

9. Aviation taxes

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Summary

- Aviation is responsible for a rapidly-growing proportion of greenhouse gas emissions. Emissions, noise pollution and congestion all provide economic rationales for aviation taxes.
- Unfortunately, international agreements prevent fuel for international flights being taxed. But taxes on tickets, passengers and flights are all permissible.
- The government proposes putting a tax on flights from November 2009, replacing the current tax on passengers, air passenger duty (APD). This should allow it to target the level of emissions more effectively than APD does at the moment.
- A reformed aviation duty on flights would strengthen incentives for aircraft to fly as fully-loaded as possible and could also be extended relatively easily to freight flights, although the revenue from taxing freight flights would likely be small.
- To be targeted precisely on the external costs of aviation, the rates of a new aviation duty might in principle have to vary by aircraft type, aircraft emissions and departure airport, as well as by distance travelled. But the more sophisticated the tax is, the more complicated it will be to administer and comply with.
- To the extent that the new tax would be passed on to passengers, if the revenue raised were to remain the same there would be both winners and losers. The winners from a relatively sophisticated aviation duty would be those flying short distances on full, clean, quiet planes from airports away from residential areas.
- Reforms to aviation taxation are likely to be followed by the inclusion of aviation in the EU Emissions Trading Scheme. The interaction of the domestic tax with this system will need careful consideration.

9.1 Introduction

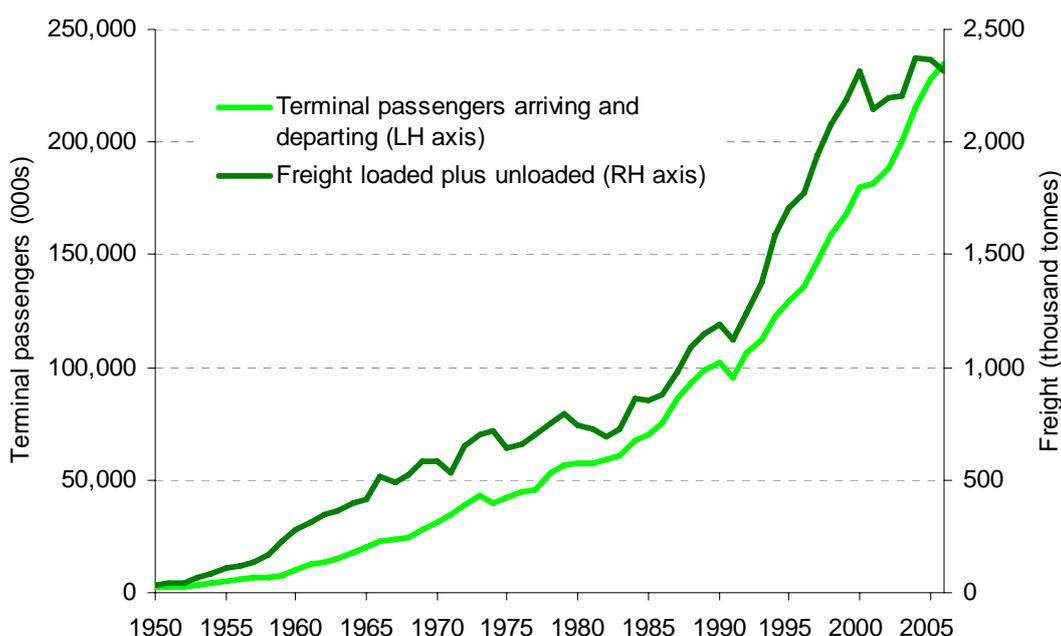
This chapter discusses the history of and possible reforms to aviation taxation. Until the introduction of air passenger duty (APD) in November 1994, air travel was effectively untaxed in the UK: tickets were (and remain) zero-rated for VAT and aviation fuel for commercial flights is exempt from duty. In the October 2007 Pre-Budget Report, Chancellor Alistair Darling announced that, from November 2009, APD would be replaced by a tax levied on flights rather than passengers, mirroring similar proposals announced earlier by both the Conservatives and the Liberal Democrats. A new per-flight tax may more effectively

¹ The authors are grateful to the Civil Aviation Authority (CAA) for providing the data on which much of the analysis of Section 9.4 is based, and to Paul Johnson for helpful advice and comments.

target the environmental effects of flying (by giving greater incentives for airlines to fill their aircraft, and perhaps by varying the tax rate according to the emissions and noise costs of different aircraft types), though this would come at a cost of making the system more complex. We discuss possible design issues below, as well as the likely impacts of the new tax. Though no name for the tax has been announced, for ease of exposition we refer to it as ‘aviation duty’ throughout.

Section 9.2 discusses the economic principles of aviation taxation and looks at the evidence on the environmental costs generated by aviation. Section 9.3 briefly recaps the history of APD since its introduction, looking at the tax structure, rates and revenues. Section 9.4 examines potential options for aviation duty, looking at how a per-flight tax could be approximated by a per-seat tax that varies by destination and describing who might gain and lose from such a tax relative to APD. Section 9.5 then discusses issues in the design of aviation duty, looking at what the tax base should be, how a per-flight tax might be introduced in practice and what the implications for domestic tax policy might be of the inclusion of aviation in the EU Emissions Trading Scheme. Section 9.6 concludes.

Figure 9.1. Terminal passengers and freight at UK airports, 1950 to 2006



Source: Table 2.1 of Department for Transport, *Transport Statistics Great Britain 2007* (<http://www.dft.gov.uk/pgr/statistics/datatablespublications/tsqb/2007edition/sectiontwoaviation.pdf>).

9.2 Economic principles of aviation taxation

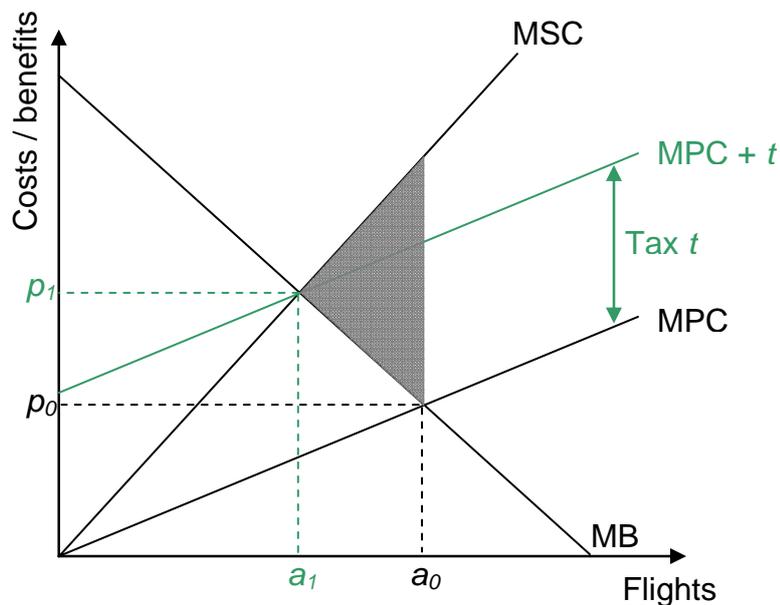
Why tax aviation?

Aviation imposes costs on society that are not wholly borne by those who fly: emissions that contribute to climate change, the noise costs for those living in the vicinity of airports and under flight paths, and congestion costs (both in the air and around airports). To the extent

that these external costs (or ‘externalities’) are not taken into account by passengers, there would be too much demand for aviation relative to the socially desirable level. Taxes are therefore a way to ensure these costs are borne by passengers, reducing demand to the level preferred by society and increasing social welfare.

Figure 9.2 illustrates this point in a very simplified way. The horizontal axis shows the level of aviation in terms of numbers of flights and the vertical axis the ‘price’ of aviation. In a very simple world where all flights were identical, this would be a representation of the entire market for aviation, though in a more realistic setting we can imagine this represents the market for flights to a particular destination on a particular aircraft type from a certain airport, etc. so that the costs and benefits (and thus the ideal tax) will vary if any of these characteristics change. The downward-sloping marginal benefit (MB) curve shows the additional benefit to society of each additional flight, which is assumed to fall as the total number of flights increases. The marginal private cost (MPC) curve shows the cost of each additional flight to airlines, reflecting the costs of purchasing and running new planes, opening new routes, buying additional landing slots and so on. Finally, the marginal social cost (MSC) curve shows the cost to *society* of each additional flight, with the gap between private and social costs showing the external costs discussed above. In equilibrium, the total number of flights will be the level at which benefits equal private marginal costs, generating a level of aviation a_0 at price p_0 . At this level, however, the social costs of flying exceed the benefits by a total amount given by the shaded triangle – this represents the welfare loss of excessive aviation. An aviation tax set at rate t , however, increases the private costs to the point where the marginal social cost equals the marginal benefits. The number of flights is reduced to a_1 at price p_1 and the welfare loss is eliminated.

