of the DALY[38] impact of those highly sleep disturbed by Night flights.
2. Estimation of the value of Night flight annoyance from an overall (all-day) measure of annoyance.
3. Valuation of the DALY impact of hypertension due to Night flights.

The chosen approach was the valuation via sleep disturbance effects[39]. Before examining this more closely, it should be noted that even if the CE Delft report's valuation approach is accepted the use of sleep disturbance affects as a metric produces by far the largest externality impact. However, there appears to be no particular reason for the choice of sleep disturbance as a preferred measure in preference to the other two.

The chart below compares the CE Delft report's estimate of noise externalities produced by sleep disturbance with those produced by annoyance and hypertension. The magnitude of this difference indicates that the choice of sleep disturbance as a metric (in preference to the other two) has a material impact on the quantification of the noise externality costs. Use of the alternative

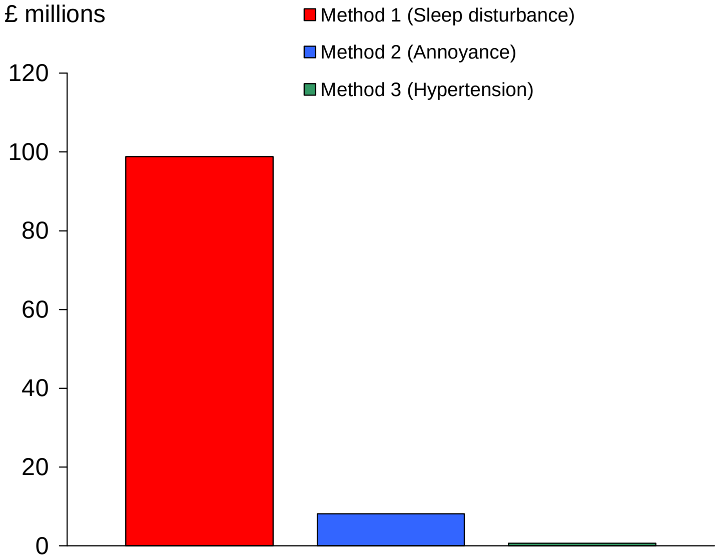
[37] Direct participants are those who make decisions which determine the market outcome, such as airlines, airport operators and air passengers.

[38] Disability Adjusted Life Years (DALY) - the sum of years of life lost due to early death and the years of "healthy" life lost due to suffering from poor health or disability.

[39] Note that despite statements in the CE Delft report that the preferred approach is to measure annoyance or the cost of "highly annoyed" people, the report's methodology (based on cited research and calculations) in fact values sleep disturbance.

approaches would have produced noise costs which are a small fraction of those estimated using sleep disturbance approach.

Chart A7-1: CE Delft report annual externality cost estimates under three approaches



Source : Delft 2011

The basic framework of CE Delft's chosen approach (valuing high sleep disturbance) is based on an accepted methodology utilised by the World Health Organisation (WHO) and Department of Transport (DfT). There are, however, a number of issues surrounding the application of this methodology by CE Delft. These issues centre around the estimate of the number of people "highly sleep disturbed" by Night flights. This figure appears to have been significantly overestimated in the CE Delft study.

The number of highly sleep disturbed was derived in two steps:

1. First the number of people exposed to (affected by) noise from Night-time aircraft between 2330 and 0600 was estimated, split according to the level of noise suffered (in decibels)
2. Then the estimated relationship between exposure to aircraft noise and high sleep disturbance (i.e. the so-called exposure-effect relationship) was applied to derive the numbers of highly sleep disturbed

There are significant issues in each of these two steps in the CE Delft study which are detailed in the following sections.

A7.3.1 The number of people affected by NQP noise

The CE Delft study takes the estimate of the numbers exposed to noise from Night flights at Heathrow from the CAA's 2007 *Noise Contour Report*[40]. The estimates are shown in Table 12 of the CE Delft study, with an estimated 207,000 people affected by Night flights. The figures are split according to the average sound level across the entire Night period (L_{Night}[41]), with an 8-hour Night-time definition of 2300-0700. However, the Heathrow NQP applies for a six and a half hour period from 2330-0600, which is the relevant window for the CE Delft report. Therefore, by using figures from the CAA's *Noise Contour Report*, the CE Delft report appears to have effectively included noise from flights outside the NQP, in the so-called "shoulder" period (2300-2330 and 0600-0700).

In this context, it is important to note the relative significance of flights in the "shoulder" period on the population exposed to different average levels of noise (L_{Night}). From mid-2010 to mid-2011 approximately 80% of flight departures and arrivals during the total 8-hour Night-time period took place in the shoulder period. In other words only 20% of Night-time flights occur in the 6.5 hour NQP.

So the average noise level during the 6.5-hour quota period is likely to be significantly lower than the 8-hour figures used by CE Delft. One would expect fewer people to be affected above a given dB threshold relevant for sleep disturbance (in the CE Delft report this is 50dB). In addition, fewer people would be exposed in the higher dB bands which have greater likelihoods of sleep disturbance. **Everything else being equal, the number of highly sleep disturbed people during the 6.5-hour Night period is therefore likely to be much lower than reported in the CE Delft study**[42].

Data from DfT (2004) on L_{Night} noise levels for the 8-hour and 6.5-hour Night periods at Heathrow provides further evidence that noise exposure levels for the population are significantly in the 6.5-hour quota period relevant to the CE Delft study. This data is shown in the chart below.[43]

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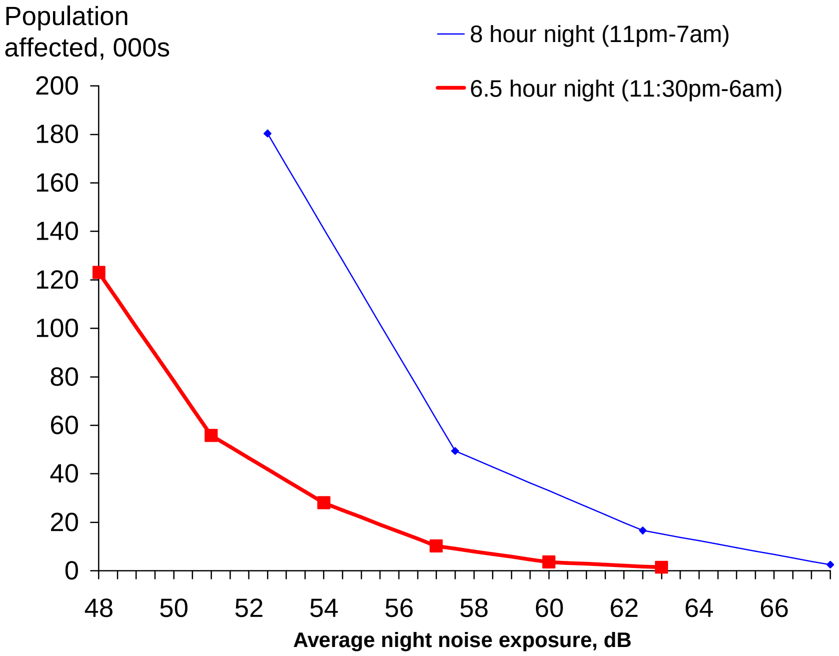
[40] CAA 2007, "ERCD REPORT 0706, London Heathrow Airport, Strategic Noise Maps 2006".

