Evaluation of the 2009 Competition Commission's BAA airports market investigation remedies

Final Report for the Competition and Markets Authority (CMA)

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A report submitted by ICF Consulting Services

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Executive summary

This study evaluated the Competition Commission's (CC) remedies applied to the airport services market. In 2006, the Office of Fair Trading (OFT) undertook a market study, which led to the CC investigating the supply of airport services by BAA within the UK. The CC concluded in 2009 that a number of features of the UK airports market gave rise to an adverse effect on competition. Its key findings relevant to this evaluation were that:

- common ownership prevented competition between BAA airports, restricted or distorted competition in relation to capacity development at BAA's London airports and exacerbated inadequacies in economic regulation in relation to BAA's London airports;
- Heathrow Airport's position as the only significant hub airport in the South-East was in itself a feature that restricted competition between airports; and
- the comparatively isolated geographical location of Aberdeen airport relative to other centres of population was a barrier to entry, which restricted competition.

As a result of the CC's investigation and its recommended remedies for addressing the market features which give rise to these adverse effects on competition, three airports were sold, one became subject to new regulation and changes were made to regulation of the sector.

Objectives of this study

The Competition and Markets Authority (CMA) is required by the Department for Business Innovation and Skills (BIS) to report annually on independent evaluations of the impact of at least two previous cases, to include one market study or investigation. In 2015, the CMA selected the CC's 2009 market investigation for evaluation, which led to this study.

The core objective of this study was to understand the effects of the CC's remedies for the UK airports market and to estimate consumer benefits, with a particular focus on airports that were directly affected by the remedies. The remedies considered were:

- divestiture of both Stansted Airport and Gatwick Airport to different purchasers;
- divestiture of either Edinburgh Airport or Glasgow Airport;
- recommendations in relation to economic regulation if airports; and
- undertakings in relation to Aberdeen Airport, to require the reporting of relevant information and consultation with stakeholders on capital expenditure.

In addition, consultation procedures and provisions on quality of service at Heathrow Airport were updated, but these were temporary measures, so were not considered in this evaluation.

Methodology

This evaluation was based on a conceptual framework that developed hypotheses regarding the anticipated impacts of the CC's remedies, drawing on the CC's market investigation. These hypotheses were then tested by gathering and analysing data and other evidence to conclude on whether and to what extent the anticipated impacts were realised in practice.

The study combined evidence from a range of sources to provide a comprehensive evaluation of the effect of the remedies. The evidence base included data and other evidence gathered via site visits to key airports, including all those directly affected by the CC's remedies, interviews with other airports, Government departments, airlines and other professionals serving the sector. It also included descriptive analysis of the market before and after the CC's remedies and econometric analysis that aimed to attribute changes in the market for airport services to the CC's remedies. This was combined with extensive desk research of literature relevant to this evaluation and to the provision of airport services.

Findings

The manner in which airports compete provides context for the interpretation of the findings from this evaluation. From a passenger's perspective, choice between airports happens only when each serves a similar route. Airports, on the other hand, compete between each other for airlines' business. Airlines do switch between airports, but are influenced by many considerations beyond those that airports can directly influence, particularly in the short term.

Further, many stakeholders reported that capacity constraints in the South East of England have a significant impact on the market. Some reported that removing capacity constraints could lead to greater competition between airports, thereby increasing the potential future benefits of the remedies that the CC implemented.

Impacts associated with airport divestments

The CC hypothesised that increased competition as a result of divestment remedies would lead to increased rivalry to provide greater passenger throughput to the market. Passenger growth reflects airports' and airlines' expansion of capacity offered to the market. It benefits consumers because more passengers are able to fly, including some that would not otherwise have done so. These passengers benefit directly from having taken those journeys. Further, expanding supply puts downward pressure on prices for air travel (all other things being the same), so even passengers who otherwise would have flown may pay less for their flights.

This study found that passenger numbers and the number of Air Transport Movements (ATMs – a take-off or landing) have increased at Gatwick, Stansted and Edinburgh since divestment. Gatwick has increased its share of passengers travelling from London airports since divestment. Edinburgh's share of passenger traffic at Glasgow, Edinburgh, Prestwick and Aberdeen has increased modestly since its sale in April 2012. There is some econometric evidence to suggest that increases in ATMs and passenger numbers at divested airports are significantly larger when compared with other UK airports. Estimates suggest that, taking into account long-term trends, ATMs at the three divested BAA airports increased by 9 per cent more than other UK airports concurrent with divestment at each, and passenger numbers by between 9 and 12 per cent. This increase is estimated to be equivalent to £295m of additional consumer benefit to date and £607m by 2020[1][2]. Qualitative evidence is consistent with this impact being attributable in part to the CC's remedies.

If Heathrow and Glasgow Airports are omitted from the group of comparator airports, estimates of the increase in passengers at divested airports increase to 15%. Using a 15% increase in passenger numbers (the highest increase estimated in analysis for this study) leads to central estimate of £422m of consumer benefits realised to date and to £867m by 2020.

The CC hypothesised that increased competition as a result of divestment remedies would also lead to greater route development at divested airports. The total number of seats available to the market continued to rise in line with an upward trend that commenced prior to the divestments, with some signs that the rate of increase has accelerated at Edinburgh and Gatwick since divestment.

The CC hypothesised that increased competition as a result of divestment remedies would also lead to an increase in service quality at divested airports. Passenger perceptions of service quality appear to have improved at the divested airports, with some variation over time and across measures of service quality.

Airlines reported that passenger satisfaction scores increased in the most recent period and some increases are reflected in recent data. ASQ data are not published by ACI and while some airports publish aspects of their individual performance, this information is limited. Insufficient ASQ data were

[1] This estimate is based on the increase observed to date remaining the same.

2 If Heathrow and Glasgow Airports are omitted from the group of comparator airports, estimates of the increase in passengers at divested airports increase to 15%. Using a 15% increase in passenger numbers (the highest increase estimated in analysis for this study) leads to central estimate of £422m of consumer benefits realised to date and to £867m by 2020.

available to ICF to carry out econometric analysis of whether there was any statistically significant change in passenger perceptions around the time of divestments of BAA's airports. Nonetheless, there is also considerable qualitative evidence reported by airports, airlines and government bodies that service quality has improved at Edinburgh, Stansted and Gatwick since they were divested by BAA. This is also generally reflected in observed improvements in quantitative estimates of passenger perceptions of airport service quality at those airports.

The CC hypothesised that increased competition as a result of divestment remedies would lead to lower aeronautical charges. While airports' prices cannot be directly observed (pricing schedules apply only to unanticipated landings), there is some evidence that the growth in airports' yields from these charges has slowed at Stansted and Edinburgh. However, outside factors can significantly affect airports revenue's from these charges, including capacity constraints, capital spending, wider market conditions and dynamics in the airlines market.

Finally, the CC hypothesised that increased competition as a result of divestment remedies would also improve operational efficiency at divested airports. There is some quantitative evidence that divestment at Gatwick has led to lower operational costs across a range of indicators. This is supplemented by considerable qualitative evidence that new owners at each of the divested airports have engaged in wide and far-reaching efforts to improve operational efficiency. Econometric analysis did not, however, reveal statistically significant evidence to support this, despite some signs that, if more data points were available, this could be observed. Further, airports reported that measures of operational expenditure can be influenced by the process of implementing changes to their services, for example where increased operational expenditure is required to manage disruption during terminal investments.

Impacts associated with Aberdeen Airport's undertakings

The CC hypothesised that Aberdeen's undertakings would lead to an increase in investment at Aberdeen Airport, which it had found to be below the level that might be expected in a more competitive market. There is some evidence that the rise in airport charges and operational expenditure has slowed or halted since the undertakings were accepted. The CAA has also identified recent and planned investment[3]. However, this study did not find quantitative or qualitative evidence linking this with the CC's remedies and few stakeholders commented substantively on these remedies.

Impacts associated with changes in Government policy and economic regulation

Qualitative evidence from stakeholders reflects a commonly-held view that the CC strongly influenced the changes to Government policy implemented through the Civil Aviation Act 2012. Stakeholders universally supported the changes, particularly with respect to the changes in the economic regulation of airports. Views on the extent of the effect were more mixed, some attributing positive change to these improvements in economic regulation, others reporting that they have not had a discernible impact on observed outcomes in the market.

Impacts at Heathrow Airport

The effects of the CC's divestment remedies on Heathrow have not been specifically quantified in this study. Nonetheless, qualitative and some quantitative evidence supports the view that Heathrow has also been subject to greater competitive rivalry from other London airports as a result of the CC's remedies as a whole. Passenger satisfaction has been increasing since the CC's remedies were implemented. Some stakeholders reported that the benefits of improved competition in the South East of England were reflected in Heathrow's behaviour and improved performance, although noting that this could also be a consequence of new management.

[3] CAA, April 2016, *Aberdeen Airport – A Market Monitoring Report,* http://publicapps.caa.co.uk/docs/33/CAP1403%20APR16.pdf

Overall Impact

The weight and breadth of evidence in this evaluation illustrates that it is reasonable to conclude that the CC's investigation had positive impacts on competition between airports. It is also reasonable to conclude that it has delivered passenger benefits, as illustrated by estimates of passenger benefit that can be observed in the market since divestment, controlling, where possible, for other factors. Wider developments in the airports and airlines market make interpreting data challenging, but these wider developments do not appear to explain the changes in passenger throughput observed in the market and do not contradict qualitative findings.

It is reasonable to conclude that quantified changes in the market that coincided with the CC's remedies have already delivered passenger benefits that outweigh the costs of divestment associated with the remedies. If these trends continue, they will go on to deliver even greater benefits over time. While not possible to specifically attribute these benefits to the CC's investigation, the qualitative evidence evaluated in this study supports that conclusion.

There remain many sources of passenger benefit for which quantification has not been possible. Collectively the qualitative and quantitative evidence identified in this evaluation demonstrates that the benefits of the CC's remedies realised to date are greater than can be quantified here in terms of passenger benefit. The majority of stakeholders reported that passengers have experienced many positive changes in the provision of airport services at airports directly affected by the CC's remedies, such as new check-in services and improvements to experience at security. There is also descriptive evidence of increasing passenger satisfaction at directly-affected airports since the CC's remedies were implemented. Some stakeholders reported that the CC's investigation was a significant contributing factor to these improvements that have been observed in passenger outcomes since the CC's remedies. Considering all the evidence assessed in this study, it is reasonable to conclude that this improvement is consistent with the CC's remedies having a positive effect on competition between airports.

1 Introduction

This is the Final Report for ICF International's (ICF's) study for the Competition and Markets Authority (CMA) to evaluate the 2009 Competition Commission's (CC's) BAA airports market investigation. This first section explains the objectives of the study, the approach taken and details the content and structure of this report.

1.1 Objectives of the study

The core objective of this study is to understand the effects of the CC's remedies for the airports market and to estimate customer benefits, with a particular focus on airports that were directly affected by the remedies. In particular, the objective was to identify cumulative effects and estimate overall consumer benefits associated with the remedies. It also included identifying factors other than the CC's decisions that have had an impact on the airports market and taking them into account.

This evaluation has been conducted in the context of reporting requirements set for the CMA by the Department for Business, Innovation and Skills (BIS). It contributes to the CMA's goal to 'deliver effective enforcement', fulfilling a requirement to conduct independent evaluations of the impact of at least two previous cases (see box below).

The CMA's reporting requirements

In the Performance Management Framework (January 2014), BIS sets out the activities that the CMA is required to carry out in order to: demonstrate its beneficial impact on consumers, on business behaviour and on productivity and growth in the economy; and prove its ability to make robust decisions and implement effective and proportionate remedies.

The Performance Management Framework also defines the CMA's requirements for each of its five strategic goals. For example, for the first goal (Deliver effective enforcement), the CMA is required to report annually on independent evaluations of the impact of at least two cases (including at least one market study or investigation). In 2015, the market study selected for ex-post evaluation was the CC's 2009 BAA airports market investigation.

1.2 The study's conceptual framework

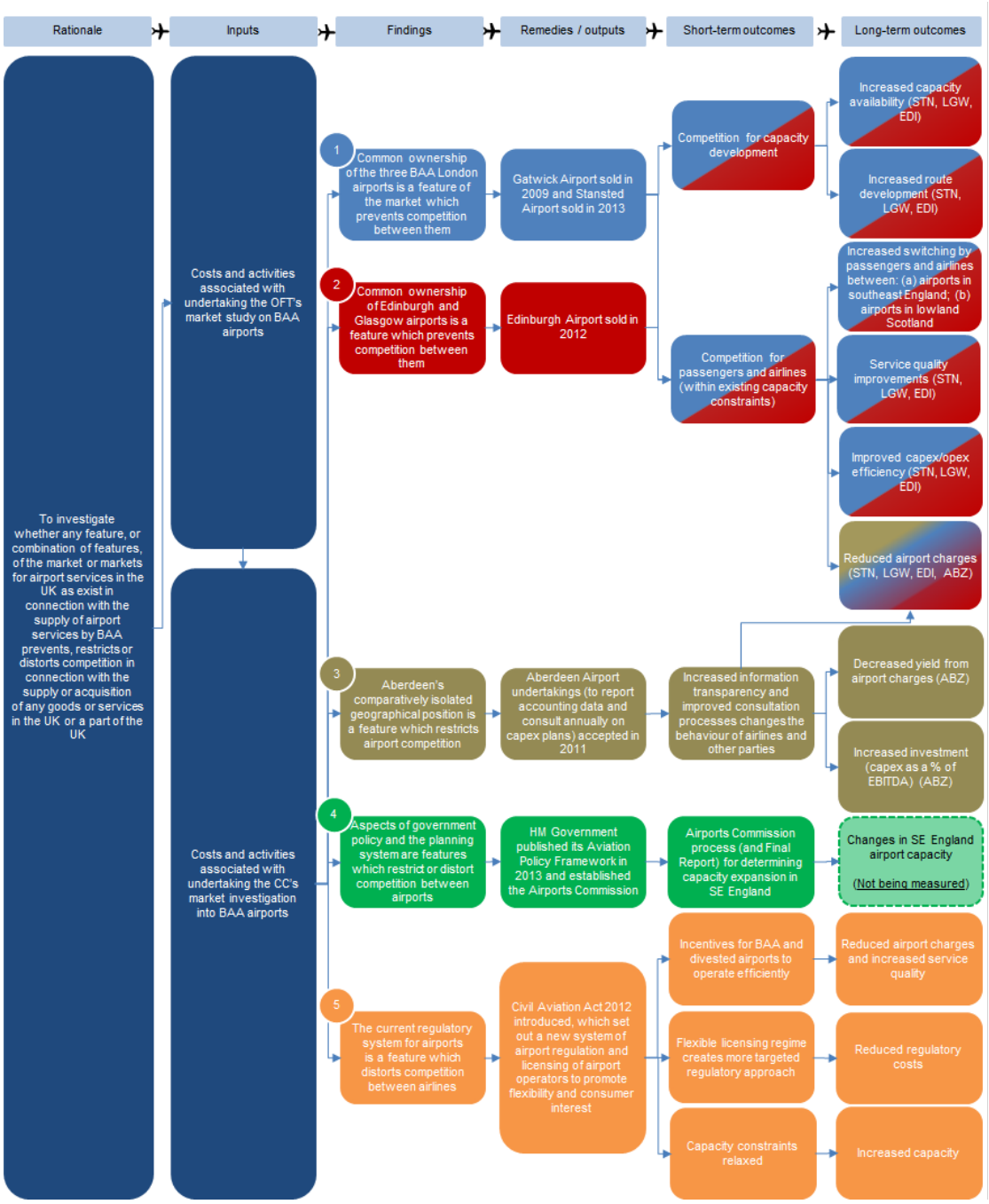
This study faced a number of challenges:

- Describing the counterfactual – what would have happened without the CC's investigation and remedies. The remedies were far reaching, leading to an airports market that now looks very different to prior to the investigation, generating many unknowns in terms of what might have otherwise happened.
- Complexity in the airports market. Airports compete for airlines', which themselves compete for passengers. Airports generate a significant portion of their revenue from passengers, but do not control all aspects of passengers' experience at their airports. Airports are also subject to significant safety regulation and some economic regulation. Airports are also capital-intensive and investments in capacity are lumpy and in some cases subject to significant government and public scrutiny. These factors can also influence indicators of competitiveness in the airports market.
- Wider influences on the airports market. Air passenger demand is heavily influenced by economic conditions, not just in the UK, but globally. The airlines market has also changed considerably and swiftly in the last two decades, changing the way some airports operate and compete for passenger traffic and airlines' business.

The conceptual framework described below intends to navigate these challenges by outlining an intervention logic that hypothesises a causal change between the CC's remedies and

observed changes in indicators of competition at airports affected by the remedies. This conceptual framework focuses mainly on impacts observed at airports affected directly by the each specific intervention.

Figure 1.1 Updated intervention logic for the CC's airports market investigation



Heathrow

The remedy imposed on Heathrow (the Heathrow Consultation and Information Protocol) was a temporary measure, so was deemed out of scope for this evaluation. Outcomes at Heathrow are therefore not specifically included in the intervention logic above.

However, Heathrow is a significant competitor for divested airports in the South East and so has been considered separately within this study, given the influence of competition at London airports on it.

The impact of these remedies was considered wherever possible by comparison with a counterfactual; that is, what would have happened in the absence of these remedies. Wherever possible, stakeholders giving qualitative evidence were asked to consider this counterfactual. Quantitative analysis in this study also set out to compare outcomes with this counterfactual, as far as was possible based on available data.

The study's findings are set out according to this structure. The main focus of this study is the investigation of divestment remedies at Gatwick, Stansted and Edinburgh (Section 3). The study also investigated evidence on the hypothesised impacts of the remedies applied to Aberdeen airport, and quantitatively investigated the impacts of changes in Government policy and the regulatory system for airports in the UK.

1.3 The study method

This study incorporated a multi-layered approach to gathering evidence and analysing this evidence to evaluate the hypotheses described above. Desk research carried out for this study included investigating the effects of competition in airports markets and the specific impacts of the CC's remedies. Data was gathered on the airports market in the UK from a wide range of public and proprietary sources, including from airports. This data was analysed descriptively and econometrically, to search for evidence of effects of the CC's remedies. A range of stakeholders from across the sector were interviewed and site visits of airports across the UK were conducted.

This broad evidence base was synthesised and tested against the evaluation hypotheses outlined above. Each method for collecting evidence is described below.

1.3.1 Desk research

The aim of the desk research was to establish the context of the study, inform the approach and to contextualise the quantitative analysis. The ICF research team identified and gathered market intelligence, data, research and information of relevance to the evaluation study and evaluation questions.

The literature review was specifically targeted on the impacts of the CC's remedies and aimed to support the different assumptions in relation to the changes in outcomes observed and attributed to the CC's decisions. It also included searching for contextual information that supported the analysis of other impacts of the CC's remedies, for which a quantitative estimate was not feasible.

1.3.2 Site visits and interview

Site visits were conducted by members of the study team to key airports in the South East of England and in Scotland, including those directly affected by the CC's remedies and others. These included Gatwick, Stansted, Heathrow, Edinburgh, Glasgow, Luton and Birmingham. At Glasgow the remedies specific to Aberdeen airport were discussed, as both are within the AGS Airports group. This gave the study team opportunities to directly observe operational challenges associated with running an airport. It also allowed the study team to see changes and improvements implemented by these airports in recent years.

ICF also worked jointly with the CMA to interview a wide range of other stakeholders from across the sector, including airlines, a freight carrier, public bodies and other companies operating in or serving the airports sector. In total twenty-three other stakeholders were invited to be interviewed a total of ten participated in the study (in addition to airports for which site visits were conducted).

1.3.3 Quantitative evidence

A broad approach was taken to examining the full range of quantitative evidence on the impacts of the CC's remedies. This included two key strands of analysis:

- descriptive analysis of quantitative information relating to a range of indicators associated with the study hypotheses; and
- econometric investigation of the same indicators (using statistical analysis to establish whether impacts of the CC's remedies can be isolated and estimated). Initially this attempted to establish causal effect of the CC's remedies. Challenges implementing this methodology with the data available led to investigating evidence for observable and statistically significant differences in the market before and after the CC's remedies. This was carried out with the objective of quantifying consumer benefits where any statistically significant evidence of impacts of the CC's remedies could be found.

1.4 Structure of this report

The remainder of this Final Report is structured as follows:

- Section 2 describes background and context for this study, including a description of key considerations when analysing competition in the airports market;
- Section 3 describes evidence on the impacts of the divestment of Gatwick, Stansted and Edinburgh;
- Section 4 describes evidence on the impacts of the other CC remedies for the airports market;
- Section 5 provides a summary of impacts and conclusions.

This document also has a number of annexes, describing the selection of potential indicators of airports competition (Annex 1), data used in this evaluation (Annex 2), additional service quality data (Annex 3), the methodology for econometric analysis (Annex 4) and the study bibliography (Annex 5).

2 Background and context

This Section describes important background and context to this evaluation. It includes an overview of the sector and an outline of key aspects of competition between airports and key trends in the sector that must be considered alongside the study findings.

2.1 Overview of the UK aviation sector

The aviation industry is a significant part of the UK economy. In the 12 months to July 2015, there were 2.16 million air transport movements[4] involving 246 million passengers and 2.3 million tonnes of air cargo[5].

The industry grew rapidly in the 25 years to 2007: air transport movements increased 250 per cent, cargo increased more than threefold and passenger numbers increased four-fold.

The industry declined between 2007 and 2010 during the global recession (movements, cargo and passengers all declined over this period). Since 2010, air transport movements and air cargo have remained stable, while the number of air passengers has grown again (at pre-recession levels of around 3-4 per cent per annum)[6].

The Civil Aviation Authority (CAA) collects statistics from more than 60 UK Airports. The data show that much of the activity in the industry is focused on four main airports: Heathrow; Gatwick; Manchester and Stansted. These four airports accounted for 46 per cent of all air transport movements and 64 per cent of all passengers in the year to July 2015.

2.2 Competition in the market for airport services

This section gives an overview of how competition functions in the market for airport services and of characteristics and limitations to that competition, which must be considered when analysing airports competition.

Airports are governed by the Civil Aviation Act 2012. The Act sets out the legal framework governing the economic regulation of airports in the UK and establishes the Civil Aviation Authority (CAA) as the industry regulator[7]. The CAA is responsible for airspace policy, safety regulation, consumer protection and the economic regulation of airports. The CAA furthermore determines whether airports should be subject to economic regulation through a licence using a market power test. In 2014, the CAA found that Heathrow and Gatwick retained some market power and still needed to be regulated in some form. Stansted, which was previously regulated, was found not to meet the tests and does not require economic licensing[8].

Airports generate revenue from aeronautical ('aero') charges, those charged to airlines, and from commercial, non-aeronautical ('non-aero') revenues generated from passengers passing through the airport. The proportion of airports' revenues generated from each component varies, but the share of aeronautical charges ranges between 52 per cent (Edinburgh)[9] and

[4] Air transport movements: "All scheduled movements (whether loaded or empty) and loaded charter movements. Empty positioning flights by scheduled aircraft and empty charter movements are excluded". Definition taken from the UK Government, available on: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/491112/aviation-notes.pdf

[5] Civil Aviation Authority. 2015. UK Airport Statistics

[6] Ibid.

[7] Heathrow. N.d. Economic Regulation.

[8] Civil Aviation Authority. 2015. Airport economic licensing and price control

[9] Computations based on Edinburgh Annual report and financial statements for the year ended 31 December 2014. https://s3-eu-west-1.amazonaws.com/edinburghairport/files/2015/06/20150629_Final_signed.pdf

61 per cent (Heathrow)[10] across directly-affected airports by the CC's remedies (Gatwick, Stansted, Edinburgh, Aberdeen) and Heathrow.

Multiple airlines, airports and other sector stakeholders reported that airports can be seen as competing for airlines' business. Airports generate both aero and non-aero revenues by attracting more flights through greater frequency on existing routes, new routes with existing airline customers, or new airlines. These dynamics influence the market for airport services, with different airlines serving customers' with different priorities with respect to service quality and price.

Passenger demand and airport catchment nonetheless has a strong influence on airports' ability to attract airlines and therefore to compete with other airports to attract airlines. Airport service quality can also influence passenger demand and behaviour. Multiple airlines reported that their routing decisions are generally based fundamentally on whether passenger demand is sufficient to make routes commercially profitable. Factors affecting passenger demand therefore significantly affect airports' ability to attract airlines. This is one reason why passenger perceptions of airports are important for them, despite competition for airlines' being the main conduit for competition between airports.

Tretheway and Kincaid (2006) identify different types of competition between airports[11]:

- competition for serving a shared local market – two or more airports are situated close to each other and can be seen as substitutes for airlines and passengers;
- competition for connecting traffic – several airports globally can be considered as a hub for connecting traffic;
- competition for cargo traffic – cargo operators can switch their routes between airports; and
- destination competition – airports can choose the quality, cost and scope of the destination they offer.

These types of competition can lead to airports' competition across the following aspects of airport service (Table 2.1)[12]:

Table 2.1 Dimensions in which airports can compete

Area	Activity
Product	Infrastructure (i.e. runways, taxiways, terminals)
	Passenger facilitation (i.e. preclearance services, security screenings, baggage processing)
	Flexible airport design (i.e. ability to respond to changing market conditions)
	Service provision and third party vendors (i.e. ground handling, fuelling, warehousing)
	Limitations of curfews and noise quotas
	Possibility of cargo traffic

[10] Computations based on Heathrow Annual report and financial statements for the year ended 31 December 2015. http://www.heathrow.com/file_source/Company/Static/PDF/Investorcentre/Heathrow-Airport-Holdings-Limited-31-December-2015.pdf

[11] Tretheway, M., Kincaid, I. (2006), "Competition between airports in the new Millennium: what works, what does not work and why", presentation at the GARS – Workshop " 8th Hamburg Aviation Conference: Competition between airports", on 16 February 2005, Hamburg

[12] Ibid.

Area	Activity
Price	Airport fees and charges Facilitation of airline efficiency (i.e. better taxiway design, more efficient ground power, dedicated facilities for shuttle services) Incentive pricing (i.e. use of innovative charging techniques – for example: rent gate for a whole day for a fixed amount instead of charging a standard charge per use of a gate)
Promotion	Air service development programs (i.e. attract new air carriers, expand existing air services) Passenger marketing (i.e. ensure passenger, travel agency and shipper awareness of available airport services) Integrated marketing approaches (i.e. combine marketing efforts with those of other members of the travel supply chain) Naming the airport (i.e. use of the city's name, use of "international") Branding (i.e. logo, style, merchandising
Physical distribution	Computer reservation systems Travel agents Airport websites

2.2.1 Limitations on competition between airports

Competition between airports should be considered in light the following monopolistic or oligopolistic characteristics:

- entry barriers and sunk costs: new airports may not be able to enter the market or build new facilities because of legal provisions or environmental issues; while existing airports' costs are largely sunk, because their assets cannot be re-purposed;
- scale effects: many airports reported significant scale effects in the operation of (individual) airports, while some reported that such scale effects do not apply across airports;

Runway capacity constraints also have a significant effect on airports competition. Airports operating at or close to maximum runway capacity reported that competition manifests itself in different ways. For example, one airport with little runway capacity reported that to increase revenues it therefore focussed on attracting premium passengers and larger aircraft (to increase aero and commercial revenues), and 'thicker' (more frequent) routes.

Joint ownership has been addressed directly by the CC's remedies. Spare capacity at airports in the South East of England and in the Scottish central belt varies by airport. In particular, Heathrow is operating very close to capacity, while Gatwick operates at capacity for certain peak times. (Table 2.2). In comparison, Edinburgh Airport is currently operating at around two thirds of its maximum capacity.[13]

One airline reported its view that airport competition functions best when there is spare capacity and airports are separately owned. It argued that this allows airlines to put competitive pressure on airports by threatening marginal route switching and gives airports incentives to compete against each other.

[13] http://www.scotsman.com/news/transport/msp-hits-out-over-edinburgh-airport-claims-1-3281637

Table 2.2 Capacity at London airports[14]

	Operating at …% capacity	Year when airport will be full, without additional capacity[15]
Heathrow	98%[16]	2010
Gatwick	85%[17]	2020
Luton	No information found	2030
Stansted	50%[18]	2041

While airports can directly influence many aspects of airport services, there are significant parts of passengers' experience that are partially or fully beyond their control. Airports and other stakeholders reported that these factors can also affect passengers' choices about which airports to fly from and also airlines' routing decisions. These include the following:

- Surface transport to airports, including road (cars and buses/coaches) and rail. Transport infrastructure can significantly affect travel time to airports. One airport reported that the reliability and quality of surface transport was a key factor in passenger perceptions of its airport. This is a key factor determining passenger demand – which can therefore affect route profitability and so influence airlines' routing decisions.
- Immigration control. Queue times at immigration control affect passengers' perception of airports and are a consideration for airlines. Some airports work cooperatively with the Border Force and/or make their own capital investment in technology that can speed the process, but only to a point[19]. However, others reported having little success when attempting to work with Border Force to match staffing profiles to incoming flights.
- Baggage handling. Although this relies on infrastructure provided by airports, airlines are responsible for delivery of baggage to arriving passengers. Usually airlines outsource this to third-party baggage handlers. However, this is an important consideration because baggage handling can cause material changes to passenger experience and passenger perception of airport quality, despite being outside of airports' control.
- Local economic factors such as relative economic fortunes within the catchment area of each airports, as this can affect local demand relative to national demand.

Airports' actions to improve their services can also take considerable time to take effect. For example, capital investments to improve service take time to plan then implement. Changes that affect airports' negotiations with airports may also take time, as they only take effect as existing commercial arrangements expire. Similarly, for third parties providing airport services, such as retailers.

[14] Excluding London City Airport. The CAA has reported that demand forecasts published by the DfT in 2013 predict that Heathrow and Gatwick will be full by 2020 with all airports in London and the South East operating at their maximum capacity by 2030. CAA (2013), *Response to the Airports Commission discussion paper on demand forecasting*, http://publicapps.caa.co.uk/docs/33/CAP1012%20AirportCommissionAviationDemandForecasting.pdf

[15] Airports Commission. 2014. Utilisation of the UK's Existing Airport Capacity

[16] http://www.heathrow.com/company/company-news-and-information/airports-commissionHeathrow

[17] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/374662/evidence-base-gatwick-airport-second-runway.pdf

[18] http://uk.reuters.com/article/britain-airports-stansted-idUKL8N13S1R420151203

[19] Most airports have invested in automated 'e-passport' gates, to a varying degree, but these still require a minimum Border Force staffing level, which caps the extent to which such investments from airports can increase efficiencies at immigration control.

2.2.2 Airlines' role in competition between airports

Competition in the market for airport services should also been seen in light of the way competition works between airlines. Airlines compete under various business models, which represents the diversity of passenger demands in relation to air travel. 'Hub-based' models vs. 'origin-destination' models. Hub-based models rely on a number of 'transfer' routes feeding long-haul routes. Under this model, commercial viability is generally required at a more aggregate level than individual routes. Airlines operating under this model generally have a 'base' airport through which the majority of their routes fly. 'Origin-destination' models do not operate a hub, with each individual route needing itself to be commercially viable. Two airlines reported that origin-destination airlines generally have more flexibility to engage in marginal route-switching between airports.

Airlines operate different business models within these general characterisations. One airline reported that marginal switching of aircraft between routes does occur and can be influenced by deals offered by airports. Airlines' reported that their decisions can be affected by airports' pricing (including any volume-based element) and airport service quality.

Airlines reported that these switching decisions are influenced by factors such as overall level of aero charges, the structure of pricing, discounts for operating new routes, maintenance facilities, the quality of airport services (such as check-in facilities), and availability of specific service offerings (such as lounges).

Airlines also noted that their wider strategies can also have a strong influence on competition between airports for their business. These were reported to include overall market positioning, long term growth or pricing strategy, or targeting specific routes or specific types of route. One airline noted that it is difficult to switch between some airports, where markets served or catchments covered differ significantly (it reported Gatwick and Heathrow as a specific example where markets served differ).

Two airlines and an airlines association also noted the influence of capacity constraints on route switching, with airlines less likely to switch away from capacity-constrained airports because of the difficult of re-gaining the slot should they wish to return. A freight carrier reported that carriers and airlines' choice of airport is dictated largely by the market that each airport serves and the proximity of major customer locations.

Larger sunk investments at airlines' 'base' can also affect airlines' switching decisions, although airlines and airports reported that even origin-destination models require one or a small number of 'base' airports where aircraft are kept overnight or maintenance operations are based. A freight carrier also reported that significant sunk costs are required for its operations, significantly reducing scope for it to engage in marginal switching between airports.

2.3 OFT and CC findings in relation to the market for airport services

In 2006, the Office of Fair Trading (OFT) undertook a market study to review competition issues involving airports in three UK regions (the South East of England, the North of England and Scotland)[20]. The study considered a number of issues including:

- the ownership of airports;
- the regulatory system;
- the prospect for adequate investment to meet anticipated growth in future passenger numbers;
- airport charges; and

[20] OFT. 2006. *UK airports: Report on the market study and proposed decision to make a market investigation reference*, https://assets.digital.cabinet-office.gov.uk/media/555de480e5274a708400013a/oft882.pdf

- indicators of service quality received by passengers at UK airports.

Overall, the OFT study found that more than 60 per cent of all UK air passengers travelled through airports owned by BAA Limited (BAA) in 2005. The market study also states that BAA was a major company, with UK revenues of £2.3 billion in 2005/06, and its activities impacted on a large number of businesses and consumers.

The key issues identified in each region can be summarised as follows:

- In Scotland, the OFT's market study concluded that BAA's joint ownership of Edinburgh and Glasgow airports had prevented, restricted or distorted competition between the two airports. It stated that while Prestwick airport (the only independent competitor in the region) had had some positive competitive effect on Glasgow airport, there was a need for greater competition to provide further benefits to air passengers, given the high barriers to entry and the issue that the airports were not subject to detailed price regulation.
- In the South East of England, the study found that BAA's ownership of Heathrow, Gatwick and Stansted was limiting competition between airports. This issue was also likely to increase in the future as the large majority of future expansion was also proposed to take place at these airports, while the study reported that BAA would only deliver this capacity, subject to planning permission and continued government support, if it was allowed an appropriate settlement at its price regulated airports (i.e. Heathrow, Gatwick and Stansted). The OFT study had also received critical feedback from airlines in relation to BAA's investment plans in the region.
- In the North of England, the OFT study found that there was more scope for competition between Liverpool, Leeds Bradford, and Manchester airports. It found that Manchester airport had reduced its prices faster than it had been required by regulations and had increased its responsiveness and quality of service, suggesting that there was not the same need for intervention as in the South East of England and Scotland.

Following the market study, the OFT made a reference to the Competition Commission (CC) under section 131 of the Enterprise Act 2002 for an investigation into the supply of airport services by BAA within the UK. The CC was required to "investigate whether any feature, or combination of features, of the market or markets for airport services in the UK as exist in connection with the supply of airport services by BAA prevents, restricts or distorts competition in connection with the supply or acquisition of any goods or services in the UK or a part of the UK."[21]

The CC concluded that a number of features gave rise to an adverse effect on competition. For each of these, Table 2.1 below illustrates whether and to what extent each of the remedies proposed by the CC was acted upon and/or introduced.

[21] Competition Commission. 2009. BAA airports market investigation - A report on the supply of airport services by BAA in the UK

Table 2.1 Implementation of the remedies

Features giving rise to an adverse effect on competition	CC remedies	Whether and how the remedies were acted upon/introduced
Common ownership: ■ prevented competition between Edinburgh and Glasgow airports in Scotland and Heathrow, Gatwick, Stansted and Southampton airports in the South East; ■ restricted or distorted competition in relation to capacity development of BAA's London airports; and ■ exacerbated inadequacies of the regulatory system, reducing the benefits of regulation and distorting competition between airlines (in relation to BAA's London airports).	Divestiture of both Stansted Airport (Stansted) and Gatwick Airport (Gatwick) to different purchasers	**Gatwick:** 21 October 2009: BAA agreed to sell Gatwick to Ivy Bidco Limited, a consortium led by Global Infrastructure Partners (GIP) for £1.5 billion[22]. 3 December 2009: the sale was completed[23]. **Stansted**: After a couple of unsuccessful appeals: 21 January 2013: BAA agreed to sell Stansted to Manchester Airports Group (MAG)[24]. 28 February 2013: the sale was completed for £1.5 billion[25].
	Divestiture of either Edinburgh Airport (Edinburgh) or Glasgow Airport (Glasgow)	**Edinburgh**: 23 April 2012: BAA sold Edinburgh to Global Infrastructure Partners for £807.2 million[26]. *(Note that BAA later chose to focus solely on Heathrow airport: 16 October 2014: BAA agreed to sell three airports, including Glasgow to a consortium formed by Macquarie Infrastructure and Real Assets (MIRA) and Ferrovial, for £1 billion)*[27]
Heathrow's position as the only significant hub airport in the South-East was in itself a feature that restricted competition between airports.	Strengthening of consultation procedures and provisions on quality of service at Heathrow Airport (Heathrow), until a new regulatory system is introduced	July 2011: Heathrow Airport Limited (HAL) (formerly BAA) issued Consultation and Information Protocol[28]. This replaces the former Annex G of the CAA's Decision in March 2008. Set out the arrangements for consultation between HAL and the Heathrow airlines concerning the development of the airport and the information that should reasonably be provided during such consultation
The comparatively isolated geographical location of Aberdeen airport relative to other centres of	Undertakings in relation to Aberdeen Airport (Aberdeen), to require the reporting of relevant	15 April 2010: BAA issued notice of proposal to accept undertakings in relation to Aberdeen[29] Consult annually on the prospective capital expenditure programme for the current and following financial years for Aberdeen with the users of Aberdeen and other interested persons.

[22] UK Reuters. 2009. BAA sells Gatwick for £1.5 billion

[23] Gatwick Airport Limited. Report and Financial Statements for the period ended 31 March 2010.

[24] CC. BAA airports market investigation. Undertakings.

[25] BBC. 2013. Stansted airport being sold to Manchester for £1.5 bn

[26] The Telegraph. 2012. BAA sells Edinburgh airport for £807m to GIP.

[27] BBC, Aberdeen, Glasgow and Southampton airports sold in £1bn deal

[28] CAA. 2011. Heathrow consultation and information protocol.

[29] CC. BAA airports market investigation. Undertakings.

Features giving rise to an adverse effect on competition	CC remedies	Whether and how the remedies were acted upon/introduced
population was a barrier to entry, which restricted competition.	information and consultation with stakeholders on capital expenditure	Ensure that a forum is available in which the capital expenditure programme may be discussed. 5 May 2010: the CC issued notice of acceptance 3 March 2011: BAA issued notice of proposal to accept segmental reporting undertakings in relation to Aberdeen[30] Publish on an annual basis audited accounts and a separate document which contains the segmental analysis on a depreciated replacement cost basis for Aberdeen together with other relevant information 19 April 2011: the CC issued notice of acceptance *(Note that BAA later chose to focus solely on Heathrow airport: 16 October 2014: BAA agreed to sell three airports, including Aberdeen to a consortium formed by Ferrovial and MIRA for £1 billion)*[31]
Competition between airports was restricted and/or distorted by: ■ Aspects of the planning system which acted as a barrier to entry of new airports and expansion of existing ones. ■ Aspects of Government policy. Competition between airlines was distorted by the regulatory system for airports.	Recommendations to the Department for Transport (DfT) in relation to economic regulation of airports	December 2009: DfT issued a decision document on reforming the framework for the economic regulation of airports[32]: set out a framework for the CAA's future financial resilience, enhancing its accountability and changing passenger representation; reform the CAA's statutory duties as economic regulator (e.g. introducing a new licensing regime and aligning airport services with passenger need). November 2011: the DfT published a draft Civil Aviation Bill[33] 19 January 2012: Civil Aviation Act 2012 set out a new system of airport regulation[34]. The Act places the interests of users of air transport services first. The CAA is required to publish information about airport performance. The Act replaces the system of fixed five-year price controls by a licensing system; the CAA has powers to licence airport operators that pass the 3 parts of the following market power test: A – the airport operator has, or is likely to acquire, substantial market power in a market, either alone or taken with other such persons as the CAA considers appropriate; B – competition law does not provide sufficient protection against the risk that the airport operator may engage in conduct that results in an abuse of the substantial market power; and C – for users of air transport services, the benefits of regulating the airport operator by means of a licence are likely to outweigh the adverse effects September 2012: the Airports Commission was established: Examine the need for additional UK airport capacity; Make recommendations to improve capacity in the short, medium and long term

[30] CC. BAA airports market investigation. Undertakings.

[31] BBC, Aberdeen, Glasgow and Southampton airports sold in £1bn deal

[32] DfT. 2009. Reformulating the framework for the economic regulation of airports

[33] DfT. 2011. Draft Civil Aviation Bill: An effective regulatory framework for UK aviation

[34] UK Government. 2012. Civil Aviation Act 2012

Features giving rise to an adverse effect on competition	CC remedies	Whether and how the remedies were acted upon/introduced
		March 2013: the UK Government presented its Aviation Policy Framework. This framework balances the economic benefits of air travel with its impact on the environment and local communities[35]

[35] UK Government. 2013. Aviation Policy Framework

2.4 Key trends and wider considerations with respect to the airports market

This section sets out key recent developments in the aviation sector, each of which can be considered alongside the findings of the evaluation set out in the remainder of this document.

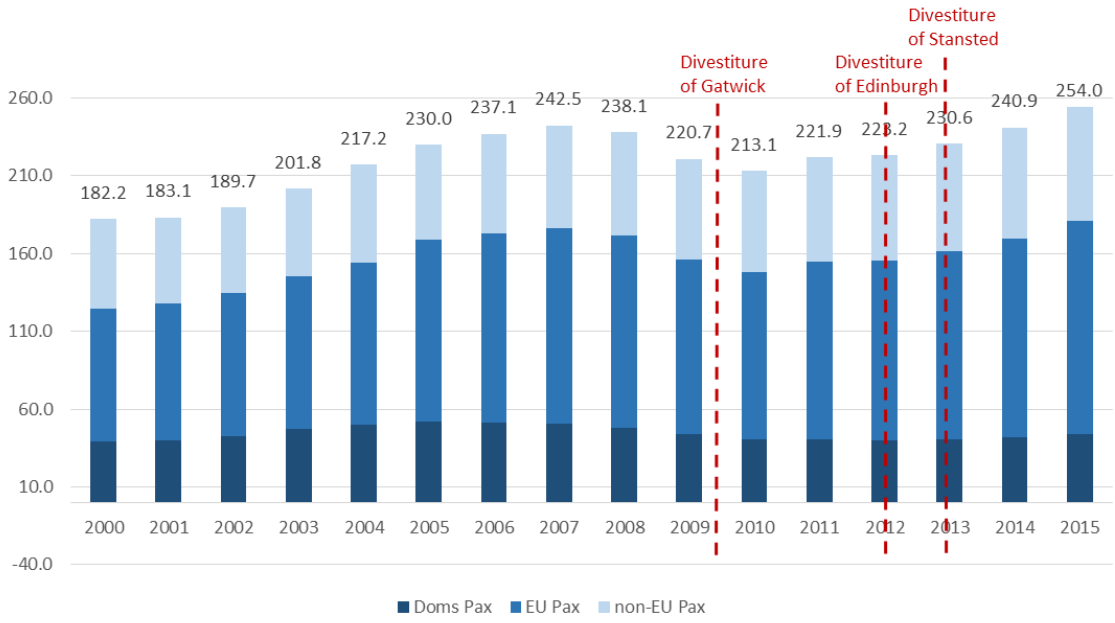
2.4.1 Passenger numbers

The number of passengers travelling by air in the UK increased continuously from 2000 to 2007 to reach a peak of 242.5 million passengers before decreasing until 2010 as shown in Figure 2.1. From 2011 onwards, passenger numbers have again experienced a continuous but slow increase. In 2015, a total of 254 million passengers travelled from the UK.

Several factors can influence the demand for air travel, in particular travel price and income but also substitutes such as rail or bus[36]. In terms of price, the literature suggests that leisure passengers are more sensitive to price variation than business travellers[37]. The International Air Transport Association (IATA) also reports that middle- to lower-income individuals are more likely to travel on short- or medium-haul routes, with higher incomes leading to a higher frequency of long-haul travel[38].

There is evidence to suggest that the financial crisis is in large part responsible for the decline in the demand for air travel after 2007[39]. As a consequence, several airlines reduced their capacities[40].

Figure 2.1 Evolution of passenger numbers (in million) in the UK in the period 2000-2015



Source: CAA data

[36] IATA. 2008. Air Travel Demand

[37] Ibid.

[38] Ibid.

[39] Ruchi Goyal, Dhanisha Negi. 2014. Impact of Global Economic Crisis on Airline Industry. *IRACST – International Journal of Commerce, Business and Management*. Vol. 3, No. 2.

[40] Ibid.

The financial crisis & jet-fuel prices

One of the main impacts of the global financial crisis on the airline sector was a strong decrease in demand.

There has been a strong upwards trend in the number of air passenger travel in the second half of the 20th century. Small fluctuations are frequent, driven by economic factors (e.g. recessions, oil price shocks), or by other factors (e.g. military conflicts, terrorism, fears of global pandemic or volcanic ash episodes)[41]. However, fluctuations caused by the global financial crisis were particularly large. In the UK, the crisis caused the largest fall in activity at UK airports since the end of the Second World War[42]. The drop in the number of UK terminal passengers in 2008-2010 was illustrated earlier in Figure 2.1.

Two effects of the global financial crisis (e.g. the decrease in air travel demand as well as increasing difficulties to access public or private financing) had a heavy toll on airlines and supply of air travel. In 2014, it was estimated that the global economic impact on civil aviation was around US$ 3.5 trillion, (i.e. around 7.5 per cent of world GDP)[43]. Many airlines declared bankruptcy as a result of the crisis[44]. Others, such as Lufthansa (reported a two-thirds fall in net profit in 2008 due in part to the impact of some troubled investments) were forced to reduce their planned capacity growth[45]. Other airlines chose to tackle the effects of the world recession by deferring the delivery of new aircraft or delaying the construction of new terminals.

The price of fuel also has a considerable impact on airlines. The price of jet fuel follows the price of crude oil, which is subject to many fluctuations over time. However, except for a plunge following the 2008-2009 financial crisis, there was an upwards trend between 2000 and 2014. The price of crude oil began to significantly fall from 2014 onwards. As a consequence, airlines are currently experience a beneficial fall in jet fuel prices: between 2014 and 2015, the fall in dollar terms was around 50 per cent (30 to 35 per cent in euro terms)[46].

On the other hand, the recent drop in oil prices was expected to boost airline profits. In 2014, the world airline industry delivered a net profit of $17.3 billion but it was expected to generate a record $33 billion in 2015 and $36.3 billion in 2016[47].

2.4.2 'Open skies' and liberalisation of aviation

The de-regulation of aviation (in particular airlines) has driven significant changes in the way airlines operate, which have a significant impact on the services that airports offer to airlines and the strategies that airports implemented to attract airlines to them.

The first European liberalisation package was introduced in 1987 and aimed at relaxing some restrictions such as capacity restrictions or the ability of Member States to block proposals for economic low fares[48]. The first package resulted in airlines being able to operate on major international routes in the European Community and to provide the capacity and charge the fares that they wished.

[41] BIS, 2011. UK Aviation Forecasts

[42] Ibid.

[43] Goyal. 2014. Impact of Global Economic Crisis on Airline Industry

[44] Oprea. 2010. The effects of global economic crisis on the air transport

[45] Financial Times. 2009. Airline industry 'in crisis'

[46] Platt. 2015. European jet fuel: turbulence ahead

[47] Pandey. 2015. Airlines Expected To Extend Profits By 10% In 2016 As Fuel Prices Drop, Demand For Travel Booms

[48] Butcher, L. 2010. Aviation: European Liberalisation, 1986-2002

The second liberalisation package was introduced in 1990[49]. It included three regulations on fares, market access and the application of Article 85 of the EC Treaty[50]. It opened up routes between almost all European airports, relaxed restrictions on fifth freedom services[51], and eased restrictions on multiple designation of airlines on particular routes. With the third liberalisation package in 1992, the EU aviation market was further liberalised[52].

In 1998, the CAA concluded that liberalisation has led to a substantial increase in airlines competition[53]. The OECD recently reported that liberalisation of the aviation market and its impacts has given rise to considerable attention in the 1990s. However, few studies have looked at the long term impacts[54].

In 2007 the EU-US Open Skies Agreement was signed between the EU and the US. The agreement enables airlines to[55]:

- operate flights to the United States from any European airport, regardless of their nationality and vice-versa;
- operate without restrictions on the number of flights, aircraft or routes;
- set prices in line with the market; and
- conclude cooperation agreements.

The Centre for Aviation found that the main result is an increase of concentration of capacity for mega carriers and alliance joint ventures[56]. A study by Winston and Yan looked at travellers' welfare and estimated the agreement has generated over $4 billion in annual gains for US travellers[57].

According to the European Low Fares Airline Association (2004)[58], the introduction of low-cost airlines as a result of airlines liberalisation has resulted in significant benefits for consumers. There are two main impacts.

- Increased consumer choice: since liberalisation and the removal of barriers to entry, the number of airlines and of available routes have increased dramatically. Air passengers have a larger choice of airlines, a greater choice of schedules, frequencies and airports to fly from.
- Lower fares: competition between budget and traditional airlines has led to a large drop in airfares.

2.4.3 New commercial models in aviation

New commercial models in the aviation sector developed as a consequence of de-regulation of aviation described above. This affects how airlines operate and has resulted in a diverse set of business models, and a diverse set of requirements that airports must seek to meet.

[49] Ibid.

[50] See http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31987R3976:EN:HTML

[51] Fifth freedom of the Air: the right or privilege, in respect of scheduled international air services, granted by one State to another State to put down and to take on, in the territory of the first State, traffic coming from or destined to a third State. See: http://www.icao.int/Pages/freedomsAir.aspx

[52] Butcher, L. 2010. Aviation: European Liberalisation, 1986-2002

[53] CAA. 1998. The Single European Aviation Market. The first five years

[54] OECD. 2015. EU Air Transport Liberalisation

[55] EUR-Lex. 2007. Open Skies agreement between Europe and the United States

[56] CAPA. 2013. The North Atlantic: the state of the market five years on from EU-US Open Skies

[57] Winston, C. and Yan, J. Open Skies: Estimating Travelers' Benefits from Free Trade in Airline Services. American Economic Journal: Economic Policy 2015, 7(2): 370–414

[58] European Low Fares Airline Association. 2004. Liberalisation of European Air Transport: The Benefits of Low Fares Airlines to Consumers, Airports, Regions and the Environment

The first budget airline, Southwest Airlines, entered the market in 1971 in the US. Market liberalisation enabled the growth of low-cost airlines. According to ICAO, European airlines such as Ryanair and EasyJet represented 37 per cent of the seat capacity on scheduled services in Europe in 2012[59]. The main characteristics of budget airlines are presented below[60].

