Air Departure Tax in Scotland:

An Economic Assessment

December 2017

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Executive Summary

In November 2014, the Smith Commission Report recommended that the power to charge tax on air passengers leaving Scottish airports be devolved to the Scottish Parliament. It also outlined how the Scottish Government '*will be free to make its own arrangements with regard to the design and collection of any replacement tax, including consideration of the environmental impact'.* Peter Brett Associates LLP (PBA) and Northpoint Aviation were appointed by the Scottish Government to undertake an independent assessment of the economic impact of reducing by 50% the current tax charged at the UK level via Air Passenger Duty (APD), in the form of the new Air Departure Tax (ADT).

Previous analysis of changes to the levels of the existing APD has tended to focus on the market response to tax cuts being to 'pass on' the tax reduction to passengers in the form of lower fares. This study has recognised that the air industry's response to changes in the tax regime will be more complex and unpredictable than this, and is most likely to comprise both (i) a degree of lower taxes being passed on to customers in the form of reduced fares; and (ii) an element of supply side response in the form of operating existing routes at a higher intensity or commencing new routes in recognition of the lower cost to the airline. As such, the latter response is also a key part of the policy of encouraging greater connectivity from Scotland's airports to short and long haul destinations not currently served directly from Scotland.

As a decision on the precise form of ADT is yet to be taken, for the purposes of analysing the potential range of outcomes, three hypothetical tax scenarios were provided by the Scottish Government to represent potential ADT regimes for Band A (0 to 2,000 miles) and Band B (over 2,000 miles) tax rates as follows:

- Scenario 1: 100% cut in Band A (short haul), no change in Band B (long haul);
- Scenario 2: 100% cut in Band B (long haul), no change in Band A (short haul); and
- Scenario 3: 50% cut in Band A (short haul) and 50% cut in Band B (long haul).

Again for the purposes of assessing a range of outcomes, under each of these scenarios, three variants were tested with respect to the degree to which the tax reduction is 'passed through' to fares as follows:

- Full pass-through of tax reduction by airlines to fares (100%);
- Partial pass-through of tax reduction by airlines to fares (50%); and
- No pass-through of tax reduction by airlines to fares (0%).

It has also been assumed that as the degree of 'pass-through' reduces, the supply side response in the form of new routes and connections increases (since a straight pass-through of the tax reduction to fares would be essentially cost neutral to the

airline). A range of supply side scenarios were therefore developed, differentiating the likely response of different airline types based on consultation with the industry and bespoke illustrative route modelling undertaken using the industry-standard APEX model.[1]

A highly segmented representation of forecast 'business as usual' passenger volumes (i.e. no change in tax from the current level) for each of Scotland's airports (split by journey purpose, passenger nationality, airline type and passenger destination) was developed. Where the tax reduction is assumed to be passed on in full, or in part in the form of lower fares, a range of price elasticities of demand[2] were applied to generate a forecast of additional passenger volumes resulting from lower fares. Where the scenario implied a supply side response, assumed passenger uplifts were applied by airline type.

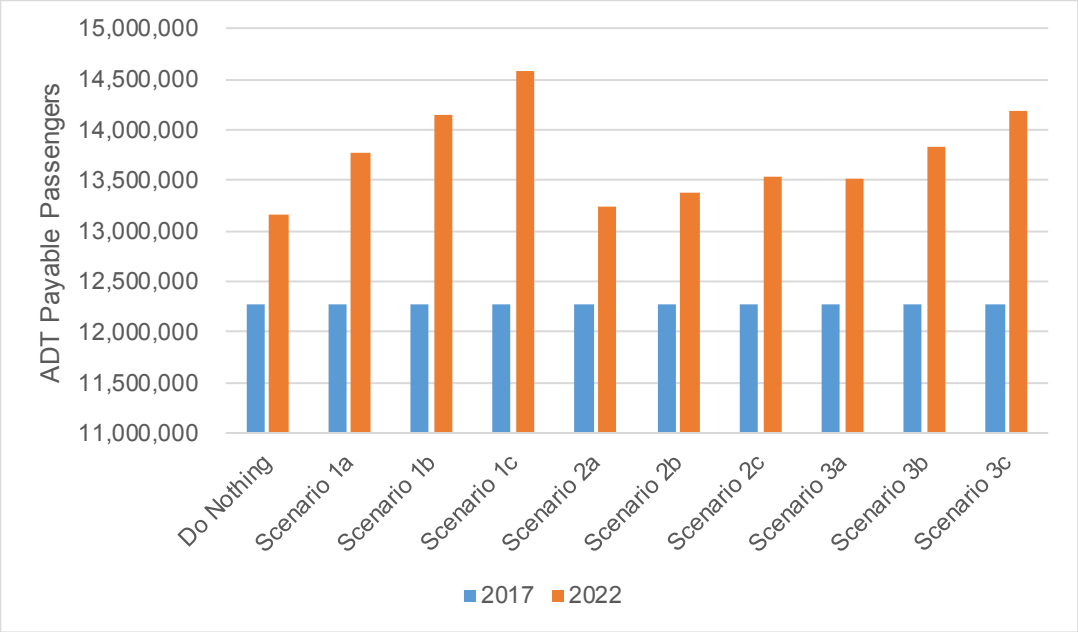
For each of the nine scenarios modelled, the application of lower fares and / or supply side response resulted in:

- A reduction in tax revenue in the region of the 50% advocated in the policy, noting that in some cases the reduction in revenue from existing passengers may be being offset to some extent by additional passengers, generating additional new tax revenue; and
- An increase in passenger numbers by market segment which differs widely by scenario.

The increase in tax-paying departing passengers associated with each scenario is shown in the figure below for a 2022 forecast and the base year. Note that the term 'Do Nothing' here refers to the scenario where current APD levels are retained in the new ADT.

[1] The APEX model is a proprietary model that is used for examining the commercial prospects for both new and existing air routes.

[2] Price elasticity of demand measures the responsiveness of demand after a change in a product's price.

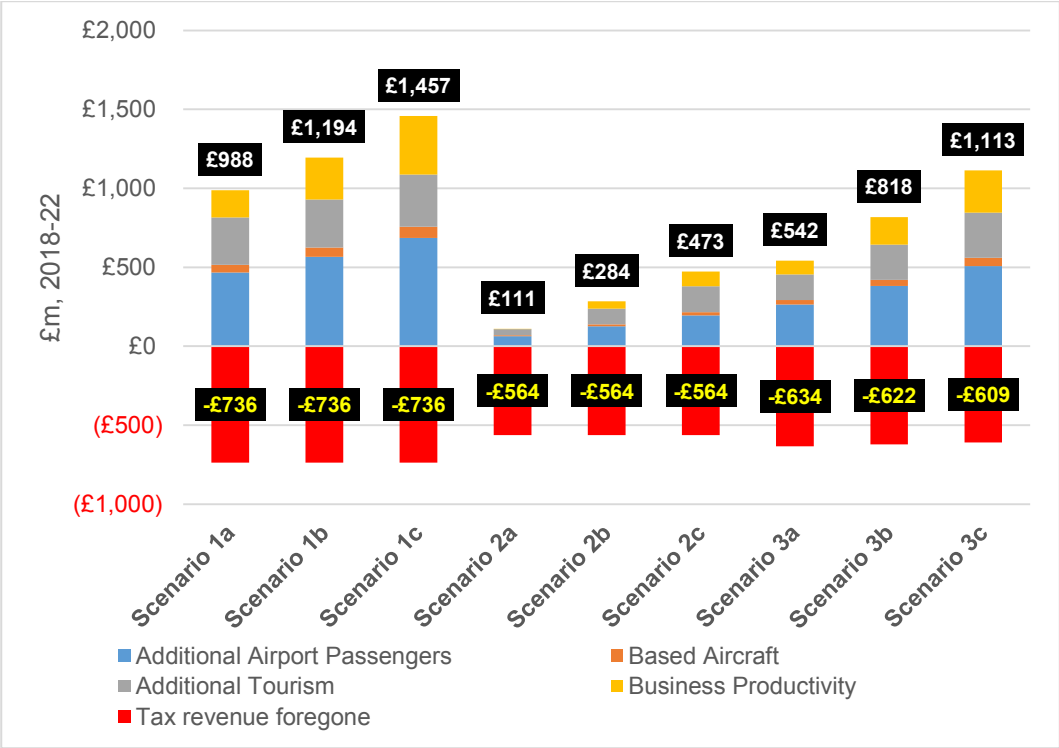


The biggest increase in passenger numbers is associated with Scenarios 1c, 1b and 3c. These scenarios are wholly or in part focussed on cutting short haul tax, as this market segment is far larger and hence applying proportional demand uplifts creates the biggest impacts.

The forecast change in passenger numbers by type was then used to generate estimates of the economic impact of these increased passenger numbers using measures of employment and Gross Value Added (GVA). There are four primary areas of impact associated with additional passenger numbers:

- **Operational impacts (1):** the economic activity associated with changes in the operations of airports and air services in Scotland resulting from increased passenger throughput;
- **Operational impacts (2):** the economic activity associated with additional 'based aircraft' in Scotland stemming from airlines basing more aircraft in Scotland and hence generating local employment;
- **Tourism / visitor impacts:** employment supported by increased inbound tourism as a result of greater connectivity and / or lower fares; and
- **Wider business impacts (i.e. productivity):** improvements in the long-term productivity level due to increased numbers of business passengers, reflecting improved access to foreign markets etc.

The results of this analysis for the nine scenarios is summarised in the figure below with respect to the ADT tax position and the estimated GVA impacts, summed over a five-year period. Whilst it is not a direct comparison, the figures here do give a feel for the potential foregone tax and additional Scotland level GVA in each case. In five of the nine cases, the figure for additional GVA is in excess of the tax foregone, suggesting that the tax cut under these permutations would have a net positive effect.



In terms of the scenarios developed here, the greatest economic impacts are therefore associated with Scenario 1c – a 100% cut in Band A, which assumes no reduction in fares and a substantial supply side response in the short haul sector[3]. This in turn generates the largest increase in passenger numbers and hence the biggest economic impact. If the tax cut was focussed only on Band B (long haul) the analysis here suggests that the additional GVA in this initial five-year period would not offset the loss of tax revenue.

Any analysis such as this is subject to a range of caveats and uncertainties. These have been set out in this report but should be borne in mind when interpreting the results. The key uncertainties here are:

- the level of supply side response in the shape of new routes, and the demand response to these supply uplifts which we have assumed to be perfectly elastic (i.e. of an airline puts on a new route, it will be utilised at the rate of existing routes);
- the response of passengers to lower fares (i.e. the elasticities used);
- the underlying growth scenario which may prove too optimistic or pessimistic – we have used a 'core' forecast and undertaken sensitivity tests around this;
- the degree of any 'leakage' brought about by additional overseas travel by Scotland's residents;
- the way in which the tax cut feeds through into responses by both airports and airlines (aside from new routes);
- the potential for more or fewer additional based aircraft than assumed here, especially in the context of an expansion of low cost long haul;

[3] It should be noted that the supply side response used here is conservative in the context of public pronouncements made by the airlines regarding their intended response to these text cute.

- developments within aviation, particularly the growth trajectory of the potential ‘disruptor’ of low cost long haul and its impact on ‘traditional’ carriers; and
- the wider picture with respect to the UK economy and Brexit.

1. Introduction

In November 2014, the Smith Commission Report recommended that the power to charge tax on air passengers leaving Scottish airports be devolved to the Scottish Parliament. It also outlined how the Scottish Government '*will be free to make its own arrangements with regard to the design and collection of any replacement tax, including consideration of the environmental impact*'[4].

Following an amendment to the Scotland Act 1998 in May 2016, the Scottish Parliament was given the power to legislate for a replacement to UK Air Passenger Duty (APD)[5]. As a result, in December 2016 the Air Departure Tax (Scotland) Bill was introduced to the Parliament[6]. The Bill sets out how Air Departure Tax (ADT) will be structured and operated, with detail on the tax rate amounts and tax bands that will apply to be delivered in secondary legislation in autumn 2017 (the Bill having been enacted in summer 2017). ADT is expected to apply to all flights departing from Scottish airports[7] from 1 April 2018, at which point UK APD will be 'switched off' in Scotland. ADT will be collected and managed by Revenue Scotland, Scotland's tax authority for devolved taxes.

The Scottish Government has a long-standing policy to reduce the overall burden of APD (i.e. the total tax receipts from APD) by 50% by the end of the current session of the Scottish Parliament, expected to be in May 2021.

The Scottish Parliament's Finance and Constitution Committee is the lead Committee for ADT and its Stage 1 Report on the Bill was published on 1 April 2017. Among other things, the report recommended that the Scottish Government commission an independent economic impact analysis of the reduction in ADT to inform the introduction of secondary legislation on ADT tax rate amounts and tax bands. The report also recommended that the Scottish Government undertake regular evaluations of the socio-economic and environmental outcomes of ADT.

To address the Committee's recommendation for an independent economic impact assessment to be conducted on the impact of a 50% reduction in the overall burden of ADT, the Scottish Government commissioned Peter Brett Associates LLP (PBA) and Northpoint Aviation to undertake this research. This report contains the findings of the research and establishes a plan for the future monitoring and evaluation of ADT.

[4] http://webarchive.nationalarchives.gov.uk/20151202171017/http://www.smith-commission.scot/

[5] https://publications.parliament.uk/pa/bills/cbill/2015-2016/0003/16003.pdf

[6] http://www.parliament.scot/parliamentarybusiness/Bills/102778.aspx

[7] Note – Airports in the Highlands and Islands are currently exempt from Air Passenger Duty on outbound flight legs and it has been assumed that this practice will continue once ADT is introduced.

Overview of Approach

The approach taken to the study has combined air travel demand forecasting with economic impact analysis. Both of these elements have been informed by a programme of consultation with key industry stakeholders from airports, airlines, industry representative groups and tourism representatives, with this building on an initial literature review.

The report is structured as follows:

- Section 2 establishes the current demand for, and supply of air services in Scotland at current tax levels.
- Section 3 establishes the 'logic modelling' framework, a process whereby the potential outcomes and impacts of the proposed tax reduction are mapped in a transparent and consistent way within an overall logic flow.
- Section 4 details the ADT scenarios to be tested.
- Section 5 considers the potential outcomes of each scenario in terms of the demand for air travel and changes in the industry supply side.
- Section 6 considers the wider economic impacts associated with each scenario.
- Section 7 establishes the monitoring and evaluation framework against which the implemented option should be reviewed over time.
- Section 8 draws together the previous sections into a set of succinct conclusions.

Scope of Study

There are a number of key points in relation to this study, which should be noted at the outset:

A number of previous studies reviewed here make assumptions in relation to reductions in APD being fully '*passed through*' to passengers in the form of lower fares, and how this then manifests itself in terms of wider economic impacts. The reality is more nuanced, with the level of pass-through potentially differing by market segment and airline / airline type. The analysis in this report attempts to account for this through detailed market segmentation and a scenario-based approach which varies the level of pass-through and a set of associated supply side responses.

The reduction in the burden of APD will trigger several complex interactions within the aviation industry, many of which will be commercial in nature. It is therefore not possible for research, no matter how comprehensive, to forecast a single defined outcome of the tax reduction. A series of sensitivity tests has therefore been undertaken to derive a 'fan' of possible outcomes and impacts around a set of core assumptions, acknowledging the significant uncertainty which exists. These difficulties of course apply to the analysis of effects of other tax increases or reductions, not just ADT.

Linked to this, a range of assumptions has been made in support of this analysis, e.g. demand elasticities, supply side responses, economic impacts etc. These assumptions are laid out transparently, with any weaknesses due to, for example deficiencies in the data, acknowledged.

In order to protect commercial confidentiality, sensitive information provided by both airlines and airports has been anonymised and where appropriate aggregated. As per the brief, the report is presented in non-technical language to ensure the outputs are widely accessible to a non-technical audience including members of the Scottish Parliament who will vote on legislation, and the general public.

This report has been produced on an entirely **independent** basis.

2. Current Aviation Market

In order to contextualise the impact of introducing ADT, it is important to set out the current passenger demand for air services to / from Scotland and the current supply side in terms of e.g. routes, frequency, aircraft etc.

Current Taxation levels / Background to APD

APD came into effect in the UK in November 1994, as a tax paid by airlines based on the carriage of chargeable passengers. The tax has evolved since its introduction (where it was initially applied at £5 per passenger to UK and European Economic Area destinations, £10 per passenger elsewhere) through a number of incarnations to a distance and carrying class based system.

APD is paid on air passenger trips beginning in UK airports, although some UK airports are exempt, including those in the Highlands and Islands. As such, APD is paid on one leg of flights to destinations outside the UK and both legs of most domestic flights.

The current APD rates for financial year 2017-18 are shown in the table below.

Table 2.1: Current Air Passenger Duty Rates and Bands[8]

Destination Bands and distance from London (miles)	Reduced rate: (for travel in the lowest class of travel available on the aircraft)	Standard rate: (for travel in any other class of travel)	Higher rate: (for travel in aircraft of 20 tonnes or more equipped to carry fewer than 19 passengers)
Band A (0 to 2,000 miles)	£13	£26	£78
Band B (over 2,000 miles)	£75	£150	£450

If there is only one class of travel available, the 'Reduced' rate applies (unless the seat pitch exceeds 40 inches). This means that for a typical UK internal return flight, the UK APD paid would be £26 per adult (2 * £13 in each direction).

For reference, the recent history of APD rates that have applied in the UK (and will apply in the remainder of the UK from April 2018) is laid out here.[9]

[8] Note that from April 2018, APD rates for Band B will increase to £78, £156 and £468 respectively. Band A rates will remain unchanged.

[9] https://www.gov.uk/government/publications/rates-and-allowances-excise-duty-air-passenger-duty/rates-and-allowances-excise-duty-air-passenger-duty

Demand Side Baseline

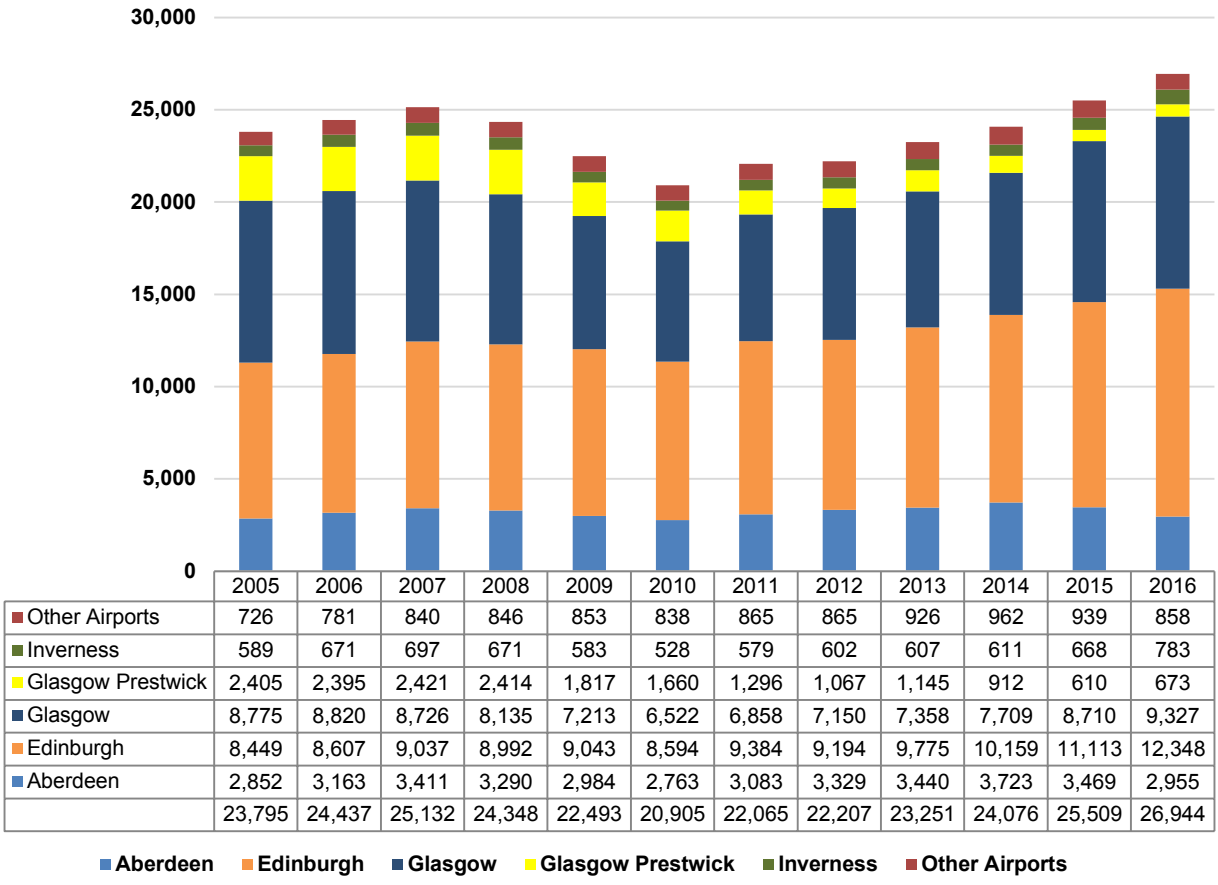
In order to understand the net additional impact of the introduction of ADT, a 2016 demand side baseline was developed setting out travel through Scottish Airports at present.

The baseline was subsequently developed into a set of forecasts for each Scottish airport up to and including the year 2030[10]. This provides the **counterfactual position** (i.e. what would happen if APD was retained in its current form), against which the impact of the introduction of ADT at a range of lower rates will be measured.

Scottish Airports – Passenger Numbers

By way of context, the recent trend in terminal passenger numbers at Scotland's airports is shown in the figure below.

Figure 2.1: Terminal Passengers at Scotland's Airports ('000, 2005-16)



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Other Airports	726	781	840	846	853	838	865	865	926	962	939	858
Inverness	589	671	697	671	583	528	579	602	607	611	668	783
Glasgow Prestwick	2,405	2,395	2,421	2,414	1,817	1,660	1,296	1,067	1,145	912	610	673
Glasgow	8,775	8,820	8,726	8,135	7,213	6,522	6,858	7,150	7,358	7,709	8,710	9,327
Edinburgh	8,449	8,607	9,037	8,992	9,043	8,594	9,384	9,194	9,775	10,159	11,113	12,348
Aberdeen	2,852	3,163	3,411	3,290	2,984	2,763	3,083	3,329	3,440	3,723	3,469	2,955
	23,795	24,437	25,132	24,348	22,493	20,905	22,065	22,207	23,251	24,076	25,509	26,944

In 2016, total terminal passenger numbers were therefore nearly 27 million. Prior to the last recession, passenger numbers peaked in 2007 before bottoming out in 2010 following the global economic crisis of 2008. Since then there has been steady growth, particularly since 2012 when growth has averaged around 5% per annum. Aberdeen Airport has more recently however been affected by the

[10] For reporting purposes, the 5-year period 2018-2022 period is used in this report.

downturn in oil and gas related activity, and has seen a 21% drop since 2014. The decline of Prestwick is also notable with a 72% reduction in terminal passengers since 2005. At a national level, these reductions at Aberdeen and Prestwick offset some of the growth seen at Edinburgh and Glasgow. The background to the introduction of ADT is therefore a position of five years of sustained growth in travel through Scotland's airports driven primarily by Edinburgh and Glasgow who together account for around 80% of passenger numbers. Figures for quarters 1 and 2 in 2017 confirm this trend of strong growth. Note that these figures relate to 'terminal passengers' – and an arriving, departing or transferring passenger is counted as a terminal passenger. APD / ADT is however charged on departing passengers only.

Current Air Passenger Duty

At present, APD is payable on air travel journeys which begin in the UK, with the rate depending on the ultimate destination and class of travel, as set out above. Journeys which begin elsewhere and interline through the UK do not typically incur APD charges, and since 1 March 2016, journeys made by those aged under 16 are also exempt. The vast majority of APD payable flights from Scotland depart from Aberdeen, Edinburgh, Glasgow and Prestwick Airports (APD is not payable on flights originating in the Highlands and Islands (including Inverness), whilst passenger numbers through Dundee Airport are very marginal (approximately 38,000 in 2016).

In order to understand what may happen to passenger demand and revenue in the future, it is essential to firstly review the functioning of the APD regime in the present day. As such, we sought to estimate the number of APD payable trips and APD tax revenue collected on flights from Aberdeen, Edinburgh, Glasgow and Prestwick airports in 2016, as follows:

- Data was obtained from the most recent CAA Passenger Survey which covered Scottish airports, which included surveys at Aberdeen, Edinburgh, Glasgow and Inverness (the 2013 survey).
- Based on the destination country and class of travel, we identified which APD band would apply to each respondent, excluding interlining trips on which APD is not charged.
- Given that different market segments are likely to respond differently to a change in price, a set of **60 passenger categories** was developed, reflecting:
    - Traveller place of residence – UK or non-UK;
    - Travel purpose – business or leisure;
    - Destination Type, i.e. destination of journey leaving Scotland – Domestic (Scotland), Domestic (Other UK), Western Europe, OECD

(outside Europe), Newly Industrialised Countries or Less Developed Countries[11].
    - Airline type – Network / National / Regional, Chartered or Low Cost Carrier.

- On this basis, we calculated the number of APD payable trips falling into each category, taxation band and airport. The analysis has assumed that travel in Premium Economy, Business Class and First Class incur APD charges at the 2017-18 standard rate.
- We then calculated the proportion of passenger trips which had been captured by the surveys, based on 2016 annual airport passenger volumes also obtained from the CAA.
- The number of passengers falling into each category at each airport was then correspondingly factored up to 2016 annual levels. Ideally, we would have applied factors specific to the passenger category, but this information was not available.
- The CAA Passenger Survey 2013 did not include responses from travellers through Prestwick Airport - we therefore generated our own estimates based on published statistics. We assumed that all travellers made return journeys, all were bound for destinations in Western Europe, all were travelling economy and none were interlining (Ryanair is the only operator at Prestwick currently). Total terminal passengers in 2016 were obtained from the CAA website and the proportions of UK / Foreign residents and Business / Leisure passengers was derived from CAA Passenger Survey data.
- In May 2015, the UK Government removed APD charges on flights undertaken by children aged less than 12, and in March 2016, they also removed APD charges on flights undertaken by those aged 12-15. Based on the proportions of travellers falling into each age band reported by the CAA Passenger Survey, and assuming an even spread of trips across the year, we correspondingly factored down the number of passengers assumed to be liable for APD payment.
- We then multiplied the number of trips in each tax band by the APD rates in 2016, to estimate total APD receipts that year.

Based on the CAA Passenger survey sample, it is estimated that in 2016, APD was payable on 12.2 million air passenger journeys, raising approximately £251m.

[11] Destination type was determined based on the categorisation provided in the UK Aviation Forecasts 2013. We also accounted for the fact that many travellers break their journey and switch airline *en route*, e.g. fly with Ryanair to Dublin, then Aer Lingus to Washington D.C. Where travellers used a different airline for the second leg of their journey, and that airline was not a partner of that used for the first leg, it was assumed that the journey was broken and the APD payable was based on the first airport reached.

Table 2.2: 2016 APD Summary, 2016

	Band A	Band B	Total
APD Payable Trips	10,750,824	1,421,411	12,172,235
APD Receipts	£141,206,297	£109,522,285	£250,728,581

Source: PBA Analysis

Band A (broadly short-haul) taxation raises 56% of total APD receipts, and the remaining 44% is raised by Band B (broadly long-haul) taxation.

Subsequent to the main elements of this analysis being undertaken a new Government Expenditure and Revenue Scotland (GERS) estimate of £264m for 2016-2017 was published[12]. Consultation with Scottish Government has identified that the methodology applied in estimating the PBA and GERS figures is largely the same – however an additional assumption has been made in this analysis regarding the tax collected on trips from Scotland to destinations using two separate flights (and therefore liable for two separate ADT / APD payments), and this accounts for the majority of the difference between the two figures. Note though that all calculations of APD accruing in Scotland at present are **estimates** and the true figure will not be known until the tax is devolved and collected in Scotland from 2018-19 onwards.