[41] L_{Night} is defined as the total sound level averaged over the entire Night period.

[42] One potential issue is whether the relationship between noise exposure and sleep disturbance is different for the 6.5-hour Night-time period in comparison to the 8-hour period. That is, for a given average dB noise level (L_{Night}), is someone more/less likely to be sleep disturbed during the 6.5 hour period compared to the 8-hour period.

[43] Department for Transport, (July 2004) *Night Flying Restrictions at Heathrow, Gatwick and Stansted - Stage 1 of Consultation on Restrictions to apply from 30 October 2005*, The 8-hour Night figures relate to flights for the calendar year 2003. The 6.5-hour Night figures related to flights from 31st October 2002 - 31st October 2003. Since 10 out of 12 months are in common it is unlikely a significant amount of the difference between the 8-hour and 6.5 estimates is due to the differing measurement periods.

Chart A7-2: Population exposed to aircraft noise at Heathrow during 8-hour and 6.5-hour Night-time



Source: Department for Transport (2004)

A7.3.2 Noise exposure and sleep disturbance

Notwithstanding the issues relating to the number of people exposed to Night flight noise detailed in the previous section, there are some question marks around the CE Delft report's translation of the exposed population into the highly sleep disturbed. The CE Delft study states that 18.13% of the noise exposed people are highly sleep disturbed. However, following the CE Delft report's methodology and replicating their calculations, our results show a significantly lower proportion that are sleep disturbed, and we are unable to arrive at a figure close to 18.13%.

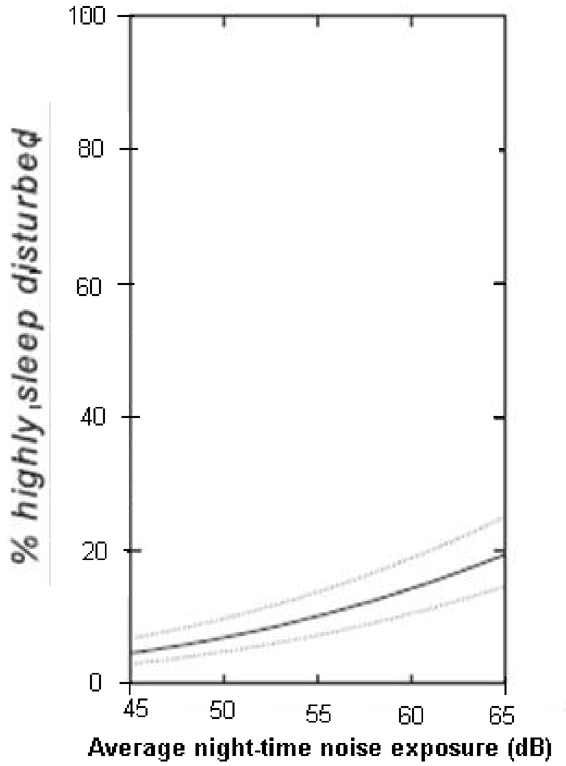
The Miedema (2007) paper on the relationship between noise exposure and sleep disturbance was used by the CE Delft report to estimate the number of sleep disturbed persons. This paper estimated an exposure-effect relationship which gives the proportion of people sleep disturbed at each average Night-time noise level (L_{Night}). Although the Miedema (2007) paper showed this relationship in a chart it did not state the precise mathematical function. Based on advice from Bernard Berry we have therefore used an equation from a previous study by the same author published in 2003.[44]

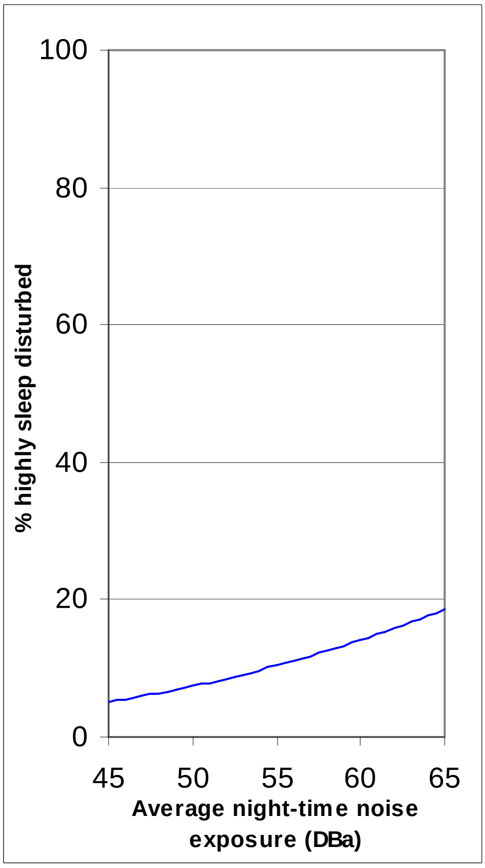
[44] Miedema, HME et al, (2003) "Elements for a position paper on Night-time transportation noise and sleep disturbance", CE Delft, TNO, (Inro Report 2002-59).

% Highly Sleep Disturbed = 18.147 – (0.956 x L_{Night}) + (0.01482 x L_{Night}^2) ***(Equation 1)***

As WHO (2011)[45] noted, the exposure-effect curves in the Miedema et al (2007) and Miedema et al (2003) are very similar and this can be seen in the chart below. Therefore Equation 1 effectively gives the same relationship between noise exposure and sleep disturbance as that used in the CE Delft report. (The WHO (2011) study itself uses the relationship expressed in Equation 1 to assess the impact of aircraft noise on sleep disturbance.)

Chart A7-3: Sleep disturbance and Night noise, Miedema et al. 2007 (left-hand chart) and Miedema 2003 et al. (right-hand chart)





Using Equation 1 it is unclear how the CE Delft report obtained a figure of 18.13% for the percentage of exposed people highly sleep disturbed. The tables below show Oxford Economics' calculations using the same figures for noise affected persons as CE Delft. As the population exposed to noise is expressed in decibel bands one can make different assumptions regarding the appropriate

[45] WHO (2011) *Burden of disease from environmental noise, quantification of healthy life years lost in Europe*".

decibel level to use in Equation 1 to derive the proportion who are sleep disturbed. Table A7-3 shows the results assuming the mid-point level for each decibel band, while Table A7-4 assumes the upper limit for each band.

Table A7-3: Number of people Highly Sleep Disturbed – "mid" estimate

L_{night} noise (dB)	Population exposed (000s)	% HSD (mid-point dB band)	Number of HSD (000s)
50-54.9	145.3	9%	12.8
55-59.9	45.7	12%	5.6
60-64.9	14.6	16%	2.4
65-69.9	1.7	21%	0.4
>70	<0.1	24%	0.0
		10.2%	**21.1**
Source: Oxford Economics calculations based on CAA (2007) and Miedema (2003)			

Table A7-4: Number of people Highly Sleep Disturbed – "high" estimate

L_{night} noise (dB)	Population exposed (000s)	% HSD (upper limit dB band)	Number of HSD (000s)
50-54.9	145.3	10%	15.1
55-59.9	45.7	14%	6.5
60-64.9	14.6	19%	2.7
65-69.9	1.7	24%	0.4
>70	<0.1	24%	0.0
		11.9%	**24.7**
Source: Oxford Economics calculations based on CAA (2007) and Miedema (2003)			

As can be seen our estimate for the proportion of noise exposed who are sleep disturbed ranges from 10.2% (mid-point estimate) to 11.9% (upper limit estimate). This means the CE Delft report's 18.13% is a significant overestimate. The analysis here suggests the number of highly sleep disturbed should be 34% to 44% lower if one were to follow the Miedema relationship cited by CE Delft, with a correspondingly lower estimate for the value of noise impacts.

