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Economic Benefits from Air Transport in the UK

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A note on the data reported in the report

Unless otherwise stated, the numbers reported in this report relate to the calendar year 2012.

Oxford Economics, November 2014

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Facts & figures

UK aviation's economic benefits

Air transport to, from and within the UK creates three distinct types of economic benefit. Typically, studies such as this focus on the 'economic footprint' of the industry, measured by its contribution to GDP, jobs and tax revenues generated by the sector and its supply chain. But the economic value created by the industry is wider still. The principle benefits are created for the customer, the passenger or shipper using the air transport service. In addition, the connections created between cities and markets represent an important infrastructure asset that generates benefits through enabling foreign direct investment, business clusters, specialization and other spill-over impacts on an economy's productive capacity.

1. Aviation's economic footprint

Contribution to UK GDP

The aviation sector contributes £52 billion (3.4%) to UK GDP. This total comprises:

- £22.3 billion contributed through the output of the aviation sector (airlines, airports and ground services, aerospace) itself;
- £16.7 billion indirectly contributed through the aviation sector's procurement from its domestic supply chain; and
- £12.9 billion contributed through the wage-financed spending by the employees of the aviation sector and its direct supply chain.

Major employer

The aviation sector supports 961,000 jobs in the UK. This total comprises:

- 341,000 jobs within the aviation sector itself;
- 350,000 jobs indirectly supported through the aviation sector's purchase of inputs from UK suppliers; and
- 269,000 jobs supported through its payment of wages which stimulates consumer spending.

High productivity jobs

The average air transport services employee generates £84,000 in GVA annually, which is over 60% higher than the whole economy average in the UK.

Contribution to public finances

The aviation sector pays nearly £8.7 billion in tax. Taxes paid by aviation firms and employees, contributes around £5.9 billion, and Air Passenger Duty (APD), a specific departure tax paid by passengers, a further £2.9 billion. It is estimated that an additional £6.3 billion of government revenue is raised in the aviation sector's supply chain and £4.9 billion through taxation of the activities supported by the spending of employees of both the aviation sector and its supply chain.

Aerospace manufacturing benefits

In addition to the benefits generated by air travel, the UK's aviation manufacturing sector makes a £9.0 billion direct, £6.7 billion indirect, and £4.1 billion induced contribution to UK GDP.

Aerospace manufacturers directly employ 102,000 people. The supply chain supports another 139,000 jobs, with a further 86,000 of induced employment.

Taking all these channels into account, aerospace supports 327,000 jobs, and contributes almost £20 billion to UK GDP.

Impacts of international tourists who arrived in the UK by air

- Spending by foreign tourists who arrived by air supported a £19.6 billion gross value added contribution to UK GDP.
- Their expenditure also supported 477,000 people in employment in the tourism industries, their supply chains and through wage consumption impacts.

2. Consumer benefits for passengers and shippers

From visiting family and friends to shipping high value products, more than 197 million passengers and 2 million tonnes of freight travelled to, from and within the UK. More than 770,000 scheduled international flights depart the UK annually, destined for over 500 airports in 131 counties. Domestically, over 420,000 scheduled flights provide seats for passengers travelling to UK airports.

The 197 million passengers pay £71.5 billion (inclusive of tax), with UK residents paying around £44.4 billion. This expenditure is likely to significantly understate the value passengers actually attach to the flights they use (see Section 2). Calculations by Oxford Economics suggest the value of the benefit to travellers from flying, in excess of their expenditure, is worth £35.6 billion a year (£22.1 billion for UK residents).

Air transport is crucial for the distribution of high value to weight products, much of it in the belly-hold of passenger aircraft. Air freight may account for less than one percent of the tonnage of EU trade with the rest of the world, but in value terms it makes up around 22% of the total.

Shippers pay airlines £3.1 billion annually to carry 2.3 million tonnes of freight to, from and within the UK. The benefit to shippers, in excess of this expenditure, is estimated as £1.3 billion. Based on the share of exports in UK trade, UK shippers receive around half of this benefit (£553 million).

3. Enabling long-term economic growth

In 2012, there were direct flights from airports in the UK to 552 airports around the world located in 131 countries. A total of 120 routes connected the UK to cities of more than 10 million inhabitants. Currently, many of these city-pair connections are only possible because of the traffic density provided by hub airports. The UK's integration into the global air transport network transforms the possibilities for the UK economy by:

- Opening up foreign markets to UK exports;
- Lowering transport costs, particularly over long distances, helping to increase competition because suppliers can service a wider area and potentially reduce average costs, through increased economies of scale;
- Increasing the flexibility of labour supply, which should enhance allocative efficiency and bring down the natural rate of unemployment;
- Encouraging UK businesses to invest and specialise in areas that play to the economy's strengths;

- Speeding the adoption of new business practices, such as just-in-time-inventory management that relies on quick and reliable delivery of essential supplies;
- Raising productivity and hence the economy's long-run supply capacity. It is estimated that a 10% improvement in connectivity relative to GDP would see a £890 million per annum increase in long-run GDP for the UK economy.

This report describes these channels in more detail.

Section 1 analyses the economic footprint of the aviation sector - the airlines, the ground-based infrastructure, aerospace manufacturing and spillover effects on tourism and trade - to quantify the value of its output and the jobs it supports in the UK.

Section 2 quantifies the benefits of air travel for air passengers and air freight shippers.

Section 3 examines the way in which the aviation sector supports long-run prosperity: by delivering supply-side benefits through a variety of different channels, which help to increase the economy's level of productivity, and hence its long-term sustainable rate of growth.

1 Economic footprint

This section investigates the contribution the aviation sector makes to the UK economy. This is sometimes known as its economic footprint.

One of the metrics used to measure the contribution is Gross Value Added (GVA). GVA is calculated either as the value of the output created by the sector less the cost of purchased inputs used up in its production (net output measure), or by the sum of profits and wages (before tax) generated from the sector's economic activity (income measure). The two approaches are equivalent. Using either approach, by adding the GVA of all firms in the economy, one derives an estimate for the economy's overall output (GDP)[1]. This is referred to as the sector's direct contribution to GDP.

From this direct contribution, the sector's economic footprint is calculated by adding to it the output (and jobs) supported through two other channels, which are referred to as the indirect and the induced contributions. The indirect contribution measures the impact of the aviation sector's expenditure on inputs of goods and services produced by UK suppliers. The induced contribution results from the sector and the firms in its direct supply chain payment of wages to their staff. A proportion of this income will be spent at retail and leisure outlets, which stimulates economic activity both at the outlets and in their domestic supply chain. Taken together, these three channels give the aviation sector's economic footprint in terms of GVA and jobs.

The aviation sector contributes to the economy in two other ways. Through the taxes levied on GVA (recall that it is equal to the sum of profits and wages), the aviation sector supports the public finances, and the public services that depend on them. Second, through its investment and its use of advanced technology, the aviation sector generates more GVA per employee than the economy as a whole, raising the overall productivity of the economy.

1.1 The aviation sector and its economic footprint

The sector is comprised of three distinct types of activity:

- **Airlines** transporting people and freight.
- **Ground-based infrastructure** that includes the airport facilities, the services provided for passengers on-site at airports, such as baggage handling, ticketing and retail and catering services, together with essential services provided off-site, such as air navigation and air regulation.
- **Aerospace manufacturing** that builds and maintains aircraft systems, airframes and engines.