Development of Demand Side Counterfactual

On 1 April 2018, it is expected that APD will be 'switched off' in Scotland by HMRC and will no longer be payable on flights departing from Scotland, with the new devolved ADT regime coming into effect. In order to isolate the effect of the introduction of ADT, we have estimated how passenger volumes and tax receipts would change if the current APD regime had remained in place in Scotland. In the subsequent analysis, this counterfactual position will be compared against a range of scenarios where ADT is introduced, with a view to identifying the net impact of the policy (i.e. the impact less what would have happened in any case).

A number of 'Do Nothing' cases[13] were developed, which reflect the range of possible demand scenarios likely to emerge if the current APD regime is retained. These 'Do Nothing' cases represent the counterfactual, against which the intervention 'Do Something' scenarios (i.e. the introduction of ADT under a number of different scenarios) have been tested. The potential Do Nothing cases are:

- DfT Low, Central and High **constrained** passenger growth forecasts, obtained from UK Aviation Forecasts 2013;
- DfT central **unconstrained** passenger growth forecasts, again from the UK Aviation Forecasts 2013; and

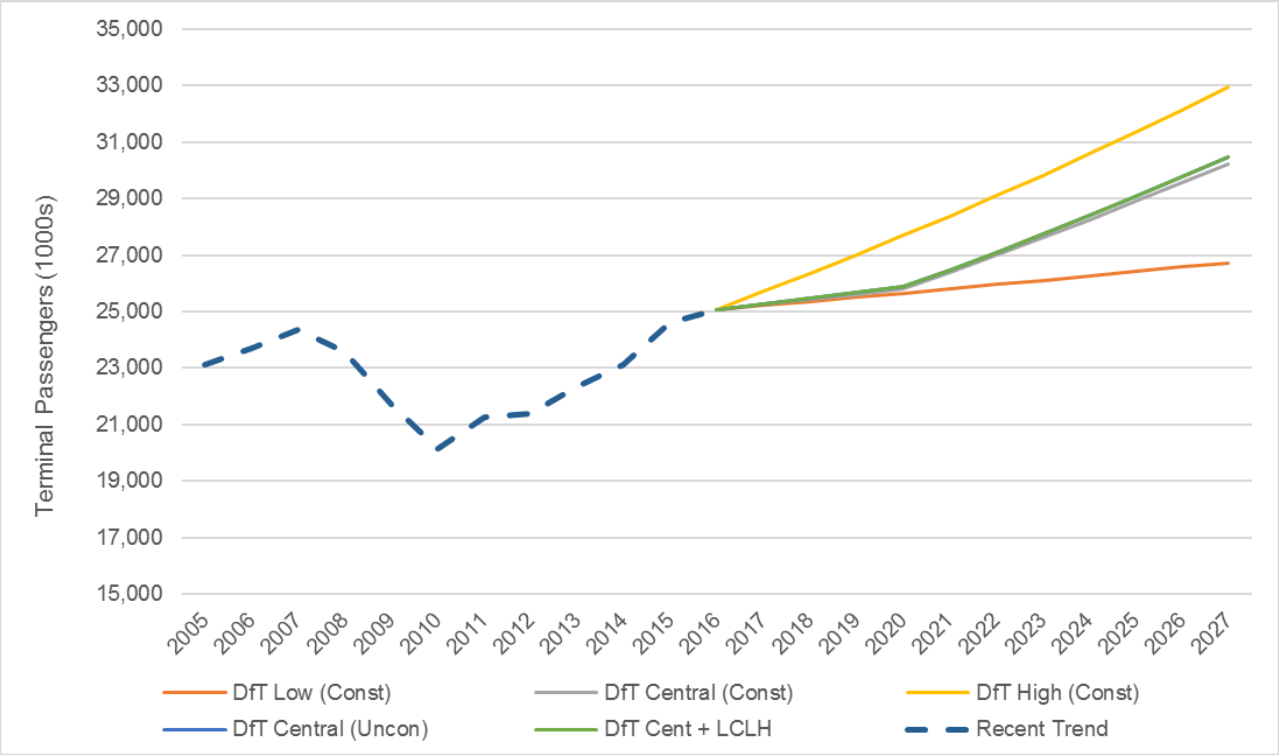
[12] http://www.gov.scot/Resource/0052/00523700.pdf

[13] Note that the term 'Do Nothing' used throughout the report refers to the scenario where current APD levels are retained in the new ADT, i.e. there is no change in tax.

- Forecasts based on DfT Central unconstrained forecasts, which also reflect the emergence of a **Low Cost Long Haul** (LCLH) market in Scotland;

These forecasts are developed by DfT at the individual airport level. The initial intention was to directly apply the DfT's forecast future passenger volumes at each of Scotland's main airports. However, some of the airports in question, including Edinburgh, have already surpassed the constrained and unconstrained 'Central' DfT forecasts for 2020. In order to work around this issue, the underlying year-on-year growth rates were developed and applied to 2016 estimates of APD Payable Movements. APD receipts for the period 2017-2027 were then estimated by multiplying the number of movements by 2016 APD rates. The chart below compares the various growth forecasts (for terminal passengers) derived from the DfT's UK Aviation Forecasts 2013, in the context of the recent trends noted above.

Figure 2.2: Forecast Do Nothing Terminal Passengers (2016-2027)[14]



It can therefore be seen that the different growth scenarios create a range of circa 27 million to 33 million terminal passengers by 2027, a significant range of 6 million passengers. DfT growth forecasts were produced prior to the emergence of a viable LCLH market in the UK, and so the decision was taken to **use the LCLH adjusted DfT Central Growth** as our **core growth scenario**.

For simplicity, average fares were assumed to be as per 2016 levels throughout the study period.

[14] Note that the DfT 'Low' and 'High' Forecasts comprise a uniform trajectory to 2030. The DfT Central projection includes an intermediate year at 2020 and this explains the different growth trajectories seen here.

The output of this process is a highly disaggregated spreadsheet-based model which:

- represents 2016 terminal passengers, ADT payable passengers, ADT revenue and average fare paid by market segment;
- provides a range of underlying growth projections to 2030; and
- is capable of testing a range of ADT scenarios as tax rate amounts and bands have not yet been set and decisions will be partly informed by this report.

Supply Side Baseline

This section sets out the supply side baseline of the Scottish aviation market, covering:

- Scheduled Passenger Operations;
- Scheduled Destinations;
- Based Aircraft; and
- Benchmarking.

As previously noted, APD is only applicable from Aberdeen (ABZ), Dundee (DND), Edinburgh (EDI), Glasgow (GLA), and Prestwick (PIK) Airports, although it must be acknowledged that APD collection on flights from Dundee is negligible (estimated at <0.1% of Scottish APD receipts in 2016).

This analysis therefore provides context for the consideration of supply side responses and could also form the 'baseline' for the subsequent monitoring and evaluation of ADT.

Scheduled Passenger Operations

This section provides an outline of the range of scheduled services from Scotland. Scotland's primary airports have a portfolio of airlines serving them both year-round and with additional seasonal services, as is illustrated in the table below:

Table 2.3: Scheduled Passenger Operators with Services to / from Scotland

	ABZ	DND	EDI	GLA	INV	PIK
Year Round Services	18	1	27	25	5	1
Seasonal Services[15]	7	0	18	14	4	1

The operators offer a range of destinations, some of which are seasonal. The tables below set out the scheduled and seasonal destinations by airport split by market segment:

[15] Note – there is a degree of duplication with year-round operators.

Table 2.4: Scheduled Destinations from Scottish Airports (Year-Round)

	ABZ	DND	EDI	GLA	INV	PIK
Scottish Internal	4	0	4	8	4	0
UK Domestic)	15	1	15	18	8	0
Short-haul Europe (excluding UK domestic)	16	0	70	34	1	8
Long-haul (Asia, Africa and Americas)	0	0	4	3	0	0
Scheduled Totals	**35**	**1**	**93**	**63**	**13**	**8**

In terms of year-round connections, Edinburgh serves the widest variety of destinations and is particularly dominant in the year round 'Short-Haul Europe' market, given the strong business connections to key European hubs, such as Paris and Amsterdam. Aberdeen has a roughly even split between 'UK Domestic' and 'Short Haul Europe'. Inverness is dominated by 'UK Domestic' traffic, with key connections to London and other UK hubs.

Year-round long-haul flights are only available from Glasgow and Edinburgh, connecting with hubs in the Middle East (e.g. Abu Dhabi, Dubai, Doha) and North America (e.g. New York Newark). Overall, however, the long-haul market from Scotland is currently very limited compared to Manchester, London Gatwick etc.

Table 2.5: Scheduled Destinations from Scottish Airports (Seasonal)

	ABZ	DND	EDI	GLA	INV	PIK
Scottish Internal	0	0	0	0	0	0
UK Domestic (excluding short-haul)	3	0	1	2	1	0
Short-haul Europe	10	0	35	38	3	8
Long-haul (Asia, Africa and Americas)	0	0	5	11	0	0
Scheduled Totals	**13**	**0**	**41**	**51**	**4**	**8**

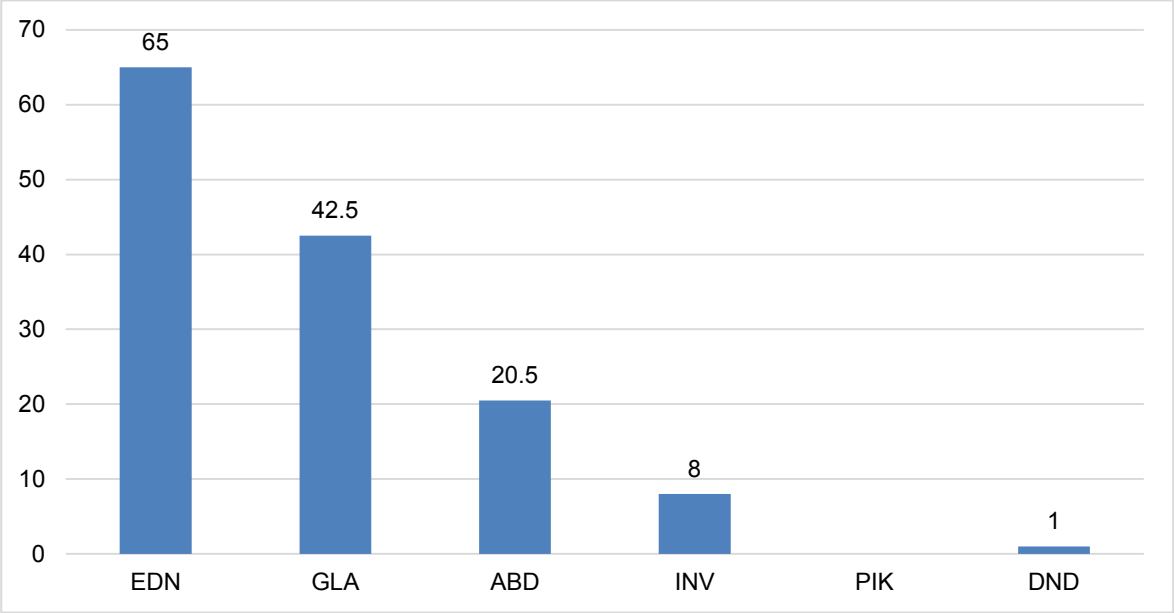
There is a significant seasonal route network operating from Scotland, predominantly to warm-weather destinations in e.g. Spain, Greece, Turkey etc. This is dominated by Glasgow and Edinburgh, although Aberdeen, Inverness and Prestwick have seasonal connections to continental Europe.

Long-haul connectivity increases significantly during the summer months from Edinburgh and Glasgow, although again this is predominantly supporting the long-haul tourism market (e.g. Florida, Mexico, Canada etc.).

It is important to note that the above is a snapshot of the aviation industry in Scotland in late 2017. Aviation is however a dynamic industry with highly mobile assets and this baseline will change and evolve over even short periods of time.

Whilst the overall number of scheduled flights is an indicator of air market vitality, the type of airports served is also key. Scheduled flights to airports that are attractive business destinations in their own right (e.g. Zurich), and / or key hubs (e.g. Amsterdam Schipol) are economically more valuable than smaller airports (e.g. Kaunas). The figure below shows the number of scheduled links between Scottish airports and Europe's busiest airports.

Figure 2.3: Number of Scheduled Links with Europe's Top 100 Airports[16] [17]



Based on the above measure, Edinburgh is very well connected with the main European hubs with almost two thirds of links in this category, whilst just under 50% of flights from Glasgow and just over 20% from Aberdeen connect with Europe's busiest airports, the top 10 being: London Heathrow, Paris Charles de Gaulle, Amsterdam, Frankfurt, Istanbul, Madrid, Barcelona, London Gatwick, Munich and Rome.

Scheduled Destinations

Building on the above analysis, the tables below show weekly frequencies from the Scottish airports in summer and winter 2017 to key hubs / international business destinations.[18]

[16] Note – Edinburgh and Glasgow are both in the top 100 airports

[17] Seasonal flights have been counted as 0.5 of a link.

Less than 10 rotations per week indicates less than 2 per day which is usually considered a minimum base for strong business passenger use (i.e. the ability to make a day return trip). More than 15 rotations per week usually indicates at least 3 rotations per day and suggests strong business and interlining use.

Table 2.6: Summer 2017 Weekly Frequencies to Key Hubs from Scottish Airports

	ABZ	DND	EDI	GLA	INV	PIK
Amsterdam	28		56	34	14	
Brussels			13	2		
Paris – Charles De Gaulle	14		32	14		
Copenhagen	5		15			
Dublin	11		67	51	9	
Dusseldorf			3	6		
Frankfurt[19]	14		17			
Madrid			15			
Milan[20]			17	3		
Munich			13	1		
Oslo	5		9			
Rome[21 22]			7			

[18] Note – the data in the tables have been developed through a combination of data provided by the airports and searches on Skyscanner.net. The sample summer week is 14th-21st July 2017 and the winter week is 17th-24th November 2017.

[19] Combined Frankfurt and Frankfurt Hahn

[20] Combined Milan Bergamo and Milan Malpensa

[21] Seasonal from Prestwick

[22] Combined Rome Leonardo Da Vinci and Rome Ciampino

	ABZ	DND	EDI	GLA	INV	PIK
Stockholm			12			
Reykjavik			6	7		
Lisbon			3	2		
Total	**77**	**0**	**285**	**120**	**23**	**0**
London Airports						
Heathrow	68		101	67	7	
Gatwick	6		51	43	18	
Stansted		11	49	39		11
Luton	5		22	15		
City	12		67	30		
Total	**91**	**11**	**290**	**194**	**25**	**11**

Table 2.7: Winter 2017 Weekly Frequencies to Key Hubs from Scottish Airports

	ABZ	DND	EDI	GLA	INV	PIK
Amsterdam	26		42	31	7	
Brussels[23]			16	2		
Paris – Charles De Gaulle	21		43	7		
Copenhagen	6		12			
Dublin	10		50	46	3	
Dusseldorf			5	4		
Frankfurt	14		12			
Madrid			9			
Milan			14	2		
Munich			9	4		
Oslo	10		4			
Rome			5			
Stockholm			5			

[23] Combined Brussels and Brussels Charleroi

	ABZ	DND	EDI	GLA	INV	PIK
Reykjavik			9	7		
Lisbon			3	2		
Total	**87**	**0**	**238**	**105**	**10**	**0**
London Airports						
Heathrow	80		109	70	7	
Gatwick	11		49	40	15	
Stansted		11	48	36		11
Luton	4		24	16	7	
City	11		74	38		
Total	**106**	**11**	**304**	**200**	**29**	**11**

From these tables, it is clear that Edinburgh and Glasgow (in that order) provide higher frequencies to the key business hubs of London, Amsterdam, Paris and Dublin, although Aberdeen has strong connections with Frankfurt. Scotland also has highly developed connections with a second tier of key hubs such as Milan, Copenhagen, Oslo and Stockholm. Aberdeen's close links with Scandinavia are also apparent.

Seasonality is a prominent feature in the Scottish aviation market – there is an outbound 'school holidays' exodus and a summer inbound tourist surge, whilst there is also a 'flight to the sun' effect in the winter.

Scotland Based Aircraft

The planned introduction of ADT is in part intended to stimulate the Scottish economy on a variety of levels – one of these is to encourage additional 'based aircraft' in Scotland. Based aircraft are considered to be of economic and social value because they create local direct and indirect employment (this is explored further in Chapter 6), and also offer early morning departures to key destinations.

As part of the industry consultation, a group of key airlines operating in Scotland was requested to provide a record of based aircraft in Scotland. The information received by return was relatively patchy. In order to counter this, we took a sample of aircraft departing Scotland's main airports before 07:30, which was taken to be a proxy for the number of aircraft that were overnighting in Scotland.

It should be noted that some of these aircraft may not be based in Scotland and may only be overnighting, with their crew staying in hotels and their engineering support being accommodated elsewhere. However, this does give some indication of the main operations that are of value to Scotland and these include Ryanair,

easyJet, Flybe, Loganair, Eastern, Jet2 and Thomas Cook. The key European feeder flights are largely served by aircraft that are overnighting.

Table 2.8: Overnighting Aircraft by Airline (Sample taken on Friday 14th July 2017)

	ABZ	DND	EDI	GLA	INV	PIK
FlyBe	4		8	4		
easyJet			8	4	1	
Ryanair			7	2		3
Loganair	6	1	2	6	6	
Eastern Airways	6			1		
BMI Regional	2				1	
Thomas Cook				5		
Brussels Airlines			1			
KLM	1		1	1	1	
Jet2	5		5	5		
TUI Airlines UK	1		1	1		
Hop!			1			
Total	25	1	34	29	9	3

It is notable from the above table that based aircraft tend to be concentrated in the low cost carrier, charter and regional airlines sector. Edinburgh, Glasgow and, to a lesser extent, Aberdeen are more dominant in this respect, although this is to be expected given the higher overall flight frequency.

Benchmarking Against Comparable Airports

In developing the analysis, a degree of benchmarking was undertaken with 'secondary' comparator airports on the European periphery, with a view to identifying the level of Scottish connectivity compared to other 'peripheral' European airports. The results are shown in the table below:

Table 2.9: Benchmarking with EU Peripheral Secondary Airports (2015)

City / Airport	Passengers (Million)	Long Haul Routes	Short Haul & Domestic Routes	National Population (Million)	International Tourists (000s), 2013[24]
Edinburgh & Glasgow (Combined)	*19.8*	*6 & 10 Seasonal*	*113*	*5.3*	*2,700*
Lisbon	20.1	25 & 5 Seasonal	137	10.5	8,324
Copenhagen	26.6	36 & 7 Seasonal	139	5.6	8,068
Helsinki	16.4	20 & 8 Seasonal	96	5.4	4,226
Dublin	25.0	18 & 16 Seasonal	132	4.6	7,550
Keflavik	4.9	16 & more seasonal	48	0.3	807

It is important to note that the Scottish airports do not represent an entirely 'like-for-like' comparison with the other cited airports for the following reasons:

- The benchmarked airports are national capitals and thus represent the primary airports in those countries. The long-haul connectivity of the Scottish airports is impacted heavily by the dominance of London Heathrow, and to a lesser extent London Gatwick and Manchester.
- Lisbon and, to a lesser extent, Dublin serve large national diaspora further afield – e.g. Brazil and a number of Atlantic islands in the case of the former and the east coast of the USA in the case of the latter.
- Scotland does not have a national carrier, unlike these other countries.
- There will be different taxation and charging regimes with respect to air travel and airports in these countries.

Whilst not direct comparators, it can be seen from the above table that the main two Scottish airports significantly lag other European peripheral airports in terms of overall connections, but particularly in terms of long-haul connections. This in effect means that Scotland is less well connected to key current and growing markets. Whilst APD is only one of a large number of factors determining the scope and scale of the route network, the reduction of taxation under the ADT proposals is likely to act as a stimulant to route development.

[24] World Tourism Organisation (UNWTO) Tourism Highlights 2014 Edition

Development of Supply Side Counterfactual

The supply side counterfactual would ideally describe how the destinations served, frequency of connections and airline seat capacity will change between 2016 and 2027. However, this information was not available to the study team beyond published plans, and in many cases is commercially confidential information. We are aware that several low-cost carriers with operations in Scotland have placed substantial orders for new aircraft, and so it is reasonable to assume that there will be some route growth in the absence of changes to APD. We have however assumed that trend supply side expansion and corresponding changes in passenger demand are implicitly accounted for within growth factors derived from the UK Aviation Forecasts 2013.

Supply Side Summary

The supply side baselining has demonstrated that Scotland is relatively well-connected to key short-haul destinations in Europe, with direct flights to the likes of Amsterdam, Paris and Frankfurt amongst others. Scottish passengers can also access an extensive network of global connections through the hub airports to which Scotland is connected, including London Heathrow, Amsterdam Schipol, Dubai and Paris Charles de Gaulle.

However, the direct long-haul connections from Scotland are generally limited to hubs in the Middle East and the east coast of the USA. This compares unfavourably to other countries on the European periphery, such as Iceland, Ireland, Denmark and Finland which have a much more extensive route network (Table 2.9).

The airline industry in Scotland is also dominated by low cost, regional and charter carriers, with only a few of the higher value network carriers (e.g. Emirates and Qatar) operating a significant route network from Scotland (and none of whom have based aircraft in Scotland).

3. Logic Modelling Framework & Method

In detailing the potential *outcomes* and *impacts* of the introduction of ADT and with it potential tax reductions, a logic modelling approach was developed. A logic model is simply a mechanism by which the sequence of events between cause and effect is set out in logical and sequential steps. The set of intervention logic models are intended to identify and demonstrate how the reduction in APD would feed through to wider outcomes and impacts.

The development of the logic models was informed by a detailed literature review, which considered the approaches to modelling the outcomes and impacts of changes to APD found in other studies. The main finding of this review was that the bulk of previous research studies have assumed that any reduction in APD would be passed straight through to the end-user (i.e. the passenger). This, in our view, is unrealistic given the complexities of aviation economics and the number of potentially affected parties, and the approach adopted in the logic mapping below therefore considers potential variations in pass-through.

The structure recently put forward by the Tavistock Institute for the DfT[25] with respect to transport evaluations has been adopted here and this suggests the following logic chain as the basis for considering the impacts of a transport intervention: *Context – Input – Output – Outcomes – Impact*. This structure is typical of logic modelling approaches which are widely used across disciplines, and this is expanded on below:

- ***Context*** *– issue addressed and the context in which it is taking place:* the issues to be addressed are (i) the concerns surrounding the current APD tax regime and its impact on airlines, air travel, connectivity & the economy, and (ii) the recent devolution of power enabling Scottish Government to set the parameters of this tax.
- ***Input*** *– What is invested, e.g. money, skills, people, activities:* essentially an acceptance of reduced tax revenues from this source and the specification of the tax rate and bands / thresholds etc.
- ***Output*** *– What has been produced?* The primary output is reduced costs to the airlines as their tax liability per passenger will fall.
- ***Outcomes*** *– Short and medium term results:* this reduction in costs to the airlines may: (i) generate reductions in fares (depending on the degree to which the tax saving is passed on); (ii) lead to new or improved connections; and / or (iii) lead to changes in organisational structure within the airlines. Therefore, there are essentially two **outcomes**:
    - Changes in the organisation of airlines / airports in response to changes in costs, passenger numbers and new opportunities created **[supply side response]**.

[25] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/3817/logicmapping.pdf

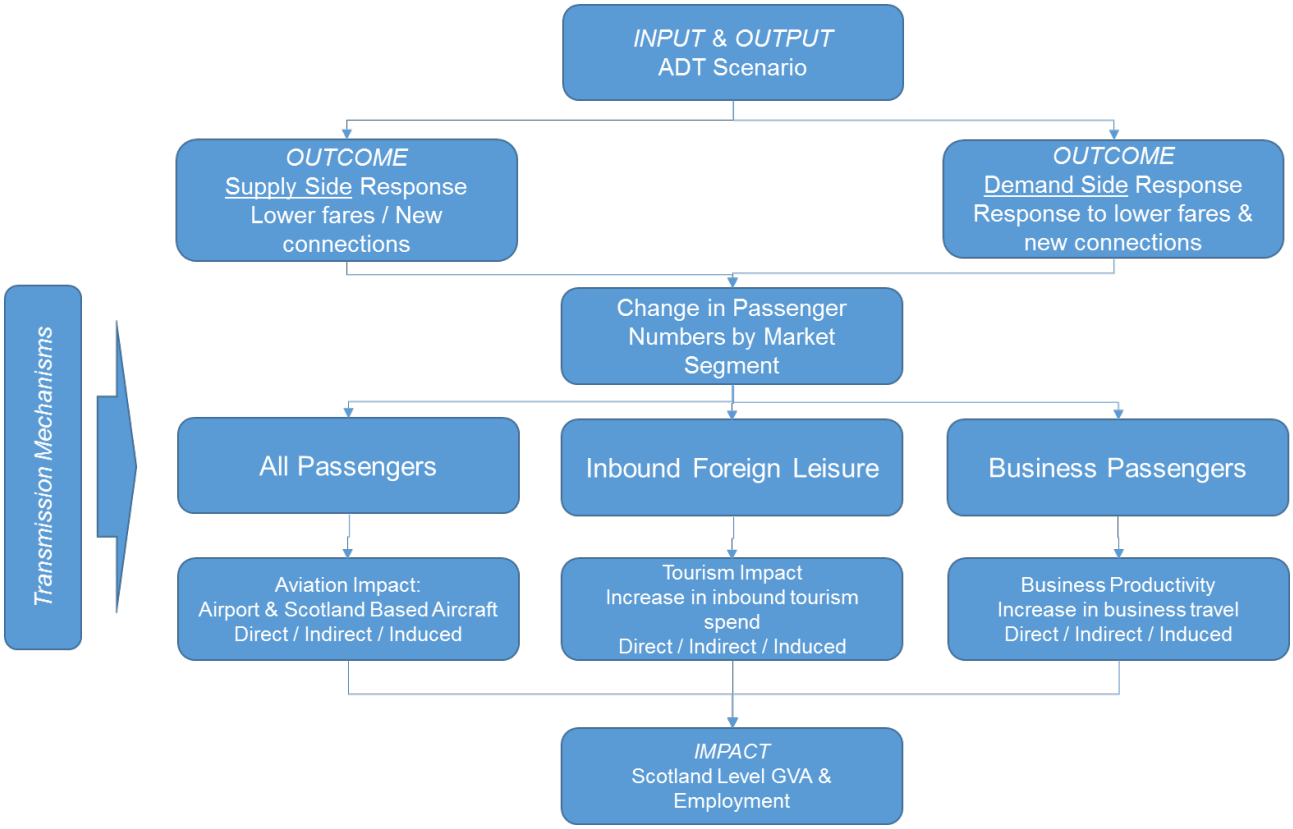
- Consumer behaviour and hence spending patterns change in response to lower fares and new / improved connections **[demand side response]**.
- The supply side response of different airlines will vary both in terms of the degree of pass-through and the time horizon over which changes occur.

- ***Impacts*** – *Long term outcomes:* these should reflect the long-term objectives of the policy, as reflected in the Bill documentation e.g.:
  - '*boost Scotland's air connectivity and economic competitiveness;*
  - *encouraging the establishment of new routes which will enhance business connectivity and tourism;*
  - *secure new routes and capacity;*
  - *encourages airlines to base more aircraft in Scotland*'; and
  - also, contribute to SG overarching Purpose and other policy objectives (i.e. creating & safeguarding employment and generating net additional GVA).

It is notable that the policy objectives are formulated around greater connectivity for Scotland, rather than cheaper air travel. This underlines the importance of understanding and accounting for the potential range of supply side responses, rather than focusing solely on the possibility of cheaper fares.

The key issue for this study has been to work through this logic, considering in particular a range of possible outcomes and impacts via a framework of demand, supply and economic impact logic models. The process adopted is outlined in the figure below and expanded on in the sections which follow.