- **Pricing techniques**: low-cost airlines offer lower fares, simple fare structures and price strategies; typically, they adopt yield management techniques (i.e. increase the price of fares as the plane fills up). However, budget carriers generate a large proportion of their profits with non-flight revenues. Air passengers pay for the flight but are charged for each additional convenience or service (e.g. food, beverages, luggage, etc.).
- **Routes model:** budget airlines offer only non-stop flights and point-to-point services (e.g. no connections). They tend to fly during off-peak hours, thereby avoiding traffic delays and high landing charges. Low-cost airlines typically do not operate in 'hubs', but rather use secondary airports. The advantages are twofold: secondary airports are usually less busy and tend to charge less.
- **Personnel on-board aircraft and staff at airport**: the number of staff on-board aircraft is regulated at an international level. However, budget airlines can save money by reducing the ground crew. They encourage customers to use internet booking, e-ticketing and online checking to reduce staff at airport.
- **Aircraft utilisation:** low-cost carriers are characterised by high aircraft utilisation and fast turnaround times. The time spent on ground air airport is kept at a minimal thanks to several techniques (e.g. equipping aircraft with no unnecessary equipment to minimise maintenance time, offering no seat allocation for a faster boarding, using terminals that are close to aircraft parking stands).

The increased competition in the aviation sector led the traditional airlines to adopt some of the characteristics of the low cost airlines to better survive in a new deregulated environment[61]. Thus, legacy airlines are cutting their costs by reducing perks and charging for extras (e.g. food service, entertainment and luggage)[62]. As a result, the cost gap between traditional and budget airlines fell by an average of 30 per cent between 2006 and 2013[63]. However, legacy airlines are still more expensive than budget ones (operating an Airbus A320 between London and Rome costs $12,000 more on each round-trip for a legacy airline than a low-cost airline[64]). Many traditional airlines therefore seek efficiencies through consolidation and mergers[65].

2.4.4 Airport charges

Airports' aeronautical revenues are used as a proxy for airport charges and include charges for services or facilities directly related to the processing of aircraft and their passengers and cargo in connection with facilitating travel, such as landing and take-off, security, noxious emissions, etc.[66].

The Airport Charges Regulations introduced in 2011 establishes a common framework by which UK airports consult their airline customers about airport charges, service level agreements and major infrastructure projects. These Regulations require airports to[67]:

[59] ICAO. 2016. Low Cost Carriers (LCCs)

[60] Rosario Macario, Viegas Jose, Reis Vasco. N.d. Impact of low cost operation in the development

[61] Ibid.

[62] Goyal. 2014. Impact of Global Economic Crisis on Airline Industry

[63] The Economist. 2013. Legacy vs low-cost carriers – Spot the difference

[64] Ibid.

[65] Ibid.

[66] Amedeo R. O. 2007. Airport Revenues and User Charges

[67] CAA. 2015. Airport Charges Regulation.

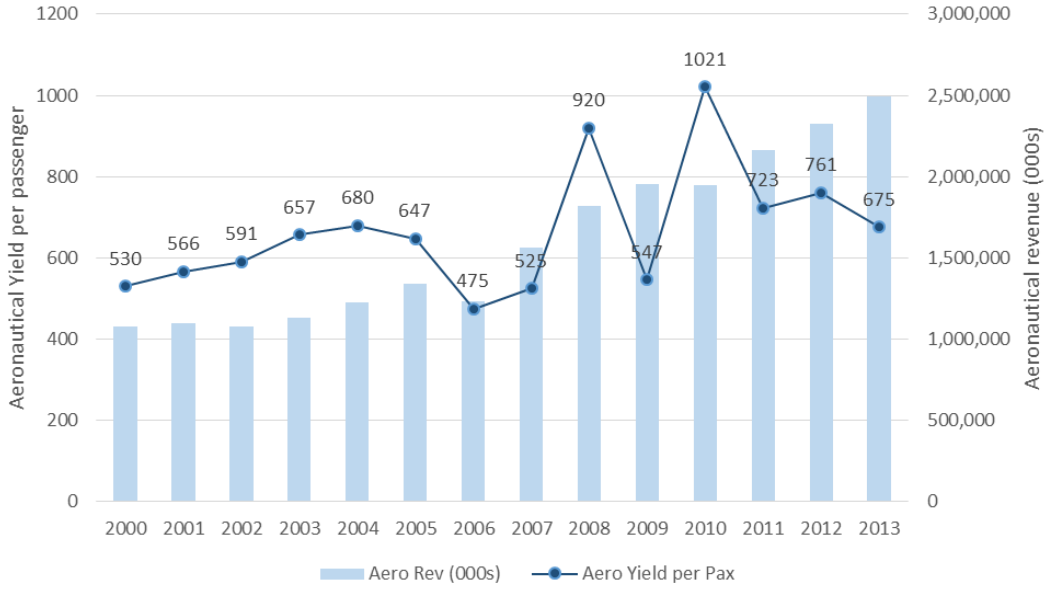
- consult airlines about airport charges annually;
- give at least four months' notice of proposed changes to airport charges;
- provide specific information to airlines on how airport charges are calculated;
- announce decisions on changes to airport charges at least two months before they come into effect; and
- consult airlines on major infrastructure projects.

It is interesting to note that these regulations are similar to the CC's recommendations for Heathrow and Aberdeen (e.g. strengthening of consultation procedures and provisions on quality of service and requiring the reporting of relevant information and consultation with stakeholders on capital expenditure).

The Airport Charges Regulations apply to airports with more than five million passengers in the two years prior to the current year. This means that airports with more than five million passengers in 2014 will be covered by the regulation in 2016. The airports covered in 2016 include: Heathrow, Gatwick, Manchester, Stansted, Luton, Edinburgh, Birmingham, Glasgow and Bristol[68].

Figure 2.2 shows that aeronautical charges have been increasing over the period 2000-2013. However, looking more specifically at airport charges per passenger, the figures show that there has been a large fluctuation over the period 2005-2011. In part, this can be explained by the decline in the number of passengers described earlier. From 2011 onwards, the aeronautical charges remain relatively constant. This might be the result of the Airport Charges Regulation introduced in 2011.

Figure 2.2 Aeronautical revenues in £ and per passenger in the UK



Source: Leigh Fisher Data and ICF Calculation

2.4.5 Technological changes

Technological change in the last decade or so has significantly influenced the service that airlines and airports are able to offer their passengers. This needs to be considered alongside

[68] CAA. 2015. Airport Charges Regulation.

comparisons of service quality and consumer perceptions over time and when attempting to attribute these to increased competition.

Airports are increasingly using technology to improve passengers' experience at airports by decreasing the time they spend on check-in or security, and increasing their available time to use airport facilities (e.g. restaurants and retail). Innovations that change passengers' experiences of airports include:

- online ticketing;
- online check-in: in 2014, around 92 per cent of world airports surveyed by SITA Aero were equipped with kiosk check-ins, which speed up passenger entry into the airport and decrease staff costs[69];
- unassisted bag-drop: this was available in 16 per cent of world airports surveyed by SITA Aero in 2014, and was expected to grow to 62 per cent by 2017[70]; and
- apps: in 2014, 50 per cent of world airports surveyed by SITA Aero provided flight status updates to passengers via mobile with a further 40 per cent of airports planning to provide it by 2017[71].

Further innovations are expected to come in the future years, which will improve air passengers' experience, such as faster security screening (laser-powered security scanners), shorter queues (self-service biometric passport gates that use facial recognition technology), more enjoyable shopping experience (virtual shopping walls, holographic helpers)[72].

[69] SITA Aero. 2014. Airport IT trends survey 2014, available on https://www.sita.aero/globalassets/docs/surveys--reports/airport-it-trends-survey-2014.pdf

[70] Ibid.

[71] Ibid.

[72] BBC. 2015. Future airports could become hi-tech pleasure domes

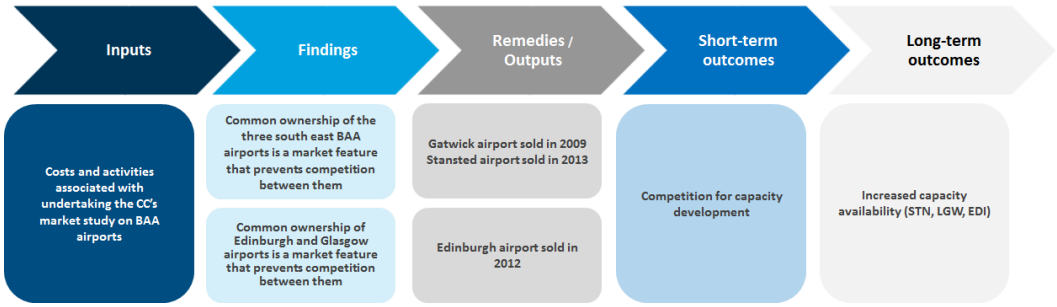
3 Impacts of the divestment of Gatwick, Stansted and Edinburgh

This section sets out study findings in relation to the divestiture of Gatwick, Stansted and Edinburgh airports. Findings represent a synthesis of all quantitative and qualitative evidence collected during this study.

3.1 Competition for passenger throughput

This section examines the study hypothesis outlined below (Figure 3.1). It examines evidence on whether the divestiture of Gatwick, Stansted and Edinburgh had an effect on airports' provision of passenger throughput.

Figure 3.1 Increased available capacity as a result of BAA divestment



According to the CC's market investigation report, *"A principal effect of rivalry between the airports under separate ownership would be to compete with each other through innovation and capacity development, a process which will of itself bring benefits as well as erode the current constraints on competition."* This could be reflected through innovation to increase effective capacity of existing runways, for example by increasing the number of passenger movements for existing runway capacity.

In the longer-run, increased rivalry between airports should lead to improved matching of runway capacity to overall demand conditions. In the context of rising passenger numbers (both in the South East of England and at Edinburgh), in the long run this would lead to increasing airport capacity. In practice, observed effects are likely to be the short-term effects described above, given the relatively short time that has passed since the CC's remedies were implemented.

In the South East of England, competition for increased capacity availability is also manifesting itself in competition between Heathrow and Gatwick for approval for new runways. Constraints on building new runway capacity could, up to a point, be expected to lead to greater focus on innovation to maximise passenger throughput available from existing runway capacity. It also might lead to increased competition for higher-value passengers so as to maximise revenues from a constrained number of passengers.

This section examines evidence on whether divested airports (Gatwick, Stansted and Edinburgh) have increased their efforts to increase passenger throughput or revenue available from existing assets. Passenger numbers display significant seasonal variation, within the annual averages presented below.

Passenger growth reflects airports' and airlines' expansion of capacity offered to the market. Passenger growth (called 'passenger throughput' in this analysis) benefits consumers principally in the following ways. First, more passengers are able to fly, including some that would not otherwise have done so. These passengers benefit directly from having taken those journeys. Second, expanding supply puts downward pressure on prices for air travel (all other things being the same). This means that even passengers who otherwise would have flown may pay less for their flights.

3.1.1 Competition for capacity development

This section examines the anticipated short-term effect of divestiture on available passenger throughput. Divested airports were expected to compete harder with other airports to provide greater passenger throughput. The effects of increased competition for capacity development depend on the level of spare capacity available at each airport:

- airports that are not constrained by runway capacity limits can expand passenger throughput by attracting new airlines or increasing the number of flights provided by incumbent airlines; and
- airports that are constrained by runway capacity limits have to compete by taking measures to increase the number of Air Transport Movements (ATM – a take-off or landing) from existing runways, seeking to increase capacity utilisation at times that are not constrained (e.g. in the winter or at off-peak times) or seeking to increase revenue from existing ATMs, either by increasing the number of seats per ATM or by increasing aero and non-aero revenues per passenger.

Existing literature focuses mainly on the impact of expansion of runway capacity on competition. The OECD (2014) found that capacity expansion facilitates market entry and is likely to reduce market concentration[73]. This highlights the importance of spare runway capacity in determining how increased competition may be reflected in the indicators identified in this study. GAP (2008) found that capacity constraints can limit competition, as airports with capacity constrains can handle only limited output and have no incentive to reduce prices[74].

Fageda and Fernandez-Villadangos (2009) looked at the dynamics of airline competition in the Spanish airline market, to assess the role of removal of capacity constraints at major airports. The study set up a demand function for a route *k* depending on the population, the GDP per capita and the tourism intensity of the route city-pairs, as well as a dummy variable for whether the airport is a hub. The study found that airlines acted more competitively after capacity expansion only at large airports that are not hubs of network carriers[75]. This highlights the importance of airlines' business models in determining how they choose where to base and route their assets.

Hardaway (1991) noted that the constraints on existing airport capacity have been identified in several studies as one of the key elements which determines the extent to which competition actually develops[76]. Hardaway finds that existing studies appear to imply that in a competitive environment, capacity expansion contributes to airports remaining competitive. However, no empirical studies have been found on the specific impact of competition on capacity expansion.

3.1.2 Evidence on the effect of the CC's remedies

To examine the effect of the CC's remedies on competition to provide passenger throughput, the following data was examined (as detailed in Annex 1 and Annex 2):

- Qualitative evidence on airports' efforts to increase passenger throughput, based on interviews with airports.
- Passenger numbers (transfer vs O&D and Domestic vs EU vs Non-EU) and air transport movements (ATMs) – these indicators can signal additional available capacity being

[73] OECD. 2014. Expanding Airport Capacity: Competition and Connectivity

[74] GAP. 2008. The market power of Airports, Regulatory Issues and Competition between Airports

[75] Fageda, F. and Fernandez-Villadangos, L. 2009. Triggering competition in the Spanish airline market: The role of airport capacity and low-cost carriers

[76] Hardaway, R.M., 1991. Airport Regulation, Law and Public Policy: The management and Growth of Infrastructure. Quorum Books, New York.

provided to the market, which can be influenced by airports' competitive efforts to provide capacity to the market (as well as other significant factors); and

- Econometric analysis of the indicators above, where feasible.

Of the airports that were divested from BAA, Edinburgh and Stansted remain relatively unconstrained in terms of ATMs, while Gatwick reported being more constrained at peak times of demand, although it retains some capacity during winter and off-peak times. This was supported by several stakeholders during interviews for this study.

Qualitative evidence from airports

The research identified several examples of the ways in which airports have altered their aeronautical charging structures in order to become more competitive.

Gatwick has made significant changes to the way in which airlines are charged since its divestment in 2009. The airport has replaced its previous regulatory-led approach with a new 'contracts and commitments' framework, based around general 'conditions of use' of the airport and bespoke contracts agreed with individual airlines. The previous Regulatory Asset Base (RAB) based approach was reported to be relatively inflexible and had created tensions with airlines, which perceived that unnecessary capital expenditure projects were being progressed in order to increase the RAB and the charges applied to airlines. It was also reported that Gatwick did not offer discounts on aero charges prior to its divestment, nor did it have any commercial arrangements to incentivise change to airline operations.

Under the new framework, all airlines are now subject to Gatwick's 'conditions of use', which define the services offered, charges, and obligations on airlines to use the airport. Gatwick has also implemented contracts for the majority of its airlines, which set out the level and terms of aero charges for the next three to ten years as well as setting out bespoke commercial arrangements and incentives. This new approach has introduced greater flexibility, transparency and security for airlines and provided increased opportunities for negotiation. For example, negotiations between Gatwick and one airline led to the consolidation its operations at the North Terminal (rather than both terminals). Gatwick has also introduced discounts for airlines in winter, with no landing fees, in order to incentivise and attract additional flights during quieter periods and thereby increase annual utilisation levels. In contrast, a new summer charging structure introduced higher landing charges and lower passenger fees in order to encourage larger and fuller aircraft and help to maximise capacity in summer months.

Contracts negotiated at Gatwick also now define guaranteed service standards with rebates paid for the failure to meet these defined service levels. By linking contracts to the Service Quality Rebate (SQR), Gatwick can demonstrate to airlines that its incentives to ensure adequate service quality are aligned with airlines' objectives to satisfy their passengers. Gatwick reported that while these changes would have been possible under the previous framework, there was no real incentive to make such changes without the competition created by the divestments.

Edinburgh Airport reported changing its approach to negotiations with airlines after divestment, compared with when it was part of BAA. It reported making a significant investment in its airline development team, which increased from one member of staff to four dedicated full-time employees. It also reported introducing volume as a factor in commercial agreements with airlines, not just price, in part targeted to encourage airlines to increase capacity. Edinburgh Airport also reported efforts to stress the economic attractiveness of its catchment, compared with Glasgow in particular, which it reported was restricted under BAA management.

There have also been significant changes to airline charging and negotiations at Stansted Airport. The airport and airlines reported that negotiations and discussions were somewhat limited and infrequent prior to the CC remedies, due to a strong regulatory focus at the airport. The airport suggested that its ability to negotiate long-term, bespoke agreements with airlines was also restricted by the OFT/CC inquiry, the decision to place Ryanair on the CAA price tariff in March 2007, and the involvement of the regulator in negotiations. Stansted reported

that when it acquired Stansted, airlines were being charged the maximum price allowed by the regulator, but there were still shortfalls in airport revenues because passenger volumes were lower than expected.

Since the divestment of Stansted, however, the airport has adopted a more flexible charging strategy, including the negotiation of bespoke commercial contracts, to provide airlines with greater confidence and security relating to future airport charges. It was reported that long-term contracts had been agreed with most airlines at Stansted (accounting for around 95% of passengers). Examples included a five year agreement with one airline and a 'five plus five year' bilateral agreement with another. These extended contract periods were seen as important in providing airlines with confidence that investments at the airport would not result in premiums being added to charges, while also providing sufficient time for airlines and the airport to justify business cases for investments to improve services and stimulate growth. Airlines also reported a more commercial approach to contracts and charges at Stansted and cited the introduction of quality commitments in their agreements including the provision of rebates linked to the quality of airport services (e.g. queuing time at security checkpoints). MAG hopes that its more flexible approach will help Stansted to attract new airlines and add new destinations. For example, Stansted reported using its pricing agreements to incentivise the development of new routes by providing discounts on charges to reduce the risks for airlines of developing and trialling new routes.

Case study: working with Border Force to improve passenger experience at immigration

The three divested airports (Gatwick, Stansted and Edinburgh airports) and Heathrow all reported an increased 'passenger focus' following the divestments. The airports stated that they are increasingly targeting improvements in service quality in order to improve passenger experiences and increase passenger satisfaction. For example, Heathrow reported having an objective to provide passengers with "the best airport service in the world". Service quality is important because it directly influences passengers' choice of airport, while improvements can also deliver other benefits (e.g. reduced queuing times at check-in, security and immigration can increase time and expenditures in the departure lounge).

There are many different components of service quality, some of which can be influenced directly by the airports (such as parking, drop-off and shopping infrastructure), while others are also dependent upon other parties (such as transport to airports, security and baggage handling). All components are important as passenger experiences do not differentiate between the services that are within or beyond the control of the airport.

One area of focus at all airports has been to improve passenger experiences when going through security and immigration control. This was reported as a priority at Gatwick immediately after the divestment. However, this is one of the areas that is beyond the direct control of the airports, and some airports reported working cooperatively with the Border Force as well as making their own capital investments in technology to help minimise queueing times. Some examples of increased cooperation between airports and the Border Force are provided below.

- Stansted reported working more closely with Border Force since the divestment to coordinate investments in technology and minimise queuing times at immigration control. The airport reported that passenger satisfaction had previously been affected by poor experiences of immigration control at Stansted, due to staff resourcing and investments in technology being prioritised at Heathrow and Gatwick. However, the divestment of the airport provided opportunities to work more closely with Border Force to improve passenger experiences in relation to immigration. Stansted suggested that improvements had been significant and reflected investments in the relationship with

Border Force and investments in new technologies, such as ePassport gates, to reduce queueing times.

- Heathrow reported that its new management team had been working more closely with wider stakeholders, including the Border Force, in order to improve passenger experiences and satisfaction. Examples of investments and changes for immigration control include:
  - Developing a single large Airports Operations Centre (APOC) in place of 27 separate control centres. The APOC encompasses Border Force and other organisations and is using enhanced intelligence to inform the allocation of resources to improve passenger experiences. For example, the APOC constantly monitors traffic flow on the M25 and arrival times of the Heathrow Express train service so that the Border Force can plan and allocate staff resources effectively to minimise immigration queueing times. Heathrow also holds regular joint planning meetings with Border Force to identify opportunities to enhance staff allocation and minimise queueing times.
  - Introducing a key performance indicator for queueing times at UK immigration. An independent team records queueing times for passengers (the time taken from joining the queue to passing through immigration control). Measurements are taken every 15 minutes at all Heathrow terminals and information regarding Border Force's performance is published on the airport's website every month. Heathrow reported that immigration queueing times had improved as a result of these changes.

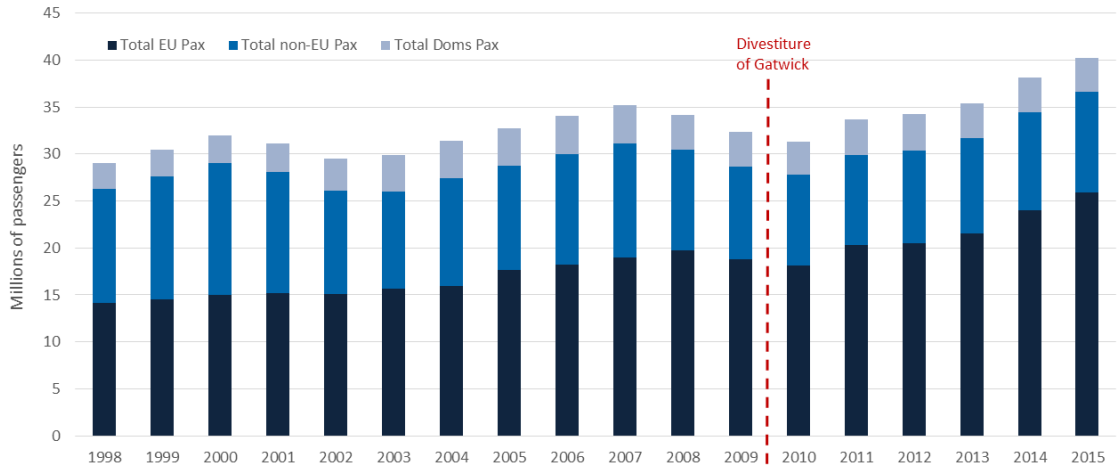
Passenger numbers and ATMs

Passenger numbers can provide an indication of the extent to which divested airports have been able to expand their capacity.

Passengers travelling through Gatwick have increased since its sale was completed in December 2009 (Figure 3.2). Gatwick Airport reported that the increase in available passenger throughput (and therefore passenger numbers) reflected efforts to attract airlines, primarily through changes to their aeronautical charging structure to provide more available capacity (more routes, more aircraft) particularly at off-peak times of the year and day. These efforts are explored below in Section 3.2 and Section 3.3.

One airline reported that Gatwick has achieved these increases despite operating close to capacity for much of the time on its one runway. It reported that this increase has been achieved by encouraging fewer empty seats on aircraft through new pricing structures (as discussed above), larger aircraft and by increasing the operational efficiency of its runway.

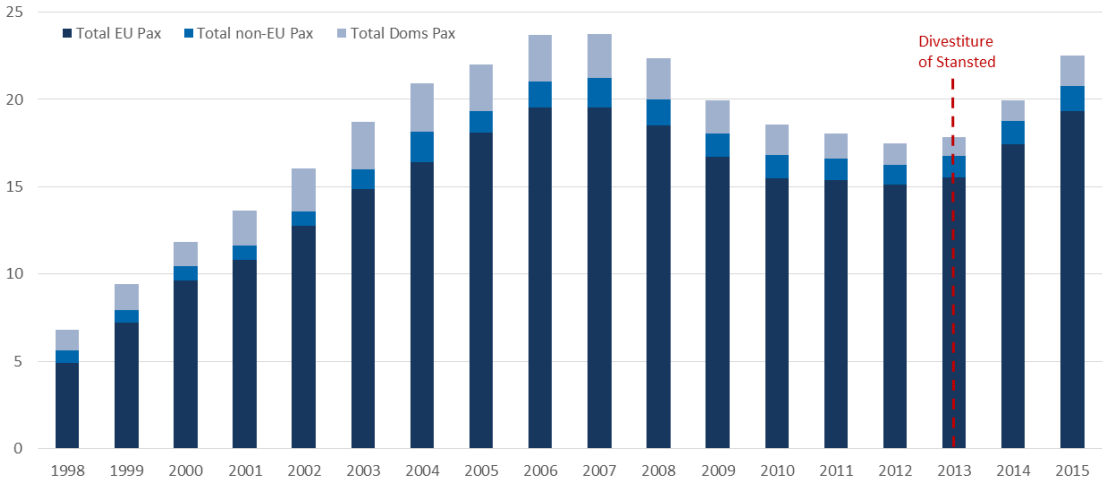
Figure 3.2 Passengers at Gatwick 1998 to 2015 (in million)



Source: CAA data

Passengers travelling through Stansted have shown a sharp increase since it was sold in February 2013, after experiencing a significant decline from 2007 (Figure 3.3).This decline lasted longer at Stansted than Gatwick and Edinburgh, persisting even when economic conditions were improving. Growth in passenger numbers began only in 2013 (and more in 2014) following divestment.

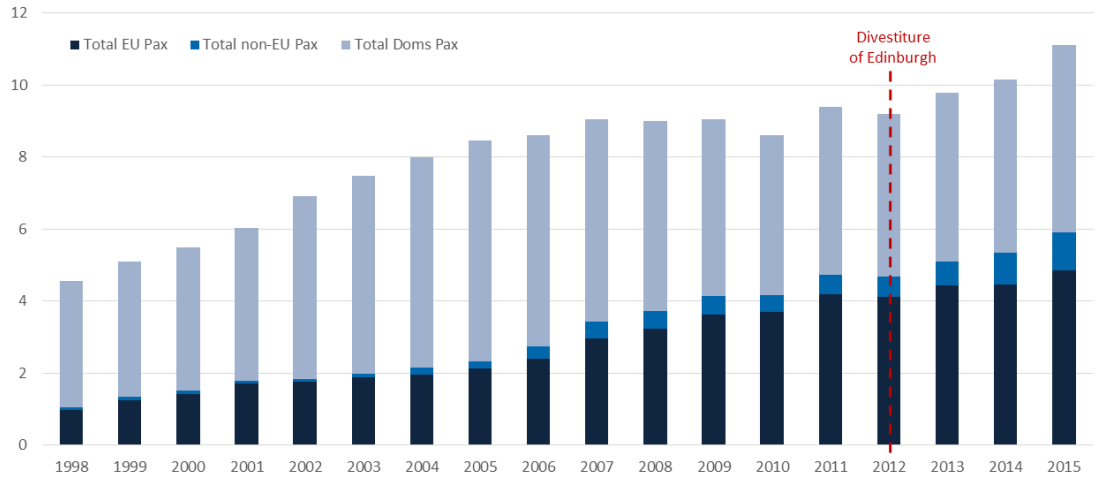
Figure 3.3 Passengers at Stansted 1998 to 2015 (in million)



Source: CAA data

In Scotland, Edinburgh has seen a gradual increase in passenger volume over time, almost doubling between 2000 and 2015. Since BAA sold Edinburgh in April 2012, the rate of passenger growth has increased (Figure 3.4). Stakeholders reported that this has coincided with a significant decline in passenger numbers at Prestwick airport and passengers travelling through Glasgow airport declined from 2006 to 2012.

Figure 3.4 Passengers at Edinburgh 1998 to 2015 (in million)



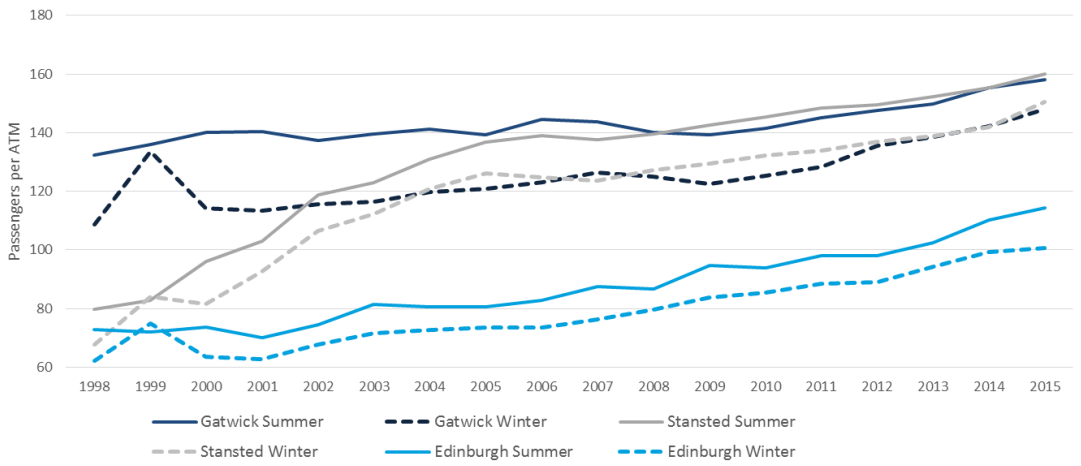
Source: CAA data

In interviews for this study, each of the airports in question reported actions taken since divestment to expand the availability of passenger throughput at their airports (as discussed above). As outlined above, overall passenger numbers are heavily affected by macro factors such as general economic conditions. This is clearly evident in overall passenger numbers at Gatwick, Stansted and Edinburgh following the financial crisis. The increase in passengers travelling at each airport is, nonetheless, consistent with stakeholders reporting an increase in competitive efforts by these airports to increase available capacity.

The relationship between passenger numbers and ATMs may provide further evidence of airports' efforts to increase capacity availability. This is particularly the case for airports with constrained runway capacity (and therefore ATMs), for which increasing revenue per ATM is more important.

At each divested airport, there was an increase in the number of passengers per ATM between 2000 and 2015 (Figure 3.5). Passengers per ATM are higher during summer at both Gatwick and Stansted and Edinburgh airports, but this upward trend is consistent across both seasons. These trends appear to be relatively consistent before and after divestment at each airport, with some visual evidence that passengers per ATM at Gatwick has increased at a faster rate after 2011.

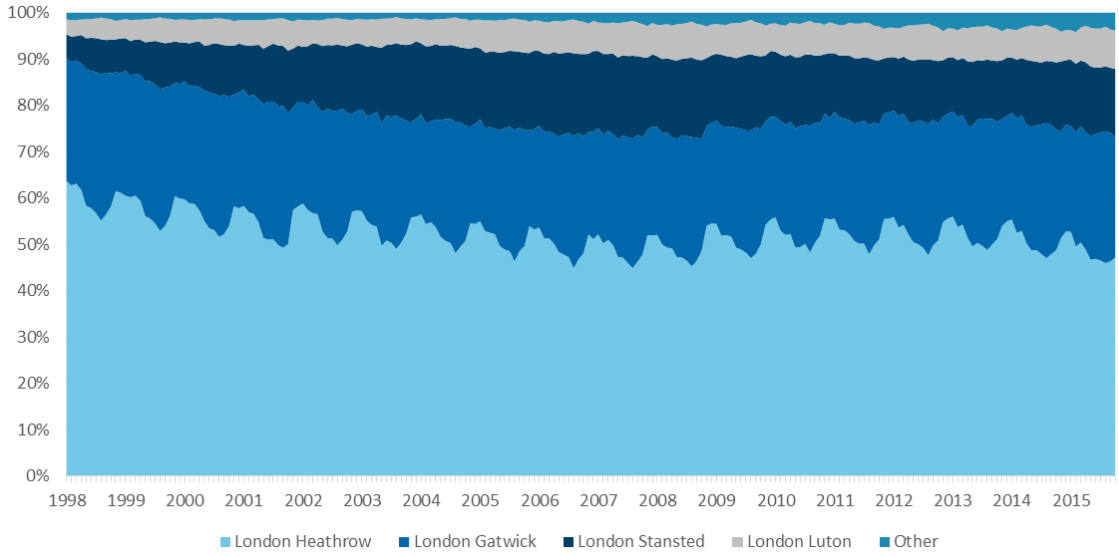
Figure 3.5 Passengers per ATM at Gatwick, Stansted and Edinburgh airports, 1998-2015



Source: CAA

Gatwick's share of passenger traffic across Heathrow, Gatwick, Stansted, Luton and London City airports has remained similar since its sale following the CC's remedies. Figure 3.6 shows that in January 2009 the market share of Heathrow was 55 per cent while Gatwick had 22 per cent, Stansted 14 per cent and Luton 6 per cent. Six years later, in January 2015, the market share of Heathrow accounted for 53 per cent, Gatwick had 23 per cent, while the market share of Stansted and Luton remained unchanged. As outlined above, this may reflect the greater influence of constraints on Gatwick's runway capacity at peak times. Stansted's share of South East traffic has increased since it was sold in February 2013, even as total passenger numbers have increased during that time. This may reflect the increased effort Stansted reported to provide greater passenger throughput to the market. However, it may also reflect spare runway capacity at Stansted.

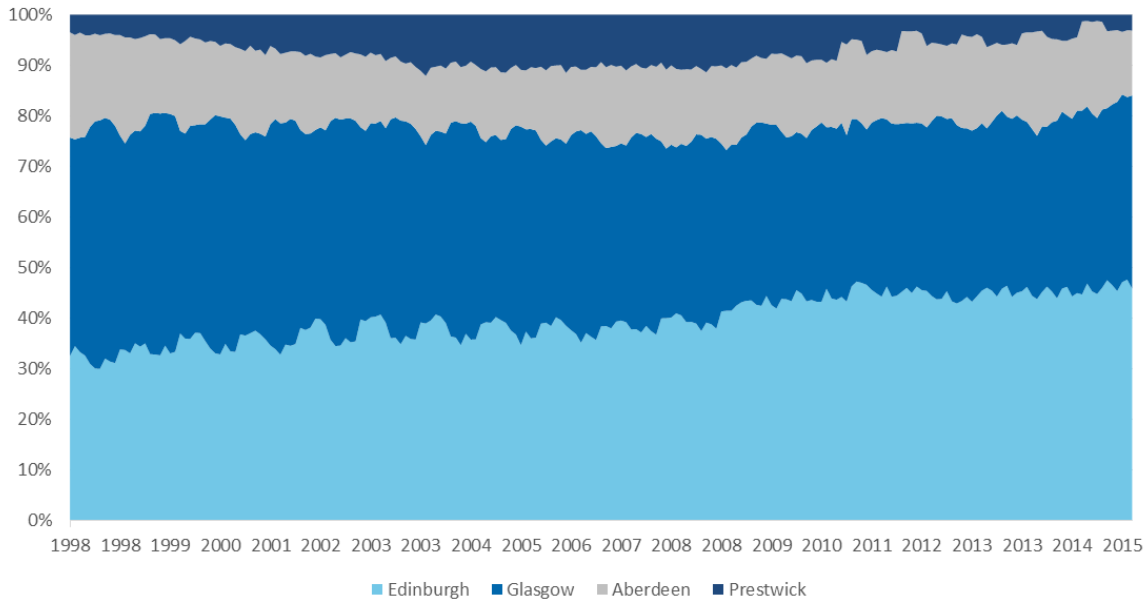
Figure 3.6 Passenger traffic shares in the South East of England



Source: CAA

Edinburgh's share of passenger traffic at Glasgow, Edinburgh, Prestwick and Aberdeen has increased modestly since its sale in April 2012 (Figure 3.7).

Figure 3.7 Passenger traffic shares in Scotland



Source: CAA

Quantitative estimations

Econometric analysis was undertaken to identify possible observable impacts of the divestment of the three BAA airports on capacity development, measured as the number of ATMs and total number of passengers served by each airport[77]. The approach to identify the causal effect used corresponding data from 21 other large or mid-sized UK airports (the control group)[78], and compared these to the three BAA airports (Gatwick, Stansted and Edinburgh), to build a counterfactual scenario in which the divestiture did not take place. The analysis also took account of the timing of the sale of each of the three BAA airports in order to compare passenger throughput before and after each divestment (the three airports are considered as a whole, rather than individually)[79].

The analysis identified a rise in ATMs and passenger numbers around the date of finalising the sale of the respective airports, although most other UK airports also experienced increasing passenger numbers over this period. Overall, passenger throughput at UK airports increased between 1998 and 2007, followed by a period of decline to 2011, before increasing more slowly from 2012 onwards.

The analysis also compared differences in ATMs involving domestic, EU and non-EU locations for the three BAA airports since their respective divestments, to identify drivers of any observed changes. The data suggest consistent increases across EU and non-EU destinations for both Gatwick Airport and Stansted Airport, although domestic ATMs have

[77] The analysis was based on monthly ATM and passenger numbers from the CAA. The figures focused on the period between January 1998 and October 2015 and included all scheduled and charter flights involving domestic, EU and non-EU origins or destinations.

[78] The 21 airports in the control group were selected from the 34 largest UK airports after excluding airports that were not comparable to the three BAA airports, which included: the Scottish Islands' airports (due to them mainly serving the oil industry); the Channel Islands and Isle of Man airports (due to them being natural monopolies); Doncaster Sheffield Airport and London Southend Airport (due to them not being operational throughout the full period of investigation); and London City Airport (due to it being a 'city centre' airport which predominately serves the business market using smaller aircraft than seen at the majority of UK airports, which have a strong leisure mix and use of larger, narrow-body and wide-body aircraft).

[79] This describes a panel regression. Difference-in-difference analysis, which would have estimated the effect at each individual airport, was explored but was found not to be feasible with data available to this study.

declined. Edinburgh Airport has increased passenger throughput on non-EU international destinations, reflecting its reportedly increased efforts to attract long-haul flights.

The analysis also considered the seasonality of passenger throughput across the sample of UK airports, to account for changes in passenger throughput between winter and summer. It suggests that there was relatively little change in the seasonality of passenger numbers at Gatwick. However, the data suggest changes for Edinburgh, where the seasonality of passenger numbers has increased, due to a relative increase in passenger movements during the summer months. In contrast, passenger numbers at Stansted have become less seasonal since they peaked in 2007 This may reflect its reported efforts to increase revenues by introducing charging structures that seek to encourage airlines to continue flights during winter, thereby bring more passengers through the airport at those times.

STN experienced a marked increase in ATMs and passenger numbers immediately following the divestment – albeit based on a relatively short period of time following divestment – while the growth in ATMs and passenger numbers at Gatwick and Edinburgh took a little longer to become established following their respective divestments.

Panel regression[80] (across all airports as a group) and time-series analysis were employed to test whether the positive changes in overall ATMs and passenger numbers were above what would have been expected in the counterfactual scenario. Different models were employed for the analysis including yearly models, based on annual data, and monthly models, based on a moving average of 12 months of data (i.e. providing many more data points and accounting for seasonality). The results suggest that the effect of the divestments on capacity development were positive and broadly similar under all models.

In summary, there is some econometric evidence to suggest that increases in ATMs and passenger numbers at divested airports are significantly larger when compared with other UK airports. Analysis suggests that passenger numbers increased by 9-12% as a result of divestment and ATMs by around 9%, after accounting for longer-term trends at each airport[81]. A detailed description of this analysis can be found in Annex 4.

However, these findings should be interpreted in light of limitations identified in the data and consequently in the analysis. Modelling based on monthly data suggests there has been a significant positive impact. Modelling based on yearly data does not, but this may be due to the smaller number of data points[82]. Estimations based on this data suggest that ATMs in the three BAA airports were 9 per cent higher than the control group, while passenger numbers were between 9 and 12 per cent higher, compared with other similarly-sized UK airports, and taking into account trends over time at each divested and control-group airport.

[80] Panel regression uses data from a number of series (in this case, airports) collected over time.

[81] The analysis attempts to estimate long-term trends at each airport (before the CC's remedies were implemented), thereby removing their effect from any estimation of the impact of the CC's remedies, thereby intending to avoid biasing those estimations.

[82] The coefficients based on the annual models suggested that ATMs in the divested airports were between 6 per cent and 7 per cent higher than the counterfactual scenario, while passenger numbers were between 8 and 9 per cent higher, although these results were not significant. However, the coefficients from the monthly models were significant (at the 99.9 per cent level) due to having 12 times as much data. If these models were representative, it suggests that ATMs in the divested airports were 9 per cent higher than the counterfactual scenario, while passenger numbers were between 9 and 12 per cent higher.

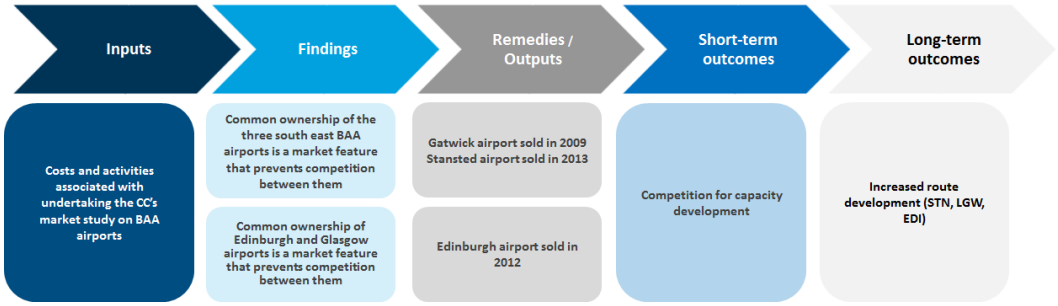
Conclusions

- Passenger numbers have increased since divestment, at each of Gatwick, Stansted and Edinburgh. Quantitative evidence suggests that across the three airports passenger numbers increased by 9-12% and ATMs by around 9% after divestment compared with developments at other airports, even when accounting for long-term trends observed at each airport prior to divestment.
- Qualitative evidence suggests that these increases have been supported by increased efforts by each divested airport to attract airlines and passengers. In particular, these airports reported changing pricing structures to attract airlines to off-peak times, making better use of capacity, and to link charges to service quality as a way to signal commitment to service quality for their passengers.
- The increase in passengers is also reflected in increasing numbers of passengers per aircraft movement, though this is consistent with long-term trends that pre-date the CC's investigation and remedies.
- The share of London passengers travelling via Gatwick has increased by one per cent since divestment. This may reflect capacity constraints at Heathrow (which has lost 2 per cent share of London passengers), in a market that is growing overall.
- Since divestment, Edinburgh airport has increased its share of traffic among the main Scottish airports. This also reflects the continuation of a long-term shift away from Prestwick and, to some degree, Glasgow, towards Edinburgh.

3.2 Route development

This section examines the study hypothesis outlined below (Figure 3.8). It examines evidence on whether the divestiture of Gatwick, Stansted and Edinburgh had an effect on the routes flying from each airport.

Figure 3.8 Increased route development as a result of BAA divestments



This hypothesis is based on the rationale that increased rivalry between airports should lead to improved matching of routes offered with demand for routes. This could be expected to be associated with an increase in routes flown from the airports in question.

As with other hypotheses, the complexity of the airports market and its interaction with airlines makes interpretation of route development indicators complex. The following interactions are considered. Route development is influenced by:

- The type of airline flying from each airport. Airlines with a significant hub presence structure their routes according to that airline model (generally a transfer route network that supports long-haul routes).
- The amount of spare runway capacity. The less runway capacity is available, the greater the incentive for an airport to maximise revenue per ATM, either by encouraging larger aircraft (generally on longer routes) or by attracting higher-value passengers, generally flying longer routes or with more 'premium' airlines. This view of airport competition was also supported by an airline interviewed for this study.

These trends would generally be expected to be observed only in the longer-term, given the time required for route-development efforts to be reflected in airlines' decisions. Furthermore, interviews carried out for this study and IATA (2013) indicates that there are airport-specific factors that influence route development which cannot be observed, yet have a significant impact on route development. These include, for example, changes in airport strategy or wider developments in the airline market (such as individual airlines' strategies or performance).[83]

IATA (2013) suggested that route development and route switching reflects the high level of competition within the liberalised airline sector. They also reported that airline have a very strong incentive to optimise their route networks to generate yield[84]. Copenhagen Economics (2012) reported that airlines are increasingly competing to establish new routes[85]. Their analysis showed that route overlap is high and that over 50 per cent of the destinations served at the largest airports across Europe (with over 25m passengers) are also served from one or more airports around it. They also reported that competitive pressures from greater airline and passenger choice have been strengthened by more airport marketing and more differentiated

[83] IATA. 2013. 'Airport Competition'. See page 21. Available at: https://www.iata.org/whatwedo/Documents/economics/airport-competition.pdf

[84] Ibid.

[85] Copenhagen Economics. 2012. Airport Competition in Europe

offerings. Similarly, research by ICAO (2013) reported that, in Europe, marketing and route development expenses have more than doubled over the last 10 years[86].

However, airlines interviewed for this study reported that that there is likely to be more competitive pressure on routes that could credibly switch between airports, particularly routes with lower frequency. Further, a range of airlines reported during interviews that airlines with origin-destination models are more likely to engage in this sort of route switching and use this during negotiations with airports. This may therefore be a more appropriate way to view competition between airports with a large share of origin-destination flights, rather than airports with a greater proportion of 'transfer' flights. Comparisons of route overlap should therefore be considered with care and are not included in this analysis as route overlap is only one potential indicator of competition between airports and may be more applicable to some airports than others.

Airlines interviewed for this study also reported that airlines' decisions about where to route (and base) their aircraft are multi-layered, indicating that airports' competitive efforts to attract airlines may therefore not be the main consideration in such decisions. Other factors noted by airlines included where aircraft are 'based' (potentially including significant sunk-cost investments in maintenance facilities), strategic decisions about airlines' route networks and wider factors in the airlines market that go beyond factors affecting competition between airports.

From a passenger's perspective, choice between airports arises when multiple airports serve the same routes. This is reflected in literature that treats duplicate routes as a sign of competition between airports for airlines' business. Marginal airline switching can occur between duplicated routes, as airlines may change the frequency (or seasonal coverage) of any given route.

Nonetheless, airports primarily compete for airlines. Competition between airports manifests itself at the margins where airlines may alter the frequency, aircraft size or operational period of the year for any given route. One airport reported that, as a consequence, airports with route duplication might exhibit less route and airline switching, because route duplication generally indicates that catchment areas can support routes from both airports.

This competitive dynamic therefore implies that route duplication may not be a good measure of competitive rivalry between airports, so this is not an indicator that has been explored in this analysis. Competition between airports with respect to route development does not necessarily lead to significant changes to the total number of routes flown from each airport, but could merely lead to greater route 'churn' (i.e. route destinations changing, but the total number of destinations remaining the same).

3.2.1 Evidence on the effect of the CC's remedies

To examine the effect of the CC's remedies on competition to increase route development, the following data was examined (as detailed in Annex 1 and Annex 2):

- route capacity and number of routes. This is a high-level indicator of an airport's success in developing a larger route base;
- route churn. This indicator shows the total amount of route switching by airlines, based on the total number of routes offered from each airport by each airline flying from that airport. Route churn may increase if airlines switch routes between airports, but this differs from the total number of routes flown from each airport; and
- econometric analysis of the indicators above, where feasible.

[86] ICAO. 2013. Worldwide air transport conference - sixth meeting, airport competition

Route capacity and number of routes

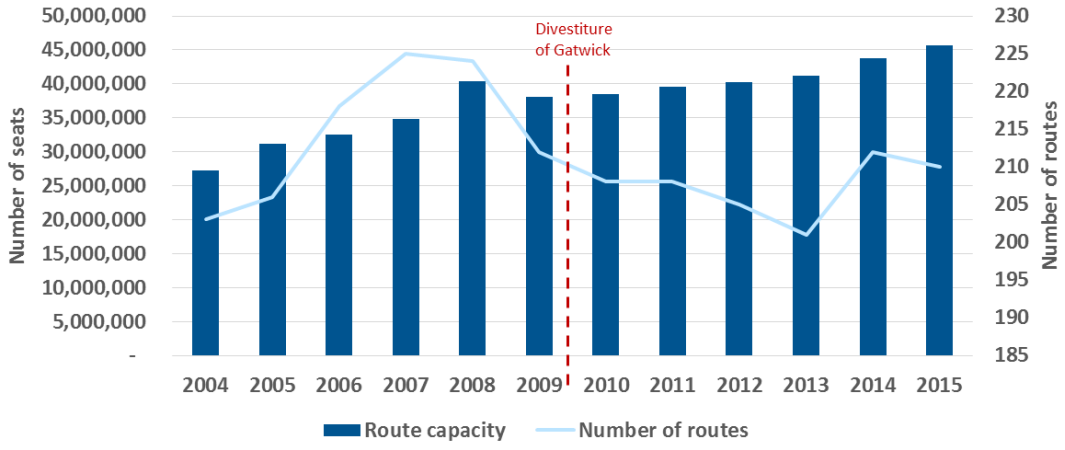
It was reported by one stakeholder that under BAA ownership, route development was not a matter for individual airports in the South East. A central decision was made about how each airport should be used and how airlines and flights should be allocated. This is reflected in new owners of each of Gatwick, Stansted and Edinburgh reporting a significant increase in marketing efforts to airlines for route development, following their purchase of the airports. One airport owner in the South East reported that it felt that the CC remedies had been the main driver for this change, with changes to economic regulation being less influential in this regard.

One airline reported that in Scotland, BAA had sought to split leisure and business traffic between Glasgow (leisure) and Edinburgh (business). It reported that this split is beginning to unwind, reportedly as a consequence of increasing competition between the two airports for airlines' business. It was reported that BAA had no incentive to compete between the two airports because of significant overlap in catchment areas. It was reported that individual airports could therefore not make offers to airlines because airline routes were negotiated by BAA at a Scotland-wide level. Glasgow and Edinburgh could therefore not 'sell' their relative advantages to airlines. Discussions with airlines reinforced this view.

Following the sale of Gatwick Airport in December 2009, from 2010 to 2015 total route capacity from Gatwick has been increasing (Figure 3.9). Examination of data on the number of airlines and routes reveals that this upturn in passenger throughput coincided with an increase in the number of routes being offered from Gatwick. A significant drop in the number of routes flown from Gatwick occurred in 2009. Falls in the number of routes across the market suggests that this was largely a consequence of outside factors, such as the financial crisis. This suggests that passenger choice over destination has increased since the sale of Gatwick by BAA. This has not been matched by passenger choice over airlines flying from Gatwick, which has declined from 2008 onwards. This may, in part, have been a consequence of airline consolidation in that time.

One government stakeholder reported that, after the recession, low-cost airlines were able to finance aircraft comparatively cheaply, allowing them to price cheaply and expand quickly. This helped to support a rapid change in demand following the recession. Gatwick and Stansted in particular have responded to this increase, which is reflected in passenger throughput offered from those airports.

