

Empirical methods for assessing behaviour, performance and profitability of airports

Contents

1. Introduction.....	2
Purpose of this working paper	2
Key themes emerging.....	3
Structure of this paper	3
2. Historical capital expenditure	5
Uses for information about historical capital expenditure	5
Analysis.....	6
Indicators of airport congestion.....	7
Capex ratios.....	10
Summary – Historical capital expenditure	12
3. Service quality and process efficiency.....	13
Operating efficiency	14
Service quality	16
4. Airport profitability.....	23
Designated airports	23
Non-designated airports.....	23
Summary – profitability analysis	26
5. Summary and conclusion	27

1. Introduction

- 1.1. This working paper updates the working paper of the same title published by the CAA in November 2010 and supports the CAA's "Market power assessment guidelines for airports" published in April 2011.¹

Purpose of this working paper

- 1.2. The behaviour and the financial performance of a firm can provide some evidence to assist in assessing the level of competition it faces. Companies enjoying high degrees of market power might earn excessive profits by: setting prices consistently above the competitive level; reducing output or investment below the competitive level; or lowering standards of service quality below the level that would be delivered in a well-functioning airport market. Assessing the historical performance of an airport, either quantitatively or qualitatively, could therefore provide useful information for a competition assessment.
- 1.3. The purpose of this paper is to consider methods that could be used to support analysis of an airport's behaviour, performance and profitability as part of an assessment of market power, focusing on techniques that have been used previously in the context of airport analysis and/or involve a significant element of quantitative analysis. However, the results of any of the methods discussed in this paper need to be assessed in their proper context, which may require the consideration of further evidence not covered by this paper. The CAA's guidance on market power assessments provides a fuller overview of the types of evidence that the CAA expects to take into account when assessing the degree of market power held by airports.
- 1.4. The current paper is intended to stand as a record of empirical methods that have previously been used to analyse airport market power. It does not provide a definitive guide to the analysis that the CAA would expect to undertake and, as such, does not form part of the Market Power Assessment guidelines.
- 1.5. Throughout this paper, the CAA has sought to use examples to illustrate the analytical approaches described. The CAA has also sought to identify general issues relating to these types of approaches, rather than to assess the merits of using a particular approach. The merits of any approach will depend upon the purpose of the assessment, the circumstances of each airport and the range of other evidence available.

¹ CAA, Guidance on the assessment of airport market power, April 2011, available at <http://www.caa.co.uk/default.aspx?catid=78&pagetype=90&pageid=68>.

Key themes emerging

1.6. This paper discusses a range of techniques, which have differing advantages and disadvantages. However, a number of themes emerge from the discussion set out below:

- No technique in isolation is likely to provide definitive evidence on the strength of market power of an airport.
- All quantitative techniques require some judgment to be applied, either through the determination of required input assumptions, the appropriate structuring of the modelling, or in the interpretation of the results.
- The interpretation of analysis of airport behaviour will need to reflect the time period over which analysis is carried out and reflect the capital-intensive nature of airports.
- By their nature, quantitative techniques all rely – to a greater or lesser degree – on historical data and cannot, therefore, capture the potential for airports, airlines or passengers to change their behaviour in future (an issue that is particularly relevant to forward-looking analysis of airport competition). Whilst the methods described in this paper are mainly used to analyse historical and current data in order to assess an airport's past and current performance and profitability, they could also play a role in assessing the likely incentives that an airport may have in terms of its future conduct.
- Any analysis relying on comparisons between airports is likely to be complicated significantly by the degree of variation between airports. This variation can result from a range of factors including: airport size; the type of airline services offered at the airport (e.g. transfer or point-to-point, premium or low cost); passenger characteristics (such as whether they are travelling for leisure or business); whether airports are privately or publicly owned and operated; whether airports are jointly or separately owned; and the differing regulatory environments within which airports operate, as well as their regulatory status. Whilst these differences can make high-level comparisons difficult, it may still be possible to collect useful benchmarking evidence, by comparing individual services or processes rather than airports as a whole.
- The ability to make inferences about the market position of an airport from its financial performance depends upon whether the airport is currently subject to detailed economic regulation, as price cap regulation is designed to prevent airports from earning excessive returns, and affects service quality and investment outcomes.

Structure of this paper

1.7. The structure of this paper is as follows:

- chapter 2 discusses indicators and methods to assess an airport's level of historical capital expenditure;
- chapter 3 details some methods used to assess airport process efficiency and service quality;
- chapter 4 reviews the methods that could be used to evaluate an airport's financial performance and profitability; and
- chapter 5 concludes.

2. Historical capital expenditure

Uses for information about historical capital expenditure

- 2.1. Evidence about the pattern and nature of historical capital expenditure (capex) and any resulting spare or scarce airport capacity could be a useful source of information for airport market power assessments.
- 2.2. First it might provide useful information about investment decisions taken by the airport and could provide evidence as to whether those decisions have been influenced by factors relating to the acquisition or exploitation of a position of substantial market power (SMP). Second, evidence about the degree of available or scarce airport capacity resulting from historical over- or underinvestment might also provide useful information when assessing the potential for airlines to switch between airports. These two different purposes are explained further below.

Evidence regarding the potential exploitation of SMP

- 2.3. An airport holding SMP – absent economic regulation – might find it profitable to take one of two possible courses of action:
 - a) to withhold investment in additional capacity, in order to create artificial scarcity that would put upward pressure on prices, or
 - b) to over-invest pre-emptively, in order to prevent the entry of a competitor.
- 2.4. However, airports subject to price control regulation might have different incentives regarding investment, in some circumstances irrespective of the degree of market power they hold. For example, it is generally recognised that price controls based on a Regulated Asset Base (RAB) can incentivise airports to over-invest in order to increase the RAB and consequently the price cap. Any analysis of historical capital expenditure must therefore take full account of the potential influence of economic regulation on airports' past and present investment decisions.

Evidence regarding airline switching costs

In general terms, the relative availability of spare capacity at an airline's current and alternative airports is likely to affect the degree of an airline's switching costs. An airport with low runway and terminal utilisation may generally have low pricing power and a strong commercial incentive to retain existing, and secure additional, airline traffic, for example through offering lower charges to airlines, thereby affecting the costs airlines would face when considering switching some or all of their operations between airports. Information about airport utilisation, or the availability (or scarcity, as the case may be) of airport capacity, might therefore provide some useful evidence for an analysis of airlines' switching costs. However, such evidence would need to be considered in the context of other factors that might affect airlines' switching decisions. For example, the specific requirements of an airline's business model would also be important to an airline's switching decision.