Figure 3.1: Overview of Logic Model Approach



The *Inputs* and *Outputs* in this case are essentially the resources required (i.e. the tax take forgone, or *Inputs*) to enable the level of tax to be reduced, i.e. the *Output*. The following sections consider the treatment of *Outcomes* and *Impacts* in more detail, together with the underlying *transmission mechanisms* through which the change in tax becomes an impact 'on the ground'.

Supply Side *Outcomes*

The first substantive step in the developing the logic modelling approach overall is to consider the potential impact of the introduction of ADT and the expected reductions in taxation on the supply side (i.e. the aviation industry) as it is the first link in the chain that ultimately leads to the passenger.

The outcomes associated with the reduction in APD will be determined by the rates and bandings applied, and **the extent to which the tax reduction is passed on to the end user in the form of reduced fares**. This will determine the balance of the outcomes and impacts in terms of the supply side (i.e. new routes, higher frequencies etc.) and the demand side (i.e. increased passengers through lower prices / new routes).

Rates & Bandings

For the purposes of this research, and for modelling purposes, the scenarios introduced later in this report assume that the current APD tax bandings structure remains intact, with changes in the rates within the bands only. This is because modelling a new bandings regime would introduce a further range of scenarios which would detract from the analysis of a tax rate cut which is the central objective/scenario running through the analysis. This analysis does not preclude a change in bandings either from April 2018 or in the future.

Extent of Pass-Through & Impact on Services

The extent to which the APD-related reduction in fares is passed through to the end customer is determined by a wide range of factors, including but not limited to:

- The way in which **the airlines currently impose this tax** (and the transparency with which they do so) – some airlines, such as British Airways, clearly itemise the tax on bookings / invoices, whilst other airlines (particularly low cost carriers) do not explicitly recognise the APD burden within the fare.
- Whether the airline is **expanding its network** and seeking additional utilisation of its assets or **contracting its network** through reducing aircraft / routes.
- **Airline cost structure** and how they account for APD currently (i.e. as a central overhead or on a per passenger by route basis).
- The **level of competition** – this will be particularly pertinent for airports served by multiple airlines. It will be less significant where one airline tends to be dominant at a particular airport or cluster of airports.
- The **extent of interlining** – for several long-haul carriers, the objective of their short-haul connections is to feed passengers into their more lucrative long-haul route network.

The type of supply side response is likely to vary by airline type. Based on consultations with industry, we have set out below how we think the respective sector will respond:

- **Domestic Scotland** (e.g. Loganair): Pass-through where appropriate, but potentially also using APD reduction to support the viability of 'thin' routes (either altogether or in terms frequency).
- **Network** (e.g. British Airways, United Airlines, Emirates): More likely to pass on reduction to customer as 1) less likely to commence any new routes from Scotland (unless low cost); and 2) can potentially support primary objective of getting passengers onto their long-haul network / interlining.
- **Regional** (e.g. FlyBe / Eastern Airways): Likely to use APD reduction to either support 'thin' routes or support new route development, depending on the strategic objectives of the airline. The chosen strategy will influence the degree of pass-through.
- **Low Cost** (e.g. easyJet and Ryanair): With large interchangeable fleets and airport networks, the APD reduction is likely to be at least partially retained and used as the basis of further route development / asset utilisation.
- **Chartered** (e.g. Thomas Cook and Thomson): Given the highly competitive nature of the package holiday market, it is likely that the cost reduction will be passed on (either directly or indirectly) to the end customer. However, APD is likely to be a very small element of the total cost of package (and especially all-inclusive) holidays.

It is important to note that the timeline over which the supply side response will be manifested will vary. A number of low cost airlines, including Ryanair and easyJet, have already committed in-principle to new routes at the point at which ADT changes are introduced. With other market segments, particularly long-haul, the market response may be in the medium-term (e.g. 2-5 years), although some long-haul routes may come forward more quickly than they otherwise would have.

It is worth noting that the **airports may also 'skim' a proportion of the APD reduction** through increasing landing charges levied on airlines, so even where an airline offers full pass-through, this is potentially less than the actual amount of the tax reduction. This in itself is perhaps less of an issue if the airport uses the additional funding to support further expansion of its operation / route network. It only becomes an issue if the airport is engaging in a form of '*rent extraction*'[26]. In any case, it is not possible to systematically lay out this impact, as details of the contracts that airlines have with airports are commercially confidential, but it is an issue and risk worth highlighting as a further complication in the analysis.

In terms of estimating the supply side impacts and outcomes of the APD reduction, different scenarios of pass-through have been modelled (i.e. full, partial and zero

[26] Rent-extraction is the use of the resources of a company, an organisation or an individual to obtain economic gain from others without reciprocating any benefits to society through wealth creation.

pass-through). The analysis also picks up on the likely differential impact on short-haul and long-haul connections.

For each airline type under each scenario, the subsequent analysis has made an assumption on a supply side response, drawing on a combination of the industry consultation and desk-based review considering the following potential outcomes which are likely to emerge:

- **Larger aircraft on existing routes** - assuming aircraft can be accommodated within airport parameters (e.g. stand capacity, runway length & capacity etc.), larger aircraft may be deployed to meet an increase in demand.
    - This outcome is most likely to emerge where there is **full or near to full pass-through** of the APD reduction to the end user, generating additional demand from lower fares.
    - This is likely to be the least prominent outcome as a number of airlines, particularly the low cost carriers, operate a single aircraft type. This outcome may nonetheless occur with airlines with a larger or more diverse fleet.
- **Higher frequencies on existing routes**
    - This outcome is again most likely to emerge where there is **full or near to full pass-through** of the APD reduction to the end user, generating additional demand from lower fares.
    - Without an airline procuring additional aircraft or using available spare capacity, there will be an opportunity cost associated with increasing the frequency on any given route (due to aircraft being redeployed from elsewhere). This impact is therefore only likely to materialise where the yield from running additional services from Scottish airports exceeds the next best alternative.
    - This extent to which this outcome will materialise in the short-term is limited. However, a number of airlines, including easyJet and Ryanair, have substantial orders in place for new aircraft and thus enhanced frequencies on existing routes could be a more prominent outcome in the medium-term. This could also feed into the longer-term aspiration to have more aircraft based in Scotland.
- **New direct routes** - the development of new routes is the most likely supply side outcome associated with the reduction in APD. There are two derivatives of this outcome:
    - Where the APD reduction is largely **passed through to the passenger**, this will generate additional demand but would be largely cost neutral from the perspective of the airline. The demand (and resultant revenue) which would be generated would need to be capable of covering the cost of operating the route.
    - Where the APD reduction is largely **retained by the airline**, this may reduce the break-even point for any given route, thus making it more viable.

In terms of the above outcomes, the establishment of new routes is, from a Scottish Government policy perspective, likely to be one of the most desired outcomes emerging from the APD reduction.

Demand Side *Outcomes*

There are two potential demand responses which may emerge (neither of which are mutually exclusive):

- Additional demand generated as a result of lower prices on existing routes; and / or
- New demand generated as a result of new routes / connections / higher frequency etc.

This section considers how the demand side outcomes are represented within the overall logic framework.

As discussed in Section 2, a representation of the present day Scottish air market by market segment was developed, and an estimate of the value of APD raised, by segment, class and distance band was established. Our analysis suggests *circa* £251m of APD was collected on flights from Scotland in 2016.

Similarly, estimates of future **Do Nothing** demand (i.e. continuation of existing APD levels) were developed via a number of 'Reference Cases'. These reference cases reflect a variety of potential baseline growth scenarios and represent the counterfactual, against which ADT intervention scenarios have been tested.

Estimating the 'Do Something' (tax reductions from APD levels) Demand

There are two elements to estimating future demand as a result of the introduction of ADT at a lower rate than the current APD: 1) demand generated as a result of reduced fares (i.e. demand side change); and 2) demand associated with new direct connections to / from Scotland (supply side change).

Reduced Fares & Elasticities

The introduction of APD could result in a reduction in air fares and the size of the saving will dictate the scale of the market response. As such, in order to understand how much of a saving will be made under future ADT scenarios, it is also important to incorporate average 2016 air fare data within the baseline. Fare data from the CAA Passenger Survey was used in the first instance to calculate average fares for each passenger category; however, only *circa* 30% of CAA Passenger survey responses included this information and so there remained a number of categories for which passenger data were missing. To address these gaps we:

- Generated factors based on the whole CAA Passenger Survey 2013 dataset (circa 55,000 responses), which illustrated the relationship between average single and return fares, and average Band 1 (Reduced Rate) and Band 2 (Standard Rate) fares. These factors were applied where average fare data

was available for Band 1 but not Band 2 or vice versa, and similarly with single / return fares.
- Where gaps still remained, we identified the most common country destination of passengers falling within that passenger category and then the most commonly used airport within that country.
- In the first instance we searched RDC Aviation fare data for air fare estimates between the relevant airports and destinations, and then supplemented this data with that from an online fares search (Skyscanner), assuming travel in October 2017.

Fares from the 2013 CAA Passenger Survey were inflated to 2016 levels through application of the GDP Deflator series from WebTAG, the UK Government's transport appraisal guidance. Fares obtained online were assumed to be representative of 2016 levels. Having established a robust fare for each market segment, the estimation of demand as a result of reduced fares is fairly straightforward, applying the relevant price elasticities of demand to the different market segments.

Academic and Government studies of price elasticity of demand within the air travel market have generated a wide variety of potential elasticities. Our core analysis has utilised elasticities from the DfT's UK Aviation Forecasts 2013, and sensitivity testing has been undertaken applying two sets of alternative elasticities, from widely cited papers applied as a sensitivity as follows:

- InterVISTAS Consulting Inc. (2007). Estimating Air Travel Demand Elasticities, Final Report. International Air Transport Association (IATA);
- Gillen, D., Morrison, W., and Stewart, C. (2003). Air Travel Demand Elasticities: Concepts, Issues and Measurement. Department of Finance, Government of Canada.

New Connections

As noted previously, some airlines are likely to treat a reduction in air passenger taxation as a reduction in their cost base and therefore:

- fly new routes which are currently not viable;
- reinstate routes which have been withdrawn; and / or
- convert seasonal routes to year-round routes.

The APEX[27] modelling tool has been used to test a sample of new routes across the different airports and market segments. These case studies have been used as context to develop a series of supply side response factors (by airline type and short haul / long haul) and, in turn, an estimate of passenger numbers which will emerge from this.

[27] APEX is a proprietary model available by online subscription that is recognised as an industry standard tool for examining the commercial prospects for both new and existing routes.

A supply side reaction is unlikely to be immediate, and consultations with airlines suggests that the lag time will vary by market segment. Our modelling has assumed that any supply side reaction would be staggered over three years, beginning in 2019. It is noted though that this will vary by airline and some may make an early symbolic gesture in recognition of the new policy.

Uplift in Passenger Numbers

The combined uplift in passenger numbers from (i) reduced fares and (ii) new connections is compared against the various Reference Case / Do Nothing forecasts and fed into the economic impact model.

Determining Economic *Impacts*

An economic impact model was developed, fed from the disaggregated forecasts of passenger numbers by market segment to derive the economic impacts of changes to ADT for each year between 2018 and 2027. These impacts are expressed in the form of jobs and GVA at the Scotland level.

There are four main elements to this model:

- direct operational impacts ((i) airport related, and also (ii) the basing of additional aircraft in Scotland);
    - additional airport and airline staff required to handle additional passenger numbers;
    - additional aircraft based in Scotland, with Scotland-based crews (also implies more flights);
    - increased density of aviation operation, creating the potential for spin-off employment in terms of e.g. maintenance.
- wider economic impacts (associated with (iii) tourism, and (iv) improvements in business performance / productivity etc.).

The objectives for the introduction of ADT set by the Scottish Government explicitly recognise the potential of any tax reduction to increase tourism in Scotland. The logic applied is that lower prices will stimulate visitor demand on existing routes and create the demand for new routes.

Similarly, there is a recognised relationship between business productivity and business air travel, as a proxy for increased business connectivity. This is used to develop productivity impacts of increased business travel brought about by ADT cuts and is discussed further in Chapter 6.

The approach taken to the estimation of each of these impacts is discussed in more detail in Chapter 6.

4. ADT Scenarios

The manifesto commitment of the current Scottish Government was to reduce the overall tax burden associated with APD by 50% by the end of the current session of the Scottish Parliament. There are theoretically a large number of means by which this can be done and modelling all of them would be both time-consuming and potentially confusing. This section sets out a necessarily limited number of scenarios which the Scottish Government specified for testing in this research.

The following scenarios are modelled in the subsequent analysis:

- Scenario 1: 100% reduction in Band A rates only, i.e. 100% **reduction of the short-haul tax** rate with Band B tax rate (long haul) remaining at current levels.
- Scenario 2: 100% reduction in Band B rates only, i.e. 1**00% reduction of the long haul tax** rate with Band A tax rates (short haul) remaining at current levels.
- Scenario 3: 50% tax reductions in both Band A and Band B rates.

Given the uncertainty surrounding the degree to which the reduction in tax will be passed on in the form of cheaper fares, for each of the scenarios outlined above, three different levels of 'pass-through' are also modelled (resulting in 9 scenarios in total), as follows:

- **Variant A: Full** pass-through – i.e. the full tax reduction is **passed on** to the end passenger in the form of reduced fares – this is assumed to minimise supply side response;
- **Variant B: Partial** pass-through (assumed to be 50%) – i.e. half of the tax reduction is **passed on** to the end passenger in the form of reduced fares, whilst the other half is **retained** by the airlines/or absorbed by airport operators and / or used to increase supply.
- **Variant C: Zero** pass-through – i.e. the full tax reduction is **retained** by the airlines and/or absorbed by airport operators – assumed to maximize supply side response.

It is important to note that the above pass-through scenarios are deliberately illustrative and simplistic in nature. Airlines, particularly low cost carriers, are unlikely to manage their pricing decisions on such a simplistic basis, whilst it is possible (as mentioned above) that airports would extract some of the value of the tax reduction in additional fees. Nonetheless, the variants are both appropriate and proportionate in terms of picking up the key issues of pass-through and supply side response, the effects of which have not generally been explicitly considered in previous research.

The next section considers the anticipated demand and supply side assumptions associated with each of the above scenarios.

5. Outcomes – Demand Side & Supply Side

The proposed introduction of ADT, and associated reduction in taxation, has the potential to increase passenger demand for air travel and also improve air connectivity from Scotland. This section describes the approach taken to estimate the demand and supply side responses to reduced ADT, and associated estimates of ADT Payable Trips and total ADT receipts under each of the 9 scenarios described above.

Demand Side Approach

Theoretically, a reduction in tax should lead to a reduction in the cost of air travel, which in turn should generate a corresponding increase in demand. The demand side response to a change in air fares was estimated as below:

- Existing APD charges were deducted from average air fares for each airport and passenger category to identify the base untaxed cost.
- The ADT charged under the three proposed scenarios was then calculated together with how much of the saving would be retained by the airline/airports under all three sets of pass-through assumptions. *For example, if a return flight from Aberdeen to London cost £150 in 2016, then the untaxed fare was £137. If Band A rates reduce by 50%, and 50% of the saving was passed through to passengers, then the fare under the new ADT scenario would be £146.75 (£137 + 0.5 * 0.5 * £13 = £146.75).*
- The proportional change in price was calculated and then price elasticities of demand (PED) applied. PEDs from the UK Aviation Forecasts were applied in the first instance (with a further two sets of alternative PEDs used in sensitivity analysis).
- 'Ramp-up' factors (taken from the (rail) Passenger Demand Forecasting Handbook (PDFH)) were then applied to reflect the fact that behavioural change, which results from a reduction in price may not be immediate.

Supply Side Approach

As noted previously, some airlines are likely to treat a reduction in air passenger taxation as a reduction in their cost base and therefore may:

- fly new routes which are currently not viable;
- reinstate routes which have been withdrawn due to viability issues; and / or
- convert seasonal routes to year-round routes.

As discussed, the airline industry response is expected to depend on the specific sub-sector of the industry. EasyJet and Ryanair have already published statements that they plan to increase the number of flights they operate out of Scotland, if cuts to APD go ahead, while British Airways has said that while it is supportive of the cuts, it does not expect a substantive increase in supply.

The APEX modelling tool has also been used to test a sample of new routes across the different airports and market segments. These case studies have been used to

develop a potential uplift in supply and, in turn, an estimate of passenger numbers which will emerge from this. The APEX modelling work is detailed in Appendix A. In summary, of the 24 routes analysed, the modelling suggested that tax reductions would have a material impact on the viability of 10 routes (42%) and a modest impact on the viability of a further four (17%), so the modelling does support the supposition that a significant supply side response is likely.

In the light of this analysis and the engagement with the industry, Table 5.1 sets out the assumed supply side responses used in the forecasts in the event of a **zero pass-through** of tax cut to fares i.e. full supply side impact (Scenarios 1c, 2c, 3c). These values were estimated on the basis of Scenario **3c** (i.e. a 50% cut in in Band A and Band B, as shown in **bold** in the table below). In the scenarios where the tax in a band is reduced to zero (i.e. a 100% reduction), we have factored the 50% reduction uplift factors by 1.75. In the absence of suitable data, this figure is a study estimate intended to reflect the fact that doubling the tax cut may not necessarily double the supply side impact.

Similarly, where a **partial pass-through** was assumed (Scenarios 1b, 2b, 3b), we have halved these values (i.e. assumed half the supply side impact).

Where there is a **full pass-through** to fares (Scenarios 1a, 2a, 3a), for simplicity we have assumed no additional impact on the supply side other than that associated with accommodating the additional passengers on existing routes.

The biggest supply side impacts have been assumed to be for low cost long haul, but it should be noted that these uplifts are applied to a very low base figure.

Table 5.1: Supply side uplift by scenario and airline type (2019-2021), Zero Pass-through

Scenario	Airline Sector	Band A Uplift	Band B Uplift
1c) 100% cut in Band A only	Network / National / Regional	0.0%	n/a
	Chartered	2.8% per annum / 9% overall	n/a
	Low Cost Carrier	8.1% per annum / 26% overall	n/a
2c) 100% cut in Band B only	Network / National / Regional	n/a	8.1% per annum / 26% overall
	Chartered	n/a	5.5% per annum / 17% overall
	Low Cost Carrier	n/a	17.3% per annum / 61% overall
3c) 50% cut in Band A and 50% cut in Band B	Network / National / Regional	0.0%	4.8% per annum / **15%** overall
	Chartered	1.6% per annum / **5%** overall	3.2% per annum / **10%** overall
	Low Cost Carrier	4.8% per annum / **15%** overall	10.5% per annum / **35%** overall

A supply side reaction is unlikely to be immediate (depending on other commitments / timetable plans etc.), and consultations with airlines suggest that the lag time will vary by market segment. Our modelling has assumed that any supply side reaction would be staggered over three years, beginning in 2019. It should be noted that the supply side responses here are conservative compared to the public pronouncements made by some airlines in relation to their planned response to cuts in APD / ADT.[28]

Note that we have assumed that the demand associated with the new routes accrues at the same rate as existing routes – i.e. the demand response to supply uplifts is perfectly elastic, the logic being that airlines would presumably anticipate load factors on the new routes in line with existing routes. The analysis also assumes a uniform response regardless of the level of supply side uplift – again on the assumption that airlines would only operate routes if commercially viable.

[28] See for example: http://corporate.easyjet.com/~/media/Files/E/Easyjet/pdf/about-easyjet/easyJet-scottish-apd-consultation-response-final-v2.pdf or http://www.scotsman.com/news/transport/ryanair-announces-new-edinburgh-routes-if-air-tax-is-cut-1-4368437

Published plans from airlines reflect growth on existing conditions and so the corresponding uplift in passengers has been calculated by applying these values to the number of 2016 APD Payable Trips.

Market Composition

In order to provide further context for the analysis, the figures below show firstly the estimated market breakdown by key market segment in total, and secondly the same sectors split by short haul (ADT Band A) and long haul (ADT Band B).

These figures have been derived by PBA from analysis of the CAA passenger survey data for Aberdeen, Edinburgh, Glasgow and Prestwick airports and are split by travel by UK residents and Foreign Residents.

Figure 5.1: Scotland's Air Market by Segment (CAA Passenger Survey Data)

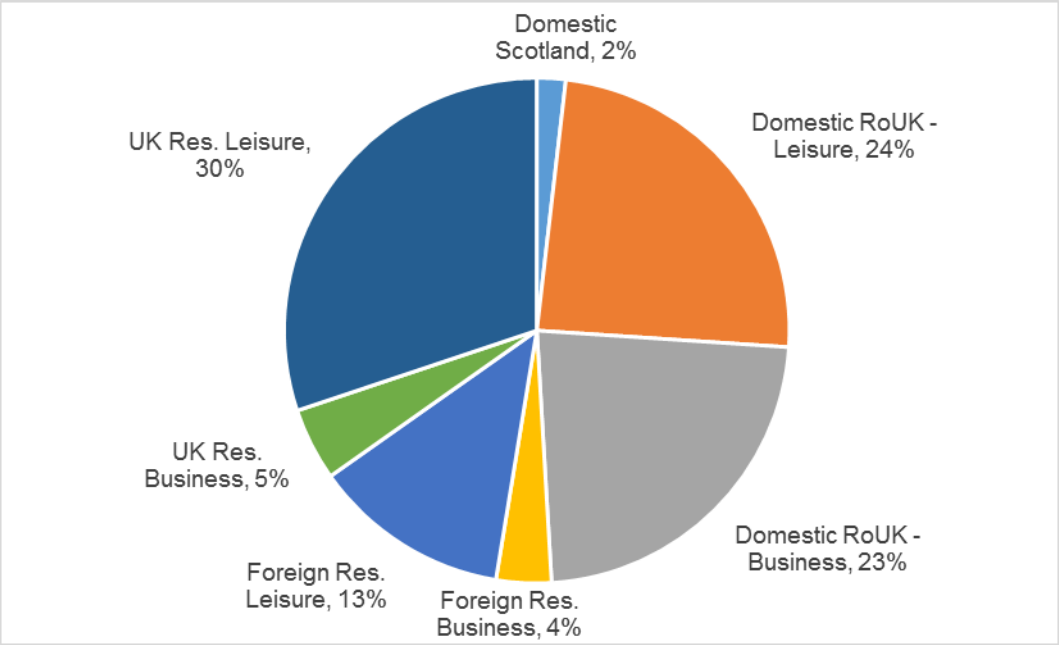
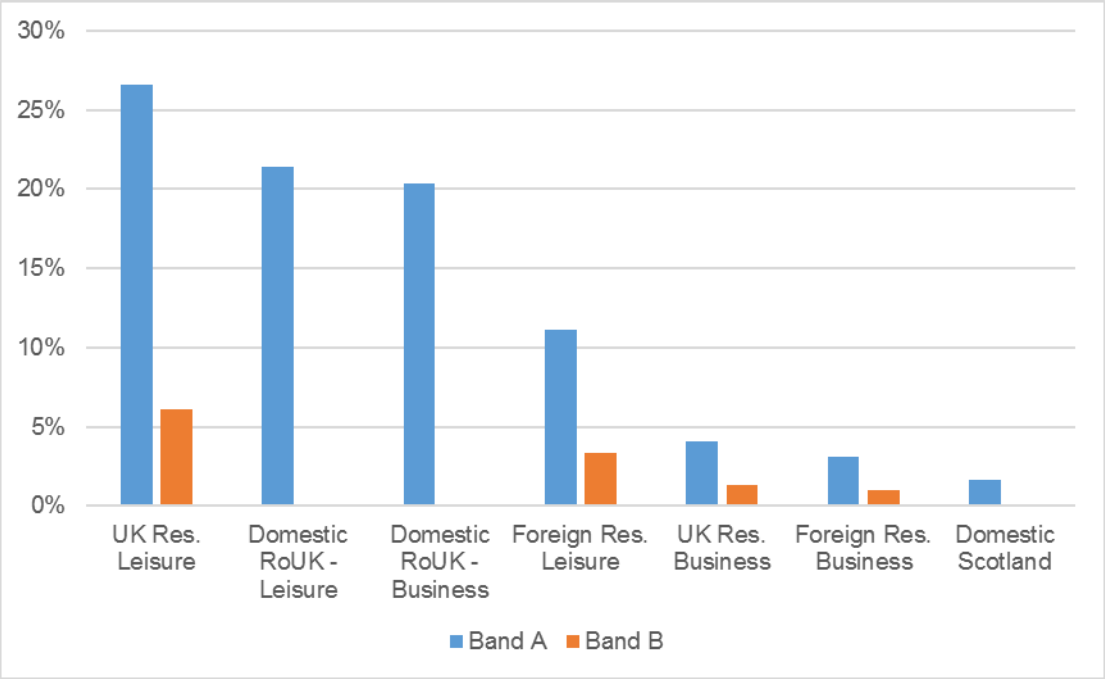


Figure 5.2: Scotland's Air Market by Segment and Short / Long Haul (CAA Passenger Survey Data)



The key points which emerge from this in the context of the ADT Scenarios are:

- The very large majority of ADT paying passengers pay the Band A (short haul) rate. Any change in Band A tax rates, and therefore fares and / or supply will therefore have a bigger absolute impact than the same changes to Band B.
- Band B comprises a higher proportion of Foreign Leisure at 29% than Band A (13%) – on a proportional basis, cuts to Band B would therefore be expected to have a bigger impact on inbound tourism numbers than cuts to Band A.
- Around 30% of the market is for business travel – the evidence from e.g. DfT's UK Aviation Forecasts 2013 suggests that these trips are far less sensitive to changes in fares but would still be responsive to changes in supply.

Headline Results

This section discusses the forecast changes to ADT payable movements and ADT receipts under each of the three scenarios set-out by the Scottish Government and associated variant pass-through assumptions. In this section, a 5-year period from the introduction of ADT in 2018 is reported (i.e. 2018 to 2022). For reference the nine scenarios are listed in the table below.

Table 5.2: ADT Scenarios Modelled

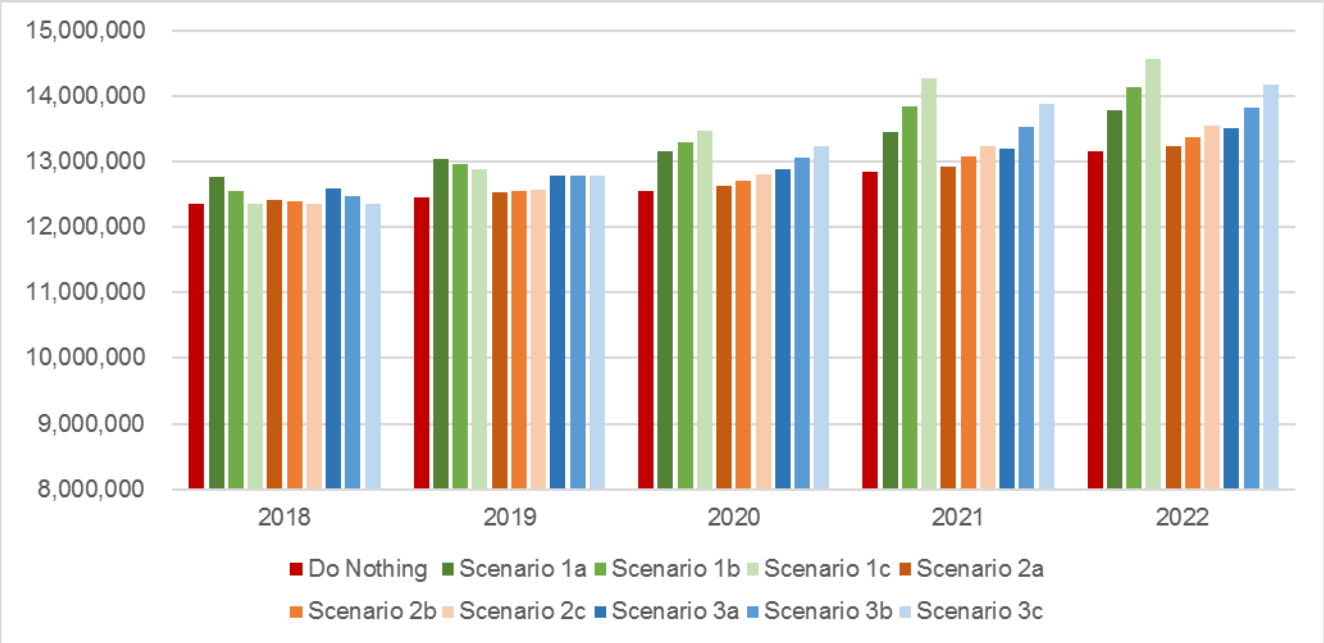
Scenario	Degree of Pass-through of Tax Cut to Fares Reductions	Supply Side Response[29]
1) 100% cut in Band A, no change in Band B	**1a**: Full pass-through (100%)	None
	1b: Partial pass-through (50%)	Partial
	1c: None (0%)	Full
2) 100% cut in Band B, no change in Band A	**2a**: Full pass-through (100%)	None
	2b: Partial pass-through (50%)	Partial
	2c: None (0%)	Full
3) 50% cut in Band A and 50% cut in Band B	**3a**: Full pass-through (100%)	None
	3b: Partial pass-through (50%)	Partial
	3c: None (0%)	Full

The figures below provide a high-level comparison of the nine combined ADT and pass-through sub-scenarios in terms of ADT payable movements and ADT receipts. These figures reflect our core assumptions of:

- Underlying Growth: DfT Central Unconstrained Growth (inc. LCLH factor); and
- Price Elasticities of Demand: DfT UK Aviation Forecasts 2013.