Figure 9.2. Aviation externalities – a stylised illustration



Taxes that aim to internalise external costs in this way are known as ‘Pigouvian taxes’.² If this is the main justification for aviation taxes, then a number of points should be made on the tax level:

- The tax should be set at the level that ensures that the socially optimal level of output (in this case, air travel) is produced – in other words, the tax should be equal to the *marginal* externality at the social optimum. This need not be, and indeed is unlikely to be, the tax level that raises the most revenue or the level that ensures total revenues equal the total externalities imposed on society. Intuitively, the tax is not meant to be a penalty designed to compensate society for harmful effects imposed on it, rather an instrument by which the socially optimal level of a good is produced.³
- Determining the optimal tax rate for a particular flight is difficult. Noise costs will depend on local population levels and may well vary with time of day and aircraft type, and emissions costs will also depend on the aircraft’s destination and engine type, for example.
- As an inherently international business, there may also be concerns about tax competition in aviation tax design (for example, taxes imposed on aviation fuel unilaterally by the UK would encourage airlines to refuel abroad in a zero-tax environment, substantially mitigating the environmental benefit).

Aviation taxes may also be used as revenue-raising tools. When APD was introduced in November 1994, the major justification was that the sector was under-taxed compared with private transport because of VAT zero-rating (though this is true of other forms of public transport) and exemptions from fuel duty. We discuss the revenue-raising versus environmental aspect of APD in Section 9.3.

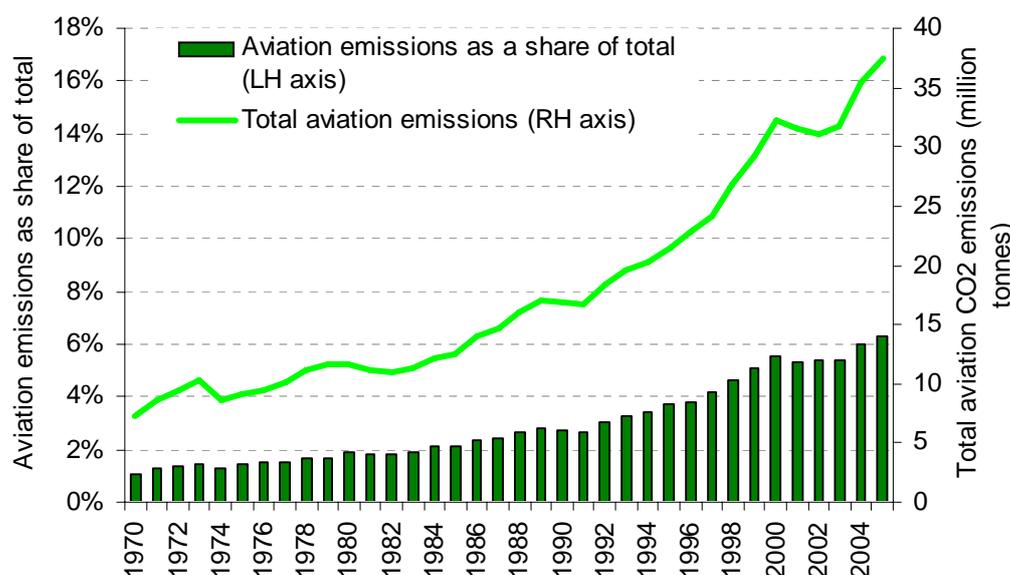
To the extent that the environmental/externalities argument for aviation taxes is central, it is important to have good evidence on the scale of the marginal externality for effective tax design. The rest of this section examines how aviation emissions have changed and evidence from the economic literature on the size of the external costs involved in aviation.

Trends in UK aviation emissions

Under reporting guidelines agreed as part of the United Nations Framework Convention on Climate Change (UNFCCC), against which progress towards Kyoto Protocol targets is judged, only emissions released by domestic flights are included in a country’s emission estimates. The UK government also includes only estimates of domestic aviation CO₂ emissions for its target to reduce CO₂ emissions by 20% from the 1990 levels by 2010. However, estimates of emissions generated by fuelling done in the UK (whether by international or UK carriers) are included as memo items in reported greenhouse gas inventories. Figure 9.3 shows total UK CO₂ emissions from domestic and international aviation since 1970 and aviation’s share in total CO₂ emissions over the same period.

² A. C. Pigou, *The Economics of Welfare*, Macmillan, London, 1920 (available at <http://www.econlib.org/Library/NPDBooks/Pigou/pgEW.html>).

³ For a more comprehensive discussion of this point, see chapter 2 of A. Leicester, *The UK Tax System and the Environment*, IFS, London, 2006 (<http://www.ifs.org.uk/comms/r68.pdf>).

Figure 9.3. UK aviation CO₂ emissions, 1970 to 2005

Note: Total emissions include domestic aviation and estimates of international aviation emissions. The overall total against which the share of emissions is measured includes additionally estimates of international shipping emissions. Source: Table 5 of Department of Environment, Food and Rural Affairs, *e-Digest of Statistics* (<http://www.defra.gov.uk/environment/statistics/globalatmos/download/xls/gatb05.xls>).

Emissions have risen fairly consistently, and particularly rapidly over the last 15 years or so: over the whole period, the average increase in aviation CO₂ emissions has been around 4.8% per year, and since 1990 slightly faster at 5.4% per year. Total aviation CO₂ emissions have increased more than fivefold from around 7 million tonnes of CO₂ to over 35 million tonnes, and the aviation share of total emissions has risen from 1% to more than 6%. Year-on-year falls in emissions have been relatively rare – recently only the recession of the early 1990s and the decline in aviation post-11 September 2001 have led to falls in aviation emissions.

The ‘greenhouse effect’ caused by aviation is greater than that caused by CO₂ alone. Additional effects are caused by emissions of water vapour, nitric oxide (NO), nitrogen dioxide (NO₂), sulphur oxides (SO_x) and soot. The Intergovernmental Panel on Climate Change (IPCC) estimated in 1999 that the total effect that can currently be quantified is between two and four times the effect of CO₂ alone.⁴ Much of the uncertainty surrounding this estimate has to do with the unknown effect of the formation of aviation-induced cirrus clouds. A more recent study⁵ also investigated the relative effects of these gases and came to a qualitatively similar conclusion to the IPCC.

How large are the external costs of aviation?

Various studies have attempted to quantify the marginal external costs of aviation and thus the appropriate size of an aviation tax. Some have focused exclusively on the emissions

⁴ J. E. Penner, D. H. Lister, D. J. Griggs, D. J. Dokken and M. McFarland (eds), *Aviation and the Global Atmosphere*, a Special Report of IPCC Working Groups I and III, Cambridge University Press, Cambridge, 1999. A useful summary for policymakers is available at <http://www.grida.no/Climate/ipcc/aviation/>.

⁵ R. Sausen et al., ‘Aviation radiative forcing in 2000: an update on IPCC (1999)’, *Meteorologische Zeitschrift*, 2005, 14(4): 555–61 (http://folk.uio.no/gunnarmy/paper/sausen_mz05.pdf).

externality. Bleijenberg and Wit (1998),⁶ for example, examined tax rates that varied by length of journey and aircraft type based on estimates of the shadow price of each emissions type. Illustratively, they suggest a tax on a Boeing 747-400 flying 2,000 kilometres (roughly the distance from Heathrow to Morocco or Aberdeen to Italy) should attract a total tax of around \$1,700 to \$11,000 depending on uncertainties over the quantity of emissions generated and the size of the externality (in particular, the cost of emissions released at altitude). This equates to around \$3 to \$20 per passenger assuming two-thirds of the plane is filled, or around \$1.50 to \$10 per 1,000 passenger-kilometres flown. A smaller F50 plane, flying 500 kilometres at two-thirds capacity, has an estimated externality of around \$60 to \$350, or \$1.40 to \$8.30 per passenger (\$2.80 to \$16.60 per 1,000 passenger-kilometres).

A later study by Dings et al. (2003)⁷ examined both environmental and noise externalities. Noise externalities are clearly largest on take-off and landing since airports are more likely to be closer to residential areas than flight paths and because these activities are relatively noisy. For longer flights, the marginal noise externality per kilometre flown is lower as this 'local' externality is not much different for short- and long-haul flights (leaving aside the fact that long-haul flights tend to use larger aircraft). The authors estimated, for example, that a 100-seat plane travelling 500 kilometres generates local externalities (largely noise, NO_x and particulate emissions) of around €12.50 per 1,000 passenger-kilometres, or €6.25 per passenger, whilst a 400-seat aircraft covering 6,000 kilometres (roughly the distance between Gatwick and Washington, DC) would generate a marginal local externality of less than €1 per 1,000 passenger-kilometres. The difference in climate externalities is much smaller – around €7.20 per 1,000 passenger-kilometres for the short-haul flight (€3.60 per passenger) and €4.40 for the long-haul flight (€6.40 per passenger). These figures could be much larger if the uncertain climatic impact generated by contrails (the condensation trails left by planes) is included: in the short-haul case, the authors estimate a marginal climate externality of €17.90 per 1,000 passenger-kilometres for the short-haul flight and €6.10 for the long-haul flight, or €8.95 and €6.60 per passenger respectively. Excluding these effects, they suggest the externalities could amount to around 5% of the price of a long-haul flight and 20% to 30% of the price of a short-haul flight.