The aviation sector supports GDP, employment and tax receipts through four distinct channels. These channels are:

- **Direct** – the output and employment of the firms in the aviation sector.
- **Indirect** – the output and employment supported through the aviation sector's purchases of input of goods and services from its UK supply chain.

[1] It is only true to an approximation that GVA is equal to the sum of profit and wages, or that the sum of GVA across firms equals GDP. The difference in each case, however, is small enough for us to proceed as if the equalities do in fact hold. The differences are explained in Annex A to this report.

- **Induced** – employment and output supported by the aviation sector and the firms in its supply chain paying wages to their staff, who spend part of their income in the UK.
- **Catalytic** – the economic activity enabled by the aviation sector. Some of these include the activity supported by the spending of foreign visitors travelling to the UK via air, and the level of trade directly enabled by the transportation of merchandise.

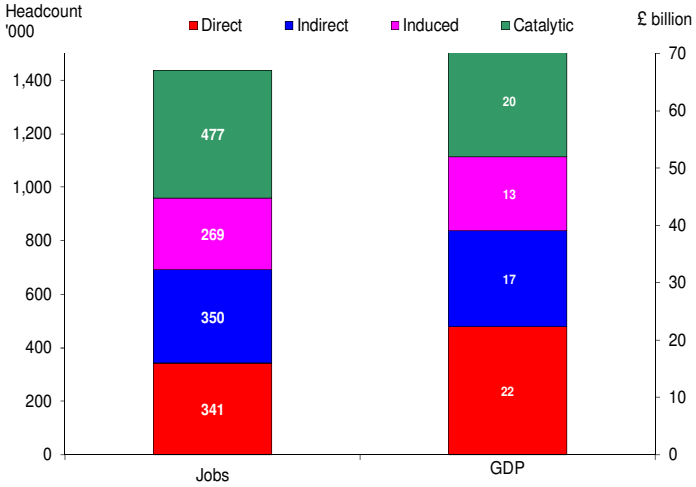
Table 1.1: Aviation's contribution of output and jobs to the UK

	Direct	Indirect	Induced	Total	% of whole economy
Contribution to GDP (£ million)					
Airlines	5,210	2,553	3,122	10,884	0.7%
Airports and Ground Services	8,137	7,478	5,660	21,275	1.4%
Aerospace	9,000	6,682	4,124	19,807	1.3%
Total	**22,347**	**16,713**	**12,906**	**51,966**	**3.4%**
Catalytic (tourism)	7,232	8,513	3,886	19,632	1.3%
Total including catalytic	**29,580**	**25,226**	**16,792**	**71,597**	**4.7%**
Contribution to UK employment (000s)					
Airlines	82	53	65	200	0.7%
Airports and Ground Services	157	158	118	433	1.5%
Aerospace	102	139	86	327	1.1%
Total	**341**	**350**	**269**	**961**	**3.3%**
Catalytic (tourism)	223	175	79	477	1.6%
Total including catalytic	**565**	**525**	**348**	**1,438**	**4.9%**

Source: ACI, IATA, ONS, Oxford Economics

The table above reports the economic contribution of the airlines, airports and aerospace for each of the four channels. Each channel of impact is measured using the two metrics of GDP and employment. In the following pages the analysis looks in turn at the airlines, the ground-based infrastructure, aerospace and catalytic benefits of greater trade and tourism, and describes their economic contribution in more detail.

Chart 1.1: UK Jobs and Output supported by the aviation sector



Source : ONS/ IATA/ Oxford Economics

The aviation sector's economic footprint is illustrated in Figure 1.1. The top panel shows the three activities that comprise the aviation sector: aerospace, air transport services, and the airports and ground-based infrastructure. The panel below represents their supply chains with boxes that list the most important inputs purchased by each activity. The third panel from the top describes the induced contribution that comes through the sector and the firms in its direct supply chain payment of wages, which in turn are spent by staff stimulating further economic activity. The bottom panel, entitled 'economic footprint', reports the total GVA, jobs and tax contribution. These totals are the sum of the numbers reported in the panels above

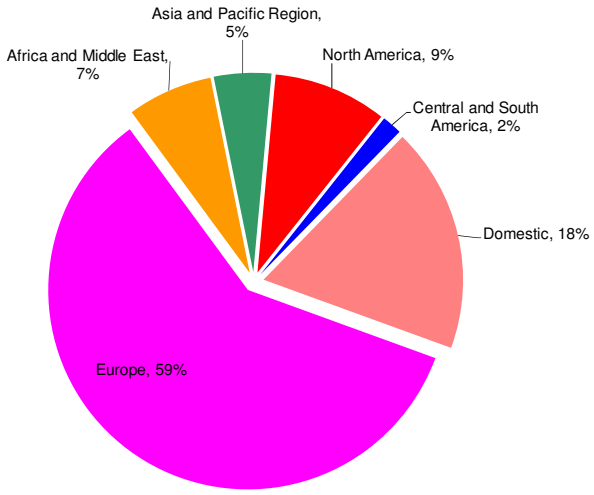
Figure 1.1 UK aviation sector[2]

[2] For a definition of GVA please refer to the Annex.

1.2 The airlines

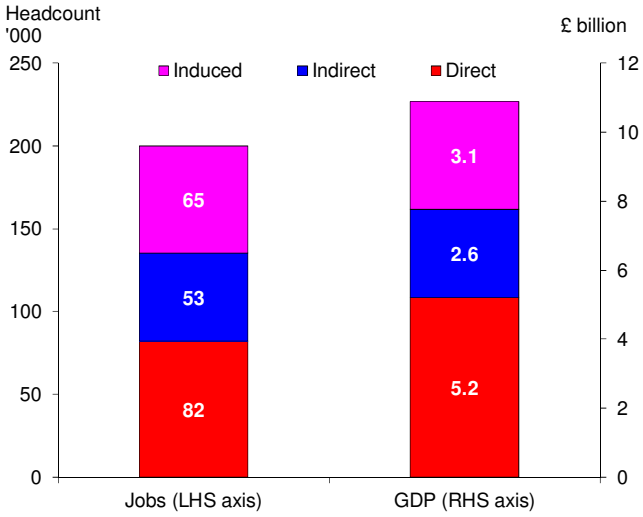
Airlines registered in the UK carry 134 million passengers and approximately 1.1 million tonnes of freight a year to, from and within the UK[3]. Among the many reasons that people and businesses use air transport, people rely on it for holidays and visiting friends and family; while businesses use air transport for meeting clients and for the speedy and reliable delivery of mail and goods often over great distances. The air transport network, the "Real World Wide Web", offers practical, fast and reliable transport across the globe. The regions which travellers fly to and from underline its global reach (see Chart 1.2).

Chart 1.2: Global destination of served by passenger trips originating in the UK



Source : CAA

Chart 1.3: UK jobs and output supported by airlines



Source : ONS, Oxford Economics

Airlines registered in the UK directly employ 82,000 people locally. Their procurement of inputs of goods and services from UK suppliers supports a further 53,000 jobs. Examples of these supply-chain jobs include those in the distribution sector delivering aviation fuel; and jobs in the catering sector preparing the meals served on airlines. A further 65,000 jobs are supported through airlines' and the firms' in their direct supply chain payment of wages to their staff which stimulates consumer spending.

These airlines directly contribute around £5.2 billion to UK GDP. The sector contributes indirectly another £2.6 billion through the output it supports down its supply chain. A further £3.1 billion comes from the wage-financed spending of the employees of the airlines and their supply chains.