Figure 3.9 Annual route capacity (number of seats) and number of routes from Gatwick airport, 2004-2015

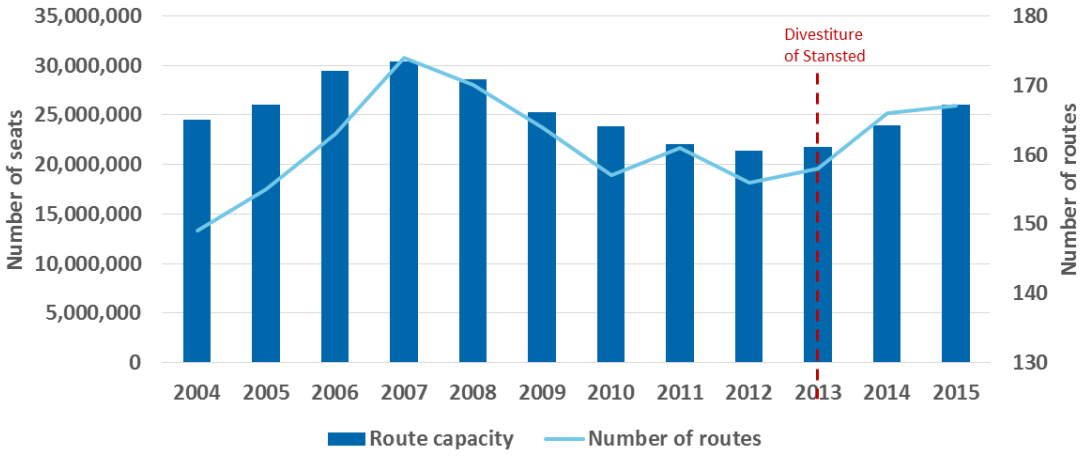


Source: IATA SRS and CAA data. Timing of airport divestments in this figure and those below is denoted by the dashed red line.

The number of routes from Stansted Airport showed significant decline from 2007 to 2012 but, since its sale in February 2013 has shown a discernible increase. One airline reported its view

that the route expansion that has occurred at Stansted since divestment could not have occurred if it were owned by BAA. This stakeholder attributed that expansion to the freedom that Stansted has had to negotiate commercial arrangements with Ryanair, its largest airline customer. This increase in passenger throughput at Stansted has coincided with an increase in the number of routes available since its sale, although this has not been accompanied by an overall increase in the number of airlines flying from Stansted in that time. Again, this may be a consequence of airline consolidation that has occurred over that time.

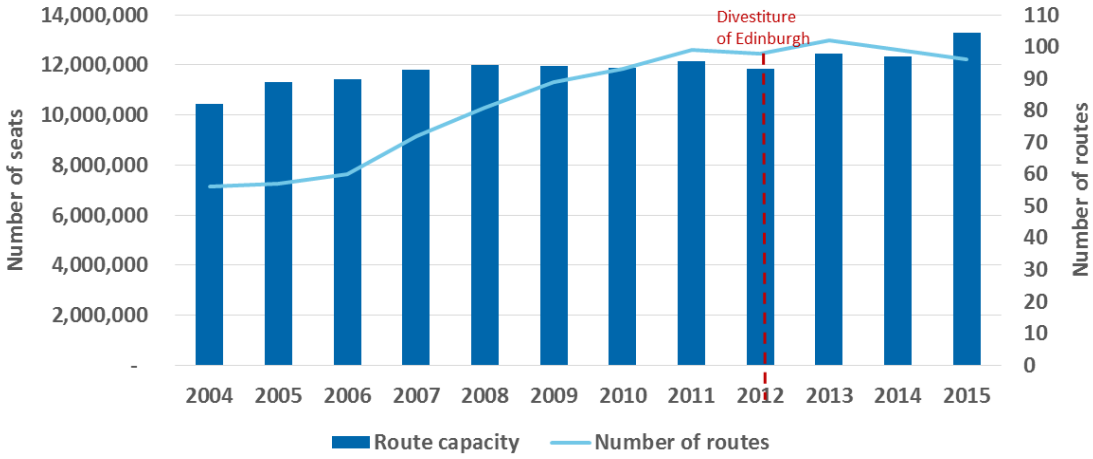
Figure 3.10 Annual route capacity (number of seats) and number of routes from Stansted airport, 2004-2015



Source: IATA SRS and CAA data

Since the sale of Edinburgh airport in April 2012, total passenger throughput flying from Edinburgh has fluctuated although, in 2015, total route capacity increased significantly (Figure 3.11).

Figure 3.11 Annual route capacity (number of seats) and number of routes from Edinburgh airport, 2004-2015



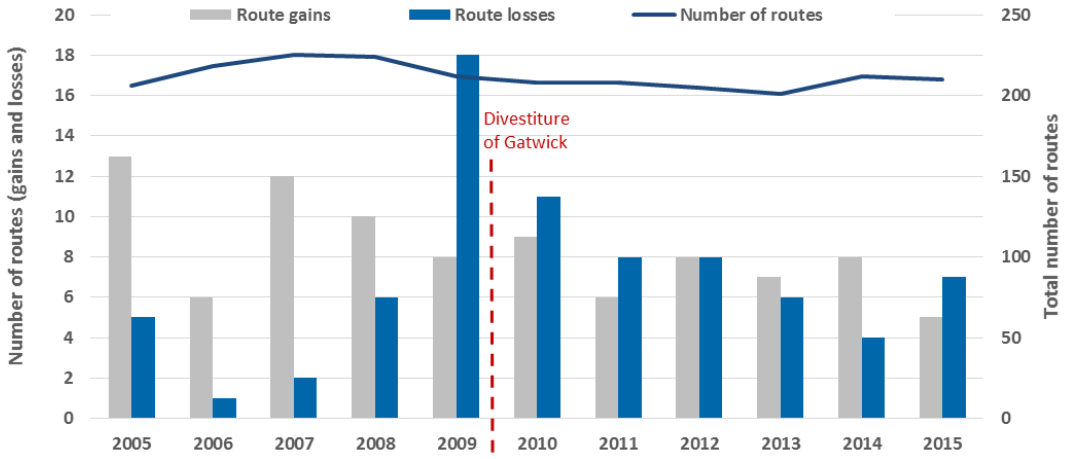
Source: IATA SRS and CAA data

Route churn

A number of industry stakeholders reported during interviews that, since divestment, Gatwick, Stansted and Edinburgh have increased effort expended on marketing to attract new airlines and encourage existing airlines to offer new routes. One airports representative noted that this was particularly evident at Gatwick and Stansted. Discussions with airlines also supported the view that airports have invested heavily in marketing to airlines.

Following the sale of Gatwick Airport in December 2009, total route churn decreased compared with 2008 and 2009 (Figure 3.12). These may have been exceptional years due to turmoil in the airlines market after the financial crisis, as reflected in the spike in route churn that occurred across all three airports directly affected by the CC's requirement for BAA to divest airports. Route churn does not appear to have increased since the sale of Gatwick, with route gains and losses both exhibiting variation, preventing discernible trends being observed.

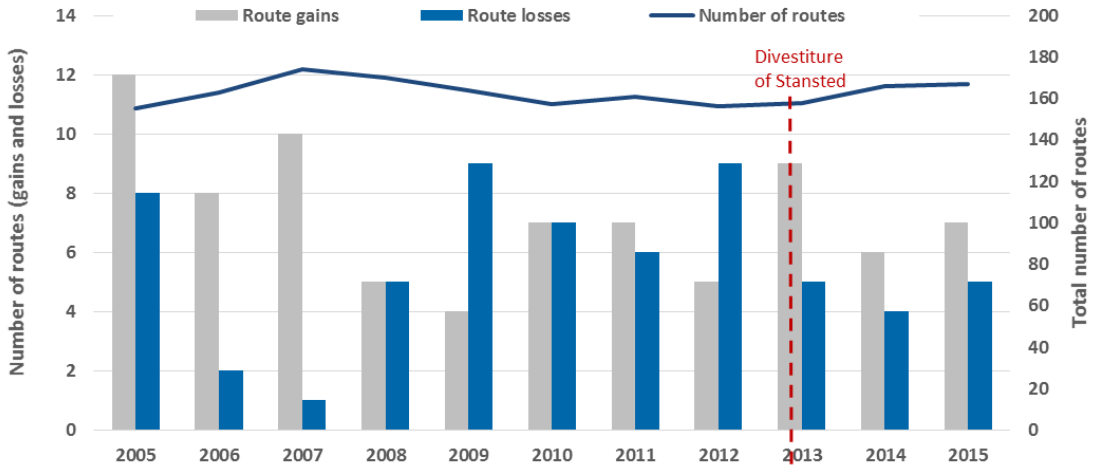
Figure 3.12 Route gains and losses at Gatwick airport, 2005-2015



Source: CAA data

Similarly, the number of routes gained and lost at Stansted exhibit significant variation, although in 2013-15, the number of route gains has been higher than losses (Figure 3.13). While this is not reflected in overall churn, this can be observed in the increase in the number of routes offered by individual airlines shown above.

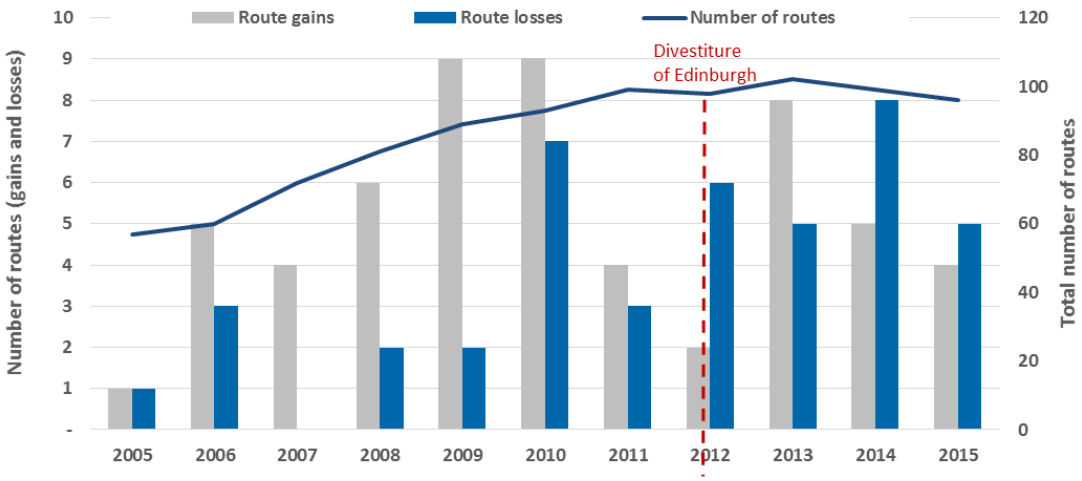
Figure 3.13 Route gains and losses at Stansted airport, 2005-2015



Source: CAA data

Edinburgh has exhibited significant route churn since its divestment in April 2012. While the total gained and lost routes individually do not appear atypical of the period prior to divestment, overall churn shows signs of having increased since divestment (Figure 3.14).

Figure 3.14 Route gains and losses at Edinburgh airport, 2005-2015



Source: CAA data

Further observations relevant to route development are also made below (Section 3.3), where these relate to wider efforts by airports to attract airlines to their airports.

Econometric analysis of indicators

Econometric analysis was undertaken to identify observable impacts of the divestment of the three BAA airports on route development. The analysis explored potential changes in the numbers of new routes, closed routes and an indicator of 'route turnover'[87] [88]. Comparisons were made between the 24 largest airports in the UK[89], including the three BAA airports. The analysis took account of the timing of the sale of the three BAA airports to compare changes in route development before and after each divestment (as before, the three airports are considered as a whole, rather than individually).

The indicators of route development are broadly similar between the three BAA airports. New routes have accounted for between one and three per cent of all routes since the divestment of each airport, although these routes have only accounted for around 0.5 per cent of seat capacity at these airports in each year. The seat capacity rate of 'route turnover' is also broadly consistent between the three divested airports with new and closed routes accounting for around one per cent of the seat capacity of all routes (including closed routes) at each airport since each divestment. These indicators are also consistent across most other UK airports in the control group since 2009.

Overall, the data do not provide significant evidence to support the hypothesis that the divestments have had a positive effect on route development (as measured by changes in the numbers of new routes, closed routes and an indicator of route turnover). The share of new routes and the level of 'route turnover' have both declined at each of the three BAA airports following their divestment, while the share of seat capacity on those new routes has remained relatively stable. These trends appear consistent with the experience at other UK airports,

[87] 'Route turnover' provides an indicator of new routes as a proportion of all route and is defined as: (new routes + closed routes) / (actual routes + closed routes). The indicator is 100% if all routes are new in a given year and zero if and only if there were no new or closed routes. However, it is not possible to tell for a value between the two extremes to what extent the turnover signals new routes opening or old routes being closed.

[88] The analysis was based on monthly data from the IATA Schedule Reference Service (SRS) for route and seat capacity on scheduled flights between UK airports to 635 other UK and international airports. The figures focused on the period between August 2003 and June 2016. [IS THIS A FORECAST?]

[89] The number of airports included in the control group depended in each specification on a visual inspection of the data, after which any obvious outliers or spurious data series were removed.

which suggests a wider industry trend of declining route development between August 2003 and June 2016[90] (the dates to which the data analysed relates).

Panel regression (across all airports as a group) was employed to test whether the changes in the development of new routes were more significant amongst the divested airports than would have been expected in the counterfactual scenario (i.e. amongst the 21 other large and mid-sized UK airports). These econometric results were not statistically significant under any of the three specifications tested (i.e. using the share of new routes and share of seat capacity on new routes and the seat turnover indicator). There is no econometric evidence, based on available data, to support the claim that the divestments had a positive effect on increased route development.

Conclusions

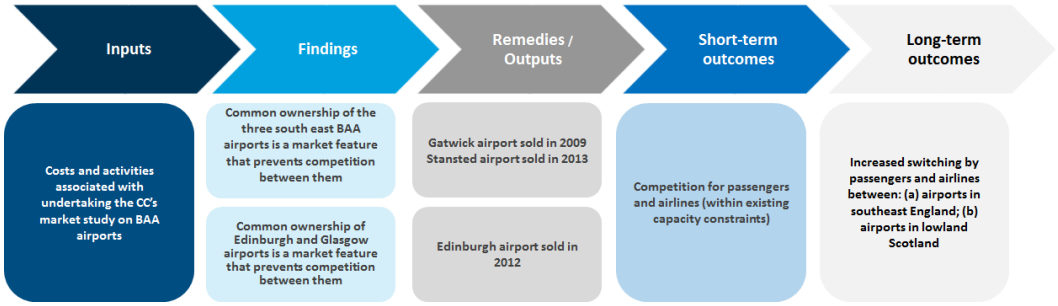
- Most qualitative evidence supports the hypothesis that the CC's remedies have led to airports engaging in greater competitive efforts to attract new airlines and new routes. Some stakeholders specifically indicated that some of this activity would not have occurred under common-ownership of the three former BAA airports (Gatwick, Stansted and Edinburgh).
- This is reflected in observable increases in the number of available seats flying from each airport and the number of routes available from each airport in recent years. The total number of seats available in the market at divested airports has increased at each since divestment. At Gatwick and Edinburgh, this appears to be consistent
  - at Gatwick this appears to be consistent with a long-term trend, with some signs that the rate of increase has increased since divestment after a relatively flat period from 2008 to 2012; and
  - at Stansted and Edinburgh, this increase appears to have reversed periods of decline in available seats from around 2006-7 to 2012.
- It has not been possible to establish quantitative evidence that divestments have coincided with statistically significant increases in route capacity or the number of routes. This may be due to constraints of the available data (such as it being annual data only).
- Variation in the number of route gains and losses makes it difficult to discern trends in route churn since divestment. There are some signs that route churn may have increased at Edinburgh airport, which could be indicative of increased competitive pressures. However, wider factors in the aviation market have a significant effect on route churn and this must be taken into account.

[90] Although this was a future date at the time of writing, airlines report their schedules in advance for the season and, although these schedules may change slightly in practice, any such changes are not reflected in the IATA's data (i.e. even past data is based on projections reported to the IATA at the time they were submitted.

3.3 Passenger and airline switching

This section examines evidence on the hypothesis that the divestiture of Gatwick, Stansted and Edinburgh has led to increased competition between airports, for passengers and for airlines (Figure 3.15).

Figure 3.15 Increased competition for passengers and airlines as a result of BAA divestments



The divestiture of Gatwick, Stansted and Edinburgh was expected to created new competitive incentives for rivalry between airports that were not present when BAA owned those airports. The hypothesis being tested here is that those incentives should have led to increased efforts by those airports to compete for passengers' business and airlines' business. According to the CC's market investigation report, *"markets that are competitive generate feedback from customers to firms which, in consequence, direct their resources to customers' priorities. In addition, firms are encouraged to meet the existing and future needs of customers as effectively and efficiently as possible."*

Airline switching (or airline churn) can be indicative of competition between airports for airlines' business, but can also be influenced by a large range of factors such as airport size and maturity of the route[91]. For airlines, switching can be costly, particularly for those with significant sunk costs invested with respect to specific airports. Airlines may need to relocate assets and staff, and may have long-term commitments that are costly to renege on, or lose economies of scale[92]. These costs will vary by airline according to their commercial position and business model and by airport location.

The specific effects of the CC's remedies must be considered in the context of changes to the airlines market outlined above. Airlines have become more able and willing to switch between airports, as indicated by analysis by Copenhagen Economics (2012) demonstrating a high degree of airline switching across all scheduled airline capacity in Europe between 2002 and 2011[93].

Passenger switching is becoming easier, ICAO (2013) reported that nearly two-thirds of Europeans are within two hours' drive of at least two airports[94]. This provides significant scope for airports to compete for passengers. However, the proximity of an alternative airport can only represent a relevant choice if it offers a substitutable service, such as a comparable itinerary. IATA found that passengers' preference for travelling from their local airport is very strong – for every 1 per cent increase in distance, the likelihood of passengers flying from that airport declines on average by 4 per cent[95]. Copenhagen Economics (2012) found that since 2002, the leisure segment has generally recorded the highest traffic growth. They also found

[91] IATA. 2013. 'Airport Competition'. See page 21. Available at: https://www.iata.org/whatwedo/Documents/economics/airport-competition.pdf

[92] IATA. 2013. 'Airport Competition'. See page 17. Available at: https://www.iata.org/whatwedo/Documents/economics/airport-competition.pdf

[93] Copenhagen Economics. 2012. Airport Competition in Europe

[94] ICAO. 2013. Worldwide air transport conference - sixth meeting, airport competition

[95] IATA. 2013. Airport Competition

that leisure passengers are more price-sensitive and less time-sensitive than business passengers[96].

Gatwick Airport noted in 2013 that, following the recent sale of Stansted Airport, competition between both airports for airlines and passengers was expected to increase, with one of the airports winning and the other losing passenger traffic[97].

3.3.1 Evidence on the effect of the CC's remedies

To examine the effect of the CC's remedies on competition for passengers and for airlines, the following evidence was considered (as detailed in Annex 1 and Annex 2):

- airports' competitive efforts to attract airlines, collected from site visits to airports and from interviews with other stakeholders across the sector;
- airline switching (churn), as indicated by the number of airlines flying from each airport over time. The overall level of airline switching may therefore shed further light on competition between airports; and
- passenger switching between airports in the South East of England and airports in lowland Scotland, as indicated by changes in passenger numbers, although this should be considered in the context of passenger demand across the UK[98].

Econometric analysis of the impact of route development share of passengers and airports' share of passengers is also relevant for this section, but results have not been repeated here (Section 3.2).

Qualitative evidence of airports' competitive efforts to attract airlines

Several stakeholders across the sector reported considerable qualitative evidence of increased rivalry between airports in the South East of England and in the Scottish central belt. Some also reported that this has had an effect on a wider set of airports competing with those in each of these areas. One airports representative reported its view that the increase in competition among London airports was strongly influenced by the CC's divestment remedies for Stansted and Gatwick. In particular, in its view, these airports and other competitor airports have increased their efforts to attract airlines through pricing and structure of aero charges, as well as other commercial offerings. Another two observers also reported similar views, in particular noting that Edinburgh airport, once divested, expanded its route-development team, publicised its work to expand routes and became more active in encouraging international route development. One airline also reported observing a significant increase in competition overall between London airports, although it noted that overall capacity constraints in the South East were limiting the effect of this competition on overall aeronautical charges.

Commercial arrangements between airports and airlines can include adjustments to the structure of charges to incentivise airlines to adapt their routing, aircraft or operations to align with airports' commercial incentives. For example, 'budget' airlines offering cheaper prices can have quicker turnaround durations reflected in their charges, allowing the airport to increase stand turnover. Such arrangements are beneficial to airlines and to passengers because not all passengers or airlines want the same level of service.

Airports reported that the structure of these incentives can include not just price, but also agreements to facilitate investment. For example, airlines that want their passengers to have

[96] Copenhagen Economics. 2012. Airport Competition in Europe

[97] Gatwick airport. 2013. 2013 Gatwick capital investment programme

[98] Econometric analysis of passenger switching because data examined only included total passenger numbers. Examining switching between airports would require complex analysis of passenger data that was beyond the scope of this study.

lounge access may invest in providing such facilities in return for a longer-term contract with the airport.

One sector stakeholder reported that when owned by BAA, Gatwick did not offer any discounts on aero charges, or have any commercial arrangements to incentivise airlines to change their routes, aircraft or operations. Gatwick has now implemented contracts for the majority (over 80 per cent) of its airline customers, which set out the level and terms of aero charges for 3-10 years.

Airports also link aero charges to other factors, such as the volume of aircraft and new airlines flying new routes. These provide airlines with some certainty as to how they can achieve discounts and also align pricing (and therefore airlines' incentives) with airports' operational incentives. At Gatwick, these contracts are also related to service quality measures linked to the Service Quality Rebate (SQR). These allow airports to demonstrate to airlines that their incentives to ensure adequate service quality align with airlines' desires to satisfy their passengers.

Several stakeholders reported an increase in the number of airlines signed up to these kinds of fixed-term contracts at Gatwick. One sector stakeholder specifically identified that Edinburgh, Heathrow and Stansted all offer such discounts. Another airline and Gatwick Airport reported that Stansted and Edinburgh have similarly adopted such contracting arrangements with airlines, linked to service quality and volume. Another airline stakeholder indicated that Stansted and Edinburgh do not offer it long-term contracts for such discounts in the manner that Gatwick does.

Stakeholders also reported that Gatwick is offering discounts to airlines during winter periods. These charging structures help the airport to attract more flights during quieter periods, which allows it to increase aero and non-aero revenues despite runway capacity constraints at peak times. One stakeholder reported that under BAA ownership, Gatwick had no incentive to innovate in this manner to increase its utilisation of its limited capacity.

One airline reported that divestment has had a positive impact on Stansted's competitive activities to attract airlines. It reported seeing a more commercial approach, demonstrated through new commercial agreements struck with airlines flying to Stansted, some of which are reported to include discounts linked to the quality of airport services.

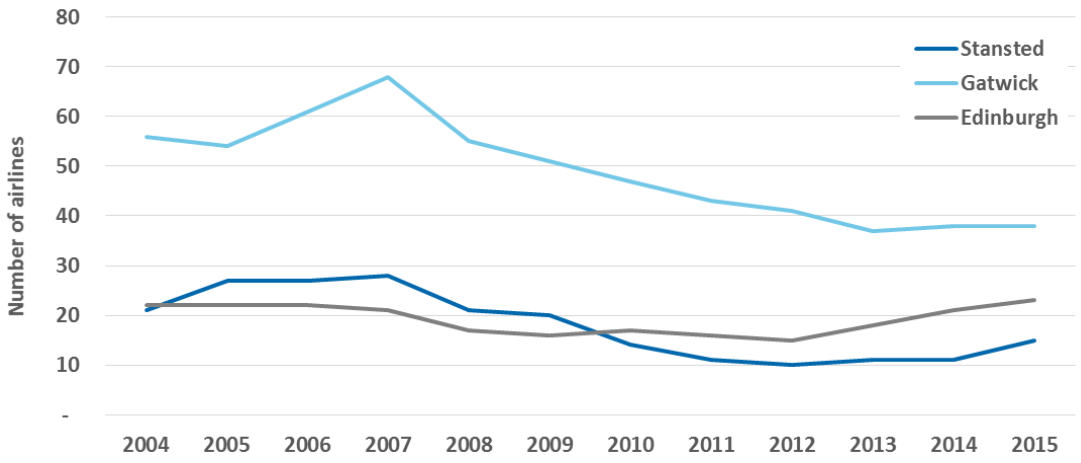
Stansted Airport in particular reported increasing its efforts to attract freight carriers and indicated that this increased focus on freight would not have occurred under BAA. For example, it reported an increase in the number of major cargo operators flying out of Stansted. However, another stakeholder reported that the CC's remedies have had little effect on the freight market, and reported no noticeable impacts of any of the CC's remedies on divested airports or on other airports.

Airline switching

Airline switching can be represented by the number of new airlines that airports attract and lose, or for airlines with enduring relationships with airports, the rate of route churn (new routes and curtailed routes for individual airlines). Route churn was analysed above specifically in relation to route development (Section 3.2). This section therefore focuses on evidence of any impact of the CC's remedies on pure switching between airports (new airlines and airlines lost to competitors).

The total number of airlines flying from each of the divested airports was in decline from 2007 to 2013 (Figure 3.16), although this may be a consequence of airline consolidation during that time. This trend appears to have halted at each divested airport in 2013, with gains in the number of airlines flying from Stansted and Edinburgh observed since then. Across all three airports there appears to be some similarity, indicating that wider factors in the airline market may be influencing these numbers significantly, in particular this may reflect wider market dynamics in the airline industry which have resulted in many airlines closing (as reported by one airline still operating).

Figure 3.16 Total number of airlines at Gatwick, Stansted and Edinburgh airports, 2004-2015



Source: IATA SRS

One freight carrier noted that freight operators tend to have high sunk costs at airports and so tend to have long-standing arrangements with them. Although in theory they could switch airports, the cost of doing so would be high and factors such as the location of their customers are more important.

Passenger switching

Changes to the number of passengers travelling from each airport were outlined above (section 3.1) and so are not repeated in this section, similarly changes in the share of passengers travelling from each airport.

In summary, the changes in passenger numbers are strongly influenced by changes to overall passenger demand across all UK airports. However, significant changes in the share of passengers, particularly at Stansted and Edinburgh airport, indicate that some passengers are choosing to travel via those airports in preference to other competing airports.

Conclusions

- Most stakeholders reported observing an increase in competitive rivalry at divested airports in the South East. The best evidence of this increase is qualitative evidence of a more commercial approach to attracting airlines. This includes adapting the structure and level of charges to compete with other airports for airlines' business (and for new routes) and linking service quality to charging to demonstrate commitment to passenger quality and therefore to attract airlines. This has also been reflected in the expansion of airport personnel charged with attracting new routes and airlines.
- Views were more mixed with respect to competition in Scotland, although the majority reported that this had increased, particularly between Edinburgh and Glasgow.
- A small number of airline stakeholders did not agree that airports are now competing more with each other, and reported little change in competitive conditions.
- There is some quantitative evidence that these efforts are being reflected in changes in passenger numbers, as outlined in Section 3.1, and some tentative evidence that passenger switching is resulting in overall changes to the share of passengers served by divested airports. However, it was not possible to isolate these observed effects in an econometric analysis of statistically significant differences before and after the CC's remedies were implemented.

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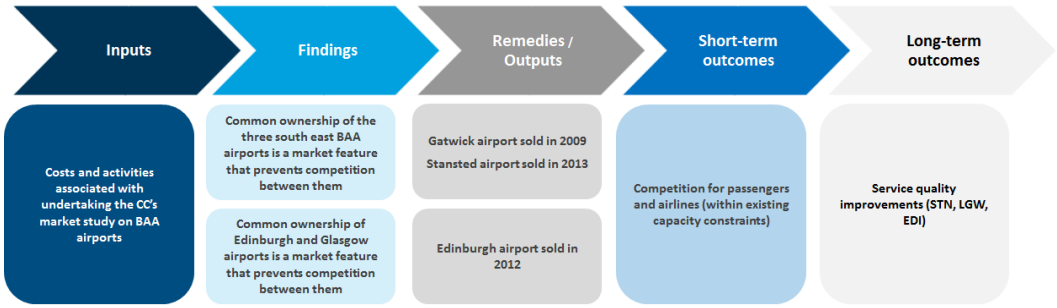
3.4 Service quality

This section examines evidence on the hypothesis that the divestiture of Gatwick, Stansted and Edinburgh has led to improved service levels for passengers, as outlined below (Figure 3.17). It examines the quality of service that passengers receive, which reflect airports efforts to attract airlines and passengers.

Figure 3.17 Summary of hypothesis for improving service quality as a result of divestiture of Gatwick, Stansted and Edinburgh airports



Competitive rivalry for passengers' business (or for airlines' business) may lead to improvements in the quality of services offered to passengers as they pass through the airports. This may be observed as investment in passenger lounges, improved security experiences and/or upgraded terminals. As a result of the CC's decisions, it may be expected that there would be service quality improvements at Stansted, Gatwick and Edinburgh. Individual airports may also have different strategies for attracting airlines which impacts on service quality (e.g. those attracting budget airlines versus those attracting more 'premium' passengers).

The CC reported that service quality improvements should be considered in the context of price competition (for airlines). Any such price competition may influence the level of service offered at a given airport. *The CC commented in its market investigation report that: "not only that different airports supply different services to airlines as consumers, but that the services provided by each airport to airlines will differ according to the requirements of those airlines: these differences can be expected to increase in a more competitive market for airport service".*

The literature suggests that increasing airports competition leads to improvements in service quality in order to attract more airlines as well as more passengers. Copenhagen Economics (2012) concluded that there was substantial evidence that the competitive pressures on European airports were generally increasing, with a disciplining effect on their behaviour[99]. It found that European airports had become more commercially focussed[100] and that any European airports had responded to the increased competition by investing in service quality upgrades[101]. To attract more point-to-point traffic, airports developed dedicated low-cost terminals and invested in improved surface access to the airport. In addition, the OECD (2014) reported that airport and airlines compete via services that improve the passenger experience, including in relation to waiting times for security, immigration and luggage, shopping facilities, cleanliness, friendliness of staff, etc.[102].

Changes in customer service is considered in the context of the following key factors:

- Capital investments, which in the long-run tend to increase service quality and passenger perceptions, though can cause significant disruption in the short-run, which can harm

[99] Copenhagen Economics. 2012. Airport Competition in Europe

[100] Ibid.

[101] Ibid.

[102] OECD. 2014. Expanding Airport Capacity: Competition and Connectivity

passenger experience. Such investments can also cause significant disruption in the short term, which can have a detrimental impact on service quality and passenger perceptions of airports.

  - At Gatwick, soon after taking control of the airport, GIP announced a £1 billion investment programme designed mainly to improve the standard of passenger service at the airport. Projects included the redevelopment of the South Terminal Pier 1 with a new baggage system, and the extension of the North Terminal, providing more baggage belts and increased check-in capacity[103].
  - At Stansted, shortly after taking control of the airport, M.A.G. set a strategy to make Stansted the best airport in London for airlines and customer experience. Projects included the introduction of new technology such as self-check in and bag drop, the relocation and enlargement of the security area, and changes to the baggage system[104].

- Activities influencing passenger experience that are not within the direct control of airports. As highlighted above (Section 2.2.1), these include surface transport, immigration control and baggage handling.
- Temporary disruption caused by investment in facilities. Two airports reported that investments undertaken to improve their facilities often resulted in periods of disruption that temporarily caused service (and perceptions) to decline, followed by improvements once they are complete.
- Airports' strategies for attracting airlines: Individual airports may also have different strategies for attracting airlines which impacts on service quality (e.g. those attracting 'budget' airlines versus full-service airlines and/or those targeting premium passengers).

One airport suggested that, unlike other indicators of competition, investment in service quality should not be constrained by airports operating at or close to capacity, as it could be one strategy for attracting more upmarket airlines or passengers and therefore increasing airport revenues.

Terminal investment and impact on service quality

The three divested airports (Gatwick, Stansted and Edinburgh) and Heathrow all reported making investments in airport terminals as a means of improving service quality and increasing passenger satisfaction. While investments in terminals had been taking place before the CC investigation, the importance of such investments was perceived to have increased following the divestments and an increasingly competitive market. The airports reported placing greater focus on service quality in order to influence passenger decisions and expenditures but also to attract new airlines and increase the efficiency and effectiveness of airport and airline operations. Key examples of recent terminal investments are described below:

- Heathrow has invested £2.6 billion investment to provide a new Terminal 2 facility including the introduction of family lanes, play areas for children, shared check-in desks and self-service kiosks. These investments aim to deliver efficiency savings for airlines, while reducing queues and improving passenger experiences. Baggage handling facilities at Heathrow's Terminal 3 have also been automated to improve speed and accuracy. Further, Heathrow has developed the Airports Operations Centre (APOC) to continually track demand for airport services and passenger comments on social media, so that the airport can identify and address issues as they occur, thereby maximising service quality and minimising any negative media coverage;

[103] Leigh Fisher. 2013. Airport performance indicators.

[104] Stansted airport. 2015. Sustainable Development Plan

- Gatwick invested £1 billion, immediately following its divestment, to redevelop the South Terminal Pier 1 with a new automated baggage system, extend the North Terminal, and provide more baggage belts and increased check-in capacity. These investments aimed to improve passenger security processing and check-in facilities to reduce queuing times for passengers and operating costs for airlines. They were considered necessary to enable the airport to compete more effectively for new business. Gatwick has also invested (alongside Network Rail) in upgrading its rail station and adding a 7th platform and has future plans to upgrade the station concourse and platform circulation infrastructure. This aims to improve service quality and perceptions of the airport amongst customers and particularly business passengers, who were not considered a priority market for Gatwick before its divestment. Gatwick has also prioritised layout and process improvements to improve service quality at its terminals alongside these capital expenditure projects.
- Stansted airport is investing heavily in its terminal facilities, having spent £60 million per year in the first two years following its divestment. This represents a significant increase as previous investments had tended to focus on essential maintenance rather than new developments or improvements. In the last two years, Stansted has invested in airport lounges, new retail space, car parking services and ePassport gates. It is also developing a new 'Satellite One' terminal facility, which it aims to use to attract airlines (and passengers) that are not currently using Stansted, such as providers and users of long-haul services and full service carriers. This aims to ensure Stansted is better placed to compete with Heathrow, Gatwick and other international airports.
- Edinburgh airport has made investments in security and check-in facilities, including self-service check-in desks. These investments have helped to reduce queuing times but also enable the airport to provide tailored services for airlines, covering low-cost options as well as airlines that want to offer full check-in services.

All four airports reported tracking and analysing passenger satisfaction using Airport Service Quality (ASQ) data. They reported a causal relationship between investments and passenger satisfaction, which typically improves after major investments (once teething problems had been resolved). The strength of this relationship reinforces the perceived importance of terminal investment in supporting service quality and passenger satisfaction.

ASQ data provide evidence to support these statements. Data for Heathrow and Gatwick suggest that passenger satisfaction has steadily improved between 2009 and 2014 across most indicators. The trends for Edinburgh and Stansted are less clear, primarily because of the limited data points available following their respective divestments. The data suggest minimal changes for Edinburgh since 2012, although some indicators (particularly waiting times at security and check-in desks) fell sharply in 2013 before recovering slightly in 2014. This may suggest disruption and declines in passenger satisfaction while the new facilities were being installed at the airport. Similarly, several indicators have declined for Stansted in the year following divestment, including the ease of finding your way through the airport, the ambience at the airport, waiting times at security and check-in desks and the retail and restaurant facilities. This may also represent the impacts of renovations and disruptions experienced by passengers.

The airports reported benchmarking their service quality performance against other comparator airports, while Heathrow also described comparing its performance to other brands with high levels of customer satisfaction, such as John Lewis and Apple. This aimed to support Heathrow's objective of providing passengers with "the best airport service in the world".

3.4.1 Evidence on the effect of the CC's remedies

To examine the effect of the CC's remedies on competition for passengers and for airlines, this study considered the evidence on the following indicators.

- Passenger satisfaction, based on ACI's passenger satisfaction survey, which generally covers the period from 2009 to the end of 2014, depending on the specific airport.
- Qualitative evidence of innovation and service quality improvements from stakeholders;
- Service Quality Rebate data (SQR), which provides partial coverage only. Gatwick was fully regulated and provided SQR data only from 2009, Stansted until June 2014 (updated to SQC after that) and Edinburgh and Aberdeen were never subject to Service Quality Rebate by the CAA; and

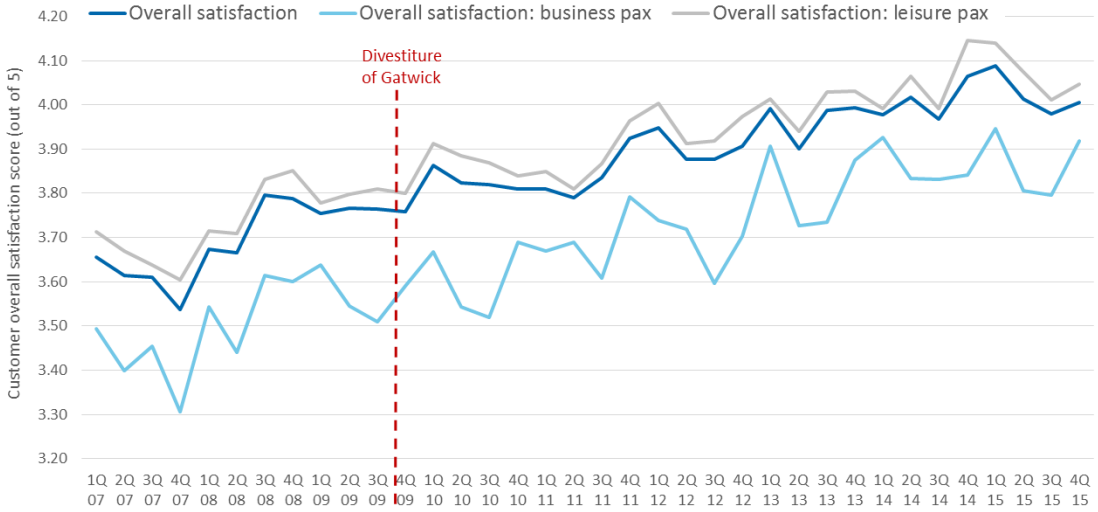
The following indicators were also investigated, but could not be analysed for the following reasons:

- ASQ data on passenger perceptions of airport service quality. Insufficient ASQ data were available to ICF to carry out econometric analysis of whether there was any statistically significant change in passenger perceptions around the time of divestments of BAA's airports. ASQ data are not published by ACI and while some airports publish aspects of their individual performance, this information is limited.
- other data on key service areas. Airports were requested to provide any additional data on service quality that might be relevant. Edinburgh airport provided the results of its Passenger Satisfaction Survey; and
- on-time performance data were considered but deemed not to be relevant to airports' service quality, as stakeholders reported that it is primarily determined by airlines.

Passenger satisfaction

Passenger satisfaction at Gatwick has generally increased since 2007. This general trend has continued since the divestment of Gatwick airport (Figure 3.18). A score of 3.5 means that there is 70 per cent satisfaction while a score of 4.0 represents 80 per cent satisfaction and 4.5 represents 90 per cent satisfaction.

Figure 3.18 Overall satisfaction scores, London Gatwick Q1 2007 to Q4 2015



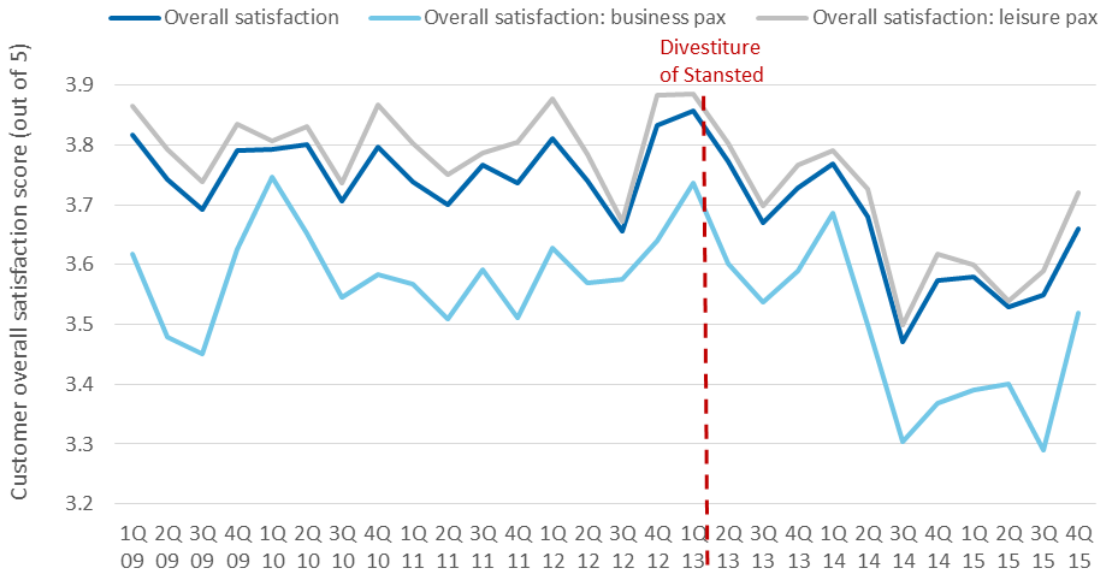
Source: Gatwick Airport, ACI ASQ

A breakdown of annual averages of passenger satisfaction shows that this general trend is reflective of increases in passenger satisfaction across a range of individual indicators of passenger satisfaction, grouped by passenger experience at check in and security (top left), terminal navigation (top right), airport staff and facilities (bottom left) and retail experience (bottom right) (set out in Annex 3).

Passenger satisfaction at Stansted airport, although fluctuating, has recently declined to the end of 2014 (Figure 3.19). As discussed above, this may reflect investment undertaken at

Stansted's terminal, which Stansted has reported caused considerable disruption for passengers. Satisfaction scores increased significantly in the fourth quarter of 2015.

Figure 3.19 Overall satisfaction scores, Stansted airport Q1 2009 to Q4 2015



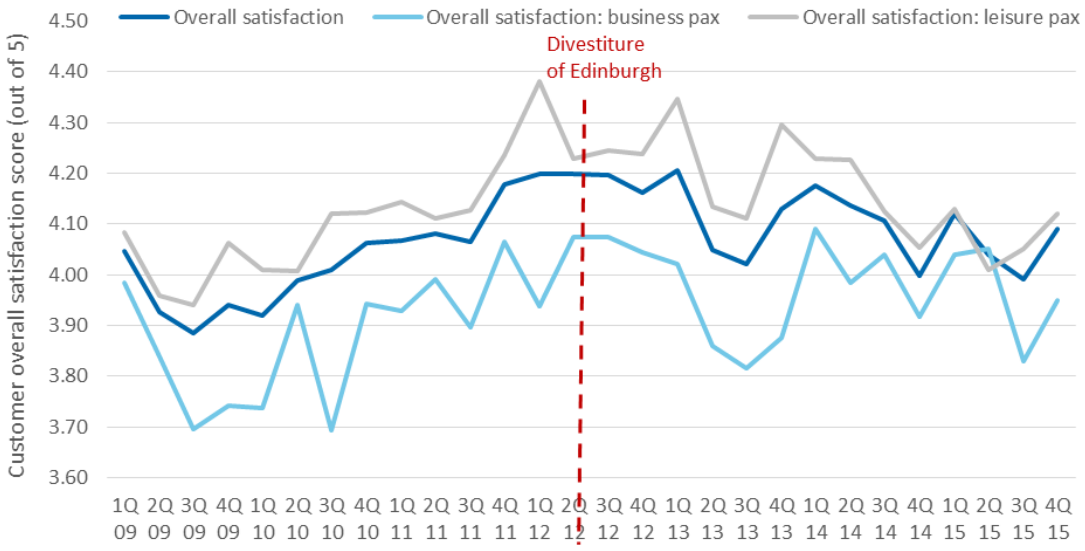
Source: Stansted Airport, ACI ASQ

A closer examination of key components of the overall passenger satisfaction survey indicates some variation in satisfaction across these measures, but indicates that overall satisfaction is representative of the general decline in satisfaction over this time. See (Annex 3).

Stansted airport noted that this decline coincided with major investment and re-configuration of its terminal, which resulted in significant passenger disruption during this time. As Stansted has only one terminal, it is reasonable to argue that such disruption may have a larger effect on its overall ratings than for other airports with multiple terminals (if renovations occurred only at one of these).

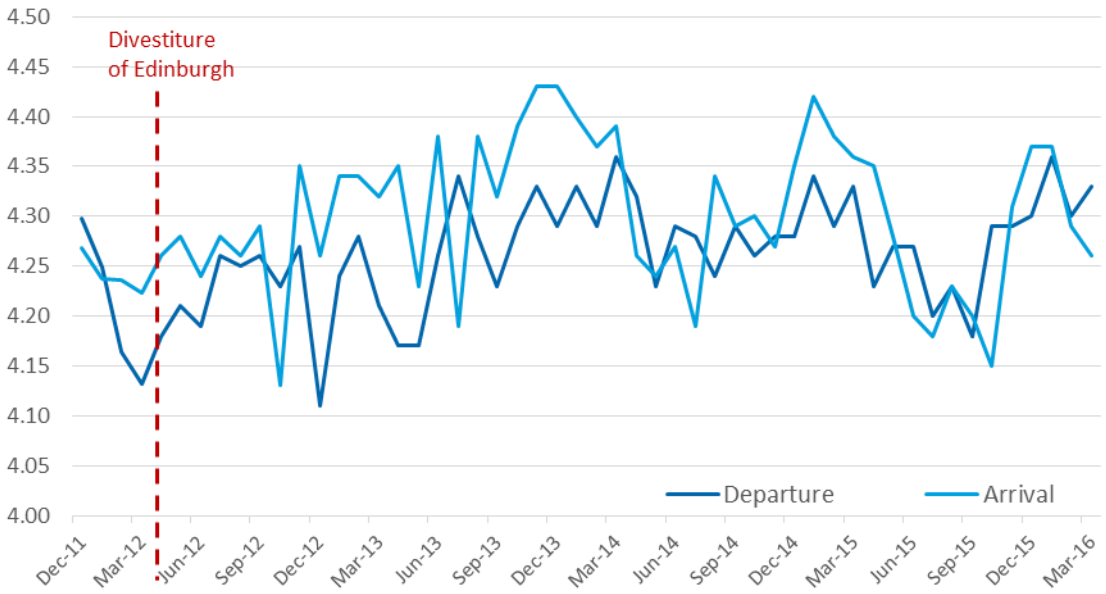
Passenger satisfaction at Edinburgh Airport has shown a mixed trend since 2009, including a marked dip during 2013. Edinburgh Airport reported that this coincided with a reconfiguration of its security hall and reported that problems associated with its introduction have now been resolved. This may explain the dip and the subsequent recovery of overall passenger satisfaction (Figure 3.19). Edinburgh Airport also provided its own data for 2015, which is not directly comparable to ASQ scores covering the period prior to that, but do span the period since divestment (Figure 3.21). This shows that overall satisfaction has been consistently higher since divestment than at the time of divestment and that dips in passenger satisfaction in mid-2014 and mid 2015 appear to be temporary.

Figure 3.20 Overall satisfaction scores, Edinburgh Q1 2009 to Q4 2015



Source: Edinburgh Airport, ACI ASQ

Figure 3.21 Overall satisfaction scores, Edinburgh December 2011 to March 2016



Source: Edinburgh Airport

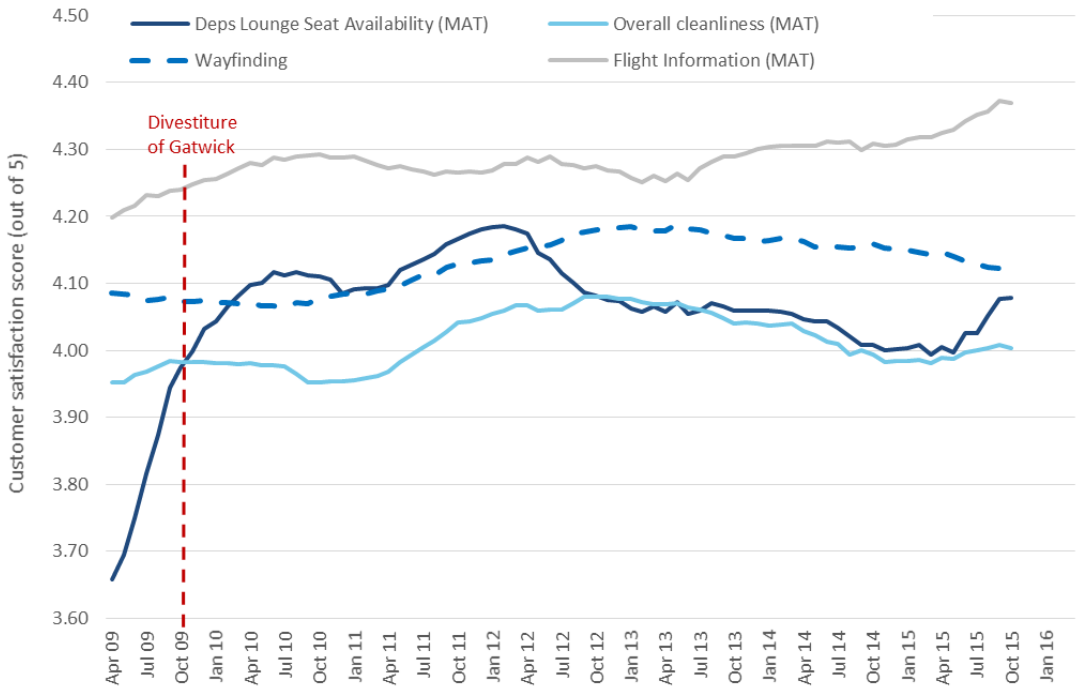
The breakdown of key components of passenger satisfaction is set out in annex 3 and reflects the overall trend above, with 'ease of finding transfer flights' and 'internet connection' possible exceptions that show some increase in 2013 and 2014 data. Passenger satisfaction with immigration control and security dipped considerably in 2013, which likely reflected temporary operational problems that Edinburgh reported experiencing when it introduced a new process at security (Figure A3.1).

Service Quality Rebate data (SQR)

Service Quality Rebate data has also been considered for Gatwick Airport, which continues to publish this data. As outlined above, limited data is available for Stansted so are not analysed here (see Annex 3 for available data). No data is available for Edinburgh Airport.

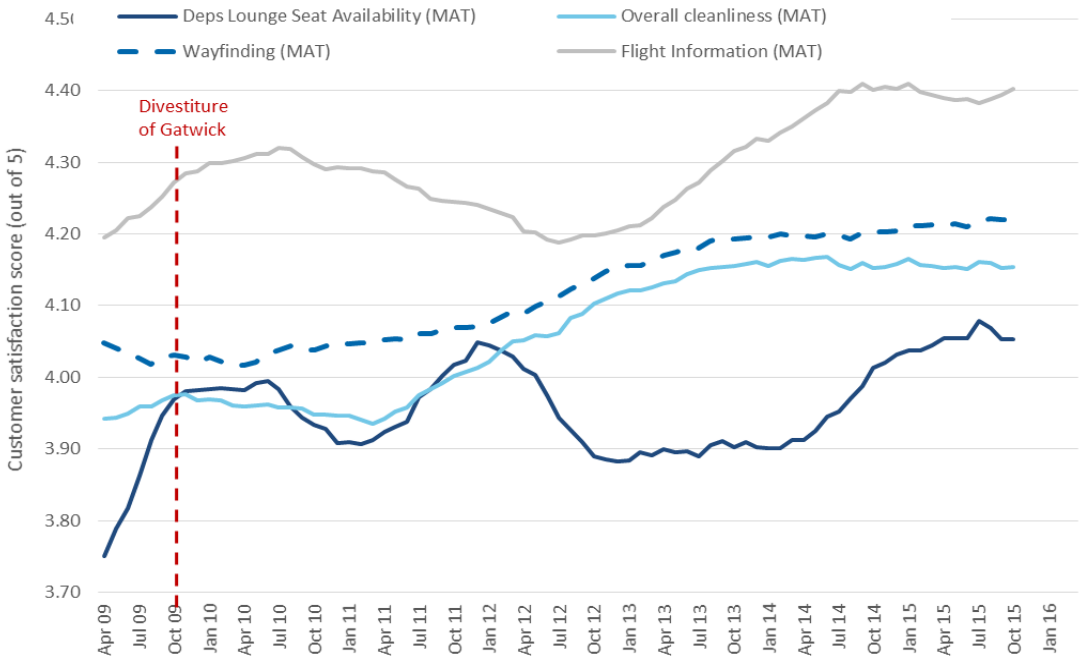
The data from Gatwick show a mixed picture since divestment. At its North Terminal, performance with respect to wayfinding, lounge seat availability, wayfinding and flight information has fluctuated over the period, although notably ratings of flight information have improved from mid-2013 onward. At its South Terminal, wayfinding and overall cleanliness have increased since divestment in 2009. More recently, lounge seat availability and flight information have also improved considerably.

