intergenerational foundation

Fairness for Future Generations

Flying in the Face of Fairness: Intergenerational Inequities in the Taxation of Air Travel

A report for the Intergenerational Foundation

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October 2012

Table of Contents

Foreword

This report is groundbreaking. It looks at aviation policy in an entirely new way. The statistics it uses are familiar: £11 billion annual subsidy received by the UK aviation industry through tax-free fuel and being zero-rated for VAT; the significant —and growing — contribution aviation makes to climate change. What is new is the way the report assesses the implications of these statistics for future generations.

Flying in the Face of Fairness produces compelling evidence that future generations will pay the price of the failure of this generation to control flying. It concludes that

> because total UK emissions are capped, maintaining the subsidy to aviation means that the wider economy will have to shoulder even steeper carbon cuts to accommodate growing aviation emissions. The costs of these extra cuts will be borne by future generations.

The report reveals that, even today, it tends to be older – and wealthier – people who benefit most from subsidised flying. It is the 55—64 age group which flies the most. In total the annual subsidy to flying is the equivalent of £400 per UK household or "enough to pay a quarter of the total interest on the UK national debt."

If this subsidy was eliminated overnight, the amount of flying would be cut by a third. If, under a more realistic scenario, it was phased out over a period of 20 years, the rate of growth in air travel would be slowed, reducing the need for new runways. Business travel would be the least affected as it is the most resilient to higher fares.

This report, though, is much more than a plea to be fair to future generations. It is an economically literate report that spells out the detail of the subsidies received in an informative and convincing manner. Its authors also show a thorough understanding of the science of climate change. It should be essential reading for all those involved in the debate about the future of aviation.

John Stewart

Chair of UECNA, the pan-European anti-airport-expansion network

Main points

- UK aviation pays no fuel tax or VAT – effectively subsidies that cost the government over £11 billion each year.

- Without these subsidies the cost of a return trip by air would increase by around £100 on average.

- The subsidy is equivalent to £400 per UK household and would be enough to pay a quarter of the total interest on UK national debt.

- If airline subsidies were eliminated overnight the amount of flying would drop by about a third; but phasing in the changes over 20 years would simply slow the rate of passenger growth.

- The impact would be greatest on leisure flights, and so would help reduce the UK's "tourism deficit", while business travel would be more resilient.

- Eliminating the subsidies would greatly reduce the case for new runways.

- People aged between 55 and 64 benefit more than younger people from government support for flying, because they are flying more, as well as (in all likelihood) spending more per air ticket.

- Aviation policy is contributing to climate change, which will affect younger and future generations most.

- Because total UK emissions are capped, maintaining the subsidy to aviation means that the wider economy will have to shoulder even steeper carbon cuts to accommodate growing aviation emissions. The costs of these extra cuts will be borne by future generations at large.

Executive Summary

Outline

The UK is living through a period of austerity in which Government expenditure is being cut and (some) taxes are being increased to reduce the deficit, so that future generations are not crippled by the size of the national debt.

At the same time, the record Arctic ice-melt of summer 2012 has given us a stark reminder of the threat of climate change. Future generations will bear the costs of today's emissions as they suffer the impacts of rising temperatures, and of any investment decisions today that increase emissions, as they will face the task of decarbonising the UK economy.

In this context it is important to scrutinise the tax paid by different economic sectors, and the effect of fiscal policy on greenhouse gas emissions. A sector that is under-taxed is arguably contributing to the burden of debt that will be borne by future generations, since the tax shortfall could otherwise be used to reduce the deficit. If the same subsidy is accelerating the growth in greenhouse gas emissions, it has a doubly inequitable impact on future generations.

The aviation sector pays no fuel tax or VAT, and in this report we seek to quantify the extent to which aviation can be said to be "under-taxed", and put this figure in the context of other national expenditures. **(Part 1)**

We also examine two related issues that raise questions about whether current aviation policy treats different generations fairly. The first is an issue of inter-generational fairness amongst the living – is the favourable tax treatment of aviation benefitting older people more than younger people today? **(Part 2)**

The second issue is the implications of current aviation policy for future generations. Light taxation keeps air travel cheap and stimulates demand. But with growth in demand comes growth in greenhouse gas emissions, the impacts of which will be borne by future generations – although forecasting and monetising these effects is notoriously difficult.

The framework chosen for analysing this effect is the target for UK GHG emissions under the Climate Change Act 2008. The more aviation emissions are allowed to grow, the more other sectors will need to reduce their emissions – at a cost that we seek to quantify. **(Part 3)**

The current treatment of aviation not only represents an inadequate fiscal contribution that will contribute to the debt borne by future generations, but is storing up an emissions problem that will be faced in its sharpest, costliest form by future generations.

By contrast, gradually increasing the taxation of air travel until it is aligned with taxation of private car travel would improve the UK's public finances and bring emissions down to a level that is manageable (although still costly) in the context of the UK's 2050 climate change objectives.

Although it is not the purpose of this report to assess the economic benefits of aviation, we recognise that these are significant. However, we suggest as a general observation that since business flying is far less price-sensitive than leisure travel, an increase in air fares would have little effect on levels of business travel and connectivity which are the main drivers of economic benefits. By contrast a reduction in leisure travel may benefit the UK economy, since outbound spending on leisure travel far outweighs inbound spending – the so-called "tourism deficit".

Key findings

Bold numbers in brackets eg **(1.1)** refer to the relevant section of the report.

Part 1 – Is aviation under-taxed?

- Air Passenger Duty contributed £2.6 billion to the Exchequer in 2011. **(1.2)**

- The European Union Emissions Trading System (EU ETS) will generate a small amount of revenue from the auctioning of emissions allowance. However, since around 70% of airlines' allowances requirements will be allocated free of charge, they are likely to generate windfall profits by passing on the opportunity cost of these permits to passengers. These profits are likely to outweigh their costs. **(1.3.1)**

- Other airline business costs (e.g. airport charges) are sometimes presented to customers as "taxes" at the point of purchase when they are not – although the exact practice varies widely from airline to airline. **(1.3.2)**

- The tax revenue forgone by the exemption of aviation fuel from VAT and duty is around £10.4 billion today. **(1.4.1)**

- The revenue forgone by the zero-rating of airline tickets for VAT is around £2.6 billion today. **(1.4.2)**

- Zero-rating for VAT allows airlines to reclaim VAT paid on their inputs, which they did to the value of £0.8 billion in FY 2010—2011, even though VAT paid on their outputs was only £0.2 billion. **(1.4.2)**

- Airports can generate revenue from concessions to duty-free retailers in the region of £0.3 billion annually, although the loss of excise duty to the Exchequer is probably at least twice this sum. **(1.4.3)**

- The aviation sector (including aerospace) enjoys a range of other benefits that have not been quantified but which support the industry and ultimately suppress airfares:

  - Route Development Funds – direct Government support to set up marginally profitable air routes **(1.5.1)**
  - Government support for surface access schemes **(1.5.2)**
  - Underwriting of aerospace exports through the Export Credit Guarantee Department **(1.5.3)**
  - Direct state aid to the aerospace sector (at national and EU level) **(1.5.4)**
  - Rules allowing aircraft to be leased through offshore structures based in low-tax jurisdictions **(1.5.5)**
  - Protection through international treaty of the bandwidth used for Air Traffic Control, meaning that commercial airlines do not face full market competition for their use of the radio spectrum. **(1.5.6)**

- **The overall quantifiable 'effective subsidy' to the aviation sector is around £11.4 billion today. (1.6)**

- £11.4 billion represents, for example:

  - Over £400 per UK household
  - More than is spent annually on GP services or school buildings
  - A quarter of the interest on the UK's national debt. **(1.8)**

Part 2 - Intergenerational implications today

- The groups with the highest propensity to fly are those aged 55 to 64 and those aged 25 to 34. For leisure flying alone, the 55 to 64 age group takes proportionally the most flights.

- The 55—64 age group in particular, as well as flying for leisure more often, also appears to be spending more on air travel than other age groups.

- This age group therefore appears to benefit from the tax breaks on fuel duty and VAT that aviation enjoys to a greater extent than do other age groups.

Part 3 – Implications for future generations

- The current tax status of aviation suppresses airfares and therefore inflates passenger demand. The Department for Transport currently forecasts 470 million passengers and 49 $MtCO_2$ (Metric tonnes of Carbon Dioxide) in 2050. This forecast is based on no new runways; catering for growth by expanding airports would lead to around 520 million passengers and 55 $MtCO_2$. **(3.1)**

- By contrast, gradually applying taxes at the rates identified in Part 1 would slow growth significantly (but not reverse or eliminate it), and reduce the perceived need for additional runways. **(3.1)**

- The policy of the previous Government was to cater for growth at the artificially inflated level, but this policy became untenable because the consequent growth in greenhouse gas (GHG) emissions could not be reconciled with targets under the Climate Change Act 2008. **(3.2.1)**

- The policy of the Coalition Government initially recognised this, but now appears to be veering back towards a predict-and-provide model, although no decisions on runway capacity will be taken until after the 2015 general election. **(3.2.2)**

- The Committee on Climate Change (CCC) recommends that aviation emissions should be stabilised at around today's levels in order to achieve the UK's climate change objective of an 80% reduction on 1990 levels of GHG emissions by 2050. This would require passenger numbers to be no more than 370 million in 2050. **(3.3)**

- The CCC scenario requires other sectors to make deeper cuts than 80% to achieve the overall objective, since aviation is being allowed an increase of around 100% on 1990 levels. These cuts will cost approximately £7 billion in 2050. **(3.3)**

- Allowing aviation emissions to grow will place an even greater burden on other sectors. The Department for Transport central forecast of 470 million passengers and 49 $MtCO_2$ in 2050 implies cuts in other sectors that would cost over £9 billion. Catering for growth by expanding airports would lead to around 520 million passengers and 55 $MtCO_2$ — implying cuts in other sectors that would cost over £10 billion. **(3.3)**

- The costs to other sectors in 2050 are likely to be underestimates, since:

    - Emissions reductions become progressively more expensive as the required cuts become steeper (since the easy/cheap reduction measures are implemented first).

