UNIVERSITY OF SURREY

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Measuring Regional Economic Effects of Low-cost Carriers in the UK: A Panel Data Econometric Approach

By

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For my wife Terry Leung
Abstract

This study proposes an analytical framework to measure regional economic effects of low-cost carriers (LCCs) by examining the interplays of LCCs, airports and regional tourism. A measurement framework based on panel data analysis is developed. Two empirical studies are carried out in the context of the UK. In Airport Study, it is found that despite making less contribution to an airport's aeronautical and non-aeronautical revenue, LCCs also impose much less pressure on an airport's operating cost. There is strong evidence that LCCs are having positively significant impact on airports financial performance. The findings suggest that there exist mutually beneficial relationships between LCCs and the regional airport. In Tourism Employment Study, the results demonstrate that LCCs have positive and significant impact on both full-time and part-time employment in tourism-related sectors. However, the numbers are rather small. Sectoral analysis is also conducted and shows that LCCs impact is mainly felt on the accommodation and recreation sectors.

The empirical studies have important policy implications. It is recommended that it is the airport, rather than the regional authority, that should be in the driving seat to negotiate deals with LCCs. Those privatised/commercialised airports should be given full autonomy in deciding terms and conditions that they can offer to attract LCCs. This study makes original contribution to the literature by integrating air transport into tourism research. It also successfully demonstrates how panel data analysis can be applied to a research characterised by short time-times and small cross-section observations.
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<td>ABI</td>
<td>Annual Business Inquiry</td>
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<td>AEA</td>
<td>Association of European Airlines</td>
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<td>BAA</td>
<td>British Airport Authority</td>
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<td>CGE</td>
<td>Computable General Equilibrium</td>
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<td>CRI</td>
<td>Centre for the Study of Regulated Industries</td>
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<td>DCMS</td>
<td>Department for Culture, Media and Sport</td>
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<td>EU</td>
<td>European Union</td>
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<td>FE</td>
<td>Fixed Effects</td>
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<td>FTE</td>
<td>Full-time Equivalent</td>
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<td>GDP</td>
<td>Gross Domestic Product</td>
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<td>GDS</td>
<td>Global Distribution System</td>
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<td>GMM</td>
<td>Generalised Method of Moments</td>
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<td>HND</td>
<td>Higher National Diploma</td>
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<td>IATA</td>
<td>International Air Transport Association</td>
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<td>ICAO</td>
<td>International Civil Aviation Organisation</td>
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<td>LCCs</td>
<td>Low-cost Carriers</td>
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<td>LFS</td>
<td>Labour Force Survey</td>
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<td>Least Square Dummy Variables</td>
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<td>NVQ</td>
<td>National Vocational Qualifications</td>
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<td>OECD</td>
<td>Organisation for Economic Co-operation and Development</td>
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<tr>
<td>OLS</td>
<td>Ordinary Least Squares</td>
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<tr>
<td>ONS</td>
<td>Office of National Statistics</td>
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<td>PAYE</td>
<td>Pay As You Earn</td>
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<td>POLS</td>
<td>Pooled Ordinary Least Squares</td>
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<td>Acronym</td>
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<td>RE</td>
<td>Random Effects</td>
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<td>SIC</td>
<td>Standard Industrial Classification</td>
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<td>Tourism Satellite Account</td>
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<td>UK CAA</td>
<td>Civil Aviation Authority</td>
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<td>US DoT</td>
<td>US Department of Transportation</td>
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<td>VAT</td>
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Chapter 1 Introduction

1.1 Introduction

This research measures regional economic effects of low-cost carriers (LCCs). The main idea which lies behind this study is that the striking development of LCCs across Europe over the past decade is changing the geography of tourism and landscape of the regional airport\(^1\). The focus of the research, therefore, is on regional tourism, measured by tourism employment, and the airport.

Despite the obvious interconnections that exist between air transport and tourism; LCCs and the regions they operate from, their relationships have not been well understood in the literature. The remainder of this Chapter is, thus, organised as follows. Section 2 briefly reviews the relationship between air transport and tourism development. In Section 3, the inadequacy of the previous research in air transport and tourism is addressed. The reasons behind the inadequacy are explored in Section 4 and on these grounds, a new analytical framework is proposed. Section 5 then goes on to state the research objectives of this study, while Section 6 presents the structure of the Thesis.

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\(^1\) Throughout this thesis, the terms regional airport and secondary airport are used interchangeably until otherwise stated. This is because secondary airports can be treated as regional airports as well. For example, Luton and Stansted are secondary airports to Heathrow. They are also regional airports to Luton and Essex regions, respectively.
1.2 Background

Transport is a prerequisite and integral part of tourism. Historically, each breakthrough in transport technology results in profound changes in tourism development. As Prideaux (2000: 53) pointed out, "from travelling on horses to steam train, car and aircraft, each new breakthrough in transport technology...has enabled the traveller to go further, at greater speed, for a cheaper price, and in greater comfort and safety".

Air transport plays a vital role in international tourism. According to figures from the UNWTO (2005a), in 2003 air transport represented 42 per cent of total international tourist arrivals. Although its share was lower than that of land transport (accounting for 51 per cent), over time, the importance of air has been growing at the expense of transport over land (road and rail). Between 1990 and 2000 air transport grew at an average rate of 5.5 per cent a year, against 3.5 per cent a year for land transport. As a result, air transport increased its share by 4 percentage points in the period 1990-2000, while land transport lost 4 percentage points.

The era of mass intercontinental travel started from the launching of the wide-bodied aircraft such as Boeing 747 in the 1970s (Debbage, 2005). This also triggered the rapid growth of the tour operating industry. By block-booking large numbers of airline seats, tour operators are able to provide all-inclusive tours incorporating flight arrangements, accommodation and sightseeing at low prices (Debbage, 2005). To further reduce the costs, major tour operators also operate their own charter airlines. In fact, the development of mass
tourism in the Mediterranean is largely due to the emergence of charter airlines which have linked the tourist market and the destination directly to each other (Pearce, 1987a, 1987b). As aircraft technology has improved, major tour operators have emerged and the relative costs of charter travel have decreased, newer and more distant markets in the Mediterranean have been opened up. Medlik (1993) claimed that it was charter airlines which were responsible for the growth of international tourism following the Second World War. Laws (1997) further argued that no mass-market destination can attract sufficient visitors to sustain a fully developed tourism industry without regular access of charter flights.

Is it still so now? Following liberalisation of the European aviation market, completed in 1997, a new breed of low cost no-frills carriers was encouraged to establish scheduled short-haul services across Europe. The nature of air travel in Europe has changed dramatically since then. Compared to traditional charter airlines destinations, featured by sun, sea and sand, LCCs deliberately choose flying to regional airports. This opens up opportunities for peripheral destinations to attract travellers. The low fare, high frequency and flexibility offered by LCCs significantly stimulate demand for short-haul air travel and lead to phenomenal growth of short breaks or weekend holidays in Europe. It appears LCCs have huge impact on regional tourism and economic development. In many peripheral regions, the tourism industries would not exist if deprived of flights by LCCs (Barrett, 2004). Vigorously stimulated by the possibilities offered by LCCs and coupled with the changes in consumer tastes, it is observed that tourists are gradually switching from all-
inclusive tours to independently organised holidays by using the internet to obtain travel information, organise and book trips (UNWTO, 2002). It seems that LCCs are bringing fundamental changes to tourism development, particularly at the regional level.

1.3 Inadequacy of Previous Research

The importance of transport for tourism has been acknowledged by almost every tourism textbook, however, transport is often viewed from a geographical perspective and analysed in terms of tourist flows occurring between tourist generating regions to tourist receiving destinations (Prideaux, 2000). Within this area, some researchers (e.g. Miossec, 1976, Lundgren, 1982) developed conceptual models showing the evolution of transport as a component of tourist development. In these models, transport is often given a less important or passive role which only exists to cope with the development of tourist resort. Although others (e.g. Inskeep, 1991; Page, 1994, 1999, 2005) acknowledged the links between tourism and transport, the literature remains largely descriptive and fails to establish any rigorous relationships between the two.

Wheatcroft (1994) and Debbage (2005) are probably two of the very few academics who explicitly addressed the interconnections between air transport and tourism. Wheatcroft (1994) reviewed changes in aviation regulation and their subsequent impact on tourism development. Although a number of examples are given, no rigorous empirical study has been carried out. Moreover, the simple model he developed is too loose to be used for
effective tourism and aviation policy evaluation. Furthermore, the role of the airport is ignored in his study.

Although Debbage (2005) acknowledged that airports play a role in air transport and tourism development, he did not address it in any detail. Debbage's main contribution to the field of air transport and economic development lies in his insights to propose studying the impact of changes of airlines competitive strategy. The idea is illustrated in a paper (Debbage, 1999) where he examined the linkages that exist between airline passengers, the structural composition of the regional economies and the competitive strategies of the airline industry in Carolinas. In his empirical study, figures from enplaned passengers and administrative/auxiliary employment were just simply compared in the forms of tables. Other factors contributing to the growth of the two variables have not been taken into account. Although the study is insightful, the method used casts doubt on the validity of the findings.

In the literature of tourism demand modelling and forecasting, travel cost is normally considered an important factor determining tourists' destination choice (e.g. Martin and Witt, 1988). Airfare is usually used as a measurement of travel cost between the tourist origin and destination areas. However, due to complexity of airfares, this variable is difficult to be measured. The use of inaccurate proxies (e.g. oil price) always yields meaningless estimates. The inference of the impact of the airfare on tourism demand is, thus, notoriously unreliable. Due to these problems, it has gradually become the common
practice in tourism demand modelling literature to drop travel cost variable from the analysis (Sinclair, 1998).

Similar to the inadequate study on the interface of transport and tourism in tourism literature, this area is also overlooked in transport research. As Page (2005) summarised, many of the early transport studies texts are written from a disciplinary perspective such as economics, while other texts focus on the operational, organisational and management issues associated with different form of transport. The movement of tourists is only indirectly discussed.

In the literature of transport and engineering, there is abundant research on the relationship between travel characteristics (e.g. time, cost and choice of mode) and travel decisions (Coto-Millan, et al., 1997; Hensher, 1993; Mayeres, et al., 1996). However, the issue has not been pursued sufficiently in the context of tourism (Prideaux, 2000).

Page (2005) made an interesting calculation. In the period 1982-2003, only four full-length papers on transport and tourism have been published in Annals of Tourism Research and Tourism Management, respectively. The situation is similar in transport research. Between 1994-2003 only six tourism-related articles were published in the Transportation Research series of journals.

In summary, despite the obvious synergies between tourism and transport, the above discussion highlights the limited attention that both tourism and
transport researchers have devoted to it. As Prideaux (2000:55) pointed out "transport and tourism research has not been assessed in a meaningful way". Our flawed knowledge on air transport and tourism will affect academics' ability to correctly understand the dynamic and interactive relationship between air transport and tourism development. For policy makers, this will hamper the design of the strategies to stimulate tourism and economic development with effective aviation policy. Why does this happen and what shall we do? These are the issues to be discussed in the next Section.

1.4 The Need for a New Analytical Framework

Last Section highlights the inadequacy of previous research in air transport and tourism development. The first part of this Section sets to explore reasons behind the inadequacy. Subsequently, a new analytical framework for the study of LCCs and regional tourism development is proposed.

1.4.1 Reasons behind the Inadequacy

Page (2005) argued the main reason for overlooking the interconnection that exists between tourism and transport research arises from the definition of tourism. Tourism is a composite product, involving transport, accommodation, catering, entertainment, natural resources and other facilities and services such as shops and currency exchange (Sinclair, 1998). Therefore, despite numerous attempts have been made to define tourism from both supply and demand sides over past decades, a universally accepted definition has not been reached so far (Riley et al., 2002). This is mainly because tourism does not have a unique base as an industry because its related commodities are
viewed as heterogeneous in terms of consumption and production practices (Eadington and Redman, 1991). Therefore, it is very debatable to define tourism as a single industry. Sinclair (1998:14) argued “it is useful to examine tourism not as an industry per se but a collection of interrelated industries and markets...” The Tourist Satellite Account (TSA) project proposed by the World Tourism Organisation (UNWTO) also considers that it is better to view tourism as a group of industries whose principal productive activity is a tourism characteristic productivity (UNWTO, 2000).

However, partly due to many years advocates by tourism lobby bodies and some academics, the term ‘tourism (or tourist) industry’ has gained its popularity. It is widely perceived by academics and laymen alike that there is a so called tourism (tourist) industry. The conceptual definition proposed by Leiper is probably the most popular one, in which he suggests “the tourist industry consists of all those firms, organisations and facilities which are intended to serve the specific needs and wants of tourists (Leiper, 1979:400)”. By this definition, such sectors as accommodation, restaurant, travel intermediaries (tour operators and travel agencies), attraction and transportation are all part of the ‘tourism industry’ while air transport seems to be a minor component of it.

Nevertheless, researchers and practitioners in air transport usually do not consider that the air transport is part of the ‘tourism industry’. Air transport is

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2 For instance, in a tourism conference, Mr Karl-Heinz Neumeister (2001), Secretary General of the Association of European Airlines (AEA), addressed to the delegates, “We in AEA would not normally describe ourselves specifically as part of the tourism industry but we would describe tourism as part of our industry – a very important part".
a major industry in its own right (Button, 2004). It includes the suppliers and operators of aircraft, engine manufacturers, fuel suppliers, airports and air traffic control systems (Air Transport Action Group, 2000). Tourism is considered as one of the air transport industry's customers. Therefore, based on the definitions of the both 'industries', it seems there is a tendency by researchers to overlook the interaction of air transport and tourism (Page, 2005).

To overcome the problem arising from the confusion of the definitions of tourism and air transport industries, Page (2005) suggested to take multidisciplinary approach to study the field of tourism and air transport. Although tourism study is multi-faceted and it is prevalent to adopt multidisciplinary in tourism research, the multidisciplinary approach is criticised by Leiper (1990). He argued that when each discipline potentially has something relevant to contribute, it is difficult to integrate the ideas and methods from them. Moreover, if the different perspectives are not easily integrated, it would be difficult to take this approach (Leiper, 1990).

To avoid or minimise the difficulties arising from multidisciplinary approach, Leiper (1990) suggested to adopt an interdisciplinary approach. According to Leiper (1990), interdisciplinary approach involves, first, working between the disciplines, drawing on whichever ones are relevant to a particular topic and second, combining their contributions by the use of systems models. The next Sub-section then discusses the new analytical framework developed based on the system model.
1.4.2 Towards a New Analytical Framework

System models use system theory, initially developed by Bertalanffy and others in the 1970s. Systems thinking has revolutionised many disciplines in the physical, social and business sciences during the past decades (Leiper, 1990). The main objective of systems thinking is to reverse the subdivision of the sciences into smaller and more highly specialised disciplines through an interdisciplinary synthesis of existing scientific knowledge (Bertalanffy, 1972). It has the merit of seeing things which are previously overlooked or bypassed (Bertalanffy, 1972) and can clarify and thus simplify what would otherwise seem complex (Leiper, 1990).

A conceptual model of LCC-airport-regional tourism is developed based on the system approach to understand the inherent complexity and dynamics of LCCs and regional tourism (see Figure 1.1 below). Three elements are identified as key actors in the system, namely, LCCs, airports and regional tourism.
From Figure 1.1, it can be seen that the airport lies in the centre of the model. This is because LCCs impact a region through their impact on the airport. Airports, which enhance the competitiveness of the economy, play an integral role in regional economic development. In many cases, tourism potential of a destination cannot be realised until direct air services and suitable airport infrastructure is provided (Graham, 2001).

However, the role of the airport in regional tourism development has largely been ignored by the academic community. Few articles, if there are any, explicitly address this issue in detail. Although there are abundant studies about the importance of airports for regional economy, the majority of them were produced or commissioned by airport lobby bodies, such as Airport Council International. The usual analysis involves direct, indirect and induced
impacts with the use of input-output model. The importance of airports has always been exaggerated, which made the results unreliable. More seriously, that kind of discussion is usually conducted without explicitly and adequately addressing the role of airlines. In fact, the reality is which role an airport can play in regional economic development is largely dependent on the decision of the airlines regarding which airport to operate from.

Having said that, as strategically important assets, airports are widely considered as key engines for regional economic growth (Button, 2004). In terms of tourism, Thurot (1973, cited in Pearce, 1989) pointed out that the modern air-based travel system is nodal in nature, with the expansion of international tourism in particular, being associated with the development of new nodes (airports) and routes linking those nodes. In many places, the traffic at the airport reflects the vitality of the tourist industry (O'Connor, 1995). According to the British Tourist Survey, around 60 per cent of overseas visitors tend to stay in the region served by their arrival airport (cited in Robertson, 1995). It appears in the ever competitive tourism market, regions with a well-managed airport could provide them with more competitive advantage than those without to draw tourists to their regions and so gain the spending benefits locally.

Since the late 1980s, the process of commercialisation and privatisation has swept across many of the world’s airports, particularly Europe. Accordingly, the business model of an airport has transferred from the traditional model where airports see their primary task as having to meet the basic and
essential needs of passengers, airlines, freight forwarders and other direct
airport customers of users to that of the commercial airport model (Doganis,

By adopting the commercial model, maximising economic benefit, particularly
those revenues from retail, has become the top priority of the airport
management. From a regional development perspective the interests of the
airport shareholders may not necessarily coincide with regional and national
economic interests. Private owners are unlikely to give away revenue
streams from an airport purely for the greater economic good of the region
(Humphreys and Francis, 2002). Thus, from this perspective, understanding
the role of airports in the model is the key to gain insights into assessing the
impact of LCC on regional tourism development.