Overall, these airlines contribute £10.9 billion to the economy and support 200,000 jobs in the UK.

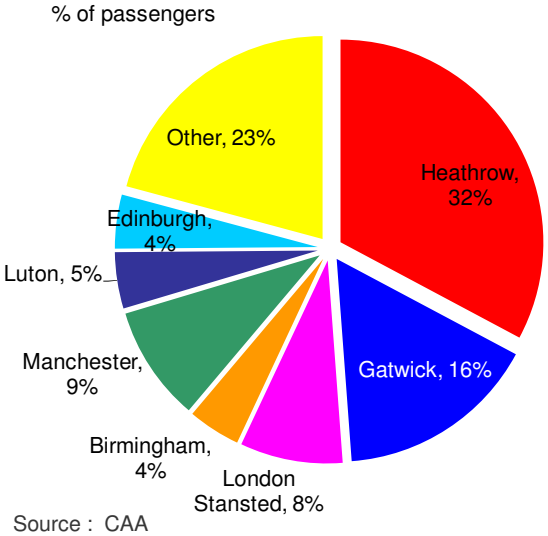
[3] This figure relates to all passengers carried by UK airlines. Some of this total would be passengers carried on trips that originate and end outside the UK.

1.3 The airports and ground-based services

Airlines need ground-based infrastructure to operate. This infrastructure includes the facilities at UK airports that serve passengers, such as baggage handling, ticketing, retail and catering outlets. Less visible are the essential services which are sometimes provided off-site, such as air navigation and air regulation, as well as the local activities of freight integrators.

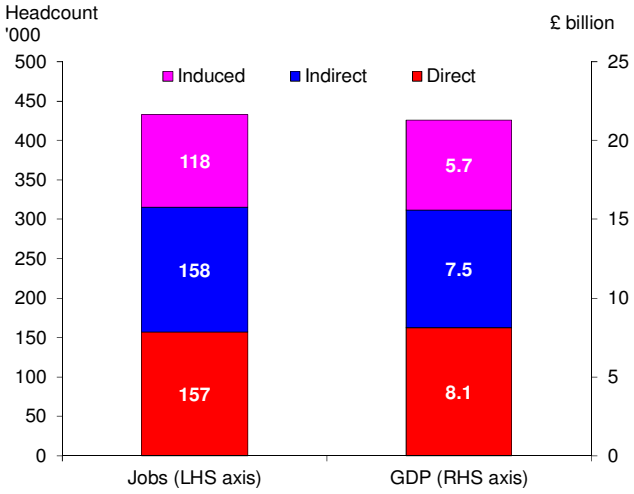
There are 55 airports in the UK.[4] In total over 220 million passengers arrive or depart from them each year (Chart 1.4).[5] 2.3 million tonnes of freight is handled annually.

Chart 1.4: Number of passengers using UK airports



Source : CAA

Chart 1.5: UK jobs and output supported by airports and ground-based services



Source : ONS, ATAG, NATS, Oxford Economics

Aviation's ground-based infrastructure employs 157,000 people. Its expenditure on inputs of goods and service made by UK suppliers supports a further 158,000 jobs in its supply chain. These indirectly supported jobs include, for instance, construction workers building or maintaining facilities at airports. The payment of wages by airports, ground-based services and the firms in their direct supply chain stimulates consumer spending which supports a further 118,000 jobs at retailers, leisure outlets and at their domestic suppliers.

The ground-based infrastructure directly contributes £8.1 billion to UK GDP. It contributes indirectly another £7.5 billion through the output it supports down its supply chain. A further £5.7 billion comes through the spending that results from the payment of wages to staff.

Heathrow is the UK's principal hub airport. It handles more passengers annually than any other airport in Europe. As a hub airport for intercontinental passenger traffic, Heathrow can offer UK residents and

[4] Aberdeen; Barra; Belfast City; Belfast International; Benbecula; Birmingham; Blackpool; Bournemouth; Bristol; Cambridge; Campbeltown; Cardiff; City of Derry; Coventry; Doncaster Sheffield; Dundee; Durham Tees Valley; East Midlands International; Edinburgh; Exeter; Gatwick; Glasgow; Gloucestershire; Heathrow; Humberside; Inverness; Islay; Isles of Scilly (St.Marys); Isles of Scilly (Tresco); Kirkwall; Lands End (St Just); Leeds Bradford; Lerwick; Liverpool; London City; Luton; Lydd; Manchester; Manston; Newcastle; Newquay; Norwich; Oxford; Penzance heliport; Plymouth; Prestwick; Scatsta; Shoreham; Southampton; Southend; Stansted; Stornoway; Sumburgh; Tiree and Wick John O'Groats.

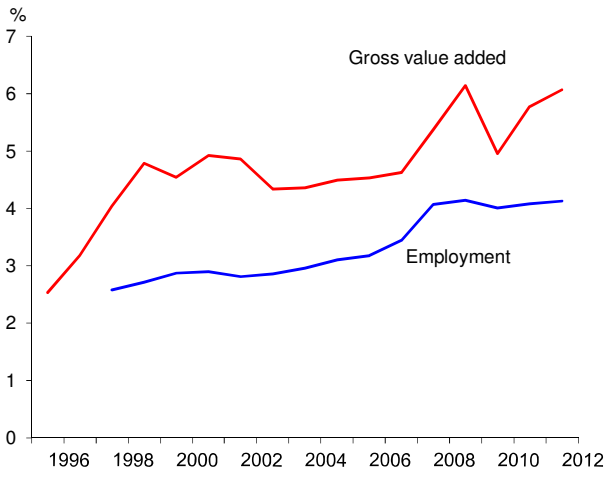
[5] This figure is equivalent to the 202 million passenger number used elsewhere in this report but the larger figure also includes the count of passengers arriving at airports on a domestic flight, effectively counting these domestic passengers twice compared to international passengers with origin or destination airports outside of the UK.

businesses a higher frequency to more destinations. Where local demand is strong, point to point airports have also been able to secure vital connectivity for their catchment areas. This adds to the UK's overall connectivity. As discussed in Section 3 of this report, such network benefits enhance a country's connectivity, which in turn can feed through to the economy's overall levels of productivity and GDP.

1.4 Aerospace

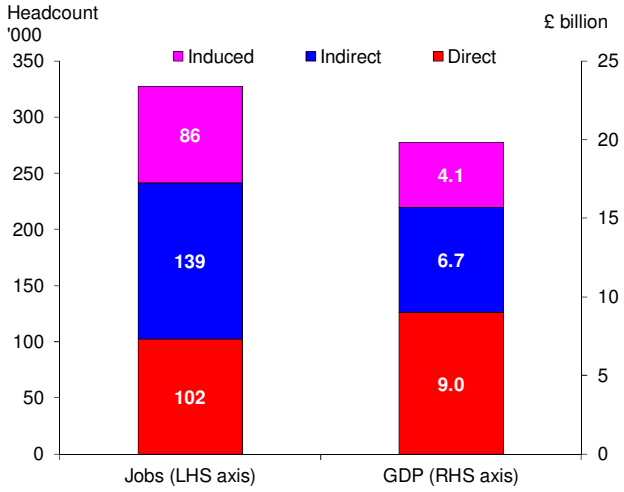
Aerospace manufacturing comprises firms that manufacture and maintain aircraft systems, airframes and engines. In the UK, this accounts for around 4% of total manufacturing jobs, and just above 6% of total manufacturing output.