Analysis

- 2.5. In principle, for either purpose the analysis of historical capacity expenditure might consider the following:
- a) the existence of any persistent excess or shortage of capacity;
 - b) how the observed level of capacity might compare with a well-functioning market (the counterfactual); and
 - c) the possible reasons for any divergence between the observed situation and the counterfactual.
- 2.6. To assess a), it may be useful to consider whether there is reliable evidence of persistent congestion, as in a well-functioning airport market, high levels of congestion at an airport might provide a signal to that airport or its competitors to provide additional capacity. Persistent levels² of congestion could, therefore, indicate that there are significant barriers to entry / expansion. Similarly, persistent excess capacity might indicate that an airport is strategically over-investing to restrict the development of competition, or might result from the distorting effects of regulation.
- 2.7. However, it is important to understand the causes of any congestion and to put it in the context of the costs of expanding capacity, before concluding that there is evidence that an airport is artificially withholding capacity, over-investing or holds substantial market power. Indeed, a degree of congestion and/or capacity scarcity are features that might be expected in a well-functioning airport market, reflecting the capital-intensive nature of airports and the potential for some capacity expansions only to be delivered in relatively large increments.
- 2.8. To assess b), it might be useful to compare investment levels at an airport to those at other airports, in order to assess whether there is any evidence of over- or under-investment that might indicate a position of SMP. Ideally, such comparisons would be made between airports that are comparable in terms of size and types of services. However, due to the heterogeneity of airports, it is unlikely that a direct comparison of the absolute level of capex for any two airports would provide sufficient reliable information.
- 2.9. To assess c), it seems likely that it will be necessary to rely on qualitative analysis of the reasons behind the pattern of investment and capacity scarcity. This might include factors such as restrictions imposed by the planning regime, the incentives set by economic regulation and evidence on the availability of any alternative commercially viable expansion projects (including the reasons why they were not pursued).

² Due to the potentially 'lumpy' nature of large airport investments projects the provision of additional capacity to relieve congestion might involve long lead times before coming on the market, which needs to be taken into account when assessing whether congestion is 'persistent'.

- 2.10. The remainder of this chapter considers two aspects where quantitative approaches could be applied to inform the analysis of issues (a) and (b), namely:
- assessing congestion by considering the level of runway utilisation and punctuality and delay statistics; and
 - assessing capex ratios as measures of the level of historical investment.

Indicators of airport congestion

- 2.11. As discussed above, high levels of congestion could be a sign that there are significant barriers to entry/expansion and/or that an airport holds a degree of market power, although it is important to consider very carefully other factors that could play a role in creating high levels of congestion. One such factor is the administrative process by which the maximum capacity of airports is declared.³
- 2.12. Airports provide a number of different types of capacity that is often split into two main areas: runway capacity and any associated infrastructure for the landing, manoeuvring, parking and taking off of aircraft (including taxiways, aircraft stands and aprons); and terminal capacity and any associated infrastructure for the reception, processing and embarking and disembarking passengers onto and off aircraft. Congestion can, in principle, be caused by a bottleneck in - or within - any one of these different areas, even if there is sufficient capacity in other areas. For example, if there are insufficient aircraft stands this could limit the airport's ability to accept additional aircraft movements, and the associated passengers, even if the runways and terminals have sufficient capacity. Similarly, terminal congestion could limit the ability to accept additional aircraft at an otherwise unconstrained runway and airfield. It is, therefore, important to understand what aspect of an airport's operation is causing congestion and/or limiting expansion.
- 2.13. The CC previously assessed, in the context of its market investigation of BAA, the level of runway utilisation as one indicator of airport congestion.⁴ The CAA also carried out work for the Department for Transport (DfT) regarding the runway resilience at Heathrow and Gatwick.⁵ Both reports found that when an optimal level of runway utilisation is exceeded, adding more traffic can have detrimental effects on the degree of service quality, in that it could lower the operational resilience of the runways to unplanned events and lead to a higher level of flight delays, which in turn could increase

³ The Competition Commission provided an explanation of this process in its "Working paper on the assessment of technical airport capacity" in the context of its BAA market investigation:

http://www.competition-commission.org.uk/inquiries/ref2007/airports/pdf/working_paper_airport_capacity.pdf.

⁴ See, for example, http://www.competition-commission.org.uk/inquiries/ref2007/airports/pdf/working_paper_airport_capacity.pdf.

⁵ SH&E for CAA, UK CAA Runway Resilience Study – Final Report, December 2008.

congestion at the airport caused by planes and passengers waiting to take off.

- 2.14. A second indicator of airport congestion is the level of flight delays, as significant, persistent delays could be an indicator of excessive use of the existing infrastructure. However, flight delays can be caused by a wide variety of factors, and any analysis of flight delay data needs to be careful to differentiate between these different reasons for delays. Further work is currently being carried out as part of the South East Airports Task Force to assess the reasons for delays at Heathrow, Gatwick and Stansted. This work will be published in summer 2011.
- 2.15. These two indicators are discussed further in turn below.

Runway utilisation

- 2.16. Data on runway and terminal utilisation are available for some UK airports from ACL's website⁶. These data are also broken down by season and by time of day.
- 2.17. Runway use can be measured in several ways. Total air traffic movements (ATM) – capturing commercial passenger, cargo and general aviation movements – can describe overall aviation activity at an airport. An alternative is to consider the total number of passengers and/or cargo tonnage, which can also be used to provide information regarding the traffic volume per ATM. The appropriate choice between these different metrics will depend on the individual airport and the specific question that is being addressed. For example, using metrics based on passenger numbers could be more relevant when considering evidence of investment in passenger-relevant infrastructure, such as terminals.
- 2.18. The analysis of runway utilisation would also need to take into account the distribution of activity over the day and/or year. For example, there might be very high levels of runway utilisation in peak periods (e.g. in the morning or in the evening) but comparatively low utilisation levels outside these peak periods. Similarly, utilisation may vary between seasons; at most UK airports there are typically higher traffic volumes in the summer season than in the winter season.
- 2.19. These variations are also likely to depend on airline and passenger demands at the airport in question. For example, charter carriers are likely to have significantly more traffic in the summer season than in the winter season, and network carriers might concentrate usage at their hub airports in a few periods during the day, at times which enable connecting services. The characteristics of passengers may also play an important role, with some passengers (notably those travelling for business) having strong preferences to travel at certain times of the day, whilst others (notably some leisure passengers) might be more willing to fly at a range of different times. When

⁶Airport Coordination Limited, www.acl-uk.org. Data are available for Heathrow, Gatwick, Stansted, Manchester and London City.

interpreting runway utilisation data it may, therefore, be important to consider the differences in the types of passengers and airlines using an airport.