In Europe, regional airports are characterised by thin traffic, conventional
scheduled airlines always find it difficult to operate on those routes. As a
result of difficult to reach critical mass of traffic, many regional airports suffer
from financial loss. Before the advent of LCCs, regional airports, at the best,
could only act as spoke points in network carriers' hub-and-spoke system or
are dominated by charter traffic. The recent rise of LCCs demonstrates that
they can make regional airport work in a way that traditional airlines cannot by
stimulating local demand for travel and bringing in passengers from a much
wider catchment area through low fares (Barrett, 2000). Evidence shows that
regional airports which embraced LCCs saw a dramatic increase in traffic.\textsuperscript{3}

\textsuperscript{3} Please refer to Section 3 in Chapter 3 for details.
However, there are also conflicts between LCCs and regional airports. LCCs operate a different business model in which cost minimisation is the top priority. After pushing all the cost input into a minimal level, airport charge is the main cost variable that LCCs can squeeze. Led by Ryanair, LCCs always win concessions of airport charges from regional airports because LCCs can threaten to fly elsewhere unless reductions in charges or commercial incentive are granted by the airport. It appears that the advent of LCCs has made the traditional airline-airport relationship more complicated and the rulebook is being re-written.

Despite the complex relationship that exists between regional airports and LCCs, for those commercialised/privatised airports, the main motivation to deal with LCCs is whether they can make a profit. Therefore, the real question is whether additional traffic generated by LCCs can be translated into the revenue and cover the cost paid to attract LCCs. If the answer is yes, the relationship is win-win and sustainable. If the answer is no, airports would have to rethink their relations with LCCs and might choose to cease their cooperation with them.

For regional authorities, different strategies need to be developed to deal with the two scenarios. If there is a win-win relationship between LCCs and the airport, there is no need for the regional authority to interfere. What it needs to do is to work closely with the airport and LCCs to promote the region effectively and maximise tourist arrivals. The increase in visitor numbers may
then have a spin-off effect on employment generation in tourism-related industries.

If LCCs win but airports lose (e.g. revenue generated by the airport cannot cover the cost paid to attract the LCCs) or LCCs lose but airports win (e.g. high airport charges imposed to LCCs), the relationship will not be sustainable in the longer term. The end result would be either the regional airport ceases cooperation with LCCs or LCCs pull out of the region. This will lead to instability for the region where predictable availability of routes is a necessity for economic and tourism development. Under these circumstances, regional authorities have to interfere in the issue by choosing whether or not to subsidise LCCs to fly to the region, or to compensate the regional airport for the lost revenue. Before taking any actions, the most crucial issue here is to what extent LCCs are beneficial to regional economic, particularly, tourism development. If LCCs' impact is great, then subsidies can be justified. If the impact is negligible, it does not make good economic sense for the financial support.

As can be seen, to understand the dynamic and interactive relationship between LCCs, airports and regional tourism, two questions must be answered. To what extent do LCCs have positive impact upon an airport's financial performance? To what extent are LCCs beneficial to regional tourism development?
1.5 Research Objectives

As stated at the beginning of this Chapter, the aim of this research is to measure regional economic effects of LCCs. Based on the above discussions and the analytical framework proposed, the objectives of this study are set as follows:

(1) To review the literature on the relationship between air transport, tourism and regional economic development.

(2) To examine the economic effects of LCCs in the UK, with a particular focus on a regional perspective.

(3) To develop a framework for the measurement of the economic effects of LCCs.

(4) To measure the impact of LCCs on regional airports financial performance

(5) To assess the impact of LCCs on regional tourism employment

The empirical study based on the UK experience is provided. The UK is chosen as the focus of the empirical study and this decision is based on careful considerations. Firstly, the UK is the biggest and most competitive market for LCCs in Europe. Secondly, the UK is the only country in Europe that permits a study of the longer-term impact of LCCs. Thirdly, the UK is one of the top tourist destinations in the world. And finally, it is due to data availability.
1.6 The Structure of the Study

In Chapter 2, theories in regional economic development are reviewed and the importance of tourism for regional economic development is highlighted. Then the business model of LCCs is examined in the context of airline competition. Chapter 3 goes on to examine the interplays of LCCs, airports and regional tourism with particular reference to the UK. Together the both chapters provide literature review for the Thesis and fulfil the objectives 1 and 2, respectively.

In Chapter 4, a framework for the measurement of the economic effects of LCCs is developed (Objective 3). Panel data analysis is considered more appropriate than case study approach. Therefore, it is adopted as the method for the empirical study. In Airport Study, the impact of LCCs on airports financial performance is measured from the perspectives of aeronautical, non-aeronautical revenue, operating cost and operating profit. In Tourism Employment Study, the choice of tourism employment as an indicator for regional tourism development is justified. Difficulties in defining tourism employment are highlighted. The UK official definition for tourism-related industries is adopted. On these grounds, the impact of LCCs on employment in tourism-related industries is investigated at two levels, namely, aggregate and disaggregate; full-time and part-time employment are assessed separately.

The findings are presented in the two subsequent Chapters. Chapter 5 describes findings for the impact of LCCs on airports financial performance
(Objective 4), while Chapter 6 assesses the impact of LCCs on regional tourism employment (Objective 5). Finally, in Chapter 7, findings from the empirical study and their implications for policy makers are discussed and the conclusions are drawn.
References


2.1 Introduction

Governments favour tourism mainly because of its contribution to economic development. To develop tourism, air transport is an essential ingredient as discussed in Chapter 1. From the perspective of regional tourism development, the biggest difference between LCCs and conventional scheduled airlines is that LCCs deliberately fly to regional airports. In so doing, it has affected tourists travel patterns and led to growth in new destinations and tourism boom in what were, previously, secondary destinations (Forsyth, 2006). The increased additional tourist flow will naturally lead to increased tourism expenditure in the region, hence impacting regional tourism and economic development. It is in this way that LCCs and regional tourism and economic development are brought together.

The purpose of this Chapter is twofold. One is to review the literature to establish the relationships between tourism and regional economic development. The other is to examine the business model of LCCs and explore the role of regional airports in building up LCCs competitive advantages.

Therefore, the remainder of this Chapter is organised as follows. Section 2 reviews theories in regional economic development. Section 3 examines the role of tourism for regional economic development. Section 4 looks at LCCs
business model and assesses the role of regional airports played in LCCs business strategy.

2.2 Theories in Regional Economic Development

This Section first reviews two mainstream theories in regional economic development, namely, neoclassical growth theory and endogenous growth theory. Then Markusen's alternative theory of profit cycle is introduced. The implications of these theories for regional economic development are presented subsequently.

2.2.1 Neoclassical Growth Theory

Neoclassical theory, rooted in neoclassical equilibrium economics, explains regional growth in terms of the availability and use of productive factor inputs. The theory was initially developed by Solow (1956) and it argues that development proceeds as firms and households make increasingly more efficient use of their labour, capital and natural resources.

Neoclassical theory assumes diminishing returns to investment. It argues that provided there are no major barriers to the operation of market forces, in an integrated national space economy there are strong pressures leading to the general convergence of regional incomes over time. Regional disparities are unlikely to be persistent, since such inequalities will set in motion self-correcting movements in prices, wages, capital, and labour, which impart a strong tendency toward regional convergence. Two of the earliest and most
influential statements of this view are Borts and Stein's (1964) classic study of regional development in the United States (US) and Williamson's (1965) analysis of the evolution of regional income differences in advanced industrial countries.

Over the past decade, empirical work by economists on cross-national and cross-regional convergence has proliferated. Barro and Sala-i Martin's studies (1991, 1992a, 1992b and 1995) on US states, the Japanese prefectures, the European regions and Canada provinces are probably the most cited ones. They tested for absolute convergence of regional per capita incomes across those regions and found the speed at which regions of different countries converge to their respective national means is about 2 per cent per annum. Although it showed evidence of long-term convergence, the slow rate is much less than would be expected from a standard neoclassical view of the regional growth process (Martin and Sunley, 1998). Moreover, another problem is that they assumed the underlying convergence-generating process is identical across space, when in reality it is likely that the rate of convergence will vary from region to region (Quah, 1993; Canova and Marcet, 1995). Furthermore, the approach fails to take into account how different regions relate to one another, whereas the growth trend of a region may actually depend crucially on the growth trajectories of others (Quah, 1993). The study by Armstrong (1995) and Quah (1996) demonstrated that spillover effects of labour, capital, technology and other influences on growth are geographically localised. All these cast doubts on the validity of neoclassical
growth theory and its assumption of diminishing return to investment is questioned.

2.2.2 Endogenous Growth Theory

The increasingly dissatisfaction with neoclassical growth theory gives rise to endogenous growth theory. Instead of assuming factors, in particular technological change and human capital, as exogenous by neoclassical growth theory, endogenous growth theory treats them as endogenous to the growth process (Martin and Sunley, 1998).

Endogenous growth theory has its origin in cumulative causation theories linked to Weber (1909), Isard (1956), Myrdal (1957) and Hirschman (1958). There are several main types of endogenous growth theory (Martin and Sunley, 1998). One focuses on the returns to capital investment, another on learning-by-doing and the improvements in knowledge, skills, and human capital that workers accrue as a result of being employed. Another variant is called Schumpeterian and is based on the temporary monopoly rents which companies gain from innovations, which in turn drive the growth process. In all three cases some of the increasing returns gendered in human capital and through innovations may be geographically defined (Sunley, 2000).

According to endogenous growth theory, there are no necessary reasons why regional growth and incomes should converge, even over the long run (Martin and Sunley, 1998). To the contrary, regional divergence is more likely. The models of regional growth advanced by writers such as Perroux (1950), Myrdal
(1957), and Kaldor (1970) predict that regional incomes will tend to diverge, because market forces, if left to their own devices, are spatially disequilibrating. Economies of scale and agglomeration lead to the cumulative concentration of capital, labour, and output in certain regions at the expense of others. Regional development is highly path dependent; temporary conditions and shocks, as well as historical "accidents", may have permanent effects as pattern of specialisation, of economic success or economic backwardness, become "locked in" through external and self-reinforcing effects. Various countervailing forces (congestion diseconomies, "trickle-down" effects, and governmental fiscal transfers) may keep regional divergence in check, but are considered unlikely to be sufficient to promote regional convergence (Martin and Sunley, 1998).

Economies of agglomeration play an important role in the process of cumulative causation. The advantages of agglomeration are summarised by Amin (2000) as follows. Firstly, it reduces transaction and transport costs. Secondly, there are economies deriving from specialisation, both by the locality in a given product, and by its firms in a particular task. Thirdly, the specialisation of an area is more likely to continuously stimulate spin-off and new entrepreneurship.

In their seminal book, Dicken and Lloyd (1990) argued that an important basis of agglomeration economies is the connections or linkages between economic activities within a relatively restricted geographic area. In the final analysis, any firm is but one part of a complex chain of production held together by
direct or indirect linkages between a series of firms. Through such linkages, 
external economies are transmitted to the individual production unit via its 
network of interconnections with other elements in a system. In addition, 
another economies may be derived by association. Moreover, complementary 
or similar industries, by recruiting and training a labour force, for instance, 
provide a localised cluster of particular labour skills. These skill pools add to 
the attractiveness of such areas for particular specialised industries (Dicken 

Porter's (1990, 1998) study of cluster moves the theory of economies of 
agglomeration one step forward. According to Porter, cluster is defined as 
"geographic concentrations of interconnected companies, specialised 
suppliers, service providers, firms in related industries, and associated 
institutions (for example, universities, standards agencies and trade 
associations) in particular fields that compete but also cooperate" (Porter, 
1998: 197). Rather than focusing on the need to build industries with linkage 
to many other industries, Porter (1998) argued what is important is to 
encourage the development of fields with the strongest linkage to or spillover 
with each cluster.

2.2.3 Markusen's Profit Cycle

In both neoclassical and endogenous growth theory, corporate decision 
markers are relegated as passive agents whose spatial behaviour is dictated 
by free market conditions. This approach is heavily criticised by Markusen 
(1985). In her profit cycle theory, Markusen suggested that regional shifts in
production and employment are not simply the product of changing factor endowments or shifting consumer demands but of disparate strategies undertaken by corporations experiencing different historical moments of longer-term profitability cycles.

The profit cycle model (see Figure 2.1 below) developed by Markusen (1985) is built upon Schumpeterian growth dynamics, Mandel's super-profits, product cycle theories of business economics and oligopolistic models from Industrial Organisation.

Figure 2.1 Profit Cycle
Source: Markusen (1985: 28)
The five stages in the profit cycle model are hypothesised to constitute the usual evolutionary history of an industry (Markusen, 1985). Markusen argued that in the first stage of the profit cycle, the focus of the companies or industries was on innovation, research, design and experimentation. Both of output and employment were low or non-existence. Average unit cost was high as a result of unable to produce in mass scale. Consequently, the price was high and the profit was low or non-existence.

Then when new products were developed and mass production became regular, new companies proceeded to the second stage of super-profit by garnering substantial profits from the relative novelty of their product and the absence of immediate competition. At this stage, employment expanded rapidly with much of the occupation concentrating on the professional-technical end of the spectrum. The emphasis of the firm was on product design, improvement and firm strategy.

Then when the companies or industries progressed to the stage of normal profit, Markusen then suggested that "The strategy of the firm turns from product design and market outreach to more efficient management" (Markusen, 1985: 32). The emphasis is on scale economies, mass production, and both vertical and horizontal integration, in an effort to cut costs and increase productivity. The number of competitors will decline as economic pressures encourage companies to cut costs and rationalise production.
In the fourth stage of normal profit, the competition may become excessive and the market saturated. Faced with the prospects of gradual or no growth in market share, Markusen suggested that the key firms may respond by oligopolising. "Domination of the market by a few sellers will permit these corporations to reinstate greater-than-normal profits by the classical maneuver of restricting output and raising prices" (Markusen, 1985: 33). Markusen argued that previously healthy industries can wither when subject to long-term oligopoly, particularly when faced with competition from young and more inventive competition from other parts of the world. The end result, i.e. stage V of the profit cycle, would be job losses and plant closures as corporations take absolute profit losses on production.

Apart from providing a theoretical framework, Markusen also provided empirical evidence by examining the evolutionary patterns of sixteen US industries through the form of case study. In general, the case studies confirmed that the proposed stages were identifiable and once an industry passed through its major period of innovation, it tended to progress to the eras of competition, maturity and decline.

The real strength of Markusen's profit cycle is that it focuses on the dynamic evolutionary patterns of individual industries. But it has a serious limitation. As admitted by Markusen (1985), the interaction among different industries and the aggregate consequences of corporate behaviour of this interaction

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4 The 16 industries that Markusen (1985) examined are: steel, computer, semiconductor, basic aluminium, cotton, knitwear textiles, pharmaceutical, women's clothing, auto assembly and parts, brewing, shoe, wine, soybean oil, fish processing, tobacco and cigarette as well as lumber milling.
can also profoundly affect profitability patterns of the industry in question, but, this significant issue cannot be examined by simply applying profit cycle model.

2.2.4 Implications for Regional Economic Development

With so many different and sometimes competing theories, it is important for regional policy makers to adopt appropriate strategy based on their own circumstances. Neoclassical theory suggests investing on infrastructure and this is the strategy that has been adopted by regions. But it appears that infrastructure investment is only a necessary but not sufficient condition for regions to achieve sustainable economic development.

Endogenous growth theory focuses on increasing returns and positive externalities. The major source of increasing returns comes from economies of agglomeration. The result of the operation of a circular and cumulative process of economic development is that the geographic pattern of development is uneven. Such unevenness is structured in a particular manner into two major components: a dominant core and a subdominant periphery (Dicken and Lloyd, 1990). It is obvious that some economic activities exert a more powerful effect on development in an economic system than others. Therefore, for the development of a periphery region, it is critical to find a growth pole, which consists of a cluster of expanding industries that are spatially concentrated and set off a chain reaction of minor expansions in the surrounding hinterland (Haggett, 1975).
In the meantime, regional policy makers should bear in mind that industrial development is not synonymous with regional growth (Markusen, 1985). As Sheppard (2000) puts it in the search of increasing competitive advantages firms have more options and powers than regions. Firms can relocate their activities and staff to a new place which suits their strategic purposes, while regions cannot move (Sheppard, 2000).

Markusen (1985) also warned that incentives and enticements to firms in the form of free land, tax abatements, or capital subsidies may not be linked to job creation. These types of aid may increase the corporate mobility or accelerate their movement through the profit cycle, with adverse longer-term consequences for the regional economies. Above all it suggests that aiding firms no longer guarantees aiding workers because boosting the profitability of a company is not necessarily linked to job creation in any particular sector, in any particular location.

Therefore, this prospect raises challenging questions about regional policy makers' ability to plan at the local level and about the adequacy of current economic development policy tools. Regions on the one hand, endeavour to seek the propulsive sectors that could act as growth poles for the region. On the other hand, they need to remain vigilant about the potential harm that oligopolists could cause to the regional economy in the longer run.

To qualify as a propulsive industry or firm, Dicken and Lloyd (1990) argued that there are four requirements. Firstly, the industry or firm should be
relatively large if it is to generate sufficient direct and indirect effects. Secondly, it should be relatively fast-growing. Thirdly, it should have a high linkage with other industries or firms in order for the effect of its growth to be transmitted. And finally, it should be innovative.

Tourism might be an economic sector to fulfil this role. A development based on natural or human-made attractions offers the tourism sector comparative advantages over other economic sectors. As an export leader, tourism attracts large income from demand outside the region but is still dependent on strong local linkages. Moreover, the tourism sector is largely combined with small and medium sized enterprises with their roots in the local economy. Technology is also crucial for the tourism sector, exemplified by the development of computerised reservations systems in the 1960s and the subsequent global distribution systems (Buhalis, 2003). Nowadays, even small accommodation establishment and tour operators take advantage of the internet and promote themselves globally. Tourism seems to have the ability to exert a propulsive force on the regional growth. The next Section then sets to examine the role of tourism in regional economic development.

2.3 The Role of Tourism in Regional Economic Development

Tourism is a significant economic activity. According to the UNWTO there were more than 763 million international tourist arrivals in 2004, generating US$623 billion international tourism receipts (UNWTO, 2005b). World Travel and Tourism Council (WTTC) argued that worldwide tourism directly and indirectly employed 8.3 per cent of total workforce and contributed to 10.6 per
cent of total Gross Domestic Product (GDP) in 2005 (WTTC, 2005). Although the details of WTTC's calculations are open to debate, it is certainly true that tourism is a significant source of income and employment in many developed and developing economies. Apart from being a big economic sector, over the past decades tourism has been growing rapidly. Expenditure on tourism has been rising at an average of about 5 per cent per annum since 1970 (WTTC, 2005). It is widely believed that tourism is one of the fastest growing areas of the world economy (UK DCMS, 2004). All predictions for the next decade – UNWTO or WTTC – are very optimistic.