[29] As set out in Table 5.1.

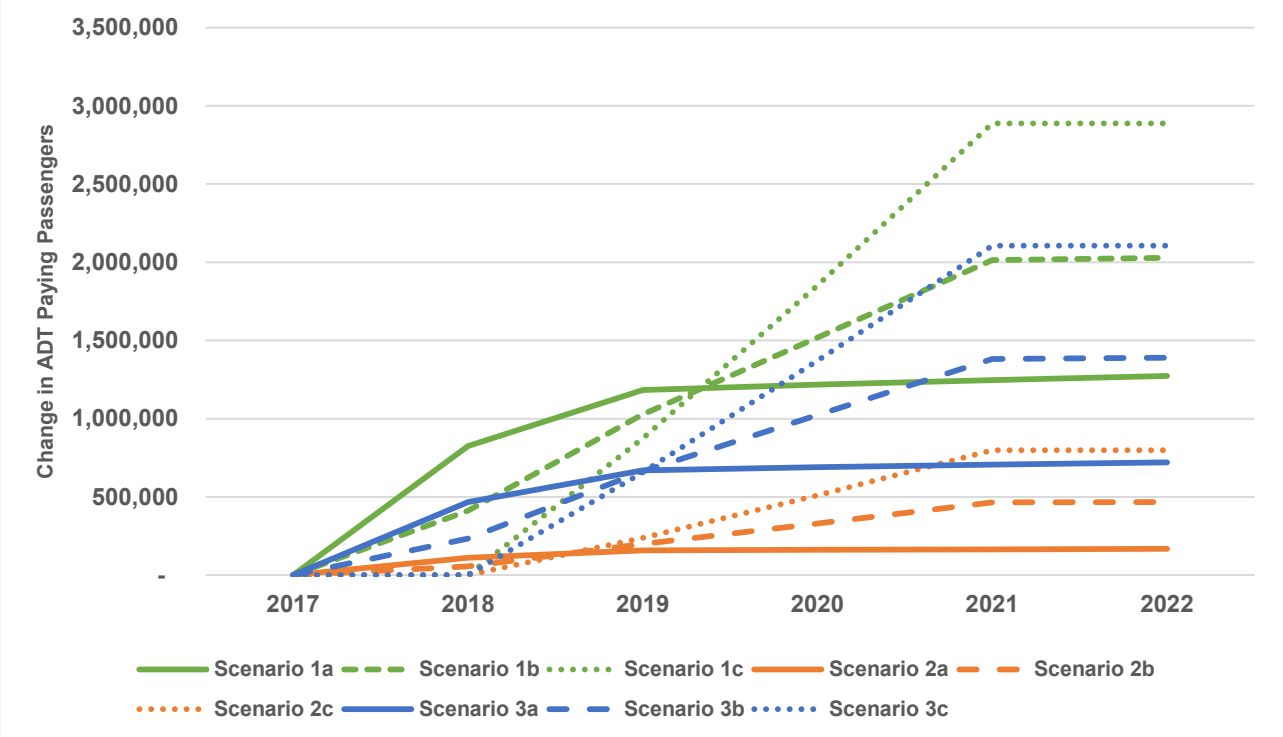
Figure 5.3: Number of ADT payable trips by scenario



It can therefore be seen that even in the 'Do Nothing' case (i.e. current APD rates), ADT paying passengers are projected to increase from 12.4m to 13.2m per annum by 2022. By 2022, under Scenarios 1c and 3c, the figures rise to 14.6m and 14.2m respectively.

To provide greater clarity on the impacts of each scenario, the change from the Do Nothing case for each is shown in the figure below.

Figure 5.4: Additional ADT payable trips – change from Do Nothing



As has been noted there are two main transmission mechanisms through which lower rates of ADT will translate through to an impact on passenger numbers: (i)

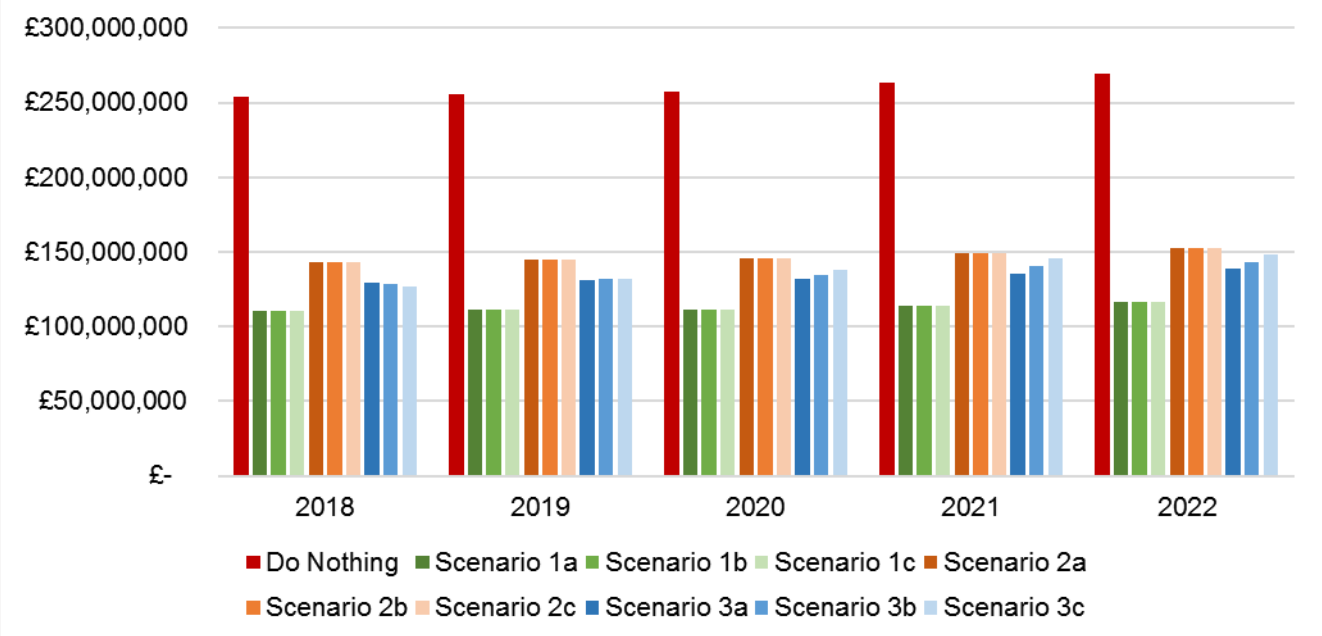
through reduced fares; and (ii) through increased supply resulting from new routes – this additional capacity is assumed to be utilised at the prevailing rate (otherwise these routes would not be operated).

These have differential impacts on demand as noted below:

- In terms of total volumes, Scenario 1 (short haul abolition) and Scenario 3 (short and long haul cuts) typically produce greater increases in ADT payable passengers than Scenario 2 (long haul abolition). The smallest passenger number increases are seen with Scenario 2, where the PEDs and supply side responses are being applied to a lower base volume.
- For any scenario, as the degree of assumed tax reduction pass-through reduces (i.e. as you progress from Variant A to Variant C), the level of assumed supply side response (in the shape of new routes operated) increases. As the assumed supply side response is greater than the fares impact, under all scenarios, Variant C sees the greatest increase in passenger numbers.
- By some margin, the biggest increase in passenger numbers is associated with Scenario 1c, where there is a significant demand side response, which affects some of the main market segments.
- The incremental demand side expansion can be seen in 2018, 2019 and 2020 and the incremental supply side expansion can be seen in 2019, 2020 and 2021. After this the underlying growth rate (as per the Do Nothing) resumes meaning that the scenarios with no reductions in fares (all Variant C scenarios) flat line. The other scenarios continue to see growth relative to the do nothing due to the lower fares.

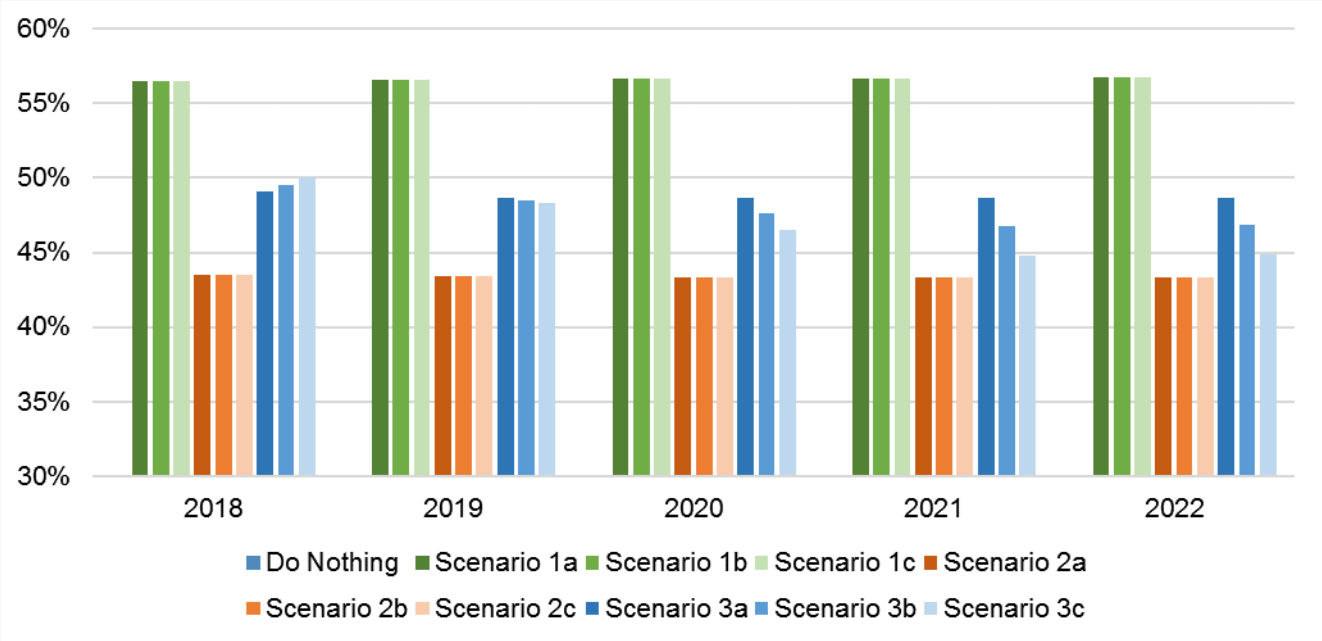
The figure below now shows the associated ADT revenue by scenario by year.

Figure 5.5: ADT Tax Revenue by Scenario



As shown here, under the Do Nothing scenario (and the Core underlying growth assumption), the level of ADT tax would be expected to grow to around **£270m** by 2022. If the DfT Low and High growth scenarios were applied however, this figure could range from **£259m** to **£290m**, representing a significant uncertainty. Again, for clarity, the change in ADT revenue from the Do Nothing for each scenario is shown below.

Figure 5.6: Reduction in ADT Tax Revenue from Do Nothing by Scenario



In Scenarios 1 and 2, the tax is abolished for Band A and Band B respectively. This means that the tax raised relates to only Band B or only Band A, and these will therefore be unchanged from the Do Nothing. Given the balance of tax take by band, this means that the tax take would reduce by around 56% and 44% under Scenarios 1 and 2 respectively. Under Scenario 3, once fully established, the tax take would be reduced by between 46% and 50%. These figures account for the additional tax attributable to the additional passengers resulting from lower fares and increased supply. These figures also suggest a degree of honing of the tax rates would be required to align the future tax take with the manifesto commitment of a 50% reduction in tax take. This should become a possibility when ADT outturn data begins to emerge early in 2018-19.

Scenario Based Sensitivity Tests

The impact that alternative underlying growth and PED assumptions would have on these 'core' values has been analysed. The purpose of this was to demonstrate how the forecasts are impacted by changes in the underlying assumptions.

In addition to the core test (DfT Central (unconstrained) Growth / UK Aviation Forecasts Elasticities), the eight sensitivities are:[30]

- DfT Low Growth / Core (UK Aviation Forecasts) Elasticities

[30] See Chapter 3 for details of the Intervistas and Gillen elasticities

- DfT Low Growth / Intervistas Elasticities (higher than DfT)
- DfT Low Growth / Gillen et al Elasticities (higher than DfT and Intervistas)
- DfT Core (Central (unconstrained)) Growth / Intervistas Elasticities
- DfT Core (Central (unconstrained)) Growth / Gillen et al Elasticities
- DfT High Growth / Core (UK Aviation Forecasts) Elasticities
- DfT High Growth / Intervistas Elasticities
- DfT High Growth / Gillen et al Elasticities

To provide an indication of the degree of sensitivity associated with the differing underlying growth scenarios and elasticities, the table below shows, for each scenario:

- the Core ADT paying passengers and associated revenue for 2022; and
- the lowest and highest figures determined from applying the various elasticities and underlying growth scenarios.

Table 5.3: Summary of ADT Scenarios Modelled

	ADT Paying Passengers (millions, 2022)			**ADT Revenue (2022)**		
DfT passenger growth scenario	***Core***	**Low**	**High**	***Core***	**Low**	**High**
1a	*13.8*	13.2	15.6	*£117m*	£113m	£127m
1b	*14.2*	13.6	15.5	*£117m*	£113m	£127m
1c	*14.6*	14.0	15.5	*£117m*	£113m	£127m
2a	*13.2*	12.7	14.3	*£153m*	£146m	£164m
2b	*13.4*	12.8	14.4	*£153m*	£146m	£164m
2c	*13.5*	13.0	14.5	*£153m*	£146m	£164m
3a	*13.5*	12.9	14.9	*£138m*	£133m	£154m
3b	*13.8*	13.3	15.0	*£143m*	£138m	£156m
3c	*14.2*	13.6	15.1	*£149m*	£143m	£159m

It can therefore be seen that these values typically fall within -5% to +15% of the core values by 2022. These results are reported in more detail in Appendix B where each chart provides a ‘fan’ of results which compares each of the underlying growth and PED combinations with the Core forecast.

Other Issues to Consider

The preceding analysis set out potential outcomes associated with the different scenarios related to the introduction of ADT. The analysis undertaken assumes that, out-with the reduction in duty, all other things remain equal. Whilst this is a pragmatic research assumption, there are a number of wider issues and events that could have a material impact on the forecasts. These are set out below:

- Opportunities
    - Improvements in aircraft technology are creating a climate for the emergence of low cost long-haul. This could be a major 'market disruptor' and presents an important opportunity for Scottish airports. The main prospect in the Scottish context currently is Norwegian, which is offering low cost flights to a number of cities in the United States, predominantly on the East Coast. However, Level, an IAG (International Airlines Group) subsidiary, has commenced flights from Barcelona to the United States, the Dominican Republic and Argentina. If this segment grows in a similar manner to how the short-haul low cost sector did in the 1990s and early 2000s, it could represent a fundamental evolution in the aviation industry. We have included an estimate of the scale of potential impact of this sector in the above analysis, but in reality the overall impact remains uncertain.
- Risks
    - The industry consultations highlighted the significant risk posed by the United Kingdom's planned departure from the European Union. On both the demand and supply side, aviation is an industry which relies as far as possible on the free movement of people and assets. The industry consultation highlighted the significant risks to the aviation market posed by a so-called 'hard Brexit' and explained that, if these risks materialise, the impacts will outweigh the positive impacts of introducing ADT at lower levels than the current APD regime.
    - The introduction of ADT will stimulate demand for additional air travel, either directly through lower prices or indirectly via additional routes / connections / frequency. In order to keep pace with demand, there may need to be a series of supply side responses to address constraints associated with e.g. terminal capacity, stand capacity and ultimately runway capacity over time. Investment may therefore be required to deliver the long-term demand forecast (this is captured in airport masterplans to some degree), although the forecasts undertaken here do not suggest that this point will be reached in the short term.
    - It is conceivable that reducing the level of ADT would have very little or no impact on either the fares paid by passengers or the level of connectivity provided out of Scotland. In this case, the tax cut would be subsumed within the aviation sector with no discernible supply side impact and therefore no wider economic impact. However, we consider the likelihood of this outcome to be low given the level of competition in the air market in Scotland, the evidence from cuts in

similar taxes elsewhere, and the public pronouncements on this matter made by some airlines to date.

It is also worth noting that:

- Passenger traffic through Aberdeen Airport is disproportionately affected by the performance of the oil and gas market. In the context of business travel from Aberdeen, the trend in the oil price is likely to have a much more significant impact on passenger numbers than the introduction of ADT at lower levels than the current APD regime.
- APD is not currently paid for trips originating from the Highlands & Islands. It is assumed in this study that this position will continue when ADT is introduced.

6. Economic Impacts

Having defined the *outcomes* in terms of the aviation industry, this chapter considers the wider economic *impacts* on Scotland as a whole, corresponding with the final step in the Logic Map. The analysis presented below makes use of Scottish Enterprise's *Economic Impact Assessment Guidance*[31] in determining the net additional impact of introducing ADT on jobs and Gross Value Added (GVA) at the Scotland level.

The anticipated economic impacts associated with the introduction of ADT stem from an expected increase in passenger numbers, either in direct response to a reduction in fares or indirectly as a result of responses to supply side improvements (or more realistically a combination of the two effects). The impacts of introducing ADT can be defined in terms of three broad areas:

- **Operational impacts:** the economic activity associated with the changes in the operations of airports and air services in Scotland (including 'based aircraft' as a separate entity).
- **Tourism / visitor impacts:** employment supported by increased inbound tourism.
- **Wider business impacts (i.e. productivity):** improvements in the long-term productivity level due to increased numbers of business passengers.

It is important to acknowledge that, whilst standard economic impact assessment measures provide an indication of the scale of impacts based on various parameters, they do not necessarily evidentially record causality between an outcome (i.e. additional passengers) and impact (i.e. additional employment). For example, by relating an uplift in passenger numbers to a jobs per additional passenger factor and then to a GVA per job factor, it is possible to develop an estimate of the impact of introducing ADT at a lower rate than that currently charged. However, what this analysis does not reveal is the means by which this happens (i.e. the 'transmission mechanisms'). The economic impact model estimates contained within this chapter are therefore supplemented by an economic narrative, which sets out the transmission mechanisms as well as any limitations in the modelling approach.

The next section sets out the key principles of Economic Impact Assessment (EIA), with the subsequent section applying these for each of the above noted impacts.

Economic Impact Assessment

An economic impact assessment is focussed on calculating the **net additional impacts of a public sector investment** – i.e. what level of benefits arise because of the intervention that would not otherwise have occurred. There are five key determinants of what economists refer to as 'additionality':

[31] https://www.scottish-enterprise.com/~/media/.../economic-appraisal-guidance-note.pdf

- **Deadweight** – benefits that would have occurred without the intervention, so in this case the extent to which passenger numbers would have grown if the current APD regime was maintained:
- **Leakage** – the proportion of benefits that accrue to those outside of the intervention target area or group;
- **Displacement** – the proportion of intervention benefits accounted for by reduced benefits elsewhere in the target area; and
- **Substitution** – arises where a firm substitutes one activity for a similar one to take advantage of public sector assistance.
- **Multipliers** – multipliers estimate further economic activity (e.g. jobs, expenditure or income) associated with additional local income and local supplier purchases.

The premise of the above is that the net additional impact is calculated by subtracting the deadweight from the 'gross' impacts. That is, the additional impact is equal to the total impact minus what would have happened without the intervention (i.e. the deadweight).

For reference the full equation is shown below:

$$AI = [GI \times (1 - L) \times (1 - Dp) \times (1 - S) \times M] - [GI^{*} \times (1 - L^{*}) \times (1 - Dp^{*}) \times (1 - S^{*}) \times M^{*}]$$

AI =	Net additional impact	Dp =	Displacement
GI =	Gross impact	S =	Substitution
L =	Leakage	M =	Multiplier

The economic impact in relation to each area of impact was estimated at a Gross level. Though deadweight is taken into account through comparison with the Do Nothing scenario (i.e. the continuation of the current APD regime), there is insufficient data available to quantify the leakage, displacement and substitution effects. These are picked up in a qualitative manner in the supporting narrative.

In the analysis which follows, a five-year period from the introduction of ADT in 2018 is used for reporting purposes. The jobs presented in this analysis are therefore a cumulative figure developed over five years from 2018 to 2022 (inclusive). Note though that a new job is only counted once in the year in which it appears. GVA also accrues on an annual basis in line with the increase in passenger numbers, and this GVA is also cumulative over the five-year period. In this case though, GVA which is generated in e.g. Year 1 is assumed to recur in each year over the five-year period and is therefore accounted for in successive years.

For brevity, the figures reported in this chapter reflect the core assumptions with respect to the underlying growth scenario (DfT Central (unconstrained) including Low Cost Long Haul adjustment) and UK Aviation Forecasts elasticities. The

sensitivity analysis presented previously provides an indication of how these jobs and GVA figures may vary using different underlying assumptions, broadly plus or minus 10% over this five-year period although this range would grow over time. For simplicity, GVA figures are presented in un-discounted[32] nominal terms and are not converted to a constant price year. Therefore, they do not account for inflation or that future benefits are valued less at present.

Operational Impacts

There are two discrete impacts within this overall criterion:

- The impact associated with additional passengers on airlines, airports and their supply chain.
- The impact associated with additional based aircraft at Scottish airports.

Additional Passengers

There will be a *direct* economic impact associated with a change in passenger numbers, in terms of:

- additional airport and airline staff required to handle additional passenger numbers (additional based aircraft are considered in the next section);
- increased density of aviation operation, creating the potential for spin-off employment in terms of e.g. maintenance, ground-handling services; and
- Increased demand for e.g. parking, airport public transport connections, retail etc.

The direct economic impact of the estimated increase in passenger numbers was calculated based on the most recent research commissioned by ACI Europe in 2015[33]. In overview, this research established that every 1,000 passengers through an airport generates one additional job. However, this varies by:

- the size of the airport: the presence of economies of scale suggests that larger airports employ fewer staff per 1,000 passengers; and
- traffic / airline type: passengers flying on low cost carriers have a smaller direct employment impact than other types of traffic, generating 20% fewer jobs per 1,000 passengers.

Therefore, a set of assumptions about additional direct employment as a result of the estimated increase in passenger numbers was applied to Aberdeen, Edinburgh, Glasgow and Prestwick airports based on their size and type of traffic[34]. Direct

[32] Discounting is the process of determining the present value of a payment or benefit or a stream of payments or benefits that is to be received in the future.

[33] 'Economic Impact of European Airports: A Critical Catalyst to Economic Growth', Intervistas for ACI Europe, January 2015.

[34] Note – Dundee Airport is excluded from the analysis due to the very low passenger numbers and Inverness is excluded as no APD / ADT is payable there.

GVA was then calculated based on the Scottish Annual Business Survey[35] statistics for the transport sector.

Indirect economic impacts (i.e. employment and GVA generated by the aviation industry supply chain) and *induced* economic impacts (i.e. employment and GVA generated by the income expenditure of the direct and indirect employment) were calculated using Scottish Input-Output Tables[36] Type I and Type II[37] multipliers for the air transport sector.

The job impact figures have been calculated as follows:

- calculating the additional passengers per annum across the listed airports for each of the forecast years;
- applying the additional passengers by airport to the ratio of jobs per additional passenger;
- applying the Type II employment multiplier to the direct job numbers to calculate the indirect and induced jobs; and
- the additional jobs accrue on an annual basis, aligning with the annual increase in passenger numbers.

The GVA figures have been calculated by:

- applying the additional direct jobs generated to a 'GVA per job' figure; and
- applying the Type II GVA multiplier to the direct GVA to calculate the indirect and induced GVA.

Based on the above calculations, the table below sets out the anticipated gross and net additional jobs and GVA associated with the increase in passenger numbers through the above listed airports.

[35] http://www.gov.scot/Resource/0052/00523747.xls

[36] http://www.gov.scot/Resource/0052/00522790.xlsx

[37] Type I: A supply linkage multiplier (sometimes referred to as an indirect multiplier) due to purchases made as a result of the intervention and further purchases associated with linked firms along the supply chain; Type II: An income multiplier (also referred to as a consumption or induced multiplier) associated with local expenditure as a result of those who derive incomes from the direct and supply linkage impacts of the intervention.

Table 6.1: Economic Impact of Additional Airport Passengers, 2018-2022

		100% Reduction in Band A			100% Reduction in Band B			50% Reduction in Bands A & B		
Cumulative 2018-2022	**Do Nothing**	**S1a: Full Pass-through**	**S1b: Partial Pass-through**	**S1c: Zero Pass-through**	**S2a: Full Pass-through**	**S2b: Partial Pass-through**	**S2c: Zero Pass-through**	**S3a: Full Pass-through**	**S3b: Partial Pass-through**	**S3c: Zero Pass-through**
Gross Additional Jobs	**3,340**	5,780	7,200	8,840	3,670	4,260	4,910	4,720	6,000	7,380
Gross Additional GVA	**£321m**	£787m	£886m	£1,006m	£384m	£447m	£516m	£585m	£702m	£827m
Net Additional Jobs		2,440	3,860	5,500	330	920	1,570	1,380	2,660	4,040
Net Additional GVA		£466m	£566m	£685m	£63m	£126m	£195m	£265m	£381m	£506m

Note:

- *Jobs are rounded to the nearest 10*
- *GVA is rounded to the nearest £million*

The table above highlights that the net additional jobs and GVA associated with direct operational impacts tend to be largest:

- where pass-through is lowest – in each scenario, the largest impact accrues in the zero pass-through scenario, i.e., where the maximum supply side response variant is assumed; and
- where the reduction in Band A is largest (i.e. Scenario 1, which provides for a 100% reduction in short-haul APD therefore records the largest impact).

By extension of the above, Scenario 1c (100% reduction in Band A with zero pass-through) records the largest benefit followed by Scenario 1b and 3c. Whilst the development of the long-haul network may potentially be more advantageous in terms of the wider Scottish economy, the biggest impact under this category will be realised in the short-haul sector, given that the market is much larger (and thus will generate more additional passengers).

As noted above, the jobs and GVA highlighted in the table represent the cumulative growth over a five-year period. Purely as an example, the illustrative charts below highlight the build-up of the net jobs and GVA impacts for Scenario 1b (S1b).