- Aviation has significant non-CO_2 impacts that approximately double its overall contribution to climate change (compared to the effects of CO_2 alone). Accounting for these impacts without policies to limit growth would require emissions reductions in other sectors that are probably not feasible. **(3.3)**

PART 1 – Is aviation under-taxed?

1.1 Context

International aviation enjoys an exemption from fuel tax that has its origins in the 1944 Chicago Convention, the treaty that laid the foundations for the modern international air transport system. The exemption has been cemented in the numerous bilateral air services agreements concluded between pairs of countries.[1]

There is nothing to prevent any government levying duty on fuel used for domestic flights, as do the United States and Germany. But domestic aviation accounts for a far smaller proportion of fuel consumption than international aviation for every country in the world with the exception of the United States.

Aviation fuel is also exempt from VAT, and the sector enjoys a range of other fiscal privileges, as well as receiving some public funding for ancillary activities such as research and development or surface access to airports.

A number of countries have introduced substitute taxes on the aviation sector in the form of ticket taxes (or quasi-ticket taxes) that partly counterbalance this favourable treatment: for instance France, Germany and Ireland, as well as the United Kingdom, which has levied Air Passenger Duty (APD) since 1994.[2]

Section 1 of this report discusses the fiscal treatment of the aviation sector and aims to quantify both taxes paid and taxes forgone (where this is feasible) in order to arrive at a figure for the size of the notional "subsidy" enjoyed by aviation.

The sector has also entered the European Emissions Trading System (EU ETS). The extent (if any) to which this imposes a cost is discussed in section 1.3.1 below.

1.2 Tax paid – Air Passenger Duty (APD)

The aviation sector contributed £2 billion to the Exchequer through APD in 2010 and £2.6 billion in 2011.[3] This figure is forecast by the Office for Budget Responsibility to rise to £3.0 billion in FY 2013—14 and to £3.9 billion in FY 2016—17.[4]

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[1] For example, the so-called "Open Skies" Treaty is the bilateral air services agreement between the EU and the United States.

[2] APD is not strictly a 'ticket tax' but an excise duty levied on the airline per passenger carried, but the cost is almost universally passed through by airlines to passengers and listed as a separate cost item in the total ticket price.

[3] *Air Passenger Duty Bulletin*, HMRC, April 2012

[4] *Economic and Fiscal Outlook*, Office for Budget Responsibility, March 2012, Table 4.7 on page 101. Note that the OBR forecasts are for fiscal years only; other figures are given for calendar years.

1.3 Other taxes?

1.3.1 EU ETS

Since 1 January 2012, all flights to and from EU airports have been included within the European Emissions Trading System (EU ETS). This is often presented by airlines as equivalent to a tax, but in fact the small amount of government revenue generated by auctioning allowances is likely to be far outweighed by the revenues airlines can generate by passing through the cost of free allowances. The overall effect of EU ETS is discussed briefly below and more fully in Appendix 2.

Airlines will be required to surrender emissions allowances equivalent to the total CO_2 they have emitted on these routes at the end of each year. Airlines can acquire emissions allowances in one of three ways:

- through free allocation: 85% of the sector's total "cap" (approximately, 2005 levels of emissions) will be distributed free of charge;
- by purchasing them from a government auction (of the remaining 15% of the cap);
- or by purchasing them from other private sources: chiefly other economic entities covered by the EU ETS or from Clean Development Mechanism projects in developing countries

Since governments keep the proceeds of emissions auctions, they represent a revenue transfer from the aviation sector[5] to the public purse.

The UK government's receipts from auctioning aviation EU ETS credits are likely to amount to only a few tens of million pounds. The total cost of purchasing allowances (both from auctioning and Clean Development Mechanism projects) for the 20 largest UK-administered airlines has been estimated as £76 million per annum,[6] and would increase if aviation grows.

Crucially, though, the EU ETS represents an effective subsidy to airlines as well as a cost, since a large proportion of emissions allowances will be given out for free. This amounts to handing airlines an economically valuable resource for nothing, and in these circumstances airlines will seek to recoup the opportunity cost of using (rather than selling) the allowances by passing on their cost to passengers, resulting in a windfall profit — as happened in the electricity generation sector.

The considerable debate about the extent to which this will happen in the airline sector is summarised in Appendix 2. Estimates range from 29% to 150% with a majority of commentators expecting an average of around 100% (with differential effects on freight, low-cost and full-service airlines).

[5] Although the activity base is different to that for Air Passenger Duty – see Appendix 2 for details.
[6] *Aviation emissions and the EU ETS*, Sandbag, 2012

What is clear, however, is that — since around 70% of airlines' emissions permits required in 2012 will be allocated for free — a cost pass-through of only 30% is required to break even, which is at the very bottom of the estimated range.

EU ETS is therefore overwhelmingly likely to be profitable for airlines. Profit estimates are given in Appendix 2 for a range of allowance prices and cost pass-through rates. These range from £100 million to £720 million.

The true extent of any windfall will only be known once the empirical data is available. Given this uncertainty, and the fact that the activity basis differs from the fuel duty and VAT estimates above (i.e. incoming and outgoing flights by major UK-administered airlines vs. flights from UK airports), neither the auctioning revenues nor the windfall effect is included in the overall summary of UK aviation's effective subsidy given in Section 1.6 below.

1.3.2 Airline costs presented as "taxes"

Anyone who has flown on a low-cost airline in the last decade will be familiar with the fact that the final cost of a fare is often well above the advertised ticket price. The Advertising Standards Agency has now cracked down on the practice of luring customers in with eye-catching but misleadingly low fares. Nonetheless, many airlines still break down the overall cost of the fare into elements that represent their own business costs, and present these to the customer as if they were government taxes, giving the impression that aviation is taxed more heavily than it really is.

To take an example, on the day of writing, a Ryanair flight from London Gatwick to Dublin, departing 7 September 2012, could be booked for a total of £64.09. This price was itemised as in Table 1:

Table 1: Components of a sample low-cost fare

Fare	£22.99
EU 261 Levy	£2.00
Web check in	£6.00
ETS Levy	£0.25
Taxes / Fees	**£32.85**
Aviation Insurance / PRM levy	*£6.49*
UK Air Passenger Duty	*£13*
UK Passenger Service Tax	*£13.36*
Total Price	**£64.09**

Source: Ryanair.com

Of the three items labelled 'Taxes / Fees', only APD is a tax:

- The "aviation insurance / PRM levy" is, as a further page on Ryanair's website clarifies, a combination of two elements: i) a surcharge to reflect the increased insurance costs faced by airlines after the 9/11 terrorist attacks, and ii) a small surcharge to recoup the cost of providing special assistance for passengers with reduced mobility (PRM).[7] On any analysis, these are costs of doing business, not "fees" or even less, "taxes".

- The "UK Passenger Service Tax" is, in Ryanair's own words "a charge made by the airport authority to an airline for the use of the terminal, runway, emergency services, security facilities etc." Therefore it is not a tax, and it is not levied by the UK.

Of the other additional cost items:

- the "EU 261 Levy" recoups the cost of compensating stranded passengers where flights are cancelled for reasons beyond its control;

- "Web check-in" is self explanatory; and

- The tiny ETS levy represents the total cost of purely environmental policies to the traveller – although Ryanair is correct not to label it as a tax.

Practices vary from airline to airline. Some exclude fuel surcharges from the ticket price, lumping them in with "taxes and charges". The combinations of costs into a single "charge" are often inexplicable and obscure the value of the individual costs being added, e.g. Flybe charges as one item a fee of £8 for "Security, Insurance & Emissions Trading System".

As a footnote, passengers can claim back the APD they have paid when they cancel a flight, even where every other element of the fare is non-refundable. Almost all airlines, however, charge an administration fee for the refund that often means it is not worthwhile to claim it. Ryanair charges a £17 administration fee, but APD on all Ryanair flights is only £13. Collecting these taxes on behalf of the Government then effectively refusing to refund them when they are no longer payable is reportedly a significant income stream for some airlines.

[7] See www.ryanair.com/en/questions/what-is-covered-by-taxes-fees-and-charges-in-my-reservation

1.4 Tax foregone

1.4.1 Taxes on fuel

The tax paid by the aviation sector should be considered in the light of "tax forgone"– the notional revenue that would be due if aviation fuel attracted fuel duty and VAT. The notional duty rate used for this comparison is the rate of fuel duty on petrol and diesel paid by private motorists, compounded by the rate of VAT (which is added after fuel duty).

Note that there is no single Government rationale for setting this rate, and even if legal and political obstacles to aviation fuel duty were removed, the aviation rate could be set independently of the road vehicle rate. Arguments could be advanced for setting the rate both higher (flying is generally more discretionary than driving) and lower (for instance, the risk that airlines will refuel abroad to avoid tax) and in any case it would be advisable to phase in any tax increase on aviation gradually. But flying and driving are the two activities of private individuals that consume by far the largest volumes of hydrocarbon fuel, and the existing fuel duty rate is therefore the obvious choice to highlight the discrepancy in the tax treatment of the two.