In the literature, the analysis on the benefit of tourism on regional economic development is usually confined to inbound tourism. The outbound tourism is normally viewed as tourism imports. However, outbound tourism can also have indirect contribution to regional economic development such as generating business opportunities for international cooperation and stimulating exports (Li, 2004).

Tourism activities have high linkage with other industries as tourists require a variety of goods and services in the destination, including accommodation, food and beverages, entertainment, local transport services, souvenirs, and so on (Telfer, 2002). Therefore, tourism offers opportunities for backward linkages throughout the local economy. These opportunities include both direct links, such as the expansion of the local farming industry to provide food for local hotels and restaurants (Telfer, 1996) and indirect links with, for example, the construction industry (Telfer, 2002). In addition, there is also
induced income generation in the host economy resulting from tourist expenditure and associated investment (Sinclair, 1998). Two main approaches, namely, the Keynesian multiplier model and the input-output technique, have been used extensively in the tourism literature to assess the direct, indirect and induced impact of tourism (Archer, 1977; Sheldon, 1990; Fletcher and Archer, 1991).

However, it needs to bear in mind that tourism's income and employment generation are affected by the level of national income and wealth, the associated trading relationships and the proportion of GDP arising from tourism (Sinclair, 1998). For example, developed economies tend to have higher intra-industry linkages and lower leakages from tourists' expenditure, than developing countries.

Development of tourism on a large scale can also create external economies. Improvements in transportation networks, water quality and sanitation facilities may have been prompted by the tourism activities but benefit other sectors of the economy. An international airport for tourism development provides improved access to other regions for locally produced goods (Vanhove, 1997). Peppelenbosch and Tempelman (1973) demonstrated that infrastructure requirements for tourism could act as regional development tools.

Therefore, Porter (1998) suggested that the building of a tourism cluster in developing economies can be a positive force in improving outlying infrastructure and dispersing economic activity. Michael (2003) argued
tourism-based cluster formations may enhance multiplier and externality effects, accelerating opportunities for new forms of economic wealth by creating a demand for a host of complementary activities which in turn generate their own effects. Based on the above discussion, it seems tourism has the ability to act as a propulsive sector to trigger regional economic development. However, little empirical research has been found addressing this issue explicitly.

Apart from the above discussed role of tourism in regional economic development, it is argued that the main reason for government, especially those in the developed countries, to promote tourism is its potential to create valuable employment opportunities (Mihalic, 2002). Tourism is labour intensive and it has a high degree of semi-skilled and unskilled employees, which make it relatively accessible (Vanhove, 1997). Moreover, as high linkage between tourism and other sectors, the expansion of tourism has strong direct, indirect and induced impact on employment generation across many different industries from agriculture, construction, manufacturing to retail trade, finance and so on. Therefore, regional policy makers see tourism an attractive sector of reducing unemployment in regions where few other employment opportunities are available.

Tourism employment also has some distinctive features which make it very different from other types of employment. First, tourism is a sector with a high percentage of part-time jobs, which is partly due to seasonality of the tourism. Hudson and Townsend (1992) revealed that in the UK 38 per cent of the men
and 56 per cent of the women working in the hospitality sector (hotels, restaurants and cafes) are part-time workers. Moreover, tourism sector has many small firms and self-employed and has the benefit of generating entrepreneurial activity (Szivas, 1997; Vanhove, 1997).

Nevertheless, tourism employment is sometimes subject to a series of criticisms in the literature because of its low pay, part-time and seasonality nature. However, in a world where traditional industries in the primary and secondary sectors are in decline, tourism is considered a particularly valuable source of employment. Moreover, the rapid development of the tourism sector is likely to provide more significant new job opportunities. In the developed countries, tourism provides employment in peripheral areas, thereby counteracting rural-urban migration. And tourism employment, thus, is closely connected with regional development issues in the developed world. Therefore, despite those problems associated with tourism employment, the employment contribution of tourism to development is considered effective and is currently the most justified role of tourism in regional development (Mihalic, 2002).

The other economic benefits of tourism include contribution to GDP and personal incomes, provision of tax revenue for the government, generating foreign-exchange earnings, alleviating balance of payment and redistribution of wealth. Most of them are associated with the national level and have been well documented (Sinclair, 1998). It is not the intention of this Section to examine them further.
As we can see there are a number of benefits in choosing tourism as an engine for regional economic development. Like any other economic activities, tourism also has its negative aspects. Tourism demand tends to be very unstable due to changes in fashion, unfavourable exchange rates, environmental catastrophes, terrorism, war, spreading of epidemic, etc. Therefore, over-dependence on tourism can be very risky. Moreover, if tourism sector in a region is dominated by foreign firms, leakages from the local economy can be substantial. This is particularly true in developing countries as many tourist-needed products have to be imported.

To maximise the tourism benefits and avoid or minimise the drawbacks, the government has always been playing a vital role. Ellilot (1997) argued that by providing political stability, security and legal and financial framework, government provides the essential environment for the survival of the tourism sector. Oppermann and Chon (1997) indicated that governments can influence tourism development through fiscal and investment policies such as investment into the general infrastructure of a destination or region; investment into tourism infrastructure; investment incentive for companies; and influencing exchange rates. Hall (1994) outlined seven roles of government in tourism: coordination, planning, legislation and regulation, entrepreneurship, providing stimulation, social tourism and interest protection. Each of these roles can be adapted to varying degrees of success to help promote regional development.
In the EU, the most significant financial interventions for tourism development are the Structural Funds and Cohesion Funds (Davidson and Maitland, 1997). These financial instruments are used with the EU's Regional Development Policy to strengthen economic and social cohesion within the EU, to reduce the disparities between the regions of the EU and to help regions which are over dependent on tourism and suffering from its negative impacts (Davidson and Maitland, 1997). To develop regional tourism, it is widely considered that accessibility is an important issue to be solved. LCCs provide direct air links to many European regions. The next Section then moves on to examine the emergence of LCCs.

2.4. The Emergence of LCCs

The most significant impact in the airline industry over the past three decades has been the trend towards airline market deregulation, which directly resulted in the emergence of LCCs and has had profound impact both on market structure and on operating patterns (Doganis, 2006).

Therefore, this Section first reviews airline regulation regime. As the first country that thoroughly liberalised its domestic airline market, the US has seen the rapid expansion of LCCs in the 1980s to model themselves to the LCC pioneer, Southwest. However, most of the new entrants failed within five years operation. All these provide valuable insights into the study of the European low-cost sectors. Therefore, the second Sub-section focuses on the development of LCCs in the US. After that, the development of LCCs in Europe is examined.
2.4.1 Brief Introduction of Airline Regulation

The air transport industry has been highly regulated throughout the whole of its history. Regulation can be broadly divided into technical and commercial regulation. Regulation on technical and operational standards has been strictly controlled in the interests of safety and, it is likely to continue to be closely regulated (Wheatcroft, 1994).

Regulation on the aspects of economics and commercial can be further divided into international and domestic markets. The regulation of international aviation has its origin from the 1944 Chicago Convention on International Civil Aviation. Summarised by Wheatcroft (1994), four basic principles were accepted by the states. Firstly, each state has complete and exclusive sovereignty over the air space above its territory. No scheduled international air service may operate over or into the territory of a contracting state without the previous consent of that State. Secondly, each state has equal rights of participating in the traffic. Thirdly, international aviation regulation must be without distinction as to nationality, i.e. non-discrimination. Finally, each state has complete freedom in designating the national airlines which will operate air services.

In the international market, the regulation is governed by the so called 'freedom of flights' (see Appendix 1 for details). The first five 'freedoms of flights' were defined in the two supplementary agreements: the International Air Services Transit Agreement and the International Air Transport Agreement, approved by the 1944 Chicago Convention. Another three 'freedoms of
flights’ were subsequently established. Together, these ‘freedom of flights’
gave rise to series bilateral agreements between national governments
controlling traffic rights, frequencies of service and capacity.

The Chicago Convention also set up the International Civil Aviation
Organisation (ICAO) which was an intergovernmental agency primarily
concerned with government interests in aviation. In the following year, the
International Air Transport Association (IATA) was also founded to represent
the interests of airlines and its most important function has been to set airline
fares and cargo rates (Doganis, 2002a). Consequently, air transport industry
became one of the most heavily regulated industries.

Apart from tight regulation on international aviation, the domestic air market
was traditionally under heavy control, and it is still the case in many countries.
Button et al., (2002) asserted that the motives for regulating aviation market
are largely to protect the national carriers because beyond strategic
considerations, they are seen as important vehicles for furthering a nation’s
prestige and commerce. Moreover, commercial regulation of air transport
services is generally intended to achieve public policy goals which it is felt
would not be realised through the operation of free market forces (Holloway,
1998). Economic theory would justify intervention in response to a failure of
markets to allocate resources efficiently. Some markets are not sufficiently
dense to support active competition at high enough levels of frequency to
provide an adequate service to the public, and it can be argued that in such
cases regulators have a legitimate role to play as surrogates for real
competition. Regulating the industry can prevent destructive competition and instability.

However, regulation usually results in low efficiency, high costs and high fares. In a report submitted to Australian Government advocating liberalising domestic aviation market, the Industries Assistance Commission (1989: 59) came to the following conclusions: "Regulation of services, government ownership of carriers, and infrastructure and pricing policies impose a high cost on travellers, tourism, the airline industry itself, and the welfare of the Australian people. Fares and costs are higher than they need be, capacity is constrained and even at these prices, Australia is turning away potential customers. Travellers are denied the range of prices and services they would enjoy in a more competitive environment".

2.4.2 The Development of LCCs in the US

The US Airline Deregulation Act 1978 marked a milestone in the airline industry and it directly resulted in the emergence of LCCs in the US. This Sub-section first reviews the airline deregulation in the US. Then the business strategy of LCCs' role model - Southwest Airlines - is examined. After that, reasons for the failure of the first wave of US LCCs are explored.

2.4.2.1 The Airline Liberalisation in the US

In the US, there was a strong pressure for deregulating the airline industry from both the public and government in the 1960s and 1970s. Two important
economic thoughts also played an important role in the process towards airline deregulation. One was the *laissez faire* government policy advocated by the Chicago School economists. The other was the development of contestability theory which argues that the threat of potential competition will deter any efforts by a monopoly or quasi-monopoly operator to exploit air travellers, provided there is free entry to and exit from a market (Baumol, et al., 1982).

By the 1960s-1970s, several economic studies of regulatory inefficiencies (Caves, 1962; Levine, 1965; Jordan, 1970; Keeler, 1972; Douglas and Miller, 1974) together with the US Congressional hearings led by Senator Edward Kennedy contributed directly to a reconsideration of regulatory policy (Goetz and Jutton, 1997). An economic and political consensus was emerging that regulation resulted in the inefficiency and restricted growth of the industry. As a result, the US Congress passed and President Carter signed into law the Airline Deregulation Act of 1978 to liberalise the US domestic market. In essence, this Act stripped the Civil Aeronautical Board of its authority to control entry and exit, fares, subsidies, and mergers. Today, carriers that are "fit, willing, and able" can serve any route and charge fares to any level that they deem appropriate (Morrison and Winston, 1986).

Deregulation dramatically changed the structure of the airline industry. The wide-spread of LCCs was regarded as one of the most important outcomes (Morrison and Winston, 1995). Southwest Airline was the first LCC in the US. Although it established before airline liberalisation, its rapid development
started from 1978. The low cost and low fare strategy adopted by it has significantly stimulated demand for short-haul air travel in the US. In the airline industry, there is well known 'Southwest Effect' where Southwest flies, there is decrease in airfare and increase in traffic. It also achieved exceptionally good financial performance among all US airlines. The success of Southwest Airlines attracted a large number of new-entrants to adopt the low cost and low fare strategy. The next Sub-section, thus, devotes to examine the business strategy of Southwest.

2.4.2.2 The Role Model of LCCs: Southwest Airlines

The rise of LCCs is characterised by the strategy of cost leadership. According to Porter (1980), cost leadership is that firms aim to be the low-cost producer of goods or services by producing a standardised product. Southwest Airline is probably the most successful airline pursuing cost leadership strategy. Southwest began operations in 1971 with three Boeing 737-200 aircraft in Texas, US based on a low-fare, low-cost philosophy. Its first routes were from Dallas to Houston and Dallas to San Antonio. Southwest has a distinctively different product feature from those conventional scheduled airlines, which is summarised in Table 2.1 below:
### Table 2.1 The comparison of product features of conventional scheduled and Southwest Airlines

<table>
<thead>
<tr>
<th>Product features</th>
<th>Conventional airlines</th>
<th>Scheduled airlines</th>
<th>Southwest Airlines</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fares</strong></td>
<td>Numerous types, complex, many restrictions</td>
<td>Low, simple, unrestricted, non-refundable</td>
<td></td>
</tr>
<tr>
<td><strong>Network</strong></td>
<td>Hub-and-spoke</td>
<td>Point-to-point</td>
<td></td>
</tr>
<tr>
<td><strong>Distribution</strong></td>
<td>Primarily taken by travel agents, tickets produced</td>
<td>Mainly sold through internet or telephone</td>
<td></td>
</tr>
<tr>
<td><strong>In-flight</strong></td>
<td>Two or three classes, seat assignment, free meals</td>
<td>Single-class, high density, no seat assignment, no free meals</td>
<td></td>
</tr>
<tr>
<td><strong>Aircraft</strong></td>
<td>A large fleet of different sized aircraft, lower utilisation</td>
<td>Single type, high utilisation</td>
<td></td>
</tr>
<tr>
<td><strong>Airport</strong></td>
<td>Principal airports, 45-60 minutes turnaround</td>
<td>Secondary or uncongested airports, 20-25 minutes turnarounds</td>
<td></td>
</tr>
<tr>
<td><strong>Sector</strong></td>
<td>All sorts of stage length</td>
<td>Short-haul, average below 800 km</td>
<td></td>
</tr>
<tr>
<td><strong>Staff</strong></td>
<td>More cabin crew</td>
<td>Minimum cabin crew on board, productive-based wages</td>
<td></td>
</tr>
</tbody>
</table>

*Source: compiled by the author*

Southwest does not offer airport lounge, meals, assigned seats, interline baggage checking, or premium class of service. It focuses on point-to-point, rather than hub-and-spoke, service in markets with frequent, conveniently timed flights and low fares. Southwest concentrates on flying passengers and does not carry any freight. It operates only one aircraft type, the Boeing 737, which simplifies scheduling, maintenance, flight operations, and training activities. Southwest does not interline or offer joint fares with other airlines, nor have any commuter feeder relationships. Only simple class is provided on
its flights. It employs a relatively simple fare structure, featuring low, 
unrestricted, unlimited coach fares, as well as even lower fares available on a 
restricted basis. But Southwest does provide frequent flyer programmes. 
Frequent customers receive one free ticket after purchasing and flying eight 
roundtrips. Both the product and delivery process design have been 
dramatically simplified in Southwest's business model. In return, its unit costs 
are much lower than those conventional scheduled airlines.

By 1978, Southwest had expanded its route system to serve most of the 
larger communities in Texas. Following the implementation of the Airline 
Deregulation Act in 1978, Southwest began a cautious expansion. From the 
start, Southwest's cost leadership approach was based on high-density 
operations. High density was maintained by selecting cities for service that 
were relatively close in air distance and had a high demand for travel. 
Management felt that low fares, frequent flights and convenience of 
scheduling could lure people away from their automobiles (Sorenson, 1991). 
Network growth has been accompanied by increased capacity, which allowed 
the airline to maintain high flight frequencies within its system. In 1978, 
Southwest's average number of flights per airport per day was 29.1 
(Sorenson, 1991). By 2003, its density score jumped to 47.5 (Southwest 
Airlines, 2004). The rapid increase of frequent flights has helped Southwest 
consistently rank first in market share in 90 per cent of its top 100 city-pair 
markets. In the aggregate, it holds around 65 per cent of the total market 
share in those markets (Southwest Airlines, 2004).
In order to profit from the lower costs associated with increased density, Southwest has had to ensure that it maintains high load factors by selecting protected markets that generate high demand. Its network philosophy includes selecting places that will generate the required demand, operating directly between those places, and maximising the number of flights that a city pair can support. Additionally, to fortify itself from competition, Southwest selects airports that are close to the city centre and that are not used, to a significant degree, by other airlines, such as Houston Hobby, Chicago Midway, Dallas Love, and the Detroit City Airport.

Southwest's frequent flights on high density routes are complemented by carefully selected airports. It favours alternative (secondary) airports in major US cities, avoiding congestion in competitors' hubs. This enhances the airlines ability to sustain high employee productivity and reliable on time performance. This operating strategy also permits the company to achieve high aircraft utilisation. Aircraft are scheduled to minimise the amount of time the aircraft are at the gate, with a turnaround of approximately 25 minutes, thereby reducing the number of aircraft and gate facilities that would otherwise be required.

To maintain its cost advantage, Southwest constantly looks for ways to reduce costs. It was the first carrier to offer e-ticket through its website. By the end of 2003, 54 per cent of Southwest's passenger revenues came through its Internet site, while only 16 per cent were booked through travel agents (Southwest Airlines, 2004). Consequently, Southwest announced it would no
longer pay commission to travel agents from 15 December 2003 as part of its cost reduction measures.

Apart from pursuing the cost leadership strategy, Southwest differentiates itself from other airlines by consistently low fares, high frequent flights and friendly service. Sorenson (1991) argued that Southwest's cost leadership strategy is also complemented by gaining monopoly control of access to key secondary airports in metropolitan areas. Although control of those airports does not allow Southwest to dominate the metropolitan areas, it does ensure that passengers interested in flights to downtown airports will look to Southwest before considering a flight on other airlines (Sorenson, 1991).