Chart 1.6: Aerospace as a share of total manufacturing



Source : ONS

Chart 1.7: UK jobs and output supported by aerospace



Source : ONS, Oxford Economics

The aerospace industry employs 102,000 people, many in highly skilled engineering and related technical roles. Through its procurement of inputs of goods and services from UK suppliers it supports a further 139,000 jobs. Many of these indirectly supported jobs are in other manufacturing sectors, for instance, in firms that produce navigational and control equipment. A further 86,000 jobs are supported through the wage-financed spending of those working in aerospace and its direct supply chain.

The aerospace industry directly contributes £9 billion to UK GDP. It contributes indirectly another £6.7 billion through its purchases of inputs from UK suppliers. A further £4.1 billion comes through aerospace companies and firms in their direct supply chain paying their staff wages, a proportion of which is spent at retail and leisure outlets.

Taking all these channels into account, aerospace supports 327,000 jobs, and contributes £19.8 billion to the UK economy, around 1.3% of GDP.

1.5 Tax contribution

Aviation makes a substantial contribution to the public finances. This section analyses the corporation tax paid by aviation companies, the income tax paid by their employees, National Insurance contributions (both employer and employee), and the revenue collected through aviation taxes. These estimates reflect the direct tax payments of the aviation sector. It also estimates the taxes paid by the aviation sector's supply chain and taxes raised through induced spending channels. The estimates do not include increases in the overall UK tax base driven by aviation's contribution to investment and productivity growth in the wider economy.

Table 1.2: Aviation makes a substantial contribution to UK tax receipts[6]

	£ million	£ million
Taxes on Aviation Sector's GVA		5,883
Comprised of:		
Corporation Tax	137	
Income tax and Social Secturity payments	5,747	
Air passenger duty		2,800
Aviation sector's direct tax contribution		**8,683**
Tax generated through the aviation sector's indirect and induced impacts		**11,150**
Total tax attributable to the aviation sector's economic footprint		**19,833**

Source: HMRC, OECD, ONS, Oxford Economics, Individual Company Accounts,

The aviation sector contributed almost £6.0 billion in taxes through corporation tax and the income and National Insurance contributions (both employee and employer). The value of the tax receipts are likely to increase further, as the sector recovers following a number of difficult years where many firms suffered losses. Air passengers paid a further £2.8 billion in Air Passenger Duty. Very indicatively, it is estimated that a further £11.2 billion of government revenue is raised via taxation through the indirect (£6.3 billion) and induced (£4.9 billion) channels.

1.6 Productivity

Apart from these transformative effects on the wider economy, air transport services – the airlines, airports and ancillary services, such as air traffic control – form a capital intensive sector that invests heavily in aircraft systems and other advanced technology. Moreover, the UK aerospace sector is an area of national excellence in advanced technological engineering that invests heavily in research and development.

[6] Indirect and Induced Tax contribution is approximated by applying an economy wide average tax figure (as a proportion of GDP) to the Indirect and Induced GVA estimates, using data from the Oxford Economics Global Macroeconomic Model.

Table 1.3: Investment by the aviation sector

	Investment as % value of GVA
Air transport services	25.4%
UK Economy	19.8%
Aerospace	9.4%
UK Manufacturing	8.6%

Source: ONS, Oxford Economics

Table 1.4: Labour productivity in the aviation sector

	Productivity (GVA per employee)
Air transport services	£84,322
UK Economy	£51,247
Aerospace	£87,971
UK Manufacturing	£59,525

Source: ONS, Oxford Economics

Table 1.3 reports the investment intensity of the aviation sector, as measured by its investment as a proportion of GVA. Investment in air transport services is equal to 25.4% of GVA, 5.6 percentage points higher than in the whole economy. Investment in aerospace has been hard hit by the recession and in 2012 was equal to 9.4% of GVA, ahead of the average for UK manufacturing as a whole. The high rate of investment in air transport services partly explains why labour productivity in the aviation sector is above the whole economy average (Table 1.4). Measured as GVA per employee, the productivity of airside air transport services (the airlines and the ground-based infrastructure) is around £84,000. This is well above the whole economy average (£51,000). As one might expect, the aerospace industry segment of air transport services is a high productivity sector. This is the case even when measured relative to manufacturing as a whole. Labour productivity in aerospace is about £88,000, almost 50% higher than the manufacturing sector as a whole.

1.7 Catalytic effects

1.7.1 Benefits to UK tourism

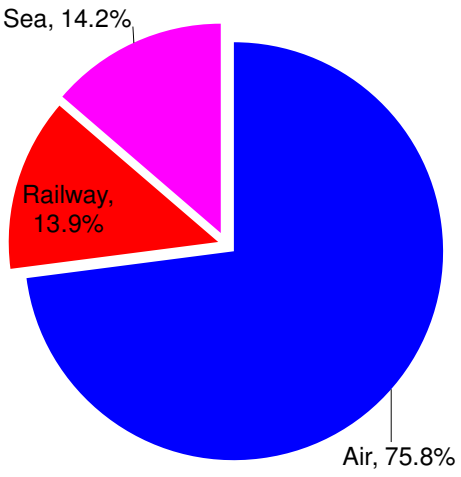
Air transport lies at the heart of global business and tourism. Through its speed, convenience and affordability, air transport has expanded the possiblities of world travel for tourists and business travellers alike, allowing an ever greater number of people to experience diversity of geography, climate, culture and markets.

Tourism, both for business and leisure purposes, makes a large contribution to the UK economy, with foreign visitors spending approximately £22.6 billion in the UK economy each year.[7] Three quarters of these visitors arrive by air (Chart 1.8), so that tourists who arrive by air probably spend around £17 billion in the UK.[8]

[7] Based on IMF statistics.

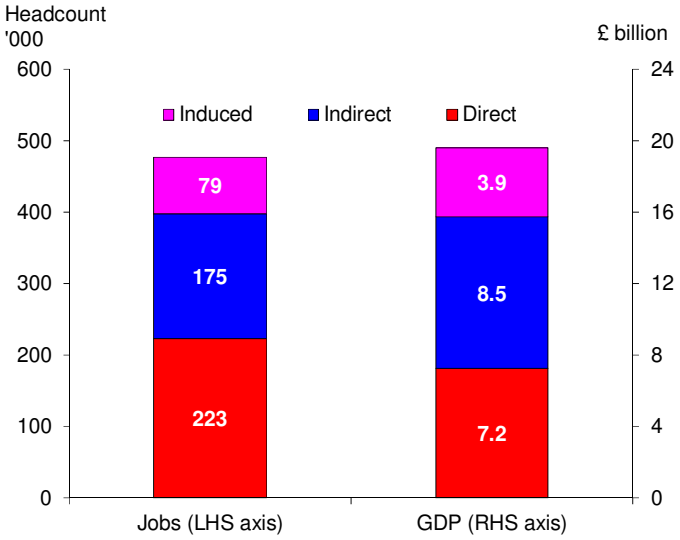
[8] Includes foreign visitors arriving on both domestic and foreign carriers.

Chart 1.8: Foreign visitor arrivals by mode of transport



Source : Oxford Economics, UNWTO

Chart 1.9: Travel and tourism's contribution to UK GDP and Employment



Source : Oxford Economics

Oxford Economics estimates that in 2012 the travel and tourism industry employed 1,680,000 people. A further 1,560,000 and 655,000 jobs are supported in its supply chain and through staff spending of their wages. Of these jobs, we estimate that 223,000 (direct) and 175,000 (indirect) and 79,000 (induced) were supported through the spending of foreign visitors who travelled by air.