Instead of £99 million per year the cost of noise impacts should therefore be in the range of £56 million – £65 million per annum. Taking the centre point of this range (£60.5 million per annum) substantially reduces the estimated net present value of noise costs from the £821.7 million estimated by CE Delft to £503.2 million.

Note that this is not a formal Oxford Economics view on a noise cost figure. It is simply a correction for an apparent mistake in the CE Delft report.

The figure of £503.2 million should, in fact, be considered a **generous maximum**. This is in part because, this revised estimate is developed purely from correcting the translation of the noise exposed population to those sleep disturbed. If one were to correct for the likely overestimate of the numbers exposed to aircraft noise, detailed in the previous section, the revision would be even more significant.

Further, the issue raised above about sleep disturbance producing the highest possible externality measure should also be noted. The use of other estimates might produce values which are a small fraction of those estimated by sleep disturbance.

It should also be noted that the Miedema curves of the percent Highly Sleep Disturbed are based on *self-reported* sleep effects. They are not based on objective data on Awakenings.

Survey respondents were asked about experiences in previous Nights and had to indicate how disturbed they had been on a numerical scale. Respondents scoring at the higher ends of the scale, typically above 7 on a 10-point scale, would be classed as Highly Sleep Disturbed.

It is known that most people experience about 10- 20 spontaneous awakenings per Night but hardly notice them. One or two might be caused by noise but in a self-reporting survey the effects can be over-estimated.

Moreover, the above calculations do not take into account the basic statistical uncertainty in the Miedema curves. It is worth noting that, in the EU Position Paper, based on the Miedema work, the authors note the following:

"With regard to the relations for aircraft noise it should be noted that the variance in the responses is large compared to the variance found for rail and road traffic. This means that the uncertainty regarding the responses for Night-time aircraft noise is large, and such responses can be considered as indicative only

A7.3.3 External framework of the analysis

Leaving aside the issue of the internal calculation of noise impacts by CE Delft, an "external issue" is whether the scenario set up by CE Delft is actually viable. Issues concerning scenario viability are further examined in Appendix 8.

As indicated in the CE Delft report, a key assumption of the report's Scenarios "R1" and "R2" is that NQP flights continue to operate into Heathrow but at different times.

Leaving aside the feasibility of this (discussed below and in Appendix 8) the CE Delft report argues that this rearrangement has no impact on noise externalities during the day, as the dB impact of an additional flight during the day is much smaller than during the Night. The argument here seems to be that the effective marginal noise cost of daytime flights is zero.

In consultations with Oxford Economics and MPD, Airport Coordination Limited (ACL) indicated that the only way in which such rescheduling could be made feasible would be through the use of "mixed mode" operations. These would effectively involve more continuous noise from flights over given areas surrounding Heathrow.

In theory, mixed mode operations hold the potential to increase Heathrow's effective takeoff and landing capacity. Yet this raises the question of why mixed mode operations have not been adopted before. The South East Airports

Taskforce has previously rejected the use of mixed mode operations at Heathrow. In particular, there are *terminal* capacity and aircraft gate and stand capacity issues associated with its usage. However a key reason is community opposition to such daytime noise impacts. This suggests that the marginal cost per flight during the day is not zero.

It is difficult to reconcile the opposition to mixed mode operations with the CE Delft report's claim that daytime noise costs in the event of rescheduling are zero. What is more likely is that much of the noise cost would simply be "shifted around" to the daytime hours. A robust scenario analysis, which carefully asked questions about the true difference between the "base case" and any "option cases", would consider this. However this would also imply that the net gain to society – the net reduction in the noise externality – might be much smaller than is estimated by the CE Delft report.

In addition as indicated in the main body of the report and in Appendix 8, a number of flights are in fact likely to divert to Gatwick. Although, the population in the immediate vicinity of Gatwick is much smaller than is the case at Heathrow, it is nonetheless the case that this implies a shift of noise costs rather than a decrease in such costs. Further, the fact that Gatwick has a single runway means that unlike the situation at Heathrow, it is not possible to distribute the noise burden by shifting between runways. These issues are not examined in the CE Delft report.

A7.4 Producer surplus

A review of how the CE Delft report treats the issue of producer surplus (i.e. essentially profits before deducting fixed costs) should consider two approaches, namely:

- *The internal framework* –The internal logic and calculations within of the CE Delft report, accepting the scenarios set up by CE Delft.
- *The external framework* – Whether the assumptions made in the CE Delft report can be justified given the nature of the airline operations at Heathrow and surrounding areas and what the implications of alternative arrangements might be.

A7.4.1 Internal framework of the analysis

As indicated, producer surplus is one of the key components of a CBA. The CE Delft report sets up three scenarios for the analysis of noise impacts and analysis of profits is rightly considered as a factor in assessing costs and benefits in all three scenarios.

In considering changes in producer surplus, the CE Delft report adopts the following approach:

- Loss of profits by UK carriers to UK residents constitutes a transfer with no welfare impacts.

- A reduction of UK resident spending on foreign commodities (i.e. air transport) is a benefit to the UK.
- Loss of revenues and profits due to the loss of transfer passengers (Scenario R2) will be proportionate to the actual passenger loss (e.g. a 35% loss in passengers equates with a 35% loss in profits though the same number of flights appear to operate).
- Losses due to lost foreign tourism are estimated using value added in Scenario R3.
- Changes in freight revenues, non-airside revenues (e.g. airport parking and airport shopping) and the efficiency of aircraft utilisation are not included due to a lack of data.

This approach is governed by the ringfencing adopted by the report in considering that only UK residents and UK business entities have standing.

A7.4.1.1 Loss of profits as a transfer

In terms of the first point above, it is not clear why profits lost by UK carriers are considered a "transfer" to UK consumers or whether such an argument would hold consistently across all scenarios modelled. By the same argument any loss in profits by any domestic industry might simply be considered a transfer to consumers, with no gain or loss to economic welfare[46].

Scenario R1 assumes that flights are simply rescheduled with no loss in profits (though the viability of this scenario is open to question- as further discussed in Appendix 8).

Scenario R2 appears to assume that the same number of transfer flights operate (although with reduced loads). As discussed elsewhere the viability of this scenario is also open to question and it is difficult to conceive what demand and supply assumptions were used by CE Delft.

In the case of Scenario 3, if the removal of NQP flights (a supply side shock) results in leftward shift in the supply curve for flights then producer surplus may well fall, as assumed by CE Delft in scenario R3. However, with a downward sloping demand curve this implies that prices would rise, **reducing** (not increasing) consumer surplus for UK residents, along with foreigners (although the latter are not given standing). The result would not be a simple transfer. Instead there would be a net economic loss.

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[46] Such arguments may relate to the exclusion of local residents in economic impact assessments of events such as local festivals. Only "outsider" revenues are included by many analysts in such cases,. However CBA uses a quite different framework to such an approach and is distinguished by its emphasis on consumer utility. In particular, the shape and nature of the demand curve already allows for substitute and complementary uses of spending.