Southwest became a major player in 1989 when it exceeded the billion-dollar revenue mark (Lawton, 2002). It was the only US airline to make consecutive net profits in its 31 operating years and its cumulative net income by 2002 was US$3.5 billion (Gillen and Lall, 2004). In 2002, the market capitalisation of Southwest exceeded that of all major US airlines put together (Gillen and Lall, 2004). Of the major airlines in the US, Southwest also scored best in measures of customer satisfaction (Southwest, 2004).

2.4.2.3 The Failure of the First Wave of LCCs in the US

The huge success of Southwest encouraged many smaller local service, intrastate, and charter airlines as well as massive new entrant carriers to adopt the low-cost, no frills strategy to challenge the dominance of the ten major trunk airlines (United, American, Delta, Eastern, TWA, Western, Pan...
Am, Continental, Braniff, and Northwest). In the face of this competition, the ten majors saw their market share of domestic revenue passenger miles slip from 87 per cent to 75 per cent between 1978 and 1983 (Bailey et al., 1985). However, the US airline industry experienced a massive wave of bankruptcies, mergers, and acquisitions during the whole 1980s. Between 1983 to 1988, more than 200 carriers failed or were absorbed and the majors re-established their dominance (Goetz and Jutton, 1997). The market share of eight major carriers rose to 93 per cent in 1995 (Goetz and Jutton, 1997). Why do so many new entrant airlines fail? Does the cost-leadership strategy really work in the airline industry? This Sub-section attempts to explore reasons of the high percentage of the casualties in the US LCC sector.

Porter (1980) argued that cost leadership is an extremely difficult strategy in any competitive environment as it requires constant attention to cost. Every decision that managers make must be guided by the principle of cost control. Cost leadership is an even more difficult strategy in the airline industry as there are strong indications that increasing the number of places and routes in an airline's network will not reduce unit costs and the economies of scale are often minor or non-existent (Sorenson, 1991). In a study, Caves et al., (1984) attempted to identify the cost advantage of trunk airlines over smaller regional airlines. Based on the data from 1970 through 1981 in the USA, they found that any differences in scale have no role in explaining higher cost for small airlines. The primary factors explaining cost differences are lower density of traffic and shorter stage lengths for the regional airlines. Both earlier and later
studies confirmed that there are no significant economies of scale at the firm level (Caves, 1962; Strazheim, 1969; White, 1979; Gillen et al., 1985, 1990).

Therefore, an airline cannot substantially reduce unit costs by expanding scale, but there exist economies of density in the airline industry. In aviation, there are both the supply and demand side economies of density. Supply side economies of density exist if an airline's unit cost declines when the airline adds flights or seats on existing routes, all other things held constant (Gillen et al., 1985). These increasing returns to density are due primarily to improved utilisation of aircraft capacity and crew. Demand side economies of density usually reflect higher route frequencies. This will decrease the average time cost experienced by the traveller and hence induce a higher demand for air transport, especially from business travellers. Morrison and Winston (1986) found that a doubling of the frequency of domestic routes in USA would increase the demand from business travellers by 21 per cent. However, it is argued that the demand for leisure air travel is less likely to be much affected by the frequency of service as most leisure trips are planned days, weeks, or months in advance. Whether there are two or three daily departures on a route is unlikely to influence demand (Nordic Competition Authorities, 2002).

However, an airline that builds its strategy on density economies is not well protected either. The discussion in the previous Sub-section demonstrated that Southwest has successfully exploited the economies of density, both demand and supply sides. For conventional scheduled airlines, the hub-and-
spoke network was developed after airline deregulation. It consolidates traffic to hubs from spoke routes which enables airlines to obtain economies of density from directing passengers via hubs, since they may use larger aircraft and/or fly with higher frequencies.

Without barriers associated with economies of scale and density, an airline that attempts to compete through cost leadership must use supplemental strategies to provide the barriers needed to defend its position. Porter (1980) suggested that non-scale barriers include those associated with a differentiated product, capital requirements, buyer switching costs, limited access to distribution channels, entrant cost disadvantages, and government policies favouring the incumbent. Of these, differentiation, capital requirements, and government policy are likely barriers that an airline cost leader can use to protect its market position (Sorenson, 1991). The cost leader can differentiate its service based on frequent flights, consistently low fares, and established presence in a market. The requirement for a large, fuel-efficient fleet to sustain a density operation may deter smaller airlines from entering the firm's markets. The use of government policy reflects the control of key assets in the airports. The discussion in the previous Section showed that Southwest has been successful in building the three barriers into its strategy to protect its markets.

Apart from those non-scale barriers, one strategy of many of the early cost leadership airlines relied on was their ability to pay less for labour and lower the price paid for production elements (Sorenson, 1991). However, it was not
well protected from the manoeuvres of their older, established rivals. As the older firms renegotiated contracts with labour and other suppliers, the cost advantage of the new entrants was eroded.

Another initial advantage that the new entrant, low-cost firms enjoyed was equipment suited to their markets (Sorenson, 1991). The new carriers were able to purchase or lease (with a relatively small investment) used, short-range, medium-sized jets that were efficient on their short to medium-haul routes. The established carriers, on the other hand, had a mix of large wide body jets suitable for long-haul markets with narrow body aircraft suitable for shorter routes. The equipment advantage of cost leadership firms was degraded as the established carriers re-equipped themselves with fuel efficient aircraft and switched to hub-and-spoke networks that allowed them to employ their equipment more efficiently by concentrating wide body aircraft in traffic dense markets (Brenner, 1985).

By gaining labour concessions and re-deploying their aircraft, many of the incumbent airlines were able to bring operating costs down to a competitive level with the new entrant airlines in the three to four years following deregulation. In 1983, the average new entrant carrier was producing an available seat mile for $0.0760 compared to $0.0781 for the former trunk airlines (Brenner, 1985). In addition, due to their more abundant resources, the established carriers were able to match the LCCs' fares as soon as a new firm attempted to gain a foothold in an established market.
The adjustments that the large, established airlines made to their cost position presented the new LCCs with a problem. They were faced with either inventing ways to guard their low-cost position by driving costs even lower, or changing strategy, or going out of business (Sorenson, 1991). For the most part, the airlines that entered, intending to compete by using a low-cost strategy, have gone bankrupt or have been absorbed by other airlines.

By the late 1980s, the majority of new entrant airlines failed and it had become apparent that larger carriers had significant advantages. In his seminal article, Leivine (1987) discussed incumbent airlines' strategies in detail. Initially, incumbents engage in price wars, matching or undercutting the new entrant's fares for all capacity on the routes. This behaviour removes any price advantage for the new entrant, although it is unattractive to incumbent airlines either as it causes short-term losses. More often the incumbent airlines beat low-cost entrants out of the market by practising price discrimination supported by sophisticated yield management, frequent flyer programmes and market power (controlling airport slots and gates). They match new entrant's lowest fare with a low fare restricted to confine its attractiveness to the leisure-oriented, price-sensitive passengers; match business-oriented fares and offer extra benefits to retain the loyalties of travel agents and frequent flyers; and flood the market with capacity until new entrants are driven out of the market.

In contrast to the enormous new start-ups entering the air travel market in the 1980s, the first half of the 1990s saw a much reduced rate of entry of new
airlines. From 1995, the airline industry saw a resurgence of new entrants in the US such as Vanguard and JetBlue. In this wave of entry, many new entrants deviate in some respects from Southwest's simple business model, for example JetBlue provides leather seats and satellite TV on board. However, the essential feature of low cost and low fare remains the same for the new entrants.

2.4.3 The Development of LCCs in Europe

The last Sub-section demonstrated that cost leadership strategy is extremely difficult to be employed in the airline industry. It is widely debated whether European LCCs can maintain their success in the longer term. It is not the intention of this Sub-section to explore this topic in great depth. Instead, the main purpose of this Sub-section is to explore sources of the European LCCs cost advantage and to understand the role of regional airports in building up LCCs sustainable competitive advantages. To realise this aim, airline liberalisation in the EU and the structure of the European airline industry are reviewed first.

2.4.3.1 Airline Deregulation in the EU

Following the airline liberalisation in the US, the airline deregulation gradually spread to the other side of the Atlantic. To match the growing trend of deregulation, the European Union (EU) launched Three Aviation Liberalisation Packages which took ten years from 1987 to 1997 to gradually liberalise the aviation market of Member States. From 1993, EU airlines became able to fly between member states without restriction and within member states subject
to some controls on fares and capacity. National restrictions on ticket prices were removed with safeguards only if fares fell too low or rose too high (Button and Stough, 2000). Full cabotage was implemented on 1 April 1997, since then all eight freedoms were allowed for EU carriers within the EU market (plus Norway and Iceland) (Button and Stough, 2000; Chang and Williams, 2001).

Consequently, the EU became the most liberalised region in the world. Any airline with a valid Air Operators Certificate can operate within the EU at market-determined prices (Gillen and Lall, 2004). Furthermore, the Third Package abolished the distinction between scheduled and charter carriers, permitting the latter to re-designate their flights as scheduled if they so wished (Graham, 1998). In addition, the enlargement of the EU in 2004 extended the Single Market to ten new member states.

Similar as airline deregulation in the US, the phenomenon of LCCs was transferred to Europe as well. Ryanair adopted the low-cost, no frills strategy in 1995 and was generally considered the first European LCC. In 1994, Ryanair carried 1.7 million passengers to handful destinations. The passenger number Ryanair transported jumped to 24.6 million in 2004 and its routes were also expanded to 266 destinations (Ryanair, 2005). Many of them had previously never seen a scheduled air link. In 1997 Ryanair was successfully floated on the Dublin and New York stock exchanges. In the financial year 1997-8 alone its profits rose by 51 per cent to US$53 million.
Ryanair's sparkling financial performance was an encouragement to other European entrepreneurs to assess the low-cost, no-frills models as a way of entering European aviation markets. In October 1995 and June 1996 easyJet and Debonair respectively launched intra-European low-fare services from London's Luton Airport. They were followed by Virgin Express at Brussels, Go and Buzz both from London Stansted Airport (Doganis, 2001). In 1995 less than three million passengers were flying on low-cost European carriers, most of them on Ryanair. By 1999, this figure had risen to about 17.5 million. By 2004, over 100 million European passengers were using the LCCs (Doganis, 2006). The rapid expansion of LCCs has profound impact on the structure of the European airline industry, which will be examined in the next Sub-section.

2.4.3.2 The Structure of the European Airline Industry

Before the advent of LCCs, the European air travel market was neatly divided between conventional scheduled and charter carriers. 75 per cent of the market was controlled by conventional scheduled carriers focusing on business travellers, while 25 per cent of the market was being provided by charter airlines as part of the package holidays (Binggeli and Pompeo, 2002).

After observing average airline market and capacity share on a typical route of the EU network, Janic (1997) found that it had been relatively stable during 1989 to 1993. The index of market concentration, HHI, only varied around 0.5 on an average route, indicating that airlines have carefully sustained and balanced their position on the market. A study by Burghouwt and Hakfoort
(2001) examined the number of competitors at the route level and found that the total number of airlines on a route had remained stable over the period 1990-98.

However, the rise of LCCs over the past few years has rapidly reshaped the structure of the European airline industry. The market share of the charter airlines went down to 21 per cent of intra-European air travel (Binggeli and Pompeo, 2002). In 1998, there were only three LCCs in Europe, namely, Ryanair, easyJet and Virgin Express, but the number jumped to fifteen in 2002\(^5\) and thirty-one in early 2004\(^6\). Figure 2.2 below shows market penetration of LCCs on intra-European and domestic markets in March 2005.

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\(^5\) The LCCs in 2002 were Ryanair, easyJet, Virgin Express, bmibaby, FlyBe, Germanwings, Hapag Lloyd Express, Sky Europe, Basiqair, Air Berlin, easyJet Switzerland, Jet 2, MyTravelLite, Go and Buzz.

The UK and Ireland had the highest penetration of LCCs. Over 40 per cent of scheduled domestic and intra-European air traffic in the both countries was carried by LCCs. There are a number of reasons for the high market share of LCCs in the UK and Ireland. Firstly, the UK and Ireland had a liberal bilateral agreement and airline competition was encouraged by the both governments (Francis, et al., forthcoming). Secondly, there was a relatively large number of underused airport capacity in the both countries. Managers of privatised/commercialised airports are willing to offer reduced airport charges to LCCs in order to raise passenger throughout and gain commercial revenue from the increased passenger traffic (Francis, et al., 2003). Thirdly, corporate tax and social security payment to staff in the UK or Ireland are much lower than most mainland European countries (Doganis, 2006).
As seen from Figure 2.2 above, although compared with the UK, the penetration of LCCs in other EU countries is relatively low, market share of LCCs in those countries increased very rapidly over the past few years. For instance, in Germany the LCC's share of total airline capacity on routes to other EU states jumped from less than 3 per cent in summer 2002 to about 23 per cent in March 2005 following the launch of several German LCCs. By March 2005, all other EU countries, except Greece, have seen the market shares of LCCs reached between 10 to 25 per cent.

Recently, it seems big LCCs such as easyJet and Ryanair have moved to the stage of consolidation. There are two major acquisitions in easyJet's history. To expand into the Swiss market, easyJet purchased TEA in 1998 and rebranded it easyJet Switzerland. Low-cost carrier, Go\(^7\), was bought by easyJet in August 2002 for £374 million, increasing the number of bases it operated to nine when it added Go's bases at Stansted, East Midlands, and Bristol. Compared with easyJet, Ryanair's expansion tended to be more organic. There was only one major purchase in its operation, namely, the acquisition of Buzz\(^8\) for £15.6 million. The combined passengers of easyJet and Ryanair reached 42.5 million in 2003.

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\(^7\) Go was established by British Airways in May 1998 as a wholly owned low cost subsidiary in the aim of defending its short-haul market from being nibbling up by LCCs. But soon Go went into competition with its parental company on a number of city pair routes. Consequently, Go was sold by British Airways in June 2001 to a management buy-out team (22% of shares) and investment company 3i (78%) for ¬110m and was sold to easyJet a year later.

\(^8\) Buzz was established by KLM in January 2000. It was losing €30m a year when it was took over by Ryanair.
Figure 2.2 above only shows the market share of LCCs on intra-European and domestic markets. As the majority of LCC traffic is within Europe, if international routes out of the EU are taken into account, the market share of LCCs was considerably lower, 16 per cent in the UK market and less than 5 per cent in France and Germany in April 2003 (Francis et al., forthcoming). Among conventional scheduled airlines, the supply of scheduled air transport service is heavily concentrated in the hands of a few major airlines. The top three carriers accounted for 43.5% of total Association of European Airlines (AEA) Revenue Passenger Kilometres in 2000, with the top six accounting for 64% (Chang and Williams, 2001).

2.4.3.3 Sources of Sustainable Competitive Advantage

The Sub-section 2.4.2.3 shows that even in the US, numerous airlines aiming to emulate Southwest's low-cost strategy failed in the face of fierce competition from the incumbent carriers. Porter (1996) argued that as a whole, the low-cost business model is robust, and the outstanding performance of Southwest Airlines for more than 32 years has proved it. The success or failure of individual airlines is decided by their strategic choices.

It remains to be seen whether European LCCs can sustain their current performance and replicate the Southwest success story. The in-depth discussion of this topic is beyond the scope of this Study. Instead, the purpose of this Sub-sector is to explore sources of LCCs cost advantage and to understand the role of regional airport in building up LCCs sustainable competitive advantages.
There are numerous studies attempting to analyse the cost competitiveness of LCC over full service network airlines. The research carried out by Doganis (2001) is probably the most comprehensive one. Following a detailed assessment of the data on which the cost comparison of British Midland and easyJet was based as well as a review of other similar studies, Doganis (2001) summarised where costs per seat of LCCs can be reduced on a 'sustainable basis' when compared to those of a conventional airline operating on the same or a similar routes and using the same type of aircraft. He concluded that the unit cost of LCCs could be reduced to around 41 per cent of that of conventional scheduled airlines. This is consistent with an earlier study conducted by the UK Civil Aviation Authority CAA (UK CAA, 1998), which came to the figure of 48 per cent per passenger. Details of Doganis' calculation is shown in Table 2.2 below.

It shows that the cost advantages of LCCs can be classified into two categories: non-airport related and airport-related. Non-airport related cost savings include higher seating density, lower flight and cabin crew salaries, outsourcing maintenance/single aircraft, no free in-flight catering, no agents' commissions, reduced sales/reservation costs and smaller administration costs. They represent 40 per cent of cost advantages over conventional scheduled airlines. The remaining 19 per cent of cost reduction is airport-related, including higher aircraft utilisation, using cheaper secondary airports, minimal station costs and outsourced handling.
Table 2.2 Cost advantages of LCCs on short-haul routes

<table>
<thead>
<tr>
<th>Carrier type</th>
<th>Cost index</th>
<th>Cost reduction for LCCs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional scheduled airlines</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Operating advantages:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Higher seating density</td>
<td></td>
<td>-16 (84)</td>
</tr>
<tr>
<td>Higher aircraft utilisation</td>
<td></td>
<td>-3 (81)</td>
</tr>
<tr>
<td>Lower flight and cabin crew salaries</td>
<td></td>
<td>-3 (78)</td>
</tr>
<tr>
<td>Use cheaper secondary airports</td>
<td></td>
<td>-6 (72)</td>
</tr>
<tr>
<td>Outsourcing maintenance/single aircraft type</td>
<td></td>
<td>-2 (70)</td>
</tr>
<tr>
<td>Product/service features:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimal station costs and outsourced handling</td>
<td></td>
<td>-10 (60)</td>
</tr>
<tr>
<td>No free in-flight catering</td>
<td></td>
<td>-6 (54)</td>
</tr>
<tr>
<td>No agents' commissions</td>
<td></td>
<td>-8 (46)</td>
</tr>
<tr>
<td>Reduced sales/reservation costs</td>
<td></td>
<td>-3 (43)</td>
</tr>
<tr>
<td>Other advantages:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smaller administration costs</td>
<td></td>
<td>-2 (41)</td>
</tr>
</tbody>
</table>

*Note: assumes 100 per cent direct sales and none through agents for LCCs. Source: Doganis (2001:150)*

It can be seen the greatest single saving for LCCs arises from higher seating density. By removing business class and reducing the seat pitch and galley, LCCs can significantly increase the number of seats for sale in their aircraft. If all their operating costs were similar, Doganis (2001) considered that it could result in cost per seat-km of LCCs being 16% lower than their conventional counterpart. However, the business class can bring higher yields to conventional scheduled airlines and the real advantages of the LCCs are therefore likely to be smaller than the bare figures indicate.
Another significant saving of LCCs is from bypassing travel agents and using e-tickets. Therefore, they can avoid paying commission to travel agents and reduce sales and reservation costs, which represents 11 per cent of the cost reduction. It is beyond doubt that aggressive use of the Internet and direct selling to the public have been key to the success of LCCs. However, after facing the growing pressure from LCCs, conventional airlines are also fighting back by cutting commissions paid to travel agents, from 10 per cent in 2001 to 1 per cent in 2005 on most short-haul flights.