The Department for Transport (DfT) estimated the forgone fuel duty at £8.5 billion in 2008,[8] but this figure apparently does not include the forgone VAT on fuel. Since that time, aviation fuel consumption has declined somewhat due to a reduction in passenger demand resulting from the economic downturn. On the other hand, the rate of road fuel duty has increased. VAT rates have also fluctuated between 15% and 20% over the period. Table 2 below sets out the broad evolution of these parameters.[9]

Table 2: Fuel Duty and VAT forgone on aviation fuel, 2008—1012

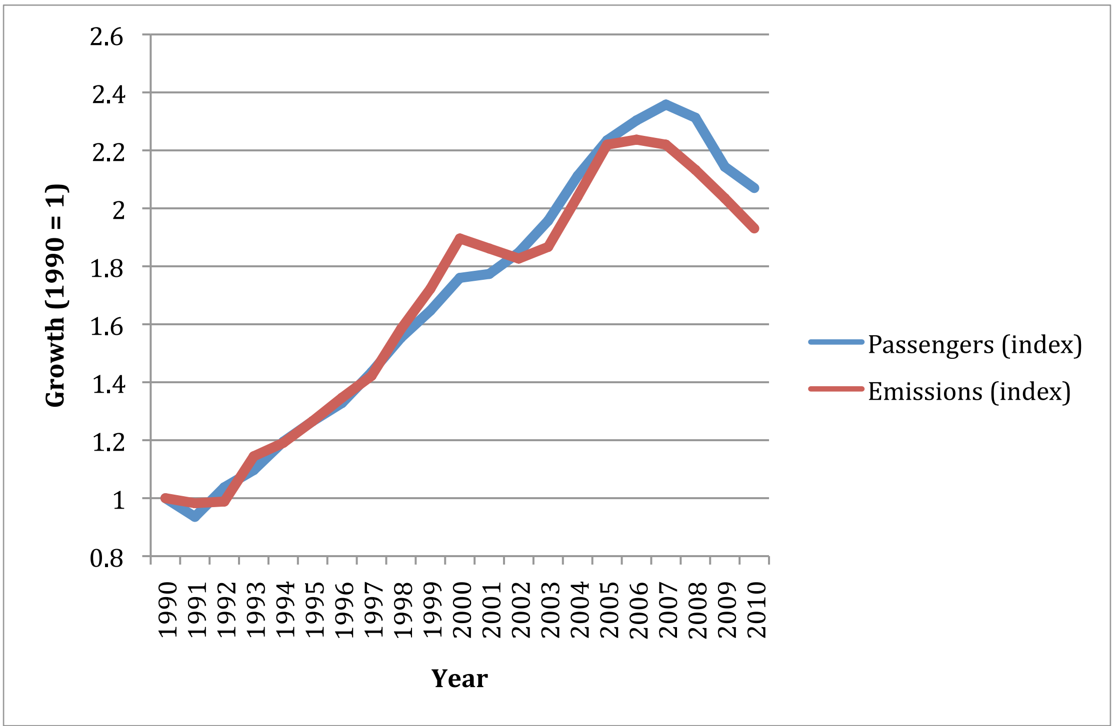
Year	Fuel Duty (p/l)	VAT	Effective fuel tax rate (p/l)	Aviation fuel consumption (bn litres)	Tax forgone (£ bn)
2008	50.35	17.5%	59.16	16	£9.5
2009	54.19	15%	62.32	15.3	£9.5
2010	57.19	17.5%	67.20	14.5	£9.7
2011	57.95	20%	69.54	15.0 (est)	£10.4
2012	57.95	20%	69.54	n/a	n/a

[8] *The future of aviation: Government response to the Committee's First Report of Session 2009–10*, House of Commons Transport Committee, February 2010, page 8

[9] The tax rates for the majority of the calendar year in question are given although in some cases they were altered part-way through the year.

Note that fuel consumption data for 2011 has been estimated by increasing the 2010 figure in line with the growth in passenger numbers (approximately 4% in 2011 over 2010). As fuel consumption has closely tracked passenger numbers at UK airports since 1990 (see figure 1 below), it is reasonable to assume a proportionate increase in UK aviation fuel consumption.

Figure 1: Trends in UK air passengers and emissions, 1990—2010



Source: CAA Airport Statistics, Defra GHG statistics

Applying the effective combined fuel tax rate for 2011 to the estimated fuel consumption of the aviation sector gives a total for fuel taxes forgone in 2011 of £10.4 billion.

1.4.2 VAT on tickets

Airline ticket sales are zero-rated for VAT.[10] The forgone VAT on airline tickets therefore represents a further significant way in which tax is not charged on the

[10] Zero-rating is different to, and more favorable than, VAT exemption. HMRC explain that: "If you sell zero-rated goods or services, you can generally reclaim VAT on any purchases that relate to those sales. This is in contrast to if you sell only exempt goods or services, where you cannot normally reclaim VAT on your purchases." See www.hmrc.gov.uk/vat/forms-rates/rates/rates.htm

sector. In 2010, total household spending on air travel was £12.4 billion.[11] If VAT had been charged on this expenditure at the 2010 rate of 17.5%, it would have amounted to some £2.2 billion. Assuming that expenditure grew in line with passenger numbers in 2011, and applying the 2011 VAT rate of 20%, the forgone VAT on tickets would have been approximately £2.6 billion.

This is the notional figure that could be collected if VAT were to be introduced on tickets. However, the airline industry today reclaims VAT that it has paid on purchases related to sales of airline tickets, as allowed by HMRC rules for zero-rated products and services. In addition, aircraft repair and maintenance, and sales and charters or civil aeroplanes are zero-rated for VAT.

Information release by HMRC under Freedom of Information rules has allowed the value of this arrangement to the industry to be quantified: in FY 2010—11, the passenger and freight air transport sectors declared output tax of £210m and claimed input tax of £804m, meaning the net VAT bill was a transfer of £583million from the Exchequer to the industry.

The total size of the annual VAT benefit to aviation is therefore around £3.2 billion, since rather than claiming £0.6 billion as it does today, the industry should be contributing £2.6 billion.

1.4.3 Duty-free shopping

Duty-free shopping was introduced at Shannon airport in Ireland in 1947 and has grown into a global business worth US$46 billion today, of which 34% is in Europe. Heathrow airport alone is reported to have had duty-free sales of over US$1billion (£640million) in 2010.[12]

There seems little *a priori* justification for this anomaly: it undermines the public health objectives of taxing alcohol and tobacco, deprives the state of revenue and provides an artificial boost to aviation. Duty-free for intra-EU passengers was abolished in 1999.

The loss to the Exchequer of tax that would have been levied on the sale of goods should be considered separately from the additional revenue that airports can leverage from sales generated by the tax concession. While the former exacerbates the UK's fiscal balance sheet, it is the latter that can be used to cross-subsidise airport charges and so ultimately reduce airfares and stimulate additional demand.

All duty-free goods are exempt from VAT, and in addition alcohol and tobacco are exempt from the additional duties they attract.

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[11] *Consumer Trends Q4 2011*, Office of National Statistics, March 2012, item 7.3.3

[12] By the Tax-Free World Association, see www.multivu.com/mnr/53836-tfwa

The loss to the Exchequer from duty-free sales is therefore at least 20% of the total sales and is likely to be significantly higher – tax (VAT and excise duty) accounts for an average of 74% of the cost of a bottle of spirits, 56% of a bottle of wine[13] and 78—88% of the cost of a packet of cigarettes.[14] On a conservative estimate that tax would represent an additional 50% cost on the value of duty free goods, the tax forgone at Heathrow alone is over £300 million per annum.

Concessions charged to duty-free retailers are an important source of revenue for airport operators. Revenue from duty-free was the single largest component of retail revenue for BAA Ltd in 2011 and raised over £140 million, or around £1.30 per passenger.[15] Revenue from duty-free retail at Gatwick was worth nearly £60 million in 2011, or around £2 per passenger.[16] As these airports represent around two-thirds of UK passengers, the overall value of the concession to the aviation sector is estimated at around £0.3 bn in 2011 – although this is the more conservative figure, as the loss to the Exchequer is likely to be higher.

1.5 Other ways in which aviation receives favourable treatment

There are numerous other ways in which the aviation and aerospace sectors receive favourable treatment. These are discussed briefly below, but are not included in the final assessment of the size of aviation's overall tax break due to difficulties in establishing comparisons. Some, however, are considerable in size, and all in one way or another boost the profitability of the industry, keeping airfares low and stimulating demand.

1.5.1 Route Development Funds

Route Development Funds (RDFs) are government support given to airlines to develop new air services – subsidising additional new routes that airlines would otherwise be unwilling to risk. Although relatively modest in scale, RDFs are a direct way in which government subsidy increases aviation activity.

Changes to EU State Aid Guidelines from 2005 restricted the circumstances in which such funds could be disbursed, but even within this newly restricted framework, the European Commission approved up to £25 million of RDF grants by the UK Government in 2006. These went to authorities in Wales, the North East of England and North West of England to support airlines with up to 50% of marketing costs and airport charges on eligible new routes.[17]

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[13] According to the Wine and Spirit Trade Association, see www.wsta.co.uk/taxation.html
[14] According to the Tobacco Manufacturers' Association, see www.the-tma.org.uk/policy-legislation/taxation/
[15] *Annual report and financial statements for the year ended 31 December 2011*, BAA Ltd, pp. 10-11 BAA Ltd is the group owning the companies that operate Heathrow, Stansted, Edinburgh, Glasgow, Aberdeen and Southampton airports.
[16] Gatwick Airport Ltd: Report and Financial Statements for the year ended 31 March 2011, page 16.
[17] See Letter 'C (2006) 1844 final' from the European Commission of 16 May 2006.

The State Aid Guidelines are currently being reviewed, and the UK is pressing the European Commission for greater liberalisation, apparently so that it can expand this subsidy in order "help with the establishment of new services at airports outside the South East, where such aid would not distort competition."[18]

1.5.2 Road access support

The policy of the previous Government was that airport operators should bear the costs of improving surface transport links to airports where the airport was the sole beneficiary.[19] Since even road schemes that directly serve airports will usually have other beneficiaries (e.g. by removing airport traffic from other roads), this policy allowed for public funds to contribute to numerous airport surface access schemes. The Coalition is continuing this support. Its latest draft policy document lists the following:

- £165 million for the Airport Link Road to Manchester Airport;
- £19.5 million for junction enhancements to the M1 which will improve access to Luton Airport;
- £18 million for the construction of a road link between Doncaster and Robin Hood Airport;
- £160 million for widening the A453 between Nottingham, the M1 and East Midlands Airport.[20]

1.5.3 Export finance assistance for the aerospace sector

The UK's Export Credit Guarantee Department (ECGD, now also using the name UK Export Finance) "complements the private market by providing assistance to exporters and investors, principally in the form of insurance and guarantees to banks".[21] Support for the aerospace sector (almost exclusively to Airbus) dominates its activities: in 2011—12 it issued 31 separate guarantees for civil aerospace contracts, amounting to £1,832 million (out of a total of £2,318 million). The guarantees supported the delivery of 132 aircraft — 26% of the total aircraft delivered by Airbus.

The ECGD is largely financed by its own income – the guarantees for civil aerospace generated £65.5 million of premiums in 2011—12. Therefore the size of the guarantee should not be taken as equivalent to a subsidy to the sector.