The travel and tourism industry directly contributed £54.4 billion to the UK economy (GDP), £76.2 billion indirectly through the output it supports down its supply chain and a further £32.3 billion through the induced effects of consumer spending. When only considering the contribution linked to the spending of foreign visitors arriving by air on UK produced goods and services, the sector contributes £7.2 billion directly to the UK economy, £8.5 billion indirectly and a further £3.9 billion through induced effects.

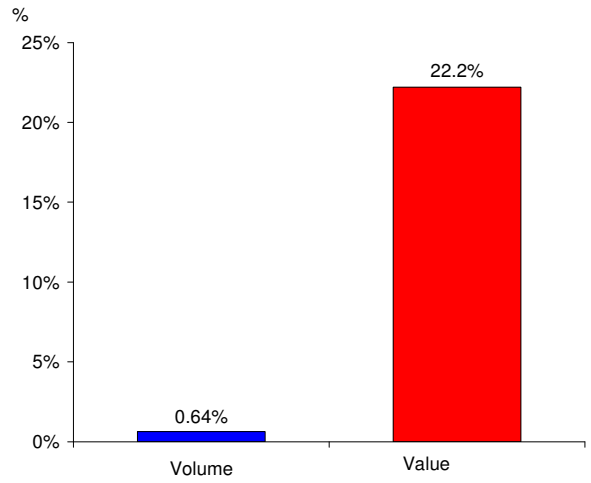
1.7.2 Benefits to UK trade

Compared to other modes of transport, air freight is fast and reliable over great distances. However, these benefits come with a cost attached. Consequently, it is mostly used to deliver goods that are light, compact, perishable and that have a high unit value.

These key characteristics of air freight are most apparent in the data on the modes of transport used in world trade. For example, data on the weight (volume) and value of goods carried by air, sea and land transport is available for EU trade with the rest of the world. While air accounts for less than 1% of the tonnage of EU trade (Chart 1.10), air freight makes up over 22% of the value of EU trade with the rest of the world.[9]

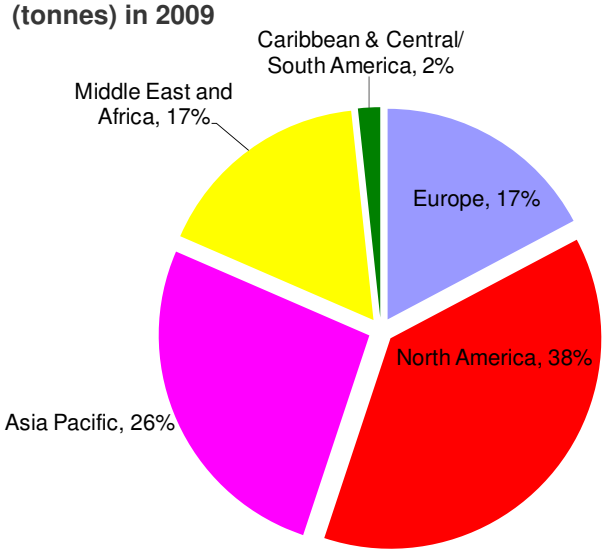
[9] Data for 2009.

Chart 1.10: Proportion EU trade with rest of the world transported by air in 2009



Source : Eurostat, Oxford Economics

Chart 1.11: Global distribution of UK air freight (tonnes) in 2009



Source : Eurostat, Oxford Economics

As with passenger services, air freight operations make up an essential part of the global transport network. Air freight's global reach is clearly illustrated from Chart 1.11. Measured in terms of tonnage carried to and from the UK, almost 40% is linked to trade with North America with a further quarter linked to trade with the Asia Pacific region. Freight shipments within the European region equate to 17% of the total, with a similar proportion relating to the Middle East and Africa.

2 Consumer benefits for passengers and shippers

The aviation sector – comprising the airlines together with the airports, air navigation and other essential grounds services that make up the air transport infrastructure - carries over 197 million passengers[10] and 2 million tonnes of air freight to, from and within the UK. More than 775,000 scheduled international flights depart the UK annually, destined for over 500 airports in 131 countries, carrying not only passengers but many of them also carrying freight in their belly-hold.. Domestically, over 420,000 scheduled flights provide seats for passengers destined to almost 50 airports.[11]

Among the many reasons that people and businesses use air transport, people rely on it for holidays and visiting friends and family; while businesses use air transport for meeting clients and for the speedy and reliable delivery of mail and goods often over great distances. For this reason, the air transport network has been called the Real World Wide Web[12].

The most important economic benefit generated by air transport is the value generated for its consumers, passengers and shippers. Passenger spent £88.4 billion (inclusive of tax) on air travel in 2012 and shippers spent £4.4 billion on the transportation of air cargo.[13] With its speed, reliability and reach there is no close alternative to air transport for many of its customers. This means that many are likely to value air services higher than what might be suggested by their expenditure on these services. But this economic value will vary from flight to flight, and from consumer to consumer, making it difficult to measure.

2.1 Consumer benefits

The value of consumer benefit varies because as you fly more often, the value you attach to each additional flight will in general fall. As frequent flyers know, the more they fly, the less excited they get when they step on a plane. There comes a point when the fare exceeds the value we place on taking an additional flight, and we choose instead to spend our money on other things. For this reason the air fares that we are willing-to-pay do not reflect the value we place on air transport so much as the value we place on the last flight we have flown. Much the same applies to the market as a whole. Air fares reflect the value placed on the service by the marginal passengers - those who would forgo the flight were prices to rise - and not the value that passengers as a whole place on air transport services.

For this reason, valuing the consumer benefits for air passengers and air freight shippers cannot be inferred simply from observed fares and shipping charges. In addition to the fares paid, we need an idea of how the passengers and shippers value air transport other than at the margin. Unfortunately there is no readily available data on this, and so we must rely instead on judgement, informed by economic theory, to guide us. Economics tells us that the estimated benefits hinge on the sensitivity of demand to changes in fares – the *price elasticity of demand*. Estimates of prices elasticities are available from previous research. Economic theory also tells us that price elasticities will fall as we move away from the margin, but it offers less guidance on how much they may fall by. This matters, because lower the price elasticity – the less sensitive passengers are to a change in price – the higher the consumer benefit.

[10] This is a count of passengers on domestic flights as well as passengers arriving and departing on international flights. Each passenger connecting to another flight at a UK airport is counted once on their arriving flight and again on their departing flight.

[11] Annual estimate of international and domestic operations for 2012 based on CAA data.

[12] "Aviation – The Real World Wide Web", by Oxford Economics. Available at http://www.oxfordeconomics.com/samples/airbus.pdf.

[13] Passenger spending based on fares from IATA's PaxIS database plus estimates for taxes and surcharges paid. Cargo spending based on freight rates from IATA's CargoIS database. IATA data for 2009 updated to 2012 using ONS air transport consumer price deflators.

It follows that taxation of air travel or cargo directly reduces the economic benefit of all passengers and shippers, as well as, at the margin, stopping a number of people travelling and stopping a number of shippers using air cargo services.

2.2 Estimated consumer benefits

Given its sensitivity to our assumption about how price elasticities vary, we have taken a very conservative assumption that probably understates the true benefits (see Annex). With this mind, we calculate that air passengers and shippers valued the air transport services they used at around £131 billion and £6.3 billion respectively. Contained within these amounts, the consumer benefits derived on top of that measured by expenditure on travel and shipments were about £42.5 billion for passengers and £1.8 billion for shippers.