Conventional scheduled airlines are also seeking ways of bypassing Global Distribution Systems (GDS) by streamlining their Internet booking facilities (TTG UK & Ireland, 2003a). British Airways claimed that 37% of short-haul leisure fares are now booked online (TTG UK & Ireland, 2003b). Lufthansa recorded 1.4 million visitors to its web site in July 2002, representing a rise of 442 per cent year-on-year (TTG UK & Ireland, 2003c). In the meantime, a collective negotiation between AEA airlines and the main GDS providers regarding GDS fees is ongoing. It is likely the charges paid by AEA airlines to GDS will be dramatically cut.

On the one hand, LCCs have achieved considerably saving from bypassing travel agents. On the other hand, to offset the absence of travel agents as a distribution channel, LCCs have to be more dependent on advertising. With growing competition from conventional scheduled airlines and other LCCs,
high advertising spend is likely to continue. Consequently, it is questionable whether or not LCCs can maintain this cost difference in the longer term.

Lowering flight and cabin crew salaries represent another 3 per percent of cost reduction for LCCs. However, the wage gap between the low-cost and conventional scheduled carriers may eventually narrow as the former come under pressure to increase pay and the latter win wage concessions. Similarly, the start-ups usually enjoy smaller administration costs than their established competitors. When they grow up, controlling the cost may be not easy.

Other non-airport related savings including outsourcing maintenance/single aircraft type, no free in-flight catering and smaller administration costs, have all been pursued by US LCCs in the 1980s when they were competing with major airlines. However, from the discussion in Section 2.2.4, it is evident that none of these measures provided long-term protective barriers from competition.

In Europe, when conventional scheduled airlines learn how to compete with LCCs, the gap in those non-airport related cost advantages is very likely to be narrowed. As a matter of fact, many European major airlines have adopted some strategies used by LCCs to drive their cost down. For example, after facing fierce competition from Ryanair and the collapse of its long-haul traffic to the US after 11 September 2001, the Irish flag carrier, Aer Lingus, took various measures to cut its cost. Firstly, staff were reduced by one third,
wages were frozen and work practices radically reformed. Secondly, management costs were reduced by 55 per cent, and sales and distribution costs were cut by 56 per cent, partly by switching more than half of all sales to the internet. Thirdly, many of the frills were taken out of the in-flight services. Fourthly, the fleet is being restructured and a single type aircraft (i.e. the Airbus A320 family) was in use for the European network. Finally, low, simplified fares were adopted which pushed up demand and seat factors rose to close to 80 per cent. As a result of all these measures, by 2003, Aer Lingus’s unit costs had been cut by 35 per cent and generated a €78.7m net profit in 2003, representing an operating margin of 7.8 per cent (Doganis, 2006).

The above example clearly shows that by adopting LCCs strategy major airlines can significantly reduce their cost gap with LCCs. This highlights unsustainability of non-airport related cost saving. So, can LCCs maintain cost advantage derived from the use of regional airports?

We start by examining airport-related costs. First, LCCs benefit enormously from low airport charges and station costs. For example, Frankfurt/Hahn costs Ryanair €4.25 per departing passenger and there is no landing fee; in contrast a 737 operator at Frankfurt/Main pays €13.00 per departing passenger and a landing fee of about €1.75 (Button, et al., 2002). More interestingly, in Charleroi Airport, Belgium, Ryanair was paid €3.4 per
passenger for using the airport in return for flying a set number of passengers each year to boost the local economy (Dennis, 2004).\textsuperscript{9}

Second, higher aircraft utilisation is achieved through the greater productivity of aircraft and crew from quick turnarounds in the secondary airports. The rationale was discussed in Section 2.4.2.2 when analysing Southwest’s business model. Table 2.3 uses the London-Frankfurt route as an example to show by flying from London Stansted-Hahn, Ryanair could achieve 60 per cent better productivity than British Airways flying London Gatwick-Frankfurt. Although Doganis (2001) claimed that 19 per cent cost reduction of LCCs with respect to conventional scheduled airlines is airport-related, a brief examination here seems to suggest that the savings derived from the use of regional airports have been seriously underestimated.

<table>
<thead>
<tr>
<th>Route</th>
<th>Block Time</th>
<th>Turnaround</th>
<th>Output per 14 hour day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stansted-Hahn</td>
<td>1:15</td>
<td>30 min</td>
<td>8 sectors</td>
</tr>
<tr>
<td>Gatwick-Frankfurt</td>
<td>1:50</td>
<td>45 min</td>
<td>5 sectors</td>
</tr>
</tbody>
</table>

Note: All timings with Boeing 737 aircraft
Source Dennis (2004)

After examining airport-related savings, a natural question to ask is whether network carriers can also base their operation at regional airports. A simple and obvious answer is no. Network carriers employ hub-and-spoke system which ties themselves to hub airports. The model aims to provide connectivity, allowing passengers to fly from anywhere to anywhere through a system of

\textsuperscript{9}More is discussed in Chapter 3, Section 3.3.3.
connected airport hubs. It requires effective processes for transferring passengers and baggage at the airport. Good airport facilities and superior on-board and ground services are also essential to ensure a high level of convenience and comfort for passengers. Therefore, airports must be relatively large and close to the markets they serve and easily accessible. These are unlikely to be regional airports which are usually small and do not have adequate facilities for transfer passengers.

The hub-and-spoke network is essentially built for business traffic. In general, business passengers represent only one third of passengers but 70 per cent of revenues for network carriers. As business passengers generally prefer major airports with good access and superior facilities, it is unlikely for network carriers to switch their operation base to regional airports.

Although hub-and-spoke network provides a number of benefits to network carriers (Nero, 1999, Barla and Constontatos, 2000), it also makes their operation inherently costly (Nero, 1999; Franke, 2004; Costa, et al., 2002; Wojahn, 2001). From the perspective of business models, Hansson et al., (2002) claimed that 70 per cent of the cost differences between LCCs and network carriers can be attributed to their business model choices, i.e. point-to-point service and hub-and-spoke network; another 15 per cent to work rules and labour agreements; and 12 per cent to differences in balance sheet structure and financial arrangements. This is supported by Gillen and Lall (2004) asserting the sustainable advantages that LCCs have are mainly derived from the adoption of point-to-point operation.
On these ground, it can be summarised that at the beginning of the competition, LCCs could enjoy various cost advantages over network carriers. Over time, non-airport related cost savings will be eroded when majors learn how to compete, while airports-related cost advantages could be sustained in the longer term as network carriers cannot base their operation at regional airports given the importance of business passengers and of network feed. In conclusion, the most sustainable competitive advantages that LCCs possess derive from point-to-point operation based on regional airports.

2.5 Summary

Chapter 2 firmly established the relationships between tourism and regional economic development. The strong linkages of tourism and its ability for employment generation were highlighted. This was followed by examining the emergence of LCCs in both the US and Europe. The US experiences showed that the cost leadership strategy employed by LCCs was extremely difficult to maintain due to lack of economies of scale and other protective barriers in the airline industry. A scrutiny of the cost advantages of European LCCs concluded that the competitive advantages that LCCs have are mainly derived from point-to-point service based on regional airports. Chapter 3 will further explore the interplays of LCCs, airport and regional tourism in the context of the UK.
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Chapter 3: The Role of Low-cost Carriers in UK Regional Tourism Development

3.1 Introduction

Following the discussion in Chapter 2, the purpose of this Chapter is to examine the economic effects of LCCs in the UK, with a particular focus on a regional perspective. The complexity of the interplay of LCCs, airports and regional tourism is discussed based on the conceptual framework proposed in Chapter 1. The remainder of this Chapter is organised as follows. Section 2 examines LCCs and airports relationship. Section 3 explores the impact of LCCs on regional tourism development. Issues of measurement are discussed in Section 4, while Section 5 presents the summary.

3.2 The LCCs and Regional Airports Relationship

The analysis in the previous Chapter shows that the most sustainable cost advantages that LCCs possess arise from the use of regional airports. LCCs owe much of their success to the support from regional airports. So what are the benefits the regional airport can get from dealing with LCCs? What are the consequences of the LCC-regional airport relationship? These are the issues to be pursued in this Section. We start by examining the evolution of the UK airport business.
3.2.1 The Evolution of the UK Airport Business

As strategically important assets, airports traditionally have been administered and controlled either by central, local government or a state appointed body. Although it is still the case in many countries, over the last two decades, there has been a trend to reduce the states' control in favour of greater commercial sector involvement (Pitt, 2001). Freathy (1998) argued that privatisation has been prompted primarily by the state's desire to avoid the financial burdens associated with subsidising airport capital investment. He further asserted that another motivation is that by allowing private sector organisations to manage airports, it is more efficient and cost effective for the state to maximise revenue while at the same time minimising the degree of risk, improving customer service and quality standards.

The UK was the pioneer in airport commercialisation and privatisation in the world. In 1986, the Airport Act went into effect and all airports with turnover of over one million pounds in two of the previous three years have to be formed into limited companies (UK Government, 1985). Part one of the Airport Act privatised the seven airports of the British Airport Authority (BAA), which includes Heathrow and Gatwick. Part two of the Airports Act commercialised 16 municipally owned airports. By 2004, a total of 45 airports had been set up as companies, but their shares were initially being held by the original local authority owners (CRI, 2005).

However, borrowing for investment had become virtually impossible because of the public sector borrowing restrictions imposed by the UK government
Moreover, airports could no longer receive subsidies from their governments and had to become financially self-sufficient. But management at airports were given more responsibility and airports could sell their shares to private investors if they wished (Graham, 2004). Consequently, a number of airports chose to look to the private sector for investment by being partially or fully privatised such as Birmingham, East Midlands, Bournemouth, Cardiff, Bristol, Belfast, Luton and Liverpool.

Airport commercialisation and privatisation coincided with airline deregulation. Before the airline industry was deregulated, airports, especially those hub airports, could easily pass their costs to airlines, while the latter passed them to passengers. Airline deregulation in Europe prompted airline competition and airfares have been facing a downward pressure ever since. Consequently, airlines are seeking ways to reduce the cost. Compared with around 2.5 to 3 per cent normal industrial net profit for major airlines, big airports were making much more profit. For example, Borgo and Bull Larsen (1998) noted that the profitability of privatised airports such as the BAA, were at 17 per cent, almost five times the return on investment than major airlines.

Therefore, it is not surprising to see that airlines continually put pressure on airports to reduce charges. The charges levied on airlines by airports, for using their facilities have remained relatively static since the late 1980s. For

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10 Although in the UK big airports persistently make substantial profits, many small airports are struggling to improve their financial performance. These issues will be addressed in due course.
instance, between 1997 and 2002 Heathrow and Gatwick airports set the annual increase in airport charges below the rate of inflation.

On the other hand, the percentage of total income generated by commercial activities has increased for many airports. For the BAA's seven UK airports, retail revenues represent the largest single contributor to income (BAA, 2003). Humphreys and Francis (2002) found that in 1986 only 40 per cent of the 16 newly commercialised airports had commercial revenue over 30 per cent of the total revenue. Thirteen years later, all the airports' commercial revenue reached that level. The emphasis on commercial revenue has led to the increased development and utilisation of revenue generating space and the rapid development of the airport sites with business parks, hotels, freight facilities and maintenance facilities. Table 3.1 below shows the share of revenue from commercial services for 1984/5 and 2002/3 for a number of UK regional airports. The dramatic increase in the share of non-aeronautical revenue demonstrates that the UK regional airports have largely been successful in diversifying revenue over the time.

<table>
<thead>
<tr>
<th>Airport</th>
<th>Pax '02/03 (000)</th>
<th>% non-aero 02/03</th>
<th>%non-aero 84/85</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manchester</td>
<td>18,993</td>
<td>46</td>
<td>29</td>
</tr>
<tr>
<td>Birmingham</td>
<td>8,268</td>
<td>36</td>
<td>25</td>
</tr>
<tr>
<td>Luton</td>
<td>6,599</td>
<td>52</td>
<td>42</td>
</tr>
<tr>
<td>Bristol</td>
<td>3,613</td>
<td>49</td>
<td>28</td>
</tr>
<tr>
<td>E. Midlands</td>
<td>3,663</td>
<td>39</td>
<td>22</td>
</tr>
<tr>
<td>Leeds Bradford</td>
<td>1,598</td>
<td>34</td>
<td>16</td>
</tr>
<tr>
<td>Cardiff</td>
<td>1,523</td>
<td>26</td>
<td>21</td>
</tr>
<tr>
<td>Teeside</td>
<td>691</td>
<td>40</td>
<td>13</td>
</tr>
<tr>
<td>Norwich</td>
<td>431</td>
<td>48</td>
<td>25</td>
</tr>
<tr>
<td>Exeter</td>
<td>357</td>
<td>47</td>
<td>20</td>
</tr>
</tbody>
</table>

Source: Graham, 2004
However, the abolition of duty free in intra-Europe travel in 1999 was a serious blow to airports' ability in generating non-aeronautical revenue. As the progress of the Single European Market, movement of goods between member states was no longer treated as 'exports' or 'imports' for tax purposes and it was deemed inappropriate for member states to waive the tax and duty on intra-European travel. However, intra-EU sales of tax and duty free were of fundamental importance for many airports due to the significant revenues they generated. Of the US$3.5bn worth of tax and duty free goods sold through European airports in 1996, US$1.9bn was to passengers on intra-EU flights (ETRF, 1997). Compared with major airports, it is those regional airports that were hit hardest as the vast majority of their traffic was intra-European.

The removal of duty free on intra-European travel had serious impact upon the commercial activities of European airports. To make it worse, airports require significant capital investment to meet the growth of new traffic and the necessary redevelopment. To survive and succeed in this unfavourable environment regional airports have to think hard how to generate more revenue and improve their financial situation. Embracing LCCs is the strategy many regional airports adopted. Before moving to that topic, the structure of the UK airports is examined first.

3.2.2 The Structure of the UK Airport Sector

In the UK several major airport groups dominate the ownership of airports, namely, BAA, the Manchester Airport Group and TBI (see Table 3.2 below).
### Table 3.2 UK airport ownership

<table>
<thead>
<tr>
<th>Airport</th>
<th>Current owner</th>
<th>Part of larger airport group</th>
<th>Private interest %</th>
<th>Date of first privatisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>London Heathrow</td>
<td>BAA</td>
<td>Yes</td>
<td>100</td>
<td>1987</td>
</tr>
<tr>
<td>London Gatwick</td>
<td>BAA</td>
<td>Yes</td>
<td>100</td>
<td>1987</td>
</tr>
<tr>
<td>London Stansted</td>
<td>BAA</td>
<td>Yes</td>
<td>100</td>
<td>1987</td>
</tr>
<tr>
<td>Southampton</td>
<td>BAA</td>
<td>Yes</td>
<td>100</td>
<td>1961</td>
</tr>
<tr>
<td>Edinburgh</td>
<td>BAA</td>
<td>Yes</td>
<td>100</td>
<td>1987</td>
</tr>
<tr>
<td>Glasgow</td>
<td>BAA</td>
<td>Yes</td>
<td>100</td>
<td>1987</td>
</tr>
<tr>
<td>Aberdeen</td>
<td>BAA</td>
<td>Yes</td>
<td>100</td>
<td>1987</td>
</tr>
<tr>
<td>Manchester</td>
<td>Manchester Airport ***</td>
<td>Yes</td>
<td>0</td>
<td>N/A</td>
</tr>
<tr>
<td>East Midlands</td>
<td>Manchester Airport ***</td>
<td>Yes</td>
<td>100*</td>
<td>1993</td>
</tr>
<tr>
<td>Bournemouth</td>
<td>Manchester Airport ***</td>
<td>Yes</td>
<td>100*</td>
<td>1995</td>
</tr>
<tr>
<td>Humberside</td>
<td>Manchester Airport/local authority</td>
<td>Yes</td>
<td>82.7</td>
<td>1999</td>
</tr>
<tr>
<td>Belfast International</td>
<td>TBI</td>
<td>Yes</td>
<td>100</td>
<td>1994</td>
</tr>
<tr>
<td>Cardiff</td>
<td>TBI</td>
<td>Yes</td>
<td>100</td>
<td>1995</td>
</tr>
<tr>
<td>London Luton</td>
<td>TBI/Bectel</td>
<td>Yes</td>
<td>100**</td>
<td>1998</td>
</tr>
<tr>
<td>Belfast City</td>
<td>Bombardier Aerospace</td>
<td>No</td>
<td>100</td>
<td>N/A</td>
</tr>
<tr>
<td>Biggin Hill</td>
<td>Regional Airports Ltd</td>
<td>Yes</td>
<td>100</td>
<td>1994</td>
</tr>
<tr>
<td>Birmingham</td>
<td>Local authority/Aer Rianta and others</td>
<td>Yes/part owned</td>
<td>51</td>
<td>1997</td>
</tr>
<tr>
<td>Bristol</td>
<td>Cintra/Macquarie Bank</td>
<td>No</td>
<td>100</td>
<td>1997</td>
</tr>
<tr>
<td>Exeter</td>
<td>Local authority</td>
<td>No</td>
<td>0</td>
<td>N/A</td>
</tr>
<tr>
<td>Highlands and Islands Airports</td>
<td>Highlands and Islands Airports Ltd</td>
<td>Yes/public body</td>
<td>0</td>
<td>N/A</td>
</tr>
<tr>
<td>Kent (Manston)</td>
<td>Wiggins Group</td>
<td>Yes</td>
<td>100</td>
<td>1997</td>
</tr>
<tr>
<td>Leeds Bradford</td>
<td>Local authorities</td>
<td>No</td>
<td>0</td>
<td>N/A</td>
</tr>
<tr>
<td>Liverpool</td>
<td>Peel Holdings/local authority</td>
<td>No</td>
<td>76</td>
<td>1990</td>
</tr>
<tr>
<td>London City</td>
<td>Desmond Dermot</td>
<td>No</td>
<td>100</td>
<td>N/A</td>
</tr>
<tr>
<td>Newcastle</td>
<td>Local authorities/Copenhagen Airport</td>
<td>Yes</td>
<td>49</td>
<td>2001</td>
</tr>
<tr>
<td>Norwich</td>
<td>Local authorities</td>
<td>No</td>
<td>0</td>
<td>N/A</td>
</tr>
<tr>
<td>Prestwick</td>
<td>Infratil</td>
<td>Yes</td>
<td>100</td>
<td>1987</td>
</tr>
<tr>
<td>Southend</td>
<td>Regional Airports Ltd</td>
<td>Yes</td>
<td>100</td>
<td>1994</td>
</tr>
<tr>
<td>Teeside</td>
<td>Local authorities</td>
<td>No</td>
<td>0</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Source: Modified from Humphreys and Francis (2002)

Notes: * Airport owned by a geographically remote local authority.