If it is argued that the demand curve is flat under Scenario R3, and the supply curve shifts inwards, then there would also be a loss of producer surplus. There would be no impact on fares and no offsetting gain or loss in consumer surplus from UK residents. The loss of producer surplus, however, should relate to income from all passengers – UK residents and foreigners. In other words "gains" to UK residents do not offset producer surplus losses because there are no such gains.

In short, it is difficult to fully understand the rationale for treating UK resident spending on UK carriers as a simple re-distribution of welfare in the event of a supply side shock such as this one. The practical consequence is that, at the very least, producer surplus losses should be larger than estimated by the CE Delft report, because producer surplus losses relating to UK residents should also be taken into account. More fundamentally, a ban on flights in the NQP would alter the normal functioning of markets with established consumer preferences and this should be allowed for in the modelling.

A7.4.1.2 Treatment of resident spending on foreign commodities

Likewise, the CE Delft report argues that profits lost to foreign airlines may be considered a benefit to the UK, as the monies could be re-directed within the domestic economy. Presumably this would mean a rightward shift of the demand curve(s) for other commodities. However, this seems similar in principle to protectionist arguments for trade barriers, in that such barriers would generate benefits to domestic businesses through reduced spending on foreign commodities and increased expenditures on domestic ones. Likewise, it is subject to the same critiques. These involve consideration of consumer surplus impacts in conjunction with those of producer surplus. (A full discussion of consumer surplus impacts in general is provided below).

When UK consumers no longer travel with foreign airlines they suffer a welfare loss (unless the aviation demand curve is flat). For example, a leftward shift in the supply curve could raise prices and reduce consumer surplus, as indicated above. This is distinct from the reduction in foreign airline profits – which are rightly excluded by CE Delft. What is relevant is that UK citizens are worse-off since their choice to travel with foreign carriers has been blocked by regulatory action (the NQP ban). As Boardman et al (2006) demonstrate, from a CBA perspective the net effect on welfare is the one measured in this "primary" market for aviation services – in other words the secondary market effects described by CE Delft should not be allowed for in the analysis of social welfare impacts except under special circumstances[47].

[47] If consumers do indeed purchase more domestic goods in "secondary markets" then they could face higher prices. While producer surplus in such markets would increase (presumably the impact suggested by CE Delft) as Boardman et. al. (2006), Cost-*Benefit Analysis* demonstrate, this would be more than offset by reduced consumer surplus.

The fact that UK travellers could face higher prices, reduced choice and/or less convenient travel arrangements (regardless of the nationality of the carriers) is not reflected in the CE Delft report's modelling of scenarios R2 and R3. Yet this would indeed impact negatively on UK resident consumer surplus.

Further, the CE Delft report itself acknowledges that no allowance is made for the fact that UK consumers may simply switch to other imported goods. However data from the ONS' 2005 input-output tables indicates that the average UK household spent 15% of its budget on imports in 2005.

A7.4.1.3 Internal consistency of Scenario R2 profit calculation

Another issue, noted above, is that the assumed loss in passenger revenues and profits is assumed to be proportionate to the number of lost passengers in Scenario R2. That is that the disappearance of foreign transfer passengers travelling on British aircraft would be accompanied by a directly proportionate decline in profits.

However, there is no indication in Scenario R2 that the number of flights has changed. The presumption must therefore be that the same flights are operating with reduced loads. Given the thin margins typical of the airline industry this seems unlikely.

It could be argued that smaller aircraft would be put on the same routes, however this point does not appear to be made in the report and the economics of it could be questionable. It is more likely that the disappearance of transfer passengers would make the operation of many Night flights and the connecting transfer flights (or "early morning flights" as referred to by CE Delft) unviable. This is an issue which is further discussed below and in Appendix 8. However, if this is the case then UK carriers will simply run fewer flights – which would imply greater impacts on profitability than indicated by CE Delft in Scenario R2.

In short, the internal consistency of profitability calculation in Scenario R2 is difficult to understand.

A7.4.1.4 Foreign tourism income

A further issue relates to the assessment of lost foreign tourism income in Scenario R3. This is assessed using lost value added. However lost value added is not a welfare measure – since value added comprises both gross operating surplus (roughly equal to producer surplus) and wages.

While allowing for this would reduce the assessed costs in Scenario R3 it is worth recalling that it should be considered in conjunction with the other measures suggested above and below. In short, due to the number and range of identified specification errors, it is far from clear that Scenario R3 (or R1 or R2) would produce positive cost benefit ratios even with such revisions.

A7.4.1.5 Summary of points

Considering the points above and accepting the construction of CE Delft's scenarios, this implies that:

- Losses in profits should be related to specific assumptions about how demand and supply schedules and prices have changed. It is difficult to justify the argument that reduced profits by UK carriers are simply a transfer to UK consumers. For example, if the supply schedule shifts inward and the demand curve is flat then the losses should include forgone profits from UK residents, with no offsetting "gain" in consumer surplus. So producer surplus losses appear to be underestimated by the CE Delft report.
- There should be no allowance for "saved travel expenses" as a benefit. This implies that the assessment of benefits in R2 and R3 is reduced by £22.9 million and £39.2 million (on an NPV basis) respectively.
- Further consideration should be given the internal consistency of Scenario R2. The losses in profitability in this scenario appear to be underestimated.
- Foreign tourism losses in Scenario R3 may be overstated. However, revision of this factor should be reconsidered in conjunction with a wholesale revision of other costs and benefits.

While issues such as the loss of freight and lost non-airside revenues are not dealt with in the CE Delft report it is understood that the primary reason for this is due to a lack of data, These issues are, however, discussed below.

A7.4.2 External framework of the analysis

A second set of issues surrounds the external validity of the producer surplus analysis in the CE Delft report – that is whether the report omits key issues and construction of the scenarios themselves can be logically justified.

A7.4.2.1 Omitted revenue data

In terms of the omission of key issues, as indicated, the CE Delft report omits inclusion of freight profits due to a lack of data. This is understandable, however the enquiries with the airline industry for this report indicate that annual profits from connecting bellyhold cargo (i.e. freight which passes through Heathrow to third countries) are material.

"Point to point" cargo profits terminating in the UK would be relatively unaffected by a Night flights ban – it would likely be routed to other flights, perhaps with some delays. However, a substantial part of connecting bellyhold cargo profits would likely be lost with the disappearance of Night flights due to commercial expectations of delivery times and the logistics of the flights concerned. A large portion of such profits are derived from freight transferring from flights originating in Asia, Africa or the United States using Heathrow as a hub for transfers to the other two regions. If Heathrow was unavailable then the freight would find other routings using non-British carriers – e.g. Singapore freight bound for the US east coast might travel via another European or Asian hub.

Estimates of lost connecting underbelly cargo profits were provided to Oxford Economics for this report from aviation sources. These allow for the fact that only some of the totality of such profits would be lost by identifying specific routes and flights which would be most affected. While the precise figure cannot be released for reasons of commercial confidentiality, the loss of such profits would, by itself, offset substantial portion of the gains from reduced noise pollution (using the revised noise estimates above).