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[18] *Draft Aviation Policy Framework*, Department for Transport, July 2012, para 2.58
[19] *The Future of Air Transport*, Department for Transport, December 2003, para 4.58
[20] *Draft Aviation Policy Framework*, Department for Transport, July 2012, paras 2.68, 2.81, 2.82
[21] All quotations and figures in this section taken from *Annual Report and Accounts 2011–12*, Export Credits Guarantee Department, June 2012

The effective subsidy is the difference between the premiums Airbus paid to ECGD and the premiums it would have had to pay to a commercial lender. The function of the ECGD is to guarantee loans that the private sector would otherwise be unwilling to provide, so it is impossible to estimate the true value of its support to Airbus.

1.5.4 Government support for the aerospace sector

In 2004 the United States initiated a complaint at the World Trade Organization (WTO) challenging a variety of assistance measures provided by the European Community and four individual Member States (France, Germany, UK and Spain) to Airbus. The measures included support from a wide range of sources for research, development and launch of large civil aircraft in the period 1995—2004.

A detailed history of the complaint is beyond the scope of the report, but a selection of the measures examined by the WTO panel is given at Annex 1, in order to give a flavour of the state support enjoyed by Airbus. Loans from the European Investment Bank total nearly €1billion, while grants under the Fourth, Fifth and Sixth Framework Programmes amount to well over €1billion.

1.5.5 Offshore structure for aircraft leasing amounting to tax avoidance

Airlines traditionally bought aircraft from manufacturers by taking out bank loans. Aircraft leasing originally emerged for a number of reasons. There can be tax advantages for both the airline and the lender if the transaction is instead structured as a lease. Changes in UK tax regulations in 2006 eliminated many of the advantages for leases taken out since then, but there still are some tax advantages.[22]

Cross-border leasing allows leases to be structured in a way to take advantages of differences in the tax treatment of leases in different jurisdictions. Ireland offers particularly favourable treatment of leasing companies and has many double taxation treaties. It is the main international centre for aircraft leasing; nine of the ten biggest aircraft leasing companies operate there. Leasing companies based in jurisdictions with favourable tax treatment can make a profit offering aircraft leases at lower rates than they would if based in countries such as the UK. Competition between the companies means that airlines also benefit from these tax avoidance arrangements by the leasing companies. Under the Tax Avoidance Disclosure Regulations, HMRC has to be notified of any cross-border lease in excess of £10 million where one party is entitled to capital allowances. It is not possible for us to estimate the scale of the taxes avoided by UK airlines leasing aircraft.

[22] Business Leasing Manual, HM Revenue & Customs, 2007. See: http://www.hmrc.gov.uk/leasing/

1.5.6 Protected spectrum rights

The radio spectrum is managed in the UK by the telecommunications regulator Ofcom. As demand for telecommunications increases, spectrum is becoming an increasingly scarce resource. Ofcom's response has been to seek efficient use of the spectrum by moving towards market pricing.

The part of the spectrum used for aeronautical navigation is protected by international treaty[23]. Ofcom is therefore unable to apply the pure market approach of spectrum auctioning to these frequencies.[24] Instead it is seeking to extend the use of "Administered Incentive Pricing", by setting fees that reflect demand pressures as well as simply the costs of managing the spectrum. It hopes that this will lead to more efficient allocation of spectrum *amongst aeronautical users*. However it remains of the view that in the absence of international restrictions, aeronautical spectrum users would face competition from other users.[25]

1.6 Quantifying the effective subsidy to UK aviation today

The figure of a £10 billion effective subsidy has been used for some time in the debate around aviation taxation.[26] It was confirmed as a reasonable estimate by the Government as recently as 2010 (for the year 2008), although the DfT cautioned that it should be regarded as a notional, first-order estimate and that should taxation at this level be applied, there would be substantial behavioural effects to consider — in other words, this amount of money would never in practice be raised for the Exchequer by applying taxes at these rates, as it would act as a disincentive that reduced levels of aviation activity.

This survey suggests that the figure of £10 billion remains a reasonable estimate – see Table 1 below. While aviation activity has been reduced slightly since 2008, and the tax-take from APD has increased slightly, the rate of both fuel duty and VAT has increased, increasing the notional revenue forgone per litre of kerosene.

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[23] As a signatory to the International Telecommunications Union ("ITU"), the UK has international treaty obligations to ensure non-interference with the use of spectrum in the band 117.975 to 137 MHz for aeronautical communications.

[24] Spectrum auctioning can generate significant sums of money – the auction of spectrum for the UK's 3G mobile network raised £22.5bn in 2000. The 4G auction is planned for 2013.

[25] *Applying spectrum pricing to the Aeronautical sector: A second consultation*, Ofcom, December 2009.

[26] At least since the publication of *The Hidden Cost of Flying*, Aviation Environment Federation 2003.

Table 3: Approximate size of effective subsidy to UK aviation, 2011 (£bn)

	£ bn
APD	-2.6
EU ETS	-
Fuel taxes	10.4
VAT on tickets	2.6
Reclaimed VAT	0.6
Duty free	0.3
Rounded Total	**11.3**

1.7 The effective subsidy and economic benefits

Aviation brings significant economic benefits to the UK and has an economic output of around £17 billion.[27] These benefits, cannot however, be compared to the size of the effective subsidy or be said to "outweigh" it. Tax breaks that keep the price of flying artificially low only stimulate demand at the margin – the policy is not one of "spending" £11 billion to get £17 billion of benefits, but to get the additional benefits from those who would be deterred from flying if prices were higher in the absence of any subsidy.

The price elasticity of demand for business flying is very much lower than that for leisure flying;[28] in other words business travellers are more willing to pay higher prices to continue to fly and an increase in airfares would depress leisure travel to a much greater extent than business travel. Since the majority of benefits to the UK economy are derived from business travellers, this implies that prices could be raised without inflicting significant damage to the overall economic benefits delivered by the sector.

Indeed, it is arguable that leisure travellers export wealth, since the total spent abroad by leisure travellers (approx. £31 bn in 2011) is far greater than that spent in the UK by foreign visitors (approx. £18 bn in 2011).[29] The net effect of reducing demand for air travel would therefore be to increase demand for holidays in the UK, boosting our tourism sector overall and keeping more economic activity flowing in our economy, rather than abroad.

[27] *Draft Aviation Policy Framework*, Department for Transport, July 2012, para 1.8.
[28] UK passenger forecasts assume -0.7 for leisure and -0.2 for business travel. *UK Aviation Forecasts*, Department for Transport, August 2011, para 2.18
[29] See *Overseas Travel And Tourism - Q4 2011*, Office for National Statistics, April 2012.

1.8 The effective subsidy in context – some comparisons

£11.3 billion represents:

- £180 a year, or £3.50 a week, for every man, woman and child in the UK;
- £510 a year, or nearly £10 a week, for every household in the UK;
- Around £100 per passenger departing from a UK airport;
- More than the annual budget of the Home Office or Ministry of Justice.

By way of illustration, an additional £11 billion of Government Revenue could be used to:

- Easily exceed spending on GP services (currently £7.7bn), Community Healthcare (£8.4bn) or Mental Health services (£8.4bn);
- Almost double investment in school buildings (currently £5.9bn), or increase the schools budget (£52.8bn) by 20% overall;
- Increase spending on defence equipment (£22.7 bn) by 50%;
- Fund the activities of the Home Office (£10.5bn), Ministry of Justice (£9.5bn), Department of Energy and Climate Change (£8.1bn) or Department for International Development (£7.7bn), or fund the Department for Environment, Food and Rural Affairs (£2.7bn) four times over.
- Finance a quarter of the UK's annual debt interest (currently £43.9bn)

Part 2 – intergenerational implications today

2.1 Frequency of flying amongst different age groups

The Civil Aviation Authority (CAA) conducts annual passenger surveys at a selection of the UK's largest airports. The CAA surveys include data on passengers' age, income, socio-economic group.

It has been noted before from this data that there is a significantly higher propensity to fly amongst better-off sections of society. Since it is known that (up until retirement age), higher age groups have higher incomes, we set out to test the proposition that older people also have a higher propensity to fly than younger people.

CAA data are split between UK and foreign passengers. We have taken data only for UK passengers, as it is these who are directly influenced by UK policies in their choice of when and whether to fly.

Firstly the data for the 12 airports surveyed by CAA[30] in 2010 were aggregated to give UK totals. Secondly, the age ranges were equalised as far as possible, given the mix of age bands presented by CAA.[31] Thirdly, 2011 census data for England and Wales were used to convert the raw percentages of passengers in each age band into relative frequency of flying – that is how often those in a given age group fly, compared to the national average.

The results are presented in Graph 1 for all passengers, and for leisure and business passengers separately in Graphs 2 and 3.