**Luton local authorities own the airport but Bechtel and TBI have a 30-year concession to develop and operate the airport.

***Manchester airport is owned by 10 local authorities – pre 1974: 100% owned by City of Manchester; 1974-1986:50% owned by City of Manchester and 50% owned by Greater Manchester County. Since Manchester Airport Plc was set up in 1986, 55% owned by City of Manchester and 5% each by Bolton, Bury, Oldham, Rochdale, Salford, Stockport, Tameside, Trafford and Wigan.

90
Ownership by a larger group enables small airports to benefit from economies of scale in terms of central management functions, improved marketing and better bargaining power with suppliers and third party contractors and increased access to funding for development (Humphreys and Francis, 2002).

In contrast, independently owned airports may find themselves at a competitive disadvantage relative to airports within larger groups, if they cannot invest as heavily. Moreover, their unit costs are likely higher due to lack of economies of scale (Humphreys and Francis, 2002).

Apart from ownership polarisation, there exists geographical imbalance in capacity and demand for UK airports. Although 57 UK airports have scheduled air services, the majority traffic is concentrated on few airports. As we can see from Figure 3.1 below, in 1993, Heathrow and Gatwick airports handled 59 per cent of all terminal passengers at UK airports. When the other three London airports (i.e. Stansted, Luton and City airports) are taken into account, the share increased to 63 per cent. Manchester, the largest airport outside London, handled 11 per cent of UK terminal passengers in 1993. The other 51 airports only accounted for 26 per cent of traffic. As a matter of fact, many of the 51 airports existed only for essential social air service provision in the remoter peripheries of the UK, most notably the Scottish Highlands and Islands.
As seen from Figure 3.1 above, Graham and Guyer (2000) asserted this essentially static picture reflects the inertia built into the air transport system by the geography of demand. Both London and south east of England have long been business centres with concentration of economic activities and population. Humphreys and Francis (2002) further point out that the pattern of concentration on very few airports is driven partly by bilateral history, and airline behaviour. Airlines locate services where they think they will maximise profit for their shareholders. For the majority of scheduled airlines (not the low cost carriers) they select airports based on the size of potential market available and its propensity to fly.

The UK government has sought to encourage the distribution of air traffic to the regional airports through proposals for greater liberalisation by offering
open access to all its bilateral partners on international routes to regional airports, provided that UK airlines can operate on the same routes (Graham and Guyer, 2000). But this approach is criticised by Graham and Guyer (2000). They argued that this policy is unlikely to have much effect as apart from Manchester, Birmingham and Glasgow, almost all of the regional airports traffic is intra-European, which have already opened to any European Economic Area airlines following the full implementation of EU liberalisation in 1997. For international routes outside of European Economic Area, the traffic is usually too thin to support scheduled flights from regional airports.

Graham and Guyer's (2000) criticism is probably true. However, both of them and the UK government underestimated the role of LCCs in dispersing passengers to regional airports. Unexpectedly, it is the rise of LCCs that have the most important impact on the airport traffic. As can be seen from Figure 3.1 above, market share of UK airports changed gradually over the period of 1993 to 2003. In 2003, the share of Heathrow and Gatwick dropped to 46 per cent. The most dramatic change was happened to the other London airports. Their market share jumped from 4 per cent to 13 per cent. Together, the London airports still accounted for 59 per cent of total traffic, albeit slightly lower than that in 1993 (63 per cent). During this period, the other 50 regional airports saw their market share increased gradually. The increased traffic was largely attributed to the rapid expansion of LCCs, which will be addressed in due course. As for Manchester Airport, its market share had remained very stable varying between 11 to 10 per cent during the eleven years period. The
impact of LCCs on regional airports traffic is further examined in the next Subsection.

3.2.3 The Impact of LCCs on Regional Airports Traffic

It appears there are significant economies of scale in the airport industry. Profitability in the industry is to a large extent dependent on the volume of passenger and freight traffic throughput. An ICAO study found the average unit cost for airports of less than 300,000 Work Load Units\textsuperscript{11} (WLUs) is to be US$15. When the WLUs increased from 300,000 to 2.5 million, the average unit cost could be reduced to US$9.4 and it could be further cut to US$8 when airports handling 2.5 – 25 million WLUs (Graham, 2003). The ICAO study is supported by a research done by Doganis et al., (1995).

The existence of economies of scale in the airport sector is because as traffic throughput increases, the impact on aeronautical revenues should be positive as additional air transport movements contribute to aeronautical revenue streams through payment of aeronautical charges. In terms of non-aeronautical revenues, as passenger traffic increases, there should be additional opportunities for airports to provide either directly or indirectly (through concessionaires) commercial services such as shops, catering outlets, car parking, car rental and advertising etc, which are typically highly profitable activities for airports compared to aeronautical services (Graham, 2004). Similarly, increased freight volumes should provide opportunities to develop and lease space and facilities to freight forwarders, airlines and in

\textsuperscript{11} WLU is defined as a passenger or 100kg of freight.
some cases companies seeking to locate industrial units close to airport facilities. In short, as traffic throughput increases, revenue streams become more diverse and more profitable.

However, Starkie (2002) asserted that the evidence for the existence of economies of scale is somewhat equivocal. Kunz (1999) has pointed out that the co-existence of several terminal operators at a single airport indicates that there are no significant scale economies. Pels took the debate further by examining a number of large European airports (cited in Starkie, 2002). He found that Rome Fiumicino, Frankfurt, Munich and Zurich were all operating under decreasing returns to scale, while Amsterdam, Brussels, Manchester, Paris Orly and Stockholm showed partial evidence that this was also the case.

The reasons for diseconomies of scale might be due to the fact that at a certain point, it is increasingly difficult and expensive for a large airport to design, build and operate facilities that co-ordinate (spatially and functionally) activities across an expanding area (Starkie, 2002). However, it is beyond doubt, for small regional airports, they have much stronger motivation to grow in order to achieve the critical mass of traffic.

Nevertheless, regional airports are usually characterised by thin traffic as a result of economic poverty, high unemployment, small-scale enterprises and sparse population in the peripheral regions where they are based. Therefore, conventional scheduled airlines always find it difficult to operate on those routes. Before the advent of LCCs, regional airports, at the best, could only
act as spoke points in conventional scheduled airlines hub-and-spoke network.

For regional airports, LCCs can make them work in a way that traditional airlines cannot by bringing in passengers from a much wider catchment area (Barrett, 2000). A report in Air Transport World (Buyck, 2004) provided some interesting evidence about the impact of LCCs on regional airports traffic. Based on the UK CAA data, passenger throughput at all 60 reporting UK airports rose 6 per cent in 2003, but it was those regional airports having LCCs operation that achieved the most significant growth rates. London Heathrow traffic remained stable and London Gatwick rose 1 per cent. Meanwhile, Blackpool grew its passenger throughput 164 per cent to 186,740, as a result of the advert of two Ryanair routes. Southampton increased 54 per cent of passengers to 1.2 million as it became a base of flyBe, while Nottingham East Midlands posted a 32 per cent growth to 4.3 million because it was the home base of bmibaby. Traffic in Glasgow Prestwick jumped 25 per cent to 1.9 million by benefiting from Ryanair’s adding a third aircraft as well as the expansion of Scottish LCC Flyglobespan.

The traffic impact of LCCs on UK regional airports can be best illustrated by looking at the individual airport. Based on the data from the UK CAA, changes of traffic types at twenty-one regional airports are examined in Figures 3.2 – 3.6 in turn. Airport traffic is divided to LCC, full service and charter traffic based on the number of passengers carried by these three

12 The data used to compile Figures 3.2 – 3.6 come from the dataset for the empirical study 1 (Airport Study).
types of carriers. The data in 2003/4 are compared with that in 1995/6. Figure 3.2 below shows the changes of traffic types at Gatwick, Manchester and Stansted airports.

![Figure 3.2: Change of Traffic Types in Large-sized airports: 1995/96 to 2003/04](chart)

Data source: UK CAA, various years

Both Gatwick and Manchester airports managed to realise just over 30 per cent traffic growth over the nine-year period. In contrast, Stansted Airport grew its passenger throughput 370 per cent to 19.4 million. As can be seen from Figure 3.2 above, the vast majority of traffic growth at Stansted Airport was attributed to LCCs, rising from just 1 million passengers in 1995/6 to over 17.5 million in 2003/4. During the same period, passengers carried by charter airlines at Stansted only had marginal growth from 1 million to 1.2 million, while passengers carried by full service carriers even decreased from 2 million to 729,000.
Figure 3.3 below shows changes of traffic types at Birmingham, Glasgow, Edingurgh and Luton airports. LCC traffic recorded much higher rate of growth at all the four airports than that of full service and charter carriers. Traffic at Luton Airport jumped 264 per cent following it becoming the operation base for easyJet in 1995. As we can see, the vast majority of traffic growth at the four airports came from LCCs.

![Traffic Changes in Medium-sized Airports](image)

Data source: UK CAA, various years

Traffic changes at East Midland, Newcastle, Belfast International and Bristol airports are showed in Figure 3.4 below. All the four airports had seen dramatic increase in LCC passengers over the nine-year period. At East Midlands, Belfast International and Bristol airports, the LCC passengers became the dominant traffic type in 2003/04. In contrast, charter traffic only managed to secure marginal growth, while the number of passengers carried by full service carriers even decreased dramatically at East Midland and Belfast International airports.
Figure 3.4: Changes of Traffic Types in Medium-sized UK Airports (II):
1995/96 to 2003/04

![Bar chart showing changes in traffic types at various airports]

Data source: UK CAA, various years

Figure 3.5: Changes of Traffic Types in Medium-sized UK Airports (III):
1995/96 to 2003/04

![Bar chart showing changes in traffic types at various airports]

Data source: UK CAA, various years

Figure 3.5 above shows the traffic changes at Liverpool, Aberdeen, Leeds Bradford, Cardiff and Southampton airports. The number of passengers carried by full service and charter carriers remained stable at the five airports.
In stark contrast, all these airports had seen dramatic increase in LCC traffic. At Liverpool Airport, since easyJet set up a base there in 1997, there had been phenomenal growth of the number of passengers carried by LCCs, from 171,000 in 1995/96 to over 2.5 million in 2003/04. Total passenger throughput jumped by 500 per cent.

![Figure 3.6: Changes of Traffic Types in Small-sized UK Airports: 1995/96 to 2003/04](Image)

Data source: UK CAA, various years

Finally, traffic changes at five small regional airports, namely, Teesside, Humberside, Bournemouth, Exeter and Blackpool, are showed in Figure 3.6 above. By 2003/4, charter airlines controlled Teesside, Humberside and Exeter airports, while LCCs dominated Bournemouth and Blackpool airports. In contrast, passengers carried by full service carriers at Teesside, Exeter and Blackpool airports had decreased to a varying degree during the observation period, which is probably due to fierce competition from LCCs.
In summary, the examination of the twenty-one UK regional airports have showed over the nine-year period, the passenger traffic types in those airports have undergone fundamental changes. Starting from very low-level, LCCs quickly became dominant carriers in a number of airports. Its traffic increase was the greatest compared with that of full service and charter carriers.

The dramatic increase in LCCs traffic has profound impact on regional airports financial performance. However, very few empirical studies explicitly address this issue. Stansted Airport provides a good example to illustrate how LCCs changed its operating profit (Figure 3.7). When Stansted opened in 1991, it was operated as a regional airport for East Anglia and to some extent East London. It only served by Air UK and some of the European major scheduled airlines. For anyone from Central London or surrounding area, Stansted was not an attractive airport as it had lower frequencies than Heathrow, similar fares and a longer access journey (Dennis, 2004). Low passenger number made Stansted difficult to reach critical mass of traffic. As a result, it suffered from huge losses. In 1995/96, Stansted only handled 4.1 million passengers and had operating losses of £10m.
In the same year, Ryanair transferred itself to a LCC and established its base at Stansted. Since then, the average fare levels at Stansted had been reduced to the half of those of Heathrow and people bypassed their nearest airports to fly from Stansted. A year later (i.e. 1996/97), Stansted’s passenger throughput increased to 4.9 million and for the first time in its history, it recorded an operating profit of £100,000.

Over the next few years, Stansted has seen rapid expansion of LCC operations in its airport. In 2000 Stansted was the fastest growing major international airport in the world with a year on year passenger growth of 25.6% (Airports Council International, 2001). In 2003/04, Stansted’s passenger throughput increased to 19 million and its operating profit also reached to £38.6m.
3.2.4 Conflicts between LCCs and Regional Airports

Although LCCs can bring previously undreamed of traffic to the regional airport, they also forced airport revenue down by negotiating low charges with airport management. In terms of conventional scheduled airlines, Doganis (2002b) argued that the level of airport charges is marginal in their route planning as it generally represents 5-7 per cent of airlines total costs (see Table 3.3 below). He further argued that conventional scheduled airlines’ route planning decisions are made on the level of anticipated demand on any potential route. This is because it is the projected level of demand that determines future revenues and therefore has the major impact on the profitability of the route.

Table 3.3 Impact of airport charges on total operating costs of intra-European air services for selected airlines in 1999

<table>
<thead>
<tr>
<th>Airline</th>
<th>Airport Charges as % total costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ryanair</td>
<td>13.2</td>
</tr>
<tr>
<td>EasyJet</td>
<td>9.1</td>
</tr>
<tr>
<td>Austrian</td>
<td>7.8</td>
</tr>
<tr>
<td>Lufthansa</td>
<td>7.0</td>
</tr>
<tr>
<td>British Airways</td>
<td>6.8</td>
</tr>
<tr>
<td>Iberia</td>
<td>6.4</td>
</tr>
<tr>
<td>SAS</td>
<td>5.8</td>
</tr>
<tr>
<td>Swissair</td>
<td>5.2</td>
</tr>
<tr>
<td>Sabena</td>
<td>4.5</td>
</tr>
<tr>
<td>Air Portugal</td>
<td>4.5</td>
</tr>
<tr>
<td>Air France</td>
<td>4.2</td>
</tr>
</tbody>
</table>

Source: UK CAA, AEA airlines, Ryanair, Adopted from: Doganis (2002b)

However, for LCCs, airport charges make up a larger percentage of total costs: 9.1 per cent for easyJet and 13.2 per cent for Ryanair (see Table 3.3 above). This is because LCCs operate short-haul flights, resulting in much more frequent landing and taking off. The difference in the percentage of airport charges between easyJet and Ryanair might be due to easyJet
targeting higher yield leisure or business passengers. By referring to easyJet's operations in several expensive major airports, Doganis (2002b) argued that airport charges will not determine the route decision of LCCs. However, competition in the low-cost sector is strong and LCCs can only maintain growth by finding cost reductions on a regular basis (UK CAA, 2003). The recent announcement of easyJet's exit from Geneva and a number of other high charge airports shows that even for easyJet, airport charges play an important role in route planning. A recent survey by Warnock-Smith and Potter (2005) to LCC managers confirmed that airport charges have become increasingly important in affecting LCCs' choice of airports (Warnock-Smith and Potter, 2005).

LCCs operate a different business model in which cost minimisation is the top priority. The low-cost operators argue that having pushed all other cost inputs to minimal levels, the only cost variable that they can further reduce is that of airport charges (Doganis, 2002b). Airport costs in some cases represent 70 per cent of ticket prices and LCCs claim that their margins are tight and have to rely on volume to generate a return (UK CAA, 2003). Clearly lower airport charges will reduce LCCs' total operating costs, and LCCs will do their utmost to reduce these charges. Where there is a choice of neighbouring airports, LCCs will choose the one offering lower charges.

The LCCs have a strong bargaining position because they can threaten to fly elsewhere unless reductions in charges or commercial incentive are granted by the airport. Starkie (2002) asserted that an airport generally has most
market power over network carriers connecting services\textsuperscript{13}, while having least market power over the LCCs' point-to-point service\textsuperscript{14}. This is because first, LCCs do not rely on transfer passengers. Moreover, LCCs passengers are usually price sensitive and are willing to travel longer distance to the airport if the fares are low enough. Therefore, LCCs have incentives to seek out airports that will minimise their operating and station costs and then create the market around them. Consequently, LCCs have more scope for switching operations between different airports in order to reduce costs.