The total benefits accruing to passengers using the UK air transport system will include those related to residents and non-residents as well as passengers already being accounted for under the benefits associated with the economy at the other end of international routes. Some 121 million or 60% of the 202 million passengers using air transport services to, from and within the UK were UK residents. As for the share of freight shipped by firms based in the UK, data is not readily available. To give a broad indication we have used instead the share of exports in total merchandise trade. This is estimated to be 42.4% of the total trade in goods in 2009.[14] From this we estimate that, out of the consumer benefits generated by UK air transport and on top of that measured by expenditure, UK citizens derived £25.5 billion in value and UK shippers around £781 million in value.

[14] Oxford Economics Global Macroeconomic Model.

3 Enabling long-term economic growth

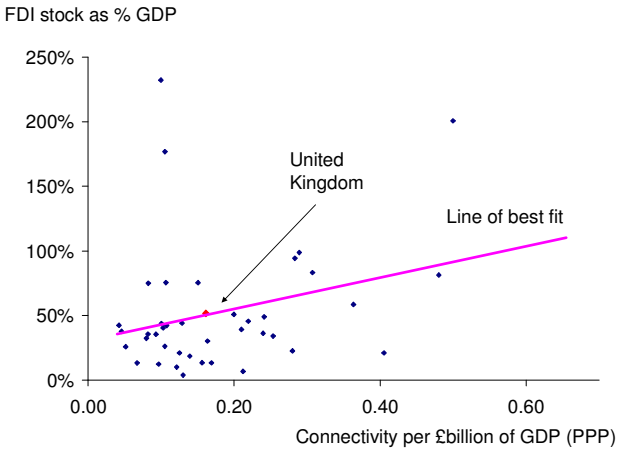
3.1 Connectivity and the cost of air transport services

The air transport network has been called the Real World Wide Web[15]. Chart 3.1 gives an idea of how extensive the air transport network is for the UK. Out of this network, in 2012, there were direct flights to 552 airports around the world located in 131 countries. There were 120 routes connecting the UK to cities of more than 10 million inhabitants.

Chart 3.1: UK air connectivity

Source : IATA

Chart 3.2: Foreign direct investment and connectivity



Source : Oxford Economics

These linkages represent the 'connectivity' of the UK's cities with major cities and markets around the world. Connectivity reflects the range, frequency or service, the economic importance of destinations and the number of onward connections available through each country's aviation network. Improvements in connectivity achieved in recent decades has brought benefits to users of air transport services by: reducing time spent in transit, increasing the frequency of service, allowing for shorter waiting times and better targeting of departure and arrival times; and improving the quality of service, such as reliability, punctuality and quality of the travel experience.

A number of these city-pair connections have point-to-point services, where passenger flow density is sufficient to make the economics work. However, current route economics mean that many of the city-pair connections that make up the UK's connectivity to overseas markets can only be served by airlines aggregating flows from a number of origins through a hub airport in order to generate a sufficiently dense flow of passengers.

Improvements in connectivity have been accompanied by a steady fall in the cost of air transport services. The cost of air transport services, in real terms, has fallen by around 1% a year over the past 40 years,

[15] "Aviation – The Real World Wide Web", by Oxford Economics. Available at http://www.oxfordeconomics.com/samples/airbus.pdf.

contributing to the rapid expansion in the volume of trade seen over this period.[16] Air transport has also steadily become more competitive relative to other modes of transport. For example, it is estimated that its relative cost has been falling by around 2.5% a year since the 1990s.[17] As its relative cost has fallen, air shipments have become increasingly important for international trade. The European Union, for instance, which reports data on the value of cargo carried by different modes of transport, has 22% of its trade with the rest of the world carried by air.

Apart from the benefits to direct users of air transport services, the largest economic benefit of increased connectivity comes through its impact on the long term performance of the wider economy.

3.2 How aviation enhances economic performance

Improvements in connectivity contribute to the economic performance of the wider economy through enhancing its overall level of productivity. This improvement in productivity in firms outside the aviation sector comes through two main channels: through the effects on domestic firms of increased access to foreign markets, and increased foreign competition in the home market, and through the freer movement of investment capital and workers between countries.

Improved connectivity gives UK-based businesses greater access to foreign markets, encouraging exports, and at the same time increases competition and choice in the home market from foreign-based producers. In this way, improved connectivity encourages firms to specialise in areas where they possess a comparative advantage. Where firms enjoy a comparative advantage, international trade provides the opportunity to better exploit economies of scale, driving down their costs and prices and thereby benefiting domestic consumers in the process. Opening domestic markets to foreign competitors can also be an important driver behind reducing unit production costs, either by forcing domestic firms to adopt best international practices in production and management methods or by encouraging innovation. Competition can also benefit domestic customers by reducing the mark-up over cost that firms charge their customers, especially where domestic firms have hitherto enjoyed some shelter from competition.

Improved connectivity can also enhance an economy's performance by making it easier for firms to invest outside their home country, which is known as foreign direct investment (FDI). Most obviously, the link between connectivity and FDI may come about because foreign investment necessarily entails some movement of staff: whether to transfer technical know-how or management oversight. But increased connectivity also allows firms to exploit the speed and reliability of air transport to ship components between plants in distant locations, without the need to hold expensive stocks of inventory as a buffer. Less tangibly, but possibly just as important, improved connectivity may favour inward investment as increased passenger traffic and trade that accompanies improved connectivity can lead to a more favourable environment for foreign firms to operate in. Chart 3.2 plots the total value of FDI built up in individual countries in relation to their GDP against an index of connectivity (produced by IATA), that measures the availability of flights, weighted by the importance of each of the destinations served. The chart shows that countries with higher connectivity (measured relative to their GDP), are in general more successful at attracting foreign direct investment. This is emphasised by the upward sloping line that confirms the statistical relationship between greater connectivity and greater FDI.

[16] See Swan (2007), 'Misunderstandings about Airline Growth', Journal of Air Transport Management, 13, 3-8, and Baier and Bergstrand (2001), 'The growth of world trade: tariffs, transport costs and income similarity', Journal of International Economics, 53:1, 1-27.

[17] See Hummels (2007), 'Transportation Costs and International Trade in the Second Era of Globalisation', Journal of Economic Perspectives, 21.3, Summer.

3.3 Connectivity and long-term growth

A thought experiment considering the impact on trade from eliminating the air transport network suggests the economic benefit of connectivity is substantial. Moreover, the experience of businesses in Europe during the volcanic ash-induced airspace closures of 2010, as just-in-time supply chains failed, provides a more concrete illustration of how dependent modern economies are on their air transport infrastructures.