A7.4.2.2 Scenario realism

A more fundamental set of issues relates to the realism of the scenarios set up by the CE Delft Report. The first scenario, R1, suggests that all NQP flights can be re-directed to daytime landings at Heathrow. However consultations with BA, BAA and ACL for this report suggest that this is not a feasible option. The main reasons for this include:

- *A lack of available daytime slots* – Heathrow is effectively "full". There simply is no additional capacity for Night flights to switch to daytime operations; and
- *A lack of available terminal and stand capacity* – Even if Night flights could be accommodated during the day there would be increased crowding within terminals (e.g. longer queues at immigration). There would also be operational difficulties in terms of parking aircraft given the compressed timeframe in which operations could occur.

Consultation with ACL indicated that it might be theoretically possible to switch to "mixed mode" operations, which would increase Heathrow's capacity.

However, the potential for mixed mode operations has long existed. As indicated, mixed mode operations would also face the difficulties due to fixed terminal and stand capacity. More fundamentally, the implementation of mixed mode is problematic due to community opposition to noise impacts. As discussed above, it is difficult to reconcile these facts with the CE Delft report's argument that the marginal cost of daytime aircraft noise is effectively zero.

The same objections relate to Scenario R2 which likewise assumes that such rescheduling occurs at Heathrow and (apparently) that transfer flights still operate (albeit with reduced passenger loads).

Scenario R3 assumes that there are no longer any Night flight operations at Heathrow, though, as discussed below, it would not appear to fully account for the economic magnitude of such a change.

The current study gathered data and undertook consultations within the aviation sector to test the validity of these scenarios. This work indicated that BA runs the majority of flights during the NQP. Based on an examination of two representative sample weeks from summer and winter 2010, some 44-50% of total NQP flights are run by BA. All scheduled NQP flights are long haul, with 37%-64% originating from South East Asia (depending on the season).

As detailed in Section 3.2, Section 3.3 and Appendices 4 and 8, consultations with BA and subsequent modelling by of a plausible scenario by MPD indicate that the effects of the banning of flights during the NQP by both BA and other airlines could be as follows:

- *Partial rescheduling to "Heathrow daytime"* - Faced with a ban on flights during the NQP, airlines such as BA will reschedule *some* flights to daytime operations. However given the lack of slots this would mean cancelling other shorthaul flights (a process known as "cascading"). This would likely involve dropping less profitable "marginal" flights. Other airlines may also be able to reschedule some flights by using their alliance slots. With fewer shorthaul flights on offer, the rescheduled Night flights are therefore assumed to lose some of their "transfer passengers" (i.e. passengers who would have transferred to shorthaul and other flights) and some freight but no terminating passengers.
- *Lost transfer flights* – As indicated, with airlines such as BA rescheduling flights many shorthaul transfer flights would no longer fly as their slots will have been "cannibalised". Only 50% of these former shorthaul passengers are estimated to continue flying to/from Heathrow on other flights. Other flights would go via another UK airport or not fly at all.
- *Limited move to Gatwick* – Some Night flights operators are assumed to move to Gatwick. Given the fact that Gatwick is unable to effectively function as a regional hub, these flights will lose nearly all their transfer passengers and nearly half their freight but with no impact on the number of terminating passengers. (it is worth noting however, that airlines which might make this move would mainly be those which deliver people "point to point" to the south-east. These would mainly be foreign carriers.)
- *Cancellation of some Night flights* – Night flights which are not rescheduled or moved to Gatwick will simply not run and neither will the reciprocal "outbound" flights. These flights will lose all of their transfer traffic to European hubs. Of passengers on these flights who were going to terminate their journeys in the UK, 50% would catch the rescheduled daytime flights directly into Heathrow, 30% would enter the UK after first transferring at a European hub and 20% would not fly at all.
- *Fewer flights scheduled in the late evening* – An NQP ban would also complicate matters for flights outside the time period of the ban itself. There would be fewer flights scheduled in the late evening due to the risk of "late running" and being held overnight, as discussed in Chapter 3.

Modelling by MPD based on these impacts was used to develop some estimates of the lost airline "value added" (i.e. GDP) due to the disruptions caused by the removal of NQP flights. As indicated in Chapter 3, MPD modelling suggests that a ban on NQP flights would result in a loss of some £82.3 million in value added. Other data supplied by MPD indicate that some 70% of this value added relates directly to airlines. The ONS.2005 input-output tables indicate that Gross Operating Surplus (analogous to Producer Surplus) equates to some 42.6% of value added for the "air transport" industry. This suggests that lost producer surplus is some £24.6 million per annum (i.e. 82.3*0.7*0.426 ~ 24.6).

Under such an approach the annual value of lost producer surplus is estimated to be £24.6 million per annum or £204 million on an NPV basis over 10 years using a 3.5% discount rate recommended by HM Treasury's *Green Book*.

This compares to an estimated losses (on an NPV basis) of £0 in Scenario R1, £28.5 million in R2 and £66.8 million in R3.

Note that this figure relates to lost airline producer surplus only and excludes non-aviation revenues (retail, parking etc.).

A7.5 Consumer surplus

In a transport CBA consumer surplus may comprise of a number of elements (which can be added under a generalised cost approach). Calculations of consumer surplus can involve consideration of factors such as:

- Fares
- Travel time
- Frequency (or alternatively waiting time)
- Reliability (or alternatively delay)
- Other preferences (e.g. comfort, preferred travel times)

Consideration of changes in travel time is often central to transport CBAs. As is the case for the analysis of producer surplus, a review of the CE Delft report's approach to consumer surplus must take into account both internal and external issues.

A7.5.1 Internal framework of the analysis

In considering changes in consumer surplus, the CE Delft report indicates that it adopts the following approach:

- Rescheduling of flights could result in reduced flight frequency which would have negative welfare impacts on passengers
- Flight rescheduling could also affect consumer utility,. given that leisure passengers are argued to prefer arriving during the afternoon, though business and transfer passengers are assumed to suffer reduced utility due to the changed arrival times.
- There is no change in "in vehicle" passenger travel time due to the fact that under Scenario R1 there is simply a rescheduling of flights, while under R2 transfers are simply made at other hubs (with no increase in travel time) and there is "insufficient data" to asses changes in travel time in Scenario R3.

A7.5.1.1 Rescheduling of flights and flight frequency

Considering the first point, frequency of service (or alternatively the value of "waiting time") is indeed an important issue in transport economics and one that is often overlooked. However while the CE Delft report refers to this issue it is less clear that it is actually measured in any of the scenarios discussed. Rather, what is assessed is actually the gains or losses in passenger utility due to the changed arrival times of flights (as indicated in the second dot point above). This is separate, again, to a true measure of the value of more (or less) frequent flights.

Given that this is the case, it constitutes an important omission. If some transfer flights now no longer operate (as indicated in Scenarios R2 and R3 and in the MPD modelling referred to above) then there will be a loss of utility to UK passengers due to the reduced frequency of service. Consumer surplus losses will therefore be higher than is indicated in scenarios R2 and R3 for this reason alone.

A7.5.1.2 Flight time preferences

The CE Delft report does make a notable attempt to assess changes in utility due to changed flight times. As with the recognition of frequency valuations, in principle, this is a positive contribution to a little discussed topic. However, the basis for these assessments is open to question.

In Scenario R1, business travellers and transfer passengers are assumed to suffer a loss in utility due to the disappearance of NQP flights, while leisure travellers are assumed to enjoy a benefit from later arrivals, because they prefer to arrive in the afternoon. Scenario 1 assumes passengers would arrive 12 hours earlier or 12 hours later than the current NQP arrival times.