Figure 3.22 Service Quality Rebate at Gatwick Airport, North Terminal Q2 2009 to Q1 2016



Source: Gatwick Airport

Figure 3.23 Service Quality Rebate at Gatwick Airport, South Terminal Q2 2009 to Q1 2016



Source: Gatwick Airport

Qualitative evidence of innovation and service quality improvements

Improvements in terms of service quality are linked to airports' efforts to attract airlines to use their airports.

Although airports' negotiations with airlines often focus on price, one stakeholder reported observing that airport negotiations increasingly include other elements (sometimes linked to price) that seek to reflect incentives to increase service quality. This is in airports' interests to the extent that it demonstrates a commitment to service quality to airlines. Airports also have operational reasons to improve some elements of service quality. For example, one airport noted that reducing waiting times at security leads to passengers having more time to spend shopping, therefore contributing to non-aeronautical revenue.

Airlines focussed on providing a premium service to their passengers reported that airport service quality is important because passengers do not differentiate clearly between quality of service provided by the airport and by the airline.

Nonetheless, airlines' strategies towards quality differ, with some 'budget' airlines focussing less on service quality and more on price. For some elements of service quality, it is difficult for airports to offer different service levels and prices to different airlines. Nevertheless, some airports offer different levels of service at different terminals or 'satellites' and then differentiate their charges to airlines using those different parts of their airports.

Together, these factors mean that service quality can form an important part of negotiations with airlines. Some airports reported negotiating joint investment with airlines in terminal facilities, such as automated check-in facilities and airline lounges. All three divested airports (and other airports in the South East of England and in Scotland) demonstrated significant investment and improvement at check-in facilities. Examples included joint investment in automated check-in facilities by Gatwick Airport and EasyJet and investment by Edinburgh Airport in automated check-in facilities that can be used for multiple airlines. Edinburgh reported that these improvements mean that more check-in facilities can be provided within a limited physical space, which improves the speed and availability of check-in services for passengers. These developments required collaboration with the relevant airlines using those facilities but, once implemented, provides benefits to airlines, the airport and passengers

One industry observer noted significant increases in investment in facilities across the divested airports and observed that this has led to improvements in passenger perception scores). More recent data would be required to test this assertion.

One airport reported that its rationale for investment in such facilities was that it considered that passengers choose to travel from that airport compared with others because of the level of service provided. It noted that its strategic priorities had evolved over time, with security and check in being prioritised first after its purchase of the airport, followed by improving airline relations and operational improvements.

All divested airports reported investments made in order to expand retail space, with each attributing this investment to a focus on increasing both aeronautical and non-aeronautical revenues. Each reported that this aligned with passengers' interests by providing them with more choice in terms of retail opportunities in the terminal. One airport reported working with airlines to increase the amount of hand baggage allowed on board. This removed a restriction on passengers and also provided a greater opportunity for non-aeronautical revenues at the airport. It was noted by the same airport that, when first introduced, this policy was quickly adopted across many other UK airports.

Divested airports also reported working with other parties to improve the service offered to customers at points in a passenger's journey that are not within the direct control of airports. One airport reported working with airlines to encourage baggage handlers to improve the reliability and timeliness of baggage delivery for arriving passengers. This included adopting commercial incentives to ensure on-time delivery.

Gatwick Airport reported voluntarily contributing to investment in its rail station in order to improve surface transport access to Gatwick. It considered that, under BAA ownership, such an investment would not have been prioritised as it may have risked encouraging passenger switching from Heathrow.

Conclusions

There is considerable qualitative evidence that service quality has improved at Edinburgh, Stansted and Gatwick since they were divested by BAA.

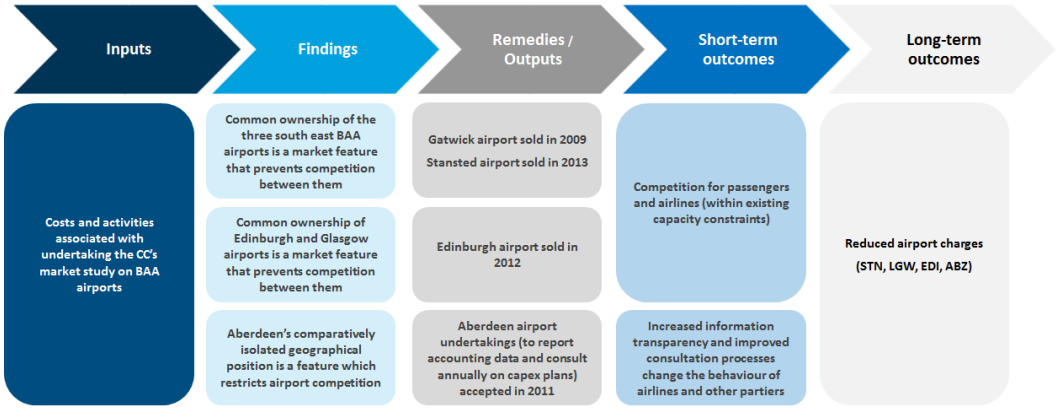
This qualitative evidence is generally supported by service quality data made available by the divested airports. Some indicators of service quality have shown temporary declines. Investments made at terminals may have had a significant temporary detrimental effect on passenger satisfaction, due to disruption caused by the changes. Improvements might therefore be expected to materialise as these investments bed in. Trends also vary across different measures of service quality. But in general, service quality appears to have been maintained or improved across divested airports.

Quantitative evidence has not revealed any statistically significant improvements in service quality following the CC's divestment remedies, but this may change as more data become available given lead times associated with investment in service quality improvements and any lag in the measurement of passengers' perception of service quality.

3.5 Airport charges

This section examines evidence on the hypothesis that the divestiture of Gatwick, Stansted and Edinburgh has led to lower airport charges than otherwise would have been the case (Figure 3.24).

Figure 3.24 Summary of hypothesis: lower airport charges as a result of the divestiture of Gatwick, Stansted and Edinburgh airports



Increased competitive rivalry between airports would lead them to compete harder for airlines' business. This may occur through changes in the overall yield (per passenger)[105], or changes to the terms that they are willing to accept in any such contracts with airlines, such as the length of contract.

Several studies have found that in some conditions competition can lead to lower airport charges. Van Dender (2007) assessed the US market and found that airports facing regional competition charge lower aeronautical fees[106]. It also found that revenues from aeronautical activities are lower when there is competition between airports in the same geographical or catchment area. Similarly, a study by Brueckner et al. provided specific evidence that multiple airport competition in a metropolitan area can have significant spill-over effects in the form of reduced airfares[107].

IATA evidence suggests the airlines' buying power often is insufficient to affect airport pricing decisions[108]. IATA evidence suggests that other macro factors can dominate (such as lower demand in an economic downturn)[109]. It showed that while half of EU airports did lower their charges in 2009, only 17 per cent of airports did so in 2010. In contrast, 31 per cent of airports increased their charges in 2009 and 36 per cent did so in 2010 even though the Euro crisis was impacting the EU[110].

Analysis of airport charges should account for the way that airports compete for airlines' business. For example, airports may wish to differentiate the level of service (and consequently the airport charges) offered to different airlines. This may be one response to increased competition for the varying demands of different airlines. Airports' overall strategies on passenger throughput may also influence the extent to which rivalry between airports

[105] The passenger yield is computed by dividing passenger revenue by revenue passenger miles. It is a measure of the average fare paid per mile.

[106] Van Dender, K., Determinants of fares and operating revenues at US airports, 2007, Journal of Urban Economics, 62 (2), 317-336

[107] Brueckner, J, Lee, D, and Singer, E., City-pairs versus airport-pairs: a market-definition methodology for the Airline industry, 2014, Review of Industrial Organization, Volume 44, Issue 1, p.1

[108] IATA. 2013. Airport Competition

[109] Ibid.

[110] Ibid.

manifests itself in increased price competition or has an effect on airport charges. These factors may mean that increasing rivalry between airports may not be accompanied by lower yields on airport charges.

These factors interact with the effect of capacity constraints on airports' incentives to compete (described above). Airports operating at or close to capacity may have less incentive to lower charges. Indeed, in these circumstances an airport may shift strategy to attract full-service airlines that are willing to pay higher charges.

These considerations complicate comparisons of airport charges over time, as changes in outside factors such as these cannot be controlled for given that they cannot be observed.

This study found no empirical evidence as to whether higher airport charges resulting from airport capacity expansion are passed through by the airlines to the passengers by charging higher air fares or whether they are absorbed by the airlines through a reduction in scarcity rent. Different viewpoints exist concerning how airlines react to increases in aero-charges and how this affects consumers, including[111]:

- Higher charges can lead to a fall in scarcity rents and airline margins.
- Because of low margins, airlines are unlikely to absorb cost increases and pass on costs to passengers (especially on short haul routes).
- A more nuanced view: whether charges increases affect airline pricing and frequency behaviour depends on whether airlines' marginal costs increase as a result.

3.5.1 Evidence on the effect of the CC's remedies

To examine the effect of the CC's remedies on airports' aeronautical charges, this study examined the following evidence:

- Total aeronautical revenue. This indicator seeks to capture the overall effect of charges on aeronautical revenue. However, it does not take into account changes in passenger numbers, which have increased significantly at divested airports, as outlined above.
- Aeronautical yields per passenger. This indicator seeks to capture the revenue per passenger generated by aeronautical charges. As this indicator is based on declared revenues, this reflects actual aeronautical revenue earned, rather than published prices. It is therefore more representative of charges paid by airlines.

Nonetheless, this indicator may still be influenced by airports' changes in strategies in terms of the priority given to maximising aeronautical revenue per customer.

- Qualitative evidence of changes in airport charges from stakeholders.
- Econometric analysis of available data on aeronautical yields.

The following indicators were also investigated, but could not be analysed for the reasons set out below.

- Published aeronautical charges. Published aeronautical charges were reported by all airports not to be representative of charges that are paid by the majority of airlines using each airport. This is because most airlines pay charges that are negotiated on a bespoke basis. Furthermore, as described above, the actual fees paid often vary according to airports' performance, and sometimes airlines' performance, in meeting service quality targets.

Total aeronautical yields

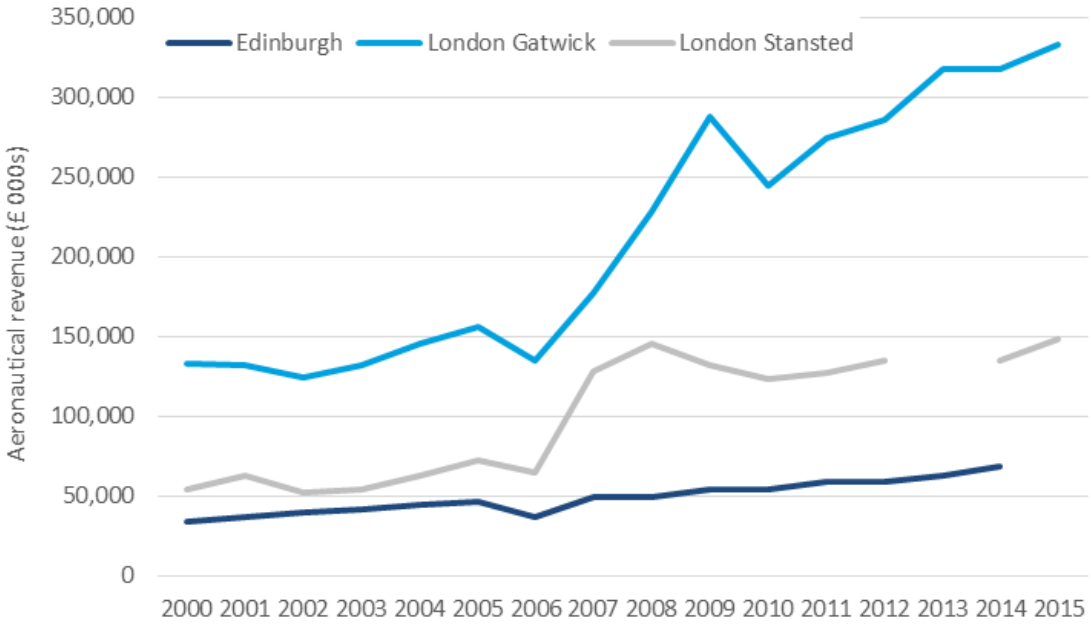
This study examined aeronautical revenues across the three divested airports: Gatwick, Stansted and Edinburgh. Available data spans only the period 2000 to 2013. This limits insight

[111] SEO economic research. 2015. Scarcity rents and airport charges

into the development of aeronautical revenue since divestment of each of the former BAA airports, particularly for Edinburgh. Nonetheless, the following observations can be made:

- divestment at Gatwick and Edinburgh was not followed by any discernible change to the general trend in total aeronautical yields and aeronautical yield per passenger; and
- insufficient data are available to assess changes in total aeronautical revenue following Stansted's divestment.

Figure 3.25 Aeronautical revenue for Gatwick, Stansted and Edinburgh, 2000-2015



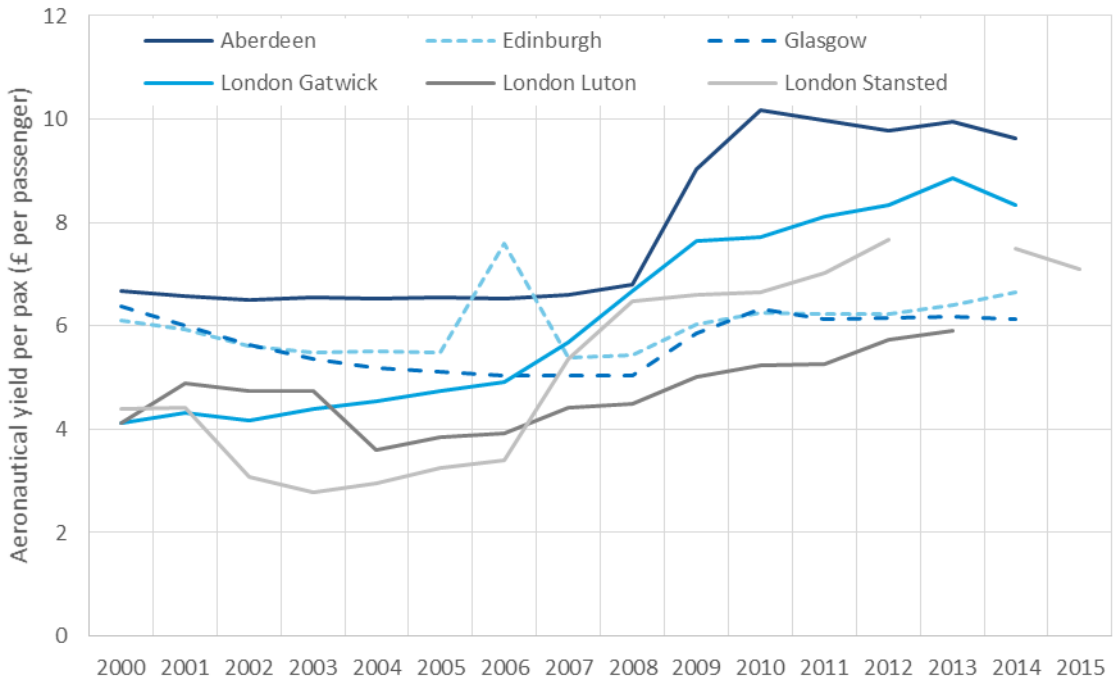
Source: Leigh Fisher analysis, airport annual reports[112]

Aeronautical yields per passenger

This measure of aeronautical revenue allows direct comparison between airports on a like-for-like basis (Figure 3.26). Since 2003, aeronautical revenue per passenger has generally increased across all key airports in the South East of England and in Scotland (Gatwick, Stansted, Heathrow, Luton, Edinburgh, Glasgow and Aberdeen). However, aeronautical yield per passenger has fallen at Aberdeen and Gatwick (in 2014). Any effect of BAA's divestments should be considered in this context.

[112] Data for Stansted is not available for 2013 (no annual report reported on Company House)

Figure 3.26 Comparisons of yields per passenger across key airports in the South East of England and in Scotland, 2000-2015



Source: Leigh Fisher analysis, airports' Annual Reports[113]

Qualitative evidence on charges in airport charges

The data above do not allow like-for-like comparison of charges paid by airlines for each type of passenger, as totals are influenced by changes in the passenger mix flying from each airport.

However, two airlines did report that Stansted lowered its price level following BAA's divestment of the airport. It also suggested that Edinburgh has also probably lowered its price level since divestment, despite charges remaining high in comparison with other similar airports. Another competing airport presented its view that airports in the South East of England (not just divested airports) had probably been forced to lower their charges as a result of BAA's divestments. The airline and airport discussed here both noted the effect of BAA's divestments was extremely challenging to distinguish from wider factors driving these market developments.

Econometric analysis of indicators

Econometric analysis was undertaken to identify observable impacts of the divestment of LGW, STN and EDI on airport charges. Airport charges have been measured in terms of annual aeronautical revenues per ATM and per passenger for each airport[114]. Comparisons were made between 20 UK airports with sufficient data on aeronautical revenues in the Leigh Fisher database, including the three 'treatment' airports. Where data were available, the

[113] The Leigh Fisher database only goes up to 2013. The data for 2014 and 2015 was collected from the airport annual reports. Data for Stansted is not available for 2013 (no annual report reported on Company House). In addition, in 2013, MAG changed their reporting period to 15 months therefore, no comparison can be made for Stansted from 2014 onwards (PAX data is based on a 12 months period). In addition, no annual report was reported on Company House for Luton.

[114] The analysis was based on data produced by Leigh Fisher on various annual revenue and cost indicators for UK airports. It focused on the period between 2000 and 2014.

analysis compared airport charges before and after each divestment (considering the divested airports as a whole, rather than individually).

The analysis suggests that average airport charges (per ATM and per passenger) remained relatively stable across UK airports between 2000 and 2013, although there have been some significant changes for individual airports. Annual aeronautical revenues typically range between £3 and £10 per passenger and between £100 and £600 per ATM (although LGW and STN are amongst a small number of UK airports with annual aeronautical revenues of around £1,000 per ATM, based on 2012).

Average revenues at Gatwick have increased consistently over time and have roughly doubled from around £4 per passenger and £500 per ATM in 2000 to around £8 per passenger and £1,200 per ATM in 2013. Average revenues have also increased significantly at STN, particularly between 2006 and 2008. Average revenues at Stansted have increased from around £4 per passenger and £300 per ATM in 2000 to approximately £7.50 per passenger and £1,000 per ATM in 2012. The corresponding data for Edinburgh shows smaller changes over time with average revenues per ATM increasing from around £400 in 2000 to £600 in 2013, while average revenues per passenger have remained stable at around £6-7 per passenger between 2000 and 2013.

The analysis does not provide significant evidence of a positive effect on airport charges resulting from the divestments. Average revenues per ATM and per passenger had increased for LGW and Stansted before the divestments, and continued to increase at a similar rate after the sale of LGW (while post-sale data are not available for Stansted). At Edinburgh, average revenues had remained relatively stable, both before and after the divestment in 2012.

Various analyses were undertaken to remove different effects and outlier airports. However, there were still significant fluctuations in the data over time, particularly for LGW, STN and many of the control airports. These very different trends, combined with the lack of post-sale data for STN and having only one period of post-sale data point for EDI, made if unfeasible to undertake a comparison via regression to assess the impacts on airport charges.

Conclusions

Since 2006 total aeronautical revenue has increased at each of Stansted, Gatwick and Edinburgh (although Edinburgh more slowly). At Stansted and Edinburgh airports growth in aeronautical yield per passenger has slowed compared with growth to 2008 and 2009 respectively. Little qualitative evidence was submitted to this study on the level of charges, although one airport in the South East (not a divested airport) did report that greater competition had forced it to lower its charges. Nonetheless, this should be considered in conjunction with significant evidence of divested airports and Heathrow innovating in terms of charging structure to create signals that encourage airlines' to use airports' capacity more efficiently (see Section 3.1.2 and Heathrow case study on page in Section 4.2.1).

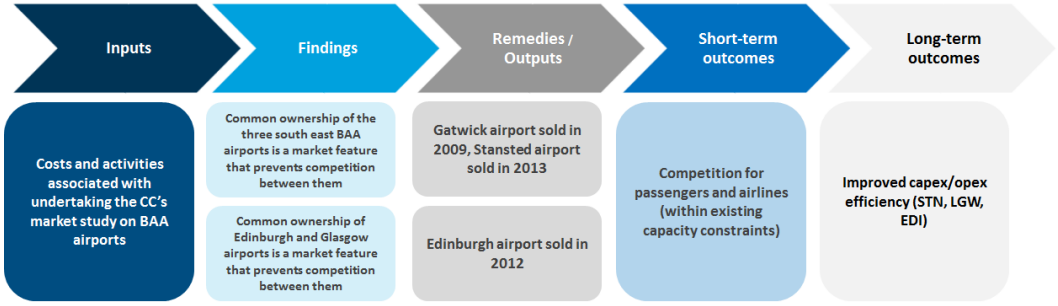
A slowing of growth in aeronautical yield per passenger has been observed for Stansted Airport and Edinburgh Airport. However, it was not possible to identify a statistically significant difference in this trend since divestment at each airport.

Outside factors exert a major influence on measures of airport charges that were examined in this study, in particular the influence of price controls and unobservable factors such as airports strategies in terms of which routes, airlines and passengers they try to attract. This makes quantitative analysis of airport charges extremely challenging.

3.6 Airports' efficiency

This section examines evidence on the hypothesis that divestiture of Gatwick, Stansted and Edinburgh has led to improved efficiency at those airports.

Figure 3.27 Summary of hypothesis on airport efficiency at Gatwick, Stansted and Edinburgh



Increased competitive rivalry between airports should give them appropriate incentives to optimise their capital and operating expenditure, so as to make any such expenditure more efficient, resulting in improved efficiency (by measures including capex or opex per passenger).

In the literature there appears not to be consensus on the impact of competition on airport efficiency. Scotti et al. (2010) used a multi-output stochastic frontier analysis and found that the intensity of competition has a negative impact on airports' efficiency from 2005 to 2008[115]. This study found that airports with higher levels of competition often have surplus capacity and therefore have lower levels of technical efficiency. D'Alfonso et al. assessed the impact of competition on airport efficiency with specific reference to Italian Airports[116]. They found that after a certain threshold the impact of competition on efficiency becomes negative which means that an excessive level of competition can have a negative effect on efficiency.

Many empirical studies also have shown that competition improves airport productivity and efficiency. For instance, Merkert & Mangia (2014) empirically estimated the effect of competition on the cost efficiency of 35 Italian and 46 Norwegian airports[117]. For both countries, they show a significant and positive impact of competition on the airports' efficiency. However, they were unable to quantify the extent to which this competition is specifically attributable to other airports. Chi-Lok & Zhang (2009) estimated the effects of competition on airport productivity for a sample of 25 Chinese airports[118]. They were able to show that airports with more competition are more efficient than their counterparts.

Other factors also need to be considered alongside analysis of measures of operational efficiency:

- Airports' investment is generally 'lumpy', meaning that large capital investments are needed, for example for new, refurbished or reconfigured terminals. These large capital expenditures may have significant impacts on capital-expenditure measures of efficiency. Similarly, operational expenditure associated with any such large investments can significantly influence operational expenditure indicators. For example, if increased operational expenditure is temporarily required to deal with disruption associated with building, renovation or reconfiguration work.

[115] Scotti et al. 2010. The impact of airport competition on technical efficiency: A Stochastic Frontier Analysis applied to Italian airports

[116] D'Alfonso et al. 2013. Assessing the Impact of Competition on the Efficiency of Italian Airports

[117] Merket, R, and Mangia, L., Efficiency of Italian and Norwegian airports: A matter of management or of the level of competition in remote regions?, 2014, Transportation Research Part A 62, p. 30

[118] Chi-Lok, A, and Zhang, A., Effects of competition and policy changes on Chinese airport productivity: an empirical investigation, 2009, Journal of Air Transport Management, p. 166-174

- Airport strategy for the quality of services. Airports targeting business passengers are likely to spend larger amounts (capex and opex) than airports targeting 'budget' leisure travellers. Airports' strategies are likely to change slowly over time, nonetheless, such changes could be responsible for significant changes to operational and capital expenditure measures independently of the efficiency of an airport.
- Regulations can also significantly affect expenditure. For example, security measures required by the CAA could have a significant impact on operational expenditure at security. Several airports reported that security represents a major share of their operational staff and therefore operational expenditure. This is an example of an outside fact that could affect efficiency comparisons using operational expenditure and staffing measures.

3.6.1 Evidence on the effect of the CC's remedies

To examine the effect of the CC's remedies on airports efficiency, this study examined the following evidence:

- operational expenditure per passenger. This is an indication of how much each passenger is costing the airport in terms of operational expenditure;
- capital expenditure per passenger, which can indicate overall trends in capital expenditure allowing for changes in the number of passengers being served;
- staff per passenger; which can indicate how efficiently an airport is operating, taking into account the number of passengers being served;
- qualitative evidence of operational changes that airports have implemented since divestment; and
- econometric analysis of available data on expenditure measures.

Operational expenditure

Operational expenditure per passenger is a key measure of the total operational cost of each airport in relation to passengers. If divestment has led to improvements in the efficiency with which those airports are operating, this could be reflected in lower operational expenditure per passenger. The CAA noted a significant increase in opex per passenger at Gatwick and Stansted airports in 2009, with a significant fall in 2010. The increases were caused by the costs incurred to prepare the airports for sale in 2009 and were considered as exceptional[119].

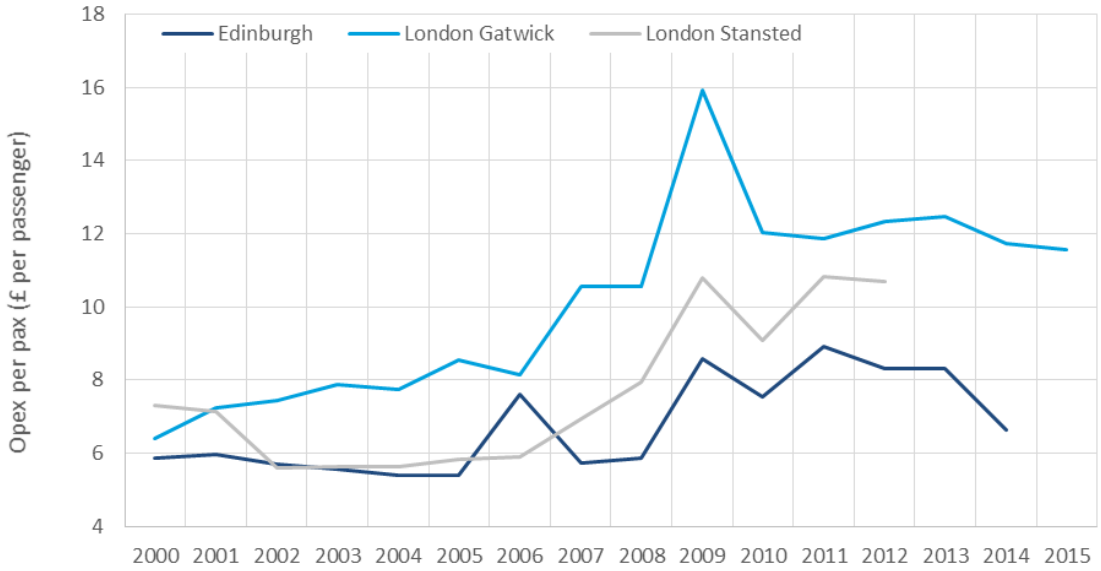
At Gatwick, operational expenditure per passenger was markedly lower in 2010 and following years compared with 2009, when it was sold by BAA. However, 2009 represents an outlier, with operational expenditure per passenger being significantly higher than in previous years.

Poor data availability from 2013 onward for Edinburgh restricts comparison before and after divestment. At Gatwick and Stansted, available data appear to indicate that operational expenditure per passenger have exhibited small falls since 2013. The temporary rise in 2009 may be due to National Air Traffic Service (NATS) changing the way it charged for its services. Before then, NATS charged airlines directly but in 2009 it started to charge the airport which then in turn passed the cost to the airlines via airport charges. This led to a rise in costs but also an equivalent rise in aeronautical revenues.

These changes should be considered in the context of a significant increase in operational expenditure per passenger across all divested airports and other airports in the region not shown in the figure below. This increase is unexplained.

[119] CAA. 2013. Airport Operating Expenditure Benchmarking Report

Figure 3.28 Comparative analysis: annual operating expenditure per passenger for Edinburgh, Gatwick and Stansted, 2000-2015



Source: Leigh Fisher analysis, airport Annual Reports[120]

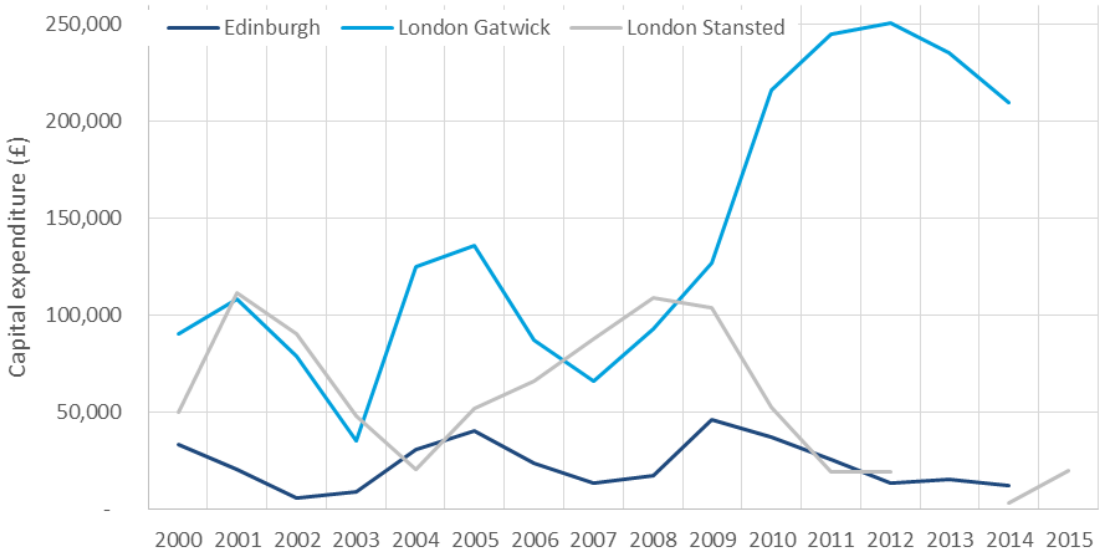
Capital expenditure

For the reasons outlined above, capital expenditure should be considered as contextual evidence relevant for considerations of airports' efficiency.

Comparison of addition to fixed assets, representing capital expenditure, indicates that Gatwick has undertaken significantly increased capital expenditure since divestment by BAA (from 2010 onward). As above, data do not cover a sufficient time period to offer meaningful comparison before and after divestment of Stansted or Edinburgh. Capital expenditure is heavily influenced by investment in new terminals or refurbishing existing terminals. This may explain Gatwick's higher rate of additions to fixed assets since it was divested by BAA in 2009 (Figure 3.29). Comparisons over time are also subject to changing accounting rules over time.

[120] The Leigh Fisher database only goes up to 2013. The data for 2014 and 2015 was collected from the airport annual reports. Data for Stansted is not available for 2013 (no annual report reported on Company House). In addition, in 2013, MAG changed their reporting period to 15 months therefore, no comparison can be made for Stansted from 2014 onwards.

Figure 3.29 Comparative analysis: annual additions to fixed assets (i.e. capital expenditure) for Edinburgh, Gatwick and Stansted, 2000-2015



Source: Leigh Fisher analysis, airport Annual Reports[121]

Passengers per staff

Airport passengers per staff can be used as another indicator of the efficiency of airport operations. At Gatwick Airport the number of passengers per staff declined after 2009, but has increased since then. (Figure 3.30). Stansted has shown a considerable decline in this measure, but began in 2008 prior to BAA's divestment of the airport in February 2013.

Data from 2014 onward are not available within this dataset. Some publicly available data has been used to augment that dataset, but making comparisons following the divestment of Edinburgh and Stansted remains difficult. More importantly, this indicator of efficiency does have drawbacks. Most notably that the number of passengers passing through an airport can be influenced significantly be wider demand and that security staff generally comprise a high proportion of airport staff, but the number of security staff required can be influenced by significant outside factors, such as security regulations.

[121] Data for Stansted is not available for 2013 (no annual report reported on Company House)

Figure 3.30 Comparative analysis: annual passengers per staff for Edinburgh, Gatwick and Stansted, 2000-2015

Source: Leigh Fisher analysis, airport Annual Reports[122]

Qualitative evidence on changes to airports' efficiency

Stakeholders reported a wide range of actions that divested airports have taken to improve their operational efficiencies since divestment from BAA.

Several examples of process improvements across the divested airports were reported. These are indicative of efforts to improve the efficiency with which these airports are operated. These cannot be specifically attributed to divestment, because it is impossible to say whether BAA would have implemented the same changes. However, many stakeholders reported views that separate ownership (as a consequence of the CC's remedies) has been a significant deriving factor behind many of the examples outlined below. Gatwick reported that experience that its new owners, GIP, brought from other sectors has contributed to significant operational improvements that it has implemented.

All divested airports reported a new focus on operational efficiency improvements, potentially to avoid capital expenditure to increase capacity. One airline supported this view by reporting a renewed focus from divested airports on operational efficiency during commercial negotiations with those airports.

At Gatwick, reported changes included changes to the layout of its terminal buildings to optimise efficiency of security (consolidating two separate areas into one), consequently avoiding, or delaying, the need to expand the terminal. It reported that these improvements have reduced bottlenecks and helped to improve passenger experience. One airline reported specifically its view that these measures to improve capacity at peak times would not have been taken under BAA ownership, which it reported was generally focussed on capital expenditure-led projects.

Gatwick also reported a new commercial focus to services outsourced to other companies. One example of this was its switch to DFS for provision of air traffic control, with the reported purpose of making further improvements to its maximum runway capacity at peak times (in terms of movements per hour). This may have contributed to the increase in passenger throughput and flights offered by Gatwick since divestment, identified above.

[122] Data for Stansted is not available for 2013 (no annual report reported on Company House)

Stansted reported as part of this study that it had observed a significant increase in the airport's cost base in the years leading up to divestment. It attributed this principally to increasing staff costs. It also reported a significant decrease in these costs since divestment, achieved with the majority support of its staff, as a result of constructive engagement with staff and their unions.

Stansted also reported achieving significant savings in operational and capital expenditure compared with BAA's expenditure plans that it had inherited following divestment[123]. For example, it reported refurbishing the carriages on its passenger transit system for less than 5% of the expenditure that BAA had planned to spend on the same programme. It also implemented significant changes to its parking pricing, to increase occupancy rates and therefore also to generate additional revenue by tying parking offerings in with other airports services (such as lounge access). It reported that this has contributed to increasing passenger numbers by making more efficient use of road as a surface transport option. It reported that increased parking occupancy represent additive passenger traffic, because the share of passengers arriving using other forms of surface transport has remained the same.

Edinburgh airport reported implementing several operational changes targeted at operational efficiencies since being divested by BAA. These include a more commercial approach to its parking services, that have significantly increased occupancy rates without increasing the average price paid by passengers for parking, implementing changes to its security processes that have led to operational improvements (after initial problems when first implemented), and implementing new IT that has drastically lowered IT costs for the airport, compared with under BAA ownership. It reported that under BAA its management would not have had the autonomy of decision making to implement many of these changes and cited this as an example of diseconomies of scale in management within BAA, as a large airport group. For those that it may have been able to implement, it reported that it would have not been able to act so quickly. One airline supported this view by reporting that under new ownership Edinburgh has become a more efficiently operated airport.

Econometric analysis of indicators

Econometric analysis was also undertaken aiming to identify observable impacts of the sale of LGW, STN and EDI on airports' efficiency. Airports' efficiency was represented by two indicators: passenger numbers per ATM; and ratios of passengers to staff numbers[124] [125]. Comparisons were made between LGW, STN, EDI and 21 other UK airports for which sufficient data was available (including number of staff). As before, where data were available, the analysis also took account of the timing of the three divestments to compare airports' efficiency before and after each divestment (as before, the three airports are considered as a whole, rather than individually).

The analysis suggests that the efficiency of UK airports has been increasing since 1998. For example, the number of passengers per ATM has been increasing across UK airports over this period. This has also been the case for each of the three BAA airports. At LGW, the number of passengers per ATM has increased from around 120 in 1998 to approximately 160 in 2015. A similar growth rate is evident for EDI, albeit with smaller numbers of passengers per ATM of approximately 70 in 1998 and almost 120 in 2015. However, the largest growth has been experienced at STN, where passenger numbers per ATM have increased from

[123] This is not reflected above, however this may be for the reasons also outlined above. This illustrates the potential difficulties of using capital expenditure as an indicator.

[124] The analysis was based on monthly ATM and passenger numbers at UK airports from the CAA for the period between January 1998 and October 2015, and annual data produced by Leigh Fisher on numbers of passengers and airport employees (i.e. FTEs averaged across the full year, including direct employees of airports only and therefore excluding sub-contractors) for UK airports for the period from 2000 to 2013.

[125] The analysis had also intended to include a third indicator based on operating expenditures per passenger but this was not possible due to a lack of post-divestment data points in the Leigh Fisher dataset.

around 75 in 1998 to almost 160 in 2015. This was due to particularly strong growth in passengers per ATM between 1999 and 2005.

The number of passengers per airport employee has also been increasing over the period between 2000 and 2013. The data suggest that the number of passengers per airport employee has increased at EDI from around 15,000 in 2000 to almost 20,000 in 2013. However, the ratios have shown contrasting trends at LGW and STN over this period, with both airports experiencing decreases from around 19,000 passengers per airport employee in 2000 to approximately 15,000 in 2012 and 2013.

When taking account of the timing of the divestments, the data suggest a positive effect on airports' efficiency as passenger numbers per ATM continued to increase at all three BAA airports following the divestments. The econometric analysis also suggests that the rate of growth increased following the divestments at LGW and EDI. There is also evidence of a possible increase in the number of passengers per airport employee following the divestments at LGW and EDI. However, these findings are inconclusive and post-sale data is not available for STN.

Comparisons with control airports were undertaken to test the significance of these potential impacts. An analysis of structural breaks in the time series data concluded that there were significant changes in the number of passengers per ATM following the divestments of the three BAA airports, relative to the control group. However, this was in contrast to the core regression analysis, which found there was insufficient econometric evidence to support the claim that the divestments had a (positive) effect on the number of passengers per ATM at the divested airports, relative to the control group. The results of the regression analysis were also inconclusive in terms of the number of passengers per airport employee, which was due, in part, to the lack of post-divestment data points (i.e. no data for STN and only one data point for EDI). The analysis therefore also concludes that there is insufficient econometric evidence to support the claim that the divestments had a (positive) effect on the number of passengers per airport employee at LGW and EDI.

Conclusions

Efficiency analysis faces several challenges, not least the large impact and uneven impact of capital expenditure on measures of airports' efficiency. Each divested airport has generally increased operational expenditure above long-term levels seen prior to divestment (with exceptions in some years), but this is a trend that can be observed across all airports in the quantitative control group, so is likely a consequence of outside factors.

There is little other quantitative evidence that efficiency has improved at these airports. However, it has not been possible to specifically identify measures of efficiency that account for changes to service quality (which may have increased with increased spending) or to account for uncontrollable cost-drivers such as security regulations. It has not been possible to identify any econometrically significant effect of the divestment on these efficiency indicators, perhaps due to these outside factors.

Nonetheless, there is significant qualitative evidence of new owners at each of the former BAA airports have implemented operational improvements that have contributed to those airports becoming more efficient. These includes improvements across many operational area, such as check in, security, (pre-flight) baggage systems and cooperation with airlines and with other airport service providers, such has baggage handlers. These improvements may deliver improved efficiency through lower cost, or a better trade-off between quality and cost.

4 Impact of the CC's other remedies

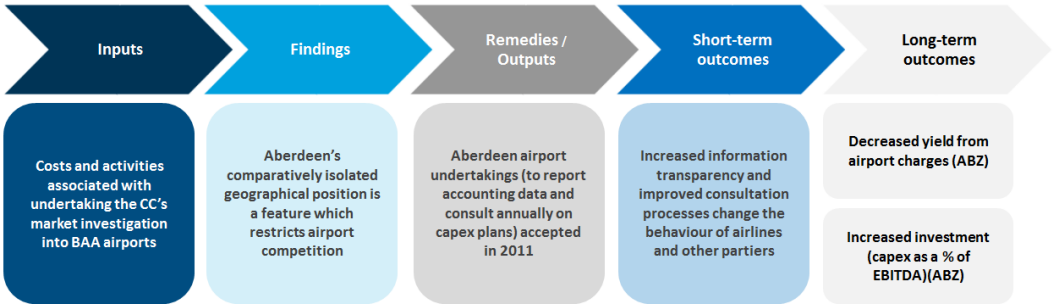
This section describes the evaluation study's findings in relation to the other remedies proposed by the CC. This includes the Aberdeen Airport undertakings and the CC's proposals with respect to aspects of Government policy and planning and the system of economic regulation for airports.

4.1 Impact of Aberdeen Airport's undertakings

This section examines evidence on the hypothesis that undertakings required by the CC at Aberdeen Airport has led to benefits in airport charges and increased capex investment (Figure 4.1).

The CC required Aberdeen Airport to publish audited accounts and segmental analysis[126] to aid transparency of airline negotiations and avoid cross-subsidies between fixed-wing aircraft and helicopters. The CC also required Aberdeen Airport to consult at least annually on capital expenditure plans, with the aim of encouraging investment.

Figure 4.1 Impact on yield from airport charges and investment as a result of Aberdeen Airport undertakings



Aberdeen Airports' undertakings were intended to address Aberdeen's relatively high charges, to incentivise appropriate investment and to be less onerous than a full price cap based on its regulatory asset base (RAB). The CC's intention, as set out in its market investigation report, was *"to reduce charges to a more comparable level with other airports while providing incentives for new investment".* This analysis tested whether investment increased following implementation of these remedies and whether airport charges decreased.

The CC concluded that Aberdeen's geographical location gave it the characteristics of a local monopoly, which led to an adverse effect on competition, resulting from its local market power. Lessening the adverse effect on competition would therefore have the effect of reducing overall airport charges. A consequence of lessening overall airport charges is that the overall yield on airport charges would also decrease. Transparency remedies were intended to have the effect of lessening the adverse effect on competition and therefore leading to higher investment since the remedies were implemented. The CC identified that the adverse effect on competition was leading to significant adverse effects on the level of investment at Aberdeen.

4.1.1 Evidence on the effect of the CC's remedies

To examine the effect of the CC's remedies on Aberdeen Airport, this study examined the following evidence.

[126] This included segmental analysis of the value of tangible assets on a depreciated replacement cost basis split by major categories of aeronautical and non-aeronautical assets; segmental analysis of revenue, operating costs and profits for major categories of aeronautical and non-aeronautical services; depreciated replacement cost return on capital employed; and average annual yield for fixed-wing aircraft and rotary aircraft and average yield per airline.

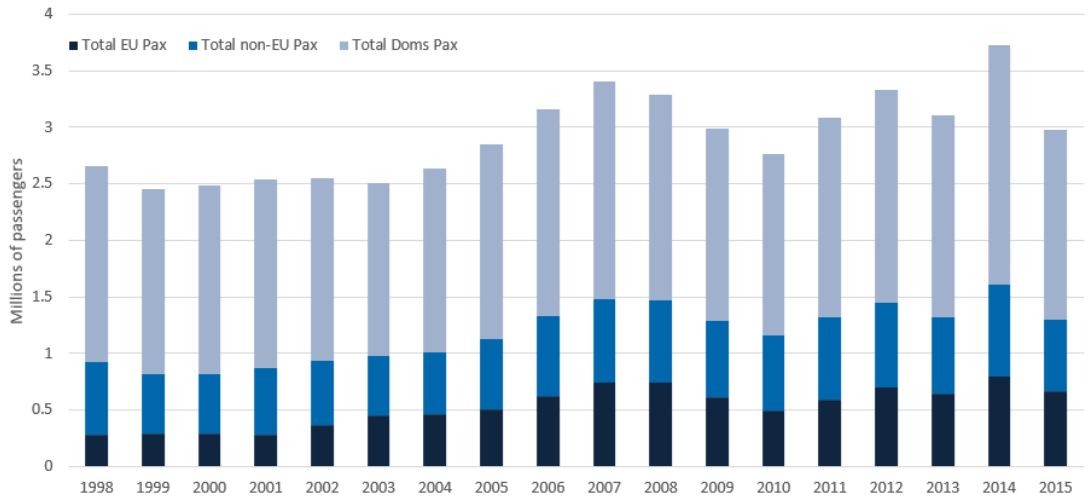
- passenger numbers; as contextual information for other indicators;
- aeronautical revenue and yield per passenger, as an indicator of the level of aero charges;
- capital investment (increases in fixed assets) and operational expenditure and staff expenditure, as an indicator of overall efficiency of the airport; and
- qualitative evidence of Aberdeen Airport's approach and operations from stakeholders.

As with the assessment of divestment remedies, published aeronautical charges were also investigated, but similarly discarded in line with stakeholders' reports that these were not representative of charges paid by airlines.

Passenger numbers

Aberdeen Airport and other stakeholders reported that Aberdeen Airport's passenger demand is heavily linked to the strength of the oil and gas sector in Scotland. Following wider market trends, total passenger numbers at Aberdeen were increasing leading up to 2007 and fell following the financial crisis. This fall was reversed in 2011, but has fluctuated since then, with 2015 showing a significant decline on 2014 (Figure 4.2). Reflecting stakeholders' comments on the source of passenger demand at Aberdeen Airport, this may reflect the recent decline in the oil and gas sector.

Figure 4.2 Pax at Aberdeen Airport, 1998-2015 (in million)

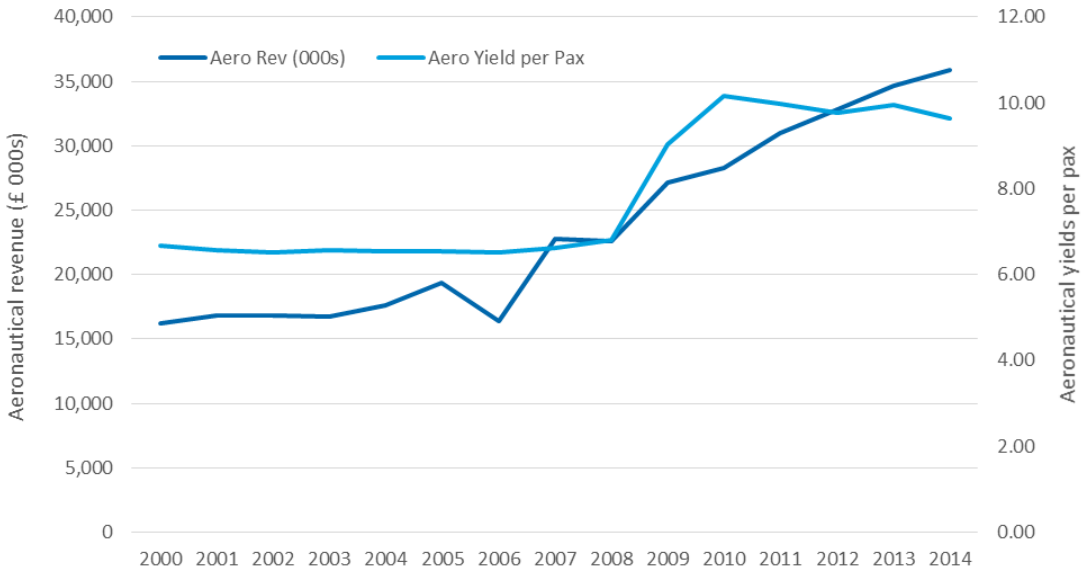


Source: CAA data

Aeronautical revenue and yield per passenger

Total aeronautical revenue at Aberdeen Airport generally increased over the period for which data are available, from 2000 to 2013 (Figure 4.3). While yield per passenger remained roughly constant from 2000 to 2008, this was followed by a significant increase in 2009 and 2010. The reason is mainly due to the change in National Air Traffic Service (NATS) charging policy; the costs were transferred from the airline to the airport and so were the revenues. Aberdeen's undertakings were applied in April 2010 and in each of the following four years, aero yield per passenger was lower than in 2010.

Figure 4.3 Aeronautical yield and revenue per passenger at Aberdeen airport, 2000-2014

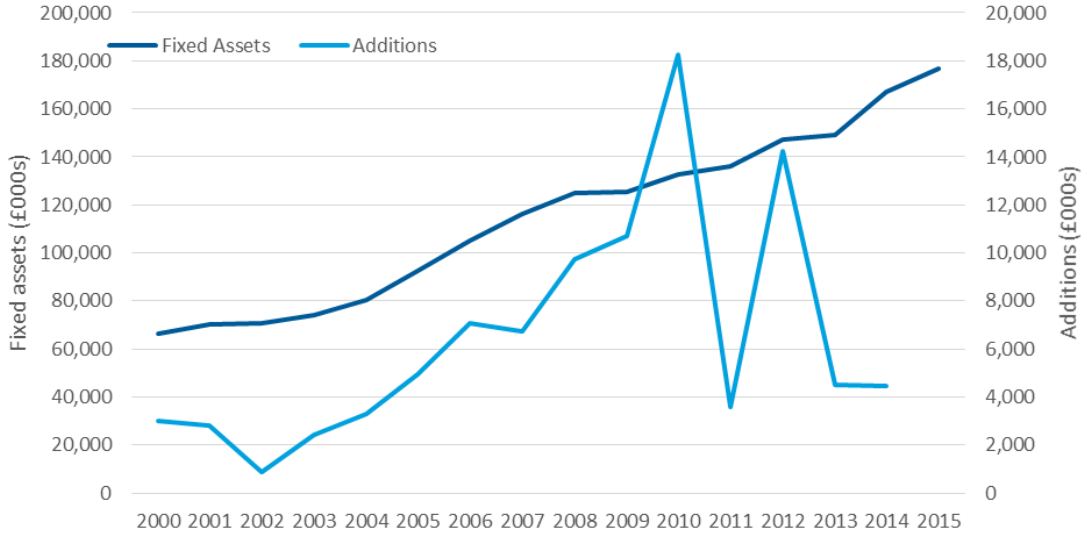


Source: Leigh Fisher analysis

Investment (capital expenditure) and efficiency measures

Once the impact of revaluations and depreciation are taken into account alongside any additions to fixed assets, increases in fixed assets (capital expenditure) appears to have continued to increase at roughly the same rate over time. There is no clear change in the rate of capital expenditure after it implemented undertakings required by the CC.