A number of recent studies have attempted to quantify the long-term impact on a country's GDP that results from an improvement in connectivity. Measuring connectivity is not straightforward. Chart 3.3 shows one measure of the UK's connectivity, compared to other economies (see Annex for details).[18] Given that the supply-side benefits of connectivity come through promoting international trade and inward investment, any impact is likely to manifest itself gradually over time. This protracted adjustment makes it very challenging to disentangle the contribution that improved connectivity has had on long-term growth, from the many of other factors that affect an economy's performance. This issue is reflected in the wide range of estimates that studies have reached for connectivity's impact on long-run growth. Three studies undertaken in 2005 and 2006 provide estimates of the impact that connectivity can have on long-run level of productivity (and hence GDP). The mechanisms through which connectivity generates this economic benefit are those described in Section 3.2. These studies suggest that a 10% increase in connectivity (relative to GDP) will raise the level of productivity in the economy by a little under 0.5% in the long run, with there being a fair degree of uncertainty around this average estimate[19]. A much wider 2006 study, based on a cross-country statistical analysis of connectivity and productivity, derived a lower estimate of 0.07% for the elasticity between connectivity and long-run productivity.[20]

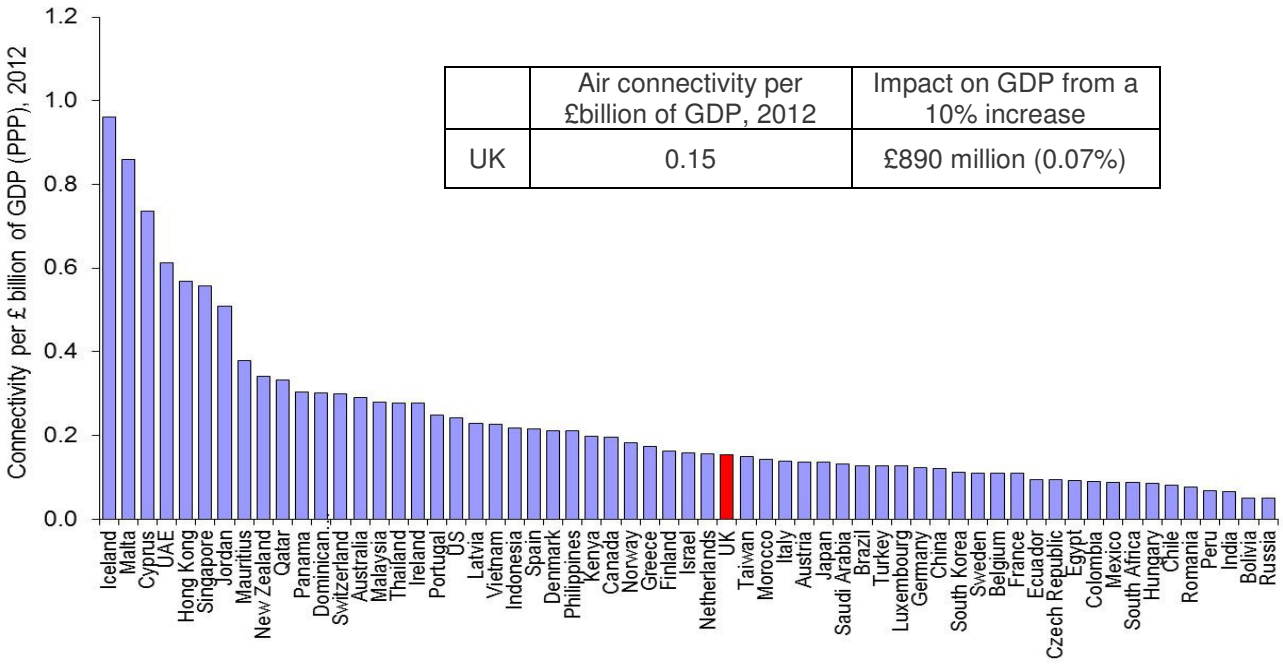
Given the uncertainty about the correct elasticity, here we adopt the elasticity of 0.07 derived from the 2006 study, as the lowest estimate among the available studies it provides a conservative estimate of the impact of connectivity on long-term GDP. Based on this estimate, a 10% improvement in the UK's connectivity (relative to GDP) would see a £890 million per annum increase in long-run GDP.

[18] This measure emphasises passenger connectivity and as such will reflect the freight connectivity associated with belly cargo capacity in passenger aircraft but may not fully capture that provided by all-cargo operations or integrator networks.

[19] 'The Economic Catalytic Effects of Air Transport in Europe', by Oxford Economic Forecasting (2005) on behalf of the EUROCONTROL Experimental Centre and 'The Economic Contribution of the Aviation Industry in the UK', by Oxford Economic Forecasting (2006). These studies also allow for connectivity to increase the long-run level of GDP through increasing investment. Allowing for this additional channel raises the total impact of a 10% increase in connectivity relative to GDP on long-run GDP to over 1%.

[20] "Measuring the Economic Rate of Return on Investment in Aviation" by InterVISTAS Consulting Inc. (2006).

Chart 3.3: Air connectivity by country, 2012



	Air connectivity per £billion of GDP, 2012	Impact on GDP from a 10% increase
UK	0.15	£890 million (0.07%)

Source: IATA. IMF for GDP (PPP basis)

4 Conclusion

This study has described and quantified a number of channels through which aviation in the UK generates important economic benefits for its customers and the wider UK economy.

Studies of this kind usually focus on the 'economic footprint' of the industry, the GDP and jobs supported by the industry and its supply chain. We provide the latest estimates for these metrics. But the economic value created by the industry is more than that. It is not just jobs that are threatened if government policies are badly designed. The welfare of voting citizens and the effectiveness of infrastructure critical to the country's long-term success in global markets are also at risk.

The welfare of travelling citizens has been conservatively quantified in this study. Not all customers of airlines serving UK airports are UK residents, but around 60% are. They currently get an economic benefit estimated to be worth £25.5 billion. Indicatively, more than 40% of the shippers using air freight services are UK companies. Taxing air transport directly reduces the welfare of these UK residents and UK businesses.

The study has also shown what a critical asset the UK's air transport network is, to business and the wider economy. Connectivity between cities and markets boosts productivity and provides a key infrastructure on which modern globalized businesses depend. Many of these city-pair connections are currently dependent on hub airports through which to generate the traffic density necessary to sustain them. All airlines supplying services at UK airports contribute to generating these wider economic benefits. These 'supply-side' benefits are hard to measure but are easily illustrated by the experience of the volcanic ash cloud, which closed much of UK airspace for a week in early 2010. Travellers were stranded. Globalized supply chains and just-in-time manufacturing processes came to a halt.

More readily measured is the 'economic footprint' supported, mostly, by the activities of national airlines. UK-based airlines were responsible for carrying around two-thirds of passengers and 50% of freight. The wages, profits and tax revenues created by these airlines flows through the UK economy, generating multiplier effects on UK national income or GDP. The economic benefits for the UK created by non-UK airlines are to be found in customer welfare and in the part these airlines play in providing the connectivity infrastructure between the UK and overseas cities and markets.

Aviation has a significant footprint in the UK economy, supporting 3.4% of UK GDP and 961,000 jobs or 3.3% of the UK workforce. Including the sector's contribution to the tourism industry, these figures rise to 4.7% of UK GDP, and more than 1.4 million or 4.9% of the workforce.

Also significant is the fact that these are high productivity jobs. The annual value added (or GVA) by each employee in air transport services in the UK is £84,000, over 60% higher than the whole economy average of £51,000.

Tax revenues from aviation are substantial. UK-based aviation companies paid almost £6.0 billion annually in direct taxes and social security payments. Passengers paid £2.8 billion in Air Passenger Duty. It is estimated that an additional £6.3 billion of government revenue is raised via the aviation sector's supply chain and £4.9 billion through taxation of the activities supported by the spending of employees of both the aviation sector and its supply chain.

All together these points demonstrate that aviation provides significant economic benefits to the UK economy and its citizens, some of which are unique and essential to the operation of modern economies, as was found when volcanic ash closed UK airspace for some time.