Pearce and Pearce (2000)⁸ explicitly studied the marginal external costs of aviation for Heathrow Airport, based on both noise and emissions estimates for different aircraft types. They considered short-haul flights (500 nautical miles) and long-haul flights (3,500 nautical miles) for various types of aircraft. They estimated, for example, a Boeing 747-400 should attract an externality tax on a long-haul flight of around £3,750 (of which the noise cost makes up around 4% and the pollution cost 96%) and on a short-haul flight of around £900 (with noise representing 19% of the total). On a per-passenger basis, this short-haul tax (assuming average loads) equates to around £3.20, or £3.50 per 1,000 passenger-kilometres. Pearce and Pearce make direct comparisons to the Bleijenberg and Wit (1998) study, and find the per-passenger or per-passenger-kilometre estimates, once suitable conversions for

⁶ A. N. Bleijenberg and R. C. N. Wit, *A European Environmental Aviation Charge: Feasibility Study*, Centre for Energy Conservation and Environmental Technology, Delft, 1998.

⁷ J. M. W. Dings, R. C. N. Wit, B. A. Leurs and M. D. Davidson, *External Costs of Aviation*, Centre for Energy Conservation and Environmental Technology, Delft, 2003 (<http://www.umweltdaten.de/publikationen/fpdf-l/2297.pdf>).

⁸ B. Pearce and D. Pearce, 'Setting environmental taxes for aircraft: a case study of the UK', CSERGE, Working Paper GEC 2000-26, 2000 (http://www.uea.ac.uk/env/cserge/pub/wp/gec/gec_2000_26.pdf).

currency and distance have been made, to be broadly comparable even though the earlier study excluded noise emissions. This may be due to differences in the estimates of pollution costs.

9.3 Air passenger duty

Structure and rates

Air passenger duty was introduced by Kenneth Clarke in the November 1993 Budget and was first charged in November 1994. The duty is incurred on flights departing from UK airports and is levied on a per-passenger-carried basis, though certain categories of passenger and aircraft are exempt. These include children under the age of 2 who do not have their own seat, passengers on short pleasure flights lasting less than 60 minutes and passengers taking off from airports in the Scottish Highlands and Islands. Most passengers getting a connecting flight do not pay APD on their second or subsequent flight as long as the two flights are linked (usually interpreted as booked together at the same time). Aircraft with fewer than 20 seats or that weigh less than 10 tonnes are also exempt.⁹

APD was initially set at £5 per passenger on flights to certain specified European destinations and £10 per passenger on flights to other destinations. All 27 EU member states (plus most dependent territories) are covered by the European rate, which is also applied to domestic flights. Since February 2007, signatories to the European Common Aviation Area that are not also members of the EU have been covered by the European rate – namely, Norway, Iceland, Croatia, Macedonia, Albania, Bosnia and Herzegovina, Serbia, Montenegro and Kosovo. Passengers flying to Switzerland, Turkey and Liechtenstein are also taxed at the European rate.

APD rates were doubled from November 1997, a change announced by Kenneth Clarke in his November 1996 Budget. A second substantial reform occurred in April 2001, when the rates became differentiated not only by destination but also by the class of seat: business and first-class passengers paid double the European/non-European rate of standard-class passengers. At the same time, the standard-class European rate was halved to £5, effectively taking it back to its introductory level. The December 2006 Pre-Budget Report announced that all APD rates were to double from February 2007. Pre-Budget Report 2007 announced rates would be frozen for 2008–09 in anticipation of the reformed aviation duty. Table 9.1 summarises the evolution of APD rates.

In 2001–02, around two-thirds of passengers paid the lowest APD rate, then £5. By 2006–07, just over three-quarters paid the lowest rate, reflecting both the growth of low-cost airlines and the expansion of the list of countries eligible for the European tax rates. Between 2001–02 and 2006–07, the number of passengers paying the non-economy European rate fell by more than half, from 4.4 million to 2.1 million.¹⁰

⁹ Full details of exemptions from APD can be found at http://customs.hmrc.gov.uk/channelsPortalWebApp/channelsPortalWebApp.portal?_nfpb=true&_pageLabel=pageVA_T_ShowContent&id=HMCE_CL_000505&propertyType=document.

¹⁰ Source: Table 2 of uktradeinfo, *Statistical Bulletin Dataset: Air Passenger Duty*, December 2007 (<http://www.uktradeinfo.com/index.cfm?task=bullair>).

Table 9.1. Rates of air passenger duty, 1994 to 2009

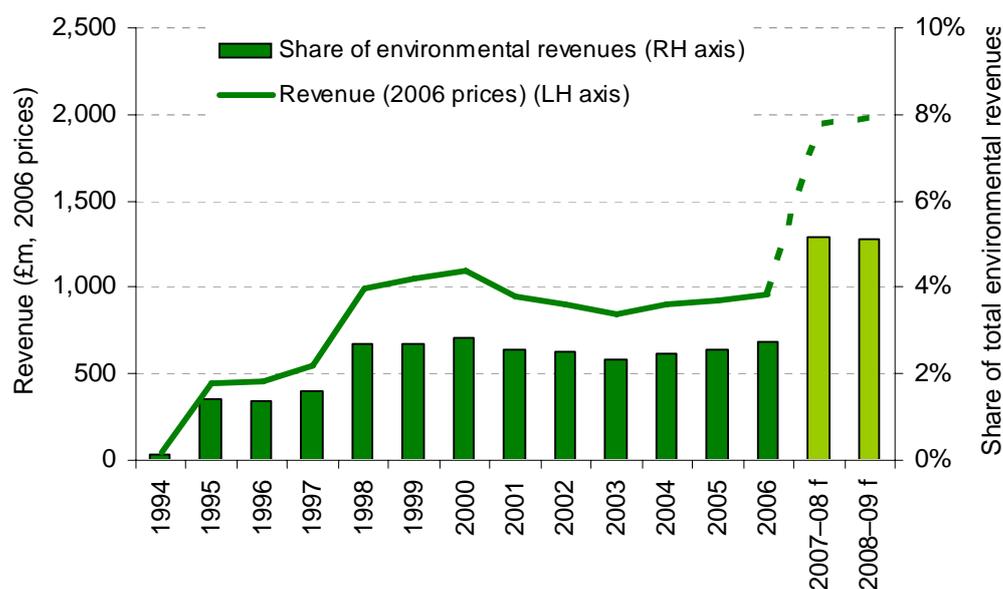
Date from which rates apply	European rate		Non-European rate	
1 November 1994	£5		£10	
1 November 1997	£10		£20	
	Economy class	Other classes	Economy class	Other classes
1 April 2001	£5	£10	£20	£40
1 February 2007	£10	£20	£40	£80
November 2009	To be replaced by new aviation duty			

Sources: HM Treasury, *Financial Statement and Budget Report*, various years; HM Treasury, *Pre-Budget Report*, various years.

Revenues

Figure 9.4 shows total revenues generated by APD since its introduction, both in real terms and as a percentage of all revenue generated by environmental taxes.¹¹ Figures for 2007–08 and 2008–09 are forecasts from the October 2007 Pre-Budget Report. Real-terms revenues

Figure 9.4. Total APD revenues, 1994 to 2008–09



Notes: 2007–08 and 2008–09 are fiscal-year forecasts from the October 2007 Pre-Budget Report converted to 2006 prices; other years are calendar-year receipts from ONS Environmental Accounts. APD share of total environmental revenue is estimated using forecast revenues for other green taxes from the Pre-Budget Report.

Sources: ONS *Environmental Accounts*; annex B of HM Treasury, *2007 Pre-Budget Report and Comprehensive Spending Review*, October 2007 (http://www.hm-treasury.gov.uk/media/F/9/pbr_csr07_annexb_305.pdf).

¹¹ Environmental taxes are as defined by the biannual ONS *Environmental Accounts* publication as at Autumn 2007 (<http://www.statistics.gov.uk/pdfdir/enva1207.pdf>). They include fuel duty (and associated VAT), vehicle excise duty, climate change levy, aggregates levy and the landfill tax as well as APD. For more on the definition of environmental taxes, see I. Gazley, 'UK environmental taxes: classification and recent trends', *Economic Trends*, 635, October 2006 (http://www.statistics.gov.uk/articles/economic_trends/ET635Gazley.pdf).

approximately doubled to just over £1 billion after rates were doubled in 1997, and fell back slightly after the rate restructuring in 2001. Revenues are again forecast roughly to double to around £2 billion after the doubling of APD rates in the December 2006 Pre-Budget Report. It is clear that APD makes up only a small proportion of all environmental tax revenues. The vast majority of these revenues come from vehicle excise duties and VAT on fuel, neither of which is levied on fuel used by aircraft. In 2006, the total revenue generated by APD accounted for less than 0.2% of total (including non-environmental) taxes and social contributions raised.

Is APD an environmental tax?

There is some controversy over whether air passenger duty is an environmental tax. While the labelling of the tax is of little practical consequence, the tax structure and rates should depend on its objective(s). If a tax is levied to internalise an externality, its optimal level would be the social marginal cost at the socially-desirable level of aviation (as demonstrated in Figure 9.2). This optimal level of the tax is unlikely to coincide with the level that would be consistent with the government's revenue-raising objectives (or indeed other objectives that the government might have).

APD was not, initially at least, considered an environmental tax by the government; its purpose was to broaden the tax base and raise revenue at a time when the public finances were strained. In introducing the tax in his Budget Speech, Kenneth Clarke made no reference to the effect of air travel on the environment nor did he do so when he raised the rates in his final Budget in November 1996. Gordon Brown, when he restructured the rates in his 2000 Budget, also made no reference to the environment (nor did the Budget document itself).