Figure 4.4 Fixed assets and rate of additions to fixed assets at Aberdeen airport, 2000-2015[127]



Source: Leigh Fisher analysis

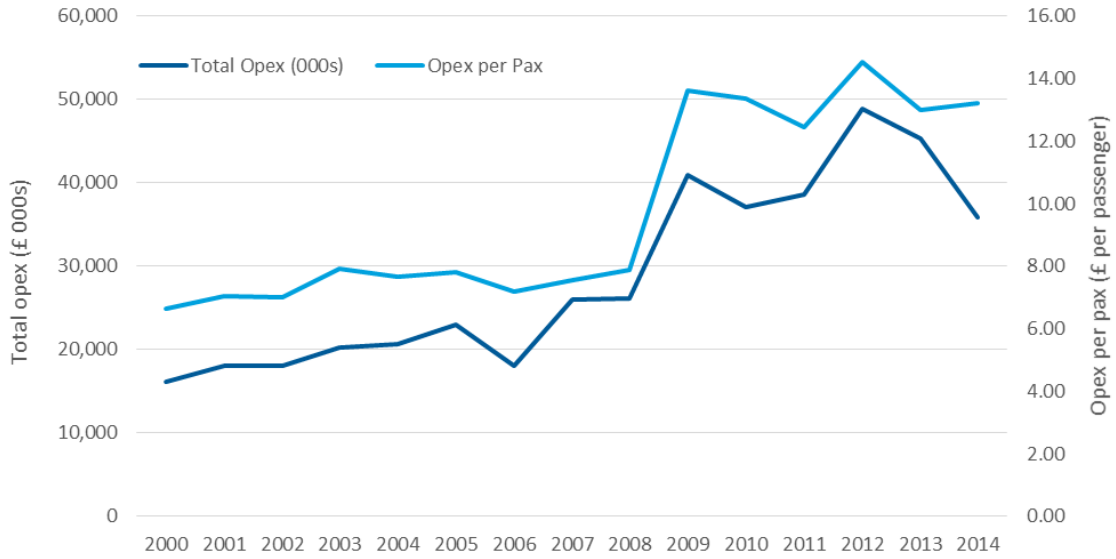
Operational expenditure and staff expenditure

Total operating expenditure and operating expenditure per passenger grew slowly from 2000 to 2008, but then increased sharply into 2009. Since 2010, when Aberdeen's undertakings

[127] "Tangible fixed assets" are used as the measure of fixed assets.

were implemented, both measures have fluctuated, but appear to follow a gradual upward path. This contrasts with the sharp rise immediately prior to this. As with other airports, the temporary rise in 2009 may be due to NATS changing the way it charged for its services. Before then, NATS charged airlines directly but in 2009 it started to charge the airport which then in turn passed the cost to the airlines via airport charges. This led to a rise in costs but also an equivalent rise in aeronautical revenues.

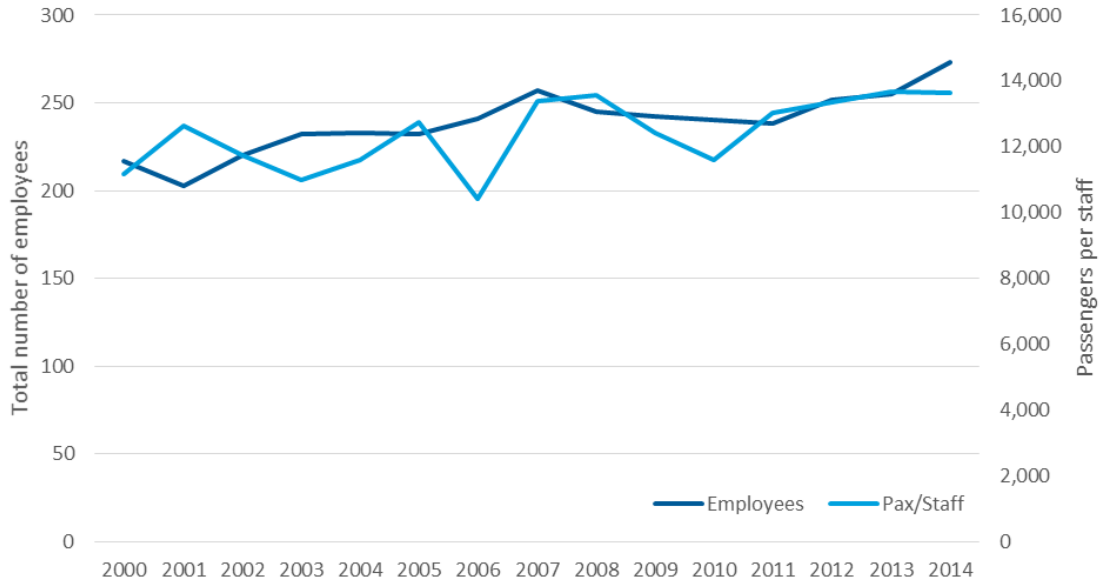
Figure 4.5 Annual operating expenditure and operating expenditure per passenger at Aberdeen Airport, 2000-2014



Source: Leigh Fisher analysis

Aberdeen Airport's total employee count and the number of passengers per employee has increased steadily over time, with some fluctuations in passengers per staff as passenger demand has risen and fallen (Figure 4.6). Little change in the long-term trend is evident since undertakings were implemented in April 2010.

Figure 4.6 Total employee and passengers per staff at Aberdeen airport, 2000-2014



Source: Leigh Fisher analysis

Qualitative evidence from stakeholders

With respect to the CMA's first remedy, to consult on its capital expenditure programme, Aberdeen Airport reported that it had only had one response to its consultation (and that was to acknowledge receipt). It reported that consequently its capital expenditure plan would have been the same without the CMA's remedy in place. It therefore sees the remedy as a burden without any positive effect, which duplicates the role of its Master Plan, which must in any case be consulted upon.

With respect to the CMA's second remedy, Aberdeen Airport reported that it had experienced little engagement from the sector with respect to its publication of audited accounts nor the separate document containing segmental analysis on a depreciated cost basis. It also reported that compiling these reports represents additional work that it would not otherwise do, as it does not operate its business based on the segmentation described in that analysis. Specifically, reporting on this basis involves reporting separate parts of the business in a way that would not be done otherwise.

Few other stakeholders participating in this study reported any views in relation to Aberdeen Airport's undertakings. One sector stakeholder reported that Aberdeen's current downturn in traffic was not a result of under-investment (which the CC had identified and targeted with its remedies), but due to the downturn in the local economy, specifically the oil and gas industry.

Conclusions

There is little evidence that Aberdeen Airport's undertakings have had any significant consumer benefit.

There is some evidence that significant increases in airport charges and operational expenditure have slowed or halted since the CC's undertakings were accepted. However, there is little qualitative or quantitative evidence linking this specifically with segmental accounting or with the requirement to consult on capital expenditure plans. This was in part because few stakeholders participating in this study commented substantively on this measure.

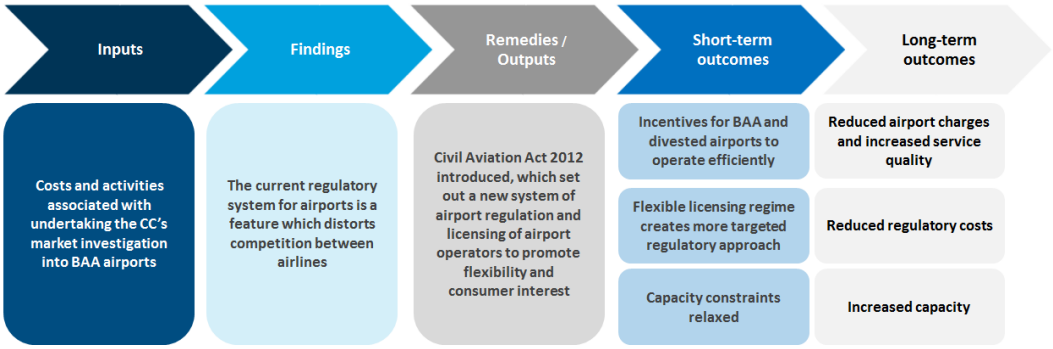
4.2 Impact of the CC's recommendations on Government policy and the economic regulation of airports

The CC's recommendations regarding Government policy related primarily to the Government's National Policy Statement on aviation. Since that time, there has been no National Policy Statement, although the Government did publish in 2013 its Aviation Policy Framework which the Government noted would "fully replace the 2003 Air Transport White Paper as government's policy on aviation, alongside any decisions government makes following the recommendations of the independent Airports Commission"[128].

The Aviation Policy Framework set out, amongst other things, the capacity challenges facing UK airports, for which the Airports Commission was established to report in 2015 on how best to meet those challenges. The Government noted that "the Aviation Policy Framework sets out the parameters within which the Airports Commission will work".[129] The Commission subsequently published its report in July 2015. The Government also noted that the Commission's final report would contain "materials to support the Government in preparing a National Policy Statement to accelerate the resolution of any future planning application(s)".[130]

This study did not evaluate the recommendations of the Airports Commission or the potential impact of future competition on the Government's decision on airport capacity expansion. To examine the effect of the CC's recommendations on Government policy and the economic regulation of airports, the study focussed on the effect of the Act on incentives for BAA and divested airports to operate efficiently and the effect on airport charges and regulatory costs.

Figure 4.7 Hypothesised impact of the CC's recommendations on Government policy and the economic regulation of airports



The CC identified that with a clear framework under which to make decisions on whether to license airports, the CAA should have the ability to target its regulatory approach on those airports where consumer outcomes are most likely to be compromised by airports' market power. The CC reported in its market investigation report that *"as a direct result of the development of competition between the south-east airports, facilitated by a more flexible regulatory regime, we anticipate that the responsiveness of the operators of Heathrow, Gatwick and Stansted to the interests of airlines and passengers will improve".* It also said stated that improved regulation could lead to more timely investment in new capacity, including runway capacity, subject to significant constraints in the South East.

[128] HM Government (2013), *Aviation Policy Framework*, Presented to Parliament by the Secretary of State for Transport by Command of Her Majesty, March, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/153776/aviation-policy-framework.pdf.

[129] *Ibid*.

[130] *Ibid*.

In a Policy Paper, the Secretary of State for Transport[131] noted that effective competition is crucial to allow growth and that competitive markets are the best way to deliver the goods and services that consumers want at minimum cost[132]. It also argued that in most sectors competition and the threat of competition law is sufficient to protect consumers from the exploitation of market power. However, it recognised that in some sectors economic regulation is needed to protect consumers and companies[133].

As a result, in November 2011, the DfT published a draft Civil Aviation Bill. The Bill included three key features[134].

- Reforming the framework for airport economic regulation.
- Modernising the CAA's governance and operations.
- Transferring certain aviation security functions from the Secretary of State to the Civil Aviation Authority. Overarching responsibility for aviation security policy would remain with the Secretary of State.

The first hypothesised outcome associated with the Act was that economic regulation would provide incentives for airports to operate efficiently, which in turn would reduce airport charges and increase service quality.

Existing literature on economic regulation presents a mixed view on the impacts of regulation of airports. Bel and Fageda (2010) and Bilotkach (2010) found that aeronautical charges do not vary markedly according to type of regulation. The imposition of economic regulation in itself is believed to create a downward pressure on charges – they suggested that all regulation overall gives the same incentives. In contrast, Barros (2008b) found that imposing regulation increased UK airport costs and decreased efficiency, suggesting that regulation may be implemented to protect the interests of consumers and not to reduce airport costs and inefficiency[135].

Dunki (2011) investigated 34 European airports between 2000 and 2009 to assess the effects of economic regulation on variable costs and variable cost efficiency.[136] Its results supported a hypothesis that regulation would increase variable costs, but did not support a hypothesis that regulated airports are less cost efficient than their unregulated counterparts. The IATA stated that "The case for independent economic regulation of European airports is clear. It improves efficiency and productivity throughout the aviation industry. It encourages timely and cost-effective new investment. It benefits all stakeholders, from the regulated airports to passengers, other users and the wider economy."[137]

The second expected short-term outcome from the Act was that a flexible licensing regime would create a more targeted regulatory approach. In the long-run, a more targeted approach to regulation by the CAA would allow it to expend costs more efficiently in the pursuit of better outcomes for consumers, thereby lowering its costs for any given outcome for consumers.

[131] Secretary of State for Transport. 2011. Draft Civil Aviation Bill: An effective regulatory framework for UK aviation, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/3309/civil-aviation-bill-vol1-policy-paper.pdf

[132] Draft Civil Aviation Bill: An effective regulatory framework for UK aviation

[133] Ibid.

[134] Draft Civil Aviation Bill: An effective regulatory framework for UK aviation

[135] Barros, C.P. 2008b. Regulation, ownership and heterogeneous technical efficiency of UK airports: 2000-06," Working paper, Technical University of Lisbon

[136] Dunki. 2011. Testing the effects of economic regulation on the cost efficiency of European airports using homogenous Stochastic Frontier Analysis

[137] IATA. N.d. Economic Regulation. https://www.iata.org/whatwedo/Documents/economics/Economic_Regulation_Summary(Europe).pdf

Barros (2008b) found that all types of regulation are expected to be associated with larger variable costs, reflecting the practical imperfections of regulatory cost efficiency incentives and possible conflicting regulatory objectives[138].

4.2.1 Evidence on the effect of the CC's recommendations

In line with the lack of specific causal logic linking the CC's recommendations to outcomes in the market, this study examined qualitative evidence to evaluate the effect of the CC's recommendations on Government policy and economic regulation. Specifically, this section supplements quantitative information set out above in relation to divested airports, so includes the following material:

- quantitative evidence in relation to Heathrow Airport regarding airport charges and passenger throughput. This evidence is examined given it is the only airport remaining fully-regulated and licensed under the new regime of economic regulation implemented in the Act. Nonetheless, this evidence is also relevant to assessment of the CC's divestment remedies, set out in Section 3. It is therefore included as a separate Section below (Section 4.3) This includes passenger numbers, revenues and yield per passenger and service quality; and
- qualitative evidence relating to stakeholders' views on the effectiveness of the new regime of economic regulation and in relation to Government policy.

Before turning to the evidence, it is noted that many wider factors need to be taken into consideration when analysing the impact of the CC's recommendations with respect to Government policy and economic regulation of airports. In particular, the Government is responsible for policy decisions on these areas, so it is not possible to specifically attribute any changes observed in the market with the CC's interventions. Nonetheless one stakeholder did report that the fundamentals of the Act came from the CC remedies recommendation for independent bodies to hold regulatory responsibilities for the sector.

Qualitative evidence

This section examines qualitative evidence on the effect of the CC's recommendations on Government policy and economic regulation.

[138] Barros, C.P. 2008b. Regulation, ownership and heterogeneous technical efficiency of UK airports: 2000-06," Working paper, Technical University of Lisbon

Structure of Heathrow's charges

There are regulatory controls on the airline charges at Heathrow, although Heathrow also reported a number of structural changes to its airline charging policy, and the use of incentives and discounts to encourage behavioural change amongst airlines. For example, Heathrow reported offering incentives to encourage:

more efficient utilisation of aircraft (which is a particularly important driver of growth at Heathrow, given the capacity constraints at the airport, and aims to restrict airlines from offering flights with low passenger numbers in order to retain slot allocations);

- reduced turnaround times for aircraft to provide efficiency gains; and
- reduced environmental impacts by incentivising the use of cleaner and quieter aircraft.

These structural changes had been implemented following consultation with the airlines, as required by the CC remedies. Other examples of charging incentives included the use of discounts for passengers transferring flights at Heathrow in order to support the airport's objective to become a major hub airport and offset the effects of the economic recession. Heathrow charging structures also provide rebates to airlines for poor service quality at the airport, such as delays for passengers queuing at security. Heathrow also reported that revenues from commercial activities such as retail, parking and property were being used to cross-subsidise these incentives and discounts for airline charges.

Stakeholders participating in this study reported generally positive views about the effect of changes to economic regulation since the CC's investigation. One sector stakeholder reported that it was a strong advocate of the flexible economic regulation framework as now applied by the CAA and that it often used the UK as a strong example for other countries to follow in discussions on regulatory change throughout Europe. One airport welcomed work to streamline the market power assessment.

One airline reported that while developments in economic regulation had been positive, it had not witnessed drastic improvements in its effectiveness. In particular, it reported that it had little buyer power at airports in the South East of England. Another airline reported that changes in economic regulation had been positive for passengers. In particular, it cited the opportunity to shorten or lengthen the price control duration and differences in the way the RAB is applied in the price control. It also supported the improved transparency of airports' investment plans, which had allowed it to contribute to the debate with respect to future investment. Nonetheless, this airline also reported the view that airports retain significant bargaining power in negotiations with airlines, so it questioned the reliance on bilateral negotiations to represent passengers' interests.

One regulatory stakeholder and an airline and one airport noted that the main regulatory change was the addition of a clear primary CAA duty to passengers. These stakeholders felt that this improved the alignment of the CAA's duties with passengers' interests. The same airline also reported a positive review about the new role of the CMA as the appeals body, as it felt this encouraged airlines and airports to negotiate constructively. Another party noted that symmetric rights of appeal created risks, as small airlines could launch appeals with little cost to the airline, but potentially significant cost to an airport.

One airline reported that the CAA's process for market power determinations at Heathrow and Gatwick had worked well and that these had confirmed the need for licence retention despite the separate ownership now in place. This airline also commented that positive features of the new regime of economic regulation included: more flexible regulation; an opportunity to shorten or lengthen the period of the price control (from the traditional 5-year window); and differences to the way the RAB is applied in the price control.

One freight carrier interviewed reported concern that the relaxation of economic regulation at Stansted could offer less protection against future price increases.

Conclusions

It is challenging to draw a direct link between the CC's recommendations and changes to Government policy and economic regulation – but it is clear that the CC influenced these changes.

Generally the changes themselves are supported by stakeholders. Particularly with respect to changes to economic regulation.

Quantitative evidence of the effect of these changes on Heathrow, (the only airport that remains fully regulated) collected in this study are inconclusive[139].

Some stakeholders did report that the changes to economic regulation had an impact on the market for airport services. Gatwick and Stansted in particular did report that partial de-regulation had been a significant facilitating factor allowing them to engage in greater commercial activities to attract airlines and passengers.

4.2.2 Costs of the CC's recommendations on Government policy and economic regulation of airports

The scope of this study focussed on the impacts of the CC's remedies on the market for airport services, rather than the implementation costs of the remedies. Previous studies have examined the regulatory and other costs of implementing the Act:

- Regulatory costs include both the direct costs to the CAA, airport operators and airlines engaging in the process and the indirect costs arising from potential distortions to price, service quality, efficiency and investment resulting from regulation[140].
- The DfT impact assessment of a package of regulatory reforms highlighted a total benefit of £194.8m. This mainly include benefits in relation to operating and capital expenditure efficiencies and a reduction in cost of capital (£174.6m) but also related to automatic references to the Competition Commission on price controls (£17.4m). These were ex ante estimates and should therefore be treated with caution in an evaluative context.

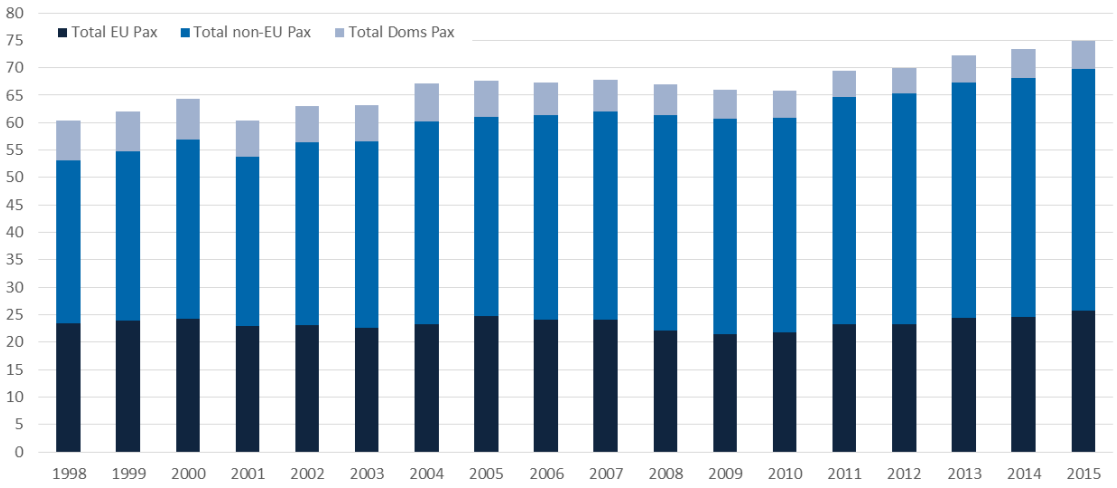
4.3 Quantitative evidence with respect to Heathrow Airport

Heathrow Airport has experienced fluctuations in the number of passengers travelling through the airport, with signs of an increase from 2010 to 2014, similarly to other London airports examined above).

[139] The DfT estimated in 2013 that reforming the framework for the economic regulation of airports would deliver gross benefits of £174m in operating and capital expenditure efficiencies and reductions in cost of capital, Department for Transport, 2013, *Reforming the framework for the economic regulation of airports, Impact Assessment*.

[140] Ashurst. 2014. How much to land? A new approach to the economic regulation of airports

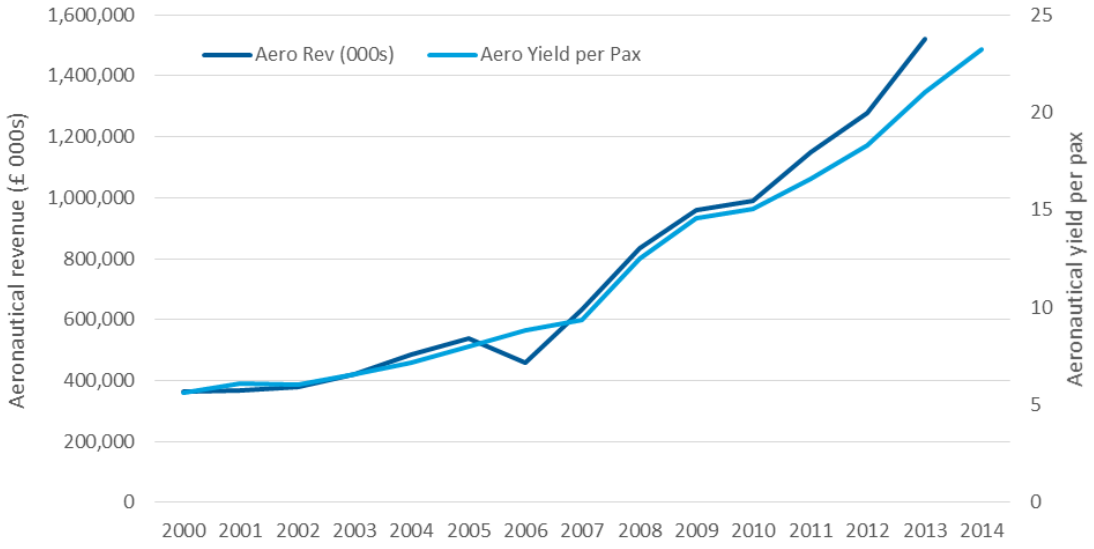
Figure 4.8 Passengers travelling through Heathrow airport, 1998-2015



Source: CAA data

Heathrow Airport is still subject to price caps set by the CAA and so earns revenues set within this price cap. Nonetheless, its total revenue and revenue per passenger have been increasing since 2000 and appearing to increase at a higher rate from around 2005-06 onward (Figure 4.9). The consistency of this trend across both aero revenue and yield per passenger indicates that while it may be attracting larger aircraft with more seats to expand revenue, revenue per passenger is also increasing. This trend may be explained by shifts in Heathrow's strategy, in particular it reported targeting more premium customers (for which it can charge a higher aero fee).

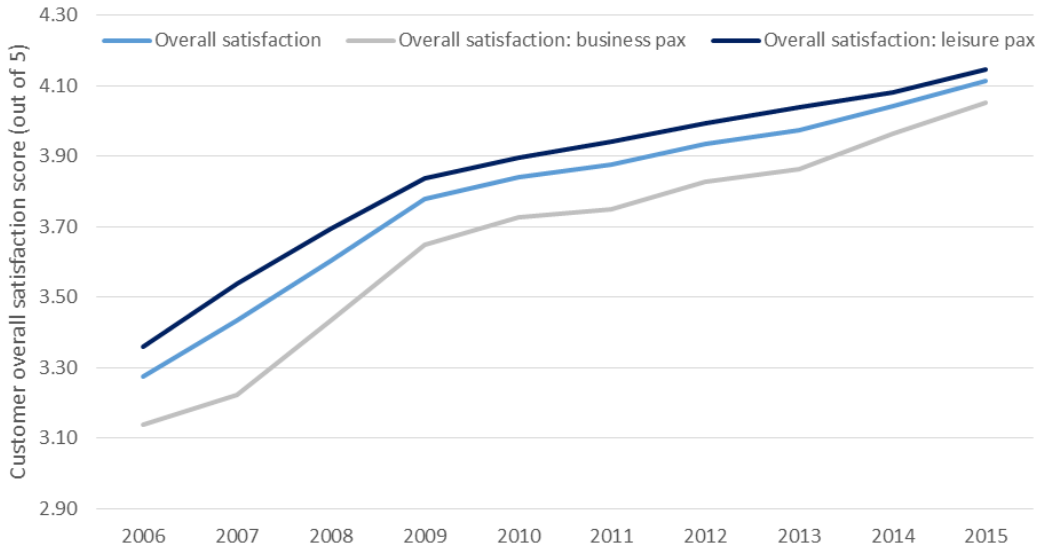
Figure 4.9 Aeronautical revenues and revenue per passenger at Heathrow airport, 2000-2014



Source: Leigh Fisher

Examining Heathrow's airport service quality measure shows increasing scores over time across almost the full range of measures that airports are responsible for (Figure 4.10). This indicates that passengers' perceptions of service quality have improved significantly since the CC's investigation, particularly given the consistency of this trend over time and across the various measures of service quality included in the data.

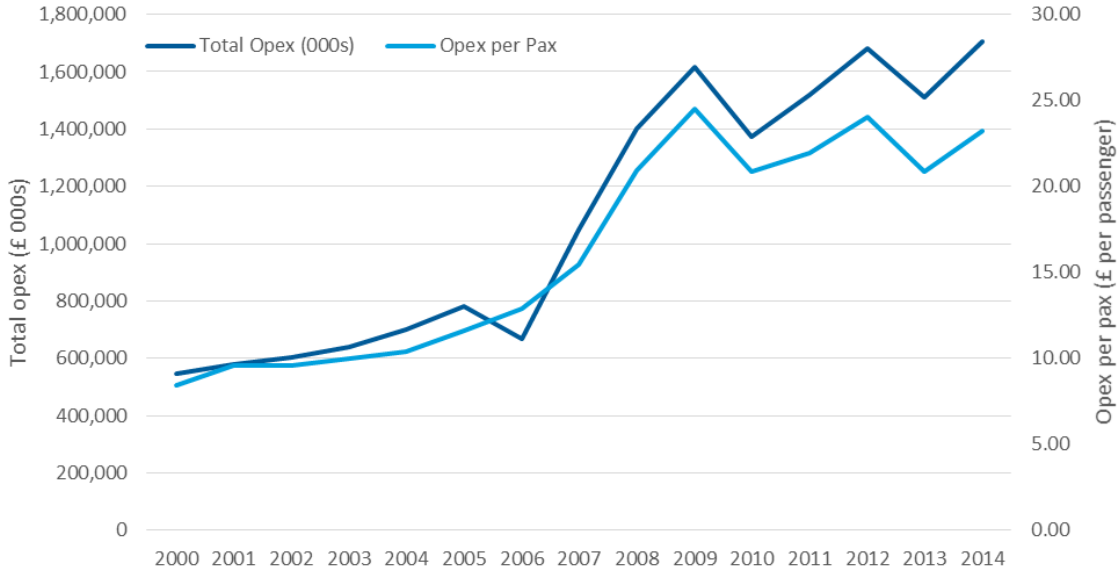
Figure 4.10 Overall satisfaction scores, London Heathrow 2006-2015



Source: Heathrow airport, ASQ ACI

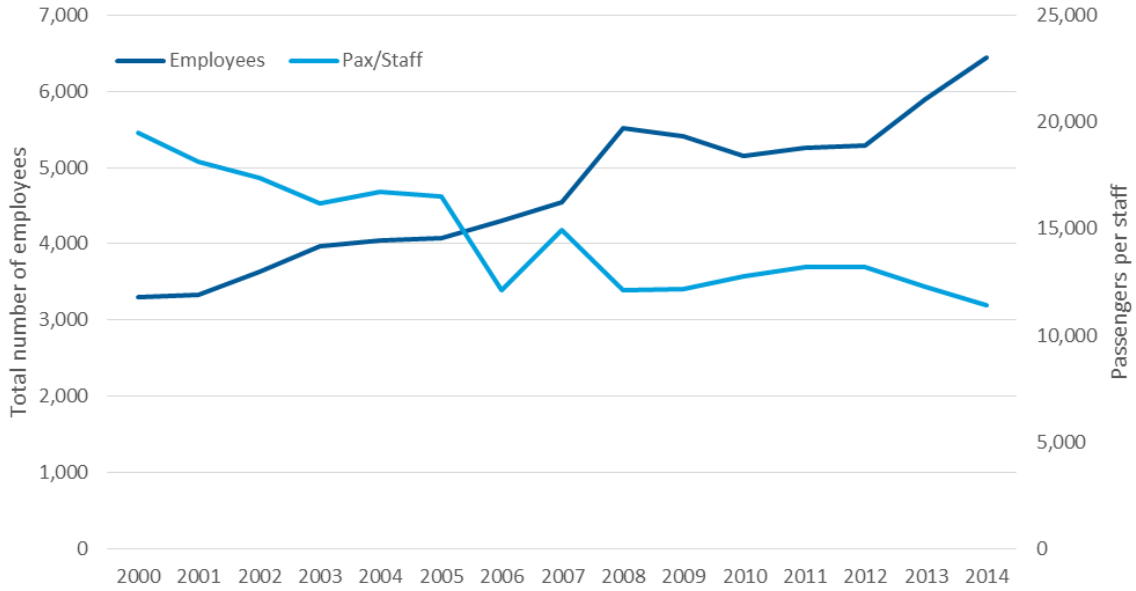
Examining Heathrow's total operational expenditure and operational expenditure per passenger provides little evidence that these increases in revenues reflect higher operational costs. Operational costs have fluctuated since 2008 but have not shown any clear overall trend to 2014 (Figure 4.11).[141] Meanwhile the total number of employees has been increasing since 2000, and the number of passengers per employee falling, but there has been no obvious change in this trend between 2000 and 2015 (Figure 4.12).

Figure 4.11 Total operating expenditure and operating expenditure per passenger at Heathrow airport, 2000-2014



Source: Leigh Fisher

Figure 4.12 Total employee and passengers per staff at Heathrow airport, 2000-2014



Source: Leigh Fisher

[141] Visual examination of this series suggests a possible structural break (around 2009) but investigation has not revealed a specific cause for any such break.

5 Summary of impacts and conclusions

This study investigated the impacts of the CC's remedies on competition in the market for airport services based on a range of evidence including desk research, airport site visits, interviews with a wide range of sector stakeholders, data collection (including requests to airports) and descriptive and econometric analysis of available data. This section presents a summary of impacts of the CC's investigation.

The study developed and tested a number of hypotheses regarding the likely impacts of the CC's remedies. It focussed on three key areas: impacts of the CC's divestment remedies, impacts of remedies at Aberdeen Airport and impacts of the CC's recommendations with regard to Government policy and economic regulation. More evidence was available with respect to the CC's divestment remedies. Stakeholders reported that this reflected the scale of these remedies and their relative importance in terms of impacts on the airport services market.

5.1 Impacts of the CC's divestment remedies

The CC hypothesised that increased competition as a result of divestment remedies would lead to increased rivalry to provide greater passenger throughput to the market. This study found that passenger numbers and the number of Air Transport Movements (ATM – a take-off or landing) have increased at Gatwick, Stansted and Edinburgh since divestment. Further, Stansted and Gatwick appear to have increased their share of passengers travelling from London airports since divestment. Edinburgh Airport has also done so, although this reflects long-term trends. There is econometric evidence to suggest that increases in ATMs and passenger numbers at divested airports are significantly larger when compared with other UK airports. Estimates suggest that ATMs in the three BAA airports were 9 per cent higher than other UK airports, while passenger numbers were between 9 and 12 per cent higher, taking into account long-term trends, although this cannot be specifically attributed to the CC's remedies.[142]

The CC hypothesised that increased competition as a result of divestment remedies would also lead to greater route development at divested airports. The total number of seats available to the market continued to rise in line with an upward trend that commenced prior to the divestments, with some signs that the rate of increase has accelerated at Edinburgh and Gatwick since divestment.

The CC hypothesised that increased competition as a result of divestment remedies would also lead to an increase in service quality at divested airports. Passenger perceptions of service quality appear to have improved at the divested airports, with some variation over time and across measures of service quality. ASQ data are not published by ACI and while some airports publish aspects of their individual performance, this information is limited. Therefore, insufficient ASQ data were available to ICF to carry out econometric analysis of whether there was any statistically significant change in passenger perceptions around the time of divestments of BAA's airports Nonetheless, airlines reported that passenger satisfaction scores increased in the most recent period and some increases are reflected in recent data. There is also considerable qualitative evidence reported by airports themselves that service quality has improved at Edinburgh, Stansted and Gatwick since they were divested by BAA.

The CC hypothesised that increased competition as a result of divestment remedies would lead to lower aeronautical charges. While airports' prices cannot be directly observed (pricing schedules apply only to unanticipated landings), there is some evidence that the growth in airports' yields from these charges has slowed at Stansted and Edinburgh. However, outside

[142] One specification of the quantitative estimates in this study suggested that the range of increase in passenger numbers may be up to 15%. However, that specification was considered less robust than others within the 9-12% range and so has not been specifically included here.

factors can significantly affect airports revenue's from these charges, including capacity constraints, capital spending, wider market conditions and dynamics in the airlines market. Furthermore, this study did find significant qualitative evidence of greater innovation in charging structures at divested airports and at Heathrow.

Finally, the CC hypothesised that increased competition as a result of divestment remedies would also improve operational efficiency at divested airports. There is some quantitative evidence that divestment at Gatwick has led to lower operational costs across a range of indicators. Changes to airport processes, such as those needed while terminal upgrades occur, can also disturb operational expenditure trends, making these harder to identify. This is supplemented by considerable qualitative evidence that new owners at each of the divested airports have engaged in wide and far-reaching efforts to improve operational efficiency. Econometric analysis did not, however, reveal significant evidence to support this, despite some signs that, if more data points were available, this could be observed.

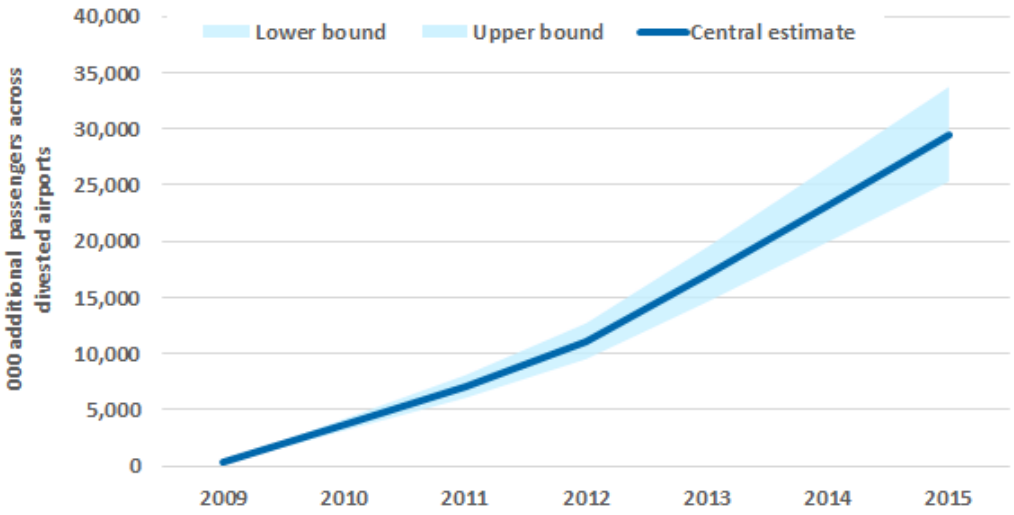
5.1.1 Quantified impact

This study sought to estimate changes in the market for airport services that could be attributed to the CC's remedies. In-depth analysis revealed that, for most indicators, current data are not sufficient to offer significant quantitative evidence to support findings from the qualitative evidence, perhaps due to a lack of data points post-remedy. Nonetheless, there is econometric evidence of a significant increase in passenger numbers following divestment, taking into account long-term airport-specific trends.

This study identified that passenger numbers have increased since divestment at each of Gatwick, Stansted and Edinburgh. Passenger growth reflects airports' and airlines' expansion of capacity offered to the market. It benefits consumers because more passengers are able to fly, including some that would not otherwise have done so. These passengers benefit directly from having taken those journeys. Further, expanding supply puts downward pressure on prices for air travel (all other things being the same), so even passengers who otherwise would have flown may pay less for their flights.

Quantitative evidence suggests that, across the three airports, passenger numbers increased by 9-12 per cent and ATMs by around 9 per cent after divestment compared with changes in passenger numbers at other airports, even when accounting for long-term trends observed at each airport prior to divestment. It was not possible to attribute this increase to the CC's remedies, but it is consistent with findings from the qualitative evidence that divested airports have innovated and upped their efforts to attract airlines and passengers. By the time all three airports were divested, an additional estimated 5.3-7.1 million passengers per year were passing through the three airports (Figure 5.1).

Figure 5.1 Estimated cumulative additional passengers at divested airports since divestment ('000)

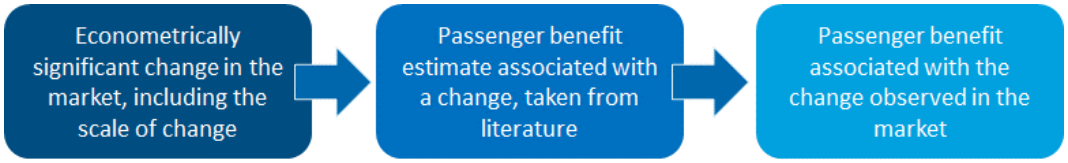


Source: ICF analysis

It has not been possible to identify the proportion of additional journeys that can be specifically attributed to divestment (rather than simply coinciding with divestment). It is therefore not possible to specifically estimate passenger benefits directly attributed to the CC's investigation, rather those that can be observed across the market, comparing before and after the investigation.

To illustrate the scale of the observed change, this study applied estimates of consumer benefit from additional passenger journeys identified in desk research. These estimates can be applied to any significant observed changes at airports subject to the CC's remedies, compared with other UK airports and taking into account airport-specific trends[143].

Figure 5.2 Approach to estimating passenger benefit



The International Transport Forum at the OECD (2014)[144] estimated passenger benefits[145] from changes in airport capacity and airline services[146]. In Summary, these estimates range

[143] This change cannot specifically be attributed to airports' divestment, as it could be explained by other factors not incorporated in the econometric assessment.

[144] OECD. 2014. Impacts of Expanding Airport Capacity on Competition and Connectivity

[145] It considered there were three types of benefits to the users of aviation. Benefits to consumers are defined as consumer surplus, or the benefit passenger enjoy in excess of the costs they perceive. Passenger benefits associated with additional passenger journeys identified in this study were estimated in the context of airport capacity expansion, which is not the same as the context of this study. However, this appears to be are the best available source of estimates of passenger benefit associated with passenger throughput.

[146] The OECD (2014) found that capacity expansion led to three key passenger benefits. 1) Connectivity gains: individual route alternatives provide connectivity benefits for consumers. These benefits can be estimated by a utility function based on generalised travel costs, which are themselves a function of travel time, weekly frequency, competition level, carrier type and connection type. 2) Competition: because capacity expansion makes market entry easier, it reduces market concentration and passengers are able to benefit from the increasing downward pressure of competition on fares. 3) Reduction in airline scarcity rents: because capacity expansion reduces airline scarcity rents, it reduces airfares and lowers airline revenues. http://www.itf-oecd.org/sites/default/files/docs/14impacts-airport-capacity.pdf

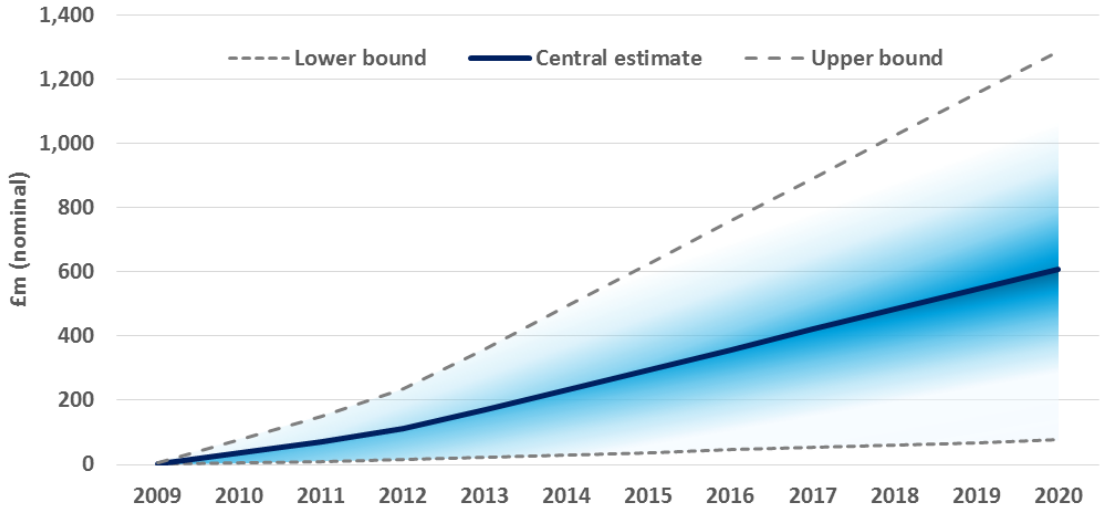
from £1.54 to £19.51 for origin-destination passengers and £0.38 to £29.23 for transfer passengers.

Using these information sources, the central estimate of passenger benefits associated with the change observed in the market is £62 million per year[147][148]. The central estimate of total benefits to the end of 2015 amounts to £295 million, or £607m by 2020, as shown below (Table 5.1).[149] The estimated range of impact of cumulative passenger benefits from observed changes in the market since the CC's remedies were implemented is illustrated below (Figure 5.3).

Table 5.1 Central estimate of nominal benefit of observed changes in the market (£m)

Airport		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Annual
Stansted	£m	-	-	-	-	16	34	53	72	91	109	128	147	19
Gatwick	£m	3	37	71	105	139	173	207	241	275	309	343	377	34
Edinburgh	£m	-	-	-	6	16	26	35	45	55	64	74	84	10
Total	£m	3	37	71	111	170	233	295	358	420	482	545	607	62

Figure 5.3 Estimated range of nominal benefit of observed changes in the market (£m)



Source: IATA, OECD, ICF analysis

If Heathrow and Glasgow Airports are omitted from the group of comparator airports, estimates of the increase in passengers at divested airports increase to 15%. Using a 15% increase in passenger numbers (the highest increase estimated in analysis for this study) leads to central estimate of £422m of consumer benefits realised to date and to £867m by 2020. These values have not been used in estimates reported above, because the preferred specification for this analysis produced the reported 9-12% range.

The estimates above of the CC's remedies are not comprehensive. While many benefits of the CC's remedies have been identified in this study, it has only been possible to quantify a proportion of the total observed effects in the market. It is important to consider these benefits in the context of the costs of the CC's remedies, which were not within the scope of this study, but were considered by the CMA in its own report on the CC's investigation.

Collectively the qualitative and quantitative evidence identified in this evaluation demonstrates that the benefits of the CC's remedies realised to date are greater than can be quantified here

[147] This estimate is based on the share of origin-destination vs. transfer passengers at each divested airport in the year in which the airport was divested.

[148] This is a mid-point between four estimates, based on a lower and upper bound for observed changes in the market and for passenger benefits from additional passengers travelling from airports.

[149] These estimates apply observed changes in passenger numbers across *all three* airports to passenger numbers at each airport individually.

in terms of passenger benefit. In particular, the CC's recommendations for Government policy and economic regulation were received well by the majority of stakeholders. Although these benefits cannot be quantified, they would appear widespread. Most stakeholders reported airports' competitive behaviour has developed considerably since divestment and that airports' service quality has increased since the CC's investigation. Estimating the specific contribution of the CC's remedies to these changes is not possible.

5.2 Impacts of the CC's other remedies

This section summarises the impacts of the CC's remedies other than its divestment remedies specifically relating to BAA.

5.2.1 Impacts of Aberdeen Airport undertakings

The CC hypothesised that Aberdeen's undertakings would lead to an increase in investment at Aberdeen Airport, which it had found to be below the level that might be expected in a more competitive market. There is some evidence that the rise in airport charges and operational expenditure has slowed or halted since undertakings to consult on capital expenditure and publish segmental accounts were accepted. However, little quantitative or qualitative evidence was found linking this with the CC's remedies and few stakeholders commented substantively on these remedies.

5.2.2 Impacts of the CC's recommendations on Government policy and regulation

Qualitative evidence from stakeholders reflects a commonly-held view that the CC strongly influenced the changes to Government policy implemented through the Civil Aviation Act 2012. Stakeholders universally supported the changes, particularly with respect to the changes in the economic regulation of airports. Views on the extent of the effect were more mixed, some attributing positive change to these improvements in economic regulation, others reporting that they have not had a discernible impact on observed outcomes in the market.

5.3 Conclusions

The weight and breadth of evidence in this evaluation illustrates that it is reasonable to conclude that the CC's investigation had positive impacts on competition between airports. It is also reasonable to conclude that it has delivered passenger benefits, as illustrated by estimates of passenger benefit that can be observed in the market since divestment, controlling, where possible, for other factors. Wider developments in the airports and airlines market make interpreting data challenging, but these wider developments do not appear to explain the changes in passenger throughput observed in the market and do not contradict qualitative findings.

It is reasonable to conclude that quantified changes in the market that coincided with the CC's remedies have already delivered passenger benefits that outweigh the costs of separation associated with the remedies. If these trends continue, they will go on to deliver even greater benefits over time. While not possible to specifically attribute these benefits to the CC's investigation, the qualitative evidence evaluated in this study supports that conclusion.

There remain many sources of passenger benefit for which quantification has not been possible. The majority of stakeholders illustrate that passengers have experienced many positive changes in the provision of airport services at airports directly affected by the CC's remedies. The weight of qualitative and quantitative evidence identified by this study supports the view that the CC's investigation was likely to be the most significant contributing factor to improvements that have been observed in passenger outcomes since the CC's remedies.

ANNEXES

Annex 1 Selection of indicators for quantitative analysis

Table A1.1 Indicators and use of sources

Outcome	Potential indicators	Description	Used?	Data source	Covers relevant airports	Time span	Availability	Other candidate sources	Comment/justification
Increased capacity availability	Air transport movements (ATMs)	Count of ATMs carrying passengers per airport annually (1 unit = 1 ATM = one landing and take-off)	✓	ACI	✓	Annual (1991-2014)	✓	CAA Leigh Fisher Annual Reports	ACI provides global airport level coverage of operational statistics which is far broader than the CAA and Leigh Fisher data.
	Passenger numbers (Pax)/ change in passenger numbers	Count of domestic and international passengers per airport annually (1 unit = 1 arriving or departing Pax)	✓	CAA	✓	Monthly (1998-2015)	✓	IATA SRS ACI Leigh Fisher	CAA data was used as they represent actuals as opposed to IATA estimates and provide long term historical data which cover the desire timeframe. ACI and Leigh Fisher can only provide annual passenger volumes.
	Freight (and mail) handled	Count of freight (and mail) handled by airport both domestically and internationally annual (1 unit = 1 tonne)	X	CAA	✓	Annual (1991-2014)	✓	ACI Leigh Fisher Annual Reports	Freight's importance is typically secondary to passengers for most major airports (with a handful of exceptions, EMA being the primary one in the UK). An increase in passenger ATMs would typically result in more freight capacity in the form of bellyhold cargo. Changes in freight capacity follows the same trend as that seen in Passengers/ ATMs.
	Type of passenger (transfer / O&D / Dom/EU/Non-EU)	Count of passengers flying from UK airports categorised into domestically, EU and non-EU based on destination. (1 unit = 1 passenger) Origin & Destination (O&D) passengers are those who begin and terminate their journey between two airports. Transfer passengers are those who fly to an airport which is not their end destination (e.g. Pax who fly MAN-	✓	CAA / IATA PaxIS	✓	(Dom/EU/Non-EU) Monthly (1998-2015) (O&D/Transfer) Monthly (2006-2015)	✓ X (O&D/Transfer shares will have to be estimates	ACI Leigh Fisher Annual Reports	The CAA can provide monthly actual data with a good level of granularity covering domestic/international subsets, while transfer/O&D splits must be calculated from IATA PaxIS estimates. IATA PaxIS is the preferred source of estimating O&D/ transfer Pax. The CAA Survey data would be an alternative but the CAA is restricted to UK airports and a far smaller sample size based on surveying passengers directly. PaxIS instead offers global

Outcome	Potential indicators	Description	Used?	Data source	Covers relevant airports	Time span	Availability	Other candidate sources	Comment/justification
		LHR-BOM) would be viewed as a transfer at LHR but not MAN or BOM).					from IATA data)		coverage and is based on ticket sale data gathered by IATA. Leigh Fisher and ACI could be used for annual domestic/ international volumes but do not offer monthly volumes.
Increased route development	Number of new routes (by airport, airline and destination)	Sum of scheduled routes operated by a carrier which were not served the previous month	✓	IATA SRS	✓	Monthly (1999-2016*)	✓	OAG	IATA SRS has future schedules which airlines plan to operate in the coming six months. OAG and IATA SRS are the sole providers for reliable airline schedules with both providers being extremely comparable. OAG has more historic datasets but IATA SRS is a more complex tool which accounts for items such as changes in airline operating codes (e.g. an airline could go out of business and its operating code (e.g. BA – British Airways) could be reused by another airline) and provides more accurate seat configurations. SRS also provides more accurate future schedules so for these reasons we have used SRS.
	Number of route closed (by airport, airline and destination)	Sum of scheduled routes operated by a carrier which was served the previous month but does no longer exist.	✓	IATA SRS	✓	Monthly (1999-2016*)	✓	OAG	See above.
	Total number of routes (by airline)	Count of operated routes	✓	IATA SRS	✓	Monthly (1999-2016*)	✓	OAG	See above.
	Seat capacity at route level	Sum of seats available, calculated by multiplying aircraft seat count by frequency of service	X	IATA SRS	✓	Monthly (1999-2016*)	✓	OAG	See above.
	Frequency on route level	Sum of departures from UK airport to destination.	X	IATA SRS	✓	Monthly (1999-2016*)	✓	OAG	This is captured as part of the seat capacity outcome above.