- 2.20. More generally, for the purposes of a competition assessment there is no clear objective measure of a degree of runway utilisation that might be observed in a well-functioning airport market. Therefore, whilst runway utilisation might provide useful information about prospects for airline switching between airports, and may inform the overall assessment of market power, it is unlikely in itself to provide conclusive evidence on the degree of market power held by an airport.

Delays

- 2.21. Information about flight delays and punctuality is an alternative indicator of the demand-supply balance at an airport, and how it changes over time, due to the likely link between excess demand and congestion. By contrast, an airport operating well within its capacity could be expected to have comparatively fewer delays. It could be argued, therefore, that a sustained period of poor punctuality might provide an indicator of under-investment and provide useful information for a competition assessment.
- 2.22. However, flight punctuality can be affected by many factors that are not directly relevant to a competition assessment, including: weather; air traffic control delays; knock-on effects from delays to an aircraft's rotation at another airport; or commercial decisions by airlines and / or airports to prioritise volume over reliability.
- 2.23. Furthermore, even if punctuality statistics could be used clearly to apportion delays to the airport under assessment, this would not necessarily provide information about the reasons for the congestion. Any competition analysis would need to consider the underlying reasons for congestion. These reasons could include the behaviour of the airport being analysed, or reflect externally imposed constraints, such as planning or Government policy on airport expansion. The relative punctuality performance of an airport could, however, provide some useful information about the overall performance of an airport and could inform a competition assessment.
- 2.24. The CAA publishes punctuality statistics for ten UK airports for all departing flights. However, these data do not distinguish between different causes of delay, and they only report how operations performed relative to the published schedule.⁷ The Eurocontrol Central Office for Delay Analysis (CODA) collects more detailed punctuality statistics for airports across the European Union, including breakdown by cause of delay. However, some of the CODA data might not be appropriate for the purposes of an airport competition assessment, due to the way that some of the data are collected.⁸

⁷ The CAA's punctuality statistics are based on operational data from UK airports and on scheduling data from ACL. It covers the following airports: Birmingham, Edinburgh, Gatwick, Glasgow, Heathrow, London City, Luton, Manchester, Newcastle, and Stansted. The statistics are available at <http://www.caa.co.uk/default.aspx?catid=80&pagetype=88&pageid=12&sglid=12>.

⁸ CODA data incorporates delay data collected by airlines (using IATA delay codes) and Air Traffic Control-specific data from Eurocontrol's Central Flow Management Unit. While airlines can apportion

The DfT has previously used these to rank the top 50 European airports according to average delay per movement. Alternatively, the CAA could obtain delay data directly from those airlines that collect data for their own flights. However, as CODA already incorporates such data in its own reporting, CODA might be a more effective source, in particular as it might be more difficult to obtain such data from non-UK airlines than from UK airlines, which might limit the ability to produce a representative sample.

Discussion – Indicators for airport congestion

- 2.25. Overall, whilst indicators of airport congestion might provide some useful information for a competition assessment – notably by informing the assessment of the prospects for airline switching – they are, by themselves, unlikely to provide a strong indication of whether an airport enjoys SMP.
- 2.26. In particular, there can be a number of different causes of congestion. Since some of these would not indicate that an airport might enjoy a strong market position, the CAA is unlikely to place considerable weight on indicators of congestion as direct indicators of market power.

Capex ratios

- 2.27. To assess whether any potentially observed over- or under-investment might indicate a position of SMP, it might be useful to compare investment levels at an airport to those at other airports. Such analysis must take account of, as far as possible, relevant differences between the airports being compared, including factors such as size, customer base, catchment area or different regulatory and/or political environments (in particular if the airports are located in different countries).
- 2.28. To adjust for size effects, it is possible to construct a ratio of capex compared to an indicator of an airport's size, such as the volume of traffic, either in terms of passenger numbers or in terms of ATMs. However, comparisons based on such ratios may be misleading if the airports serve different types of traffic. For example, airport A might serve large aircraft with high numbers of passengers per movement while airport B might serve a larger number of ATMs with smaller aircraft. This would lead to the airport B having a smaller number of passengers per ATM, potentially distorting any comparisons constructed using any of these measures of volume.
- 2.29. An alternative approach is to compare capex to a measure of earnings or profitability. The Competition Commission, as part of its BAA Market Investigation, used a ratio of EBITDA⁹ to capex over a relatively long period of time to provide a broad comparison between BAA's airports. This

delay times to different delay codes, CFMU only records the major reason for any individual flight delay. In addition to regular public reports, database access is available to authorised users through the internet portal eCODA, available at <https://extranet.eurocontrol.int/http://prisme-web.hq.corp.eurocontrol.int/ecoda/portal/>.

⁹ Earnings Before Interest, Taxes, Depreciation and Amortisation.

approach assumes that over an airport's investment or total life cycle, a reasonable share of EBITDA would be expected to be re-invested in the company in the form of capex, to retain its competitiveness over time. This approach also requires some view to be taken on what constitutes a reasonable level of re-investment for a competitive airport. In principle, this might be possible through comparisons with other airports that are considered to operate in a generally competitive airport market.

- 2.30. However, comparisons with other airports are complicated by the comparatively limited number of airports that are providing comparable levels of service or face comparable customer bases (both in terms of airlines and passengers). In addition, other factors such as the location and history of the airport's infrastructure are likely to have a strong influence on an airport's subsequent investment behaviour, and might distort any assessment of capex:profitability ratios and limit the relevance to a competition assessment.
- 2.31. For example, many of today's commercial airports in the UK make use of ex-military airfields. Therefore, the existing infrastructure would not necessarily have developed in line with passenger demand. Instead, these airports may have been vested with large, high-specification runways that gradually accommodate more passengers over time, without a need for significant investment in new runway infrastructure. Such airports might see much lower capex:EBITDA ratios than airports that were not vested with large-scale runway infrastructure and/or that have been established as commercial airports for a longer period of time.
- 2.32. Further, the choice of the time period over which the capex:EBITDA ratios are assessed can have a significant influence on the findings. As capex can occur in discrete, 'lumpy' increments and be undertaken relatively infrequently, capex might be low for extended periods, with EBITDA rising as airport capacity becomes scarcer. Consequently, capex:EBITDA ratios might only provide meaningful information if they are calculated over a full investment cycle. In practice, it might be difficult to establish the length and the start- and end-dates of such a cycle.
- 2.33. In the absence of analysis over the full life-cycle of an airport, comparisons will need to be mindful of where airports are in their overall lifecycle. For example, care would need to be taken when comparing an airport operating in a growing market with one that might be operating in a relatively mature market, as the former might be expected to be in a high investment (and relatively low profit) phase, whilst the latter might be in a low investment (and high profit) phase.
- 2.34. Finally, it should be noted that this method requires sufficient data about the airport's historical operating profits and capex, in particular given the importance of choosing a suitable long-term period.¹⁰

¹⁰ Competition Commission, BAA Market Investigation, Appendix 7.3, March 2009, para30.