In recent years, there has been a shift towards considering the tax as an environmental one. The doubling of APD rates in the 2006 Pre-Budget Report was justified as both a useful measure to combat aircraft emissions and one that would provide extra resources for domestic spending priorities. In the 2007 Pre-Budget Report, the announcement that APD would be replaced with a levy on flights was framed as a response to rising aircraft emissions. It is clear that, whatever its original purpose, the taxation of air travel is now considered by the government to be an environmental tax. However, in its current form, it is not a particularly well-targeted one: those flying relatively short distances within each tax band on full, clean planes would ideally pay less than those on empty, more polluting planes travelling long distances. We examine these issues more closely in the next section.

Comparing APD rates with the marginal external cost of aviation

APD varies only loosely with distance travelled and not at all with aircraft type or load. Given the discussion so far, it is clear that APD rates will not equate to the marginal externality generated by any particular flight though it may be instructive to compare rates of APD with the estimates of average or typical per-passenger externalities discussed in Section 9.2 above.

Estimates from Bleijenberg and Wit (1998), for example, suggested environmental externalities from aviation that varied from around \$1.40 to \$8.30 per passenger for short-haul

flights and \$3 to \$20 per passenger for medium-haul flights; in 2007–08 sterling terms,¹² this suggests current figures of some £1.13 to £7 per short-haul passenger and £2.43 to £16 per medium-haul passenger. This compares with APD rates of £10 for short-haul and £40 for (most) medium-haul flights.¹³ The Dings et al. (2003) study suggested a marginal externality (local plus climate) of just under €10 per passenger on short-haul flights and just over €30 per passenger on long-haul flights. Again in current sterling terms,¹⁴ this equates to around £7.67 per passenger on short-haul flights and £23.34 on long-haul flights. Both studies therefore suggest that APD rates are higher than the estimated externality, although once uncertainties over cirrus cloud generation are included in the Dings et al. study, the short-haul rate in particular may not be too dissimilar to the APD rate. Pearce and Pearce's (2000) estimates of short-haul taxes of around £3.20 per passenger and long-haul taxes of around £13.50 per passenger are now substantially less than APD rates of £10 and £40 even allowing for inflation (in 2007–08 terms, the estimates would be £3.88 and £16.35 respectively).

In summary, these studies all seem to suggest external costs that are, if anything, lower than current APD rates. However, it is again worth noting the huge uncertainties that surround the external costs of aviation, particularly illustrated in the Dings et al. study. In addition, these studies use estimates of the social cost of carbon that are below the 'business as usual' estimates in the recent *Stern Review on the Economics of Climate Change* and which might justify higher aviation (and other) environmental tax rates.¹⁵

In addition, it is clear that APD is not simply a Pigouvian externalities tax – it is also at least partly designed as a revenue-raising instrument, given the lack of other taxes on the aviation sector. To that end, it is perhaps not surprising that the rates may be higher than those justified by the externalities alone.

Distributional effects

There is often concern that environmental taxes (and, indeed, consumption taxes in general) are regressive – that is, they impact more on poorer households than on richer households and so are 'unfair' in a way that taxes on, say, income and wealth might not be. This often motivates calls for revenues from green taxes to be recycled to low-income households to ensure that their net position remains unchanged.¹⁶

¹² US dollar figures converted to sterling using OECD estimate for 1998 \$/£ PPP exchange rate of \$1 = £0.645 (<http://www.oecd.org/dataoecd/61/56/39653523.xls>) and then updated to current prices using the UK GDP deflator.

¹³ Assuming that 'short-haul' and 'medium-haul' can be taken as approximations for the European and non-European APD rates. The 2,000-kilometre distance assumed to be medium-haul might in fact cover some flights at the European rate.

¹⁴ Converting using a PPP exchange rate for 2003 of €1 = £0.698 and then updating to current prices using the GDP deflator as before.

¹⁵ The Pearce and Pearce study used a figure of £29/tonne and the Dings et al. study a figure of €30/tonne. Stern (2006) estimated a social cost of around \$85/tonne under 'business as usual' emissions paths and around \$30/tonne if emissions were lowered to levels that stabilised the level of global warming (see http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/sternreview_index.cfm).

¹⁶ For example, S. Dresner and P. Ekins, 'Economic instruments to improve home energy efficiency without negative social impacts', *Fiscal Studies*, 2006, 27(1): 47–74, examines how a tax on domestic fuel modelled on the existing business climate change levy may be introduced without negative distributional consequences, though they argue that it would be difficult to do so without leaving some significant losers.

Is there evidence that aviation taxes are regressive? A study by the ONS,¹⁷ using data from the 2005–06 Expenditure and Food Survey (EFS), suggested that APD accounted for around 0.08% of the average annual income of those in the poorest 20% of households and around 0.10% of average annual income for other households, which suggests that APD has relatively little distributional impact. However, APD payments are not separately recorded in the EFS and these figures rely on some rather heroic assumptions about the proportion of holiday and air fare expenditures that are accounted for by APD.

The Civil Aviation Authority (CAA) carries out an annual survey of passengers departing from the major UK airports. In its 2006 results,¹⁸ the data suggest that the average (mean) gross annual household income of leisure passengers departing from Gatwick Airport was in excess of £50,000; for Heathrow the figure was almost £60,000 and for Manchester it was almost £44,000.¹⁹ The ONS study of the 2005–06 Expenditure and Food Survey cited above suggested that average UK gross household income was around £33,000 per year, considerably below the average income of those surveyed by the CAA. This suggests that higher aviation taxes – whether increases in APD or a reformed aviation duty – are unlikely to be regressive overall.

9.4 Aviation duty: illustrative options for reform

Reforms to air passenger duty have been proposed by all the main political parties. The Liberal Democrats argued in November 2006²⁰ for a per-flight aircraft tax ‘based on the emissions of each aircraft’ and proposed revenues in the order of £4 billion from a reformed tax, roughly double current APD receipts. In his speech to the September 2007 Conservative Party Conference, Shadow Chancellor George Osborne announced a shift from APD to ‘an airline pollution duty ... empty planes will pay the same as full ones. And newer, cleaner planes will pay less than the older, polluting ones’.²¹ The October 2007 Pre-Budget Report then announced a reform from per-passenger to per-plane aviation tax from November 2009 and stated that revenues from the reformed tax would be around £520 million higher in 2010–11 than under APD. This would suggest revenues from the reformed duty at around £2¾ billion in 2010–11 (given some allowance for additional APD to be generated through higher passenger numbers and current receipts in the order of £2 billion per year).

To generate an additional £500 million or so per year from today through existing APD would require rates around 25% higher than now; to generate an extra £2 billion or so that the

¹⁷ F. Jones, *The Effects of Taxes and Benefits on Household Incomes, 2005–06*, Office for National Statistics, 2007 (http://www.statistics.gov.uk/downloads/theme_social/Taxes_Benefits_2005-2006/Taxes_Benefits_2005_06.pdf).

¹⁸ *CAA Passenger Survey Report 2006* (<http://www.caa.co.uk/docs/81/2006CAAPaxSurveyReport.pdf>). Figures for leisure passengers are annual gross household incomes where respondents are invited to pick a response from a card that matches their household circumstances.

¹⁹ The overall distributional effect of taxes on aviation is complicated by the fact that a significant proportion of passengers are business passengers who may not ultimately be liable for the taxes on the flights that they take. However, the figures reported here are for leisure passengers only.

²⁰ Liberal Democrats, *Fairer, Simpler, Greener*, Policy Paper 75, July 2006 (<http://www.libdems.org.uk/media/documents/policies/PP75%20Fairer%20Simpler%20Greener.pdf>).

²¹ http://www.conservatives.com/tile.do?def=news.story.page&obj_id=139170.

Liberal Democrats have proposed from aviation taxes would, were it to be raised through APD, require rates to at least double.

This section considers how a reformed per-flight tax may be introduced. In particular, we make some illustrative proposals for a per-seat tax (which approximates a per-plane tax since the tax is levied on empty seats as well as passengers) based on departures data from the Civil Aviation Authority. We allow the tax rate to vary by the size of the aircraft (the number of seats) and the destination. We discuss how a per-flight tax might look on a per-passenger basis and how that compares with APD. Our simulations are carried out under the assumption that everyone who flew in 2006 would also have flown under our new taxes; that is, we ignore any behavioural effects that a restructuring of the tax might induce. Our intention is not to model formally the exact effect that such a new tax might have but to illustrate the fact that, in moving from APD to a per-flight tax, on a per-passenger basis some people would gain and some would lose. Further, our simulations should not be seen as our view on how a per-flight tax should optimally be introduced. What we are able to model is limited by the data available and a per-flight tax in practice may look very different from those we describe here. In Section 9.5, we discuss in more detail some of the issues involved in the design of a tax based on the flight.

Departing flights and passengers from the UK: data

We use data for 2006 provided by the Civil Aviation Authority. The data include, for each combination of departure airport, country of destination and aircraft type, figures for total passengers carried and total flights and an estimate of the total passenger capacity from which we can derive an average load factor.²² The data include all transport flights, also covering freight-only flights. In 2006, a total of nearly 1.2 million departing flights are recorded, of which 32,527 (2.8%) are cargo-only flights, though many passenger flights of course also carry cargo. A total of about 119 million passengers were on the recorded flights. Table 9.2 details the largest airports according to flights and passengers departing.