Obviously, not every regional airport is in a vulnerable position when it deals with LCCs. Different ownership and geographical context afford airports varying degrees of strength from which to negotiate with airlines (Humphreys and Francis, 2002). In the case of Luton where the airport serves a significant population and an important business and tourism destination, the airport, thus, has a much stronger bargaining power than small regional airports. After initial five year contract ended, easyJet saw a near four-fold increase in its landing charges at Luton Airport, i.e. from £1.57 per departing passenger to £5.5 (But, it is still considerably lower than normal charges) (Button et al., 2002).

\textsuperscript{13} This market power arises from what he called agglomeration economies associated with network externalities. Airlines gain from concentrating services at a transfer point because it permits the use of larger and more economical aircraft, while passenger gain from increased frequency and network scope and, thus from a greater range of choices (Trethaway and Oum, 1992), although this is offset to some extent by more indirect routeings. Consequently, it is difficult for a scheduled airline, with a high level of transfer passengers in a hub airport, to substitute the airport.

\textsuperscript{14} To some extent, charter airlines as well.
However, in Europe, there are approximately 200 airports that can be classed as under-utilised with less than 1 million passengers per annum and the majority are loss making, publicly owned and subsidised by central or regional government (Caves and Gosling, 1999; Scheers, 2001). In the UK, the lack of a national airport policy has resulted in a number of regional airports which were developed irrespective of what is being offered at nearby competing airports (Graham, 2004). Consequently, in a number of regions there are pairs of airports with overlapping catchment areas (e.g. Liverpool–Manchester, Cardiff–Bristol, Birmingham–East Midlands, Newcastle–Teesside). The majority of the population of the UK has more than one regional airport within 90-minute drive time (Graham, 2004).

Commercial pressure on airports has led them to seek to increase passenger throughput in order to reach critical mass for their facilities. Attracting low-cost operators is an appealing way for airport managers to attempt to improve their financial performance (Francis, et al., 2003). However, LCCs are increasingly reluctant to accept standard terms, conditions and tariffs that are available to all air carriers. These issues are particularly crucial for small airports, often located in rural and remote areas that serve as a lifeline link for tourism and inward investment purposes (European Commission, 2002). This adds pressure on airport management to sell off marginal capacity cheaply (Graham, 2003).

As Doganis (2006: 169) puts it “the smaller and more unknown the airport, the greater the concessions that can be extracted from its management.” Ryanair
has a reputation for aggressive pursuit of minimum airport charges and it has been successful in most of the cases. By using secondary airports, Ryanair has followed closely the Southwest's strategy. But Ryanair pushes it further by flying to very small regional airports with little or no commercial traffic. In so doing, it was able to negotiate not only exceptionally low airport charges but also, in some cases, obtained financial supports from regional authorities.

EasyJet tends to fly to convenient regional airports. It also tries to negotiate low charges or other concessions with airports. But it used another way by inviting regional airports to tender for its routes. In the tendering process in 2003, 80 airports competed for easyJet's new European base and Berlin Schönefeld was chosen (easyJet, 2003). Although the details of the terms and contracts have not been disclosed, they are believed to be highly favourable.

Nevertheless, the competition for LCCs' customs put regional airports in a disadvantaged position. In a case study of a few European airports, Francis et al., (2003) observed that some airlines are taking advantage of their bargaining power and push for a price below the airports' marginal costs, not allowing the airport to cover costs. They further suggested that it is necessary for airports to establish the likely non-aeronautical revenue generated by passengers in order to be able to calculate exactly what they can charge LCCs for the use of runway capacity and still make a return. A rigorous test, such as econometric modelling approach, to quantify the impact of LCCs on airports financial performance, thus, should be welcomed by regional airports.
and/or regional authorities. Despite the critical importance of this issue, there has been very few robust published papers concerning this issue (McDonald and Gillen, 2003; Papatheodorou and Lei, 2006).

3.3 LCCs and UK Regional Tourism Development

Airport is a strategically important asset to regional tourism development. Having discussed the relationship between LCCs and regional airports, this Section moves on to another interrelated topic, i.e. LCCs and regional tourism. A review of UK regional tourism development is presented first. Then, the impact of LCCs on regional tourism development is explored, followed by a discussion of the collaboration between regional governments and LCCs.

3.3.1 A Review of UK Regional Tourism Development

Britain is the birthplace of modern tourism. Coupled with the rapid rise of disposable income and steady increase of paid holiday after the Second World War, the UK saw a dramatic increase in domestic tourism during the period of 1950s and 1960s. But from the 1960s onwards the British seaside resorts have witnessed a constant decline of domestic tourists in the face of greater competition from newer, better-equipped overseas destinations, particularly Mediterranean. Cooper (1997) noted that between 1978-88 39 million nights were lost at British coastal resorts. The reasons, such as cultural changes in the social construction of the tourist gaze, economies of inclusive tours, have been well documented (Shaw, et al., 1998).
In contrast to the decline of the domestic tourism, the number of the UK residents travelling abroad has experienced a rapid growth. Figure 3.8 below shows in 1977, the number of outbound tourists first overtook inbound travellers. The UK is currently a net sender of international visitors rather than a net recipient, a position that has increasingly prevailed over the last two decades. In 2002, 24 million overseas visitors came to the UK and spent £12 billion compared with 59 million UK trips travelled abroad with the spending of £27 billion (International Passenger Survey, 2003).

Figure 3.8 The number of visits to and from the UK, 1975-2002

Despite the tourism deficit, the UK remains one of the top ten tourist destinations in the world. In 2002, the UK ranked sixth in the world in terms of international tourist arrivals (UNWTO, 2003). But its market share fell from 5 per cent in 1980 to 3.4 per cent in 2002 (Shaw, et al., 1998; UNWTO, 2003).
Visitors from the EU represented the largest market share (58%) followed by North America (18%), the rest of the world (15%) and non-EU Western Europe (9%).

One of the distinctive features of inbound tourism in the UK is the seriously geographical imbalanced distribution of tourists. Overseas visitor trips were overwhelmingly concentrated in London. In 2002, London received 11.6 million of the overseas tourists, accounted for 48 per cent of the total visits to the UK. In terms of tourism expenditure, London’s share was even higher with 50 per cent or £5.8bn.

In the UK, the national government have tried to extend the benefits of tourism to all areas of the country, particularly to those regions with high unemployment and urban decay. Urban and rural tourism are two of the specific forms promoted by the government. In the UK, private and public partnership is in the form of urban development corporations and enterprise boards seeking to ‘rejuvenate’ inner-city and industrial lands (Hall and Jenkins, 1995). The advantage of developing urban tourism lies in the possibilities of exploiting the cultural potential of historical buildings (Jansen-Verbeke and Lievois, 1999). Government hopes by doing so, the regeneration can spur economic growth through strong multipliers, improve a city’s aesthetic and built environment and enhance facilities for residents (Fainstein and Judd, 1999).
Developing rural tourism is also important for the government as economies downturn in rural areas prompting government to attempt to capitalise on tourism benefits (Hall and Jenkins, 1998). It is hoped that by developing rural tourism, the local economy could become more diversified if jobs are created in tourism and tourism-related businesses (Telfer, 2002). Moreover, through tourism's multiplier effects, existing services and businesses are supported while new businesses are attracted to the area further diversifying the economy (Telfer, 2002).

In 1986, the British Tourist Authority (now VisitBritain) was asked to prioritise grants to projects assisting the development of tourism in areas of high unemployment (Pack, et al., 1995). With these policies in place, Pack et al. (1995) set out to determine whether the policy of dispersing tourism more widely throughout the UK had been successful. Their study focused on measuring the distribution of tourism demand by nationality and found that demand in the regions differs significantly not only from the national pattern but also between regions. While the results show that some dispersal of tourism has occurred, it is debatable as to whether it is due to the policies. One of their main findings was, however, that the peripheral regions did not experience the major share of tourism growth (Pack et al., 1995).

Recently, there was a movement away from the passive to active participation and a shift in the type of holiday demanded. According to Montanari and Williams (1994) this shift was predominantly driven by changes in consumption with greater emphasis on more individualistic or specialised
forms of holidays. These trends provide peripheral regions with an opportunity to meet an increased interest and demand from tourists in the niche market. A major growth point has been short breaks in inland centres, either countryside-based, such as old spa towns, or established historic centres such as Bath, Edinburgh and York.

Following on the success of these places, many other towns and cities have initiated schemes based on attracting visitors to compete for the market of short break holidays, especially out-peak season trips. However, in the highly competitive tourism market, destinations without adequate resources often find them in a disadvantaged position. For example, Glasgow, which is making a strong effort to develop as a tourist destination, saw initial success in the late 1980s, culminating in it being the European City of Culture in 1990. Since that time the number of visitor trips had fallen sharply, 44 per cent between 1988 and 1992 (Van den Berg, et al., 1995).

It is clear that there are a number of difficulties faced by peripheral regions in the ever competitive tourism market. Despite the problems such as infrastructure deficiencies, remoteness, sparse populations, small-scale traditional enterprises, high servicing costs and high unemployment rate (Lane, 1993; Baum, 1999), the major disadvantage of peripheral regions is that their locations are often the most inaccessible from the main tourist generating regions (Robbins, 1997). Accessibility is not only measured by distance, other factors such as journey time, journey cost, frequency of service and the necessity for interchange between services are all potentially
important measures of accessibility. Therefore, a destination with excellent air
links or high-speed rail links may be more accessible to a generating market
than closer destinations without such links.

The increasing severity of socio-economic inequalities between different
geographical regions is a challenge facing policy makers at both the national
and regional level. As a country's economic development concentrates in the
core, so does its population. This has the effect of weakening the economic
activities associated with the periphery. To compete effectively in the tourism
market, it is necessary for the peripheral regions to change people's
perception of remoteness and inaccessibility. Co-operation with LCCs is an
option adopted by many regions as low fares provided by LCCs significantly
generate demand for air travel in peripheral regions. The next Sub-section
examines the impact of LCCs on regional tourism development.

3.3.2 The Impact of LCCs on Regional Tourism Development

Airfare has consistently proven a significant explanatory variable with regards
to airline traffic throughout the literature; the lower the fare, the higher the
expected volume of traffic, other things being equal (Jorge-Calderón, 1996). It
is observed in the US that LCCs have significant impact on demand for air
travel. In a study carried out by the US Department of Transportation (US
DoT), in short-haul markets with LCC competition, passenger traffic had
nearly quadrupled since 1979, a 60 million passenger increase (Bennett and
Craun, 1993). Traffic in other short-haul markets only grew by 48 per cent, or
26 million passengers, over the same period (Bennett and Craun, 1993). A
recent study by the US DoT (2001) examined a route after JetBlue’s entry also provided impressive evidence of the significant impact of LCCs on traffic and fares. JetBlue launched services from New York JFK Airport to Buffalo in February 2000, with one-way advance-purchase fares starting at $47 before taxes. The study found that traffic rose 54 per cent overall and the average price of a one-way trip fell by 20 per cent. Other significant studies include Morrison and Winston (1995), Windle and Dresner (1999), and Vowels (2000).

In contrast to the abundant studies about the US LCCs, research into the impact of European LCCs on airfares or demand has been scarce. This is probably due to lack of relevant data in Europe. In the US, the DoT collect and publish 10 per cent sample of all US domestic origin and destination tickets, airport traffic data and airline operating and financial data for a number of years. However, such data are not publicly available in Europe. But it is observed that in Europe, many airfares have declined by as much as 80 per cent since the advent of LCCs (Barrett, 2004). The average price (revenues divided by the number of passengers) of the LCCs for a one-way ticket on international intra-European routes is €50 to €85, compared with €180 to €200 for British Airways and Lufthansa (Binggeli and Pompeo, 2002). This low fare attracts price-sensitive and flexible passengers from conventional scheduled and charter airlines. Moreover, it diverts passengers from trains, cars and ferries. P & O ferries have lost more than a million passengers in 2003 as travellers to mainland Europe switched to LCCs (The Guardian, 2003). Channel Tunnel also saw the traffic volume down from 2.34 million cars in
2002 to 2.28 million in 2003 as a result of the competition from LCCs (Wright, 2004).

More importantly, the low fares that LCCs provided seem to have generated substantial new traffic into the market. When low cost easyJet and Debonair commenced operations on the London-Barcelona route, passenger numbers increased by a staggering 32 per cent in the first year alone (1996-7). This compared with growth of 7 per cent in the previous year (UK CAA, 1998). Similarly, since the entry of low cost easyJet, Go and Ryanair on the London-Glasgow route, between 1995 and 2000, passenger demand increased by 53 per cent, compared to 10 per cent between 1990 and 1995 (Williams, 2001).

The above discussion shows that the rise of the LCCs directly contributes to the soaring demand for short-haul air travel. Although there has been little published research concerning the impact of LCCs on regional economic development, in the national or regional newspaper, there is numerous anecdotal evidence reporting how LCCs bring extra income to a region. An interesting example is from Scotland. According to the fifth Edinburgh Visitor Survey, the number of tourists from Ireland had risen from 5 per cent to 11 per cent in 2001/2 since the Ryanair and Go began direct flights to Dublin in competition with British Airway and Aer Lingus (Jamieson, 2002). The number of people arriving by air had more than doubled from 2000 to 2003 (Jamieson, 2003). In 2002, the spending of Irish visitors on attractions has risen 185 per cent to $40 million (Jamieson, 2002).
For regional governments, in assessing the contribution of LCCs to incoming tourism, it must be noted that very low fares tend to stimulate traffic in both directions. On most of the routes from the UK to continental Europe 60 to 70% of the passengers are UK originating (Doganis, 2001). Thus any gain in expenditure in the UK from additional incoming tourists has to be offset by reduced expenditure on UK holidays as a result of UK residents switching to European destinations because of the fare reductions.

However, as mentioned in Chapter 2, outbound travel is not necessary bad as it can also foster closer business links and generate business opportunities for local firms. In terms of regional tourism development, outbound tourism can make a significant contribution to economic development through the ownership of the outbound tourism industry and the control of international tourist flows (Sharpley, 2002). The main sectors benefiting from outbound tourism are tour operators/travel agencies, airlines and regional airports. For instance, in the UK, the Association of British Travel Agents member tour operators and travel agents collectively employed 45,000 people; most of the jobs are dependent on outbound tourism (Sharpley, 2002). In terms of airlines, in 2002, fares paid to UK carriers reached £3.1 billion (UK DCMS, 2005). Undoubtedly, a large proportion of airline jobs are supported by outbound travel.

Many regional airports owe their existence to outbound travel and this is particularly the case before the advent of LCCs. Sharpley (2002) provided an example about Newcastle Airport. During the 1950s, Newcastle Airport had
only a small number of domestic and international scheduled flights. The boom in outbound holidays during the 1960s led to a doubling of passenger numbers. In 1999, nearly 51 per cent of the three million passengers using Newcastle Airport were carried by charter airlines for overseas holidays. Similar scenario was reflected in other regional airports such as Liverpool, Leeds Bradford, East Midlands with charter traffic carrying over 50 per cent of the total passengers (Sharpley, 2002). Importantly, the substantial outbound traffic created many job opportunities in regional airports. For example, Luton Airport employed over 7,000 people, overtaking its traditional motor-manufacturing industry. Another potential opportunity is that the booming regional airports could act as catalyst for wider regional economic development, although further research is required in this area.

Having said that, the UK has been suffering from the huge increase in tourism deficit over the past decades. Although whether outbound tourism is good or bad for regional tourism development is beyond the scope of this thesis, it appears simply using the number of visitors as an indicator for tourism development is not robust enough. This issue will be further examined Chapter 4.

3.3.3 Collaboration between Regional Governments and LCCs

The discussion in 3.3.1 shows that relative inaccessibility and greater distance costs are the major hindrance to promoting regional tourism development, which undermines the potential competitiveness of those regions in the tourism marketplace. As air travel is becoming more and more important in
international tourism, the improvement of air links constitutes one of the principal strategies of regional development policies.

Low fares and high frequency offered by no-frills airlines provide opportunities for those previously hard-to-reach regions. Papatheodorou (2003) argued the close co-operation between LCCs, regional airports and regional authorities could create a win-win-win outcome for the three parties. He suggested initially, regional airports could offer preferential agreements to attract LCCs. Low fares provided by them would encourage leisure tourists to visit the region; meanwhile the enhanced accessibility by air links could create new business opportunities. Both factors might contribute substantially to regional economic development, employment and income generation. Consequently, prospective economy as well as low fares helps airports enlarge catchment areas. Better terms and conditions could be made when regional airports re-negotiate deals with LCCs. Moreover, the increased market potential could also attract other LCCs, or even conventional scheduled airlines to explore the market, thus further contributing to the regional development.

It is observed that some airports in Europe are following the strategy suggested by Papatheodorou (2003). In the UK, in view of the enormous opportunities brought by LCCs, the Scottish Tourist Board have cooperated with Ryanair and easyJet to promote Scotland to key European markets by highlighting value for money and the availability of LCCs from the European mainland direct to Scotland (The Scotsman, 2001). To attract LCCs, the
Highland and Islands Enterprise in Scotland also prepared £1.5m route development fund to assist in reducing landing charges (Ross, 2003).

A typical example is from Brussels South Charleroi Airport (BSCA), which is located 46km south of Brussels and is publicly owned by the Walloon Regional Government. The region has a population of 400,000. Its traditional industries, namely, coal, steel and glass, were in terminal decline and the unemployment rate was over 20%, twice the average for Belgian.

For the wider benefit of the region, particularly employment opportunities and financial input to the economy, the Walloon Regional government offered Ryanair a number of incentives in 2001. These are summarised as follows:

- A contribution towards promotional activities of €4 per boarding passenger, over 15 years and for up to 26 flights daily.
- Initial incentives amounting essentially to €160,000 per new route opened, for 12 routes, or €1,920,000 in total; €768,000 in reimbursements for pilot training; €250,000 for hotel accommodation costs.
- A preferential rate of €1 per passenger for ground handling services, whereas the rates normally charged to other airlines is €8-13 (European Commission, 2004).
In addition, the Walloon Region granted Ryanair a preferential rate for landing charges at Charleroi of €1 per boarding passenger, which is about 50 per cent of the standard rate (European Commission, 2004).