Outcome	Potential indicators	Description	Used?	Data source	Covers relevant airports	Time span	Availability	Other candidate sources	Comment/justification
Increased airline switching	Number of closures and openings of airline routes	Sum of scheduled routes operated by an airline which was served the previous month but does no longer exist and vice-versa.	✓	IATA SRS	✓	Monthly (1999-2016*)	✓	OAG	See above on IATA SRS.
Increased passenger switching	Change in passenger numbers	Changes in the number of passengers (Pax) from one month to the other.	✓	CAA	✓	Monthly (1998-2015)	✓	IATA SRS	CAA data was used as they represent actuals as opposed to IATA estimates and provide long term historical data which cover the desire timeframe.
Service quality improvement	Passenger satisfaction	ACI's passenger satisfaction survey	✓	ACI ASQ	X	Quarterly (2007-2015)	Airport request	CAA Surveys IATA Surveys	Data was received for: London Gatwick (overall satisfaction scores only, from Q1 2009 to Q2 2015) London Heathrow (from Q1 2009 to Q4 2015) Edinburgh (from Q1 2007 to Q4 2015) London Stansted 2009 to 2015
	Service Quality Rebate (SQR)	The SQR was introduced by the CAA to identify the service standards that airlines and passengers could expect from an airport in return for the regulatory charges they paid.	✓	SQR	X	Monthly (2008/9-2016)	Gatwick, Heathrow and Stansted only	-	This data was compiled for fully-regulated airports only, as it was generated as a CAA reporting requirement. The data available is: London Gatwick (from April 09 to Oct. 15) London Heathrow (from April 08 to Dec. 15) London Stansted (from April 09 to Jan. 16)
	Punctuality	What is the On-time performance (OTP) of the airline, presented as a % of 'on-time flights' over 'total flights'.	✓		✓	Varies, see comment	Airport request	CAA	On-time Performance (OTP) is the key metric, this is usually done at the airline level. In most instances, this is driven by the airline but airports can enforce stricter OTP control. CAA data is incomplete only major airports are included. The CAA expanded their scope in 2014 only. The data was requested to the following airports: Edinburgh, Luton, Stansted, Heathrow, Gatwick, Glasgow and Aberdeen. The data was received for:

Outcome	Potential indicators	Description	Used?	Data source	Covers relevant airports	Time span	Availability	Other candidate sources	Comment/justification
									London Luton (annual data from 2002 to 2015) London Heathrow (monthly data from Jan. 2000 to Dec. 2015)
Reduced airport charges	Aeronautical charge	Aeronautical charges are the fares paid by the airline to the airport for landing, parking the aircraft and use of the facilities (including passenger handling services such as security).	✓	Leigh Fisher	✓	Annual (2000-2014)	✓	Annual Reports	As airlines do not always pay the airport charge rates (bilateral negotiations between the airport and airline can result in airlines paying varying charges) a more comparable metric would be "aeronautical revenue per Pax". This represents an average/typical income which can be compared with other airports and can also be calculated over a time series. Historic airport charges are rarely in the public domain and as stated can differ between airlines. The release of these terms would also likely involve the approval of the airline.
Efficiency	Operating expenditure	Operating expenditure (Opex) are the costs associated with the operation of the airport on a day-to-day basis. Opex mainly consists of items such as staff costs, utilities and minor maintenance.	✓	Leigh Fisher	✓	Annual (2000-2014)	✓	Annual Reports	Key metric would be "Opex per Pax". Leigh Fisher provides a reliable and one-stop source for historic airport financials. The alternative was to purchase annual reports from company's house or via the airports' website (where published).
	Capital expenditure	Capital Expenditure (Capex) are the costs associated with acquiring or maintaining fixed assets. E.g. The development of a new terminal or the maintenance of a runway	✓	Leigh Fisher	✓	Annual (2000-2014)	✓	Annual Reports	Key metric would be "Capex per Pax". See above.
	Staff	Staff represents the number of employees working in the airport.	✓	Leigh Fisher	✓	Annual (2000-2014)	✓	Annual Reports	Key metric would be "Staff per Pax" See above.

Annex 2 Full summary of data sources reviewed

Table A2.1 Data sources identified

Dataset	Geographical scope	Time scope	Link
Increased capacity availability Potential indicators: Air transport movements (ATMs), Aircraft movements, Passenger numbers / change in passenger numbers, Freight (and mail) handled, Type of passenger (transfer terminating / freight)			
ACI	Heathrow, Gatwick, Stansted, Edinburgh, Aberdeen, Glasgow	Annual data from 1991 to 2014	Proprietary database.
CAA. UK airport statistics	Heathrow, Gatwick, Stansted, Edinburgh, Aberdeen, Glasgow	Monthly data from 1998 to 2015	https://www.caa.co.uk/default.aspx?catid=80&pagetype=88&pageid=3&sqlid=3
Leigh Fisher. UK Airports Performance Indicators	Heathrow, Gatwick, Stansted, Edinburgh, Aberdeen, Glasgow	Annual data from 2009 to 2013	Proprietary database.
IATA SRS	Heathrow, Gatwick, Stansted, Edinburgh, Aberdeen, Glasgow	Monthly data from 1999 to 2016	Proprietary database.
DfT. Air traffic at UK airports (AVI01)	Heathrow, Gatwick, Stansted, Edinburgh, Aberdeen, Glasgow	Annual data from 2004 to 2014	https://www.gov.uk/government/statistical-data-sets/avi01-traffic-passenger-numbers-mode-of-travel-to-airport
Anna Aero. Passenger numbers	Heathrow, Gatwick, Stansted, Edinburgh, Aberdeen, Glasgow	Monthly data from 2008 to 2015	http://www.anna.aero/wp-content/uploads/european-airports.xls
Gatwick airport. Traffic figures	Gatwick	Monthly data from 2012 to 2015	http://www.gatwickairport.com/business-community/about-gatwick/our-performance/monthly-traffic-figures/
Stansted airport. Traffic figures	Stansted	Monthly data from 2013 to 2015	http://www.stanstedairport.com/about-us/london-stansted-airport-and-mag/our-performance/
Edinburgh airport. Traffic figures	Edinburgh	Monthly data from 2014 to 2015	http://www.edinburghairport.com/about-us/facts-and-figures/traffic-statistics
Heathrow airport. Airport statistics	Heathrow	Annual data from 2009 to 2013	http://www.heathrow.com/company/company-news-and-information/performance/airport-statistics

Dataset	Geographical scope	Time scope	Link
Gatwick airport. Annual report	Gatwick	Annual data from 2007 to 2015	http://www.gatwickairport.com/business-community/airlines-business/investor-relations/reports/ and http://www.heathrow.com/company/investor-centre/document-centre/annual-accounts
Competition Commission, 2011. BAA airports market investigation - Working paper on the assessment of technical airport capacity	Heathrow, Gatwick, Stansted	2011 only	Proprietary database.
Copenhagen economics, 2012. Airport competition in Europe	Heathrow, Gatwick, Stansted	2012 only	http://www.seo.nl/uploads/media/2012-47_Airport_Competition_in_Europe.pdf
CAA, 2014. Airport Market Power Assessment	Heathrow, Gatwick, Stansted	2014 only	http://www.caa.co.uk/default.aspx?catid=78&pagetype=90&pageid=12275
International Transport Forum, SEO Economic Research, 2014. Expanding Airport Capacity: Competition and Connectivity and Impacts of Expanding Airport Capacity on Competition and Connectivity	Heathrow, Gatwick	2014 only	https://www.gov.uk/government/publications/additional-airport-capacity-strategic-fit-analysis
Increased route development Potential indicators: number of new routes, number of routes closed, total number of routes, seat capacity on route level, frequency of routes.			
IATA SRS	Heathrow, Gatwick, Stansted, Edinburgh, Aberdeen, Glasgow	Monthly data from 1999 to 2016	Proprietary database.
CAA. UK airport statistics	Heathrow, Gatwick, Stansted, Edinburgh, Aberdeen, Glasgow	Monthly data from 1998 to 2015	https://www.caa.co.uk/default.aspx?catid=80&pagetype=88&pageid=3&sglid=3
DfT. Air traffic at UK airports (AVI01)	Heathrow, Gatwick, Stansted, Edinburgh, Aberdeen, Glasgow	Annual data from 2004 to 2014	https://www.gov.uk/government/statistical-data-sets/avi01-traffic-passenger-numbers-mode-of-travel-to-airport
Anna Aero. Passenger numbers	Heathrow, Gatwick, Stansted, Edinburgh, Aberdeen, Glasgow	Monthly data from 2008 to 2015	http://www.anna.aero/wp-content/uploads/european-airports.xls
Heathrow airport. Airport statistics	Heathrow	Annual data from 2009 to 2013	http://www.heathrow.com/company/company-news-and-information/performance/airport-statistics

Dataset	Geographical scope	Time scope	Link
Copenhagen economics, 2012. Airport competition in Europe	Heathrow, Gatwick, Stansted	2012 only	http://www.seo.nl/uploads/media/2012-47_Airport_Competition_in_Europe.pdf
IATA, 2013. Airport competition	n/a	2013 only	https://www.iata.org/whatwedo/Documents/economics/airport-competition.pdf
CAA, 2014. Airport Market Power Assessment	Heathrow, Gatwick, Stansted	2014 only	http://www.caa.co.uk/default.aspx?catid=78&pagetype=90&pageid=12275
Increased airline switching Potential indicators: number of closures and openings of airline routes, number of closing or downgrading of hubs and bases			
IATA SRS	Heathrow, Gatwick, Stansted, Edinburgh, Aberdeen, Glasgow	Monthly data from 1999 to 2016	Proprietary database.
CAA. UK airport statistics	Heathrow, Gatwick, Stansted, Edinburgh, Aberdeen, Glasgow	Monthly data from 1998 to 2015	https://www.caa.co.uk/default.aspx?catid=80&pagetype=88&pageid=3&sglid=3
Heathrow airport. Airport statistics	Heathrow	Annual data from 2009 to 2013	http://www.heathrow.com/company/company-news-and-information/performance/airport-statistics
Copenhagen economics, 2012. Airport competition in Europe	Heathrow, Gatwick, Stansted	2012 only	http://www.seo.nl/uploads/media/2012-47_Airport_Competition_in_Europe.pdf
IATA, 2013. Airport competition	n/a	2013 only	https://www.iata.org/whatwedo/Documents/economics/airport-competition.pdf
CAA, 2014. Airport Market Power Assessment	Heathrow, Gatwick, Stansted	2014 only	http://www.caa.co.uk/default.aspx?catid=78&pagetype=90&pageid=12275
International Transport Forum, SEO Economic Research, 2014. Expanding Airport Capacity: Competition and Connectivity and Impacts of Expanding Airport Capacity on Competition and Connectivity	Heathrow, Gatwick	2014 only	https://www.gov.uk/government/publications/additional-airport-capacity-strategic-fit-analysis

Dataset	Geographical scope	Time scope	Link
Increased passenger switching Potential indicators: change in passenger numbers			
CAA. Annual survey reports	Heathrow, Gatwick, Stansted, Edinburgh, Aberdeen, Glasgow	Annual data from 1990 to 2014	http://www.caa.co.uk/default.aspx?catid=81&pagetype=90&pageid=7640
IATA SRS	Heathrow, Gatwick, Stansted, Edinburgh, Aberdeen, Glasgow	Monthly data from 1999 to 2016	Proprietary database.
DfT. Air traffic at UK airports (AVI01)	Heathrow, Gatwick, Stansted, Edinburgh, Aberdeen, Glasgow	Annual data from 2004 to 2014	https://www.gov.uk/government/statistical-data-sets/avi01-traffic-passenger-numbers-mode-of-travel-to-airport
Anna Aero. Passenger numbers	Heathrow, Gatwick, Stansted, Edinburgh, Aberdeen, Glasgow	Monthly data from 2008 to 2015	http://www.anna.aero/wp-content/uploads/european-airports.xls
Copenhagen economics, 2012. Airport competition in Europe	Heathrow, Gatwick, Stansted	2012 only	http://www.seo.nl/uploads/media/2012-47_Airport_Competition_in_Europe.pdf
IATA, 2013. Airport competition	n/a	2013 only	https://www.iata.org/whatwedo/Documents/economics/airport-competition.pdf
CAA, 2011. Passengers' airport preferences Results from the CAA Passenger Survey.	Heathrow, Gatwick, Stansted	2011 only	http://www.caa.co.uk/docs/5/Passenger%20survey%20results%20-%20FINAL.pdf
CAA, 2014. Airport Market Power Assessment	Heathrow, Gatwick, Stansted	2014 only	http://www.caa.co.uk/default.aspx?catid=78&pagetype=90&pageid=12275
HM Revenue and Customs, October 2012. Modelling the Effects of Price Differentials at UK Airports	Heathrow, Gatwick	2012 only	https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/344846/report188.pdf
Gatwick airport. Traffic figures	Gatwick	Monthly data from 2012 to 2015	http://www.gatwickairport.com/business-community/about-gatwick/our-performance/monthly-traffic-figures/
Stansted airport. Traffic figures	Stansted	Monthly data from 2013 to 2015	http://www.stanstedairport.com/about-us/london-stansted-airport-and-mag/our-performance/
Edinburgh airport. Traffic figures	Edinburgh	Monthly data from 2014 to 2015	http://www.edinburghairport.com/about-us/facts-and-figures/traffic-statistics

Dataset	Geographical scope	Time scope	Link
Heathrow airport. Airport statistics	Heathrow	Annual data from 2009 to 2013	http://www.heathrow.com/company/company-news-and-information/performance/airport-statistics
Service quality improvement Potential indicators: passenger satisfaction, service quality rebate, punctuality			
ACI, Airport Service Quality (ASQ)	Heathrow, Gatwick, Stansted, Edinburgh	Quarterly data from 2006 to 2015	Provided on request by airports
Gatwick airport. Service Quality Rebate	Gatwick	Monthly data from 2008 to 2015.	http://www.gatwickairport.com/business-community/about-gatwick/our-performance/service-standards-performance/service-quality-SQR/
Stansted airport. Service Quality Rebate	Stansted	Monthly data from 2009 to 2015	http://www.stanstedairport.com/about-us/london-stansted-airport-and-mag/our-performance/customer-service/
Heathrow airport. Service Quality Rebate	Heathrow	Monthly data from 2014 to 2015	http://www.heathrow.com/company/company-news-and-information/performance/airport-operations/service-quality-rebate-and-bonus-scheme
CAA, UK Punctuality Statistics	Heathrow, Gatwick, Stansted, Edinburgh, Aberdeen, Glasgow	Monthly data from 2000 to 2015	http://www.caa.co.uk/default.aspx?catid=80&pagetype=88&pageid=12&sglid=12
CAA, 2014. Airport Market Power Assessment	Heathrow, Gatwick, Stansted	2014 only	http://www.caa.co.uk/default.aspx?catid=78&pagetype=90&pageid=12275
ORC International, 2008. Research on the air-passenger experience at Heathrow, Gatwick, Stansted and Manchester airports	Heathrow, Gatwick, Stansted	2008 only	https://www.caa.co.uk/docs/33/ORC_CAA_report.pdf
Civil Aviation Authority, March 2009. The Through Airport Passenger Experience	Heathrow, Gatwick, Stansted	2009 only	https://www.caa.co.uk/docs/33/Passenger_experience.pdf
Civil Aviation Authority, May 2013. CAA Passenger Research: satisfaction with the airport experiences.	Heathrow, Gatwick, Stansted	2013 only	https://www.caa.co.uk/docs/33/CAP%201044%20CAA%20passenger%20research%20satisfaction%20with%20the%20airport%20experience%20(p).pdf

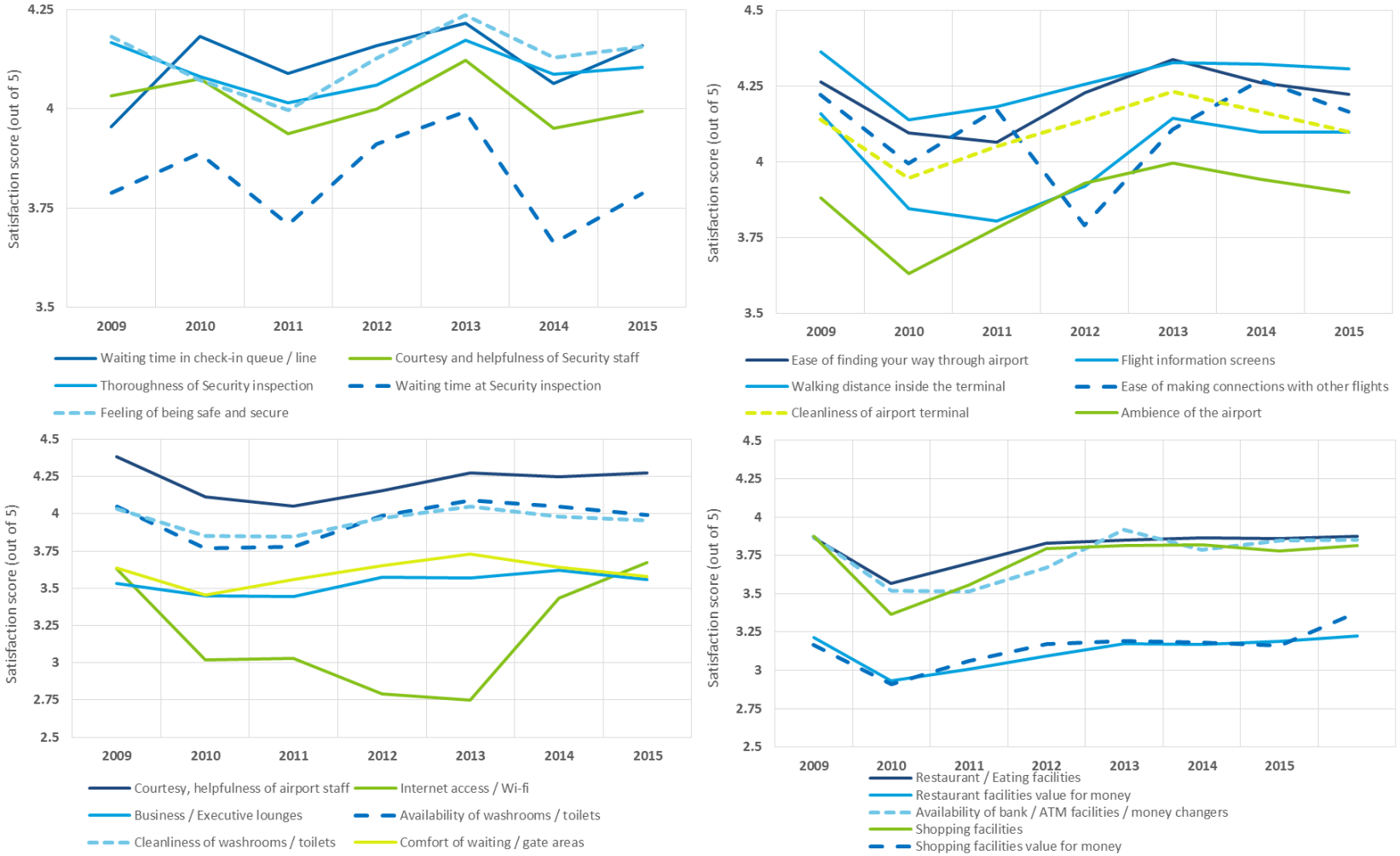
Dataset	Geographical scope	Time scope	Link
Reduced airport charges Potential indicators: aeronautical charges			
Leigh Fisher. UK Airports Performance Indicators	Heathrow, Gatwick, Stansted, Edinburgh, Aberdeen, Glasgow	Annual data from 2009 to 2013	Proprietary database.
Copenhagen economics, 2012. Airport competition in Europe	Heathrow, Gatwick, Stansted	2012 only	http://www.seo.nl/uploads/media/2012-47_Airport_Competition_in_Europe.pdf
IATA, 2013. Airport competition	n/a	2013 only	https://www.iata.org/whatwedo/Documents/economics/airport-competition.pdf
CAA, 2014. Airport Market Power Assessment	Heathrow, Gatwick, Stansted	2014 only	http://www.caa.co.uk/default.aspx?catid=78&pagetype=90&pageid=12275
ICF, 2015. Aeronautical Charges Edinburgh Airport, Benchmarking	Edinburgh	2015 only	Proprietary database.
Heathrow airport: Conditions of use	Heathrow	2015/16	http://www.heathrow.com/company/partners-and-suppliers/conditions-of-use
Gatwick airport: Conditions of use	Gatwick	2015/16	https://www.gatwickairport.com/globalassets/publicationfiles/business_and_community/all_public_publications/2015/2015-16-conditions-of-use---clean-30jan15.pdf
Stansted airport: Conditions of use	Stansted	2015/16	http://mag-umbraco-media-live.s3.amazonaws.com/1004/stansted-airport-conditions-of-use-document-2015-to-2016.pdf
Edinburgh airport: Conditions of use	Edinburgh	2015	https://s3-eu-west-1.amazonaws.com/edinburghairport/files/2015/07/20150728_EDI_COU.pdf
Aberdeen airport: Conditions of use	Aberdeen	2015	http://www.aberdeenairport.com/media/68257/AIAL-Conditions-of-Use-2015.pdf
Glasgow airport: Conditions of use	Glasgow	2014	http://www.glasgowairport.com/media/38046/glasgow-airport-limited-conditions-of-use-2014-1-nov-2013-.pdf
Efficiency Potential indicators: operating expenditure, capital expenditure, staff per passenger			
Leigh Fisher. UK Airports Performance Indicators	Heathrow, Gatwick, Stansted, Edinburgh, Aberdeen, Glasgow	Annual data from 2009 to 2013	Proprietary database.

Dataset	Geographical scope	Time scope	Link
Copenhagen economics, 2012. Airport competition in Europe	Heathrow, Gatwick, Stansted	2012 only	http://www.seo.nl/uploads/media/2012-47_Airport_Competition_in_Europe.pdf
CAA, 2014. Airport Market Power Assessment	Heathrow, Gatwick, Stansted	2014 only	http://www.caa.co.uk/default.aspx?catid=78&pagetype=90&pageid=12275
CAA, 2013. Airport Operating Expenditure Benchmarking Report	Heathrow, Gatwick, Stansted	2011 only	http://www.caa.co.uk/docs/33/CAP%201060%20Airport%20Operating%20Expenditure%20Benchmarking%20Report%202012.pdf
CEPA, 2013. Scope for Efficiency Gains at Heathrow, Gatwick and Stansted airports.	Heathrow, Gatwick, Stansted	Some time-series data (1992-2012)	http://www.caa.co.uk/docs/78/Q6CEPAEfficiency.pdf
Heathrow airport. Annual report	Heathrow	Annual data from 2008 to 2014	http://www.heathrow.com/company/investor-centre/document-centre/annual-accounts
Gatwick airport. Annual report	Gatwick	Annual data from 2007 to 2015	http://www.gatwickairport.com/business-community/airlines-business/investor-relations/reports/ and http://www.heathrow.com/company/investor-centre/document-centre/annual-accounts
Stansted airport. Annual report	Stansted	Annual data from 2007 to 2015	http://www.manchesterairport.co.uk/about-us/publications/annual-reports-and-accounts/ and http://www.heathrow.com/company/investor-centre/document-centre/annual-accounts
Edinburgh airport. Annual report	Edinburgh	Annual data from 2012 to 2014	http://www.edinburghairport.com/about-us/investor-relations
Aberdeen airport. Annual report	Aberdeen	Annual data from 2011 to 2015	http://www.aberdeenairport.com/about-us/media-centre/publications/
Aberdeen airport. Segmental analysis	Aberdeen	Annual data from 2010 to 2014	http://www.aberdeenairport.com/media/174526/aberdeen-international-airport-ltd-segmental-analysis-2014.pdf
German Airport Performance, July 2008. The Market power of Airports, Regulatory Issues and Competition between Airports.	n/a	2008 only	http://userpage.fu-berlin.de/~jmueller/gapprojekt/downloads/gap_papers/Hancioglu_Market_power_of_Airports_Regulatory_jul_08.pdf

Annex 3 Additional service-quality data

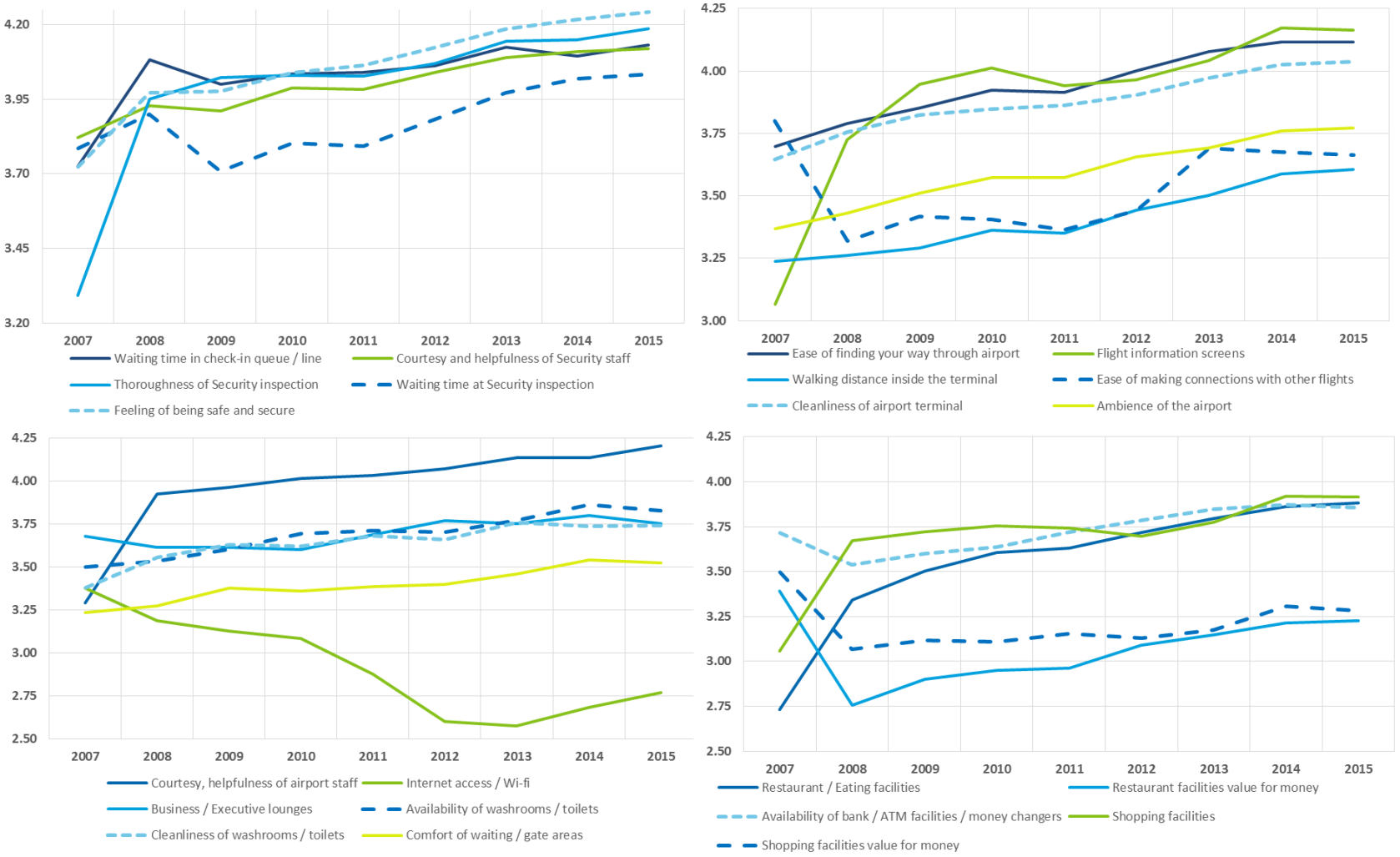
This section sets out additional service quality data, supplementing data identified above.

Figure A3.1 Passenger satisfaction breakdown, Edinburgh airport, annual averages 2009 – 2015



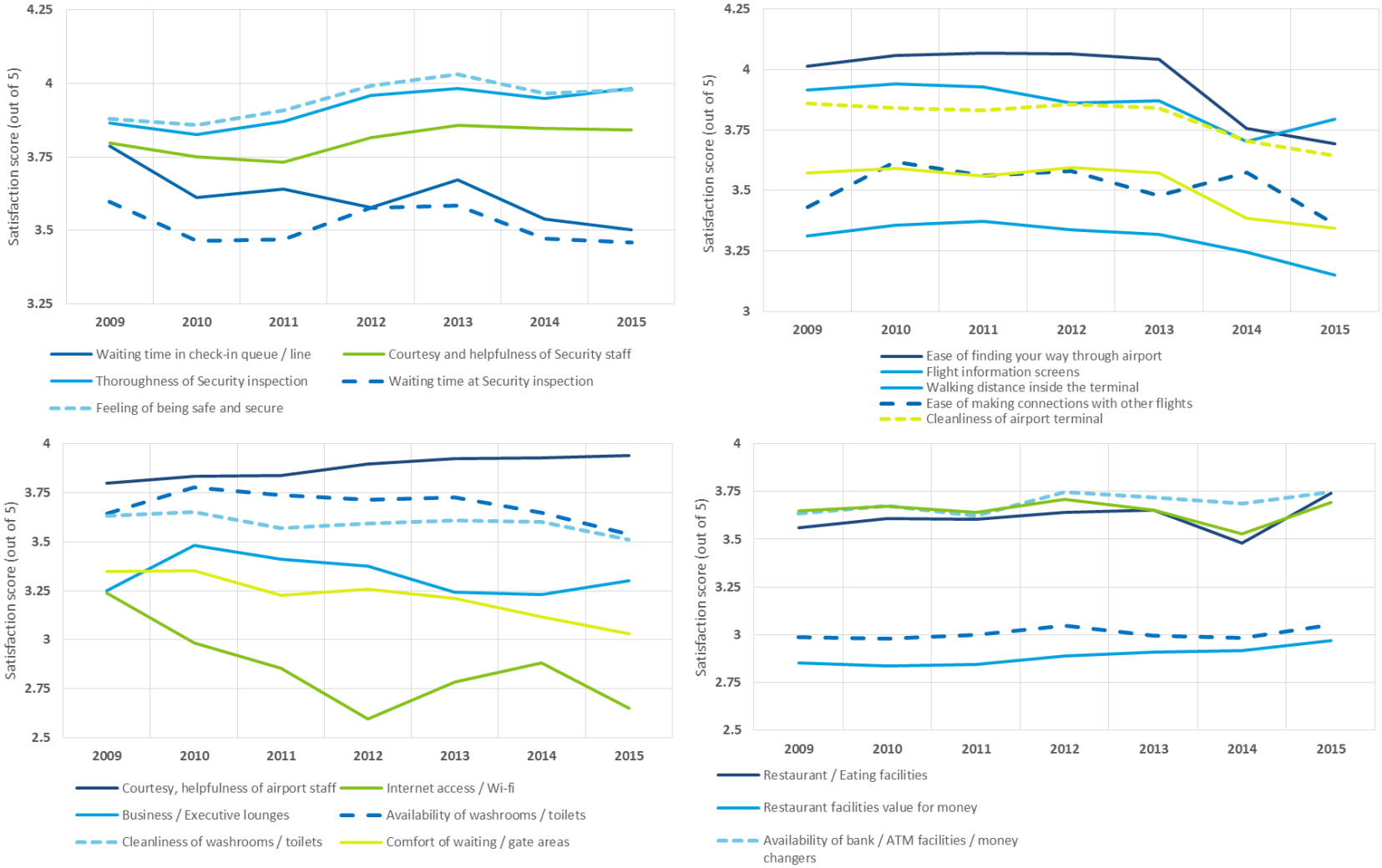
Source: ACI ASQ data from Edinburgh Airport

Figure A3.2 Passenger satisfaction breakdown, London Gatwick airport, annual averages 2007 – 2015



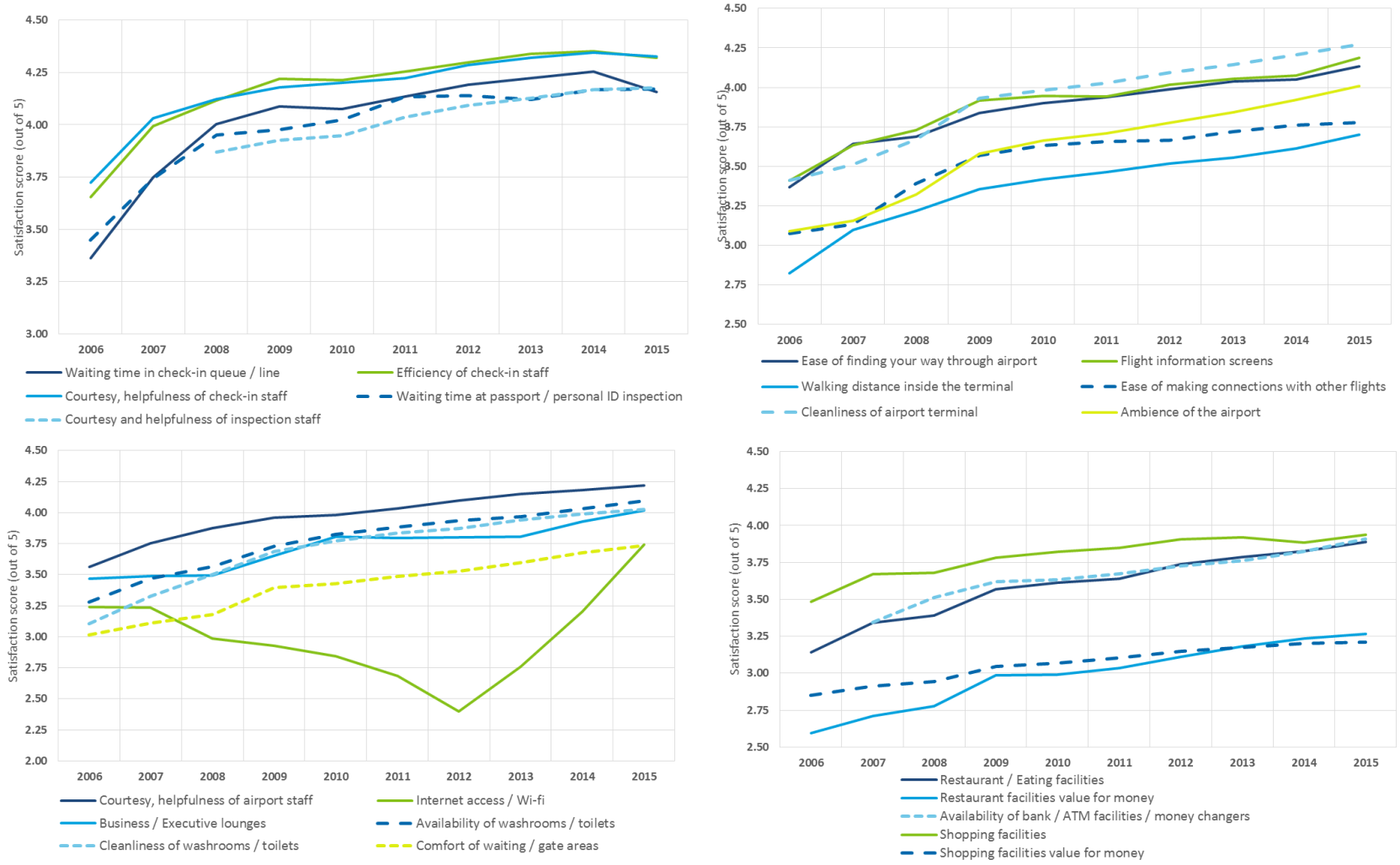
Source: ACI ASQ data from Gatwick Airport

Figure A3.3 Passenger satisfaction breakdown, Stansted airport, annual averages 2009 - 2015



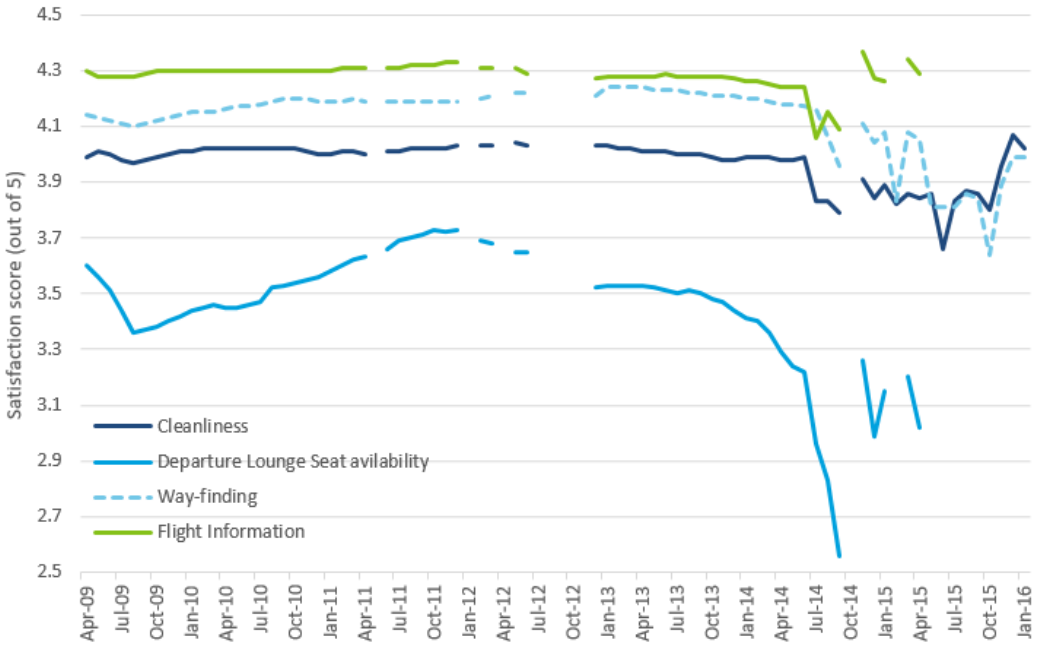
Source: ACI ASQ data from Stansted Airport

Figure A3.4 Passenger satisfaction breakdown for Heathrow airport, 2006-2015



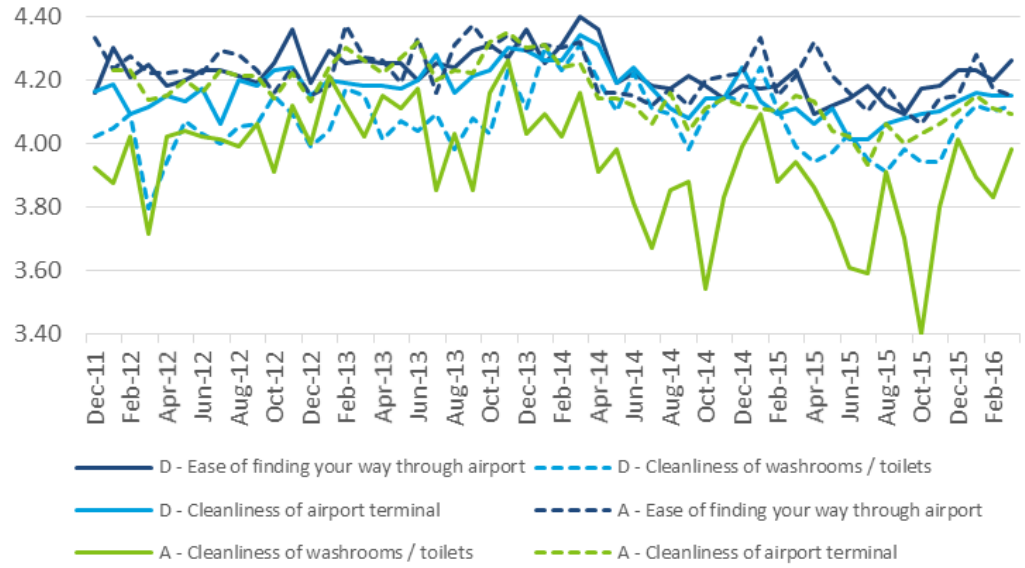
Source: ACI ASQ data from Heathrow Airport

Figure A3.5 Service Quality Rebate at Stansted airport, April 2009 to January 2016[150]



Source: Stansted Airport data

Figure A3.6 Edinburgh Passenger Survey, December 2011 and March 2016



Source: Edinburgh Airport

[150] Some data are missing and from July 2014 onwards it is called SQC Service Quality Commitment

Annex 4 Methodology for econometric analysis

A4.1 Introduction

As part of the evaluation of the Competition Commission's market investigation concerning BAA airports, to complement qualitative enquiry into the effectiveness of the actions and the in-depth examination of descriptive statistics, a quantitative counterfactual analysis work of the likely impacts was also undertaken.

The analysis sought to provide evidence on the effects of three major decisions of the Commission - on the divestment of three BAA assets London Gatwick (LGW), Stansted (STN) and Edinburgh (EDI) airports, as these were considered to have the greatest observable impact – on various operational indicators of interest at the airports concerned.

Our approach was objective, not committed to any desired finding, applying a pre-determined identification strategy and avoiding data mining in search of models that could possibly demonstrate significant effects.

This Methodological Annex presents in the following sections:

- the data used for the quantitative analysis;
- the checking and processing of the data undertaken;
- the overall approach to the econometric modelling; and
- concrete model specifications.

A4.2 Data

Data used for the analysis comes from four different datasets covering UK airports and its aviation market: (1) CAA monthly data on air transport movements and passenger numbers; (2) IATA SRS monthly data on scheduled flights; and (3) a database of key Airport Performance Indicators (API) compiled by Leigh Fisher, including data on aeronautical revenues and staff numbers. The details of the respective databases with regard to content, airport and time coverage and data gaps are as follows:

CAA database

The CAA data on monthly air transport movements (ATM) and passenger numbers (PAX) available to the team covered 66 UK airports for the period between January 1998 and October 2015. The total monthly figures were broken down to domestic, EU and non-EU relations (the origin or destination of ATM or PAX using the airport), as well as scheduled versus charter flights for the international relations.

The dataset contained a small number of gaps, with either complete records (i.e. month) missing, or only PAX or ATM data for a given monthly record. A few of these gaps – notably for Aberdeen (ABZ) and Inverness (INV) airports – could be filled by retrieving new data from the CAA database. Missing records for some small airports may signal that the airport was not operational in the given month, but the majority of data gaps could not be explained by this assumption. PAX data from incomplete monthly records was missing in several cases when there were no international ATMs for the specific airport in the specific month. However, the missing data included domestic PAX although there were domestic ATMs.

IATA SRS

The IATA SRS database contained monthly route and seat capacity data for scheduled flights for 323 airlines flown from 79 UK airports (as airport of origin), linking in a total of 635 different UK and international airports of destination to them (a total of 338,437 routes). The period covered went from August 2003 to June 2016 (i.e. including future scheduled flights for the remainder of the current season).

This database is known to contain some inevitable inaccuracies: (i) certain scheduled flights could have been cancelled but not subsequently omitted from the reported data; (ii) a few actual flights were scheduled after data reporting and hence not included in the database; and (iii) the sample week in the

given month, on which data reporting was based, might not have included a route that was otherwise operated in the given month (on other weeks).

Above and apart from these issues, the database had some gaps. Records for certain scheduled flights of a given airline that must have existed in reality with very high or relatively high probability were missing. It was not possible to accurately determine whether the data was missing or whether the route was indeed not flown in the given month, but it was clear from the review of the dataset that genuine data gaps would be at least in the high hundreds, probably thousands. Examples include cases where only one month was missing (sometimes in peak season) for a given route which was flown by the given airline every other month for years before and after the month in question. The number of observed gaps are more or less proportionate to the overall number of flights for a given airport.

As there is no tool available to accurately identify data gaps, the extent of the problem can be only very roughly dimensioned, and it appears to be incremental. The total number of possible gaps, i.e. a spell of at least one month where a certain origin/destination airport relation was not served by a given airline, although it was served before and after was 11,640. This could in theory correspond to 92,182 months missing from the records (summing the number of months missing for the apparent gaps), which would be 21% of the full database. This would be however an extreme overestimation, as we can establish with relatively high reliability that the vast majority of the gaps are genuine: these routes were indeed not served by scheduled flights by a given airline in the given month. The large majority of the gaps - 9,527, corresponding to 87,700 possible missing monthly records (95% of all) – were at least three months long, concentrated mostly around the January-February seasonal through, or even spanning several years (the longest spell of missing months was 143). These are unlikely data reporting gaps. From the 699 one-month gaps, the 459 two- and 955 three-month gaps, a relatively large proportion were again concentrated around the January-February low season. The amount of months where data on scheduled flights was indeed not reported by a given airline for a given airport pair may not exceed two or three thousands (and is possibly much lower than this) - compared to the total number of 338,437 records this would result in a 1% data gap.

Leigh Fisher API

The Leigh Fisher API dataset contains a wide range of variables on airport operations for 22 UK airports, given at annual level, including ATMs, PAX numbers, revenue and cost indicators broken down to various categories, and employee numbers, for the years 2000-2013.

Whilst certain detailed revenue and cost categories are only given for 2011-2013, higher-level indicators are well covered, save for a small number of data gaps (e.g. revenue and cost figures for STN for 2013).

In general, all the records in the datasets presented above were more complete for larger airports. Data gaps were much more present among the smallest airports.

Whilst the available number of airports to analyse (the sample) was low – 16 to 24, depending on the dataset used – this was to some extent counterbalanced by the relatively large number of observations for each airport, especially for the datasets containing monthly data. The number periods observed before the divestment of each airport was sufficient to investigate and test whether the different airports, on aggregate, moved on a common path in terms of capacity, airline switching variables, operational efficiency etc. Problems mostly arose with the small number of observations after divestment of the BAA assets (especially for yearly data), to estimate the effect of the Commission’s decisions. This is expected to lead to elevated levels of Type I errors, meaning that although there may be a genuine and observable effect, but the statistical test would not flag these as significant differences, as well as possibly to Type II errors, when a few extreme observations in the later years could let the statistical tests signal significance when there is none.

A4.3 Data control and processing

A4.3.1 Data control

All datasets were checked before the analysis for data quality (above the detection of data gaps explained in the preceding sub-section) and consistency, and efforts were undertaken to correct the problems encountered, if feasible.

The checks undertaken sought to:

- detect highly implausible values among the data reported (signalling possible data entry errors);
- clarify whether zero values are genuine zeros or rather indicate missing data;
- verify whether breakdowns of ATM or PAX numbers correctly add up to totals (e.g., did PAX numbers on scheduled and charter flights with European origin or destination flights add up to total PAX numbers on European routes?).

The quality control exercise did not identify suspicious values (point A), but detected a number of missing data wrongly coded into zeros (B) and a handful of small internal consistency problems (C). These issues were corrected by recoding 'false' zeros to missing data and by re-aggregating breakdown data to new totals.

A4.3.2 Filtering

The datasets were subsequently filtered, retaining only larger airports which are broadly comparable to BAA assets. The filtering was partially also motivated by data availability: larger airports tended to have complete or almost complete records for the periods covered in the individual datasets, whilst small airports had substantial gaps in data, as mentioned earlier.

After the filtering of the CAA monthly database, the 34 largest UK airports – measured by the number of PAX in the year 2014 – were retained initially, almost all of them with complete records. This first selection was narrowed later to exclude airports that are incomparable to the BAA assets under investigation:

- Sumburgh (LSI) and Scatsta (SCS) on the Shetland islands and the Channel islands Jersey (JER) and Guernsey (GCI), as well as the airport on the Isle of Man (IOM), these being in a peculiar position due to being positioned on islands, and the airports on the Scottish islands being also peculiar by mainly serving the oil industry;
- Doncaster Sheffield (DSA) and London Southend (SEN) as they were not fully operational throughout the period analysed;
- Derry (LDY), which is a tertiary airport for Belfast, only served by one carrier serving two routes.
- London City (LCY), which is a 'city centre' airport which predominately serves the business market using smaller aircraft
- Blackpool (BLK), which exhibited very atypical traffic patterns and was removed as an outlier from the control group of airports, not comparable to BAA assets. For most of the period observed, BLK lacked any significant schedule traffic, mostly operating small aircraft shuttles to Belfast and Isle of Man.[151]

The individual airports from the different databases that were retained for analysis are given in the table below.

[151] LCY and BLK were included in graphing ATM and PAX trends but not retained in the modelling.

Table A4.1 Coverage of UK airports in the analytical models based on the four individual datasets

Airport IATA code	Airport name	CAA	IATA SRS	Leigh Fisher
ABZ	Aberdeen	x	x	x
BFS	Belfast Int'l	x	x	x
BHD	Belfast City	x	x	
BHX	Birmingham	x	x	x
BOH	Bournemouth	x	x	x
BRS	Bristol	x	x	x
CWL	Cardiff	x	x	x
EDI	Edinburgh	x	x	x
EMA	East Midlands	x	x	x
EXT	Exeter	x	x	x
GLA	Glasgow	x	x	x
HUY	Humberside	x	x	x
INV	Inverness	x	x	
LBA	Leeds-Bradford	x	x	x
LGW	London Gatwick	x	x	x
LHR	London Heathrow	x	x	x
LPL	Liverpool	x	x	x
LTN	London Luton	x	x	x
MAN	Manchester	x	x	x
NCL	Newcastle	x	x	x
NWI	Norwich	x	x	x
PIK	Prestwick	x	x	x
SOU	Southampton	x	x	x
STN	London Stansted	x	x	x
	TOTAL airports	**24**	**24**	**22**

There was a case for removing two additional airports from the econometric models: London Heathrow (LHR) and Glasgow Airport (GLA). These were in common BAA ownership together with the three divested airports under investigation and significant competitors for the latter. It could be argued that the CC's recommendations and subsequent divestments directly affected these airports and their competitive position and, for this reason, they should not be included in the control group. However, it could also be argued that some or all other airports also have been affected by the divestments, so these too could have been seen as ineligible for being part of the control group for the same reasons, The impacts – 'spill lover effects' – may have been positive (e.g. new domestic routes opened in the divested airports would link in airports from the control group as origin or destination airports) or negative (inter-airport competition), albeit more indirect and probably less strong than for LHR and GLA. An exclusion would in theory weaken the precision of the estimates by limiting the sample size, and possibly impacting on the accuracy of the estimates as arguably the most relevant comparison airports, i.e. those serving the same local market, would fall out from the models.

Consequently, it was decided that the econometric models would be run on both the full control group and on a restricted control group excluding these two airports. Comparing estimates would give useful indications on the robustness of the method.