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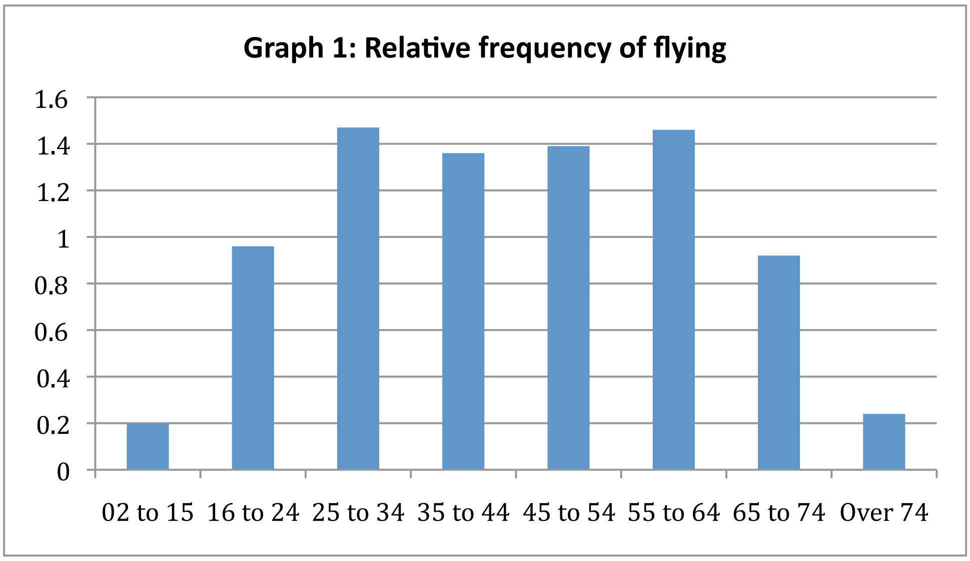
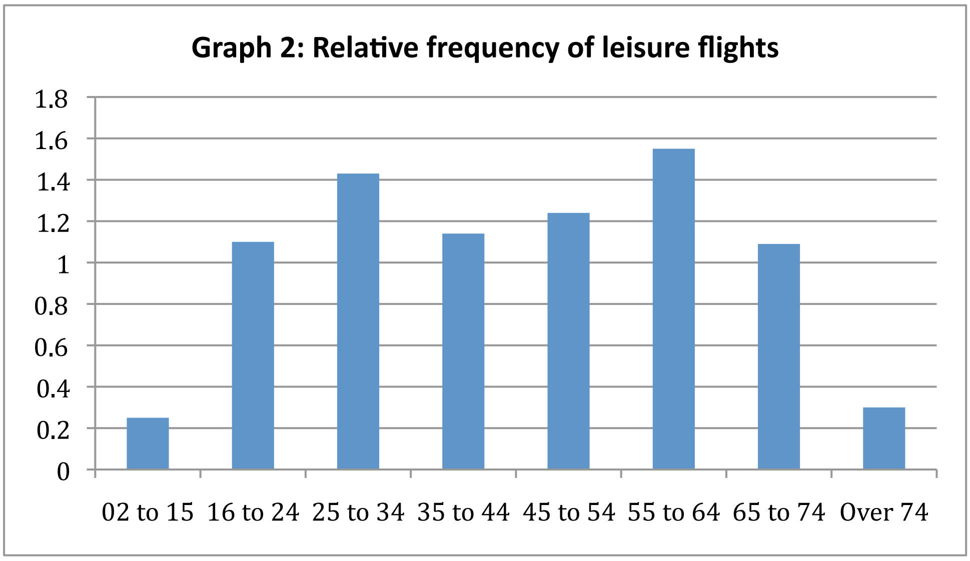
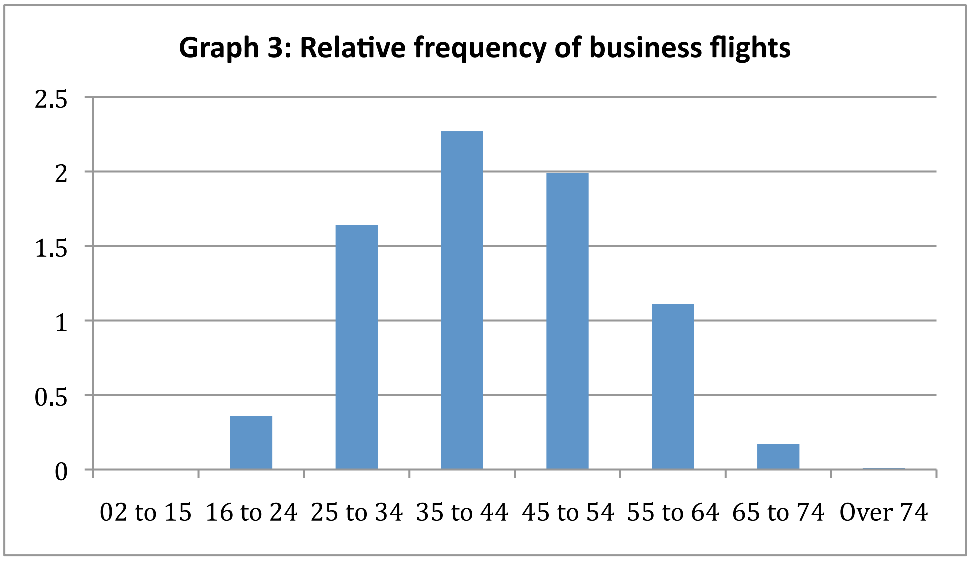
[30] Birmingham, Doncaster, East Midlands, Gatwick, Heathrow, Humberside, Leeds Bradford, Liverpool, London City, Luton, Manchester and Stansted. See *CAA Passenger Survey Report 2010*, Civil Aviation Authority, 2010

[31] The CAA age groups are a mixture of 5 and 10-year bands, with some irregularities in the youngest age bands.


Graph 1: Relative frequency of flying
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
02 to 15
16 to 24
25 to 34
35 to 44
45 to 54
55 to 64
65 to 74
Over 74


Graph 2: Relative frequency of leisure flights
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
02 to 15
16 to 24
25 to 34
35 to 44
45 to 54
55 to 64
65 to 74
Over 74


Graph 3: Relative frequency of business flights
2.5
2
1.5
1
0.5
0
02 to 15
16 to 24
25 to 34
35 to 44
45 to 54
55 to 64
65 to 74
Over 74

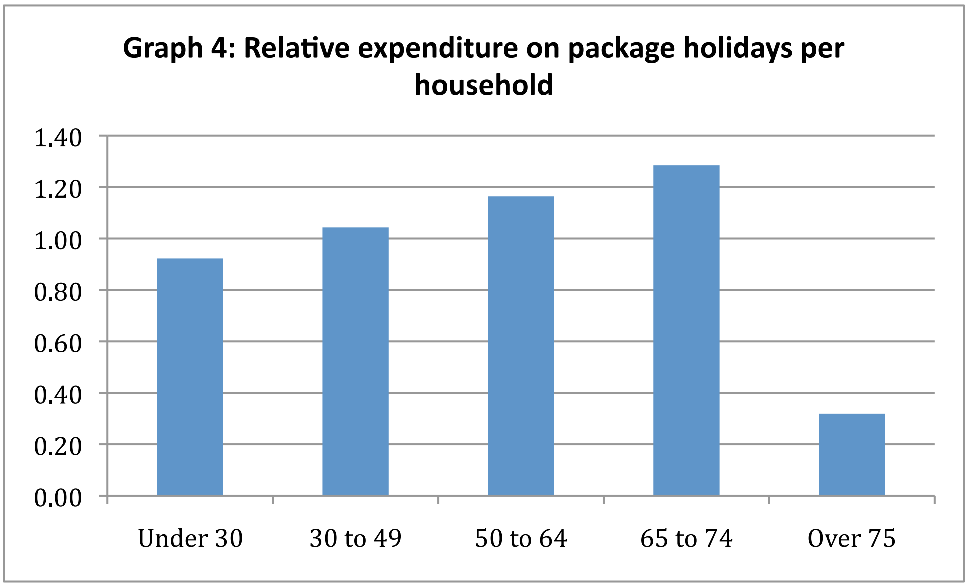
The three graphs alone show that people of working age fly more than those older and younger. The frequency of flying overall is greatest among those 55 to 64 and those 25 to 34, with slightly less flying by the age groups in between. This tendency is more marked for leisure flying, where the 55 to 64 and 25 to 34 age groups fly substantially more than the 35 to 44 and 45 to 54 age groups, who in turn fly substantially more than those younger and older than working age.

The reason for this trend is most likely that people do the most travelling for leisure in early adulthood, before they have children, and in late middle age, after children have left home. The graph of flying for business instead shows the 35 to 44 and 45 to 54 age groups doing the most flying.

2.2 Expenditure on foreign holidays

Data from the 2010 Living Costs and Food (LCF) Survey is presented below, looking at how expenditure on foreign holidays varies according to age.

The LCF records expenditure on package holidays. Graph 4 below shows that of households according to the age group of a household reference person (HRP).[32]



It can be seen that households with an HRP aged 65 to 74 spend the most on package holidays. They spend an average of £770 per household per annum. However, the pattern of expenditure increasing with age, before falling back in households with an HRP aged over 75, could perhaps be explained by older people being more likely to go on package holidays, while younger people may be more likely to book their holidays independently.

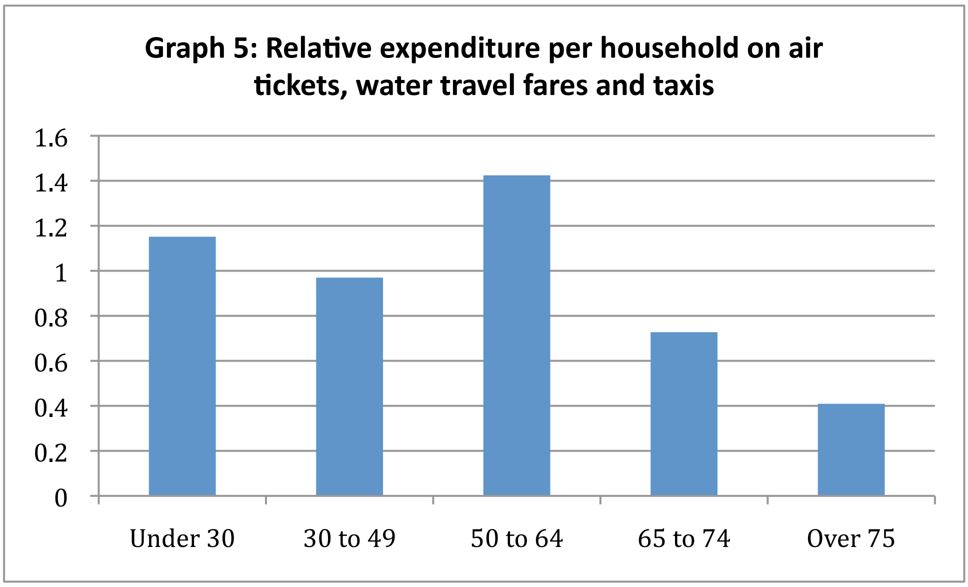
[32] The "household reference person" is the person in the household with the highest income. If two or more people have the same income, the oldest one is the household reference person.

LCF records expenditure on package holidays in a different way to how it records most expenditure. Respondents are asked about any package holiday they have paid for in the last three months.