Figure 6.1: Annual and Cumulative Jobs Growth Under S1b (Net)

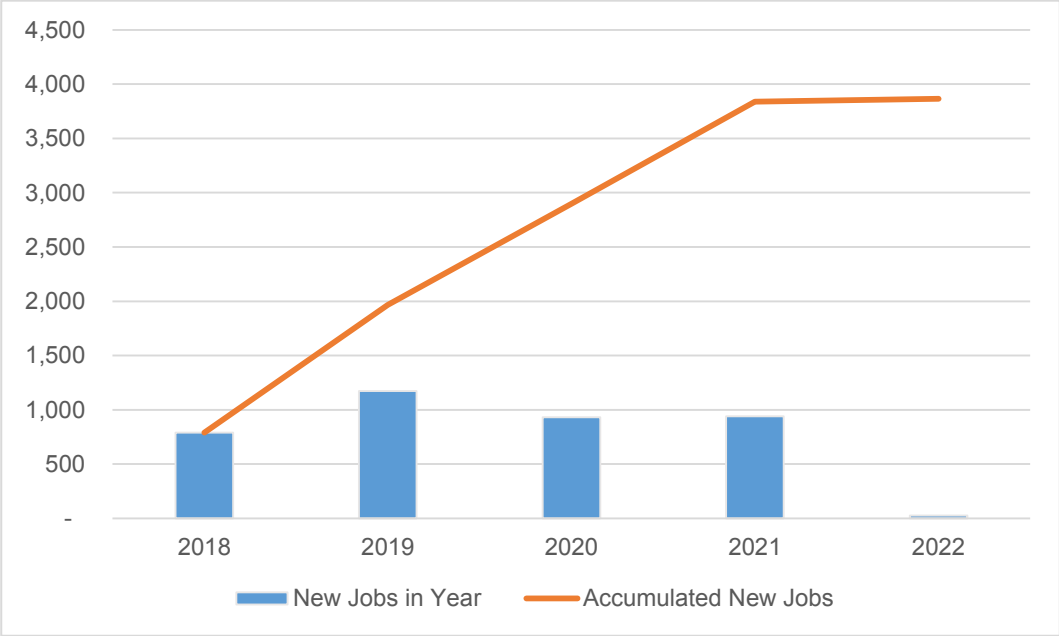
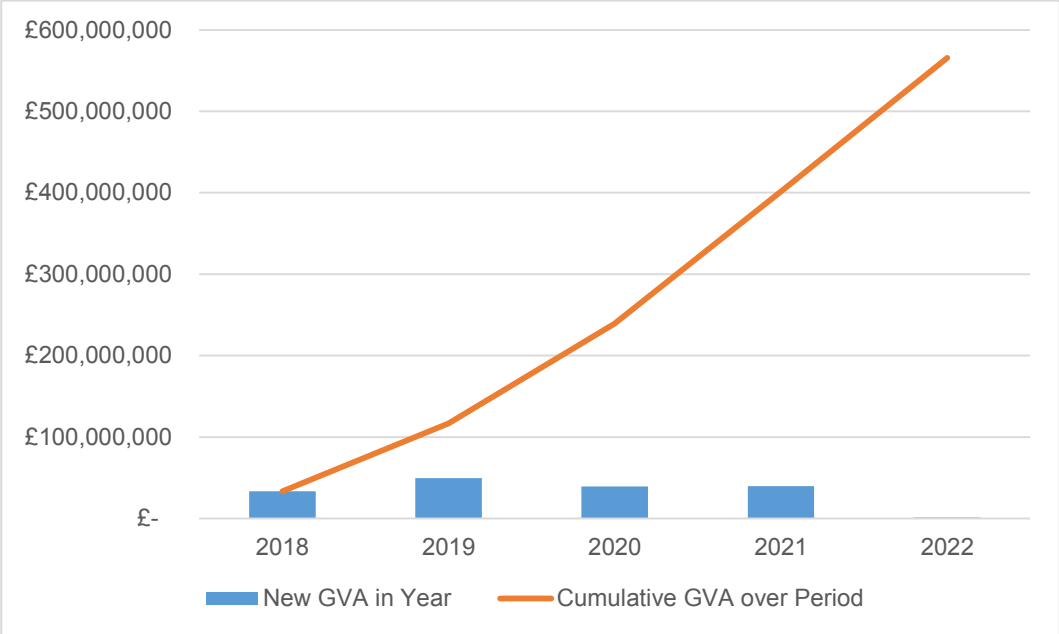


Figure 6.2: Annual and Cumulative GVA Growth Under S1b (Net)



Leakage

There is unlikely to be any leakage in the context of this impact, as passenger numbers through Scottish airports as whole are likely to increase. More generally though, additional passengers and flights will also generate additional economic activity out-with Scotland, and non-UK airports and airlines will benefit if the policy leads to greater profitability.

Displacement

A proportion of the estimated additional airport passengers from increased demand for domestic flights may comprise passengers that have switched mode from rail. Although internal Transport Scotland analysis has indicated that there could be a marginal loss of cross border rail passenger journeys if air fares decrease, particularly for the Scotland – London market, the overall impact on Scotland's rail industry of a 50% cut to ADT is expected to be relatively small. Taking this into account and the uncertainties surrounding potential offsetting effects ie. future improvements to rail services, reductions in rail fares etc., calculating this impact was considered beyond the scope of this work.

Displacement among Scotland's airports is also likely to be minimal. At the margins, there is a possibility that passenger numbers through Inverness Airport could decline if there is a reduction in Band A rates (i.e. Scenarios 1 and 3). At present, passengers departing from Inverness Airport are not liable for APD and it is assumed that this will continue to be the case when ADT is introduced. However, the comparative position of this airport will worsen as other Scottish airports benefit from a reduction in fares and / or expansion of the route network. Given the distances and travel costs from Inverness to other airports, it is likely that any such impact will be minimal. Inverness Airport's relatively small passenger numbers (783,000 per annum or 3% of the Scottish total) would also suggest the impact at Scottish level even of a more substantial displacement effect is relatively minor in Scottish terms.

There is likely to be a more notable displacement from airports in the north of England, irrespective of which tax reduction scenario is pursued. However, it should be noted that this study is reporting at the Scotland-level only and thus displacement from elsewhere in the UK is not recorded as a negative factor. A UK-wide study would count this impact however.

Substitution

There is unlikely to be any substitution effects in the context of this impact.

Based Aircraft

Previous research and our consultation with industry undertaken as part of this study suggests that a 'based' aircraft will generate a higher level of employment and GVA than a non-based aircraft. As well as additional crew, the aircraft is likely to require a range of support services to ensure its safe and efficient operation. It is important to note here that a based aircraft is not simply one which overnights at an airport, but is the home base of that plane, with support (e.g. crew, ground handling, aircraft cleaning, catering suppliers, fuel providers etc.) provided from there.

The literature and airline pronouncements identifies various jobs figures associated with based aircraft including:

- 60 jobs for an additional easyJet aircraft based at Edinburgh[38];
- 130 jobs for two Norwegian Airlines aircraft based at Edinburgh[39];
- 50 jobs with an additional Jet2 aircraft at Glasgow[40]; and
- 150 jobs associated with an additional aircraft and expanded operations by Jet2 at Edinburgh[41].

However, consultation undertaken with one low cost carrier explained that there are **43 jobs** associated with each of their based aircraft. Given that the Scottish market, particularly in terms of based aircraft, is currently dominated by Low Cost Carriers, and the likelihood that any additional based aircraft will be predominantly concentrated in the Low Cost or Charter sectors, the above figure is used as the basis of the subsequent analysis in this section. Note that the figure used here is therefore conservative compared to those quoted in the media, and new primary research with the airlines would be required to derive definitive figures.

The following steps have been undertaken in calculating the jobs associated with an additional based aircraft:

- Industry estimates, obtained through the consultation, suggest that each additional 500,000 passengers per annum will support one additional based aircraft[42].
- This aircraft will in turn support 43 direct jobs.
- Applying the Type II employment multiplier to the direct job numbers to calculate the indirect and induced jobs.
- As with the direct operational impacts, the additional jobs accrue on an annual basis, aligning with the annual increase in passenger numbers. The jobs presented in the subsequent analysis are therefore cumulative figures developed over 10 years.

The method of calculating GVA is equivalent to that used in calculating the GVA associated with operational impacts.

It is uncertain from the literature whether the economic impact of based aircraft is captured within the direct operational impacts (and the associated multipliers) or otherwise. Whilst we have presented below what we assume to be the additional jobs and GVA impact of based aircraft, there is a possibility that there may be a small element of double counting of the operational impacts identified in the previous section.

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38 http://www.bbc.co.uk/news/uk-scotland-scotland-business-12555618

39 http://www.mynewsdesk.com/uk/norwegian/pressreleases/norwegian-to-create-more-than-130-jobs-in-scotland-ahead-of-plans-for-continued-expansion-at-edinburgh-airport-1718971

40 http://www.dartgroup.co.uk/Media/News/Jet2_com_Announces_Even_More_Destinations_from_Glasgow/

41 http://www.edinburghairport.com/about-us/media-centre/press-releases/jet2-announce-massive-growth-at-edinburgh-airport

42 E.g. Ryanair = Average of 4 rotations per aircraft x 2 (i.e. inbound and outbound) x189 seats x90% load factor x 365 days a year (allows for line maintenance overnight only) = 496,692.

Table 6.2: Economic Impact of Based Aircraft, 2018-2022

		100% Reduction in Band A			100% Reduction in Band B			50% Reduction in Bands A & B		
Cumulative 2018-2022	**Do Nothing**	**S1a: Full Pass-through**	**S1b: Partial Pass-through**	**S1c: Zero Pass-through**	**S2a: Full Pass-through**	**S2b: Partial Pass-through**	**S2c: Zero Pass-through**	**S3a: Full Pass-through**	**S3b: Partial Pass-through**	**S3c: Zero Pass-through**
Gross Additional Jobs	**360**	620	770	940	400	460	520	510	640	780
Gross Additional GVA	**£35m**	£84m	£95m	£107m	£42m	£48m	£55m	£63m	£75m	£88m
Net Additional Jobs		260	410	580	40	100	160	150	280	420
Net Additional GVA		£49m	£59m	£72m	£6m	£13m	£20m	£28m	£40m	£53m

Note:

- *Jobs are rounded to the nearest 10*
- *GVA is rounded to the nearest £million*

As with the impacts associated with additional passengers, the largest net benefit in terms of additional based aircraft accrues in Scenario 1c, the 100% reduction in Band A rates with zero pass-through. This is an intuitively sensible finding as:

- Given the route-network in Scotland, short-haul carriers, particularly in the low cost carrier sector, are more likely to base an aircraft in Scotland than network carriers, which will tend to be based around larger hub airports where they benefit from economies of scale (e.g. British Airways at Heathrow and Emirates in Dubai).
- The supply side impact is assumed to be largest in the zero pass-through scenario.

Leakage

There are unlikely to be any leakage effects associated with additional based aircraft.

Displacement

There are unlikely to be any displacement effects associated with additional based aircraft.

Substitution

There are unlikely to be any substitution effects associated with additional based aircraft.

Tourism Impact

It is anticipated that a combination of lower fares, increased frequencies on existing routes and entirely new routes will lead to an increase in inbound tourism to Scotland. The literature review suggests that the 'tourism effect' will be a combination of direct additional trips to Scotland and enticing those on holiday in England (particularly in London and the South-East) to visit Scotland as part of that holiday.

Analysis of the CAA passenger survey suggests that there is a larger proportion of foreign tourists on a long-haul flight (37%) than a short-haul flight (16%). Therefore, from an economic impact perspective, the largest marginal gains will be associated with the addition of long-haul connections, although these numbers are much smaller in an absolute sense.

The additional inbound tourism expenditure was calculated by:

- Using the estimated increase in inbound foreign tourist passengers and the average spend per visit[43].
- Based on the Scottish Annual Business Survey, an estimate of the GVA factor for the tourism industry[44] (0.56) was calculated, i.e. for every £100 spent in the tourism sector, £56 is added to GVA.
- This GVA factor was applied to the additional inbound tourism expenditure to calculate additional direct employment and GVA for the Scottish tourism industry.
- Indirect and induced impacts were then calculated using relevant multipliers from the Scottish Input-Output tables.

[43] Average spend per overseas tourist visiting Scotland was £675 in 2016 using VisitScotland statistics.

[44] Proxied based on accommodation and food services sectors.

- It should be noted that the employment and GVA figures associated with increased tourism will materialise in year 1 (2018) and grow over time in line with passenger numbers.

Table 6.3: Economic Impact of Additional Tourism, 2018-2022

		100% Reduction in Band A			100% Reduction in Band B			50% Reduction in Bands A & B		
Cumulative 2018-2022	**Do Nothing**	**S1a: Full Pass-through**	**S1b: Partial Pass-through**	**S1c: Zero Pass-through**	**S2a: Full Pass-through**	**S2b: Partial Pass-through**	**S2c: Zero Pass-through**	**S3a: Full Pass-through**	**S3b: Partial Pass-through**	**S3c: Zero Pass-through**
Gross Additional Jobs	45,240	47,970	49,190	50,620	45,700	46,800	48,030	46,840	48,310	49,910
Gross Additional GVA	£5,327m	£5,629m	£5,631m	£5,658m	£5,366m	£5,426m	£5,492m	£5,490m	£5,549m	£5,614m
Net Additional Jobs		2,730	3,950	5,380	460	1,560	2,790	1,600	3,070	4,670
Net Additional GVA		£301m	£304m	£331m	£38m	£98m	£165m	£163m	£222m	£287m

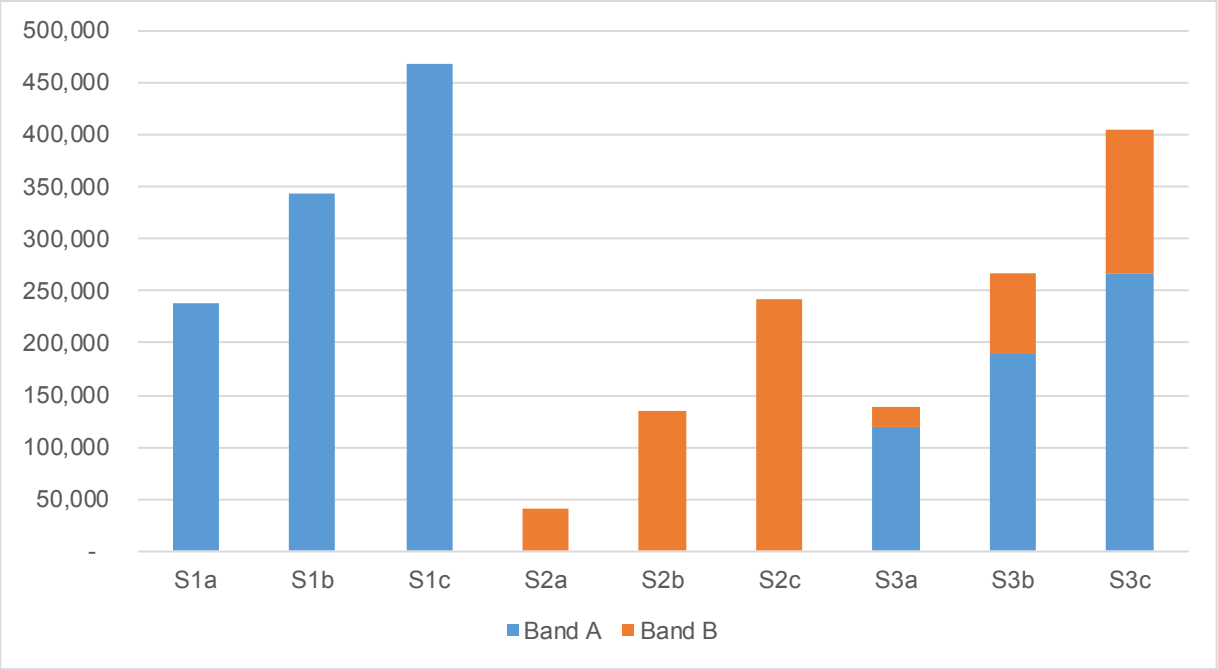
Note:

- *Jobs are rounded to the nearest 10*
- *GVA is rounded to the nearest £million*

From a foreign tourism perspective, the scenario which records the biggest impact in terms of jobs and GVA is again **S1c** (i.e. 100% reduction in Band A with zero pass-through and maximum supply side response). The differential between Scenario 1 and Scenario 2 is narrower on this occasion as the long haul market has a higher proportion of foreign leisure.

For clarity, the forecast impact of the different scenarios in generating additional inbound tourists by ADT band is shown in the figure below.

Figure 6.3: Estimated Additional Inbound Tourists by ADT Scenario, 2022



The balance between Band A and Band B reflects both the higher assumed supply side response in Band B, given the relative scale of the tax reductions, and the fact that Band B has a slightly higher proportion of inbound foreign leisure than Band A.

It should be noted that an assumed spend of £675 per foreign tourist is used to generate the employment and GVA estimates. It is however likely that foreign tourists on long-haul trips are likely to have a higher spending profile and visit for a longer period than those in the short-haul market. The employment and GVA estimates in Scenarios 2 and 3 may therefore be something of an underestimate.

Leakage

The objectives for the introduction of ADT set by the Scottish Government explicitly recognise the potential of the tax reduction to increase tourism in Scotland. The logic applied is that the reduction in tax will (i) result in lower prices which will stimulate visitor demand on existing routes and/or (ii) create viable new connections, as is evidenced in the previous section.

Whilst this is likely to be true, it is important to understand that any transport improvement is effectively a 'two-way street' – the impact of improving connectivity on the balance of tourism and subsequent economic impact therefore has to be considered. In this context, a brief review of tourism statistics suggests the following:

- There are roughly twice as many trips abroad by UK visitors as trips to the UK by foreign visitors.
- The spend per visit to the UK by foreign citizens is approximately equal to spend per trip overseas by UK citizens.

- Therefore, overall there must be a degree of net outflow of money from the UK economy as a result of all tourism as a whole.
- In terms of Scotland, analysis of the 2013 CAA Passenger Survey suggests that the ratio of outbound to inbound tourist trips through Scotland's airports is around 2.2:1, i.e. there are 2.2 outbound tourist trips per inbound trip. If this ratio holds for new trips which result from cuts in ADT, then there would be expected to be a net outflow of tourism as a result of the policy.

Therefore, in economic terms, any inbound tourism stemming from lower fares / greater connectivity creates benefits which are 100% additional to Scotland. However, additional outbound tourism stemming from lower fares / greater connectivity creates a much more complex set of economic impacts.

We are assuming here that had ADT not been introduced at a lower rate than APD, these new outbound tourism trips would not have been made. In this case, the counterfactual situations for those concerned would include:

- Leave the money in the bank: spending this money instead on an overseas trip will therefore generate leakage;
- Holidayed in Scotland: spending this money instead on an overseas trip will therefore generate leakage; or
- Spent the money domestically on goods or services: the degree of leakage in this case would depend on the balance of spend between domestic and imported goods and services.

In terms of the leakage associated with overseas travel, there are studies that suggest that domestic spending prior to travelling overseas offsets to some extent the economic leakage associated with leaving the country, i.e. not all of the spend associated with an overseas leisure trip by a UK resident is 'leaked' out of the country. The most recent of these studies was the research carried out for ABTA on *The Economic Value for Outbound Travel* (2015)[45]. The research found that, in 2015, spend abroad by UK residents was almost exactly the same as their spend in the UK prior to their holidays. It is therefore suggested that, in the context of this transaction alone, only half of the spend associated the trip is 'leaked' abroad.

Given these complexities, it is not possible to quantify the counterfactual balance of spend between domestic and imported goods and services from forecast additional overseas travel by Scottish residents.

Although it is highly likely that additional overseas leisure travel by Scotland's residents will offset to a greater or lesser degree the additional economic activity generated by increased inbound tourism, it is also important to note that whilst not

[45] https://abta.com/assets/uploads/publications/Driving_Growth_Report_2015.pdf

an *economic* benefit, Scotland's residents clearly gain a range of '*social welfare*' benefits[46] from foreign travel.

It was therefore agreed by the authors that due to the intricate nature of these interactions and the uncertainties surrounding them, a robust estimate of the potential outbound tourism leakage impacts that could arise from each of the ADT reduction scenarios was not feasible in the context of this work.

Displacement

Any cut in ADT would affect all major Scottish airports except Inverness. As Inverness has limited international connectivity, it is reasonable to assume that any displacement of inbound tourism from Inverness to Edinburgh / Glasgow would be outweighed by the overall increase in tourist visits to Scotland, many of whom would travel to the Scottish Highlands as part of their visit.

Substitution

There are unlikely to be any substitution effects associated with this impact.

Wider Business Impacts

The final impact likely to emerge from the introduction of ADT is an increase in business productivity associated with enhanced and new domestic and international connections.

In calculating the potential improvements in the long-term productivity level, the relationship between the number of business passengers and labour productivity was explored. A report by PwC[47] found that a 10% increase in business passenger numbers would result in a 0.2% increase in productivity and our literature review noted that this relationship has been widely used in similar studies. This relationship was therefore applied to the estimated number of business passengers in order to calculate changes in productivity level, which were then used to calculate employment supported by these improvements in productivity.

The table sets out the anticipated productivity benefits, expressed in terms of employment and GVA, associated with the introduction of ADT.

[46] Welfare Benefits are routinely calculated in transport appraisal and capture non-monetary benefits based on consumer surplus theory.

[47] "The Economic Impact of Air Passenger Duty: A Study by PwC", PwC, February 2013. A more recent version of this report (http://airlinesuk.org/wp-content/uploads/2015/06/The-economic-impact-of-APD-analytical-update-PwC-May-2015.pdf) supports the general finding but uses a different formulation which is less applicable here.

Table 6.4: Economic Impact of Improved Business Productivity, 2018-2022

		100% Reduction in Band A			100% Reduction in Band B			50% Reduction in Bands A & B		
Cumulative 2018-2022	**Do Nothing**	**S1a: Full Pass-through**	**S1b: Partial Pass-through**	**S1c: Zero Pass-through**	**S2a: Full Pass-through**	**S2b: Partial Pass-through**	**S2c: Zero Pass-through**	**S3a: Full Pass-through**	**S3b: Partial Pass-through**	**S3c: Zero Pass-through**
Gross Additional Jobs	2,490	3,240	4,070	4,990	2,500	2,800	3,130	2,880	3,560	4,280
Gross Additional GVA	£273m	£445m	£538m	£642m	£275m	£319m	£366m	£360m	£448m	£540m
Net Additional Jobs		**750**	**1,580**	**2,500**	**10**	**310**	**640**	**390**	**1,070**	**1,790**
Net Additional GVA		**£172m**	**£266m**	**£370m**	**£3m**	**£47m**	**£94m**	**£88m**	**£175m**	**£267m**

Note:

- *Jobs are rounded to the nearest 10*
- *GVA is rounded to the nearest £million*

In arithmetic terms, the impact of a reduction on short-haul ADT will have a larger impact than an equivalent reduction in long-haul because of the larger proportion of business passengers. This is particularly the case in Scotland, where a number of the short-haul routes are to prominent business destinations such as London, Amsterdam and Paris.

The most significant impact in terms of business productivity again occurs in terms of Scenario 1c, the 100% reduction in Band A with zero pass-through. This is because this scenario maximises the number of business passengers.

Leakage

There is unlikely to be any significant leakage effect in terms of business productivity.

Displacement

The most pertinent issue here is competition with rail and this is discussed further under ‘Wider Issues’ below.

Substitution

There is unlikely to be any significant substitution effect in terms of business productivity.

Combined Impacts

The table below set out the combined net jobs and GVA generated by all the impacts. A sub-line is included which excludes the ‘based aircraft’ impact which, as previously noted, may represent a double-count on the operational impacts associated with additional passengers.

Table 6.5: Overall Economic Impact – Jobs (Net), 2018-2022

	100% Reduction in Band A			100% Reduction in Band B			50% Reduction in Bands A & B		
Cumulative 2018-2022	**S1a: Full Pass-through**	**S1b: Partial Pass-through**	**S1c: Zero Pass-through**	**S2a: Full Pass-through**	**S2b: Partial Pass-through**	**S2c: Zero Pass-through**	**S3a: Full Pass-through**	**S3b: Partial Pass-through**	**S3c: Zero Pass-through**
Additional Airport Passengers	2,440	3,860	5,500	330	920	1,570	1,380	2,660	4,040
Based Aircraft	260	410	580	40	100	160	150	280	420
Additional Tourism	2,730	3,950	5,380	460	1,560	2,790	1,600	3,070	4,670
Business Productivity	750	1,580	2,500	10	310	640	390	1,070	1,790
Total	**6,180**	**9,800**	**13,960**	**840**	**2,890**	**5,160**	**3,520**	**7,080**	**10,920**
Total excluding based aircraft	**5,920**	**9,390**	**13,380**	**800**	**2,790**	**5,000**	**3,370**	**6,800**	**10,500**

Note:

- *Jobs are rounded to the nearest 10*

The relativities between these values are very much a reflection of the forecast passenger numbers. Scenarios 1b, 1c and 3c are forecast to produce the greatest uplift in passenger numbers and this feeds through to the economic impacts. The scale of impact varies widely with the lowest figures generally associated with scenarios abolishing Band B payments.

Key points from the above table are:

- The zero pass-through / maximum supply side response variant in each scenario generates the largest net impact within that scenario.
- Summing across all of the impacts, Scenario 1c (the 100% reduction in Band A with zero pass-through) generates the largest number of net jobs, which is dominated by the additional tourism and airport passenger effects.

- The key sensitivity in relation to the above is the potential leakage associated with Scottish residents making more outbound trips, which would significantly reduce the overall tourism impact.

Table 6.6: Overall Economic Impact – GVA (Net), 2018-2022

	100% Reduction in Band A			100% Reduction in Band B			50% Reduction in Bands A & B		
Cumulative 2018-2022	**S1a: Full Pass-through**	**S1b: Partial Pass-through**	**S1c: Zero Pass-through**	**S2a: Full Pass-through**	**S2b: Partial Pass-through**	**S2c: Zero Pass-through**	**S3a: Full Pass-through**	**S3b: Partial Pass-through**	**S3c: Zero Pass-through**
Additional Airport Passengers (£m)	£466	£566	£685	£63	£126	£195	£265	£381	£506
Based Aircraft (£m)	£49	£59	£72	£6	£13	£20	£28	£40	£53
Additional Tourism (£m)	£301	£304	£331	£38	£98	£165	£163	£222	£287
Business Productivity (£m)	£172	£266	£370	£3	£47	£94	£88	£175	£267
Total (£m)	**£988**	**£1,194**	**£1,457**	**£111**	**£284**	**£473**	**£542**	**£818**	**£1,113**
Total excluding based aircraft (£m)	**£939**	**£1,135**	**£1,386**	**£104**	**£271**	**£453**	**£515**	**£778**	**£1,061**

Note:

- *GVA is rounded to the nearest £million*

The GVA impacts are generally drawn from a measure of 'GVA per job' and thus the comparative impacts are equivalent to those reported in the employment context.

The greatest economic impacts are associated with Scenario 1c – a 100% cut in Band A, which assumes no reduction in fares and a substantial supply side response.

Wider Issues

The development and quantification of the above impacts is based on industry-standard approaches to calculating economic additionality. However, the use of an arithmetic approach only is unlikely to fully capture the depth and scale of the potential outcomes associated with introducing ADT. This section therefore sets out a wider economic narrative on the potential economic implications of the reduction in duty.

Rail Competition

A reduction in tax associated with the introduction of ADT could have two primary impacts on the rail sector: (i) impacts on volumes travelling between Scotland and airports in the north of England, and (ii) impacts on longer distance routes, primarily Edinburgh / Glasgow and London.

Lower fares and greater connectivity from Scotland's airports could lead to:

- Scottish residents who currently travel to e.g. Manchester or Newcastle Airports may use Scottish Airports instead – **reducing** rail travel on these routes; and
- Residents of the north of England may switch from their local airports travelling instead by rail to Edinburgh or Glasgow – **increasing** travel by rail on these routes.

CAA figures from the 2013 passenger survey suggest that there is far larger southbound passenger movement (555,000) than northbound movement (101,000) to airports in e.g. Newcastle / Manchester and Scotland respectively. Whilst there is a significant potential market amongst Scotland's residents to be displaced back to airports in Scotland, there is obviously a large market in the north of England which could be attracted to airports in Scotland.

Manchester Airport (at 25.6m passengers in 2016) handles more than double Edinburgh Airport's passengers. Its scale means that it provides competitively priced travel to a wide range of long haul and short haul destinations, which perhaps makes it difficult for Scottish airports to compete. The more likely competition would be between the Scottish airports and Newcastle at 4.8m passengers[48]. Overall the impact of this displacement is likely to be small, but on balance a small reduction in rail travel between Scotland and airports in the north of England may be expected.