Discussion – Capex ratios

2.35. There are a number of factors specific to the airport market that could reduce the usefulness of capex ratios as indicators of market power. The most pertinent of such factors are listed below.

- The capital-intensive nature of airports and the need to adjust the analysis to reflect the heterogeneity of airports seem likely to limit the reliance that can be placed on this form of analysis as an indicator of relative investment performance. This will be a particular issue when comparing dissimilar airports or airports that are at different stages of their overall life-cycle.
- The existence of planning and / or physical restrictions that restrict an airport's ability to undertake capital infrastructure investment.
- Economic regulation can provide a regulated airport with specific regulatory incentives with regard to investment. Consequently, an airport's capex ratio may to some extent be a function of its regulatory incentives, as well as market signals or its market power. This would affect, in particular, any comparison between regulated and non-regulated airports.
- The different histories of airports are likely to play an important role in the level of further capex being invested by different airports. Airports that have been vested with significant infrastructure (such as large ex-military airbases) may not require the same amount of capex as an airport that has started from a relatively small airfield in order to support traffic growth.

2.36. Overall, it appears that comparisons of capex to earnings and/or profitability are likely only to provide limited information for a competition assessment in an airport market.

Summary – Historical capital expenditure

2.37. As noted above, the capital-intensive and heterogeneous nature of airports is likely to limit the ability to undertake reliable quantitative comparisons of the investment performance of different airports. This suggests that any assessment of historical investment performance is likely to be based on a broad mix of quantitative and qualitative analysis, rather than on any single performance metric.

3. Service quality and process efficiency

- 3.1. In addition to increasing prices and/or reducing levels of investment, an airport with SMP might be able to reduce the quality of its service offering or face insufficient competitive pressures to drive up operating efficiency. An analysis of the quality and efficiency of an airport's service offering might, therefore, provide useful supporting information for a competition assessment.
- 3.2. In the context of its price control determinations for the designated airports the CAA has previously undertaken detailed assessments of the designated airports' operating efficiency, the effectiveness of their processes and the level of service quality they provided.
- 3.3. However, when using these types of analysis in the context of competition assessments, it would be necessary to identify the standard that could be expected in a well-functioning airport market against which the actual performance of the airport in question could be measured (the 'counterfactual'). While this might be feasible for the efficiency of some operational processes in isolation, it might not always be feasible for every operational process, and the heterogeneity of airports tends to limit the extent to which reliable comparisons can be made of an airport's overall operational efficiency.
- 3.4. Indeed, any assessment of the performance of an airport will need to consider the impact of a range of factors, including: airport size¹¹; the types of airlines and passengers using the airport; and, if comparisons were to include overseas airports, different legislative and regulatory environments.
- 3.5. In addition, existing regulatory intervention is likely to play an important role when assessing information about an airport's service quality and efficiency performance. There are currently three designated airports: Heathrow, Gatwick and Stansted. All three of these airports are currently subject to price cap regulation, which includes incentives to increase operational efficiencies. All three airports are also subject to a service quality rebate scheme that sets service quality targets for specific areas and penalises underperformances and rewards outperformance. As this regulation has the potential significantly to affect service quality performance and efficiency, the analysis of these aspects of performance might not provide particularly strong evidence about the market power enjoyed by these three airports.
- 3.6. This section considers a number of different methods used to assess an airport's operational efficiency and service quality, which have previously been employed by the CAA, international bodies or by airports themselves. The first part looks at methods assessing operational efficiency, while the second part considers different ways in which the effectiveness and quality of an airport's services might be assessed.

¹¹ It is generally accepted that above a certain airport size there are diseconomies of scale, i.e. the cost per unit increases rather than decreases with increasing traffic volume.

Operating efficiency

- 3.7. One approach to assessing operating efficiency is to isolate operating processes and benchmark their efficiency and effectiveness against comparator airports. Benchmarking could be a suitable approach to assess operating processes that occur at a large number of commercial airports and are not significantly affected by the size or different customer composition of airports.¹² Provided that the sample of comparator airports is sufficiently large, and the airports relatively similar, it may be possible to obtain useful results.
- 3.8. The following section describes a quantitative efficiency assessment of operational airport processes and a qualitative approach to operating efficiency assessments.

Quantitative efficiency analysis

- 3.9. Booz Allen Hamilton (BAH) undertook efficiency analysis for the December 2006 CAA Initial Proposals for Heathrow, Gatwick and Stansted.¹³ BAH chose operating processes for its efficiency assessment that fulfilled three criteria:
- first, they represented a significant part of total operating expenditure or were important to the functioning of the airport. The processes included in their analysis constituted c. 20-30% of operating costs;
 - second, they were distinct processes or controllable items in order to allow for a clear cost allocation; and
 - third, the processes as a group represented all the stages of the passenger flow and passenger experience.
- 3.10. On this basis, BAH chose seven operational processes for its analysis. These included security-related processes (both passenger security screening and airside and perimeter security), equipment management and maintenance processes (trolleys, passenger sensitive equipment, check-in infrastructure and baggage systems), and the management of processes related to passengers of reduced mobility.
- 3.11. For each of these, efficiency measures were defined. For example, the efficiency measures for trolley management were:
- staff productivity: measured as the demand for trolleys relative to the trolley staff deployed at any given hour of the day; and
 - asset productivity: measured as the demand for trolleys relative to the size of the trolley fleet available at the airport.

¹² For example, a hub airport might require a significantly more sophisticated baggage transfer system than a small airport serving only point-to-point traffic. However, it may still be possible to compare the management of security queues at these two airports.

¹³ Booz Allen Hamilton, Airports price control review - Initial proposals for Heathrow, Gatwick and Stansted Supporting Paper III – Airport efficiency assessment, December 2006.