A4.3.3 Imputing missing data

While data gaps could not be plugged in the IATA SRS and Leigh Fisher datasets, missing records or cells in the CAA dataset could be imputed with relative ease. This was considered useful for being able to aggregate the monthly data correctly to annual level; and to decompose the monthly data to trend and seasonal (and irregular) components. The imputation of missing CAA data in incomplete records used two different methods:

- A very straightforward completion of partially missing records using a logical relationship between variables: setting missing ATM numbers to zero when the corresponding PAX number was zero (this concerned for the 24 airports included in the modelling only 1 record out of a total of 5,136);
- Trends-based imputation: an estimated PAX/ATM ratio for the given month where data was missing was used to multiply up existing ATM number to impute missing PAX, or the other way round, dividing existing PAX number to impute missing ATM number. The estimated PAX/ATM ratio was calculated by adding an airport-specific seasonal effect pertaining to the given month (obtained through running a S3x3 seasonal filter on the de-trended series) to the value of a centred 12-period moving average of PAX/ATM ratios (this corresponds to a linear decomposition model, using a technique equivalent to the two first steps of the US Census Bureau's widely used X-12 ARIMA seasonal adjustment process; it concerned 24 records out of a total of 5,136).

For the analysis of data aggregated to annual level, ATM and PAX values for November and December of the year 2015 also had to be imputed. This was done by using trend and seasonal component estimates from the full-fledged time series decomposition of the data (see next sub-section). Notably, the obtain trend value for October 2015 was retained for both November and December, and the estimated seasonal component for November and December 2014 was added to this value.

The above imputation method is highly accurate, producing very reliable data that can be safely treated as actual observations rather than estimates in regression models.

For the IATA SRS dataset, only a few gaps in scheduled routes could have been filled with reasonable reliability (a possible approach considered would have imputed routes and seat numbers in cases when only one month outside the end-of-the-year low season was missing for a given airline and a given route midst of a relatively long spell of flights). The vast majority of gaps would have been left unplugged in any case, questioning the added value of the effort.

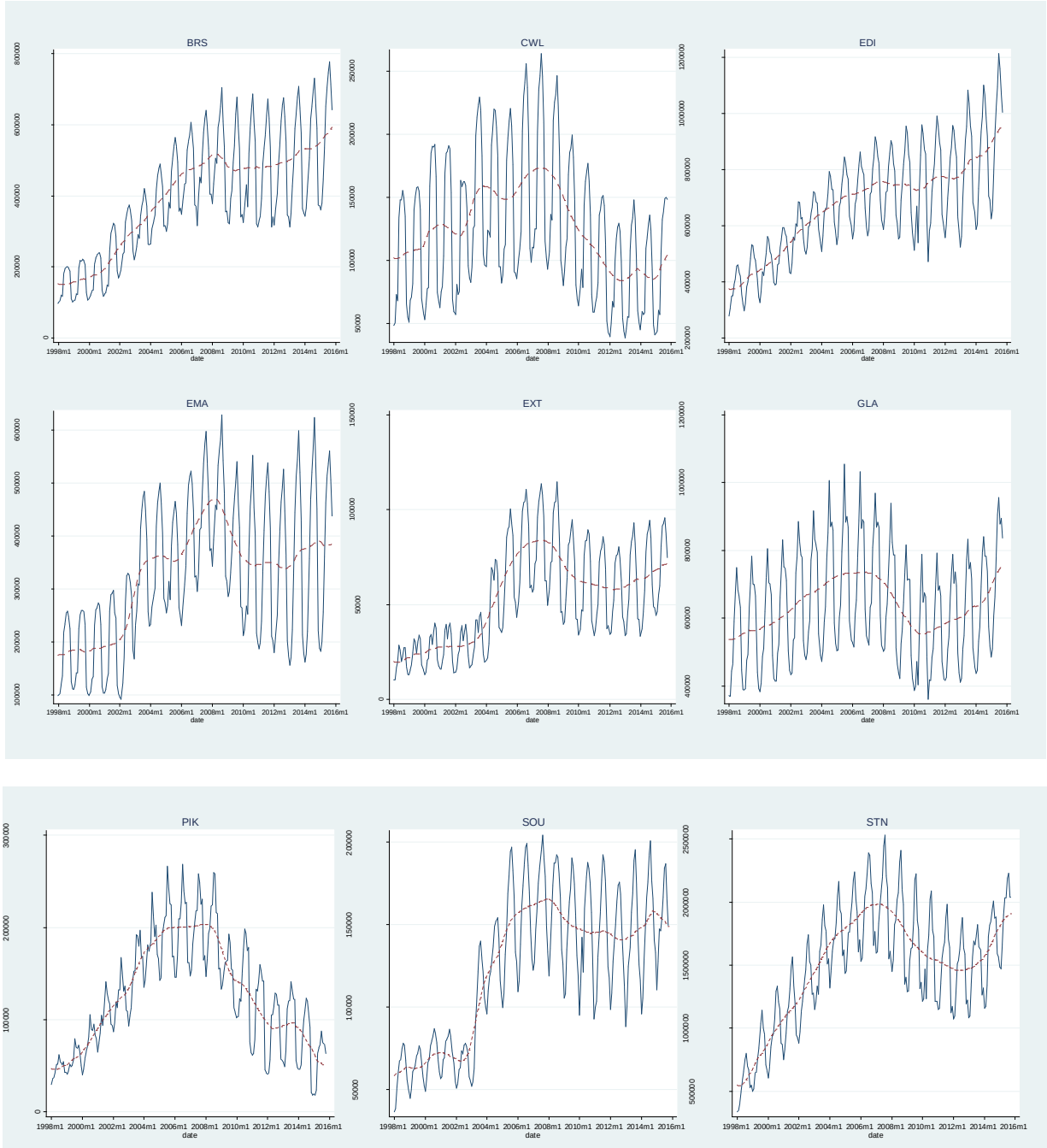
For the Leigh Fisher API dataset, intra- or extrapolating revenues based on existing data for a given airport (and possibly considering trends for other comparable airports) was not seen as reliable enough. Furthermore, it would have used the same approach to the time and airport effects than the fixed-effects regression analysis, hence probably weakening the analysis (the imputed value would have been very similar to the expected value for the given airport and year as modelled in the panel regression, suggesting that there was zero treatment effect).

A4.3.4 Seasonal decomposition

The CAA ATM and passenger data was received in a monthly breakdown, and it was decided that at least some of the regression and time series models should make use of this high level of granulation to increase statistical power. However, in order to avoid bias from the rather strong seasonal - i.e. monthly - effects, it was necessary to de-seasonalise the data by decomposing it into trend and seasonal (plus irregular) components. Analysing monthly data without de-seasonalising it might have produced very different treatment effect estimates depending on whether the 'treatment' (divesting) occurred in the summer peak –season or in the winter - given that there were only a few years observed following the treatment.

The graphs overleaf presenting the monthly evolution of passenger numbers for nine illustrative airports show that seasonal effects vary between airports – although a visible summer peak season is common for all airports.

Figure A4.1 Evolution of PAX numbers and its trend component for selected UK airports (Jan 1998 – Oct 2015)



The seasonal decomposition process built largely on the US Census Bureau's standard X-12 ARIMA seasonal adjustment process. More specifically, two iterations of a de-trending and subsequent de-seasonalising process were undertaken:

- de-trending: for each individual airport, a 12-period centred moving average was calculated on their original monthly ATM and PAX figures, and this trend estimate substituted from the original series;
- de-seasonalising: the S(3x3) seasonal filter was applied the de-trended series, with selecting months as the seasonal factors. This filter is a simple weighted moving average of the de-trended value for the given month, and the values for the corresponding month from 2 preceding and successive years, with asymmetric weights at the end of the series. The calculated (monthly)

seasonal effects were subtracted from the original series to obtain the de-seasonalised figures. The de-trending and de-seasonalising were then repeated for a second iteration.

ATM and PAX data for domestic, EU and non-EU flights were decomposed separately. Aggregated de-seasonalised figures are simply the sums of the relevant subgroups. Although subsequent econometric models used log series, the seasonal decomposition was implemented on the original series in order to avoid computation problems with zero values. The de-seasonalised figures were later logarithmised.

A4.4 Approach to the econometric analysis

The purpose of the econometric models, as described in the introductory part of this Annex, was to test whether there was a significant impact ('treatment effect') of the sale of LGW, STN and EDI on various operational indicators measured at monthly, quarterly or annual basis.

The strategy for supplying evidence of the effects tried to identify changes in relevant outcome variables that could be attributed to the divestment of the airports, as other influences independent from the decisions, such as general demand fluctuations in the UK aviation industry over time, would be controlled for. The models developed followed a counterfactual logic by trying to answer the question 'what would happened if the divestment had not taken place?', although they were kept simple rather than dwelling deep in the complexities of individual airports' operations in pursuit of establishing a very realistic case of the counterfactual situation. This would have required large amounts of detailed and sensitive data not accessible to the team, and would have inevitably led to overfitting: having too many relevant predictors in the models which were only covering a very small sample of 24 airports. The strategy was basically to compare trends in time for the three divested BAA assets and a set of comparable UK airports using two separate techniques:

- panel data regression; and
- tests for breaks in time series (with known time of the breaks).

In the proposal phase of this study, the difference-in-differences (DiD), a special case of panel data regression technique widely used for causal inference, was suggested for further exploration. However, this option was discarded as DiD models have been designed for cases for 'group treatments', i.e. when a larger number of units undergo the same treatment (e.g. a policy change in a given region), but in reality the divestment of the three BAA airports occurred at different times, and grouping them into one 'treatment group' would have led a loss of data. Furthermore, verifying the necessary assumptions of the DiD model with a treatment group comprising only three airports would not have been feasible.

The panel data regression approach chosen (complemented with a specific time series test for some outcome variables) is largely analogous to DiD but it comes with less restrictions, higher statistical power and was expected to yield considerably more robust findings. The key properties of the techniques are presented in the following sub-sections.

A4.4.1 Panel data regression

The main econometric model used was a fixed-effects panel regression with common time effects. Panel data allows observations across two components of the data – across airports and across time (this type of data has already been collected by ICF – for all UK airports over time). The airports included in the models are given in Table A4.1 on page 102. Of the 16 to 24 airports covered, depending on the dataset, LGW, STN and EDI were the 'treated' airports, the rest 'control' airports, however, in the panel data regression setting observations for the 'treated' airports preceding the date of divestment also work as control observations. The timeframes used depended on the granulation of data in the original datasets: monthly (CAA) or annual (CAA aggregated, IATA SRS aggregated, Leigh Fisher API).

Fixed-effects models allow for analysing the impact of variables that vary over time - of these our interested lies with the sign, size and significance of the coefficient for the 'treatment', i.e. the divesting of the BAA assets. The key time-variant factor included in the models was the estimated common time effect (on a monthly or quarterly basis, depending on the data).

There are undoubtedly unobserved individual characteristics of airports that may have a major impact on outcome variables, but in a fixed effects model it is assumed that these do not vary by time - as a

result, these unobserved individual characteristics will fall out from the model after individual average values are subtracted from all variables.

A generic specification of the regressions would be:

$$Y_{it} = \propto_i + \lambda_t + \rho_{it} + \varepsilon_{it},$$

Where: Y_{it} is the outcome variable measured (in certain cases the original indicator value, in other cases the logarithmised and/or de-seasonalised value)

$\propto_i$ is an airport-specific intercept (the 'fixed effect'). This falls out from the equation after differencing against the mean values for all left and right-hand side variables by airport: this is the 'within estimator' approach

λ_t is the common time effect (quarterly or annual)

ρ_{it} is the treatment status, i.e. a dummy taking the value 1 from the month, quarter or year onward when the sale of the airport was finalised, corresponding to an assumed one-off trend shift, and assuming this shift is the same for all divested airports. In an alternative model, a gradual (linear) increase of the treatment effect was assumed, with the effects beginning 12 months before the closing of the divestment, and fully unfolding 12 months after the finalisation of the divestment. This second variant tried to better model the actual adjustment process which starts already before the divestment is concluded, and takes time to mature

ε_{it} is the error term (assumed to be independent across airports and periods and homoscedastic). This error term picks up time-variant effects such as the evolution of employment, migration flows, economic performance in the airports' catchment areas – all well correlated with airport usage. Note, however, that key airport performance indicators such as passenger numbers showed far greater variance across the years and months than economic variables; and these economic variables tend to develop similarly in individual UK regions, hence their explanatory power should be limited. Also, they may not be correlated with the treatment variable and, hence, can be 'ignored' (they will not bias the results if not explicitly modelled, i.e. 'ignored' in the model)

A major assumption of the model – apart from linearity – is that the overall trend (handled via the inclusion of common time effects) is the same for all airports; systematic (i.e. non-random) deviations from it are either explained by the airport-specific fixed effect which does not change in time and is not of interest for the model, or the effect of the treatment variable. When running the regression, the estimate for the coefficient of the treatment variable and its t-test value would show whether there was a significant shift in the outcome variable(s) after the treatment.[152]

One expected issue with this specification is the risk of endogeneity and reverse causality (i.e. causality runs two ways, e.g. the CC decision does not necessarily only impact on capacity expansion and a greater volume of passengers, the perceived additional demand justifying expansion also was a force for the CC decision – therefore, this is a two-way or re-enforcing influence).

Whether or not changes in the outcome come after the respective CC decisions (confirming the hypothesis that indeed the decision made an impact), or earlier (as anticipated effects, which would invalidate the hypothesis) were assessed by a simple Granger-causality test.[153] This test is a second panel data regression run where a number of new treatment variables were included which copy the original treatment variable, only shifted one or two periods back or forward. Where the variables shifting the actual treatment back in time appear significant or at least having considerably stronger explanatory power than the original treatment variable (suggesting that outcomes react on a treatment that did not yet take place), this could be seen an invalidation of the causality hypothesis.

London Heathrow and Glasgow Airport are two airports that, although not directly affected by the CC's decisions, could be indirectly affected, hence may be less appropriate to include within the control group.

[152] Note that this approach assumes a one-off shift and not a gradual accumulation of impacts.

[153] Granger, C. W. J. (1969), "Investigating Causal Relations by Econometric Models and Cross-spectral Methods". Econometrica 37(3): 424–438.

Accordingly, the econometric models were run with and without these two airports (LHR, GLA) in the control group.

Arguments can be made both for and against including LHR and GLA in the control group. On the one hand GLA and LHR may have been affected indirectly by the CMA's remedies, which might suggest exclusion from the control group. On the other hand GLA and LHR were not directly-affected and the objective of this specific analysis was to identify the effect on airports directly-affected by the remedy.

Regression outputs showed a small difference between the two variants, with a higher coefficient compared with other regressions. Although this suggests some potential upside to the estimated scale of changes observed in the market, bottom-line results for this study are taken from models fitted on the full control group i.e. including LHR and GLA. This decision was taken principally on the basis that including LHR and GLA in the control group maintains a consistent treatment across non-directly affected airports and also preserves the maximum sample size in the control group.

A4.4.2 Alternative approaches: Difference-in-differences approaches

DiD analysis works by comparing how trends in an outcome differ between a treated (i.e. airports directly affected by the CC decision) and untreated (i.e. airports not directly affected by the CC decision) groups over a time period relevant to the intervention[154]. The use of DiD enables causality to be established (i.e. that the changes observed in the affected airports are a result of the CC decision)[155]. This enables the determination of the level of change observed in the outcome and to assign economic benefits to this change.

When using DiD, there are some key assumptions that need to be made about the untreated group (i.e. airports not affected by the CC decision) to achieve an unbiased estimate of the intervention:

1. The evolution of the outcome variable for different airports is independent of each other (there is no unit interference). Especially the untreated airports should be entirely independent of the intervention i.e. not affected by the CC decision.
2. There exists a **common trend**, on average, between the treatment and untreated group. This means the trends for both groups will be the same for potential outcomes in the absence of the treatment – although unobserved time-invariant factors (specific to given airports or groups of airports) may impact on what outcome airports can achieve, these don't affect the trends in the outcome. It assumes that in the absence of the CC decision, the time trends would be the same between the airports. Any significant difference in this trend is interpreted to be as a result of the intervention (i.e. CC decision).

   This assumption also requires that no other changes (external to the CC decision) have occurred which could impact on the outcomes for either the untreated or treated airport.

DiD also requires a sufficient sample size for statistical power and to minimise bias from possible outliers/idiosyncratic developments at individual airports, and preferably several periods of observations to ensure that the common trend assumption can be verified.

After investigating its possible application, it was found that DiD was not preferable for any of the outcome variables. The DiD method is in effect a special panel data regression with additional constraints: grouped treatment being the most important one. This was however clearly not the case for the divestments of BAA assets. In practice, setting up one common treatment time for the three airports concerned could have been done for instance by finding an 'average' treatment time or by simply dropping data from the months between the first and last divestment from the model. The first solution

[154] DiD analysis was designed as a special class of panel regression investigating treatment effects, where the treatment is indiscriminately affecting a whole group. In its classic textbook variant it covers only two time periods ('before' and 'after') and a homogenous treatment dummy, but it can be extended (and usually benefits from extending) to multiple 'before' and 'after' time periods and different treatment levels ('dosage'), as well as heterogeneous treatment effects. It can also be well combined with matching.

[155] In practice, it will focus on estimating the effect of the treatment variable and possible time-variant exogenous factors ('controls'), netting out time effects which are assumed to be the same for both the treatment and control groups.

would have led to a underestimation for the treatment effect (if we assume a positive effect) as the period assigned in the model as post-treatment would have in fact contained pre-treatment months for at least Stansted (which was the latest airport to be divested). The second solution would have resulted in a considerable loss of information, weakening the power of the models. In conjunction with this argument, the application of the DiD approach would have suffered more from the low sample size than a more flexible panel regression approach.

Due to inherent differences observed in the outcomes across treated and untreated airports, it was also considered unlikely that the common trend assumption would hold in all cases. Alternative matching approaches have been reviewed by ICF, but concerns regarding the common trend assumption persisted. The results of a DiD analysis would not have been robust in this context.

A4.4.3 Alternative approaches: Time-series analysis

The complementary time-series analysis method used, where possible, was a Wald-test of a possible structural break in the series with known break time (i.e. the time when the sale was finalised).The model was based on a regression of various outcome variables - separately for given treatment airports - over the simple average of the same variable for the control airports, and it was tested whether the corresponding coefficient was significantly different after the treatment from the coefficient before it. Where a structural break was successfully identified for all airports (i.e. all three tests for the three treatment airports), this could be interpreted as supply reasonable evidence that the divesting had an observable impact.

A4.5 Model specifications

Panel data regression models were specified for the four areas for the econometric analysis, as follows.

Capacity development

- (1) logarithm of ATM or PAX regressed on treatment and common time effect, annual data, airport fixed effects
- (2) logarithm of ATM or PAX regressed on treatment, airport-specific long-term linear trends and common time effect, annual data, airport fixed effects
- (3) logarithm of de-seasonalised ATM or PAX regressed on treatment and common time effect (years), monthly data, airport fixed effects
- (4) logarithm of de-seasonalised ATM or PAX regressed on treatment, airport-specific long-term linear trends and common time effect, monthly data, airport fixed effects

The outcome variables were logarithmised in these models to focus on growth rates rather than absolute increases, which would have made comparison between airports difficult due to the large differences in size.

The ‘treatment dummies’ for three airports (LGW, STN, EDI) took the value of 1 from the month onwards after the purchase deal was finalised. When aggregated to annual level, this resulted in a fraction of 1 for STN for the year 2013 and EDI for 2012, effectively a smaller ‘treatment dosage’ for that given year (and the base treatment value 1 for subsequent years).

To allow for airport-specific trends, a simple linear trend for 1998-2015 was fitted for individual airports on the original or logarithmised outcome variables. The rationale for including airport-specific linear trends in certain regression models as explanatory variables was to check the robustness of the model. Specifically, if the coefficient for the treatment in the full model remains close to that in the restricted model (without airport-specific trends), the assumption of a common trend (in absence of the divestment) can more easily be accepted. In a simple textbook example, the coefficient of the airport-specific trend itself would be close to zero and insignificant. This was not expected for the regression models applied in this study, because the evolution of the indicators measured at individual airports would plausibly differ from each other, yielding a positive and significant coefficient. However, the significance of the coefficient should disappear when grouping airports into treatment and control groups, lending support to the ‘common trend’ claim on aggregate.

For fitting the linear trend, two possible time periods were considered: the full time period for which data was available, or data up to 2009 only, i.e. before the first divestment or 'treatment' took place. There is indeed an observable difference in the coefficients of interest between the two alternatives, although not large.

The latter option would in theory be favourable, as the fitted trend would not be influenced by treatment effects, possibly biasing the treatment effect estimation as it would absorb some of the impacts among the divested airports. It was found, however, that the full time period for fitting the linear trend is better, as the trend up to 2009 will not take account of changes in airport-specific trends after 2009. Fitting airport-specific trends on values up to 2009, i.e. before the treatments were applied, would lead to a good fit for pre-2009 but a weak fit for later years; extrapolated figures (out-of-sample predicted values) for the post-2009 period are generally higher than the actual figures – as post-recovery passenger figures and other operational variables did not go back up to the trend line seen before the 2008-2009 economic crisis. Applying this linear trend (based on the reduced period) as an explanatory variable in the fixed-effects regression models would in any case reduce precision (because of the bad overall fit) but will also run the risk of biased estimates for airports where the trends have changed more vis-à-vis early years.

Route development

- (1) Share of new routes within total, regressed on treatment and common time effect, annual data, airport fixed effects
- (2) Share of seat capacity on new routes within total, regressed on treatment and common time effect, annual data, airport fixed effects
- (3) Seat turnover indicator, regressed on treatment and common time effect, annual data, airport fixed effects

The pre-defined outcome variables are (i) the share of new routes for a given airport (not served in previous year) within total routes operated in that year (these shares were calculated to bring all airports to approximately the same value scale, making the figures comparable); and (ii) the share of seat capacity on the new routes within total seat capacity for the given year.

A new indicator 'route turnover' was defined as RT = (new routes + closed routes) / (actual routes + closed routes), and the same for the corresponding seat capacity. This indicator is 100% if all routes are new in a given year and zero if and only if there were new routes nor closed routes. A weakness of this indicator is that it is not possible to tell for a value between the two extremes to what extent the turnover signals new route openings or old routes being closed.

Airport fees

No regression model was developed here due to clearly very different trends for airports with available data, and the very limited number of observations available (no observations post 2013, and no observation for 2013, the only post-treatment period for STN)

Airport efficiency

- (1) De-seasonalised PAX/ATM regressed on treatment and common time effect, monthly data, airport fixed effects
- (2) De-seasonalised PAX/ATM regressed on treatment, airport-specific long-term linear trends and common time effect, monthly data, airport fixed effects
- (3) Annual PAX/staff regressed on treatment and common time effect, monthly data, airport fixed effects
- (4) Annual PAX/staff regressed on treatment, airport-specific long-term linear trends and common time effect, monthly data, airport fixed effects

To allow for airport-specific trends, a linear trend on data up to 2009 was fitted for individual airports as explained under Capacity development above.

Summary

The variables used in the various models and their respective timeframe are summarised in the table below.

Table A4.2 Outcome and explanatory variables used in the fixed-effects panel data regression

Effect analysed	Model	Outcome variable	Explanatory variables	Timeframe
Capacity development	ATM1	Air transport movements (logarithm)	Common time effect (by year) Treatment dummy	Monthly
	ATM2	Air transport movements (logarithm)	Common time effect (by year) Airport-specific linear trend of outcome variable Treatment dummy	Monthly
	ATM3	Air transport movements (logarithm)	Common time effect (by year) Treatment dummy	Yearly
	ATM4	Air transport movements (logarithm)	Common time effect (by year) Airport-specific linear trend of outcome variable Treatment dummy	Yearly
	PAX1	Passenger number (logarithm)	Common time effect (by year) Treatment dummy	Monthly
	PAX2	Passenger number (logarithm)	Common time effect (by year) Airport-specific linear trend of outcome variable Treatment dummy	Monthly
	PAX3	Passenger number (logarithm)	Common time effect (by year) Treatment dummy	Yearly
	PAX4	Passenger number (logarithm)	Common time effect (by year) Airport-specific linear trend of outcome variable Treatment dummy	Yearly
Airline switching / route development	1	Share of new routes within total	Common time effect (by year) Treatment dummy	Yearly
	2	Share of seat capacity on new routes within total	Common time effect (by year) Treatment dummy	Yearly
	3	Seat turnover indicator	Common time effect (by year) Treatment dummy	Yearly
Airport fees	-	(None)	-	-
Airport efficiency	1	De-seasonalised PAX per de-seasonalised ATM	Common time effect (by year) Treatment dummy	Monthly
	2	De-seasonalised PAX per de-seasonalised ATM	Common time effect (by year) Airport-specific linear trend of outcome variable Treatment dummy	Monthly
	3	Passenger number per number of employees	Common time effect (by year) Treatment dummy	Yearly
	4	Passenger number per number of employees	Common time effect (by year) Airport-specific linear trend of outcome variable Treatment dummy	Yearly

A4.6 Graphs and regression outputs

A4.6.1 Capacity development

A4.6.1.1 Descriptive statistics on key data used

Following table gives key descriptive statistics on the filtered and imputed monthly CAA dataset used for modelling, including the number of imputed observations and mean and standard error for both the original and imputed dataset.

	No. of obs.*			Imputed obs.	Mean		Standard error	
Variable	*i*	*t*	*N*	N_{imp}	Original	Imputed	Original	Imputed
ATM	24	214	5136	24	6456	6450	8317	8313
PAX	24	214	5136	1	715378	715302	1216490	1216384

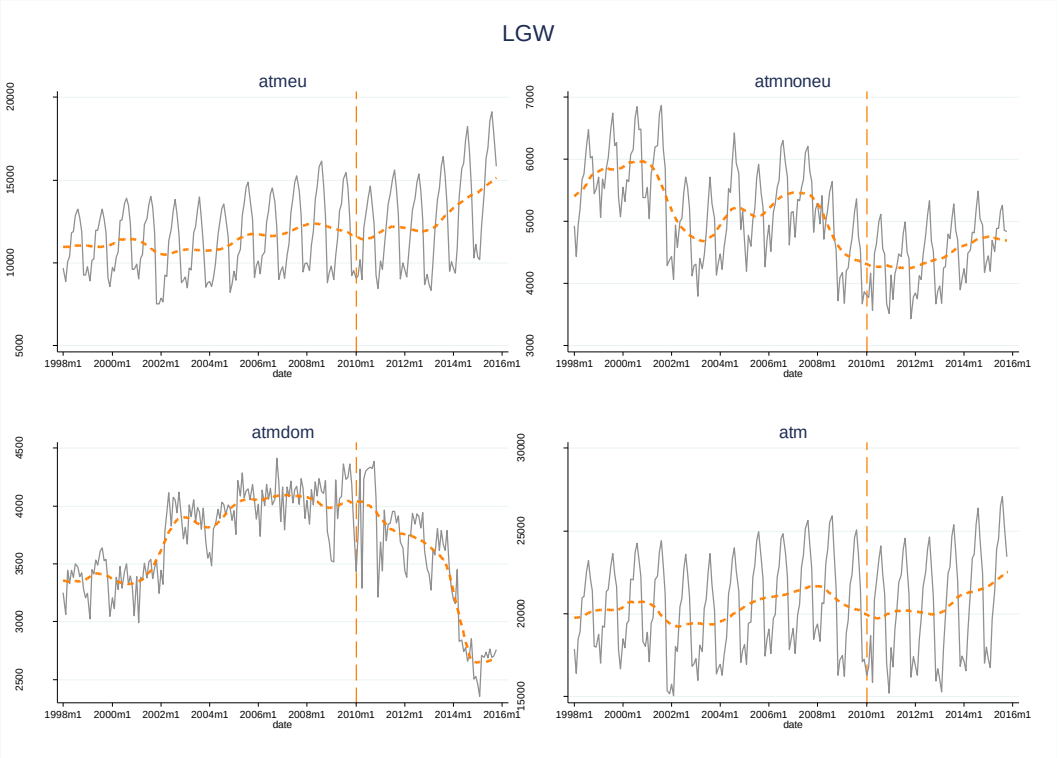
** i = airports covered (panel); t = months covered; N = total number of non-missing airport/month observations*

The particular data missing were the following: PAX - ABZ, 2013m7; ATM – all airports: 1999m12.

A4.6.1.2 Graphs

Figure A4.2 Evolution of EU, non-EU, domestic and total ATM and PAX numbers at LGW and their trend component (1998 Jan – 2015 Oct)

ATM



PAX

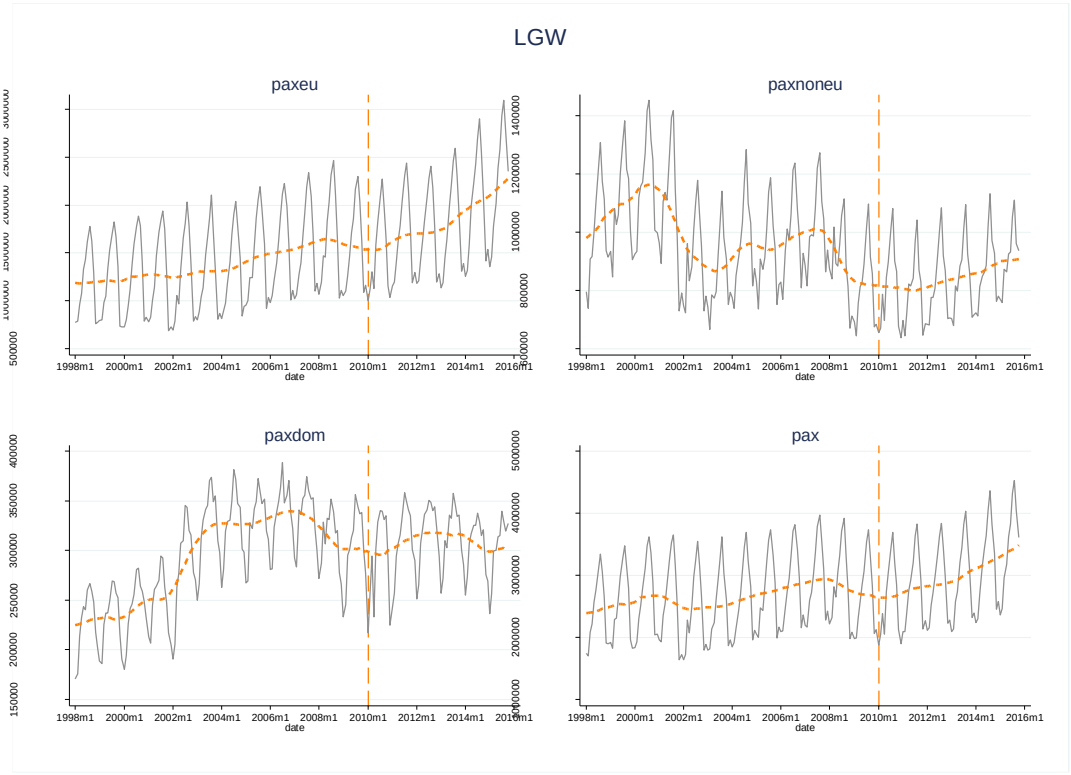
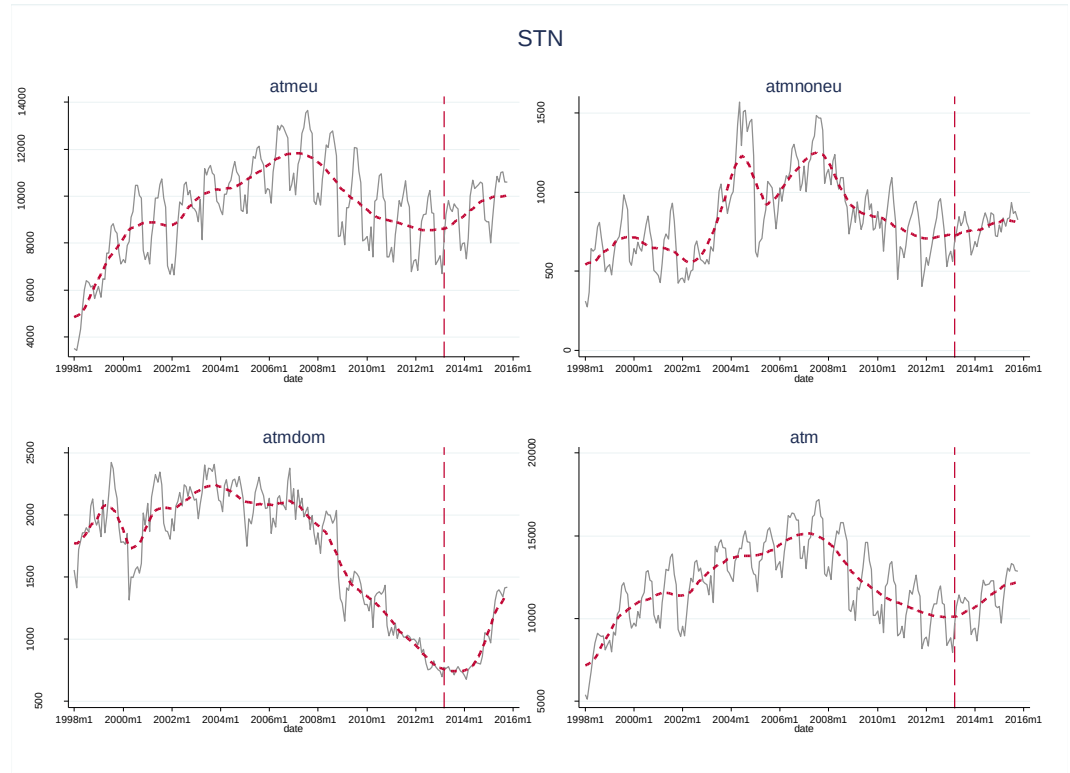
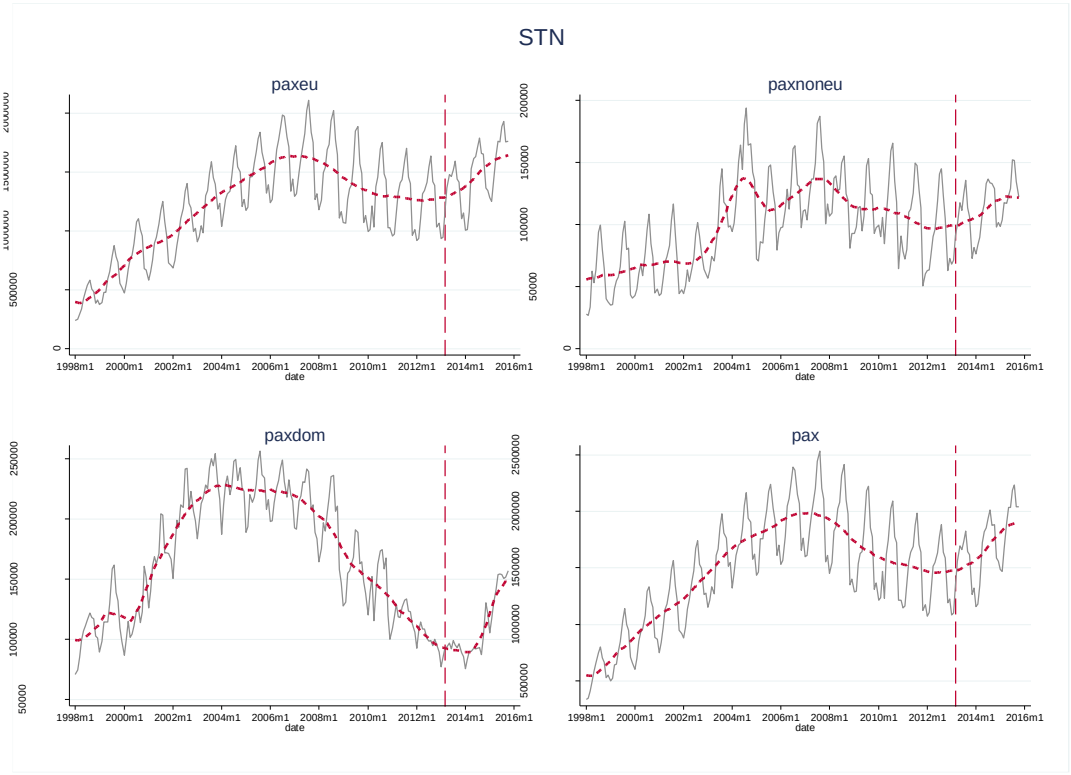


Figure A4.3 Evolution of EU, non-EU, domestic and total ATM and PAX numbers at STN and their trend component (1998 Jan – 2015 Oct)

ATM



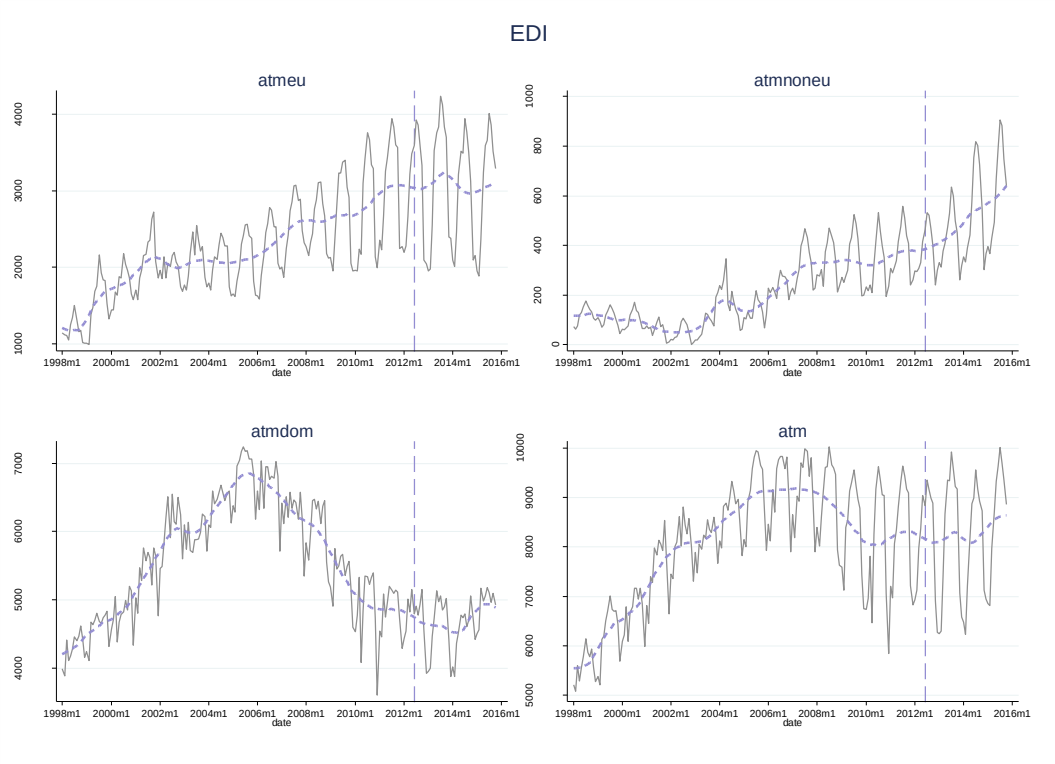
PAX



Note: The time of the application of the 'treatment' (the finalisation of the purchase deal) is indicated by a vertical dashed line

Figure A4.4 Evolution of EU, non-EU, domestic and total ATM and PAX numbers at EDI and their trend component (1998 Jan – 2015 Oct)

ATM



PAX

Note: The time of the application of the 'treatment' (the finalisation of the purchase deal) is indicated by a vertical dashed line

Figure A4.5 Evolution of annual aggregate ATM numbers (logarithm) (1998-2015)

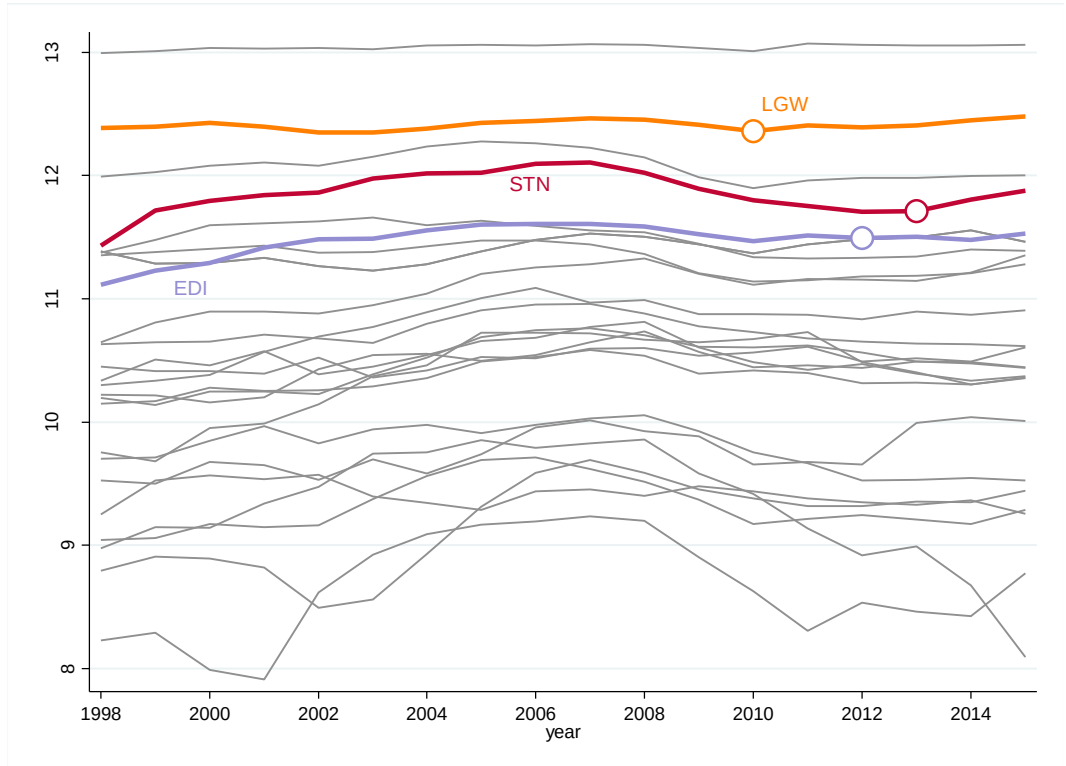


Figure A4.6 Evolution of annual aggregate PAX numbers (logarithm) (1998-2015)

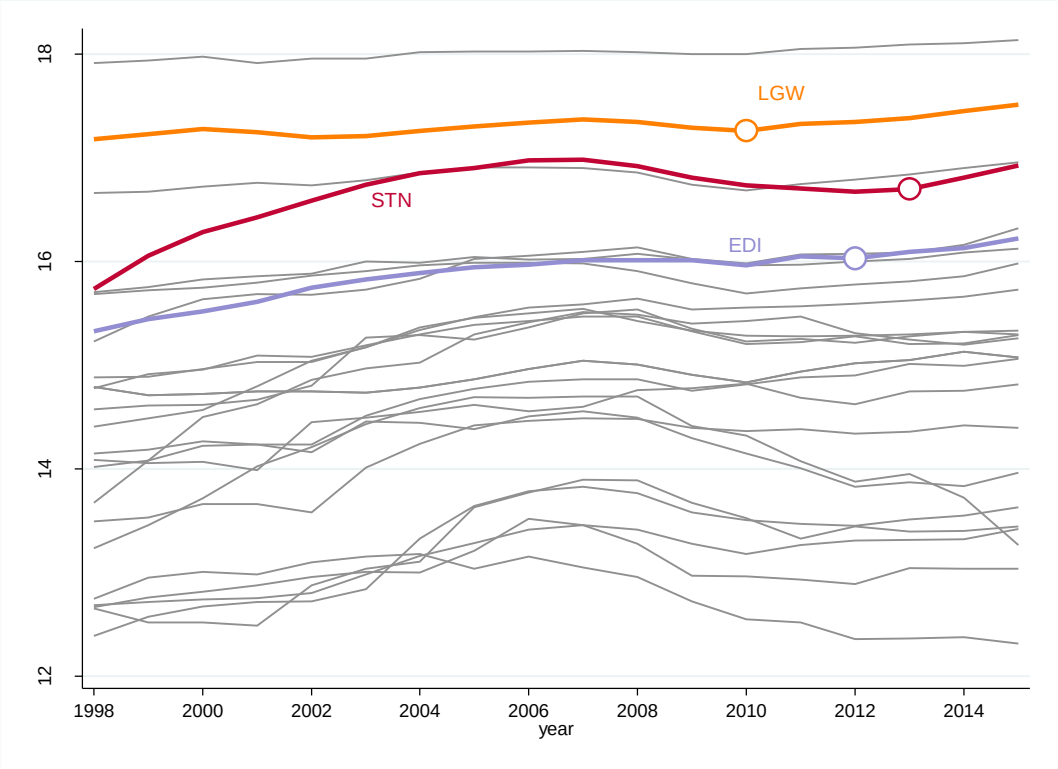


Figure A4.7 Residuals in ATM numbers (logarithm) after removing time effects and airport fixed effects

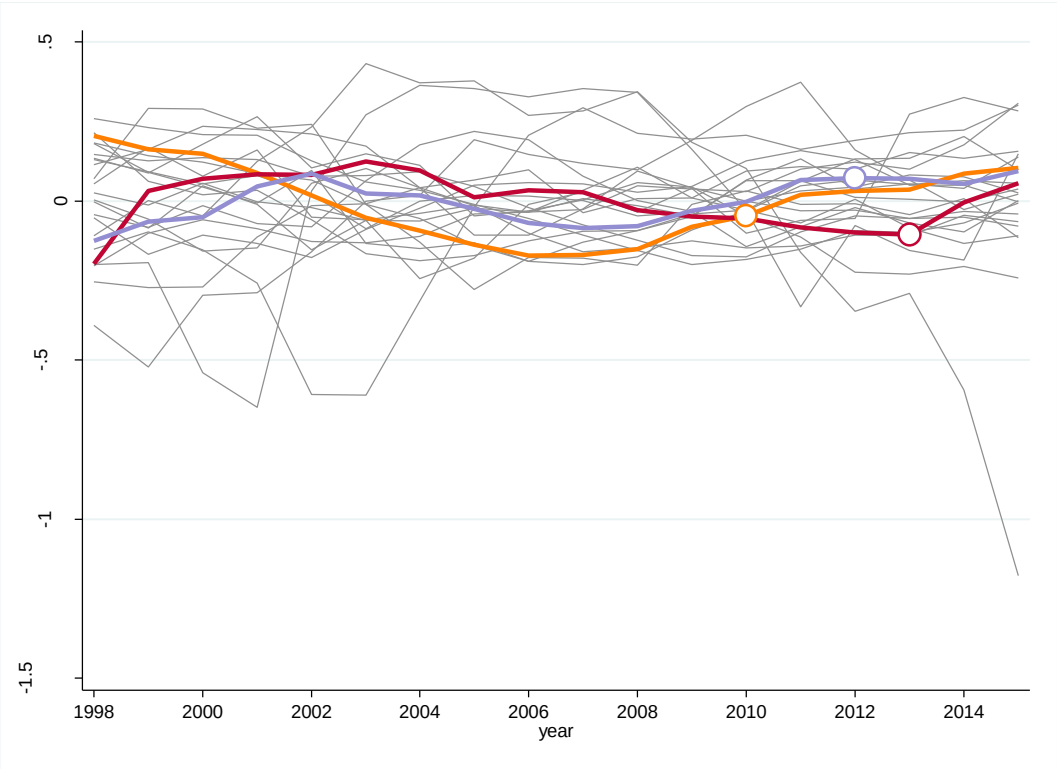
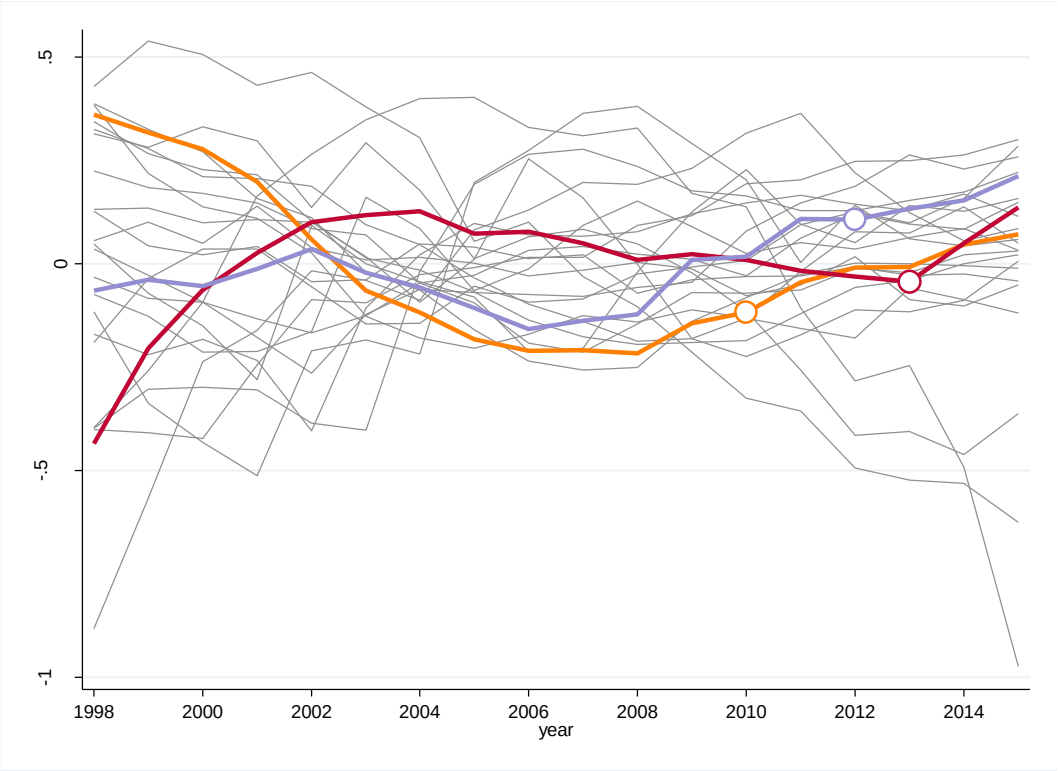


Figure A4.8 Residuals in PAX numbers (logarithm) after removing time effects and airport fixed effects



A4.6.1.3 Regression output – ATM

A. Regression output with full control group, one-off trend shift vs. gradually increasing treatment effect

	Model (1)		Model (2)		Model (3)		Model (4)	
	lnATM, yearly		lnATM, controlling for airport specific trend, yearly		lnATM, monthly		lnATM, controlling for airport specific trend, monthly	
	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Year effects	Yes		Yes		Yes		Yes	
Airport-specific lin. trend	No		Yes		No		Yes	
Treatment effect	0.06	0.06	0.07	0.07	0.09***	0.10***	0.09***	0.10***
	(0.94)	(0.97)	(1.42)	(1.45)	(6.31)	(6.5)	(7.49)	(7.71)
Constant	10.43***	10.43***	-0.18	-0.18	7.94***	7.94***	-0.15	-0.15
	(294.7)	(294.72)	(-0.25)	(-0.25)	(813.53)	(813.73)	(-0.97)	(-0.97)
N (apt x period) =	432		432		5,128		5,128	
Nk (apt) =	24		24		24		24	
R2								
- within	0.37	0.37	0.60	0.60	0.37	0.37	0.59	0.59
- between	0.20	0.20	1.00	1.00	0.23	0.23	1.00	1.00
- overall	0.02	0.02	0.99	0.99	0.02	0.02	0.99	0.99

Notes:

(a) treatment effect defined as a one-off shift (value 0 before divestment, 1 after)

(b) gradual treatment effect assumed, linear increase for the value from zero 12 months before divestment to one 12 months after.