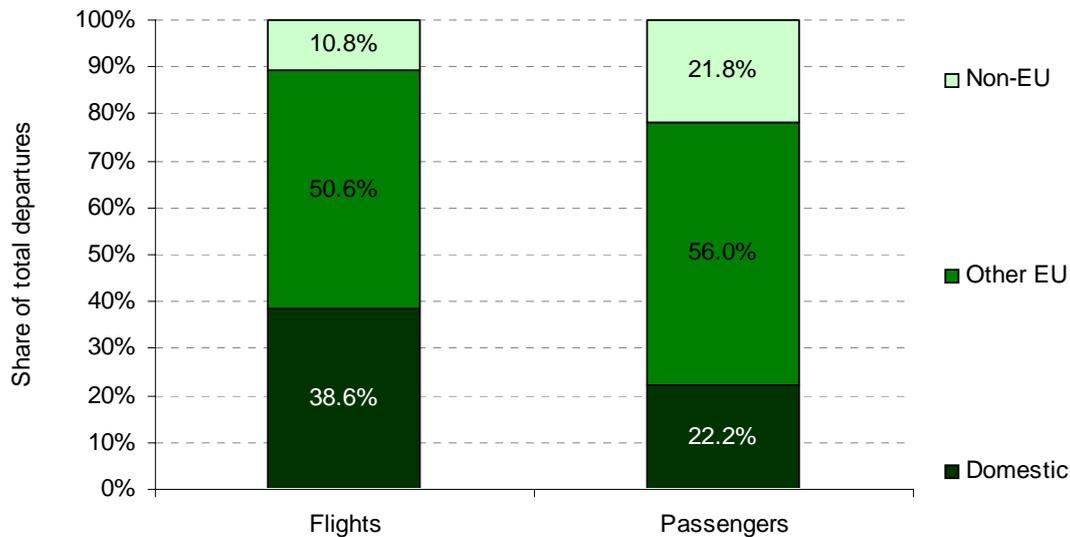
Table 9.2. Flights and passengers departing the UK, by airport, 2006

Airport	Departing flights	Departing passengers
Heathrow	235,478 (19.9%)	33,767,573 (28.4%)
Gatwick	127,198 (10.8%)	17,114,532 (14.4%)
Stansted	95,184 (8.1%)	11,818,027 (9.9%)
Manchester	106,635 (9.0%)	11,351,646 (9.5%)
Luton	39,487 (3.3%)	4,691,310 (3.9%)
Birmingham	54,348 (4.6%)	4,606,802 (3.9%)
Glasgow	48,519 (4.1%)	4,448,837 (3.7%)
Edinburgh	57,784 (4.9%)	4,295,431 (3.6%)
Other UK airports	415,737 (35.2%)	27,008,514 (22.7%)
Total	1,180,370	119,102,672

Source: Calculated from CAA departure statistics, 2006.

²² Where such information is unavailable, we assume average load factors for 2006, as described in Section 9.5, of 65.9% for domestic flights and 79.4% for international flights.

Figure 9.5. Departing flights and passengers, by broad destination, 2006



Source: Calculated from CAA departure statistics, 2006.

Figure 9.5 breaks down flights and passengers according to whether their destination was domestic (i.e. a flight to another UK airport), another country attracting the European APD rate or a non-European country. Only a minority of flights and passengers are for non-European destinations, though it is clear from these data that the number of passengers per flight is much larger for these longer-haul flights, reflecting both the larger capacity and higher load factors of long-haul aviation.

Looking at the particular country of destination, domestic flights account for 26.47 million passenger departures, around 17.44 million passengers travelled to Spain, 9.31 million to the US, 6.18 million to the Irish Republic, 5.77 million to France, 5.75 million to Germany and 5.30 million to Italy. The Netherlands, Greece, Switzerland and Portugal also attracted more than 2 million passengers each. The data include only the first leg of multi-stage journeys – there are few direct flights, and therefore passengers, recorded to Australia, for example, and none at all to New Zealand.

Our figures for total departing passengers are similar to (but not identical to) those in Section 9.3 when we examined APD rates per passenger. HMRC data for 2006 give a total of 105,448,635 chargeable passengers, around 11% below the number of passengers in our data. However, our figures here include non-chargeable passengers (such as transfer passengers) and may also include some non-chargeable flights. The split between European/non-European-destination passengers in the HMRC data is identical to ours (78.2% European-destination passengers), suggesting no variation in the proportion of chargeable and non-chargeable passengers across the two destination groups. Given that it is unclear how aviation duty might be exempted for currently exempt passenger groups (even if it should be), we assume that it will apply to such groups in the future and use CAA passenger numbers rather than scaling them to HMRC levels.

We supplement the CAA data with estimates of the distance from each UK airport to each destination country. We know only the country rather than the airport of destination, and so we assume all flights are to the capital city of each destination and use information on the

latitude and longitude of the departure airport and destination capital to estimate flight distances in kilometres.

Aviation duty: some illustrations

We begin by simulating a tax similar to APD for the departures data. We do not know the class of seat, so can differentiate only according to destination (£10 for those flying within Europe, £40 for those flying outside), though in 2006 almost 95% of passengers paid the economy-class APD rate so this is not an unreasonable approximation. In addition, we assume all passengers (including transfer passengers) are liable for the tax other than those flying from the Scottish Highlands and Islands.²³

We estimate total receipts from our simulated APD and then consider two reforms that approximate a change of tax base to the aircraft in different ways but generate the same revenue. Assuming that the number of passengers remains unchanged for each journey, we can express these per-flight charges on a per-passenger basis to compare with APD payments. Neither of the proposals we make here for a per-flight tax is how we might necessarily expect aviation duty to be introduced in practice. We have no details from the Treasury as yet as to how the new tax might operate or how the per-flight charge might be determined (nor have any opposition parties detailed how they would implement such a reform). Our results are purely illustrative and based only on the data at our disposal.

We base our illustrative aviation duty on a per-seat tax – in effect, an APD that is extended to empty seats. The different aviation tax options we examine are:

1. a two-tier seat tax where flights to non-European countries attract four times the tax rate of flights to European countries; this preserves the ratio of European to non-European duty as it stands under APD;
2. a two-part tax that combines a fixed per-seat charge with an additional component that, for a given aircraft size, increases proportionately with distance travelled.

Note that, in practice, a per-seat tax (or a direct per-flight tax) may vary by other factors as well – in particular, the emissions of the aircraft, and the airport (and perhaps time) of departure. We do not model these possibilities: to do so would require good evidence on noise and environmental emissions by aircraft type and airport that are not easily publicly available. We assume that the per-seat tax varies only by destination (in option 1) and distance (in option 2). Section 9.5 looks at the issues in tax design more closely.

Our simplified APD generates revenues of £1.964 billion in 2006, around £180 million more than the revenues from applying rates of £10 and £40 to the chargeable passenger numbers from HMRC statistics for 2006, reflecting the fact that our passenger tax applies to transfer passengers as well. The mean payment per passenger is £16.58, with a median of £10. The revenue figure of almost £2 billion is the benchmark against which we calibrate revenues from our simulated aviation duty reforms.

²³ Around 2% of flights and 0.5% of passengers depart from airports that are in the Scottish Highlands and Islands and so currently exempt from APD. We make the assumption that any aviation duty would maintain this exemption, though clearly our results will be little changed since these flights and passengers represent such a small fraction of the totals.

Option 1: per-seat tax with European/non-European variation

Our simulations suggest a European seat tax rate of £7.53 and a non-European seat tax rate of £30.14 would be required for a revenue-neutral change. These figures are below current APD rates as there are clearly more available seats than passengers. The mean duty per passenger would be £16.58, by construction the same as under our simplified APD since we assume no change in revenue or passenger numbers. The median tax would be £10.52, similar to the APD level. The difference is that we generate much more variation in the per-passenger payment according to the load factor: passengers flying in relatively empty planes have to absorb a greater tax for the empty seats than those flying on relatively full flights.²⁴

Option 2: two-part tax varying proportionately with distance

Planes that fly longer distances pollute more in total, though less per kilometre flown since most of the noise emissions occur during take-off and landing. It seems therefore that a tax should increase proportionately with distance to account for environmental emissions but with a fixed component reflecting these local noise externalities that do not vary systematically by distance. This fixed charge could also serve a revenue-raising purpose. Under such a structure, the total tax per seat increases with distance but the tax per seat-kilometre (seats multiplied by distance) falls with distance. The fixed component could vary according to aircraft type or departure airport in order to target the externalities more precisely.

It must be emphasised that under this type of structure, there are an infinite number of fixed and variable charge combinations that will yield the desired revenue. Our intention is to illustrate how the structure might work rather than to argue that our chosen combination is in any sense optimal. We select the combination of fixed charge and per-seat-kilometre charge that ensures that the average charge paid by a passenger to a European destination is the same as in our first tax simulation.