- 3.12. For all of these measures average performance across all airports included in the study was determined. An airport found to out-perform the average benchmark was deemed to have operating processes which were more efficient than the industry average. Consequently, in the context of a competition assessment underperformance against the average might, amongst other things, indicate that an airport could be subject to less competitive pressures to operate efficient processes, whereas average and/or over-performance might indicate that an airport faces relatively strong competitive pressures.
- 3.13. However, the BAH report also indicated some of the difficulties in identifying appropriate comparators for a meaningful benchmarking exercise, even if the benchmarking was undertaken on process rather than enterprise level. The selection of suitable airports to be included in their study required an extensive analysis of the drivers of the operational processes for which benchmarking was carried out. These drivers included both external factors such as the legislative and regulatory environment in which the airports operated and airport-specific factors such as the scale of an airport's operation. Indeed, scale was quoted as one, if not the principal, driver of the complexity and operations of an airport, and was thus an important factor in the consideration of appropriate comparators.
- 3.14. In addition, a snapshot assessment of operational efficiency at any one point in time might not provide a sufficient picture of the airport's performance. For example, an airport might have comparatively inefficient processes at one point in time but this might not indicate that it has any significant degree of market power if it faces strong incentives to improve its performance. Having data over a longer period of time might provide an indication as to whether the airport has improved efficiency, or whether it has been able profitably to sustain a significant degree of inefficiency.

Qualitative efficiency assessment

- 3.15. Qualitative evaluation of each operating process could also provide supplementary evidence for assessing operating efficiency. Instead of assessing the efficiency of a process using a quantitative metric, it is possible to assess the features of a process using a ranking or score to describe the capability and/or maturity of each process relative to best practice.
- 3.16. An airport scoring highly would have well-developed processes, which may suggest that it would be subject to competitive pressure providing the incentive to develop its processes and seek relative cost advantages. The under-development of these processes may indicate that the airport faces weaker competitive pressure. As is the case for the quantitative efficiency analysis, any interpretation of such qualitative results needs to be careful to consider other reasons - unrelated to the degree of competition - that affect an airport's operational performance.
- 3.17. An example of this form of analysis is the work undertaken by BAH for the CAA (quoted above). For example, BAH scored features of operating

processes, such as governance and flexibility, from 1 to 4 according to what “stage” of development they have reached.

- 3.18. Other factors might also provide supporting evidence of efficiency. For example, to the extent that there is a reliable relationship between the outsourcing of operating processes and efficiency and cost savings for the airport, it may be possible to use the level of outsourcing as a possible indicator of the strength of incentives to identify cost savings. Implicitly, this approach relies on an assumption that airports facing relatively weak competitive pressures may not accept the risks – such as to labour relations – that might be associated with outsourcing. Further, it would be important to consider whether there are significant benefits to retaining the management and operation of certain processes ‘in house’. For example, it is relatively common for UK airports to retain direct control of passenger security clearance.
- 3.19. An alternative potential indicator of efficiency is the degree of market testing that an airport performs before commissioning significant expenditure. Airports facing significant competitive constraints might be expected to undertake more extensive scrutiny of major cost items, including the potential tendering for capital or other projects.

Discussion – operating efficiency measures

- 3.20. In principle, the analysis of relative cost efficiency might provide useful evidence to identify whether an airport is performing in a way that might be expected in a well-functioning market. In particular, it may be possible to undertake some comparisons between individual processes at a number of different airports, although variations between airports can affect such comparisons even at the process level. However, care must be taken to understand the underlying causes of any identified inefficiency, and whether there is evidence to suggest that relatively poor performance is transitory or can be explained by factors that do not relate to market power. Notably, it is possible that a regulated airport’s operating efficiency may not be created by competitive pressure but could instead be a result of regulatory incentive. Measuring operating efficiency in such cases might reveal information about the effectiveness of the regulatory incentives and / or the possible degree of market power. This method might not be useful in a competition assessment for designated airports.
- 3.21. Finally, it should be noted that the relationship between market power and efficiency is in general not straightforward, and that efficient capital markets can exert significant pressure on undertakings with SMP to reduce costs, in order to increase profits.

Service quality

- 3.22. Airports operating in a competitive market may face significant pressure to maintain (or improve) their service quality in order to prevent airlines and

passengers switching to other airports with better price-service offerings. The level of service quality could, therefore, provide evidence about whether an airport faces significant competitive pressure.

- 3.23. However, any assessment of service quality might be complicated by the potential for a wide spectrum of passengers' preferences for different price-service offerings, limiting the ability to make straightforward comparisons between airports. For example, leisure passengers might not be willing to pay for the level of airport service quality expected by business passengers. It would, therefore, be misleading to compare service quality levels across airports without taking into account the heterogeneity of service offerings that can be demanded by different groups of airlines and passengers.
- 3.24. In general terms, there are two ways of collecting evidence about service quality performance. First, service quality can be assessed using passenger surveys to collect evidence about passengers' satisfaction with an airport's service provision. Second, some elements of service quality can be measured directly. One example is the time passengers queue in an airport's central security search area, or the availability of passenger-sensitive equipment such as lifts or travelators. Directly measurable service quality indicators could also focus on areas that are not immediately experienced by passengers but are relevant to airlines operating their flights in a timely and efficient manner, for example the availability of aircraft stands and airbridges.
- 3.25. The sections below discuss in turn the strengths and weaknesses of surveys and direct measures of service quality and describe some examples where these techniques have been used in practice.

Survey-based methods

- 3.26. A number of organisations carry out passenger surveys at UK airports for different purposes. This section describes surveys undertaken by the Airports Council International (ACI), airports, the CAA and the ONS. A discussion of the usefulness of survey-based service quality assessments then follows.

ACI's Airport Service Quality Ranking

- 3.27. Airports Council International (ACI) provides an Airport Service Quality (ASQ) survey conducted at over 130 international airports¹⁴. The data collected are used to rank airports in order of quality of service. ACI uses a total of sixteen indicators including:
- waiting time at check-in;
 - waiting time at security;
 - number of baggage carts available; and

¹⁴ 14 UK airports currently participate in the ASQ survey (according to the ASQ website, accessed in November 2010), including the four major London airports (Heathrow, Gatwick, Stansted and Luton) and Manchester.