A significant proportion of Scottish business travel is with the rest of the UK. In terms of flights for business purposes, London is the main destination for business flights given:

[48] Source for both figures: CAA, https://www.caa.co.uk/Data-and-analysis/UK-aviation-market/Airports/Datasets/UK-Airport-data/Airport-data-2016/

- The dominance of London as the primary business destination within the UK.
- Distance – For travel between Scotland and cities in the North of England, rail journey times compete more closely with air travel than travel between Scotland and London.

Virgin Trains, which operates the East and West Coast Mainline franchises estimate that it currently has a 33% market share for journeys to London (37% from Edinburgh, 27% from Glasgow). There is the potential for a degree of displacement from rail to air as a result of the introduction of ADT at a lower rate than APD. However, it is generally accepted that business travel is less sensitive to price than leisure travel and we do not foresee a significant supply side response between Edinburgh / Glasgow and London given the current frequency of connections. Therefore, a significant impact on the balance of the rail / air market would not be expected, particularly amongst business travellers where demand is less elastic.

In addition, the forthcoming introduction of the new *Azuma* trains on the East Coast Main Line[49], and their associated faster journey times could provide a counterweight to any change in the market share brought about by ADT. In the light of this, Virgin Trains anticipates growing the Edinburgh market share to 50% by 2023.

The introduction of ADT may therefore result in the displacement of some trips from rail to air, particularly for London but also for other destinations such as Birmingham, Bristol, Cardiff, Southampton etc. This is likely to be a small effect in the context of what is a very competitive market between rail and air, and any ADT effect may be offset by continuing improvements in rail services in the medium term. Overall we do not foresee this as being a significant issue.

Short-Haul versus Long-Haul

The economic impact calculations contained within this chapter are driven by the forecast changes in passenger numbers associated with each scenario. Given that the Scottish aviation market is dominated by short-haul flights, it is unsurprising that the largest prospective impacts are generally observed in scenarios which offer the largest reduction in fares or increases in supply in this area.

The numbers presented perhaps do not however capture the softer impacts of the quality of the connections being developed. It can be argued that increased connectivity to hub airports, key business destinations and new long-haul destinations are of greater value than point-to-point connections to small / regional airports. With this in mind, it can be argued that, whilst in numerical terms the 100% short-haul reduction seems more appealing, the wider catalytic effects of developing a more extensive long-haul network may be larger, particularly in terms of promoting internationalisation.

[49] http://www.scotsman.com/news/transport/big-emissons-savings-as-air-passengers-switch-to-rail-1-4537238

Long Haul Hub Potential

A reduction in the long-haul element of APD may potentially create a scenario where one Scottish airport (likely Edinburgh) could become a hub for passengers travelling from north-west Europe to the United States and Canada. If the tax differential with the rest of the UK was sufficient to attract transatlantic carriers to Scotland, a hub equivalent to Dublin or Keflavik could perhaps be developed, with knock-on benefits for the Scottish tourism industry. This is something of a potential longer-term impact which cannot be fully developed at this stage. In this scenario, there would also be significant scope to attract passengers from north of England airports, as there could also be a substantial tax saving for non-Scottish passengers as well as increased connectivity benefits for these passengers and also Scottish passengers depending on the tax scenario implemented.

In addition to direct benefits to the airport (such as increased direct revenue, increased retail spending etc.), a hub of this nature could provide an uplift in tourism through transit passengers breaking their journey and potentially spending one or more days in Edinburgh / Scotland (with further potential for repeat visitation). There would of course be environmental implications of this type of initiative although these are beyond the scope of this study.

7. Monitoring and Evaluation Framework

The introduction of ADT represents a significant investment of public funds. As such, there is a requirement to establish a framework for monitoring and latterly evaluating the impact of the policy once implemented.

The implementation of ADT will represent a significant change to the aviation industry in Scotland. However, as explained at various points throughout this report, its implementation will only be one of a large number of factors which influence the structure of the aviation industry and the demand for flights. Outwith general considerations, such as background economic performance, specific issues which could impact on the industry include the emergence of low cost long haul, Brexit and movements in the oil price (at least in relation to Aberdeen Airport). Even with a robust monitoring and evaluation (M&E) framework, isolating and quantifying the impact of the ADT policy will be challenging. This set of monitoring and evaluation difficulties applies to many other taxes and is not unique to ADT.

It is also important to note that, given booking systems are currently open for 2018 and aircraft rotations are already scheduled, there will likely be a short lag before the impact of ADT fully emerges (particularly on the supply side).

Despite the challenges, it will be possible to develop a monitoring framework which will allow for the subsequent evaluation of ADT (albeit taking cognisance of the above points).

Monitoring

The monitoring regime for ADT should be focussed on collecting comparable data on the demand for and supply of air travel from Scottish airports. Any monitoring regime should seek to provide data which will allow the impact of ADT to be determined on (i) the level of connectivity from Scotland's airports provided by airline type, (ii) passenger numbers by type; and (iii) the cost of air travel.

Monitoring of Demand

There are various levels at which **demand** for air services can be monitored:

- At the national level, in terms of total passenger throughput from Scottish airports each year
- At the airport level, in terms of passenger throughput at each airport – the CAA publishes monthly terminal passenger numbers through each Scottish airport
- At the route level – data are not readily available at this level but could potentially be collected through a periodic data request to the airlines.

Recording the above information over a period of up to three years should be the foundation of the monitoring exercise.

In addition, RDC Aviation Economics records **airline fares** at various levels of aggregation. This data should also be collated on a monthly basis, with a profile of average fares at different levels of aggregation maintained over the monitoring period.

The most recent **CAA survey** covering the Scottish airports (Aberdeen, Edinburgh, Glasgow and Inverness) was published in 2013. We understand that the next equivalent survey will be undertaken in 2018. As part of the monitoring process, the survey coverage should be reviewed to ensure it records travel by the following sub-categories:

- airline type (low-cost carriers etc.);
- UK / foreign passengers;
- destination region;
- price of travel;
- ADT band; and
- business / leisure split.

In terms of recording potential displacement impacts, the above data should also be collated for Inverness, Newcastle, Liverpool John Lennon, Manchester, Leeds / Bradford (although note that it will not be possible to identify causal impacts).

It is not recommended that any data on rail passengers is recorded. Whilst there may be a degree of displacement from rail, particularly in terms of business travel to and from London, the level of displacement in absolute terms is likely to be too small to effectively isolate and monitor.

The level and type of ADT paid to Revenue Scotland should, of course, also be closely monitored through statistical publications or specific, detailed data requests to Revenue Scotland.

Monitoring of Supply

The monitoring of supply will involve annually tracking changes in:

- **Airlines** – listing of the airlines by market segment operating from each Scottish airport.
- **Routes** – record of all routes operated from Scotland by market segment, with new routes flagged accordingly.
- **Service frequencies** – annotation of the record of routes with a record of service frequencies, with increased / decreased service frequencies flagged accordingly.
- **Aircraft type** – annotation of the record of routes with a record of aircraft type, with increased / decreased seating capacity flagged accordingly.
- **Based aircraft** operating from Scotland – list of the number of aircraft based in Scotland by airline / airline type, with increases / decreases annotated accordingly.

Some of the supply side data will largely only become available through consultation with the industry. We would recommend that data is collected twice a year over a three-year period, once in winter and once in summer so as to capture the seasonal variation on the supply side.

The demand and supply side data should be recorded on an annual basis in a short working paper. Comment should not be made on the data until the evaluation commences. We would recommend that data is collected for **three to five years** after the implementation of ADT.

Evaluation

The Scottish Transport Appraisal Guidance (STAG)[50] defines two discrete stages of the evaluation process.

- **Process Evaluation** – this is conducted at an early stage in the existence of a project and which is primarily concerned with how well the project has been implemented, this is also known as Formative Evaluation; and
- **Outcome Evaluation** – this is conducted once the project has been in existence for a sufficient period to enable an examination to be undertaken of actual performance against identified targets.

Process Evaluation

As the introduction of ADT is a policy borne out of the current Scottish Government's manifesto rather than an infrastructure measure, we do not consider a process evaluation to be relevant in this context.

Outcome Evaluation

The introduction of ADT is likely to have an immediate impact on the aviation industry (after a short initial lag), with a more settled position emerging over time. To this end, we would recommend carrying out a relatively light touch evaluation a year (say summer 2019) after the policy is announced, with a full outcome evaluation being carried out around 3 years after its introduction (by which time a more settled position on e.g. Brexit, low-cost long haul etc. is likely to have emerged).

Year 1 Outcome Evaluation

The Year 1 Outcome Evaluation should be focussed, drawing out changes in demand and supply from published datasets. No primary research should be undertaken at this stage.

The evaluation should involve analysis of each of the datasets outlined above and preparation of a short working-paper setting out key trends in demand and supply.

[50] https://www.transport.gov.scot/our-approach/industry-guidance/scottish-transport-analysis-guide-scot-tag/#

Outline conclusions should be drawn at this stage but it will also be important to note that these will be revisited / firmed-up in the subsequent Year 3 Outcome Evaluation.

Year 3-5 Outcome Evaluation

The Year 3-5 Outcome Evaluation should be a more involved study. The first step in the analysis would be revisiting and extending the Year 1 Outcome Evaluation. Commentary on long-term trends in terms of e.g. terminal passenger numbers, average fares etc would be provided.

If an updated version of the CAA passenger survey including Scottish airports is available by the time of the evaluation, this should be reviewed to determine changes in a number of factors by market segment (e.g. airline type, destination region, business / leisure split etc).

The Year 3-5 evaluation would also include consultation with:

- Airlines, to determine the extent to which different types of airlines have responded to the introduction of ADT (quantified where possible).
    - Specific information on additional based aircraft and the employment associated with these planes should be identified. This should be compared against the 43 jobs per based aircraft figure used in this report.
- Airports, to understand any investments they have made, the number of additional staff employed and the impact on revenue as a result of introducing ADT.
    - It would be particularly beneficial to compare the ratio of direct employment to additional terminal passengers cited in this report
- Virgin East Coast and West Coast to collect any qualitative views on displacement from Anglo-Scottish rail services.
- Tourism bodies to determine the outturn impacts of ADT on this key sector assuming they are in a position to accurately report these.

With the ADT scenario confirmed and up to three years of outturn passenger data available, the appropriate scenario economic impact calculations above should also be re-run to determine an 'outturn' economic impact, assuming that a causal impact can be determined. This analysis should take account of the revised employment ratio cited above plus any evidence collected on displacement. A comparison should be made with the forecasts included in this study and reported on.

The final element of the Year 3 Outcome Evaluation should involve a review of the trend in ADT-related revenue accruing to Revenue Scotland. This should be compared with the pre-intervention APD position and the subsequent years of ADT.

Monitoring and Evaluation Framework

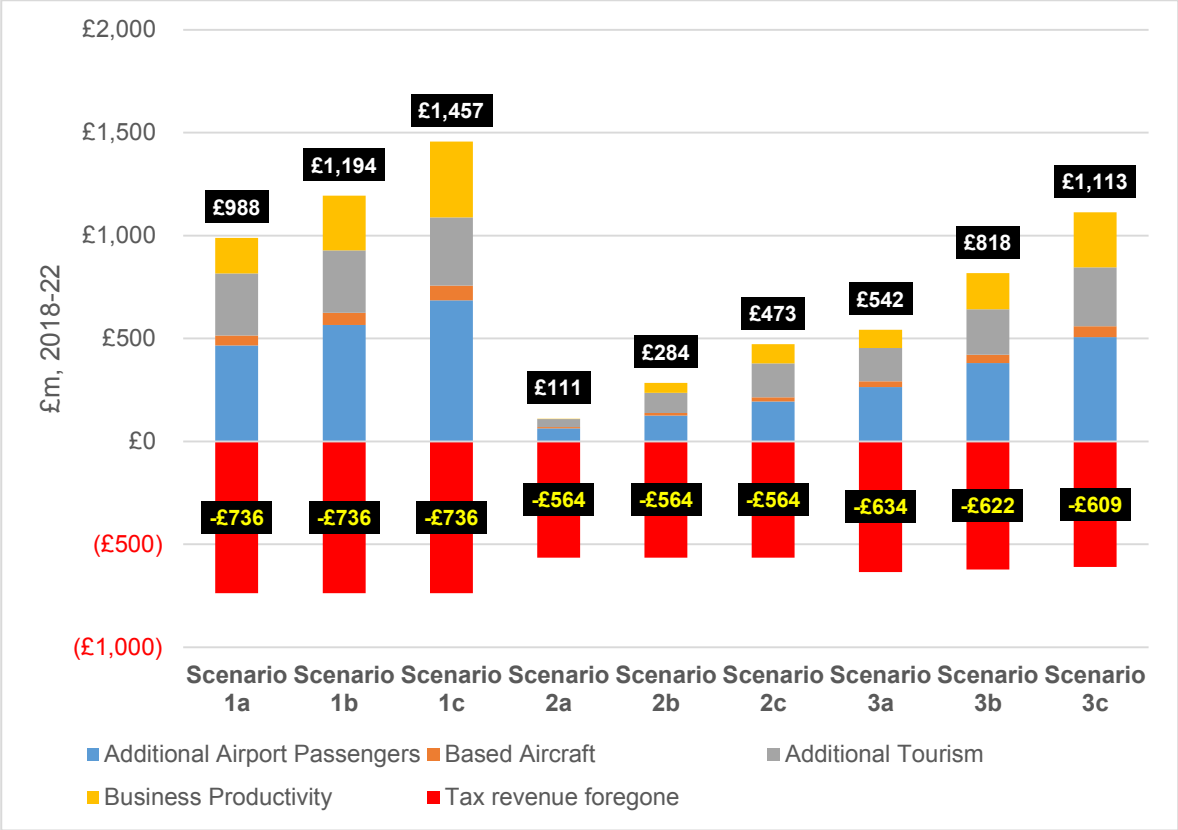
The process outlined in this Chapter is formalised in tabular form in Appendix C.

8. Conclusions

This study has undertaken an assessment of the economic impact of three variants of ADT (where this new tax is charged at a lower rate than the current APD) each with three different assumptions on the degree to which the cut in tax is 'passed through' to passengers in the form of reduced fares and / or used by airlines to develop new connections from Scotland's airports.

The results of this analysis for the nine possible scenarios we have examined is summarised in the figure below with respect to the ADT tax revenue effects and the estimated GVA impacts over a five-year period from 2018-2022.

Figure 8.1: Summary of GVA & ADT Tax Position (2018-2022)



Whilst it is not a direct comparison, the figures here do give a feel for the potential foregone tax and additional Scotland level GVA. In five of the nine cases, the figure for additional GVA is in excess of the tax foregone, suggesting that the tax cut under these permutations would have a net positive effect on these terms.

In terms of the scenarios developed here, the greatest economic impacts are therefore associated with Scenario 1c – a 100% cut in Band A, which assumes no reduction in fares and a substantial supply side response in the short haul sector. This is turn generates the largest increase in passenger numbers and hence the biggest economic impact. If the tax cut was focussed only on Band B (long haul) the analysis undertaken here suggests that the additional GVA in this initial five-year period would not offset the loss of tax revenue. Note though that in the scenarios where fares are reduced, the benefits will continue to grow year on year

beyond this initial five-year period. For scenarios where there is only a supply side response, this is represented as a step change followed by a continuation of underlying trend growth.

Most other studies reviewed as part of this analysis have worked on the premise that the reduction in tax is fed through completely to a reduction in fares. In the context of this study, this relates to Scenarios 1a, 2a and 3a (i.e. full pass-through), and the analysis here suggests that these scenarios produce the smallest GVA / jobs impacts. In this analysis, a supply side response (i.e. new routes) has been assumed where there is a partial or a zero pass-through of the tax cut to fares, and this supply side impact is greater than the fares elasticity effect associated with full pass-through of fares.

The results presented here are therefore sensitive to the assumed supply side response, but it should be noted that the supply side response assumptions used are conservative in the context of the public statements already made by airlines such as easyJet and Ryanair, where figures of 30% or more have been quoted. Nevertheless, there is a high degree of uncertainty surrounding this supply side response, which could be greater or less than that assumed here. Obtaining a substantial supply side response from the airlines would be the prime objective of the policy and source of benefits, and it is noted that this is not something which is under Government control.

The most likely outcome in any of these scenarios is therefore perhaps Variant B which would see a mixture of some reductions in fares and some additional route development. The response is likely to vary by airline type, with e.g. low cost carriers perhaps responding more on the supply side and less on fares (i.e. Scenarios 1c, 2c, 3c) and network carriers perhaps passing on the tax reduction and responding less on the supply side (i.e. Scenarios 1a, 2a, 3a).

The benefits associated with additional inbound tourism are a major component of the economic benefits identified. The figures estimated here relate to additional inbound tourism and we have not attempted to quantify the potentially offsetting negative economic impact of increases in outbound tourism from Scotland's residents, given the complexities and lack of relevant data. However, this in itself should be offset against the other benefits residents of Scotland gain from overseas leisure travel. Finally, to not pursue a policy on these grounds would be tantamount to advocating reducing international connectivity (or at best stifling it) to enhance domestic economic performance, which would seem perverse in an era where greater connectivity is seen as essential.

Any analysis, such as this, is subject to a wide range of caveats and uncertainties. These have been set out in this report but should be borne in mind when interpreting the results. The key uncertainties here perhaps surround:

- the level of supply side response in the shape of new routes, and the demand response to these supply uplifts, which we have assumed to be perfectly elastic;

- the response of passengers to lower fares (i.e. the elasticities used);
- the underlying growth scenario which may prove too optimistic or pessimistic;
- the degree of 'leakage' brought about by additional overseas travel by Scotland's residents;
- the way in which the tax cut feeds through into responses for airports and airline (aside from new routes);
- the potential for more or fewer additional based aircraft than assumed here, especially in the context of an expansion of the low cost long haul sector;
- developments within aviation, particularly the growth trajectory of low cost long haul and its impact on 'traditional' carriers; and
- the wider picture with respect to the UK economy and Brexit.

The impact of any cut in ADT will vary across the air industry, and given the complexities in aviation economics, there is likely to be a transparency issue in terms of the monitoring of its impact. A framework for monitoring and evaluating the impact of ADT has been set out here.

A wider issue with cutting the current rates of APD with the introduction of ADT is that there will be a reduction in tax revenue in 2018-19 and succeeding years, which will presumably be reflected in Government spending. This immediate loss of tax revenue is offset against a range of less tangible and less certain economic benefits as time progresses.

Appendix A – APEX Modelling

Introduction

The purpose of this Appendix is to set out the scope, methodology and headline results from additional route specific analysis, commissioned by Transport Scotland using RDC Aviation's APEX[51] route economics evaluation software. This is designed to complement the broader market segment approach employed elsewhere in the report by considering at an individual route level, the potential impact of discounting ADT for airport pairs with an origin or destination at one of the main Scottish Airports (i.e. Edinburgh, Glasgow, Aberdeen, Prestwick, Dundee).

The work subjected selected routes to commercial sensitivity testing using the RDC APEX route evaluation software, at the two levels of discounting of ADT (50% and 100% of the current APD tariff) used elsewhere in the report, enabling comparison against a baseline where ADT continues to be collected in full once powers for collecting APD are devolved to the Scottish Government. The APEX software does not explicitly model APD but by varying airfares against constant variables such as aircraft seat capacity, load factors and frequency, the impact on profitability or passenger numbers of an ADT cut can be assessed. The methodology developed by Northpoint and the way it was deployed using APEX, was discussed with RDC Aviation; they also contributed to the analysis undertaken with the model and oversight of its outputs[52].

Choice of Routes

The starting point for the APEX analysis, was to agree the routes to be examined based on a long list of options presented by the study team to Transport Scotland. Primary factors considered in the short-listing process that followed were the need to include:

- destinations from all six of the major mainland Scottish airports where enhanced connectivity is considered likely to be economically beneficial;
- a range of different types of service (i.e. long haul/short haul international and domestic, business focused/leisure orientated, and year round/seasonal);
- new links and existing services where frequency and/or competition is being added;
- airport pairs served by different types of carrier (i.e. network, regional, low cost, ultra low cost);
- routes that used to have flights but do not any longer, those that are currently marginal in terms of viability, and those that have not been tried before.

[51] APEX is a proprietary model available by online subscription that is recognised as an industry standard tool for examining the commercial prospects for both new and existing routes.

[52] RDC's contribution is gratefully acknowledged by the study team

Routes from island and smaller Scottish mainland airports were discounted as they are for the most part internal to Scotland and therefore already have operating subsidy in the form of a Public Service Obligation (PSO) or Aid of a Social Character that would exceed any benefits from changes to APD associated with the introduction of ADT in Scotland.

The table below shows the list of short-listed routes, those circled in red comprised four initial case studies undertaken to validate the methodology and outputs that were reported to Transport Scotland during one of the study progress meetings. Based on that initial presentation the analysis of the other 20 routes encompassed by the short-list were then progressed.

Table A.1: Routes used for APEX Analysis

Scottish Airport	CC Suggested Destn	TS Comments	Destn APT Options
Edinburgh	China Direct		Hong Kong, Shanghai, Beijing
Edinburgh	SE Asia Hub	Probably Singapore	Singapore, KL, Australasia
Edinburgh	USA East Coast	Atlanta before Washington	Washington, Atlanta
Edinburgh	Zurich		Zurich
Edinburgh	Dusseldorf		Dusseldorf
Glasgow	Middle East		Istanbul
Glasgow	Paris - CDG	Paris CDG or Madrid	Paris or Madrid
Glasgow	Munich		Munich
Glasgow	Brussels		Brussels
Aberdeen	Qatar		Doha
Aberdeen	Madrid		Madrid
Aberdeen	Copenhagen		Copenhagen
Aberdeen	Barcelona		Barcelona
Inverness	Heathrow		Heathrow
Inverness	Germany		Dusseldorf, Frankfurt
Inverness	Scandinavia		Oslo, Stockholm, Copenhagen
Inverness	Cardiff		Cardiff
Prestwick	Heathrow		Heathrow
Prestwick	AMS		Amsterdam
Prestwick	Dublin		Dublin
Prestwick	Stockholm	Stockholm or Copenhagen	Stockholm or Copenhagen
Dundee	Dublin		Dublin
Dundee	Amsterdam		Amsterdam
Dundee	Manchester	Manchester or Birmingham	Manchester or Birmingham

Source: Consultants in conjunction with Transport Scotland.

Methodology

The route studies using APEX required the generation of route based demand forecasts for 2015, derived from the same 2013 CAA survey data used elsewhere in the report. This enabled an estimate to be derived of the total number of passengers, flying directly or indirectly (i.e. via an intermediate airport) to the chosen end-destinations, from relevant markets across Scotland (and the North East of England). In appropriate cases, a proportion of traffic currently using alternative airports capable of serving the end-destination market were assumed to switch in response to preferred airport pairs or increased frequency, was also included in the market assessment. So for example, the Aberdeen route to Doha is considered likely to attract a small proportion of Grampian or Highlands and Islands passengers who might otherwise have used existing services from Scottish

Lowland airports to Dubai and Abu Dhabi. Data for a route to Heathrow (e.g. from Prestwick or Inverness), also takes into account traffic that may currently use Gatwick.

The next step was to grow the 'estimated catchment market' for each route by an assumed background CAGR[53] of 2% to derive a forecast baseline 2020 figure which was then factored to generate a more realistic 'potential market size' using a series of filters covering:

- Potential to attract onward connecting traffic beyond the end destination (i.e. interlining passengers)
- Scope to stimulate the existing market size by increasing frequency or adding a new route
- The extent of likely market penetration.

Each of these factors is assumption based, but the complicated commercial considerations that have been used to determine the appropriate scale at which each is applied to the routes under consideration are outlined in the footnotes to the table. The output from this process is a figure for estimated 'Total Potential Market' by route and this is a key data input to the later APEX modelling process.

The second block of analysis to inform inputs to the APEX modelling then identifies the most likely form of carrier to serve the type and size of route in question. A notional operator was then also chosen so that an aircraft type could be assigned and seat capacity potentially available therefore better understood. Frequency was then adjusted to generate a proportionate total annual seat capacity[54] and ultimately a projected load factor.

Finally, an initial indicative assessment of the likely level of impact that reducing ADT will have on individual route pairs was made at this stage prior to the APEX analysis

APEX Modelling

APEX primary value is as a route economics evaluation tool, which allows the potential commercial viability of new routes (or enhanced frequencies) on existing routes to be examined in the context of a wide range of input variables including:

- End destination;
- Airline;
- Aircraft type;
- Frequency;
- Fares; and
- Load factors.

[53] Compound Annual Growth Rate

[54] Including defining some routes as being seasonal in the way capacity is delivered.

For the purposes of this analysis, we used APEX to model the effect of changes to the level of ADT on a baseline profit/loss breakeven position on each of our case study routes. By running a series of sensitivity tests, the functionality of the model allowed us to examine the impact of changes to implied fare levels by subtracting a 'blended rate' for ADT (i.e. a proportionate mix of standard and business tariffs, based on the existing business/leisure split unique to each route) from the breakeven fare and then comparing outputs under each of the main discounting scenarios (i.e. 100% and 50%). The key output variables in the sensitivity tests are the change in the projected profit/loss position or the uplift in passenger numbers (and hence average load factors on the flights).

Results

The results from the Apex modelling were then compared with those from earlier market based route evaluations – essentially our hypothesis as to the likely impacts of changes to the level of ADT - to highlight where the different methodologies produce consistent assessments and those where the outcomes are divergent and why. These conclusions are summarised at an individual route level in the table below.

Table A.2: Summary of APEX Conclusions

Airport Pair	Type of Service	Hypothesis	Apex Result	Comparison	Conclusions re Effect of ADT Discounts
Edinburgh					
Hong Kong	LH - Network	Material	Modest	↓	Should have a positive impact at 100% discount, more marginal at 50%
Singapore	LH – Low Cost	Significant	Material	↓	Strong global hub served by LHLC, makes discount to Band B attractive
Atlanta	LH - Network	Modest	Significant	↑↑	Strong in Apex as seasonal leisure route/low ave fare. Delta interest?
Zurich	SH - Regional	Minor	Minor	✓	High fare destination with small connecting market, limits ADT impact
Dusseldorf	SH – Low Cost	Modest	Material	↑	Eurowings main operator; their LCC approach make this a prospect
Glasgow					
Istanbul	MH - Network	Negligible	Minor	✓	Network carrier, Band A, competitive market - limited effect unless LH
Madrid	SH – Low Cost	Modest	Modest	✓	LCC carrier, so discounting Band A rates could stimulate leisure pax
Munich	SH - Regional	Minor	Minor	✓	APD discount small in relation to fares from a regional business airline
Brussels	SH - Regional	Negligible	Minor	↑	As above
Aberdeen					

Airport Pair	Type of Service	Hypothesis	Apex Result	Comparison	Conclusions re Effect of ADT Discounts
Doha	Network	Material	Significant	↑	High Bus Pax, modest ave fare (£200/sector), so ADT is big incentive.
Madrid	SH - Regional	Modest	Negligible	↓↓	Weak in Apex due to high regional fares; but need to factor oil market.
Copenhagen	Network	Minor	Minor	✓	Assessments consistent; secondary hub, high fares, minor impact.
Barcelona	SH – Low Cost	Minor	Negligible	↓	Competitive market; ADT not expected to material affect fares
Prestwick					
Heathrow	Dom - Regional	Significant	Significant	✓	ADT likely to have positive impact on securing London route for PIK.
Amsterdam	SH - Regional	Modest	Material	↑	Carrier offers affordable prices due to ADT; allows market to be served
Dublin	SH - Regional	Modest	Material	↑	As Above
Stockholm (NYO)	SH – Ultra Low Cost	Minor	Modest	↑	ADT will impact Ryanair routes from PIK positively; make more viable
Dundee					
Dublin	SH - Regional	Modest	Minor	↓	High ave fare - Apex model output less positive than market appraisal
Amsterdam	SH - Regional	Modest	Material	↑	Evidence is market; reduction in ADT should reinforce this#
Manchester	Dom - Regional	Significant	Material	↓	ADT discount will have major impact on mainly business (70%) route

A guide to how the evaluation descriptors used in that table have been derived is shown in the box below.