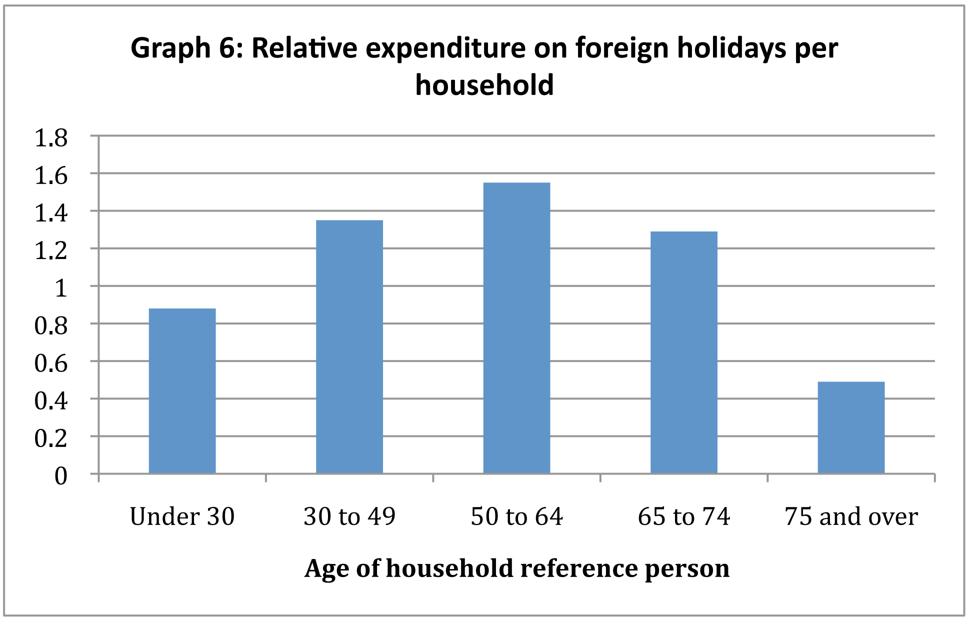
For most items of expenditure, including the purchase of air tickets for leisure travel, but not part of a package holiday, respondents are asked only about expenditure in the two-week period they keep the expenditure diary.

Data on expenditure for air tickets that are not part of a package holidays are put together with taxi fares and water travel fares in the published data, so the figures include some additional expenditures.

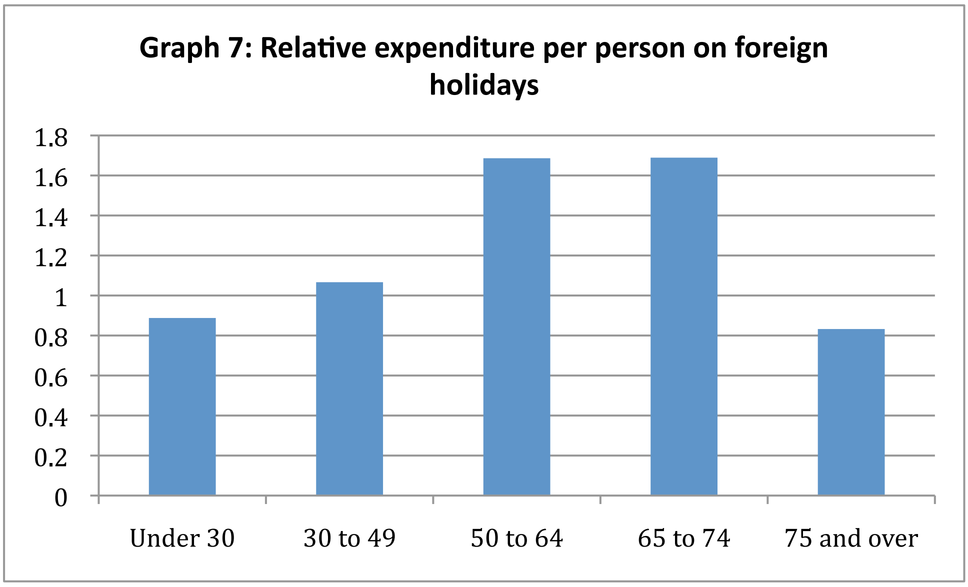
It can be seen in Graph 5 below that households with an HRP in the 50 to 64 age range have the highest expenditure by a considerable margin. On average, those households spend £490 per year on air tickets, water travel fares and taxis.



An attempt was made to calculate expenditure on foreign holidays by adding together all categories of expenditure that include it. However, figures for air tickets are put together with taxi fares and water travel fares, so the figures include some additional expenditure. Households with an HRP in the age range 50 to 64 on average spend more per household on foreign holidays than other age groups. Expenditure is expressed relative to the average, which is £1230 per year. Expenditure in households with an HRP aged 50 to 64 is 1.55 times that, or £1900 per year.



However, the average size of household varies by age. Households with an HRP aged 30 to 49 are the largest (on average 3.0 people), while households with an HRP aged 75 or older are the smallest (on average 1.4 people). When expenditure is calculated per person, the pattern is somewhat different. The age ranges 50 to 64 and 65 to 74 spend most per person. Average expenditure across the population is £530 per person. Average expenditure among households with an HRP aged 50 to 64 is about £870 per year. Average expenditure among households with an HRP aged 65 to 74 is about £880 per year. However, this comparison is not entirely fair. As well as household size declining as children leave the home, there are more single households in the oldest age groups and they will pay more for holidays because of single supplements. That may explain why expenditure per person on foreign holidays is highest in the 65 to 74 age group, even though people that age take relatively few leisure flights.



2.3 Discussion

People aged 55 to 64 have the highest propensity of any age group to fly for leisure purposes. Furthermore, people in this age range appear to spend somewhat more on flights than those in other age groups. The published data from the Living Costs and Food Survey is not disaggregated sufficiently for this conclusion to be presented as a certainty. There may be other factors increasing the spending of older age groups on foreign travel – for instance a higher number of foreign cruises, or a preference for more expensive accommodation at their destinations.

Nonetheless, it is consistent with the data — and the general observation that older age groups are willing to pay more for more comfortable modes of travel — to suggest that the 55 to 64 age group in particular, as well as flying for leisure more often, is spending more on air travel than other age groups. This age group therefore appears to benefit from the tax breaks that aviation enjoys to a greater extent than other age groups do.

Part 3 – Implications for future generations

3.1 Effect of the subsidy on demand forecasts

The effect of the tax break or subsidy that aviation receives, compared to the taxation of other activities, is to increase demand for air travel as it is cheaper than it would otherwise be. Just how large this increase is depends on the price sensitivity of demand for air travel.

The latest official demand forecasts were published in 2011.[33] The number of passengers is projected to recover from the decline since 2007 and rise from 211 million passengers per annum in 2010 to 335 million in 2030 (within the range 300 million to 380 million) and to 470 million in 2050 (within the range 280 million to 515 million). These forecasts imply average annual growth in passenger numbers to 2050 of 2.0% (within the range 1.5—2.3%), significantly lower than the 3.7% average seen in the twenty years from 1990 to 2010.

These forecasts are much lower than DfT's previous forecasts. The two main reasons for this change were that policy had changed to rule out new runways in the South East, and the effect of the recession — suspending air traffic growth and taking it off the path of exponential growth it had been following.[34] Nonetheless, in this scenario emissions are forecast to grow to 49 $MtCO_2$ in 2050 (in the range 40—58 $MtCO_2$).[35]

The forecasts do not specify how much CO_2 would result from a scenario of "unconstrained" airport capacity growth, but passenger numbers would increase a further 10% to 520 mppa (million passengers per annum) in 2050 (compared to 470 mppa).[36] The increase in emissions would be approximately in proportion to this; they would therefore total around 55 $MtCO_2$ in 2050.

These projections are based on a number of assumptions, including future taxation. The level of APD is assumed to remain constant in real terms, but the traded price of carbon in the EU ETS rises from £14/tCO_2 today to £70/tCO_2 in 2030 to £200/tCO_2 in 2050 and is assumed to be added to the cost of air fares.[37]

By comparison, fuel duty on petrol and diesel is equivalent to a carbon tax on those fuels of around £270 per tonne of CO_2.

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[33] *UK Aviation Forecasts*, Department for Transport, August 2011.
[34] *UK Air Passenger Demand Forecasts Briefing*, Aviation Environment Federation, June 2012. http://www.aef.org.uk/uploads/AEF_Passenger_Forecasts_analysis_1.pdf
[35] *UK Aviation Forecasts*, Department for Transport, August 2011, table 3.5 on page 84
[36] ibid, see paras 1.12 and 1.14
[37] ibid, para 2.36

To take a simplistic scenario, if fuel duty and VAT were introduced in full on airline tickets tomorrow, their price would rise by approximately 88% on average.

How much that price increase would reduce demand for air travel depends on the price elasticity of demand. For example, if the price elasticity of a product was -1 then that would mean that increasing the price of that product by 100% (doubling it) would reduce demand by 50% (halving it).

Various studies have made estimates of the price elasticity of demand for air travel. The 2011 UK aviation forecast takes the average elasticity of demand for UK air travel as -0.6. That implies that if fuel duty and VAT were introduced in full tomorrow it would lead to a reduction in demand for air travel of approximately 35%.

However, nobody is suggesting doing anything so sudden as that because it would clearly have a dislocating economic effect. Note, though, that even then the Treasury would gain over £6 billion of the £9 billion from fuel duty and VAT on tickets that air travel does not pay currently.

In reality, such taxation would have to be phased in gradually, rather than in a manner that would cause such disruption. It is not possible to make a detailed estimate of the effect of phasing in taxation at these levels without access to the complex DfT passenger forecasting model. However this exercise was conducted in 2002, at the behest of a group of environmental organisations (the Council for the Protection of Rural England, the Aviation Environment Federation and Friends of the Earth): a level of taxation equivalent to fuel duty and VAT were phased in over a period of twenty years from 2005 to 2025.

The result was that whereas in the official forecast at that time the number of passengers was predicted to rise from 180 million in 2000 to 500 million in 2030, in the scenario where taxation was increased in stages then the number of passengers rose more slowly to 315 million in 2030 – a reduction of 37% over the central forecast, without any disruptive effect.[38]

The results cannot be directly compared to the effect on today's forecasts, since a number of assumptions in the central forecast at the time (and the total tax level to be added) were somewhat different to those prevailing today. The results from the full model run do, however, validate the assumption that phasing in taxation at a level equivalent to that levied on private car travel would significantly slow (but not reverse or even eliminate) the growth in aviation – and therefore reduce the perceived need for additional airport capacity.