- waiting time at immigration.
- 3.28. The ASQ survey is undertaken and reported on a quarterly basis for each airport in the sample. The survey takes place at the airports, where passengers are handed a paper-based questionnaire at their boarding gate. Airports are required to collect a minimum of 350 responses per quarter to ensure a representative sample, although most survey considerably more. For example, Heathrow surveys 1,750 passengers per quarter.
- 3.29. While this survey provides a useful broad overview of passengers' perceptions of an airport in comparison to other airports worldwide, it is unlikely to provide conclusive evidence of an airport's performance in isolation, as the survey does not account for any airport specific factors that might drive an airport's performance. In addition, compared to some of the surveys discussed below the sample size is comparatively small for some of the individual airports.
- 3.30. London Economics conducted a similar investigation using data from Skytrax airport review which benchmarked airports against comparators.¹⁵

Quality Service Monitoring at Heathrow, Gatwick and Stansted

- 3.31. Heathrow, Gatwick and Stansted carry out their own passenger surveys called Quality Service Monitoring (QSM), in which passengers are asked to rank the airport's performance on a scale of 1-5 across a variety of factors relating to the quality of airport facilities, including cleanliness, way-finding, security queuing, check-in and the availability of seating.¹⁶ In contrast to the ASQ, the QSM survey is carried out as face-to-face interviews at the boarding gates. Results of the QSM, reported monthly, are also used by the CAA for the measurement of some elements of its Service Quality Rebate (SQR) scheme (see separate section on the SQR below).
- 3.32. As the CAA relies on the QSM survey results for parts of its SQR scheme, it set out a number of criteria that the QSM survey must fulfil to ensure that the results are representative and include both arriving and departing passengers, and has commissioned a number of independent audits of the survey.

Continuous CAA and ONS surveys

- 3.33. The CAA and the Office for National Statistics (ONS) run continuous surveys of passengers at UK airports. The purposes of - and questions asked by - the two surveys are very different, and are not designed to collect information about service quality.
- 3.34. The CAA Departing Passenger Survey collects a sample of responses between 3,000 and 70,000 depending on airport size. London Heathrow, Gatwick, Luton, Manchester and Stansted are surveyed continuously while

¹⁵ London Economics, Imagine a world class Heathrow, June 2008.

¹⁶ Heathrow surveys no less than 30,000 passengers, Gatwick no less than 18,000 passengers and Stansted currently interviews c. 11,000 passengers per annum.

other airports tend to be surveyed on average every four years. Unlike the ACI survey, the questionnaire is completed through face-to-face interviews at the boarding gates. The survey results are reported annually categorised according to carrier, route and quarter.

- 3.35. The ONS International Passenger Survey compiles data for air, sea and rail tunnel passengers on all major routes in and out of the UK. The main purpose of this survey is to collect data for the UK's balance of payments accounts (travel account), immigration and international tourism statistics.¹⁷ The survey is based on 250,000 responses each year from face-to-face interviews carried out throughout the year covering all major transport routes.
- 3.36. It is possible to add questions to both of these surveys to collect information about passengers' satisfaction with an airport's performance. The advantage of adding questions to the CAA's existing survey is that it focuses solely on air travel, has a relatively large sample size and is designed to provide a representative coverage of all passengers. The CAA's survey is also well established, and there tends to be a high willingness on the part of passengers to participate. However, the CAA's survey only takes place on a continuous basis at a subset of airports, with a number of other airports surveyed on a less frequent basis.
- 3.37. In 2009 the DfT added questions to the CAA's Passenger Survey about passengers' airport experience. These results have been published on the DfT website.¹⁸
- 3.38. The ONS also runs the National Statistics Omnibus Survey, which is a multi-purpose household survey undertaken on a continuous basis and reported on monthly. The samples comprise approximately 1,800 responses every month from one adult per selected household. Responses are collected through personal interviews, which can be categorised according to postcodes. The results are weighted according to region and age-sex groups in order to make them representative of the Great Britain population.
- 3.39. The DfT has previously added questions to gather information on public attitudes to air travel. The report using these results is available on the DfT website.¹⁹

Ad hoc surveys

- 3.40. When relevant airports are not sufficiently covered by existing surveys, ad hoc surveys could be commissioned to provide additional information about passenger satisfaction with airports' service quality performance. For example, as part of its market investigation of BAA, the CC commissioned a survey at BAA's Scottish airports as relevant information was not available

¹⁷ ONS website: http://www.statistics.gov.uk/ssd/surveys/international_passenger_survey.asp.

¹⁸ Department for Transport, Air passenger experience: results from CAA survey model (Quarter 1 & Quarter 2 2009), available at <http://www.dft.gov.uk/adobepdf/162469/221412/221513/caasurveyq1q209.pdf>.

¹⁹ Questions were added to the February 2010 Omnibus survey. Available at <http://www.dft.gov.uk/pgr/statistics/datatablespublications/trsnstatsatt/attitudestoairtravel>.

from existing survey data.²⁰ The CAA commissioned a stand-alone passenger survey in 2009 at Heathrow, Gatwick, Stansted and Manchester in support of its research into passengers' through airport experience for the DfT.²¹

- 3.41. Ad hoc surveys can provide a useful source of evidence, especially if there are concerns about specific elements of service quality that can be explored through a set of targeted questions.²² However, ad hoc surveys cannot, by their nature, provide a continuous picture of an airport's performance over time, something that might be relevant for a competition assessment, as service quality could vary over time in reaction to changing market circumstances.

Discussion – survey-based methods

- 3.42. Passenger surveys can provide useful sources of information about an airport's service quality performance as they can focus directly on the outcome (passenger experience) rather than any intermediate dimensions of service provision. They do not, therefore, require assumptions to be made about the aspects of an airport's service provision that passengers value most. The CAA therefore considers surveys an important source of information about an airport's service quality performance.
- 3.43. However, survey data have a number of well-known shortcomings that must be considered carefully when assessing their results. Typical sources of survey biases or distortions include: the framing of questions; the expectations passengers had regarding the airport's services; an overstatement of the importance of "nice-to-haves" compared to other crucial elements that might be taken for granted (e.g. safety); and the time elapsed between the survey and the passenger's use of the airport in question. Any of these biases are independent of the experienced service quality. For example, different individuals might have had different expectations about their airport experience, which is likely to affect their rating of the airport's performance.²³
- 3.44. Furthermore, the overall level of stated satisfaction is likely to be influenced by the performance of airports, airlines and other service providers at the airport. This can make it difficult for passengers to differentiate between those parts that are within an airport's control and those that are provided by other parties, including airlines.²⁴

²⁰ Competition Commission, Air Passengers in Lowland Scotland airports: BAA Airports Market Inquiry, October 2007, available at http://www.competition-commission.org.uk/inquiries/ref2007/airports/pdf/orc_survey_air_passengers_scot_report.pdf.

²¹ Available at <http://www.dft.gov.uk/pgr/aviation/hci/airpassengerexperience/passengersurvey.pdf>.

²² Ad hoc surveys can be used to explore other aspects of passenger behaviour, such as passenger sensitivity to price changes.

²³ To illustrate, person A might not have expected to queue for security at all and could therefore give a low service quality rating for the same queuing time that person B might have rated very highly because he had expected much worse.