However, the only basis for the claim that leisure passengers do indeed prefer to arrive in the afternoon is Lijesen (2006). His paper refers to a stated preference survey of 188 Dutch respondents in which the choices of flight characteristics "mimic" a trip from Amsterdam to New York. The results are extrapolated to suggest that westbound long-haul leisure passengers in general prefer afternoon arrivals. Despite the fact that original author takes care to stress that the findings do not necessarily apply to other routes or contexts, CE Delft have applied that unjustified conclusion universally, out of context

In the case of NQP flights to Heathrow, as indicated roughly a third to two thirds (depending on the season) originate from South East Asia with some from the Near East/Africa and a few from the United States. It is reasonable to assume (as the CE Delft report does) that business passengers and leisure transfer passengers from such regions would prefer Night flights to allow for meetings/connections early the next morning. However, it is far from clear that Heathrow NQP leisure travellers would prefer afternoon arrivals – particularly as this would essentially involve the "waste of a day" travelling during daylight hours from Asia/Africa.

Indeed it is also far from clear that leisure travellers journeying from the United Sates to Heathrow would prefer daytime flights. Data provided for this study allowed for a comparison between a number of flights originating in the United States and arriving at Heathrow in the morning period (between 0515 and 0935) with flights on the same routes arriving in the 1940-2035 period. Although details are limited by confidentiality commitments, this analysis indicated that average seat load factors were consistently higher on the morning flights.

The significance of this issue to the analysis can be easily demonstrated using figures for UK resident utility reported in CE Delft's Scenario R1. CE Delft indicate that under this scenario UK resident business passengers would suffer an annual loss in utility of £82.87 million, while transferring leisure passengers would suffer a loss of £8.23 million.

Assuming that business and leisure transfer passengers do indeed suffer a loss of utility as described by CE Delft and that leisure travellers are merely *indifferent* to the new arrangements (meaning they experience no utility loss or gain) suggests a loss in consumer utility of £91.1 million per annum (i.e. 82.87+8.23) or £757.6 million over 10 years, on an NPV basis using a 3.5% discount rate.

This is likely to be a conservative estimate of costs to passengers given that they are likely to prefer to arrive at the times of their current choosing – without the imposition of regulatory barriers such as a NQP ban.

The unit value of consumer surplus losses attributed to business and leisure travellers also seems low. The CE Delft report uses DfT unit values of time for non-air modes, stating that no better values are available. However, standard practice in transport evaluations recognises the importance of using mode-specific values of time, particularly given the salience of travel time impacts in transport appraisals.

EUROCONTROL values of time for airline passengers are freely available and offer a standard approach to such valuations. EUROCONTROL suggests an all-passenger value of time of €43-€55 per hour (in 2009 prices). Using a Purchasing Power Parity (PPP) adjustment factor and allowing for some (UK) inflation this suggests an average passenger value of time of roughly £41 per hour. This compares to CE Delft hourly values of £5.2 (leisure) to £31 (business).

The use of EUROCONTROL values of time would therefore make a further material difference to the results, particularly if broken down by business and leisure travellers, with appropriate weighting for the numbers of both.

A7.5.1.3 Changes in travel time

Most fundamentally however, the treatment of potential changes in travel time in all scenarios is open to serious question. No allowance for changes in travel times is made in the CE Delft report. This is surprising given the magnitude of the changes involved. As indicated, travel time is often the most material component of most transport CBAs and should be carefully examined.

In R1, the assumption effectively involves pushing extra flights through Heathrow within a narrower timeband. This might have a variety of effects including the following:

- *Additional arrival queuing time* – As more flights arrive within a fixed timeframe, longer entry queues could be expected at immigration/customs. Likewise, the greater volume of operations could involve increase gate access delays for arrivals.
- *Additional departure delays* – Placing more flights within a narrower timeframe would be expected to increase the potential for flight delays. (The average delay time at Heathrow was 19.6 minutes in 2007 (DFT 2009)). These would affect not only "Night flights" passengers but could ripple across the entirety of Heathrow's operations, creating the potential for substantial additional costs due to increased travel time (even if restricted to UK residents).

In other words, travel times are likely to increase with the changed arrangements suggested by CE Delft. Allowing for this in combination with the use of more appropriate (i.e. higher) values of travel time this suggests that the costs of R1 should be much higher than indicated.

These considerations would also apply to R2, if indeed it is assumed that all connecting (or "transfer") flights continue to operate with reduced loads.

The CE Delft report argues that diverted transfer passengers might instead transfer at Amsterdam or Paris under this scenario and that additional travel time there is "unlikely". However, if additional travel time at these alternative hubs is unlikely, it is not clear why passengers don't already use them. Given that the airline industry is highly competitive it is more likely to be the case that passengers are advantaged by using Heathrow. A possible reason for this may be that other hubs would have fewer connecting flights, implying longer waiting times.

No attempt is made to measure lost travel time in scenario R3. This is surprising, given the very large potential losses in travel time that could arise if passengers do not use Heathrow. For example, if long haul passengers now have to land at another European hub and then continue their journey on to London and the south-east this could involve substantial additional travel time due to transfers and additional delays. Likewise, travellers to UK regional airports would likely find fewer connections at foreign airports than in the UK. As indicated, those transferring to third countries are also likely to find poorer connections and experience longer delays – otherwise they would not have used Heathrow in the first instance.

A7.5.2 External framework of the analysis

As discussed, the feasibility of the scenarios suggested by the CE Delft report is open to question. The more likely sequence of responses in response to a NQP ban is described in the discussion of producer surplus above. This would also have implications for the calculation of consumer surplus. These are indicated below:

- *Cancellation of long haul Night flights* – With fewer long haul flights flying into Heathrow, as indicated, MPD modelling suggests that an estimated 30% of the UK-bound passengers from such flights will journey to the UK via another European hub (increasing travel times both on the ground and in the air) while 20% would not fly at all (i.e. the entire consumer surplus of the journey would be lost.). Meanwhile all transfer passengers from such flights are assumed to be lost to Continental hubs (with potential increases in waiting time). Even though consumer surplus losses are restricted to UK residents, these are likely to be substantial.
- *Rescheduling of BA long haul flights* – As indicated, the argument that passengers prefer afternoon arrivals and daytime flights is questionable, particularly in respect of flights in the NQP. While some passengers would simply take the rescheduled flights, if these arrived considerably later in the day this might implicitly involve a loss of utility (and reduced consumer surplus) given such preferences. Others might divert to flights which arrive in the mornings at either Gatwick or Heathrow. MPD modelling indicates that many of the transfer passengers from such flights would be "lost". Some might make their transfers into the UK or beyond at continental or other hubs, with poorer connections implying potential increases in ground waiting time (at the least).
- *Cancelled short haul flights* – As indicated, consultations with BA and modelling by MPD indicates that a NQP ban would result in the cancelation of short haul flights. MPD modelling suggests that only 50% of these passengers would continue to fly from Heathrow, with the remainder using other UK airports or not travelling. This would also likely impact on consumer surplus, Alternative travel arrangements are likely to be sub-optimal, given that preferred passenger choices were already reflected in the decision to use Heathrow as a hub. The use of alternative travel arrangements is likely to involve increased travel times either due to the need to use other airports and/or less direct alternative connections. There may also be longer wait times (if the cancelled flights are not fully replaced at other airports).
- *"Drop out"* –As indicated, some cases (cancelled long haul and/or short haul flights) the additional time and complexity of the altered arrangements may mean that trips are not undertaken. The total consumer surplus of people who no longer undertake trips would therefore be lost. This is effectively the reverse effect of the "induced demand triangle" formed by a transport improvement.