Table 9.3. Two-part tax for typical flights

Length of flight (km)	Typical destination	Two-part tax per seat	Two-part tax per passenger with 80% capacity	Two-part tax per passenger with 60% capacity
0	Domestic	£3.78	£4.73	£6.30
500	Paris	£5.89	£7.36	£9.82
1,000	Prague	£8.00	£10.00	£13.33
1,500	Budapest	£10.11	£12.64	£16.85
2,500	Moscow	£14.33	£17.91	£23.88
6,000	Washington	£29.10	£36.38	£48.50
7,500	Havana	£35.43	£44.29	£59.05
9,500	Hong Kong	£43.87	£54.84	£73.12

Source: Authors' calculations from CAA departure statistics, 2006. Destinations are approximate distances from Heathrow Airport to other national capitals.

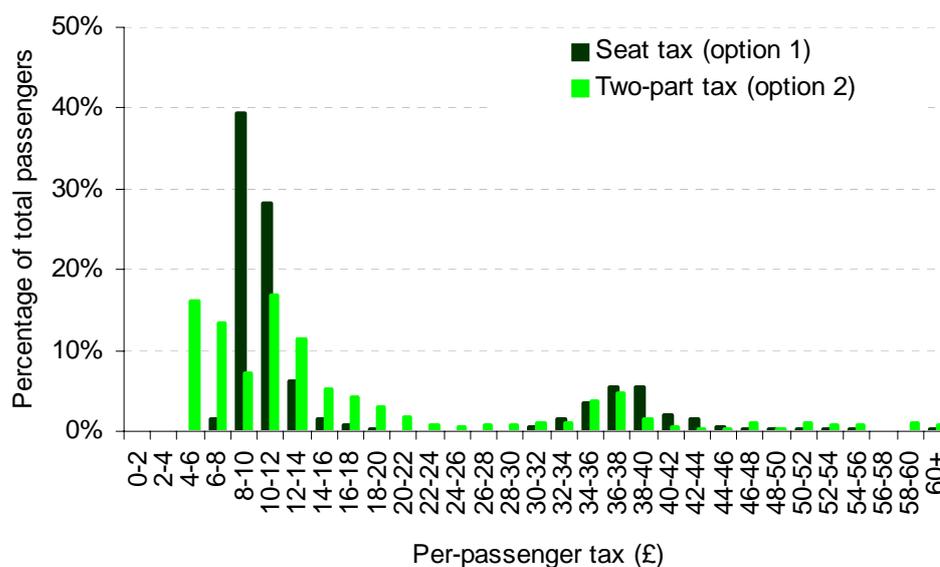
²⁴ Indeed, given that our per-seat tax varies only according to the European/non-European distinction, the per-passenger tax is determined entirely by the load factor. A European-destination craft operating at 50% load will have a per-passenger average liability of $(£7.53) \div 50\% = £15.06$, whereas one operating at 90% load will have a passenger-equivalent tax of $(£7.53) \div 90\% = £8.37$.

Our simulated tax rate per seat-kilometre flown is 0.422p (that is, just over 1p for every 2.5 seat-kilometres flown), with a fixed charge per seat of £3.78.²⁵ Expressed per passenger, this tax yields a mean charge that is the same as the previous cases (£16.58 per passenger), with a median of £11.69 per passenger. Table 9.3 illustrates the charges that would arise per seat for flights of various lengths assuming different load factors.

Comparison of the two options

Figure 9.6 shows, for our two models of aviation duty, the distribution of per-passenger payments. Recall that under APD, all per-passenger payments are either £10 or £40 in our simulations. Clearly, a seat tax varying only loosely by destination (option 1) would see per-passenger payments varying less than a fully distance-based tax (option 2). Just under 70% of passengers would pay between £8 and £12 under option 1, whereas under option 2 the distribution of payments for those currently paying the European rate of APD is much more dispersed between £4 and £18. There is also more dispersion of higher payments for longer-haul flights. Compared with the current maximum payable under APD (not allowing for seat class variation), option 1 sees 5.5% of passengers paying more than £40 whereas option 2 sees 6.7% of passengers paying more than £40.

Figure 9.6. Distribution of per-passenger payments for different tax types



Note: Per-passenger tax of £0–2 should be interpreted as greater than or equal to zero but strictly less than £2, and so on.

²⁵ A revenue-neutral shift that increased the fixed component and reduced the per-kilometre charge would, relative to this simulation, benefit those flying long-haul, whilst a reduction in the fixed component and an increase in the per-kilometre charge would benefit those flying domestically and short-haul. Note that under our simulated tax, domestic passengers pay only the fixed component per seat since we do not know the destination airport and so have assumed a zero distance, though were a tax introduced on this basis it would be possible to determine flight distances domestically as well. In practice, most countries tax domestic aviation more heavily than international flights. We discuss this in the next section.

Table 9.4. Passengers paying more than APD, by region of destination

Destination region	Seat tax (Europe/other)	Two-part tax (distance)
Domestic (UK)	77.80%	0.35%
Other Europe	36.35%	73.21%
Non-Europe	25.14%	30.36%

Note: Percentages exclude passengers from the Scottish Highlands and Islands, who are assumed to be exempt under all schemes.

Table 9.4 illustrates the fact that there would be both gainers and losers from a move from APD to a per-flight tax. It gives the percentage of passengers (broken down by destination) paying more under our two new taxes than they would have paid under APD. Under the seat tax differentiated by European/non-European destination, domestic travellers would lose out to the greatest extent, with a majority of travellers to other destinations benefiting. This reflects the fact that domestic flights are typically less fully-loaded than international flights and so domestic passengers would be required to pay the cost for these empty seats, assuming the taxes are passed on to them. Under the two-part tax, those currently paying the European rate would lose to a much greater extent than those paying the non-European rate; almost all domestic passengers benefit from paying only the fixed component.

Table 9.5. Illustrative per-passenger tax rates for different tax types

Aircraft type (country of destination)	Passengers carried	Load factor	Distance (km)	APD	Option 1 (Europe/ other) per passenger	Option 2 (distance) per passenger
Airbus A319 (to UK)	979,849	72.3%	n/a	£10.00	£10.42	£5.22
Boeing 747SP (to UK)	2,522	43.2%	n/a	£10.00	£17.42	£8.73
Airbus A320 (to France)	390,743	65.5%	427	£10.00	£11.50	£8.52
McDonnell-Douglas MD88 (to Spain)	46,858	89.8%	1,279	£10.00	£8.39	£10.22
Airbus A300-600 (to Sudan)	2,475	30.0%	5,006	£40.00	£100.46	£83.06
Boeing 767-200 (to Canada)	31,661	96.3%	5,260	£40.00	£31.29	£26.98
Boeing 767-300ER/F (to US)	327,398	79.1%	5,880	£40.00	£38.12	£28.61
Boeing 777-200 (to Japan)	35,052	55.6%	9,642	£40.00	£54.24	£80.02

Note: All flights are from London Heathrow.

Source: Authors' calculations from CAA departures data, 2006.

In Table 9.5, we illustrate various routes (aircraft/country-of-destination combinations) from London Heathrow and compare APD with the two new taxes that we simulate. In each case, we show the implicit per-passenger tax given the average capacity and load on the route in question and the distance to the national capital. The importance of load factor and, for the two-part tax, distance to the capital is clear: relatively empty planes attract the largest taxes per passenger whereas full planes attract lower taxes per passenger even if the distances

travelled are similar or even longer (for example, the simulated per-passenger tax to the Sudan for the example aircraft type in the table is three times higher than the per-passenger tax to Canada, even though the distance travelled is approximately the same, as, on average, the Sudanese flight currently operates at 30% capacity compared with the 96% capacity of the Canadian flight).

Summary

The move from a passenger-based tax to a flight-based tax could be implemented in many ways. Any such switch would create, on a per-passenger basis, winners and losers. We have illustrated only a simple method in which seats are taxed and the tax is allowed to vary with distance (either simply a Europe/other split as under APD or linearly with distance). The winners from this simulation are those who fly on fully-loaded planes and who fly relatively short distances, though by setting a high fixed component in our two-part tax we have mitigated the impact of the distance somewhat.

In practice, a per-flight tax may also be differentiated by aircraft emissions, aircraft noise, airport of departure and so on. In this case, the pattern of winners and losers would be more complicated than we have been able to simulate. Relative winners would be those flying on full, clean, quiet planes from airports away from residential areas. Relative losers would be those who do the opposite. The balance between all of these factors in determining the correct charges for different flights would be complicated and depend on the ease with which each can be incorporated accurately and cheaply into the tax design.

9.5 Issues in aviation tax reform

Choosing the tax base

The current tax base for air travel in the UK is passengers leaving UK airports, with a planned change in the base to flights leaving UK airports in 2009. This section first discusses the merits of this change and some issues that will need to be considered in implementing a per-flight tax. We then discuss other alternative tax bases – fuel and aircraft emissions – and ask whether there may be alternative or additional aviation tax reforms that would be desirable.

There are a number of considerations to be taken into account when choosing the appropriate tax base. These include:

- the degree to which the tax correlates well (or can be made to correlate well) with the various aviation externalities;
- the complexity and cost of administering the tax;
- the negative distortionary effects that the tax could induce (in terms of unintended incentives for airlines, or macroeconomic consequences such as the effect on trade or on the position of the UK as an air transport hub);
- the revenue-raising capabilities of the tax;
- any obstacles to the implementation of the tax (such as international agreements).