²⁴ For example, person A might give a high rating for the airport's performance because there were no problems anywhere along the supply chain whereas person B might give a low rating for the airport's

Quantitative service quality indicators

- 3.45. Whilst service quality at airports cannot be reduced to a single quantitative measure, some elements can be measured quantitatively. This is particularly true where an airport's service quality performance largely depends on the availability of particular equipment or infrastructure, such as the availability of escalators and lifts to allow passengers to move around easily with luggage. Another important example of quantitative measurement of service quality is likely to be that of queuing times of passengers for security screening.
- 3.46. Service quality indicators can also be used to assess the performance of an airport in terms of the services that are delivered directly to airlines, such as aircraft stand and airbridge availability, or the security clearance of airline staff.
- 3.47. The most prominent example of the continuous collection and use of service quality measures is the service quality rebate (SQR) scheme that is part of the price control settlements for Heathrow, Gatwick and Stansted.

Discussion – quantitative service quality indicators

- 3.48. Measuring service quality directly rather than through passenger surveys has the advantage that the information obtained is measured in an objective way that does not involve any subjective judgements. However, it can be important to understand the importance of individual service elements to customers to ensure that the measures obtained are relevant and a good proxy for passengers' preferences. It might also be difficult to establish the 'right' level of service quality that could be expected in a well-functioning competitive market, given the wide variety of passengers' preferences and airline business models. This issue might be addressed by using passenger surveys to determine which aspects of service are important.

Summary – service quality measures

- 3.49. There are generally two different ways in which an airport's service quality performance can be measured:
- through passenger satisfaction surveys which provide direct information about outcomes; and
 - through direct quantitative measurement that provides objective and easily comparable information about service quality aspects that are deemed to be important to passengers and airlines.
- 3.50. In light of their relative strengths, it may be useful to combine the results of both approaches, and consider whether they provide consistent results.
- 3.51. However, as set out at the beginning of this chapter, information about service quality information should not be interpreted in isolation. There is likely to be a linkage between service quality, operating efficiency, historical

performance if he had to queue for check in for a very long time, even though this is outside the airport's control.

investment and prices charged. In particular the level of service quality provision at an airport might be explained by the prices that are charged at that airport. Further, it can be important to consider service quality trends over a period of time, to understand whether an assessment that service quality is poor relative to prices charged is an indicator of some degree of market power, or is merely a transitory issue.

- 3.52. As with measures of operating efficiency, economic regulation could complicate the relationship between the level of service quality and the degree of an airport's market power. Designated airports could face regulatory incentives that could be different to their incentives absent regulation. Consequently, their level of service quality may be an outcome of regulation rather than of market power or competitive pressures, reducing the degree to which this analysis might provide a reliable indicator of market power.

4. Airport profitability

- 4.1. An airport that enjoys a position of SMP might be expected to set prices above the competitive level, and/or deliver service quality below the competitive level, and do so in order to increase its profitability. An airport's financial performance may, therefore, provide useful information to inform a competition assessment.
- 4.2. However, the ability to make inferences about the market position of an airport from its financial performance depends upon whether the airport is currently subject to detailed economic regulation. The following section considers the types of analysis that might be appropriate for designated and non-designated airports.

Designated airports

- 4.3. There are currently three designated airports: Heathrow, Gatwick and Stansted. All three are subject to price cap regulation, which is designed to prevent airports from earning excessive returns. Consequently, analysis of the financial performance of these airports is unlikely to provide particularly strong evidence about their market position, particularly if the airports choose to set their prices at, or near to, the allowed price cap.
- 4.4. As the pricing of a designated airport could affect the ability of a non-designated airport to raise its prices, it might also be important to understand the impact of regulation on pricing across the market.

Non-designated airports

- 4.5. In principle, it is possible to make comparisons between the financial performances of non-designated airports, and to use this to identify whether particular airports have financial ratios that are significantly out of line with airports considered to be operating in competitive markets. For example, TRL benchmarked 50 major airports across the world against average values of a sample of operating and financial data.²⁵
- 4.6. Such information could be useful in the context of a competition assessment, as returns for a sustained period significantly in excess of the cost of capital (the opportunity cost of investment that investors require) could be an indication of market power. However, care should be taken when undertaking analysis of financial returns, as the results can be significantly affected by a number of factors unrelated to market power, notably, the airports' accounting policies. There are a number of ways to assess profitability. Three such methods are discussed below: internal rate of return; accounting rates of profitability; and the return on capital employed.

²⁵ Competition Commission, BAA Market Investigation - Working paper on benchmarking the operating performance of BAA airports, p3.

Internal rate of return

- 4.7. Generally, the return on a project can be assessed by estimating the internal rate of return (IRR). This is the discount rate that results in the present value of the up-front investment and the subsequent revenues equalling zero. In principle, in a competitive market the returns to individual projects should fall with each additional entrant until the IRR for the marginal (least efficient) firm equals the relevant cost of capital. Consequently, if there is evidence that the IRR is persistently above the cost of capital, this could be an indicator that incumbent firms could hold a degree of market power. However, as indicated, above-average returns could also be a sign that the firm in question is more efficient than the 'marginal' firm.
- 4.8. The general IRR method is to calculate the discount rate that would set to zero the NPV of cash flows from the project over its entire life. In airport markets this can be a very long time period, stretching to as much as a hundred years for runways, and up to sixty years for freehold buildings.²⁶ An alternative approach is to undertake a truncated IRR over a shorter time horizon, by specifying a particular start and end date to the assessment. This would involve calculating the discount rate which causes the sum of the net present value of cash flows and the net present value of the closing assets to equal the opening value of the assets.
- 4.9. Truncated IRR calculations can be complicated by the fact that airport investment projects do not neatly fit into any given time period. Consequently, it can be necessary to make adjustments for assets that are in the course of construction. There may also be other data issues that might prevent the calculation of an IRR. For example, if the valuation of the asset fluctuates over time, choosing different start and end dates could significantly affect and potentially distort the IRR calculation.
- 4.10. A further issue arises with the choice of the appropriate benchmark against which to compare the calculated IRR. In order to make it comparable to an assessed cost of capital, the IRR would need to be estimated for the entire asset base. However, even if this could be done it may be difficult to assess the cost of capital of a business with a high degree of precision, particularly where there is limited availability of traded debt and equity instruments.