Negligible
Market Assessment: Very unlikely to encourage new route formation or added frequency.
Apex Analysis: No or very small changes to potential airline profitability or passenger volumes – unlikely to significantly affect airline decisions on potential new routes or encourage enhanced frequency on established ones.

Minor
Market Assessment: Underlying market/route conditions are such that ADT unlikely to have large enough impact to encourage new route formation/increased frequency; may help extant marginal routes survive or new routes already considered to have potential to come forward slightly earlier.
Apex Analysis: Changes to profitability and passenger volumes are typically less than 10% under the 50% ADT discount and 10-19% if it is removed altogether – a route or increased frequency would need to be on the edge of viability for this to level of impact to generate positive outcomes and this is unlikely in most cases.

Modest
Market Assessment: moderate changes to prices are considered likely to have a moderate positive impact on passenger demand, or help to change airline risk perceptions about the viability of 'next in line' routes and help secure earlier and possibly more substantive commitments to these.
Apex Analysis: In this category changes to profitability and/or passenger volumes are typically 15-20% under a 50% discount and 20-30% with a 100% discount, the affect being substantive enough on the outbound leg to make up for revenue losses associated with currency changes whilst still allowing some improvement to commercial prospects for new routes or enhanced frequencies.

Material
Market Assessment: Discounts offered by ADT are considered likely to have a noticeable positive impact on new route formation and encourage additional frequency
Apex Analysis: In this category changes to profitability and/or passenger volumes are typically 30-45% under a 100% discount and over 20% with a 50% discount, the affect being substantial enough on the outbound leg to exceed revenue losses associated with currency changes, whilst still allowing notable improvement to commercial prospects for new routes or enhanced frequencies.

Significant
Market Assessment: ADT is likely to transform the prospects for new routes or enhanced frequency of operations, encouraging substantial new levels of connectivity and direct frequency and opening up the prospects of links to wholly new market areas.
Apex Analysis: In this category changes to profitability and/or passenger volumes are typically over 45% under a 100% discount and plus 30% with a 50% discount, the affect being large enough on the outbound leg to materially exceed revenue losses associated with currency changes, whilst still allowing substantial improvement to commercial prospects for new routes or enhanced frequencies.

The more generic observations that we have drawn from the collective results of the individual route appraisals are then set out in our conclusions below.

Generic Conclusions

Taken together, the APEX modelling produced a third of outcomes that confirmed the initial market-based hypothesis, with an equal number one category higher and a category lower. The evaluations departed markedly in only two out of 24 cases, and in both cases for good reasons set out in the table below. These results provide some confidence that the combination of the two approaches, and especially the use of APEX, offer a useful insight into how changes to ADT may impact upon different types of route.

Table A.3: Summary of Route Evaluation Results

Category of Impact Considered Likely	Market Based Hypothesis	APEX Modelling
Significant + Material	7	10
Modest	9	4
Minor or Negligible	8	10
TOTAL	**24**	**24**

This suggests that both methodologies anticipate reductions in ADT having a noticeably positive impact on between 60-65% of the short-listed routes considered and little or no impact on the remainder.

Although the APEX modelling tends toward results that are more polarised than the more subjective market-based assessment, this can largely be explained by the fact the modelling looks at the effects on the leg affected by changes to ADT only, rather than on return trips. The latter would require input assumptions about approaches to air passenger taxation in different destination countries; since they already vary markedly and are changing constantly, it would be difficult to second guess appropriate levels three years ahead let alone five or more. Of more significance, is the relative high level consistency of expected outcome over the full suite of potential new routes (or routes where increased frequency is desirable) that we examined. This again offers some comfort that a policy of intervention based on reductions in ADT would generate materially beneficial outcomes overall, although at a route by route level there would be inconsistencies.

If we dig a little deeper into the results reported above, a number of other generic patterns can be highlighted:

a). **Types of Carrier**: Routes suitable for low cost, or ultra low cost, carriers are likely to see positive responses to changes in ADT. This is because their relatively lower fares and the price sensitivity of their majority leisure customer base will produce a much stronger price elasticity response compared with more expensive business orientated regional services using smaller aircraft with less beneficial operating economics occurring on thin routes. The latter kind of routes, exemplified

by services from smaller airports like Inverness and Dundee, where the route economics are testing, may be better supported by other means (e.g. PSOs), which under current Treasury rules are already exempt from APD. In the case of network carriers the response will depend heavily on the extent of the proportion of business passengers and whether the service is in Band A (smaller effect) or Band B (larger impact). For example, a route from Edinburgh to the Far East (Band B), appears to benefit substantially from ADT reductions, whereas one from Glasgow to Istanbul (in Band B) does not, due to a higher proportion of business passengers in the former.

b). **Long haul** routes with above 20% of total passengers flying on business or operated by a long haul low cost carrier (e.g. Norwegian) appear to perform well). The very strong projected response of the Aberdeen to Doha route is because the average fares are relatively low,) as it is assumed an A321 will be used and this makes aircraft operating costs proportionately much lower than for the larger wide-bodied aircraft used on the EDI-HKG route. At the same time, the business element of the traffic forecast to use the route is anticipated to be high, and hence the relative quantum of benefit from discounting non-standard ADT tariffs, is likely to be substantial. The APEX analysis suggests that if the whole of any change to ADT were to be passed on, then there appears scope to increase frequency over the baseline assumptions, from 5 to 6 flights a week for EDI-HKG and 4 to 5 flights a week between Aberdeen and Doha.

c). **Short haul** services to international destinations typically appear to be less responsive to changes to ADT than long haul or domestic operations (see below); this reflects the lower rates of APD that apply. At a 100% level of discount the change to ADT may still be significant enough to make some routes more attractive, but most probably those where average fares are low, competition is slight and the carrier is a low cost operator. Thin routes, using regional jets subsidiaries of network carriers appear likely to respond very little to even the highest level of ADT adjustment.

d). **Domestic services** may be more sensitive where ADT would make up a bigger proportion of the average fare than on longer short haul international routes – in addition to which there is also the ‘double whammy affect’ of having ADT/APD on both legs of the journey if it were also to be removed in say Wales and Northern Ireland (see the Cardiff service that was examined) or Heathrow with all its connecting passengers as an end destination.

In the case of Prestwick to Heathrow, the breakeven fare projected by APEX is quite modest, so we suspect that much of the reduction in ADT would be absorbed by a network carrier; similarly a low cost carrier, although perhaps to a slightly lesser extent. If all of the decrease were passed on to passengers then it would be possible to imagine an additional daily frequency being justified, but that might be likely to run into slot availability problems and hence the introduction of a larger aircraft like an A319/A320 could be a more realistic response.

Finally, of the airports we considered, Edinburgh, Prestwick and Dundee appear likely to derive the greatest benefit from the ADT scenarios examined, with

Glasgow, Aberdeen and Inverness doing less well. Although this is primarily a function of the route short-listed, what we can say is that where markets are relatively thin and short haul and hence greater reliance is placed on regional operators, the response may be less than airports where markets are larger and yields for low cost and long haul carriers higher. The scale of and form of intervention may need to be adjusted accordingly.

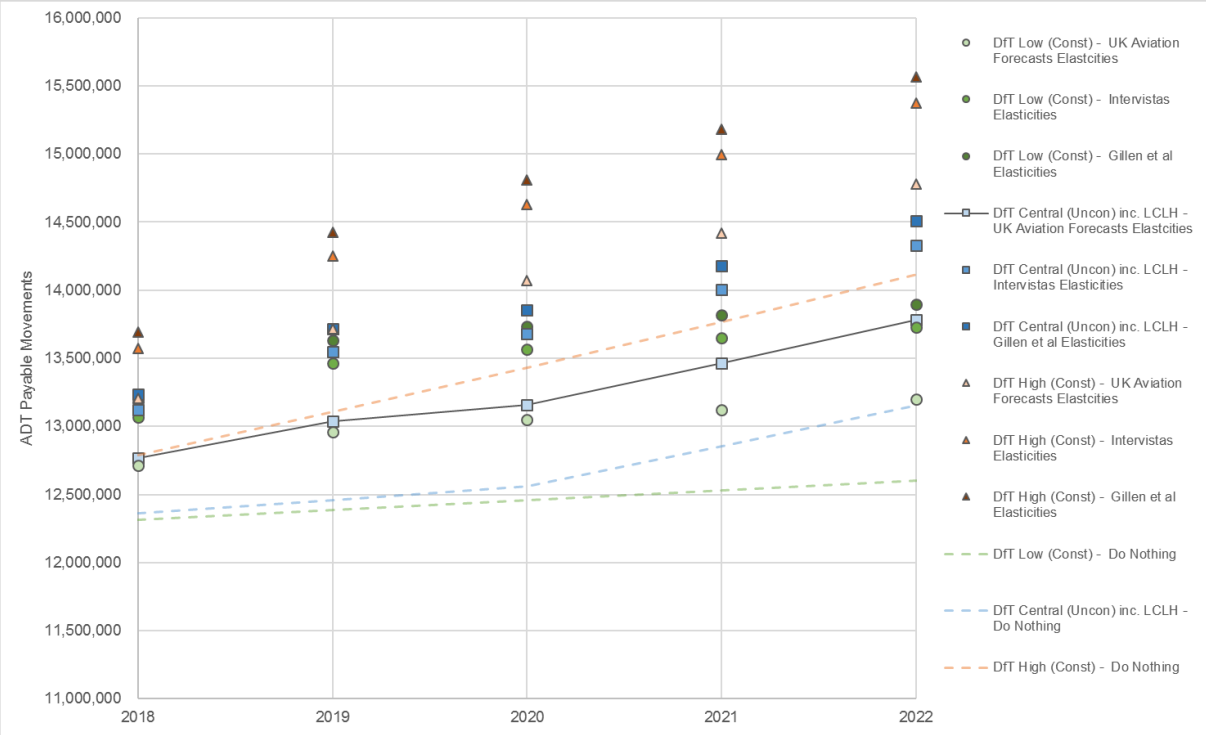
Appendix B – Sensitivity Tests

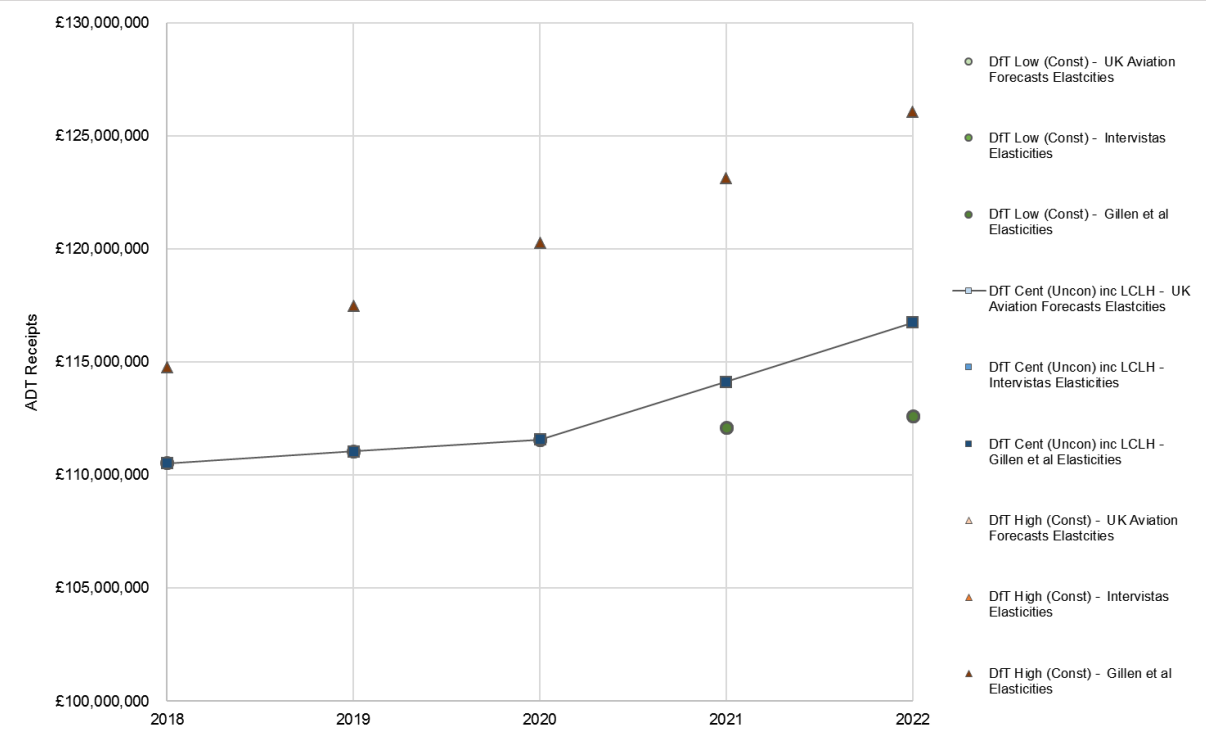
- Core Case - DfT Core (Central (unconstrained)) Growth / Core (UK Aviation Forecasts) Elasticities - in each chart the ‘core’ case is shown with a solid line.

- DfT Low Growth / Core (UK Aviation Forecasts) Elasticities
- DfT Low Growth / Intervistas Elasticities (higher than DfT)
- DfT Low Growth / Gillen et al Elasticities (higher than DfT and Intervistas)
- DfT Core (Central (unconstrained)) Growth / Intervistas Elasticities
- DfT Core (Central (unconstrained)) Growth / Gillen et al Elasticities
- DfT High Growth / Core (UK Aviation Forecasts) Elasticities
- DfT High Growth / Intervistas Elasticities
- DfT High Growth / Gillen et al Elasticities

Scenario 1a: 100% reduction in Band A: Full Pass-Through

Figure B.1: ADT Payable Movements & Receipts – Scenario 1a (Full pass-through)

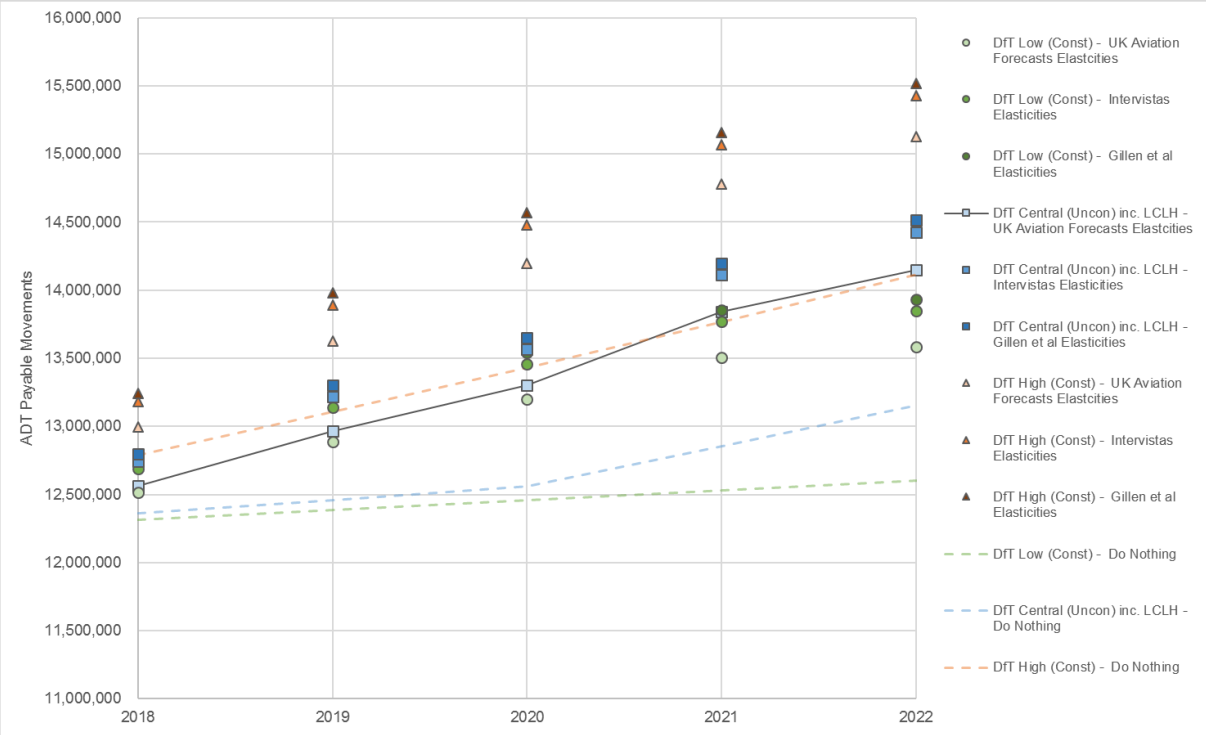


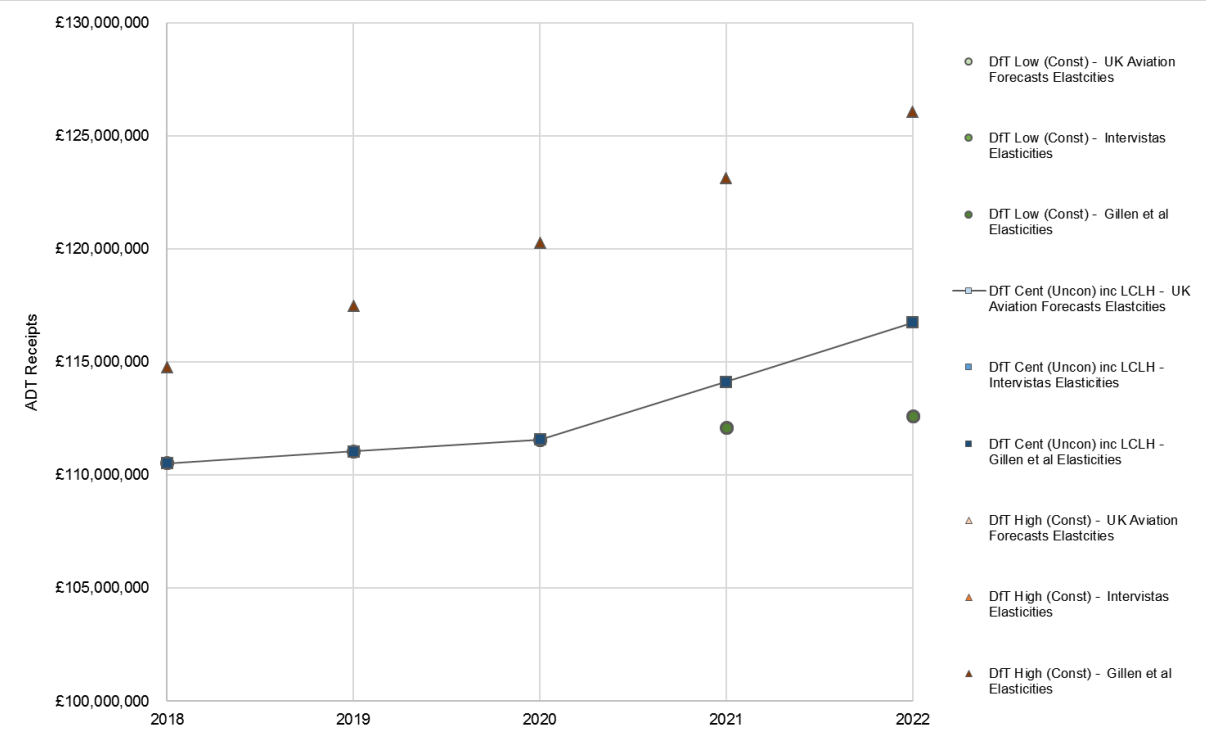


Whilst the Core assumptions result in a figure of 13.8m payable movements by 2022, this figure could range from 13.2m to 15.6m, depending on the combination of growth scenarios and elasticities used. Under this scenario, Band A passengers (who will receive the full reduction in fares) will not pay ADT and ADT receipts will be the same (i.e. Band B only), regardless of the elasticity set used. Varying the underlying growth scenario used would see the core 2022 tax receipts of £117m vary in the range of £113m to £126m.

Scenario 1b: 100% reduction in Band A: Partial Pass-Through

Figure B.2: ADT Payable Movements & Receipts – Scenario 1b (Partial pass-through)

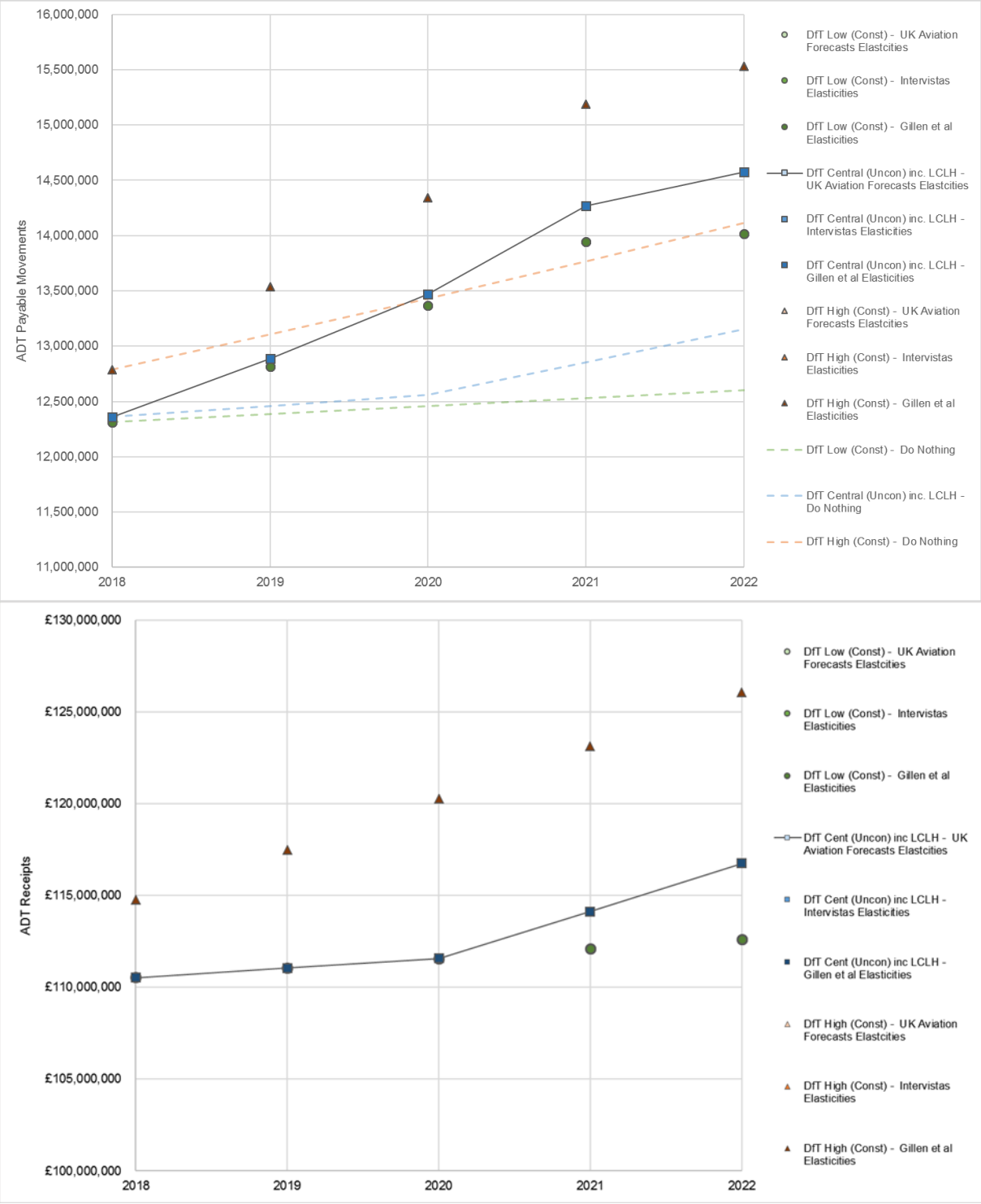




Whilst the Core assumptions result in a figure of 14.2m payable movements by 2027, this figure could range from 13.6m to 15.5m, depending on the combination of growth scenarios and elasticities used. Under this scenario, Band A passengers (who will receive the partial reduction in fares and a partial supply side uplift) will not pay ADT and ADT receipts will be the same (i.e. Band B only), regardless of the elasticity set used. **The ADT receipts will therefore be the same as Scenario 1a** and varying the underlying growth scenario used would see the core 2022 tax receipts of £117m vary in the range of £113m to £126m.

Scenario 1c: 100% reduction in Band A: No Pass-Through

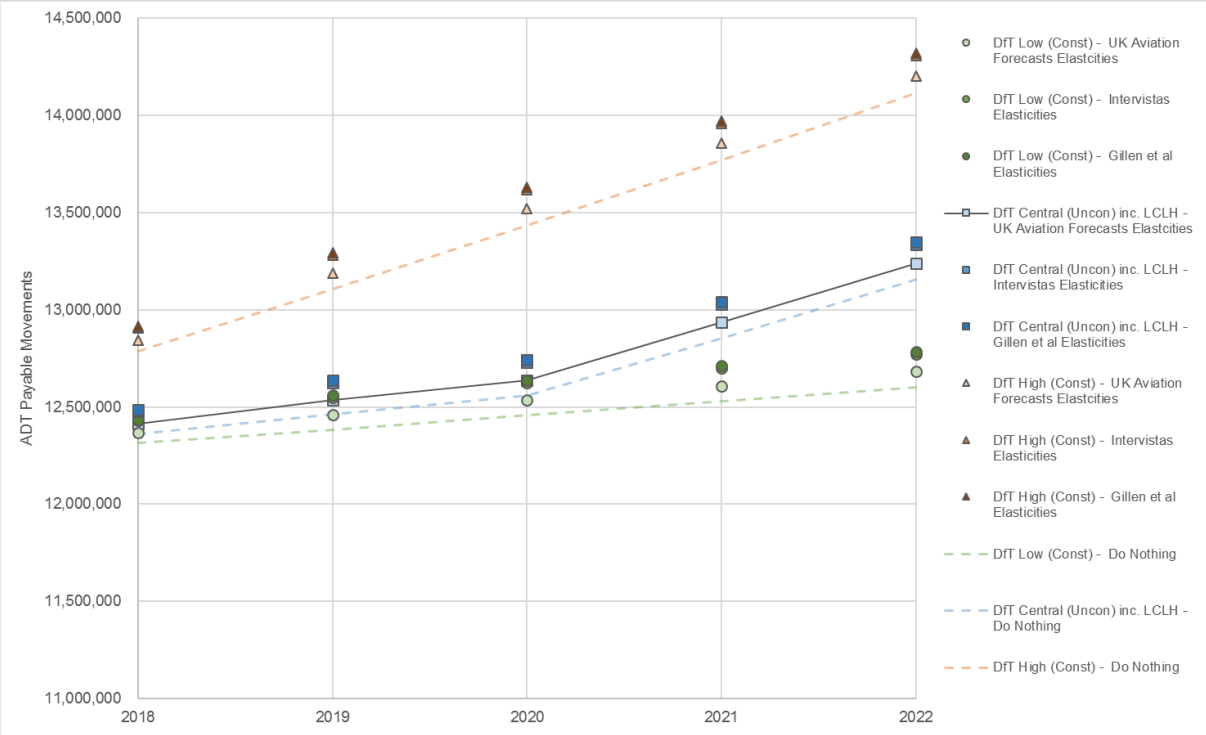
Figure B.3: ADT Payable Movements & Receipts – Scenario 1c (No pass-through)

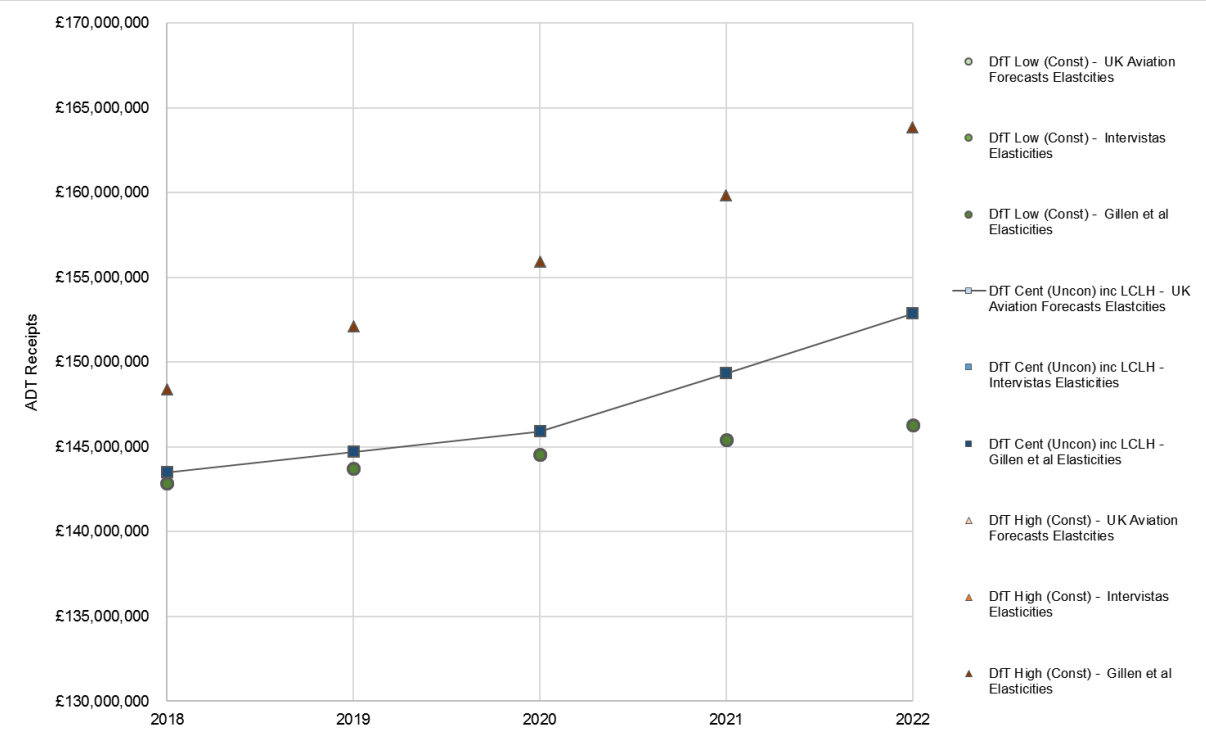


Whilst the Core assumptions result in a figure of 14.6m payable movements by 2027, this figure could range from 14.0m to 15.5m depending on the combination of growth scenarios and elasticities used. Under this scenario, Band A passengers (who will receive a zero reduction in fares and the full supply side uplift) will not pay ADT and ADT receipts will be the same (i.e. Band B only), regardless of the elasticity set used. **The ADT receipts will therefore be the same as Scenario 1a** and varying the underlying growth scenario used would see the core 2022 tax receipts of £117m vary in the range of £113m to £126m.