A point worth making in advance, however, is that there is no reason to suppose that we need limit ourselves to one tax base alone. The ideal solution to aviation taxation may involve a combination of instruments. Keen and Strand (2007)²⁶ argued that a fuel tax (which would closely align to environmental externalities) plus a ticket tax would provide an optimal system of taxes in their stylised model. Noise externalities may be additionally covered through departure taxes that could also vary by airport, for example.

Passenger or flight?

Air passenger duty at present suffers from three key disadvantages that a per-flight tax could help overcome:

- First, the link between the passenger and the externality is weak. APD varies only loosely by destination and seat class: someone flying standard class to Turkey will pay the same tax as someone flying standard class domestically despite the much longer distance travelled and the greater total emissions generated. Of course, APD could be reformed to correlate more closely with emissions, and the move to a per-flight tax should be used to consider a wholesale reform of the factors that influence the tax rate to help improve the environmental targeting. However, there is a clear trade-off between effective externality targeting and administrative simplicity. The Chartered Institute of Taxation (2007)²⁷ noted that APD is currently coded into the ticket price based on information about the class of seat and destination held in central ‘Global Distribution Suppliers’ (GDSs) that connect travel suppliers and travel agents. Since this information is already held, it is relatively straightforward for the correct APD to be levied on the ticket price, but if a future flight tax is to be graded by information not currently held by ticketing systems, then it would be important to weigh the costs of including such information against the benefits in terms of targeting and environmental outcomes.

To the extent that both per-passenger and per-flight taxes can be made to approximate the various externalities involved, this is not a clear advantage of flight taxes *per se*.

- Second, APD (and per-passenger taxes in general) do not provide any additional incentive for airlines to operate their aircraft at greater capacity. Noise and emissions depend only very marginally on the degree to which the plane is full – environmentally, it would be much better to fly one plane fully loaded than two planes at half capacity. Average seat occupancy rates have been fairly stable over the last decade or so – around 78% to 80% of the available ‘passenger kilometres’ have been occupied since 1996. International flights have a significantly higher average load factor than do domestic flights (79.4% and 65.9% in 2006 respectively).²⁸

Taxes on flights, however, do provide greater incentives for airlines to fly their planes fully loaded. Imagine an airline operating a plane with a capacity of 250 passengers. If the aircraft is taxed £1,000 to depart, then flying at full capacity results in an average tax per

²⁶ M. Keen and J. Strand, ‘Indirect taxes on international aviation’, *Fiscal Studies*, 2007, 28(1): 1–41

²⁷ Chartered Institute of Taxation, *Greener Skies: Response by the CIOT to the Consultation Paper Issued by the Conservative Party*, June 2007 (<http://www.tax.org.uk/showarticle.pl?id=5643>).

²⁸ Figures from table 2.4 of Department for Transport, *Transport Statistics Great Britain 2007* (<http://www.dft.gov.uk/pgr/statistics/datatablespublications/tsqb/2007edition/sectiontwoaviation.pdf>).

passenger of £4 whereas flying at half capacity means either the airline has to pass on a tax of £8 (which would raise its ticket price) or it has to absorb the cost for the empty seats itself.

- Third, APD and passenger taxes cannot be generalised straightforwardly to freight-only flights. This is clearly not the case when the tax base is the flight itself. At present, freight flights are untaxed in the UK but clearly they still generate noise and environmental emissions and there are no really convincing economic arguments for excluding them from any environmental tax regime. Indeed, exempting freight-only flights from any reformed aviation duty could create perverse incentives for airlines to operate two small aircraft, one for passengers and one for freight, rather than one larger aircraft carrying both passengers and freight. This would have negative environmental consequences.

CAA data for 2006 shows that there are in fact relatively few freight-only flights, accounting for around 2.8% of departures from UK airports, with more than half of those being freight flights within the UK. We attempted to simulate aviation duty extended to freight flights along the lines of the options outlined in Section 9.4: by comparing the aircraft type to the same aircraft carrying passengers, we were able to estimate the number of seats that would be available on the freight flights were they to carry passengers instead and use this as the basis for the tax.²⁹ Under both options – varying the rate by Europe/other only or linearly with distance – we estimated that revenue from cargo flights would be small (in the order of £30 to £40 million) and the impact on per-passenger taxes (assuming this additional revenue were used to reduce the tax rate on all flights) would consequently also be small.

Whilst there may be obvious advantages to a flight-based tax over a passenger-based tax, one possible problem is that flight taxes make it harder to exempt certain categories of individuals from incurring a liability than do passenger taxes. At the moment, transfer and transit passengers are exempt from APD, presumably so as not to damage the position of the UK as an international hub for air travel. In moving to a flight tax, it becomes a little more complex to exempt such passengers, though one can imagine a rebate (or discount) system that could operate to reduce the liability of planes that carry transfer passengers. However, this would come at the cost of making the tax more complex.

Alternative tax bases?

Taxes could be levied as an *ad valorem* **ticket charge** rather than a fixed per-passenger fee. One way to do this would be to bring aviation tickets into the VAT system. All forms of public transport, including aviation, are currently zero-rated for VAT. This in effect subsidises them relative to consumption that is subject to VAT. There may be good reason for this with regard to encouraging bus, coach and train use rather than private car use, but it seems harder to make a similar argument for zero-rating aviation. Including international aviation in the VAT system would involve considerable complexity such that it would really only be feasible to include domestic aviation. Note that adding VAT to aviation tickets would not affect the business demand for flights since VAT on inputs can be reclaimed.

²⁹ We were able to match cargo aircraft types to passenger aircraft types in about three-quarters of cases; where we could not (i.e. for those aircraft types built exclusively for cargo transport), we assumed the number of seats to be equal to the average on other cargo-only flights.

How much additional revenue could VAT on domestic aviation raise? In evidence to the House of Commons Environmental Audit Committee following the 2006 Pre-Budget Report,³⁰ John Healey (then Financial Secretary to the Treasury) suggested that standard-rating domestic aviation would generate revenues of around £160 million per year, which uprated to 2007–08 suggests receipts in the order of £180 million today.

Applying VAT on a ticket rather than a fixed charge on a passenger would not mitigate the weaknesses of a passenger tax relative to a flight tax. There would still be no (additional) incentive to fly planes as full as possible and the link between ticket price and externality is fairly weak.

If taxes are designed to reduce aviation emissions, then the ideal tax base is a direct **emissions tax**. There are practical problems with this: it is hard to measure the emissions from an individual flight directly and accurately and the costs of doing so may outweigh the potential environmental gains. Emissions may be estimated according to aircraft type, destination, engine type etc. though there may be inaccuracies (variation according to load, unanticipated route diversions and so on).

An alternative that is closely related to emissions but easily measurable and already traded (reducing the costs of administration) is aviation fuel. A **fuel tax** would penalise airlines that operate a relatively fuel-inefficient service and encourage greater investment in fuel-efficient aircraft. However, a tax on fuel alone would not accurately target those services that impose the greatest noise externalities on areas surrounding airports. In addition, some emissions (such as NO_x) are not closely related to fuel consumption and other instruments might be needed to take account of these.³¹

One way to tax aviation fuel would be to bring it under the scope of VAT: aviation fuel for both domestic and international travel is currently zero-rated in the UK. However, there are problems with doing this similar to those with charging VAT on tickets discussed above: VAT on fuel would have little effect on airlines, which could reclaim the VAT paid on their inputs, including aviation fuel. A fuel tax would therefore have to take the form of an unrecoverable duty, similar to those on motor fuel, to have an impact.

A number of countries have a duty on fuel for domestic aviation, including Australia, Canada, the Netherlands (alone in the EU), Norway and the US, and there would be no legal impediments to taxing domestically-used fuel in the UK.³² However, there would be a number of legal barriers to the charging of fuel duties for international flights. Article 24 of the Chicago Convention, which established the International Civil Aviation Organisation, states that ‘fuel ... on board an aircraft of a contracting State, on arrival in the territory of another contracting State and retained on board on leaving the territory of that State shall be exempt from customs duty, inspection fees or similar national or local duties and charges’.³³ In

³⁰ House of Commons Environmental Audit Committee, *Pre-Budget 2006 and the Stern Review*, March 2007 <http://www.publications.parliament.uk/pa/cm200607/cmselect/cmenvaud/227/227.pdf>.

³¹ A full discussion of these issues is contained in A. N. Bleijenberg and R. C. N. Wit, *A European Environmental Aviation Charge: Feasibility Study*, Centre for Energy Conservation and Environmental Technology, Delft, 1998.

³² Indeed, some aviation fuel is subject to duty. Aviation gasoline, or AVGAS, is taxed at a rate of 30.03p/litre and is used for small aircraft (largely private aircraft for pleasure flights rather than commercial flights).

³³ See http://www.icao.int/icaonet/arch/doc/7300/7300_9ed.pdf.

addition, there are more than 2,500 bilateral Air Service Agreements (ASAs) that go further and prohibit the imposition of any tax on aviation fuel that will be used by aircraft travelling between the two signatories. These agreements were signed with a view to preventing aircraft travelling to low-fuel-tax jurisdictions to fill their tanks, thereby introducing distortions into the market. Norway had to abolish an aviation fuel tax within months of instituting it in January 1999 as it transgressed a number of these ASAs.³⁴ Since 2003, however, it has been permissible for two EU countries to tax the fuel used on travel between them.³⁵ As yet, no countries have availed themselves of this option.