*t statistics in brackets. * Significant at 5% ** 1% *** 0.1%*

B. Regression output with LHR and GLA omitted from control group, treatment defined as one-off trend shift

	Model (1) lnATM, yearly	Model (2) lnATM, controlling for airport specific trend, yearly	Model (3) lnATM, monthly	Model (4) lnATM, controlling for airport specific trend, monthly
Year effects	Yes	Yes	Yes	Yes
Airport-specific lin. trend	No	Yes	No	Yes
Treatment effect	0.06	0.08	0.10***	0.11***
	(0.89)	(1.63)	(6.29)	(8.63)
Constant	10.27***	-0.22	7.78***	-0.19
	(273.34)	(-0.29)	(753.03)	(-1.19)
N (apt x period) =	396	396	4700	4700
Nk (apt) =	22	22	22	22
R2				
- within	0.40	0.62	0.40	0.60
- between	0.32	1.00	0.37	1.00
- overall	0.02	0.98	0.03	0.98

*Note: t statistics in brackets. * Significant at 5% ** 1% *** 0.1%*

A4.6.1.4 Regression output - PAX

A. Regression output with full control group, one-off trend shift vs. gradually increasing treatment effect

	Model (1)		Model (2)		Model (3)		Model (4)	
	lnPAX, yearly		lnPAX, controlling for airport specific trend, yearly		lnPAX, monthly		lnPAX, controlling for airport specific trend, monthly	
	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Year effects	Yes		Yes		Yes		Yes	
Airport-specific lin. trend	No		Yes		No		Yes	
Treatment effect	0.08	0.09	0.09	0.09	0.09***	0.09***	0.12***	0.13***
	(1.09)	(1.16)	(1.75)	(1.81)	(4.63)	(4.76)	(9.47)	(9.78)
Constant	14.53***	14.53***	-0.23	-0.23	12.05***	12.05***	-0.27	-0.27
	(337.68)	(337.88)	(-0.35)	(-0.35)	(999.21)	(999.32)	(-1.67)	(-1.7)
N (apt x period) =	432		432		5,128		5,128	
Nk (apt) =	24		24		24		24	
R2								
- within	0.55	0.55	0.80	0.80	0.54	0.54	0.79	0.79
- between	0.21	0.20	1.00	1.00	0.18	0.18	1.00	1.00
- overall	0.03	0.03	0.99	0.99	0.03	0.03	0.99	0.99

Notes:

(a) treatment effect defined as a one-off shift (value 0 before divestment, 1 after)

(b) gradual treatment effect assumed, linear increase for the value from zero 12 months before divestment to one 12 months after.

*t statistics in brackets. * Significant at 5% ** 1% *** 0.1%*

B. Regression output with LHR and GLA omitted from control group, treatment defined as one-off trend shift

	Model (1) lnPAX, yearly	Model (2) lnPAX, controlling for airport specific trend, yearly	Model (3) lnPAX, monthly	Model (4) lnPAX, controlling for airport specific trend, monthly
Year effects	Yes	Yes	Yes	Yes
Airport-specific lin. trend	No	Yes	No	Yes
Treatment effect	0.07	0.10*	0.09***	0.15***
	(0.98)	(2.06)	(4.3)	(11.15)
Constant	14.32***	-0.28	11.84***	-0.35*
	(315.94)	(-0.41)	(933.98)	(-2.12)
N (apt x period) =	396	396	4700	4700
Nk (apt) =	22	22	22	22
R2				
- within	0.58	0.82	0.57	0.81
- between	0.33	1.00	0.30	1.00
- overall	0.04	0.99	0.04	0.99

*Note: t statistics in brackets. * Significant at 5% ** 1% *** 0.1%*

A4.6.2 Route development

A4.6.2.1 Descriptive statistics on key data used

The table below summarises key descriptive statistics on the filtered monthly IATA SRS dataset (note: with an unknown amount of data gaps) used for the econometric modelling work.

	No. of obs.*				Mean		
Variable	***i***	***j***	***t***	***N***	**for airports**	**for airlines**	**for months**
Routes	24	323	155	302471	12603	936	1951
Flights	24	323	155	302471	485197	36052	75127
Seats	24	323	155	302471	73061334	5428706	11312723

** i = airports covered (panel); j = airline; t = months covered; N = total number of airport/month observations*

A4.6.2.2 Graphs

Figure A4.9 Evolution of the share of new routes within total (2003/04-2015/16)

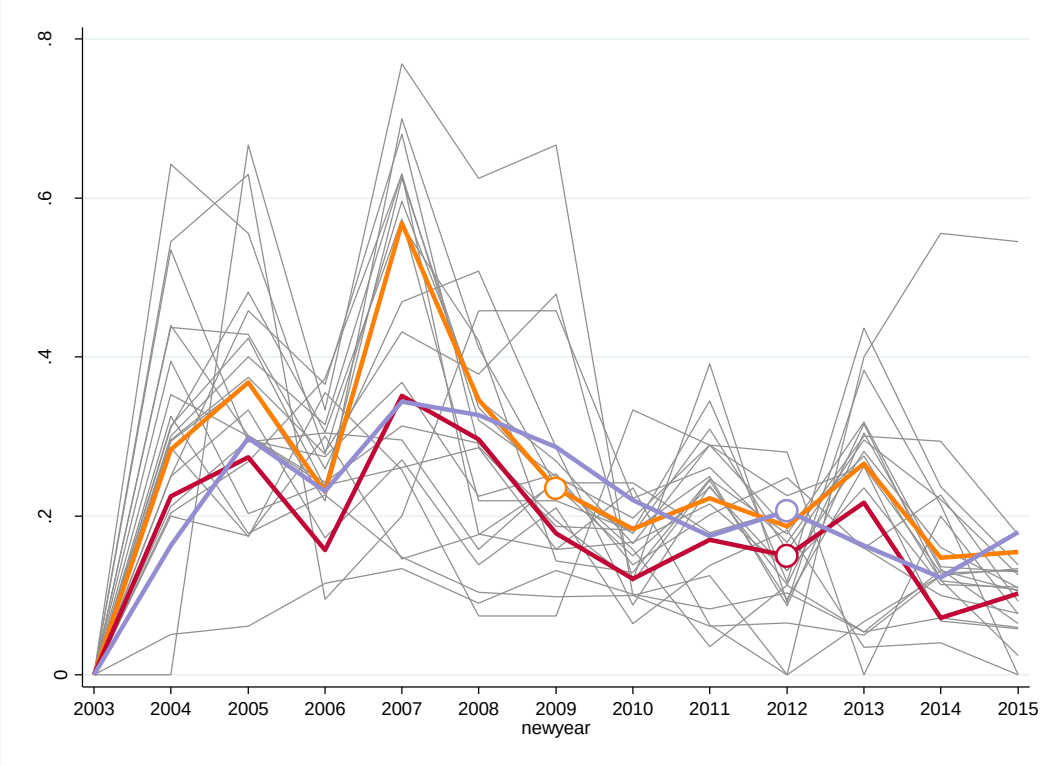


Figure A4.10 Evolution of the share of seat capacity on new routes within total (2003/04-2015/16)

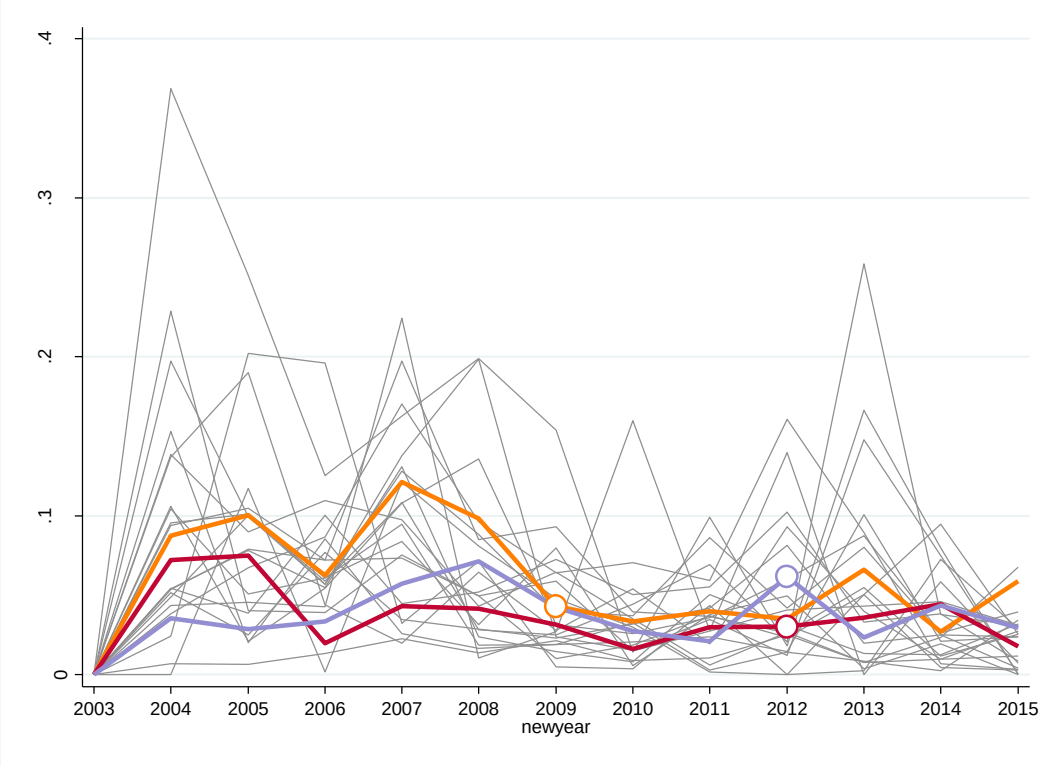
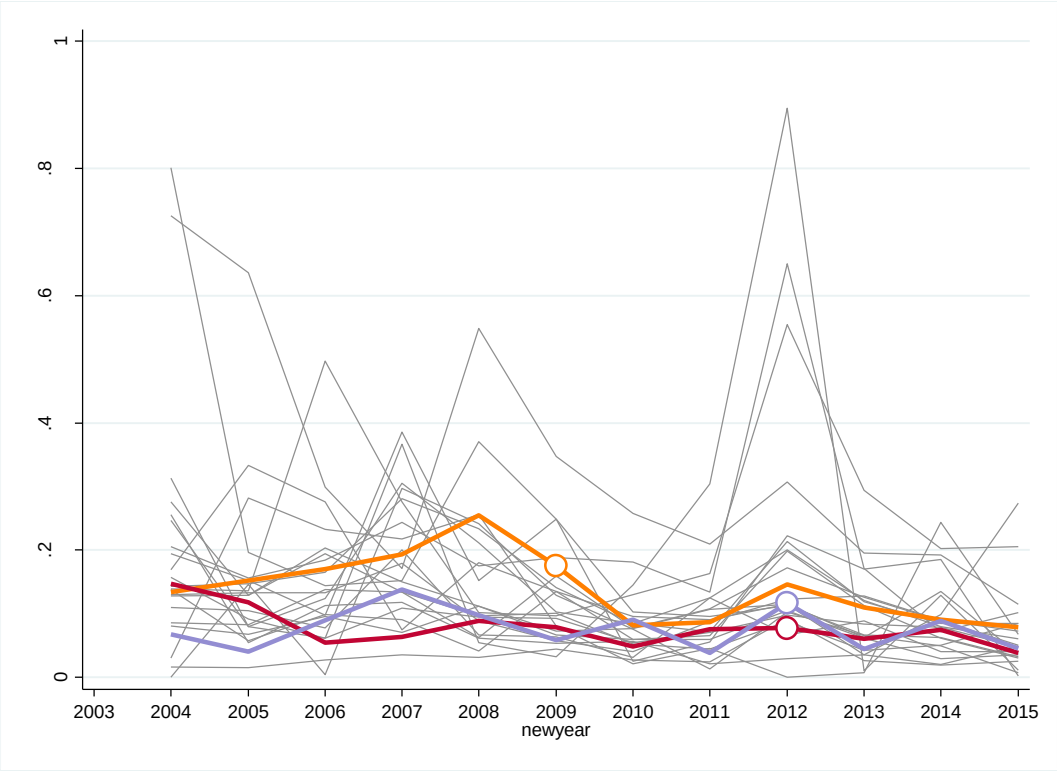


Figure A4.11 Evolution of seat capacity turnover rate (2003/04-2015/16)



A4.6.2.3 Regression output

A. Regression output with full control group, one-off trend shift vs. gradually increasing treatment effect

	Model (1)		Model (2)		Model (3)	
	Share of new routes		Share of seat capacity on new routes		Seat turnover indicator	
	(a)	(b)	(a)	(b)	(a)	(b)
Year effects	Yes		Yes		Yes	
Treatment effect	0.02	0.02	0.01	0.01	0.01	0.02
	(0.46)	(0.40)	(0.74)	(0.84)	(0.15)	(0.41)
Constant	0.30***	0.30***	0.09***	0.09***	0.20***	0.20***
	(14.15)	(14.15)	(10.77)	(10.77)	(9.79)	(9.79)
N (apt x period) =	288		288		288	
Nk (apt) =	24		24		24	
R2						
- within	0.44	0.44	0.26	0.26	0.19	0.19
- between	0.00	0.00	0.01	0.01	0.02	0.02
- overall	0.35	0.35	0.21	0.21	0.14	0.14

Notes:

(a) treatment effect defined as a one-off shift (value 0 before divestment, 1 after)

(b) gradual treatment effect assumed, linear increase for the value from zero 12 months before divestment to one 12 months after.

*t statistics in brackets. * Significant at 5% ** 1% *** 0.1%*

B. Regression output with LHR and GLA omitted from control group, treatment defined as one-off trend shift

	Model (1) Share of new routes	Model (2) Share of sea capacity on new routes	Model (3) Seat turnover indicator
Year effects	Yes	Yes	Yes
Treatment effect	0.02	0.02	0.02
	(0.53)	(1.00)	(0.48)
Constant	0.32***	0.10***	0.21***
	(13.74)	(10.65)	(9.55)
N (apt x period) =	264	264	264
Nk (apt) =	22	22	22
R2			
- within	0.44	0.28	0.20
- between	0.00	0.02	0.03
- overall	0.37	0.23	0.14

*Note: t statistics in brackets. * Significant at 5% ** 1% *** 0.1%*

A4.6.3 Airport fees

A4.6.3.1 Graphs

Figure A4.12 Evolution of annual aeronautical revenues per ATM (2000 – 2013)

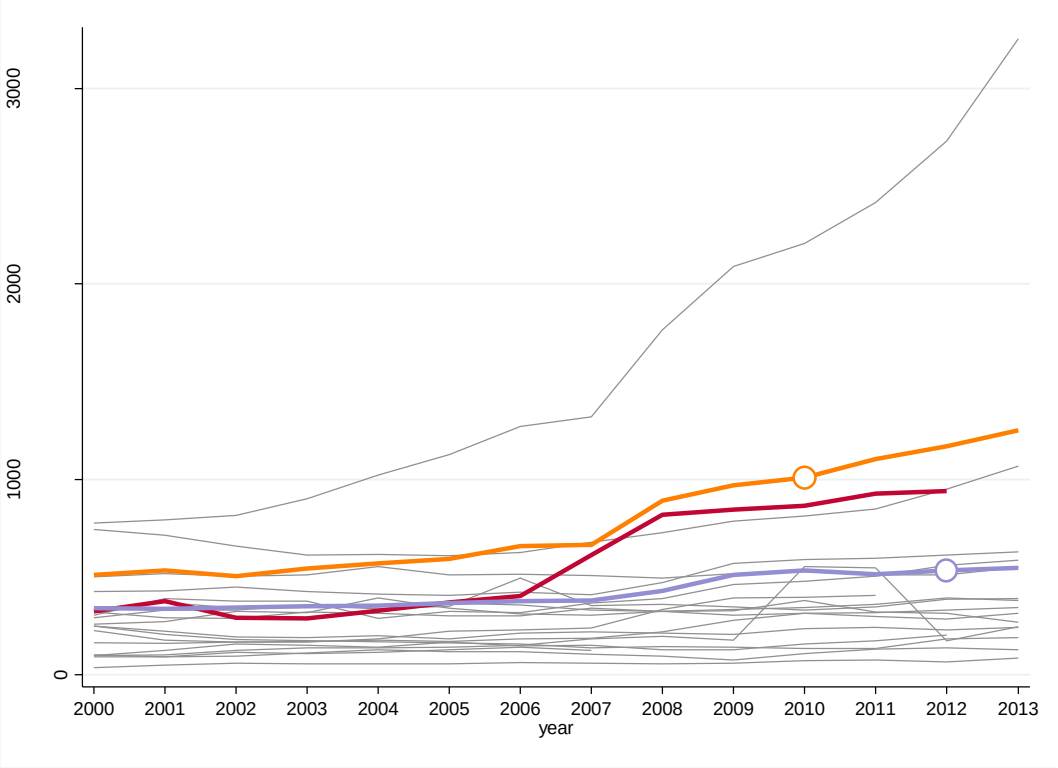
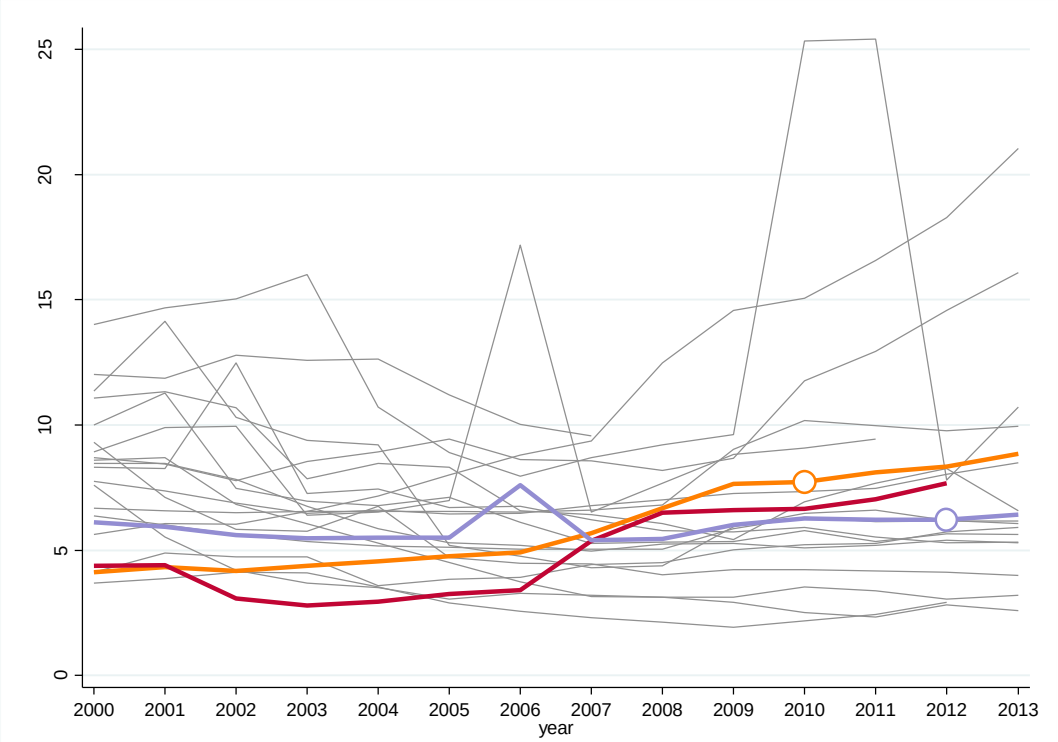


Figure A4.13 Evolution of annual aeronautical revenues per PAX (2000 – 2013)



Note: The time of the application of the 'treatment' (the finalisation of the purchase deal) is indicated by a circle

Figure A4.14 Residuals in aeronautical revenue per ATM after removing time effects and airport fixed effects

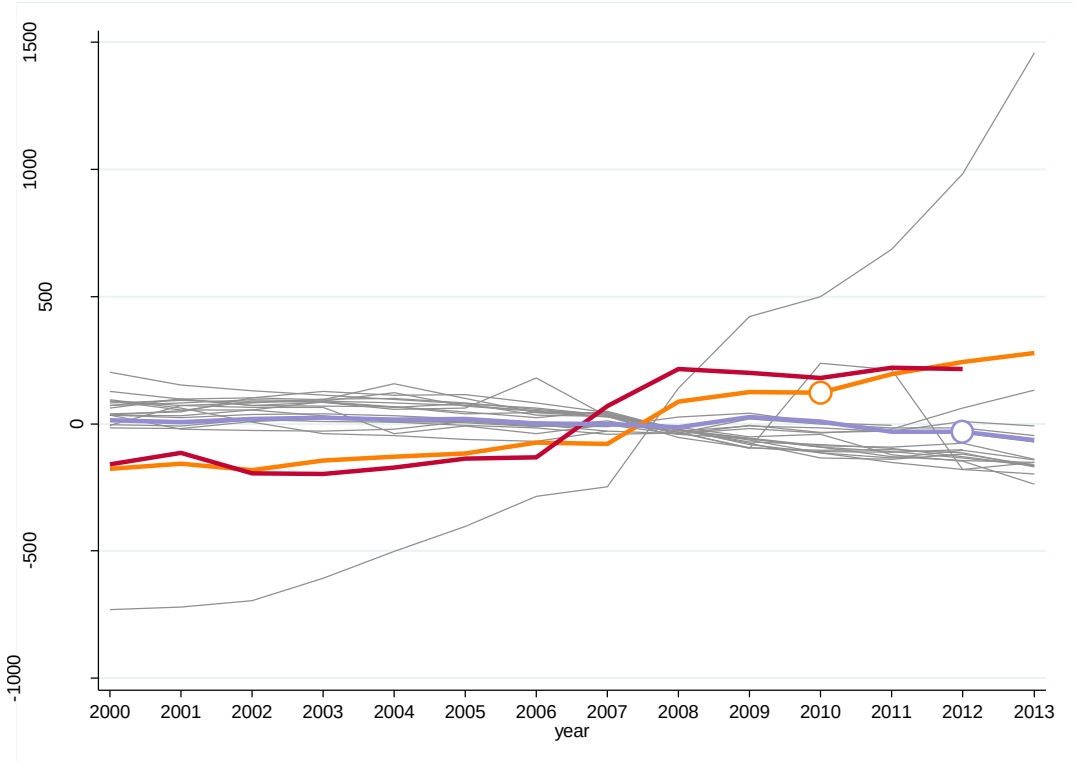


Figure A4.15 Residuals in aeronautical revenue per PAX after removing time effects and airport fixed effects

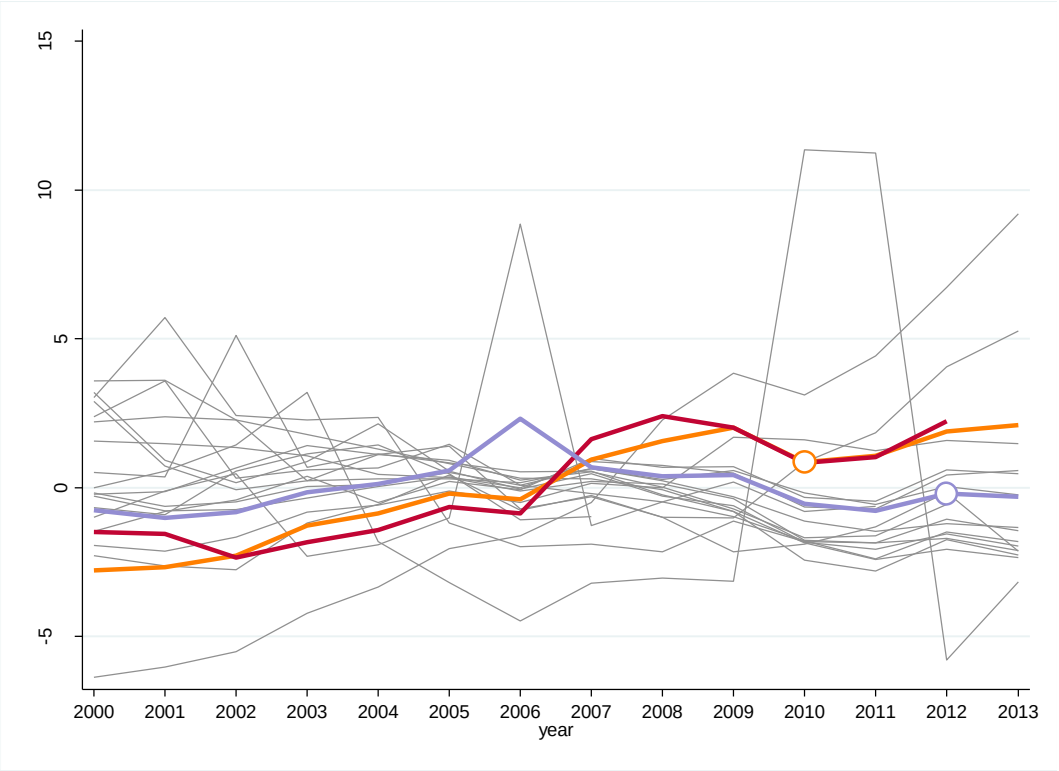


Figure A4.16 Residuals in aeronautical revenue per ATM after removing time effects and airport fixed effects – excluding LHR and MAN

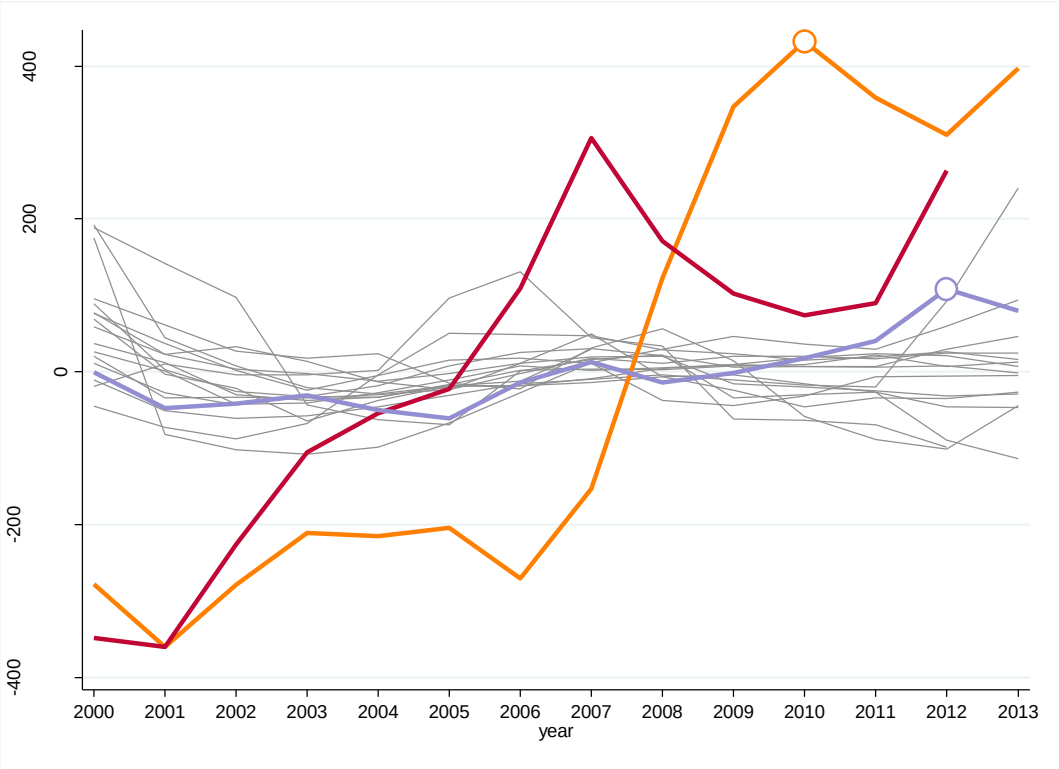
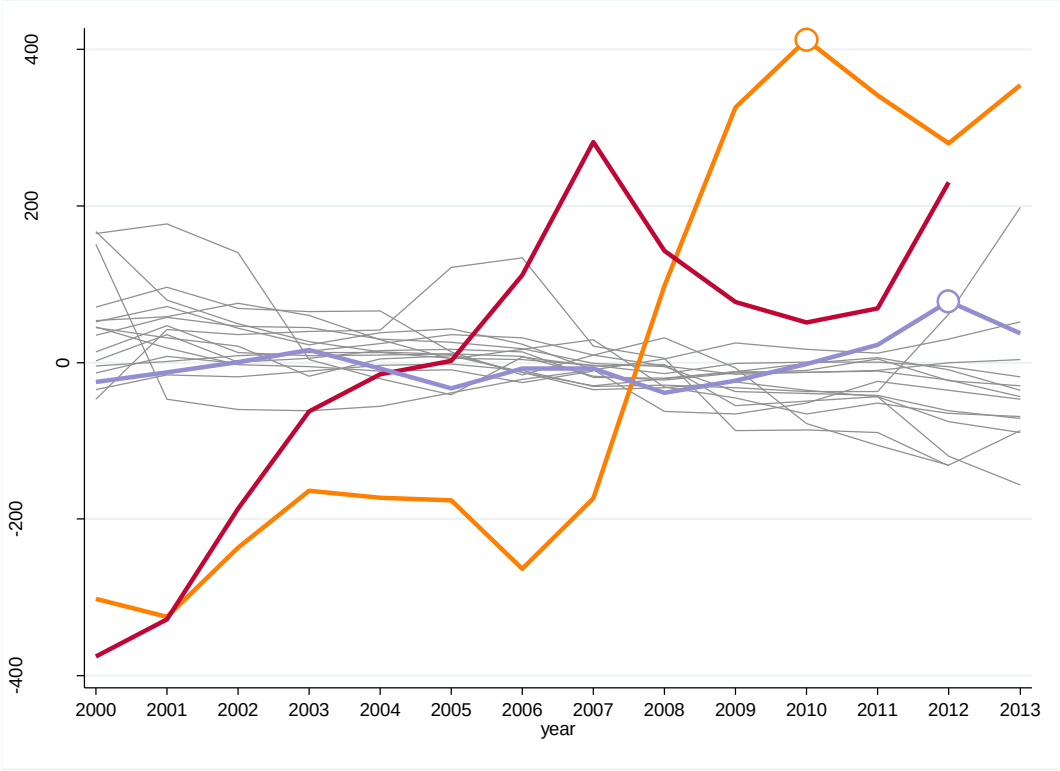


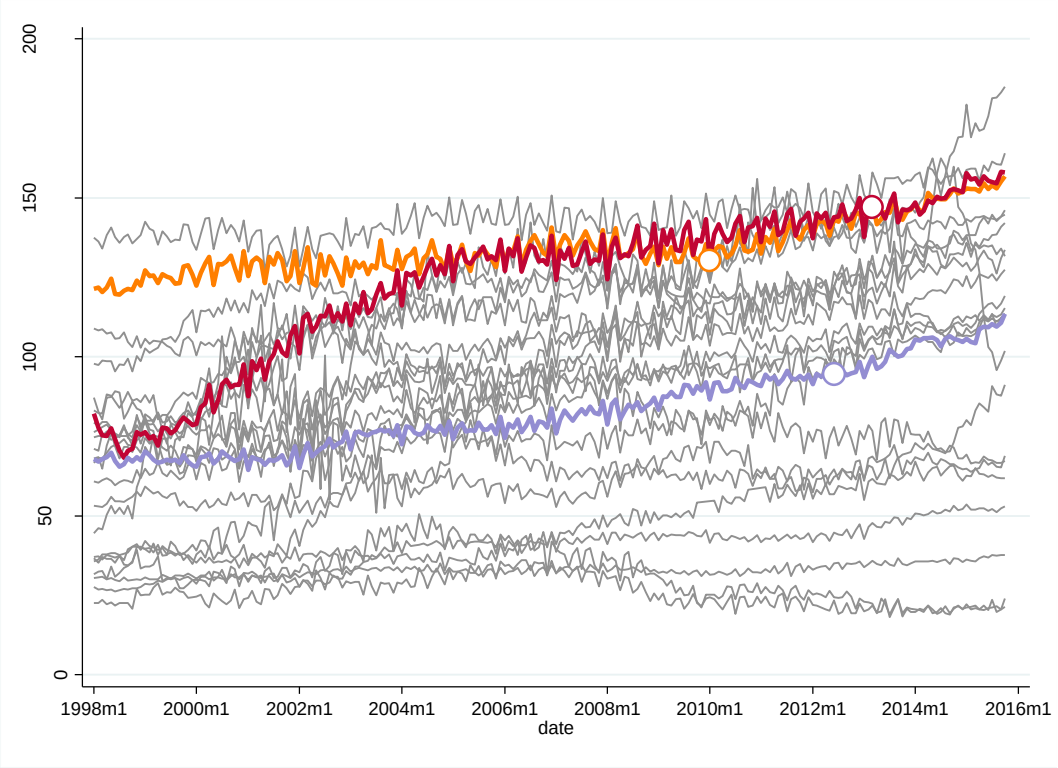
Figure A4.17 Residuals in aeronautical revenue per PAX after removing time effects and airport fixed effects – excluding EXT, LHR and MAN



A4.6.4 Airport efficiency

A4.6.4.1 Graphs

Figure A4.18 Evolution of monthly PAX/ATM figures, de-seasonalised (1998 Jan – 2015 Oct)



Note: The time of the application of the 'treatment' (the finalisation of the purchase deal) is indicated by a circle

Figure A4.19 Evolution of annual PAX / staff figures (2000– 2013)

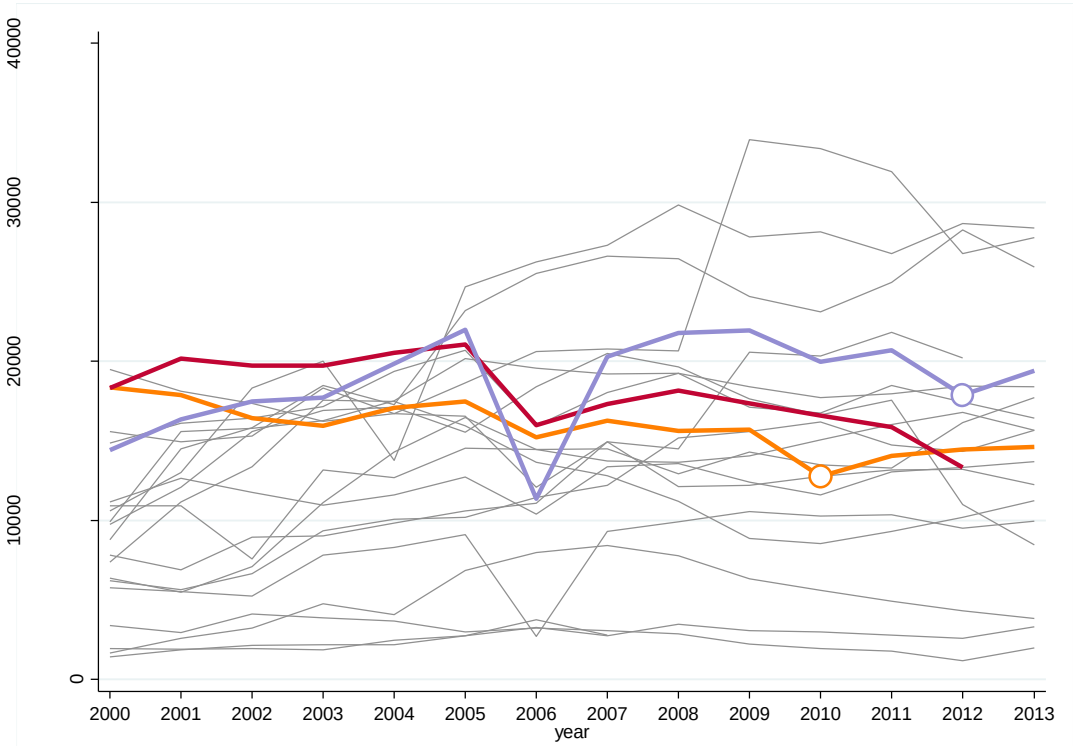


Figure A4.20 Residuals in de-seasonalised PAX/ATM numbers after removing time effects and airport fixed effects

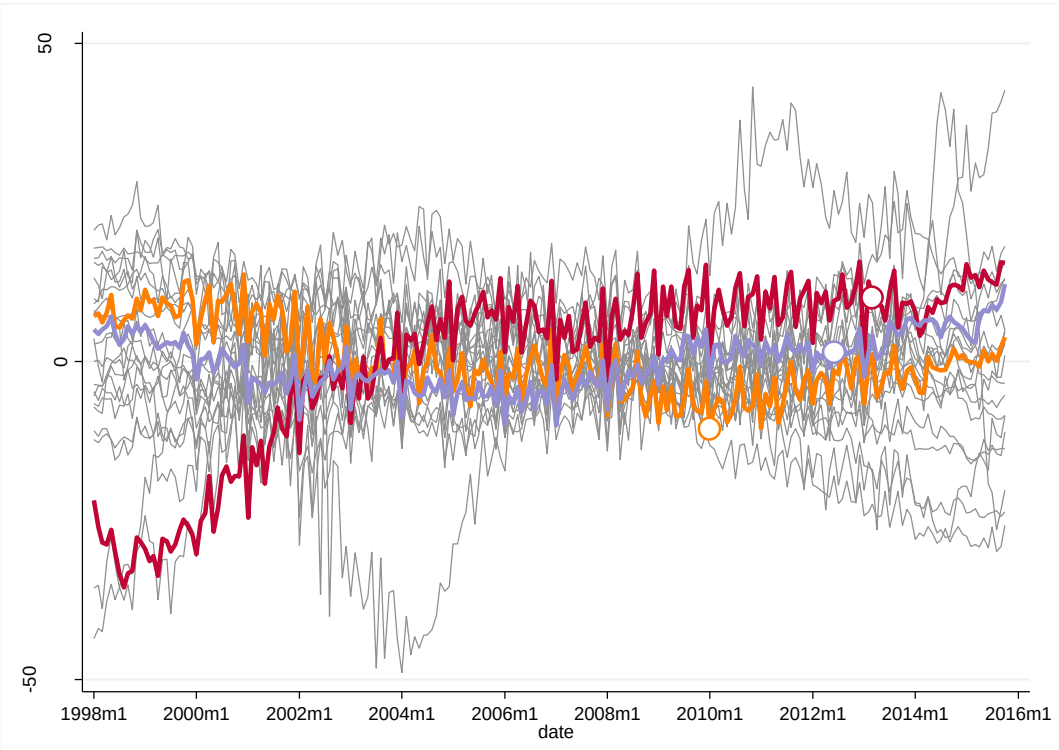


Figure A4.21 Residuals in de-seasonalised PAX/ATM numbers after removing time effects, airport fixed effects and airport-specific linear trend

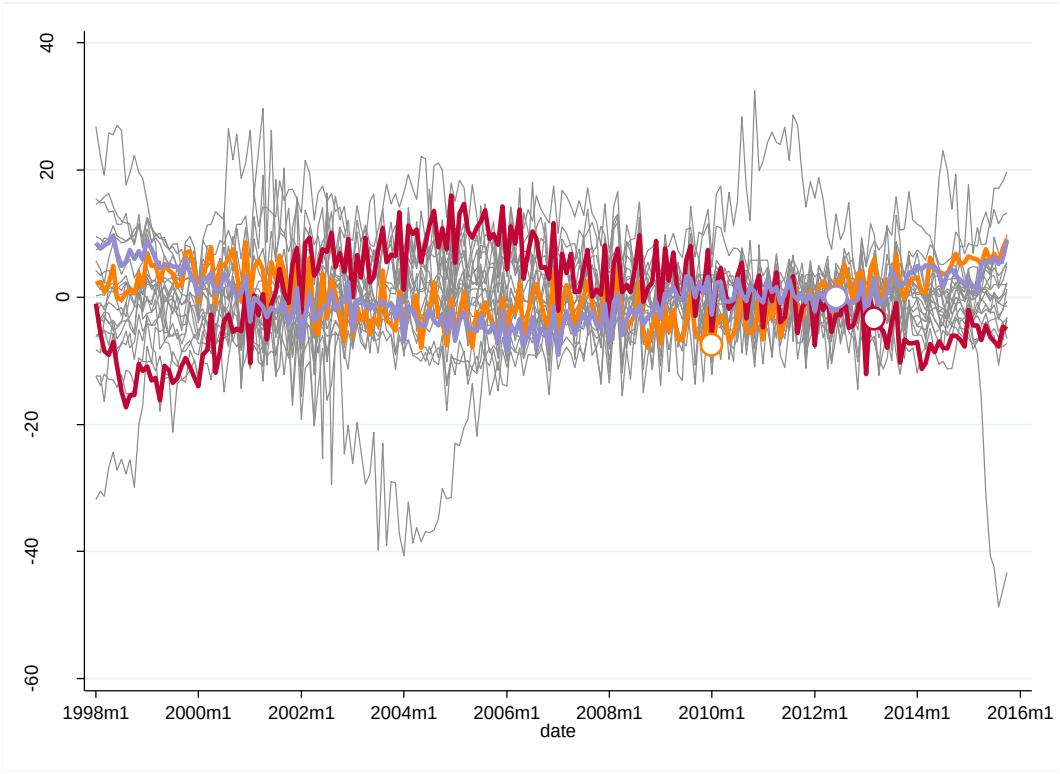


Figure A4.22 Residuals in annual PAX/staff numbers after removing time effects and airport fixed effects

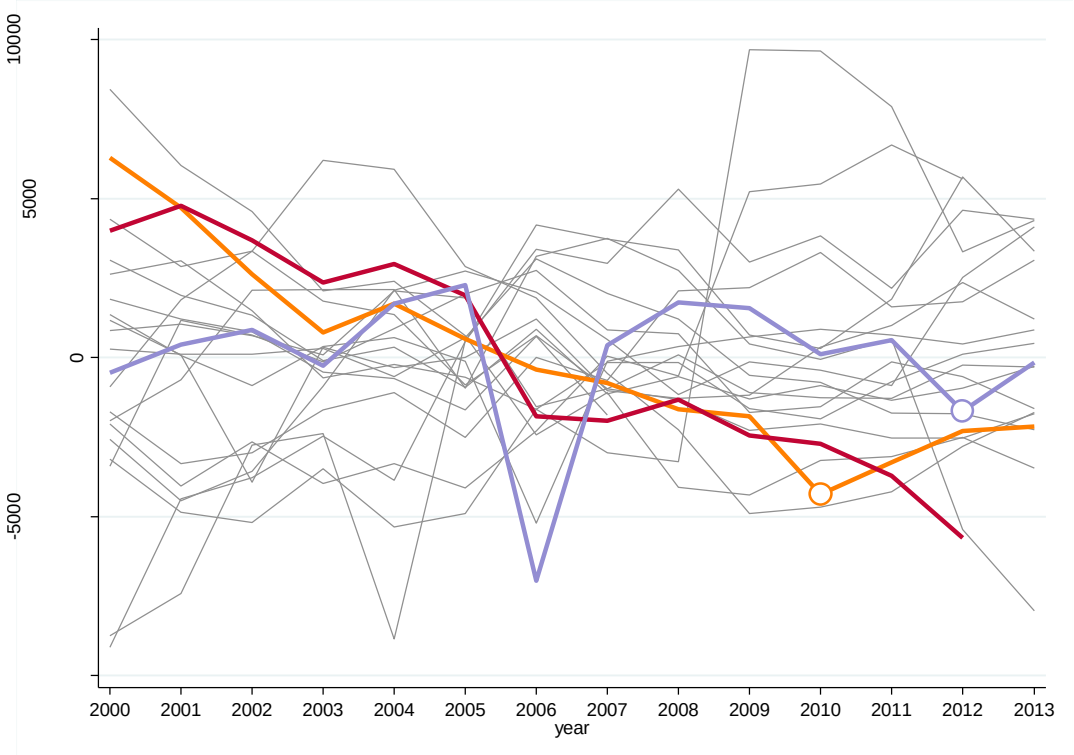
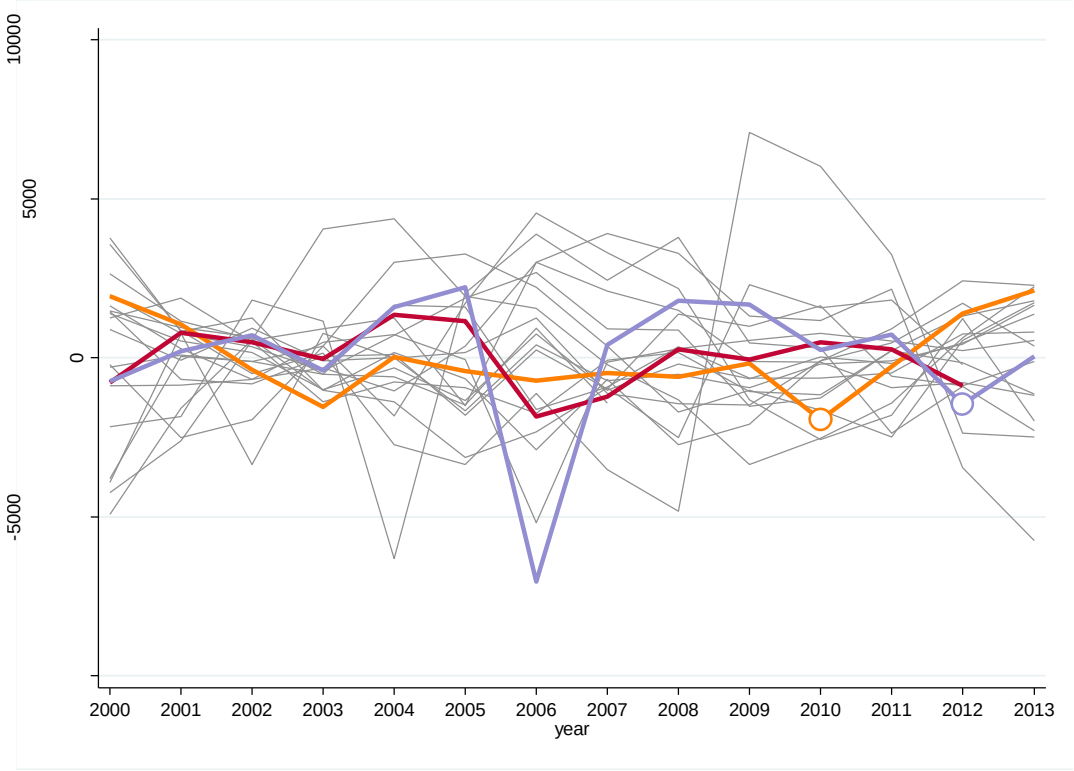


Figure A4.23 Residuals in annual PAX/staff numbers after removing time effects, airport fixed effects and airport-specific linear trend



A4.6.4.2 Regression output - PAX/ATM

A. Regression output with full control group, one-off trend shift vs. gradually increasing treatment effect

	Model (1)		Model (2)	
	De-seasonalised PAX/ATM, monthly		De-seasonalised PAX/ATM, controlling for airport specific trend, monthly	
	(a)	(b)	(a)	(b)
Year effects	Yes		Yes	
Airport-specific lin. trend	No		Yes	
Treatment effect	-1.58	-1.74	0.45	0.50
	(-1.7)	(-1.77)	(0.72)	(0.75)
Constant	67.40***	67.40***	-2.49*	-2.50*
	(110.68)	(110.68)	(-2.55)	(-2.55)
N (apt x period) =	5,128		5,128	
Nk (apt) =	24		24	
R2				
- within	0.54	0.54	0.79	0.79
- between	0.00	0.00	1.00	1.00
- overall	0.09	0.09	0.97	0.97

Notes:

(a) treatment effect defined as a one-off shift (value 0 before divestment, 1 after)

(b) gradual treatment effect assumed, linear increase for the value from zero 12 months before divestment to one 12 months after.

*t statistics in brackets. * Significant at 5% ** 1% *** 0.1%*

B. Regression output with LHR and GLA omitted from control group, treatment defined as one-off trend shift

	Model (1)	Model (2)
	De-seasonalised PAX/ATM, monthly	De-seasonalised PAX/ATM, controlling for airport specific trend, monthly
Year effects	Yes	Yes
	No	Yes
Treatment effect	-2.27*	0.73
	(-2.22)	(1.06)
Constant	63.83***	-2.75**
	(97.33)	(-2.8)
N (apt x period) =	4700	4700
Nk (apt) =	22	22
R2		
- within	0.54	0.79
- between	0.01	1.00
- overall	0.10	0.96

*Note: t statistics in brackets. * Significant at 5% ** 1% *** 0.1%*

A4.6.4.3 Regression output - PAX/staff

A. Regression output with full control group, one-off trend shift vs. gradually increasing treatment effect

	Model (1)		Model (2)	
	PAX/staff, yearly		PAX/staff, controlling for airport specific trend, yearly	
	(a)	(b)	(a)	(b)
Year effects	Yes		Yes	
Airport-specific lin. trend	No		Yes	
Treatment effect	-3328.86*	-3703.26*	-26.48	377.54
	(-2.17)	(-2.16)	(-0.03)	(0.34)
Constant	9910.60***	9910.64***	-1448.44	-1489.87*
	(14.48)	(14.48)	(-1.96)	(-2.01)
N (apt x period) =	286		286	
Nk (apt) =	21		21	
R2				
- within	0.26	0.26	0.70	0.70
- between	0.03	0.02	1.00	1.00
- overall	0.06	0.06	0.93	0.93

Notes:

(a) treatment effect defined as a one-off shift (value 0 before divestment, 1 after)

(b) gradual treatment effect assumed, linear increase for the value from zero 12 months before divestment to one 12 months after.

*t statistics in brackets. * Significant at 5% ** 1% *** 0.1%*

B. Regression output with LHR and GLA omitted from control group, treatment defined as one-off trend shift

	Model (1)	Model (2)
	PAX/staff, yearly	PAX/staff, controlling for airport specific trend, yearly
Year effects	Yes	Yes
Airport-specific lin. trend	No	Yes
Treatment effect	-3670.03*	159.86
	(-2.39)	(0.15)
Constant	9135.38***	-1613.53*
	(12.73)	(-2.07)
N (apt x period) =	258	258
Nk (apt) =	19	19
R2		
- within	0.31	0.71
- between	0.02	1.00
- overall	0.08	0.93

*Note: t statistics in brackets. * Significant at 5% ** 1% *** 0.1%*

Annex 5 Bibliography

This annex describes all sources reviewed for this study (Table A5.1).

Table A5.1 Bibliography of sources used for this study

Source	Link
Aberdeen. Annual reports	http://www.aberdeenairport.com/about-us/media-centre/publications/
Aberdeen. 2014. Conditions of use	http://www.aberdeenairport.com/media/68257/AIAL-Conditions-of-Use-2015.pdf
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