Note that EU rules about VAT now only allow it to be at three levels in a country: zero, a reduced rate (currently 5% in the UK) and the standard rate (currently 20% in the UK), so it would not be possible to phase in VAT so gradually. However, since at

[38] *Fly Now, Grieve Later*, Aviation Environment Federation, June 2005, page 16

present levels APD raises almost exactly the same as VAT would, APD could be swapped for VAT at a point during the transition.

3.2 A self-fulfilling policy?

3.2.1 Aviation policy under New Labour

From 2003 to 2010 UK aviation Policy was set by the *Future of Air Transport* White Paper, which set out detailed airport-by-airport proposals for significant growth in UK aviation (from around 200 to nearly 600 mppa in 2050). This policy was widely identified (not just by environmental groups but by Parliamentary Select Committees and the Government's own sustainability watchdog) as a "predict-and-provide" policy, of the sort that has been discredited for road building in the 1990s. The approach was to forecast the demand for aviation (as discussed in Section 3.1 above, inflated by its artificial cheapness) and then to provide matching capacity.[39]

This failed to apply insight gained from roads policy that making capacity available was itself a driver of demand; furthermore as artificially cheap air travel came to be enjoyed by more and more people it became evermore difficult to raise its price through taxation, since people had come to expect regular, cheap foreign travel and were increasingly basing their lives around it (for instance by buying second homes close to regional airports abroad, or working in one country and commuting home at the weekend).

As well as the increase in noise and other local environmental impacts that came with aviation growth, it came to be recognised that the increase in greenhouse gas (GHG) emissions was difficult to reconcile with the UK's long-term objectives on tackling climate change. The issue was given sharp focus by the passing of the Climate Change Act 2008, which set legally-binding targets for the UK to reduce GHG emission by 80% on 1990 levels by 2050. The Act established an expert advisory body, the Committee on Climate Change (CCC), whose initial reports into pathways to achieving the target recommended that a reasonable contribution from the aviation sector to achieving the UK's overall 2050 target would be to constrain absolute emissions[40] at around today's levels.[41]

This target – for absolute aviation emissions to be no more than 37.5 $MtCO_2$ in 2050 – was adopted by the previous Government, which asked the CCC to report on how it could be achieved. The CCC's subsequent aviation report identified that even with likely advances in aircraft technology, airline efficiency and biofuels, and a carbon

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[39] Although the White Paper professed to reject this approach, it did in fact provide capacity for over 90% of the demand increase it forecast.

[40] "Absolute" or "gross" emissions are those actually emitted; "net" emissions refers to the gross total minus any emissions allowances purchased to offset them, for instance through the EU ETS.

[41] *Building a low-carbon economy – the UK's contribution to tackling climate change,* Committee on Cliamte Change, December 2008, Chapter 2.

price that rose gradually to £200/tCO_2 in 2050, the maximum number of passengers in 2050 compatible with the target was 370 mppa.[42] The airport capacity allowed for in the White Paper, on the other hand, would see passenger numbers increasing to nearly 500 mppa (even allowing for the effects of the significant carbon price).

The CCC concluded that:

> Meeting the 2050 target […] is therefore likely to require policy measures to restrain demand which go beyond our central projected carbon price. The policy instruments which could achieve this restraint include a carbon tax on top of the forecast carbon price, limits to further airport expansion, and restrictions on the allocation of take-off and landing slots even where airports have the theoretical capacity available.[43]

In other words, the CCC report laid bare the inconsistency between the Government's airports policy and its climate change objectives, and called for a package of demand restraint measures, including higher taxation.

3.2.2 Coalition Government policy

The Coalition Government immediately cancelled Heathrow's third runway and ruled out new runways at Gatwick and Stansted.[44] In its first scoping consultation on a new aviation policy (in March 2011), the Government rejected the approach of the White Paper as taking insufficient account of the challenge of climate change:

> The previous government's 2003 White Paper, The Future of Air Transport, is fundamentally out of date, because it fails to give sufficient weight to the challenge of climate change. In maintaining its support for new runways – in particular at Heathrow – in the face of the local environmental impacts and mounting evidence of aviation's growing contribution towards climate change, the previous government got the balance wrong. It failed to adapt its policies to the fact that climate change has become one of the gravest threats we face.[45]

The DfT published its response to the CCC in August 2011, alongside revised forecasts for passenger numbers and CO_2 emissions. As a result of the economic crisis, and the policy of not building new runways, the central CO_2 forecast was lower than previously – 49 MtCO_2 in 2050 (as opposed to 57 MtCO_2) – and consequently the gap between the forecast and a target of stabilising emissions was smaller. The remainder of the response was an examination of the cost-effectiveness of a number

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[42] *Meeting the UK aviation target – options for reducing emissions to 2050*, Committee on Climate Change, December 2009, page 145
[43] ibid. page 146
[44] *The Coalition: our programme for Government*, Cabinet Office, March 2010, page 16.
[45] *Developing a sustainable framework for UK aviation: Scoping document*, Department for Transport, March 2011, Foreword, page 4.

of policy “levers” to reduce emissions faster than in the CCC’s scenario. These included “behavioural change” and “capacity constraints” but excluded fiscal measures on the grounds that these are “a matter for HM Treasury.”[46] (No explanation is given for why the two departments cannot collaborate to investigate the effects of taxation on emissions.)

The remaining “levers” were technological and operational measures. These all assume that improvements can be delivered faster than assumed by the CCC, and with the exception of improvements to Air Traffic Control, the only measures that deliver significant CO_2 savings have a net cost.[47] This cost would have to be borne either by the industry, or the Government in the form of ‘incentives’.

At the time of writing, and until 31 October 2012, the Government is consulting on a Draft Aviation Framework[48] (“the Draft Framework”) – a high-level policy document outlining the principles of its new aviation policy. The Framework repeats the contention of the Scoping Document that a “better balance than in the past needs to be struck between the benefits aviation undoubtedly brings and its impacts, both at a global and at a local level”, and that specific capacity proposals “would need to fit within the high-level policies set out in the […] framework”. And yet the Draft Framework is extremely vague in its approach to limiting aviation GHG:

- there has been no decision on whether to retain the 2050 Target;
- there has been no decision whether to accept the CCC’s recommendation to include international aviation emissions within the Climate Change Act targets;
- the policy in regard to regional airports is simply to let them grow in response to demand – hardly a recipe for controlling the overall growth in emissions;
- there is no discussion of the role of taxation in reducing emissions;
- aviation’s significant non-CO_2 impacts are glossed over, yet these approximately double the contribution of aviation to climate change (see Box 1 below);
- reliance is placed on an international agreement (painfully slow to develop and likely to be environmentally weak in order to secure wide support) and the EU ETS (itself too weak to drive significant changes to either demand or technology) in preference to UK action.

The Government has also announced the creation of an independent commission to examine how to maintain the UK’s aviation hub status, due to report shortly after the 2015 general election. [49] The terms of reference for the commission, and even more so accompanying media comment by senior ministers,[50] indicate a clear intention to provide more airport capacity in the South East of England.

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[46] *Government Response to the Committee on Climate Change Report on Reducing CO_2 Emissions from UK Aviation to 2050*, Department for Transport, August 2011, para 1.13 on page 6.
[47] Ibid, see Marginal Abatement Cost Curve graphs on pages 17 and 18.
[48] *Draft Aviation Policy Framework*, Department for Transport, July 2012.
[49] Written Statement by the Secretary of State for Transport, 7 September 2012
[50] For instance, George Osborne on The Andrew Marr Show, BBC 1, 2 September 2012.

Current airport policy is as yet unformulated. The general trend, however, is that there is little appetite for measures to control GHG emissions, but a growing appetite for increasing runway capacity. Although no decisions will be taken until after the next election, the current worst-case environmental scenario is therefore a return to White Paper-type policies of continuing to cater for unfettered growth through low taxation and increased runway capacity. This would mean that the DfT's most recent CO_2 forecasts are too optimistic. The implications of different levels of aviation emissions for the UK's climate change targets are the subject of the rest of this report.

As an aside, we note that any new capacity project would be subject to a cost-benefit allowance, weighing (broadly) the economic benefits of the project against the environmental downsides in monetary terms. In such analyses, future costs and benefits are discounted using an annual % rate to give all figures as present-day prices. But the practice of discounting environmental harm in the same way as financial revenues raises questions of intergenerational equity – these are discussed further in Appendix 3.

BOX 1: Non-CO_2 impacts of aviation on climate change

Aviation contributes to climate change in several ways, not only though its CO_2 emissions. When released at high altitude, oxides of nitrogen (NO_x) cause changes to atmospheric chemistry that have a net warming effect.[51] Water vapour and soot both cause a small direct warming effect. Aircraft also produce contrails in certain atmospheric conditions, and these can develop into additional cirrus clouds – both of which have a warming effect. Finally, aerosol particles in aircraft exhaust change the reflective properties of existing cirrus clouds, and although these effects are still poorly understood, it seems likely that they cause warming – potentially a very significant amount.

There is scientific uncertainty (to a varying degree) over the size of each of these effects. However, according to the precautionary principle, scientific uncertainty should not be used as an excuse for inaction. There is also debate over the most appropriate way to relate these effects to the warming effect of CO_2 – the main difficulty being that they all last for different lengths of time.[52]

[51] NO_x destroys methane (a cooling effect), but increases ozone (a greater warming effect). In both cases these effects are the end product of more complex reactions.

[52] For instance, the effects of NO_x are strong but short-lived, whereas the effects of CO_2 can go on for several hundred years. So measured over a short time, the total warming impact from a flight would be dominated by NO_x, and be many times higher than the impact of CO_2 alone. Measured over 500 years, the total impact of a flight would appear to be little more than the effects of CO_2.

The 1999 report from the Intergovernmental Panel on Climate Change introduced a metric known as the Radiative Forcing Index (RFI). This measures the present-day radiative forcing (warming where the forcing is positive, or cooling where it is negative) from each of the non-CO_2 elements, and compares it to the present-day warming from aircraft CO_2. The IPCC gave a range of 2–4 for the RFI, and a best estimate of 2.7.