Lessons for aviation duty

The discussion above and our earlier simple illustrations based on a per-seat tax suggest several lessons for how a reform of the tax base to the aircraft should be introduced:

- A simple seat tax,³⁶ whilst providing strengthened incentives to fly planes fully loaded, is probably not sufficient to target effectively the noise and emissions externalities of aviation. Ideally, the tax rate should vary according to the aircraft type, aircraft emissions, airport of departure (since marginal noise externalities of additional flights will vary according to the airport) and so on, as well as distance travelled. But, as we have warned above, the reform will need to weigh up carefully the operational costs of this more complex tax structure with the potential gains.
- The tax reform needs to be designed so as not to create incentives for airlines or passengers to try to take steps to avoid the tax. A per-seat tax, for example, may encourage airlines to fit removable seats on low-load-factor routes. With any per-flight tax that varied significantly by distance flown from UK airports, there may be a concern that passengers would have a strong incentive to take a short flight out of the country and then a connecting flight to their intended destination, even if this increased the journey time, distance travelled and total emissions. This will be more of an issue the larger the component of the final ticket price that is accounted for by the tax.
- In the long term, aviation duty could affect the pattern of air travel routes offered by airlines. As the analysis in our simulation showed, the tax would impact most strongly on flights with low load factors, and airlines may seek to reduce or limit the extent to which they operate to unpopular destinations, or reduce the choice available to passengers in terms of flight times and frequencies, in order to try to fly more fully-loaded planes. This, of course, is the point of the tax: it is supposed to reduce the number of flights taken in relatively empty planes. However, there might be concerns that reductions in marginal routes from regional airports, say, could affect the ability of those in relatively remote areas to fly. The exemption of APD for flights from the Scottish Highlands and Islands is

³⁴ ECON Analyse, *The Political Economy of the Norwegian Aviation Fuel Tax*, OECD, Paris, November 2005 ([http://appli1.oecd.org/olis/2005doc.nsf/43bb6130e5e86e5fc12569fa005d004c/5a0254861b05e21ac12570c20060da00/\\$FILE/JT00194728.PDF](http://appli1.oecd.org/olis/2005doc.nsf/43bb6130e5e86e5fc12569fa005d004c/5a0254861b05e21ac12570c20060da00/$FILE/JT00194728.PDF)).

³⁵ EU Council Directive 2003/96/EC on restructuring the Community framework for the taxation of energy products and electricity (http://ec.europa.eu/energy/res/legislation/doc/biofuels/taxation_energy_products_and_electricity.pdf).

³⁶ A seat tax was imposed briefly in Norway between 1998 and 1999. It replaced, and was subsequently replaced by, a passenger tax similar to APD. Its brief life can partly be explained by the fact that a majority in Parliament was opposed to the tax from the outset; it was only accepted as part of a settlement on the overall budget between the opposition parties and the government. See ECON Analyse, op. cit.

designed with such concerns in mind and we have assumed any reformed aviation duty would maintain this exemption.

There are clear advantages in moving from a passenger tax to a flight tax, provided the reform is carefully implemented, in particular given the many constraints on the way international aviation can be taxed. One consequence of the reform, evident in our simulations in Section 9.4, is that where there is a clear distance-based component of the tax, domestic passengers will pay considerably less than they do at present. In practice, many countries tax domestic aviation more heavily than international aviation.³⁷ Should the government wish to prevent taxes on domestic aviation falling when replacing APD with aviation duty, either the variation in the tax rate with distance would have to be limited or other domestic aviation taxes (such as fuel or ticket taxes) would have to be introduced. For international aviation, the ideal solution may well be renegotiation of international agreements to allow fuel taxes to be introduced that would capture environmental emissions reasonably well, coupled with additional levies to cover noise emissions. Given that this is unlikely, at least any time soon, a well-designed per-flight tax may be the best available option.

Aviation and the EU Emissions Trading Scheme

The basic idea of an emissions trading scheme (ETS) is that participants are allocated permits (whether through an upfront auction or allocated freely, known as ‘grandfathering’) that give them the right to generate a certain level of emissions. If they reduce emissions below their allocation, they can sell their excess permits to other participants who are finding it more difficult to reduce emissions, with the price of the permit reflecting the marginal cost of a unit of pollution reduction. Efficient abaters will do more abatement and receive payment for the excess; inefficient abaters will do less abatement and pay for the privilege. A ‘market’ for pollution is created where none existed before, and the price of permits will fluctuate according to the supply of and demand for them. Emissions are capped by the total number of permits allocated to participants and abatement to the cap should be achieved as efficiently as possible.

To the extent that there is certainty over the marginal costs and benefits, taxes and trading should generate similar outcomes and the choice between them may depend on implementation costs, international considerations and so on. Under uncertainty, taxes and trading may have different outcomes.³⁸

The EU Emission Trading Scheme began in 2005 and was described by the EU as ‘the largest multi-country, multi-sector Greenhouse Gas emission trading scheme world-wide’.³⁹ The first phase of the scheme ran until the end of 2007, with the second phase running from 2008 to 2012. Aviation was excluded from the first phase, but it is proposed that it will be included

³⁷ There is not necessarily any good economic reason for this, but the discussion throughout this chapter has highlighted the difficulties in taxing international aviation.

³⁸ For more, see section 11.2 of R. Chote, C. Emmerson, A. Leicester and D. Miles (eds), *The IFS Green Budget: January 2007*, IFS Commentary 102 (<http://www.ifs.org.uk/budgets/gb2007/07chap11.pdf>).

³⁹ For the EU ETS homepage, see <http://ec.europa.eu/environment/climat/emission.htm>.

from 2012, only three years after the reformed domestic tax is expected to be implemented. Under proposals put forward by EU environmental ministers in December 2007:⁴⁰

- From 1 January 2012, the ETS will cover all flights departing from or arriving at an EU airport, even if the destination or origin is outside the EU. Permits will be required for emissions generated anywhere along the flight path, not simply the part that is in EU airspace.
- A fixed proportion (10%) of the emissions permits will be auctioned. The remainder will be allocated according to a benchmarking scheme, with the number of permits awarded to a particular operator being proportional to the tonnage-kilometres flown by that operator. The number of permits available to the aviation sector will be capped at the average level of EU aviation emissions between 2004 and 2006. Any increases in CO₂ emissions generated by the aviation sector will therefore have to be offset by reductions in other industries.
- By the end of 2008, the Commission will put forward a proposal to address the emissions of nitrogen oxides from aviation after a thorough impact assessment.⁴¹
- Flights arriving from non-EU countries that have an emissions trading scheme will be exempt, as will flights made by airlines with less than an average of two flights per day in three consecutive four-month periods. In addition, certain flights to the most remote regions of the EU will be exempt.

The ETS will cover only (at least initially) CO₂ emissions from the aviation sector. Other emissions and noise and congestion externalities will provide continued justifications for domestic aviation taxes as well. However, it will be of crucial importance in reforming APD to a per-flight basis to consider how aviation duty will interact with the ETS, particularly given how soon after the reform the inclusion of aviation in the ETS is likely to take place.

If domestic aviation taxes are abolished or reduced, then the government loses a source of revenue which may not be replaced if, as expected, almost all permits are allocated freely rather than auctioned. If, on the other hand, aviation duty is not abolished, then customers are potentially charged twice. To avoid either of these less-than-desirable scenarios, it would seem optimal to auction the permits, and then keep that portion of domestic duty that is meant to track the noise externality and cover non-CO₂ emissions (as well as to raise revenue), but to remove that portion that is meant to internalise the CO₂ emissions externality.

9.6 Conclusion

The rapidly-growing contribution of aviation to greenhouse gas emissions provides an important motivation for a wholesale reform of the aviation tax system. The move from a per-passenger to a per-flight tax in 2009 now has cross-party support. Such a move may provide

⁴⁰ For a summary of the proposals of the Council of Ministers, see http://www.consilium.europa.eu/ueDocs/cms_Data/docs/pressData/en/envir/97858.pdf.

⁴¹ See Directive of the European Parliament and of the Council amending Directive 2003/87/EC so as to include aviation activities in the scheme for greenhouse gas emission allowance trading within the Community (http://ec.europa.eu/environment/climat/pdf/aviation_ets_com_2006_818-21273_en.pdf).

considerable environmental benefits if it can be designed so as to target reasonably accurately the various externalities involved, without incurring too much administrative complexity. Any revenue-neutral move from APD to aviation duty would create both winners and losers. A simple tax varying by distance will benefit those flying short distances on full planes, but more complicated taxes that vary with emissions, aircraft type, airport of departure, and so on will have a more complex pattern of relative benefits. Moreover, since the Treasury wants the new aviation duty to raise more revenue than the existing APD, the average losses will have to be greater than the average gains. Given the constraints on international aviation taxes, a per-flight tax may well represent the best available option at the moment, although VAT and fuel duty are also possibilities that should be strongly considered for domestic flights. The picture will also be complicated by moves to bring aviation into a system of emissions trading and it will be of the utmost importance to consider how the domestic tax and international trading systems will operate alongside one another.