Scenario 2a: 100% reduction in Band B: Full Pass-Through

Figure B.4: ADT Payable Movements & Receipts – Scenario 2a (Full pass-through)

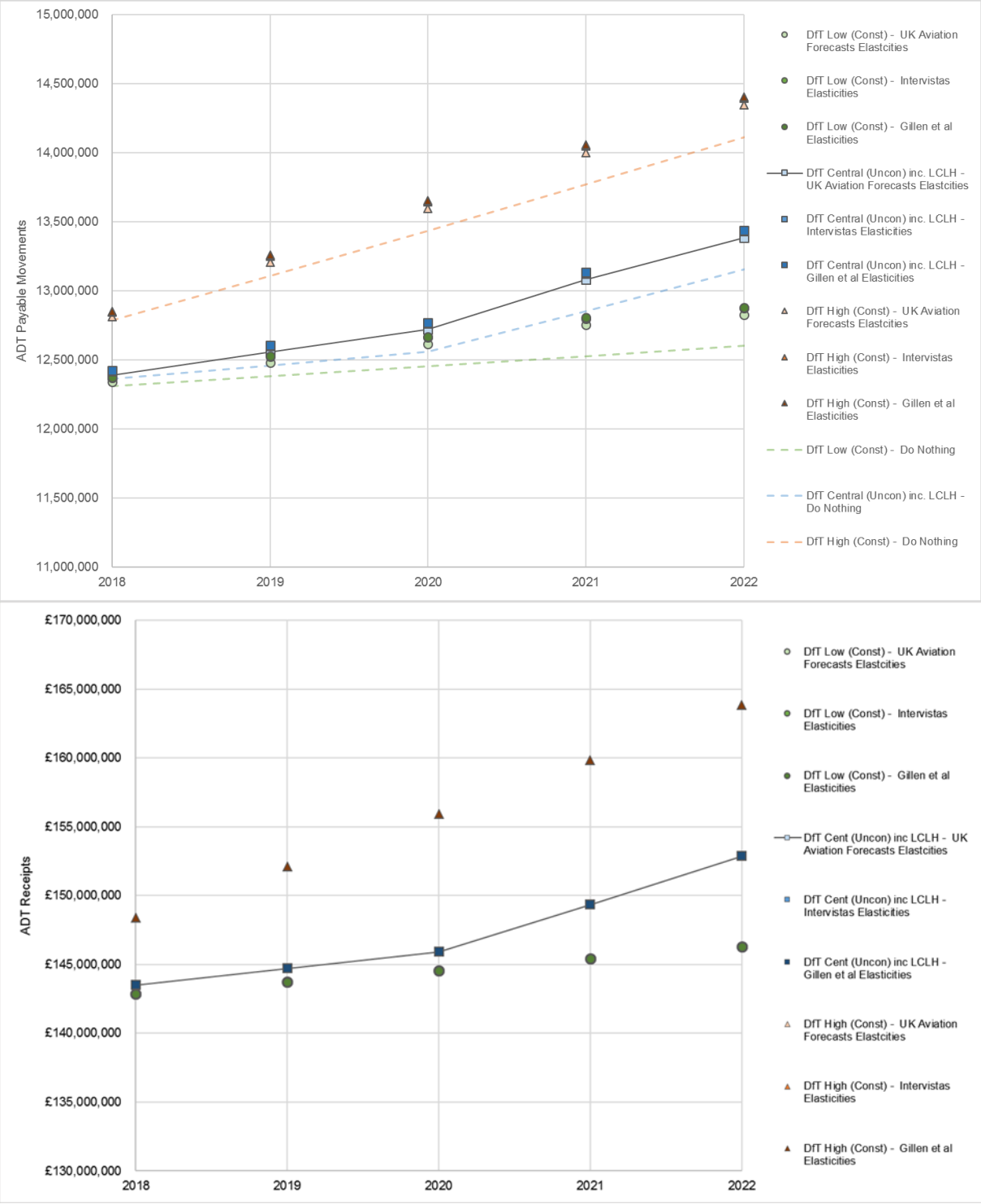




Whilst the Core assumptions result in a figure of 13.2m payable movements by 2022, this figure could range from 12.7m to 14.3m depending on the combination of growth scenarios and elasticities used. Under this scenario, Band B passengers (who will receive the full reduction in fares) will not pay ADT and ADT receipts will be the same (i.e. Band A only), regardless of the elasticity set used. Varying the underlying growth scenario used would see the core 2022 tax receipts of £153m vary in the range of £146m to £164m.

Scenario 2b: 100% reduction in Band B: Partial Pass-Through

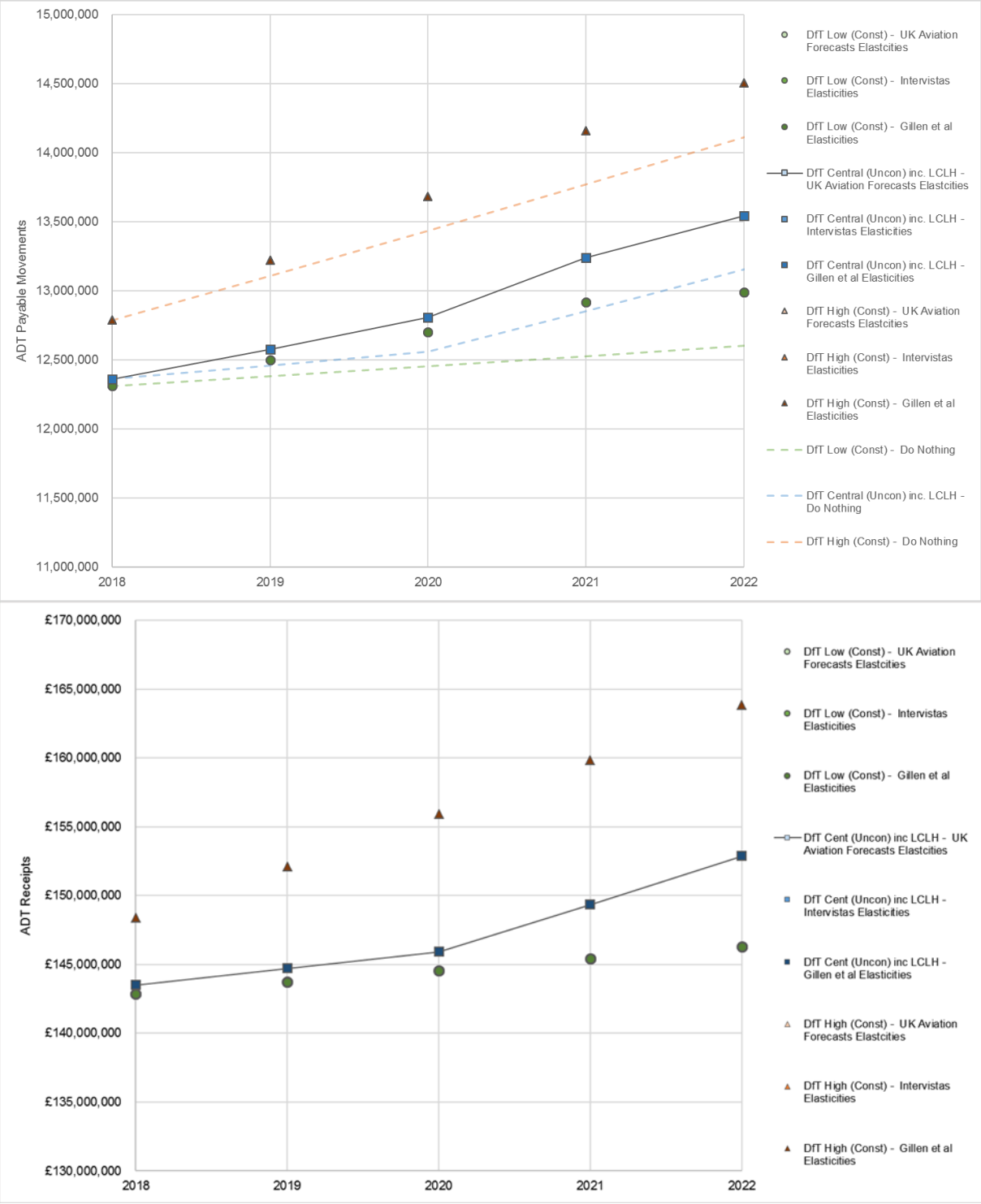
Figure B.5: ADT Payable Movements & Receipts – Scenario 2b (Partial pass-through)



Whilst the Core assumptions result in a figure of 13.4m payable movements by 2022, this figure could range from 12.8m to 14.4m, depending on the combination of growth scenarios and elasticities used. Under this scenario, Band B passengers (who will receive the partial reduction in fares and a partial supply side uplift) will not pay ADT and ADT receipts will be the same (i.e. Band A only), regardless of the elasticity set used. **The ADT receipts will therefore be the same as Scenario 2a** and varying the underlying growth scenario used would see the core 2022 tax receipts of £153m vary in the range of £146m to £164m.

Scenario 2c: 100% reduction in Band B: Zero Pass-through

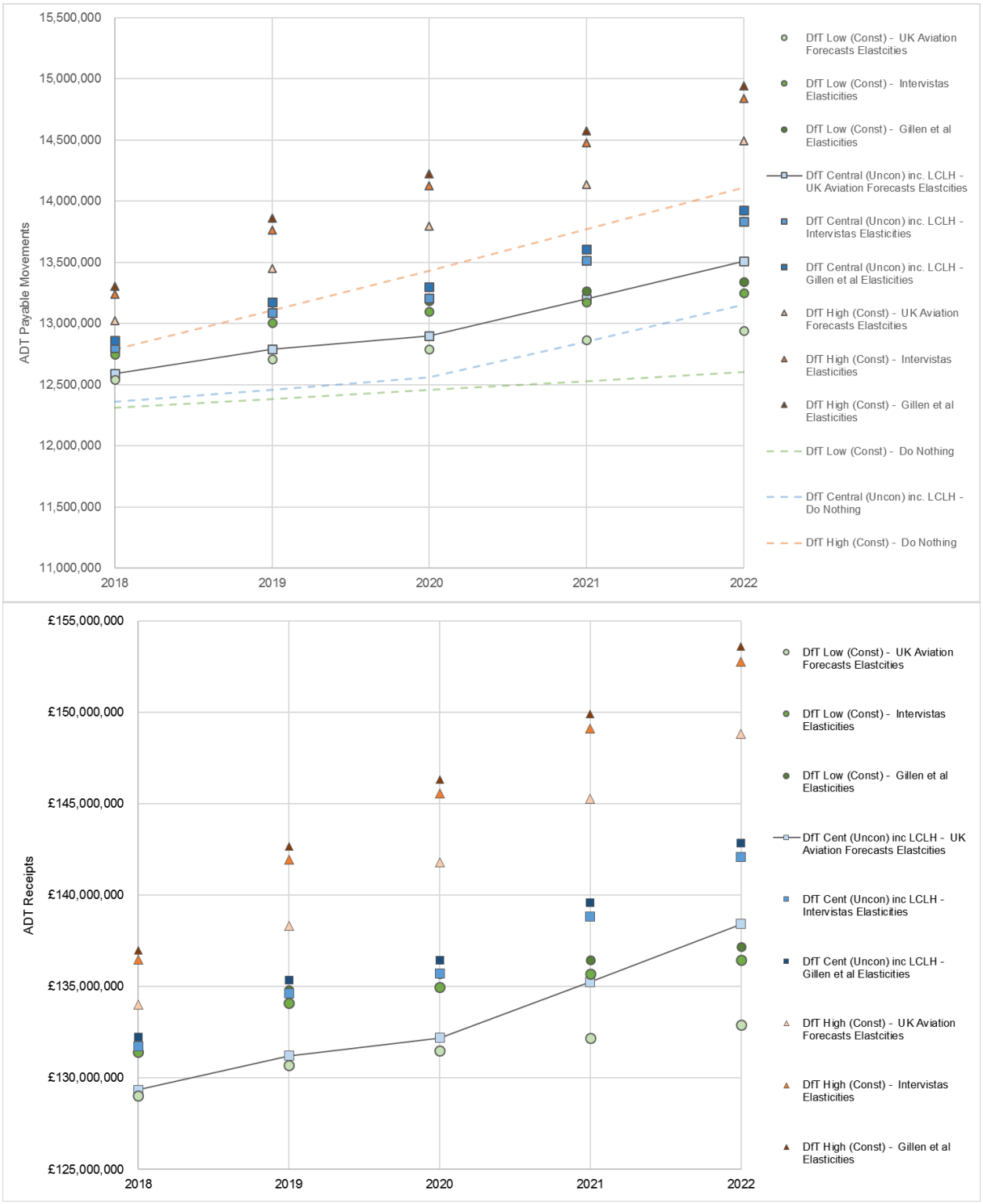
Figure B.6: ADT Payable Movements & Receipts – Scenario 2c (Zero pass-through)



Whilst the Core assumptions result in a figure of 13.5m payable movements by 2022, this figure could range from 13.0m to 14.5m, depending on the combination of growth scenarios and elasticities used. Under this scenario, Band B passengers (who will receive no reduction in fares and a full supply side uplift) will not pay ADT and ADT receipts will be the same (i.e. Band A only), regardless of the elasticity set used. **The ADT receipts will therefore be the same as Scenario 2a** and varying the underlying growth scenario used would see the core 2022 tax receipts of £153m vary in the range of £146m to £164m.

Scenario 3a: 50% reduction in Band A & Band B: Full Pass-Through

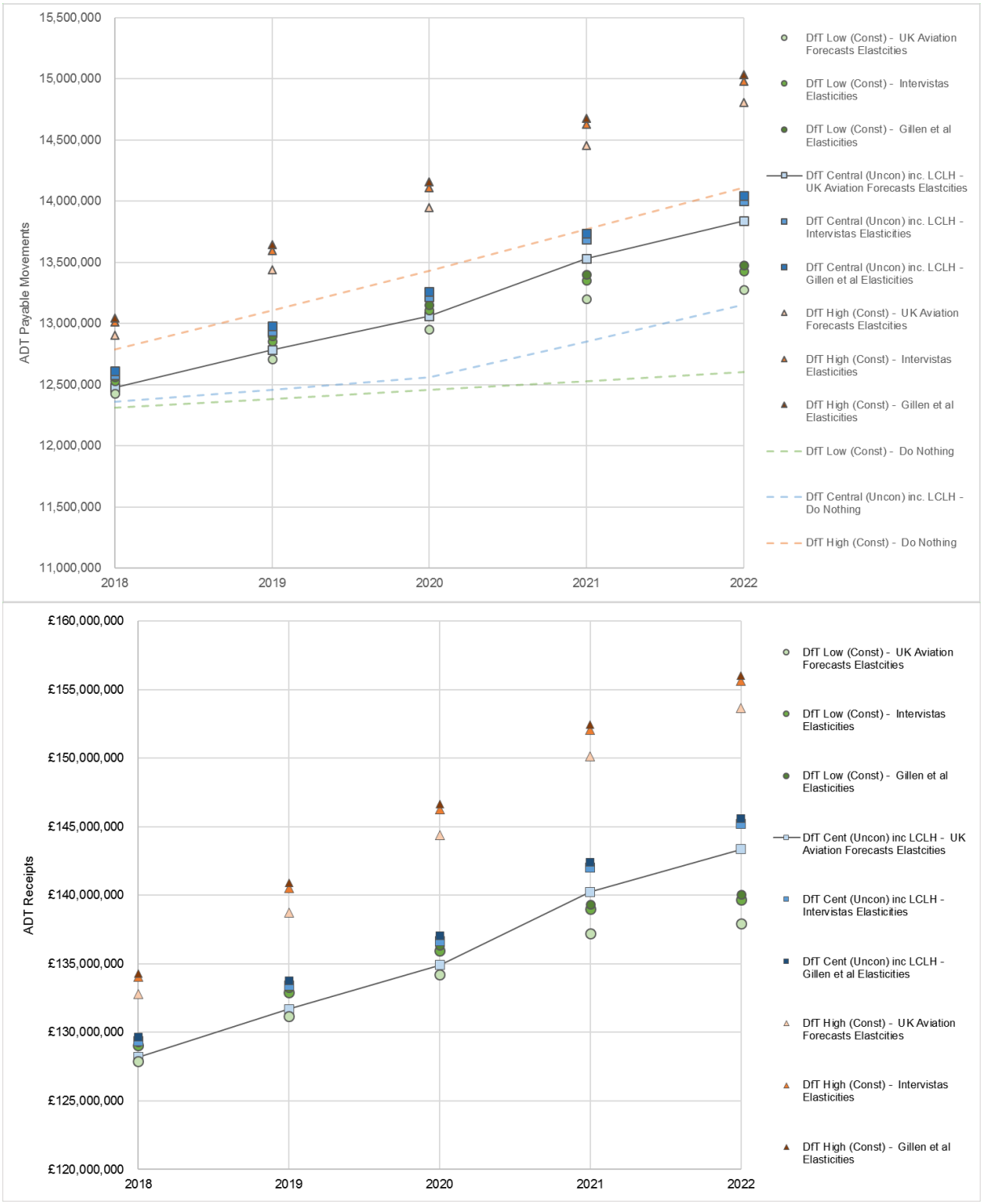
Figure B.7: ADT Payable Movements & Receipts – Scenario 3a (Full pass-through)



Whilst the Core assumptions result in a figure of 13.5m payable movements by 2022, this figure could range from 12.9m to 14.9m, depending on the combination of growth scenarios and elasticities used. Under this scenario, both Band A and Band B passengers will receive the full reduction in fares, and thus the application of different elasticities has an impact on tax receipts. Varying the elasticities and underlying growth scenario used would see the core 2022 tax receipts of £138m vary in the range of £133m to £154m.

Scenario 3b: 50% reduction in Band A & Band B: Partial Pass-Through

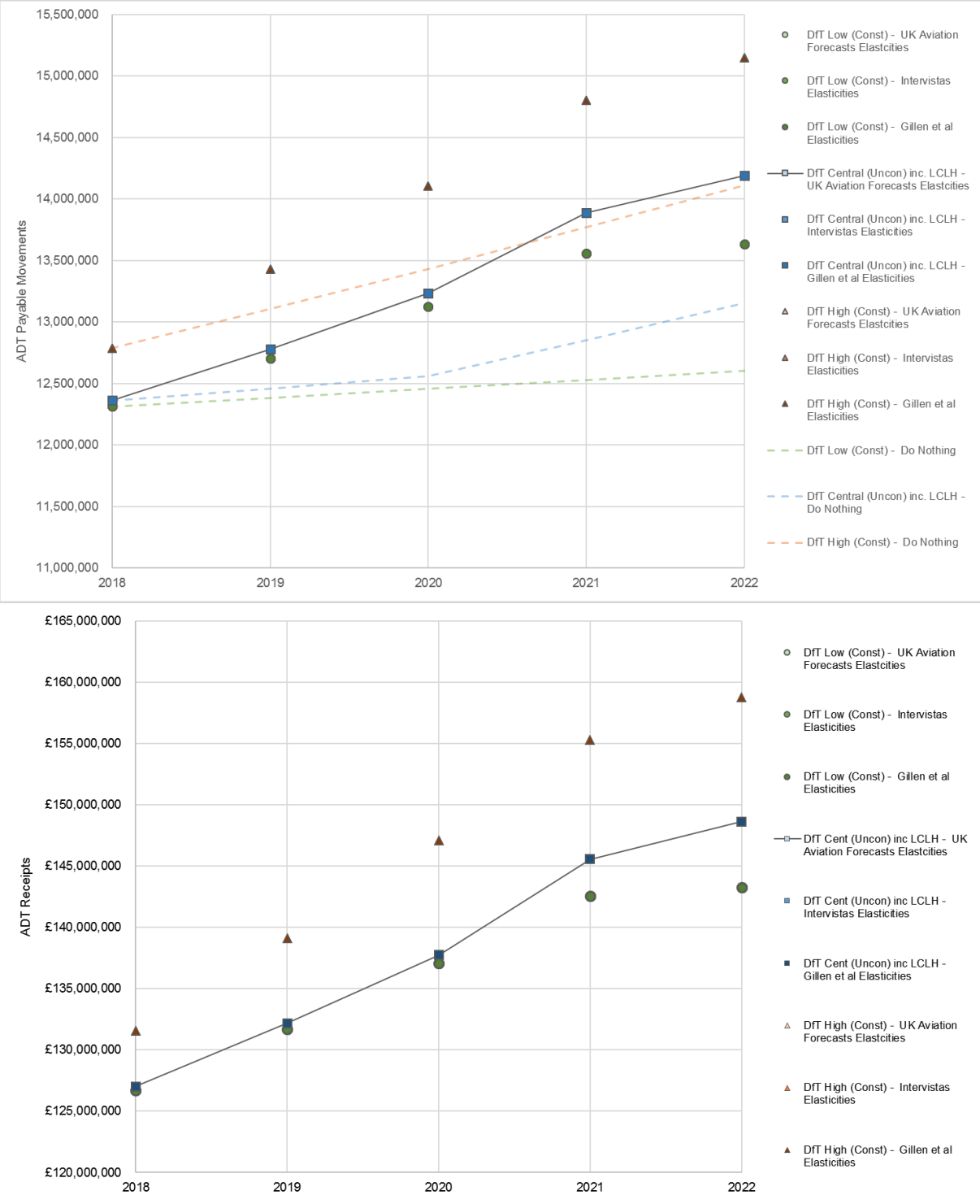
Figure B.8: ADT Payable Movements & Receipts – Scenario 3b (Partial pass-through)



Whilst the Core assumptions result in a figure of 13.8m payable movements by 2022, this figure could range from 13.3m to 15.0m, depending on the combination of growth scenarios and elasticities used. Under this scenario, both Band A and Band B passengers will receive the partial reduction in fares (and a partial supply side uplift), and thus the application of different elasticities has an impact on tax receipts. Varying the elasticities and underlying growth scenario used would see the core 2022 tax receipts of £143m vary in the range of £138m to £156m.

Scenario 3c: 50% reduction in Band A & Band B: Zero Pass-Through

Figure B.9: ADT Payable Movements & Receipts – Scenario 3c (No pass-through)



Whilst the Core assumptions result in a figure of 14.2m payable movements by 2022, this figure could range from 13.6m to 15.1m, depending on the combination of growth scenarios and elasticities used. Under this scenario, both Band A and Band B passengers will receive no partial reduction in fares (there is a full supply side response though), and thus the application of different elasticities has no impact on tax receipts. Varying the underlying growth scenario used would see the core 2022 tax receipts of £149m vary in the range of £143m to £159m.

Appendix C - Monitoring and Evaluation Framework

Outcome / Impact	Potential Indicator(s)	Rationale for Indicator(s)	Source & Availability
Outcome: Additional Passengers	1) Total passenger throughput at each Scottish airport and selected comparator airports. 2) Monthly terminal passengers at each Scottish airport and selected comparator airports. 3) Route level carryings from each Scottish airport. 4) Profile of average fares at various levels of aggregation. 5) CAA survey of Scottish airport. 6) Consultation with Virgin Trains East and West Coast on any displacement from rail - qualitative	The indicators would provide an indication of the change in passenger demand at various levels of aggregation and segmentation.	1) Published annually in Scottish Transport Statistics. 2) Published on a monthly basis by the CAA. 3) Not readily available – would require a data request to the airlines – data provision likely to be patchy. 4) Collected on a monthly basis – data is limited and would require to be purchased. Alternative is to use a web-based search 5) CAA has confirmed that there will be a further survey in 2018 which includes Scottish airport. 6) Consultation with Virgin East Coast and Virgin West Coast.
Outcome: Supply side Response, Airlines	1) Listing of airlines by market segment operating from each Scottish airport. 2) Record of all routes operated from Scotland itemised by market segment, with new routes flagged. 3) Annotation of record of routes with a record of service frequencies, noting any changes. 4) Annotation of the record of routes with a record of aircraft type. 5) Based aircraft – list of based aircraft by airline / airline type.	The indicators would provide an indication of the change on the supply side in response to the introduction of ADT.	1) Web-based search. 2) Web-based search / consultation with airports or airlines 3) Web-based search / consultation with airports or airlines 4) Web-based search / consultation with airports or airlines 5) Web-based search / consultation with airports or airlines
Outcome: Supply side Response, Airports	1) Record of any investments made by all Scottish airports.	This indicator would provide a record of any additional investments made by airports in response to ADT.	1) Consultation with airports.
Impacts:	1) Estimate of tourism implications of ADT –	This indicator would assess	1) Consultation with airports, Visit Scotland, Team

Outcome / Impact	Potential Indicator(s)	Rationale for Indicator(s)	Source & Availability
Tourism Numbers	qualitative.	the tourism related impact of introducing ADT, noted as the most significant impact of the policy in absolute terms.	Scotland etc.
Impacts: Wider economic impacts	1) Review of Economic Impact Assessment in this report.	Provides outturn economic impacts based on outturn passenger numbers	1) Use of outturn passenger figures – readily available. Comparison against current do nothing or a control group.
Impact: Revenue	1) ADT receipts accruing to Revenue Scotland.	Provides a record of financial cost of policy.	1) ADT receipts published by Revenue Scotland.

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