Annex: Methodology

Benefits to passengers and shippers

These estimates are based on the economic concept of consumer surplus, the difference between the passengers' or shippers' willingness-to-pay and the actual airfare or freight rate they face. In order to calculate the overall consumer surplus for the various fare types and for freight, we need three pieces of information: (1) data on passenger numbers, freight tonnage and their respective average fares and freight charge; (2) an estimate of how sensitive passenger numbers and freight tonnage are to changes in fares and freight, known as the elasticity of demand; and (3) an assumption about customers' willingness to pay (airfare and freight charges), reflected through an assumption about the shape of the market demand curve.

The calculations are based on 2012 data on total passenger numbers and freight tonnage arriving and departing from domestic airports, together with the average fare and freight charge, broken down by the following market segments: first class, business class, economy, economy discount, and freight. The data are sourced from CAA, HMRC and IATA.

We apply an estimate for the elasticity of demand for each market segment. We draw on the findings of several recent studies that investigate elasticities of demand for air transport, to choose elasticities for each market segment that we believe are reasonable[21]. The elasticities that we use are: first class -0.8 business class -0.9, economy -1.05, and freight -1. These indicate the percentage change in demand that would follow a one percent change in the average fare, or freight charge. Based on these inputs, we calculate consumer surplus based on the approach proposed by Brons, Pels, Nijkamp, and Rietveld (2002) that assumes that the demand curve for each market segment has a constant elasticity of demand[22].

Connectivity Index

The connectivity index is a measure the quality of a country's air transport network that reflects both the volume of passenger traffic and the importance of the destinations served. For every destination country for which there are direct services, an estimate of total passenger seat capacity is derived from data on the frequencies of service and the available seats per flight. From this underlying data, an index is constructed by attaching a weight to each destination. This weight reflects the relative importance of the destination in the global air transport network, measured by the number of seats available for passengers from that airport relative to Atlanta, the largest airport. The connectivity index will therefore have a higher value, the more destinations are served, the higher the frequency of services, the larger the number of available seats per flight and the greater the relative importance of the destinations served.

Benefits to tourism

In quantifying the benefits from Travel & Tourism (T&T) we were seeking to capture the spending by tourists and businesses on accommodation, food etc outside of their airfare (which forms part of our estimate of the direct calculation). In doing this we relied heavily on the Oxford Economics Travel & Tourism model prepared on behalf of the World Travel & Tourism Council (WTTC) which simulates

[21] 'Estimating Air Travel Demand Elasticities', by InterVISTAS Consulting Inc (2007). Available at http://www.iata.org/whatwedo/Documents/economics/Intervistas_Elasticity_Study_2007.pdf.

[22] See http://www.ecad-aviation.de/fileadmin/documents/Konferenzbeitraege/Braun_Klophaus_Lueg-Arndt_2010_WCTR.pdf .

Tourism Satellite Account (TSA) data across over 180 countries. From this we obtained data on the level of foreign visitor spending and then used mode of transport data to assign a share of this to the aviation industry. Where mode of transport data was unavailable, we used benchmark figures from economies with similar characteristics. Finally, we had to account for the fact that part of the spending would be on imported goods and services which would not contribute to an economy's GDP, which we estimated by applying the ratio of total T&T personal spending to imports from the model to our estimate of aviation-related spending. It should be noted that this is a gross measure of the benefit from tourism and therefore does not account for the spending which is effectively "lost" when domestic residents travel abroad by air.

Economic footprint

The contribution of the aviation sector is measured in terms of the value of the sector's output and the number of people it employs. For each measure, the contribution is built up from three components: direct, indirect, and induced.

The direct output component is measured by Gross Value Added (GVA). GVA is measured either as the firm or industry sales revenue less purchases from other companies, or equivalently, as the sum of employee compensation and gross operating surplus, measured before the deduction of depreciation, interest charges and taxation. In this report we treat gross operating surplus as equivalent to gross operating profit, however, the two concepts differ slightly with the former including income from land and a technical adjustment for the change in stock valuation. GVA differs from Gross Domestic Product (GDP) in the price used to value goods and services. GVA is measured at producer prices that reflect the price at the 'factory gate' together with cost of distribution. GDP is measured at market prices that reflect the price paid by the consumer. The two prices differ by the taxes less subsidies levied on the goods or services.

The indirect output component is measured using an Input-Output table that reports how industries use the output of other industries in the process of production, and how their final output is used, e.g. in final domestic consumption, changes in stocks or exports. For many countries, Input-Output tables are available as part of the national accounts. As Input-Output tables describe how an industry uses the output of other industries as inputs in the production of its goods or service, they describe its full supply chain – its direct suppliers, those industries that supply its direct suppliers, and so on. This is reported as the indirect output component.

The Input-Output table reports how much of final output is sold in the domestic economy. Using similar methods as that used to derive the indirect output component, the Input-Output table can be used to estimate how much spending on completed goods (known as final domestic consumption) is supported through the employees of the industry and its full supply chain. This is reported as the induced output component.

The three output components – direct, indirect, and induced – are converted to their respective employment components, using an estimate for the average labour productivity (GVA per employee) for the economy.

Passenger and freight volumes

Passenger and freight traffic is accounted for in different ways across the industry supply chain, depending on the focus of the operator and the purpose of analysis. For example, airlines generally count the number of passengers who board their aircraft, whereas airports often count the number of passengers arriving or departing their airport – which in some cases can lead to totals significantly larger than those reported by airlines, despite referring to the same inherent volume of passengers. The table below outlines the main

passenger and freight volumes referred to in this report. In particular, it shows how the numbers used in the calculation of consumer benefit and the economic footprint were derived.

Passenger numbers 2012	Millions	Millions	
Number of passengers arriving or departing UK airports (A)	221		
Less domestic arrivals at UK airports (to remove double counting)	-19		
Number of passenegers on aircraft flying to, from, or within the UK (B)	202	134	Carried by UK airlines (C)
		121	UK residents (D)
Freight tonnes 2012	**Thousands**	**Thousands**	
Tonnes of freight carried on aircraft flying to, from, or within the UK (E)	2,302	1,136	Carried by UK airlines (F)
		1,136	Carried by non-UK airlines

	Passenger measure	Millions	Use in report	Source
A	Number of passengers arriving or departing UK airports	221	Overall indicator of passenger arrivals and departures handled by **airports** in the UK	Department of Transport Table AVI0101 (TSGB0201) - based on CAA data
B	Number of passengers on aircraft flying to, from, or within the UK	202	Overall indicator of **airline** passenger traffic associated with the UK market	Department of Transport Table AVI0102b (TSGB0202b) - based on CAA data
C	Passenger carried by UK registered airlines	134	Overall indicator of passenger output 'performed' by airlines in the scope of the **economic footprint** analysis	Department of Transport Table AVI0102b (TSGB0202b) - based on CAA data
D	Number of UK residents on flights flying to, from, or within the UK	121	Basis for calculations of passenger **consumer surplus** accruing to UK economy	According to the CAA Passenger Survey 2012, 59.9% of passenegrs in UK market are UK residents
	Freight measure	**Thousands**	**Use in report**	**Source**
E	Tonnes of freight carried on aircraft flying to, from, or within the UK	2,302	Overall indicator of freight loaded and unloaded at **airports** in the UK	Department of Transport Table AVI0101 (TSGB0201) - based on CAA data
F	Tonnes of freight uplifted by UK registered airlines	1,136	Overall indicator of freight output 'performed' by airlines in the scope of the **econoic footprint** analysis	UK CAA; UK Airline Statistics 2012 Annual, Table 1.6

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