All of the effects described above would have the effect of reducing consumer surplus. Given their number and scale, the size of these omissions is likely to be substantial.

A7.6 Summary

As indicated, while making some attempt to capture some elements of producer and consumer surplus, as well as relevant externalities, the CE Delft report suffers from a number of shortcomings. Key issues include:

- *Overestimation of noise costs* – Noise impacts appear to be greatly overestimated. Even a modest re-estimation implies impacts with an NPV of some £503 million rather than £822 million as suggested in the CE Delft report. It is likely that noise costs are substantially smaller than this if factors such as the apparent confusion of noise impacts from the NQP and Night flights are allowed for.
- *Underestimation of producer surplus losses* – Impacts on profitability are likely to be much more severe than estimated by the CE Delft report. If an alternative modelling approach (using non-CE Delft scenarios) is adopted, lost profitability totals some £24.6 million per year or £204 million over 10 years. Lost connecting underbelly freight losses would be in addition to this
- *Underestimation of consumer surplus gains* – Consumer surplus is likely to have been underestimated due to the lack of a substantive analysis of changes in travel time and unreliable assumptions about passenger arrival time preferences, A simple allowance for lost passenger utility due to later flights implies losses of £91.1 million per year or £757.6 million over 10 years.

These shortcomings, along with the others discussed above, make the report unreliable for policy evaluation purposes. In particular, the questionable assessment of benefits and the exclusion of key costs make it likely that the benefits of a NQP ban are significantly exaggerated while the costs are greatly underestimated.

The above assessment has attempted to lay out a more appropriate scenario for the consequences of a ban on NQP flights, as well as some of the attendant consumer and producer surplus issues. A more rigorous CBA would take these issues into account and form a basis for appropriate policy decisions.

A practical illustration of the material impact of only some of the effects discussed above can be undertaken by re-considering CE Delft's Scenario R1. This compares the revised travel time and noise calculations described above. Considering the revisions to these two elements alone, produces a benefit cost ratio (BCR) well below 1.0 (i.e. 0.66) suggesting that the initiative is not worth undertaking as benefits of a ban are smaller than its costs.

Note that this is not a formal Oxford Economics view of what the appropriate BCR for the NQP ban should be, nor is it intended to be definitive. It is intended only as an illustration of one potential starting point for re-examining the CE Delft assessment, indicating the impact of correcting for two measures used by the CE Delft report. However the BCR would be even smaller if some of the other issues identified above were included in a revised calculation.

Table A7-5: Sample revised R1 CBA

Costs	£ (million)	Benefits	£ million
Travel time preferences	757.6	Noise reduction	503.2
Total	*757.6*	*Total*	*503.2*
		Benefit/cost ratio	**0.66**

Source; Oxford Economics calculations

Appendix 8: Viability of the Delft scenarios

This Appendix builds on earlier discussions and provides a detailed consideration of the viability of the scenarios modelled in the Delft report.

The Delft report considers the reactions to a hypothetical ban under Supply Side and Demand Side responses, as detailed below.

A8.1 Supply side: operators

Two supply side reactions are postulated by the Delft report:

- all flights scheduled to arrive or depart between 2330 and 0600 are rescheduled to earlier in the evening or later in the morning; or
- the flights can not be rescheduled, as LHR has insufficient capacity to permit this, and the flights do not operate.

No account is taken of the difference between runway and scheduled stand times, but at the top-down broad level of calculation used this is acceptable. However, no consideration is given to how delayed flights would be dealt with in a case of a complete curfew; or the increased severity of the scheduling "shadow" which already tends to restrict the scheduling of stand departure timings close to the NQP boundaries, because of the risks of delay into the NQP. The cost of an overnight delay in terms of lost aircraft and crew utilisation, passenger and crew expenses, and passenger time, are considerable.

The first reaction suggested, rescheduling, is largely impracticable. This is confirmed not only by the airlines, but by the independent slot allocation co-ordinators of Airport Coordination Ltd (ACL), who administer the system at LHR and other fully co-ordinated airports, and effectively ensure application of the EC Slots Regulation[48] as transcribed into UK law. Fully mixed mode operations could alleviate the runway capacity situation if permitted in the future, but its unconstrained exploitation by major rescheduling would require additional infrastructure investment in stand and terminal capacity. Mixed mode operations would also have environmental cost implications, as alternating use of LHR's right and left runways for take-off and landing, to give periodic relief from noise impacts, would cease.

Annex A to the Delft report illustrates their argument that the existence of day flights on routes with Night movements (particularly arrivals),shows that rescheduling to daytime is possible and even preferable to passengers is tautological.

Taking the first example, from their "Expedia" website source, it is shown that of seven daily arrivals at LHR from Hong Kong, three are outside the Night period. Our analysis shows that in the Summer 2011 schedules listed by the Official

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[48] Regulation (EEC) No. 95/93 on common rules for the allocation of slots at Community airports, as subsequently amended

Airline Guide, there are nine quasi-daily arrivals, of which four are outside the Night period. This compares with the situation in Summer 2003, when one out of six arrivals was evening, and the other five were between 0515 and 0620. Those five Night flights (and the evening one) are still operated at similar times by the same airlines, indicating that the Night slots have been jealously guarded. Partly to respond to increasing total Hong Kong demand, and partly through the routing of multi-sector flights, the three new flights were added (including one from a new operator) using the available slot times, which had to be outside the Night cap on movements. Their existence is no indication whatsoever of any ability to reschedule from Night to day, or of passenger preference for afternoon arrivals.

Neither does the Delft argument hold for the other examples quoted, as our analyses demonstrate. In generic terms, the fact that that some flights operate by day as well as by Night on given routes does not imply that the Night flights can therefore be moved to daytime.

The second supply side reaction modelled by the Delft report, that the flights currently scheduled within the NQP were cancelled, is a plausible, if impracticable, hypothesis. The supply side effects would not, however, end there. Although round trip fares are used for calculation of airline profit reduction (as representative of the loss of reciprocal flights), the cascade of network effects, including loss of transfer traffic on connecting flights, and the overall loss of frequency (which is part of the product the passenger is buying when choosing an airline or gateway), are not taken into account.

The possibility of rescheduling by cancelling other flights to free up slots is mentioned but not developed. This option would of course only be available to an airline with a portfolio of slots at the airport, unless another airline could be persuaded to give one up. It is in either event an unwelcome and unlikely response, from both an airline and national viewpoint - not only is the moved flight sub-optimally scheduled, but the displaced flight is lost.

It is recognised that the reactions suggested are scenarios, at the extremes of various reactions necessarily over an implementation period. In practice, airlines, particularly those LHR-based, faced with such draconian cuts to their scheduling capabilities (with implications for fleet numbers and composition, and route network viability), would be faced with the necessity to reappraise their entire complex interlocking commercial and operational strategies, with results that can not be theoretically forecast. It is recognised that for modelling purposes, some scenario format of quantifying changes in costs and revenues must be established. However, such scenarios should at least acknowledge their impracticability, and recognise their secondary effects, rather than implying that they can be simply implemented by the airlines affected.