Accounting rates of profitability

- 4.11. An alternative to IRR-based approaches is to use accounting rates of profit. In general terms, it is more likely, relative to IRR analysis, that suitable data exists to undertake this analysis. Further, the weighted average of the accounting rate of return would, under certain conditions, be equal to the IRR.²⁷ This section discusses the measures based on accounting data, and

²⁶ CRI Airport Statistics 2008/09 p67

²⁷ A detailed exposition of this point is available in Kay (1976) 'Accountants Too, Could be Happy in a Golden Age: The Accountant's Rate of Profit and the Internal Rate of Return', Oxford Economic Papers, 28, 447–60.

considers the issues associated with undertaking analysis based on historical and current cost accounting bases.

Historical and current cost accounting

- 4.12. The results of rate of return analysis could vary substantially according to whether historical or current cost accounting is used. Historical cost accounting records the values of assets at their original cost. This valuation method does not represent the “fair market value” of the asset that an airport would obtain if it were to sell the asset today. Rather, the book value of the asset is the depreciated historical cost. This requires the selection of a particular depreciation rate and profile for the asset’s life. Since the depreciation profile changes the asset’s book value over time, it affects the asset values utilised in rate of return calculations.
- 4.13. In addition, historical cost accounting does not take account of inflation, which may result in assets being valued in a way that does not reflect the current costs or value of the assets, with a consequent impact on stated profits over time.
- 4.14. An alternative approach is the use of current or replacement cost accounting methodologies. This approach values assets at current, depreciated replacement cost, which adjusts the book values of assets for inflation as well as depreciation. The resulting returns would be compared to a real cost of capital. The benefit of these cost approaches is that it adjusts returns for the impact of historical accounting treatment and makes it easier to make robust comparisons between different airports.
- 4.15. In common with other agencies, the CAA would expect to undertake analysis of profitability on the basis of depreciated, replacement cost.²⁸

Return On Capital Employed (ROCE)

- 4.16. The return on capital employed (ROCE) is one of the more common metrics used to summarise the overall financial performance of an undertaking. It is defined as the ratio of earnings before interest and tax (EBIT) to the value of the average capital employed over the same period. Since the ROCE is calculated for every year in the period being assessed, the average ROCE over the time period could be used as an approximation to the IRR. As noted above, it can be important to adjust accounting data to reflect the replacement cost of assets.
- 4.17. A further issue associated with analysis based on ROCE is that it only includes assets that are recognised by accounting standards, and does not consider intangible assets or goodwill created by an undertaking. However, this approach may still be suitable for the assessment of airports because they are capital-intensive businesses, with a large proportion of tangible fixed assets.

²⁸ Competition Commission Market Investigation References: Competition Commission Guidelines, June 2003, footnote 22.

- 4.18. As for all of the above approaches, it can be important to undertake analysis over a relatively long period of time, so as to avoid making misleading comparisons between airports based on the performance in any given year. This can also help overcome issues associated with the lumpy nature of some airport investments, which can be expected lead to a degree of cyclicity in airport profitability, with profits being below the long-term average immediately following significant capacity expansion, and being above-average immediately before there is capacity expansion in the market. Further issues can arise due to variations in accounting principles across countries, which can make international comparisons more difficult.
- 4.19. Since there is a significant degree of heterogeneity between airports, it will also be important to create a large sample from which to assess the benchmark, or average, rate of return.

Summary – profitability analysis

- 4.20. Profitability analysis can provide useful evidence to inform competition analysis. However, it is important to ensure that accounting data is suitably adjusted so as to allow for informed comparisons between airports. In particular, the CAA – in common with other competition authorities – would expect to adjust accounting data so that it reflects, as far as possible, the depreciated replacement cost of assets.
- 4.21. The CAA is also mindful of the potential difficulties in undertaking comparisons between airports in a meaningful way, particularly in light of the relatively small number of UK airports that could form part of the overall sample and the heterogeneity of airports in terms of their size, customer characteristics and geographic differences.
- 4.22. Furthermore, any profitability analysis also needs to account for the potential effects of transitory or persistent capacity constraints (and the potential for these constraints to be experienced in a well-functioning market) on the competitive price level. However, where capacity constraints confer significant degrees of market power on the airport in question, supernormal accounting profits might indicate the existence of such market power.
- 4.23. It may also be important to consider the impact of economic regulation, as this regulation could restrict an airport's ability to earn supernormal profits. Since the profits of a regulated airport may be restricted to a level below that which the airport would have charged absent regulation, the profitability of a regulated airport may not provide a reliable indicator of the degree of market power.
- 4.24. In performing profitability analysis, the CAA recognises the need to take account of the relevant methodological issues particular to each empirical method. However, the CAA acknowledges that it is equally important to interpret the output of each method in the context of all the relevant market characteristics.

5. Summary and conclusion

- 5.1. This working paper has outlined various methods that can be used to assess the behaviour and performance of airports and how these could be used in the context of a competition assessment.
- 5.2. Indicators of airport utilisation might provide some useful information for a competition assessment, notably by informing the assessment of the prospects for airline switching. However, as there can be a number of causes of high degrees of utilisation and congestion beside the exertion of market power, the CAA is unlikely to place considerable weight on indicators of congestion as direct indicators of market power.
- 5.3. Comparisons of capex to earnings and/or profitability are likely only to provide limited information for a competition assessment in an airport market. In particular, the capital-intensive nature of airports and the need to adjust the analysis to reflect the heterogeneity of airports seem likely to limit the reliance that can be placed on this form of analysis as an indicator of relative investment performance.
- 5.4. An airport's service quality performance can generally be measured through passenger satisfaction surveys and direct quantitative measurements of individual aspects of an airport's processes. In light of their relative strengths, it may be useful to combine the results of both approaches, and consider whether they provide consistent results. However, information about service quality information should not be interpreted in isolation due to the linkages between service quality, operating efficiency, historical investment and prices charged.
- 5.5. Profitability analysis can provide useful evidence to inform competition analysis. However, it is important to ensure that accounting data is suitably adjusted so as to allow for informed comparisons between airports. In particular, the CAA – in common with other competition authorities – would expect to adjust accounting data so that it reflects, as far as possible, the depreciated replacement cost of assets.
- 5.6. However, the usefulness of all of the empirical methods discussed in this working paper may be reduced when analysing airports subject to economic regulation. For example, measures of historical investment or service quality could reflect the regulatory incentives rather than the airport's degree of market power. Profitability analysis would also reflect effects of a binding price cap. More generally, the CAA considers it important to account for all relevant market conditions in interpreting the output of the various empirical methods.
- 5.7. In summary, while most of the methods discussed in this working paper could have merits in the context of assessing an airport's performance and behaviour and the wider analysis of competitive pressures, the CAA is of the

view that the results from any or all of these empirical methods should only be considered in the round, without undue emphasis being placed on the evidence from any one method on its own.