Since that time, the RFI of 2.7 has often been cited as an emissions multiplier. This is technically incorrect. RFI looks backwards, and measures the present-day effect of all historical aviation activity.

More recently, estimates have been published for a forward-looking Global Warming Potential for aviation emissions.[53] Global Warming Potential measured over 100 years – GWP(100) – is the metric used to weight the different gases covered by the Kyoto Protocol, so it is a well-accepted and understood measure. It is also appropriate to use as an emissions multiplier – i.e. for expressing the extra damage caused by a flight, or by a year's worth of aviation emissions – because it looks forward to the future warming caused by emissions.

The estimate published for the GWP(100) was 1.9-2.0, suggesting that a multiplier of 2 applied to CO_2 emissions is justified on a precautionary basis to account for the non-CO_2 effects of aviation.[54]

3.3 Environmental Impact in 2050 – the effect on climate change targets

Under the Climate Change Act 2008, the UK can emit no more than 159 million tonnes of CO_2 equivalent ($MtCO_2e$) in 2050.[55] This represents an 80% reduction on 1990 levels, and was accepted as a target by Parliament following analysis by the CCC that it represented the UK's fair contribution towards a global effort to keep average temperature rises below 2°C.

The 80% target should be regarded as a minimum, since:

[53] Lee et al. (2010) "Transport impacts on atmosphere and climate: Aviation", *Atmospheric Environment*

[54] The figure of 1.9–2.0 quoted includes the effect on cirrus clouds, which is the least well-understood element of the overall impact. Very recently, however, research has been published that calculates cirrus cloud warming by a much more robust method than previously, but produces a similar value to earlier, rougher estimates. This work therefore lends weight to the GWP estimate of 1.9–2.0. It is also worth noting that this value is very close to more recent estimates of aviation's RFI – a value of 1.9 is implied by the IPCC Fourth Assessment Report. In other words the choice of metric does not have a major effect on the policy-relevant conclusions – that aviation's overall warming effect is around double that of its CO_2 alone.

[55] Climate change impacts of greenhouse gases other than CO_2 are compared to those of CO_2 using the values for their Global Warming Potentials specified in the Kyoto Protocol. Both CO_2 and non-CO_2 emissions are then expressed as "CO_2 equivalent" or "CO_2e". See Box 1 for a discussion of aviation's non-CO_2 impacts.

- The CCC itself expressed the target as a minimum in the initial analysis underpinning it, and noted that it was consistent with a scenario with "central estimates of global average temperature rise by 2100 [of] *close to* 2°C", i.e. it is not fully consistent with a high probability of keeping warming *below* 2°C;[56]

- The UK is committed through European Council to cuts of 80—95% below 1990 levels by 2050, meaning that our current target is at the bottom of the range;[57] and

- A majority of Parties to the United Nations Framework Convention on Climate Change support a target of limiting temperature rises to 1.5°C, on the basis that the impacts of a 2°C rise on their countries would be unacceptably severe.

The CCC has recommended that international aviation CO_2 emissions should be included within the climate change targets.[58] The Government itself is planning its carbon abatement strategy for 2050 on the basis that they will be included[59] and is legally obliged to decide formally whether to include them by the end of 2012.[60] Even if they are not included, the Government must continue the current practice of setting budgets "taking into account" these emissions.[61]

For the purposes of this analysis, we follow the CCC in assuming that they are included. We also follow the CCC's assumption that emissions reductions must be achieved domestically. Although the Act allows for the purchase of offset credits to meet the 2050 target, the CCC has made clear that:

> Scope for low-cost purchase of offset credits is likely to become limited over time, as all countries will need to be on a strong downward emissions path and so opportunities to exploit low-cost abatement opportunities overseas will reduce.
> […]
> The vast majority of emissions reductions should therefore be delivered through domestic action, and we develop scenarios consistent with all reductions being delivered through abatement action within the UK.[62]

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[56] *Building a low-carbon economy - the UK's contribution to tackling climate change*, Committee on Climate Change, December 2008, page 7, emphasis added.
[57] The European Commission has also published a roadmap towards achieving this goal, see http://europa.eu/rapid/pressReleasesAction.do?reference=IP/11/272
[58] *Scope of carbon budgets: Statutory advice on inclusion of international aviation and shipping*, Committee on Climate Change, April 2012
[59] *The Carbon Plan: Delivering our low carbon future,* HMG December 2011, see note 10 on page 130.
[60] Climate Change Act 2008, s.30(3)
[61] Climate Change Act 2008, s.10(2)(i)
[62] *The 2050 target – achieving an 80% reduction including emissions from international aviation and shipping*, Committee on Climate Change, April 2012, pp.18—19

The structure of the Climate Change Act leaves the Government free to pursue carbon abatement in whichever sectors it chooses, provided the overall target is achieved; there is no requirement for all sectors to achieve a uniform 80% cut. A more generous allowance to one sector does, however, have cost implications for other sectors, which are forced to make deeper cuts than otherwise.

The CCC's advice, that international aviation emissions should be constrained at around 2005 levels (an increase of over 100% on 1990 levels) means that other sectors will need to make reductions of around 85% to achieve an overall 80% reduction. Aviation emissions at the "high" end of the range (in fact the DfT's central forecast of nearly 50 $MtCO_2$) imply cuts of 87% from other sectors.[63] A worst-case scenario where airports expand and emissions rise to around 55 $MtCO_2$ would apply still steeper cuts elsewhere.

There is no definitive way to quantify the cost of this additional burden on other sectors. One method is to use the assumed price of carbon in 2050 — £200 per tonne of CO_2 equivalent (+CO_2e) — to price the additional allowance being granted to aviation, compared to a notional scenario in which it was also asked to make an 80% reduction on 1990 levels – an allowance of around 3.5 $MtCO_2$.

This is not to suggest that this should be the allowance for aviation; it merely indicates the size of the additional effort required of other sectors, given the difficulty of deep technological abatement in aviation, and political unwillingness to place any significant constraint on demand.

Monetisation of the additional cost is set out in Table 4 below for a range of aviation emission scenarios. These include scenarios where aviation's non-CO_2 emissions have been accounted for using a multiplier of 2.[64]

Although the CCC currently recommends that non-CO_2 impacts should not be included in budgets, it has stated that if these persist over time this "could require that carbon budgets are tightened in order that the climate objective is achieved."[65] Even if this does not happen, and the non-CO_2 effects remain unaccounted for, their cost to society can be assessed on the basis of the climate change damage they are inflicting.[66]

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[63] These scenarios also assume either abatement or increase in international shipping emissions – see *The 2050 target – achieving an 80% reduction including emissions from international aviation and shipping*, Committee on Climate Change, April 2012, p. 23

[64] In this scenario, the UK's overall allowance would increase slightly, since the 1990 total would have been adjusted upwards to account for this extra impact in 1990. In this scenario, aviation's emissions in 1990 were 35 $MtCO_2e$, and an 80% reduction target in 2050 would give it a notional 2050 allowance of 7Mt CO_2e

[65] *Scope of carbon budgets: Statutory advice on inclusion of international aviation and shipping*, Committee on Climate Change, April 2012, p. 33

[66] The same value of £200/tCO_2e in 2050 is used. Estimating the cost of the damage caused by a tonne of GHG emissions is, of course, fraught with uncertainty. The Stern Review used a damage cost estimate of £180/tCO_2e in 2050, which is very close to the DECC abatement cost estimate of £200/tCO_2e in 2050. Indeed part of the justification for the targets that were selected is that they are supposed to represent the economically optimal point where damage costs and abatement costs are

Table 4: Costs to other sectors in 2050 of different aviation emissions scenarios

Aviation Emissions Scenario	Aviation emissions in 2050 ($MtCO_2e$)	Additional allowance to aviation (over 80% cut on 1990 – $MtCO_2e$)	Estimated cost to other sectors
Stabilisation at 2005 levels	37.5	34	£6.8bn
Stabilisation at 2005 levels + non-CO_2	75	68	£13.6bn
DfT central	49	45.5	£9.1bn
DfT central + non-CO_2	98	91	£18.2bn
Unconstrained	55	51.5	£10.3bn
Unconstrained + non-CO_2	110	103	£20.6bn

In practice, however, the costs of all emissions reductions are not equal. The cost per tonne of reduction starts to rise sharply when very deep emissions cuts are required, implying that the costs for the higher aviation emissions scenarios are probably underestimates.

This is illustrated by the fact that finding the final 12 $MtCO_2e$ of reductions in the building sector – to move it from the CCC's "Stretch" to its "Max" scenario (where it is fully zero-carbon) – comes at a cost to that sector of 0.2% of GDP, or approximately £8 billion. This is the scenario given by the CCC for the compensation required should there be "Barriers" to emissions reduction in aviation (and shipping), with aviation continuing along the DfT central forecast pathway rather than stabilising its emissions (a difference of 12 $MtCO_2e$). Using the DECC value of carbon, the difference between these two pathways was costed at just £2.3bn in Table 4 above.

Furthermore, there are distributional implications of imposing additional reduction burdens on other sectors: the costs of emissions reductions in various sectors are not borne equally by different sections of society. The example above provides a good illustration: additional costs to the building sector will be borne by everyone, but — in the absence of corrective policies — will affect the poorest most, as a greater proportion of their income is spent on utilities. Additional costs to aviation would be borne only by those that fly, who are (by definition) those that can afford to.

It should be stressed that the exact values of any costs given for 2050 are highly uncertain. But the overall pattern that emerges is clear: stabilising aviation emissions imposes a significant burden on other sectors and therefore on society; this cost rises significantly if aviation emissions are allowed to grow, and very substantially once aviation's non-CO_2 emissions are accounted for.

The justification for this generous approach to aviation is that technological abatement is more expensive in this sector than others. While this is true, it ignores

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equal. If this is accepted, the costs of aviation's non-CO_2 impacts will be the same whether they are inside or outside the targets.

the fact that successive governments have maintained a tax regime that artificially inflates demand while robbing the Exchequer of revenue. The longer this continues, the harder it will be to correct, as lifestyles and expectations are becoming increasingly geared to abundant cheap aviation. But with every year that passes, future generations are saddled with more debt, and more carbon emissions than they would be if aviation paid its fair share of tax.