A8.2 Demand side: passengers

Two generic scenario reactions are outlined:

- passengers displaced from Night flights opt for a different scheduled time (arrival only being mentioned), this reaction being associated with the suggested supply side reaction of rescheduling;
- displaced passengers no longer fly to (or presumably from) LHR:
  - leisure passengers do not travel (so this traffic is lost at LHR); and/or
  - use a different destination (or origin) airport, this also applying to "must fly" business passengers (so this traffic is lost at LHR but may be retained in the UK); while
  - transfer passengers, some 35% of the global LHR total, fly via another airport, presumably one of LHR's European competitors such as Amsterdam, Frankfurt or Paris, (so this traffic is lost at LHR but some of it may be retained in the UK).

As scenarios defining the extremes of passenger reactions to the flight choices presented to them if the airlines respond to a Night flight ban as suggested by the supply side scenarios, they would not be unreasonable in theory, were the supply side scenarios (other than cancellation) more practicable. Revenue loss does take account of the traffic also lost on reciprocal flights.

A8.3 Demand side: cargo

No account of the reactions of cargo shippers is taken, due to a stated lack of information. There is a twice weekly scheduled freighter arrival from Hong Kong in the early morning shoulder period, and a quasi-Nightly short haul scheduled express departure inn the late evening shoulder. But 93 percent of all flown cargo moving at Night at LHR is belly cargo on passenger aircraft, amounting to 209,000 tonnes per annum, 98% of it long haul, including significant transfer traffic. Since this is supplementary revenue on flights basically operated for passengers, at relatively negligible marginal cost (handling and the extra fuel its weight consumes) it seems disingenuous to ignore it, when scenarios are used as surrogates for estimates of how passengers might react.

Much of this belly cargo is express, with a high economic value. The literature abounds with studies on the economic importance of such traffic, and it too should not be ignored. The competitive essence of the express product is the latest pick-up from the shipper in the evening, and the earliest delivery next morning. It is thus not susceptible to rescheduling.

A8.4 Supply/demand interaction scenarios

When the supply and demand side reaction scenarios are brought together in the Delft report, three benchmark combined scenarios are defined for evaluation. They are recognised as extremes, with reality stated to be expected to fall somewhere among them, although at the economic evaluation stage it is the extremes which are headlined.

The three combined response scenarios comprise:

- R1, in which all flights are rescheduled today, all passengers accept the new timings, and there is no traffic loss. This is tantamount to assuming that there are no costs from removing Night flights. Thus, saying that the benefits of a Night ban are greater than the costs is not logically a conclusion but an assumption. In any event, this scenario is unrealistic. Slots are not presently available for flights to be rescheduled, and even if there were, no account is taken of the competitiveness of the new schedules at overseas origins/destinations, or the readiness of other European airports to take the traffic (particularly transfer) at the times which passengers are currently choosing. It is simply assumed that transfer traffic will simply wait at LHR as long as necessary, even passengers transferring to/from European competitor airports[49].
- R2, in which all flights are rescheduled but all connecting traffic (35% of the total) is lost, while terminating passengers (65%) are retained. The rescheduling assumption remains unrealistic, but the traffic loss hypothesis is not an unreasonable scenario marker, in theory, although the resultant loss of profit appears prima facie to have been miscalculated in Table 10 of the Delft report. In practice, a loss of traffic and revenue with no significant saving in cost as long as the flights continues to operate, results in an equivalent loss of profitability. Further, the way that this scenario's outcome is valued results in the apparently perverse claim that it is economically better for UK plc to lose the transfer traffic (scenario R2) than to retain it (scenario R1).
- R3, in which all NQP flights are cancelled, and all their traffic lost. The logic of the theoretical interaction of the responses is in a sense conservative, as some traffic would probably try to shift to day flights, increasing load factors. However, the cancellations would also cause cancellation of the reciprocal daytime flights, and the loss of capacity and revenue would have significant network effects (beyond traffic loss) to airlines, passengers, shippers, and the catalytic "connectivity"[50] of LHR as a viable hub.

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[49] According to the CAA's November 2008 paper on 'Connecting traffic at UK airports', one of the busiest origin/destination transfer passenger flows at LHR was between Hong Kong and Paris, with 87,000 passengers; although CDG itself had at least two daily nonstop flights to/from Hong Kong.

[50] Ibid., para. 7.22

Glossary

Statistical reference period	01 July 2010 – 30 June 2011, in order to cover the most recent 12-month period, least affected by volcanic ash disruption and traffic downturns during the banking crisis.
London Airport Heathrow	LHR
Aircraft movement	Arrival or departure, i.e. a landing or take-off
Aircraft turnaround	Arrival plus departure
Night	2300-0700 local runway time
"Core" or NQP	2330-0600 local runway time (Night Quota-Count Period)
"Shoulder" periods	2300-2329 (late evening) and 0601-0700 (early morning)local runway time.
Time	All times are local unless specified as UTC
Runway time	Time of actual landing or take off, the standard to which noise restrictions apply. This is also the operational time in which the Eurocontrol Central Flow Management Unit (CMFU) assigns a "slot" for a specific departure event. It excludes taxying time, and is expressed to the nearest minute.
Scheduled time	Also referred to as stand time, this is the preplanned, timetabled time of arrival or departure of a flight at/from its stand or gate, and thus includes an allowance for taxying. These are the times to which EU Slots regulation applies, and which are assigned by co-ordinators (ACL at LHR). In Europe all scheduled times are planned to the nearest 5 minutes. A flight with a scheduled departure time of 2250 which leaves its stand on time is almost certain to take off at 2305 runway time or later, and to be counted as a "Night flight" for regulatory purposes, as is an on-time arrival scheduled for 0710.
Origin/destination	Defined by flight number. Thus a flight from Sydney to LHR via Singapore, Bahrain and Zurich would be defined as a long haul flight with origin Sydney. CAA passenger survey data would also identify all the flight's passengers' destinations as Sydney on the reciprocal flight, although some might originate and/or terminate at intermediate points. Passengers' surface origins/destinations in the UK are as surveyed.

Passengers and passenger movements:

Terminal	All passengers joining or leaving the aircraft at the airport
Terminating	A passenger commencing or ending their journey at LHR, counts as 1 arrival passenger movement or 1 departure passenger movement.

Transfer	A passenger connecting from one flight to another at LHR, counts as 1 transfer passenger (but counts as 2 terminal passenger movements in airport statistics; and counts as 2 passengers, 1 passenger on each flight, in airline statistics). Transit A passenger who arrives and departs on the same aeroplane on which they arrived – negligible (0.2%)in the LHR context... Each passenger is counted once.
Cargo	Freight plus mail. Only flown (not trucked) cargo is considered.
Short haul	Flights originating/terminating in Albania, Armenia, Austria, Azerbaijan, Belgium, Bosnia & Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, the FYR of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Kosovo, Latvia, Lithuania, Luxemburg, Malta, Moldova, Monaco, Montenegro, the Netherlands, Norway, Poland, Portugal, Romania, Russia in Europe (effectively Moscow and St Petersburg in this context), Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, and UK, plus for the purposes of this study, Algeria, Belarus, Egypt, Israel, Lebanon, Libya, Morocco, Syria and Tunisia.
Long haul	All other States are long haul. Including all the rest of Russia. Some multi-sector long-haul flights may include an initial or terminal short-haul leg, but flights are classified according to the flight number's origin/destination.

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