In return, Ryanair agreed to a certain number of flights and has based three aircraft at the airport and has committed itself to work in partnership with the airport to promote tourism. In 1999, the passenger numbers at Charleroi were 250,000, since Ryanair's entry in early 2001, the passenger numbers have increased to 1.5 million in 2002. However, following a complaint from Air France, the European Commission conducted an investigation into this issue and recently concluded that some concessions granted to Ryanair constituted illegal state subsidies. The verdict was somewhat controversial. Ryanair was order to repay part of the incentives in reduced airport charge, reduced ground handling fees and some route aid but it was allowed to keep most of the money it got.

Following the Charleroi verdict, similar deals signed by Ryanair with Strasbourg and Skavsta have been successfully challenged in the courts. Moreover, in October 2004 Iberia accused Ryanair of signing a deal with the Catalan Government in Spain involving incentives worth €6.2m over two years to launch services from Gerona and of receiving incentives worth a further €3m over three years from another regional government for services to Santander in northwest Spain. In Germany, Air Berlin in January 2005 filed a complaint against Luebeck Airport of paying €10m in unfair support payments to Ryanair since 2000.
Such deals are increasing under scrutiny as whether it constitutes state aids to distort competition. However, many European regional governments argue that air links provided by LCCs are vital to their economic and tourism development. By taking a transparent approach, Scotland pioneered the concept of Route Development Fund to help secure new-and enhance existing-direct air services to Scotland. The fund is available to all airlines that can meet its criteria. This strategy was adopted by Northern Ireland and a number of other regions. In most cases, LCCs are the main beneficiaries of the subsidies.

However, it must be noted that LCCs are not a panacea for regional tourism development. Dennis (2004) provided some evidence that, even with very low fares, LCCs still cannot generate enough traffic. Table 3.4 provides a route level assessment of some of the under-performed Ryanair services in 2003.

Table 3.4 Performance of selected Ryanair routes 2003

<table>
<thead>
<tr>
<th>Route</th>
<th>Passengers 2003</th>
<th>Seats 2003</th>
<th>Load factor %</th>
<th>Change in pax from 2002</th>
<th>Service 2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stansted-Clermont Fer</td>
<td>42473</td>
<td>70000</td>
<td>60</td>
<td>New 2003</td>
<td>dropped</td>
</tr>
<tr>
<td>Stansted-Ostend</td>
<td>39585</td>
<td>73000</td>
<td>54</td>
<td>New 2003</td>
<td>dropped</td>
</tr>
<tr>
<td>Stansted-Pescara</td>
<td>88816</td>
<td>138000</td>
<td>65</td>
<td>-13%</td>
<td>continuing</td>
</tr>
<tr>
<td>Stansted-Brescia</td>
<td>120634</td>
<td>188000</td>
<td>64</td>
<td>-36%</td>
<td>continuing</td>
</tr>
<tr>
<td>Prestwick-Bournemouth</td>
<td>85006</td>
<td>133000</td>
<td>64</td>
<td>New 2003</td>
<td>Reduce frequency</td>
</tr>
<tr>
<td>Prestwick-Charleroi</td>
<td>85337</td>
<td>130000</td>
<td>66</td>
<td>-13%</td>
<td>Reduce size</td>
</tr>
</tbody>
</table>

Source: Traffic from UK CAA Airport Statistics Route Analysis; seat capacity and services complied from OAG schedule data and Ryanair fleet details
Adopted from Dennis (2004)
As can be seen from Table 3.4 above, two routes, Clermont Ferrand and Ostend were dropped in 2004. Clermont Ferrand is an industrial centre with limited tourist resources, while Ostend is a very short route, which is dominated by surface modes of transport. On Prestwick-Bournemouth, frequency has been cut from two flights per day to one, while an old 737-200 has replaced the larger 737-800 on the Prestwick-Charleroi route.

After the landmark Charleroi verdict, regional authorities across Europe are continuing to seek support from LCCs in the hope of developing regional tourism development. However, there is a crucial question here. Are LCCs really beneficial to regional tourism development? If yes, to what extent? Despite the critical importance of this question, very few rigorous studies have been carried out.

3.4 Issues of Measurement

Although there exist dynamic relationships between LCCs, regional airports and regional tourism, it has become evident that the overall relationship is determined by two factors: the impact of LCCs on regional airports financial performance and the impact of LCCs on regional tourism development. The previous two Sections examined the relationships between LCCs and regional airports and LCCs and regional tourism, respectively. This Section moves onto the issues of measurement. As studies on LCCs, airports and regional tourism are scarce, two broad areas are examined. One is to understand how previous researchers measure the impact of airlines on economic performance of airports. The other is to review how the impact of airlines on
regional tourism, more broadly, regional economic development, is measured in the literature.

3.4.1 Measurement Issues in Airlines Impact on Airports Economic Performance

The study on the interaction of airlines and airports have traditionally focused on airline and airport choice (Warnock-Smith and Potter, 2005; Hess and Polak, 2005), competition and network structure (Lijesen et al., 2001; Dennis, 2005; Burghouwt et al., 2003), slot allocation (Mehndiratta and Kiefer, 2003) and environmental impact (Hsu and Lin, 2005). The impact of airlines on airports economic performance has been somewhat limited. This is probably due to difficulties in obtaining detailed passenger and airport financial data.

In a groundbreaking research, Doganis et al., (1995) compared economic performance of 24 airports across 13 European countries in 1993 by using descriptive measures and simple regression analysis. Adjustments were made to minimise the problem of comparability. Airports were divided into three groups, namely, UK/Irish airports (9), Northern Europe (8) and Southern European airports (7). The comparisons were made by examining 21 different performance indicators, including measures of aggregate and disaggregate costs and revenues, labour and capital productivity, commercial performance

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and profitability. The explanatory variables in the model include size of airports, proportion of international, charter passengers and so on.

There are a number of interesting findings such as existence of economies of scale in airports, significant impact of international and charter traffic on airports non-aeronautical revenue. The main merit of the analysis is that a number of indicators for airport performance measurement were identified. However, a fundamental problem arising from this study is the small sample size. When employing cross-sectional data, only 7 to 9 observations were used for each regression analysis. Based on statistical theory, results obtained from such a small sample size are highly unreliable.

Gillen and Hinsch (2001) developed a four-step modelling approach to estimating the impact of changes to the international aviation bilaterals on airports revenue and the income, employment and tourism effects for the local economy and applied it to Hamburg Airport in Germany using a pooled time-series cross-section estimation method. Two models were developed to estimate the airport impact resulting from the changes of bilaterals. Airport impact was measured in aeronautical revenue with regards to flights and passengers; and non-aeronautical revenue with respect to passenger. In the aeronautical revenue model, they found that a 1 per cent increase in intra-German or European flights raised aeronautical revenue by 0.46 per cent, while 1 per cent increase in international flights raised aeronautical revenue by 0.16 per cent. In the non-aeronautical revenue model, they found that each European passenger added 33.82DM while an international traveller...
added 149.93DM to airport's non-aviation revenues. In other words, a 1 per cent increase in German and other European passengers raised non-aeronautical revenue by 0.29 per cent, while the same percentage increase in international passengers raised non-aeronautical revenue by 0.59 per cent.

A research carried out by McDonald and Gillen (2003) is the first study which explicitly assesses the impact of LCCs on airports non-aeronautical revenue. The study covers 16 Canadian airports over the years of 1997 to 2002. Due to data restrictions, the passenger data of WestJet and Air Canada were used as proxies for LCCs and full service carriers, respectively. They found that each WestJet's passenger made a much higher contribution to airports non-aeronautical revenue than other passengers (6.2 Canadian Dollar and 1.2 Canadian Dollar, respectively).

In a recent paper, Papatheodorou and Lei (2006) attempted to measure the impact of LCCs, charter and full service carriers on airports non-aeronautical and aeronautical revenue. They divided 21 UK airports into two groups: big and small. The data covers the period of 1995/96 to 2003/04. They found the LCC passengers' contribution to airports non-aeronautical revenue was highly significant at the 1% level across all the three samples. By contrast, charter and full service carrier passengers did not have significant impact on the whole sample and the large airport group. But their impact on the small airport group is highly significant. In the small airport group, on average, charter carrier and full service carrier passengers spent more at the airports than LCC travellers. These findings contradict to that of McDonald and
Gillen’s (2003). This might be due to the fact that the both studies were carried out in the different countries.

In the aeronautical revenue study, as passengers and flights variables were highly correlated, Papatheodorou and Lei (2006) dropped passenger variables and used the three different types of flights to capture the impact on airports aeronautical revenue. They found for the whole sample, charter flights had the largest impact on airports aeronautical revenue, followed by LCC and full service flights. Similar results hold for the large airport group. However, LCC flights emerged as the largest contributor to airports aeronautical revenue in the small airport group. This finding is interesting and suggests that the small regional airports in the UK have become more oriented towards LCC traffic.

In a case study, Francis et al., (2003) provided an excellent insight into how LCCs affected the financial performance of two European airports. Airport A is a secondary airport in the shadow of a major hub and Airport B is a regional airport owned by a combination of the local and regional public authorities. In both cases, the advent of LCCs contributed to the significant increase of traffic in the airports. In terms of the impact on airports financial performance, revenue (aeronautical and non-aeronautical revenue) in both airports was examined; cost and profit data were unavailable and only guessed. In the case of Airport A, the relationship between the airport company and the LCCs seemed mutually beneficial. In contrast, the case of Airport B showed that increases in passenger numbers alone did not bring profitability to the airport.
Francis et al. concluded that it is important for airport management to see both passengers and airlines as customers and to understand the resultant revenue streams, before negotiating preferential contracts with LCCs.

3.4.2 Measurement Issues in Airlines Impact on Economic Development

Since 1970s, there have been a growing number of studies attempting to measure the impact of air transport on national or regional economic development (e.g. Hakfoort et al., 2001; DRI WEFA, 2002). Many of those studies employ the methods of multiplier or input-output analysis. Here we examine an interesting study commissioned by Scotland Highlands and Islands Enterprise in association with Highlands and Islands Airports Limited about the economic and social impact of LCC air services in the Highlands and Islands (HIE, 2002).

By following the standard procedure of multiplier analysis, the study first obtained inbound and outbound passengers' expenditure from a survey of 400 passengers (using the easyJet service from Inverness to Luton between August and September 2002). Then a supplier and income multipliers for the Scottish tourism sector in a 1991 study was used to estimate the overall economic impact through the additional expenditure generated by the easyJet route. It concluded that the daily link between Inverness and Luton generated £12m annually to the region and supported up to 132 jobs with most of them are tourism-related.
Although the above results seem quite impressive, the methodology adopted is seriously flawed. First, the multiplier used is 11 years old which is too outdated to produce valid results. More importantly, input-output analysis itself is subject to a number of drawbacks. Firstly, it only counts the positive influence on economic activity, but ignores the negative one; therefore, it tends to overestimate the benefit (Dwyer et al., 2003). Moreover, the interactions between the economy and the rest of the world are ignored (Dwyer et al., 2003) and the role that prices play in production process cannot be revealed (Zhou, et al., 1997).

As a result of these serious limitations, the past two decades have seen rapid development of an alternative technique, i.e. Computable General Equilibrium (CGE). CGE models incorporate an Input-Output framework, but they also model markets for goods and services, factor markets, recognise resource limitations, model consumer spending, allow for government spending and taxing, and allow for external constraints (Dwyer, et al., 2004). Therefore, CGE models are widely used for analysing the impacts on economies of various changes, such as policy shifts or demand changes. Despite their distinctive advantages, CGE analysis is difficult to be applied at regional level as readily available data are usually in absence (for details, see Dwyer et al, 2004).

A popular method in analysing air transports impact on regional economic development is econometrical analysis. However, it poses problems of appropriate model specification and estimation procedures. Another major
difficulty in econometric analysis is how to choose an indicator for regional economic development. Button and Taylor (2000) acknowledged that measuring economic performance at the national level is difficult and poses even greater problems at lower levels of spatial disaggregation. There are issues of what constitutes economic progress and whether indicators such as GDP are sufficiently comprehensive. They then went on arguing that compared with GDP, employment measurement is more robust and a measurable indicator for regional economic development.

In Markusen's (1985) empirical study of evolutionary patterns of 16 industrial sectors in the US, various indicators such as output, sales, value-added, employment were used. Employment was proved superior to the other indicators. As Markusen (1985) commented, "it is possible, even probable, ... for output to continue to rise but employment to decline steadily (as a result of technological advancement, improvement of managerial abilities, etc.)." Consequently, it is not surprising to find that in empirical studies, employment has generally been used as an indicator for economic development.

Irwin and Kasarda (1991) analysed the relationship between the structure of the airline network and employment growth in manufacturing and producer services in 104 US metropolitan areas by using regression analysis and nonrecursive models. Their analysis demonstrated that the rise of aviation and changes in the airline network have been important factors reorganising metropolitan economies. They further assessed the effects of changes in an airline network on metropolitan employment growth rates and found that
changes in an airline network were a cause rather than a consequence of this employment growth. Supporting evidence is provided by Button et al. in a study of hi-tech employment in hub airport markets in which they found that "hubs create employment rather than airlines selecting cities as hubs simply because they are already dynamic" (Button, et al., 1999: 58).

However, the research by Ivy et al., (1995) appears to partially contradict these findings when examining changes in air service connectivity and administrative and auxiliary employment for the 59 largest metropolitan areas in the US for the period of 1978 to 1988. Their study demonstrated that connectivity affected, and was simultaneously affected by administrative and auxiliary employment levels. The findings suggested that changes in connectivity have a greater influence on administrative and auxiliary employment levels than changes in administrative and auxiliary employment have on connectivity.

While all the above studies analyse the complex connections between air transport and economic development, they tend to underplay the significant role that the competitive strategies of the airlines themselves can play in determining the success or failure of both airport operations and regional economy. Debbage (1999) examined the spatial and temporal patterns of air passenger flows by airport in the US Carolinas with regards to administrative and auxiliary employment levels within the context of airline competitive strategies. A major finding is that those airports that experienced significant gains in air passenger volume tended to experience comparable gains in the
employment levels of administrative and auxiliary workers, particularly in the manufacturing sector.

In a subsequent paper, Debbage and Delk (2001) expanded the study from the US Carolinas to the top 50 urban-airport complexes in the US from 1973 to 1996. The study showed that the correlation between administrative and auxiliary employment and enplaned passenger volume over time was statistically significant at the 1% level. However, the large volume of air passengers in Las Vegas generated far fewer administrative and auxiliary workers than expected. The authors argued that it was because Las Vegas is a tourist area and the employment concentrate on tourism-related industries. This vignette shows that it is very likely that tourism employment has a distinctively different feature from other sorts of employment.

However, the simple methodology, i.e. correlation coefficient, adopted by Debbage and Delk (2001) cannot exclude the influence of other factors affecting the level of employment changes and is unable to measure the magnitude of the change. In a recent paper, by using econometric model, Brueckner (2003) provided new evidence on the link between airline traffic and employment in US metropolitan areas. The empirical results showed that a 10 per cent increase in passenger enplanements in a metro area led approximately to a 1 per cent increase in employment in service-related industries. However, airline traffic had no effect on manufacturing and other goods-related employment, suggesting that air travel was less important for
such firms than for service-related business. These estimates were generated controlling for reverse causality between employment and traffic.

The above analysis demonstrated that airlines have significant impact on different types of employment although the findings are somewhat contradictory. As a relatively new phenomenon, there are very few studies about the economic impact of LCCs. Because LCCs do not carry freight, their impact on traditional manufacturing, hi-tech, or goods-related employment should be less than that of conventional scheduled airlines. But its significant low fares and the strategy of flying to regional airports appear to have a great impact on tourism, particularly at regional level.

McDonald and Gillen's (2003) study is the only research paper found explicitly modelling the impact of LCCs on regional tourism development. In their study, McDonald and Gillen attempted to measure the impact of WestJet on tourism development in British Columbia, Canada. Four WestJet destinations and one non-WestJet (full service carriers) destination were examined from 1997 to 2001. Total number of accommodation rooms and total room revenue were used as indicators for regional tourism development. It was expected that WestJet would have significantly positive impact on the both dependent variables as WestJet's low fares would result in passengers shifting destination and generating new traffic. However, the first model showed that both WestJet and full service carriers had no significant impact on total room numbers and the signs were counter-intuitive. Although the signs were
correct in the second model, both WestJet and full service carriers had no significant impact on total room revenue.

McDonald and Gillen attributed the unsatisfying results to lack of appropriate and reliable data. They argued that given the availability of data such as number of visitors and visitors expenditure, the impact of WestJet on British Columbia could be properly measured.

3.5 Summary
This Chapter started by examining the LCC-airport relationship. Airport commercialisation and privatisation across Europe have put pressure for regional airport management to increase passenger throughput in order to reach critical mass for their facilities. The recent rise of LCCs demonstrated that they could make regional airport work in a way that traditional airlines cannot by bringing in passengers from a much wider catchment area through low fares. Evidence showed that regional airports embracing LCCs saw a dramatic increase in traffic. However there were also conflicts between LCCs and regional airports as the former kept on demanding low airport charges. The burning issue here is to what extent LCCs have positive impact on regional airports financial performance.

Section 3 then looked more closely at the impact of LCCs on regional tourism development. Regions across Europe were embracing LCCs in the hope of developing regional tourism. The rapid development of LCCs over the past few years, on the one hand, provided regions with direct and effective links to
the main tourism generating market and on the other hand, accelerated outbound tourism flow. The crucial question is to what extent LCCs are beneficial to regional tourism development.

An effective measurement built on the rigid approach is the key to answer the above questions. Issues of measurement were thus discussed in Section 4. Measurement issues relating to the airlines impact on airports were first examined. Previous studies focused on the impact on revenue. There are some drawbacks with this approach as revenue is only part of the function; cost and profit are also very important. Therefore, to accurately measure the effect of LCCs on regional airports financial performance, revenue, cost and profit all need to be taken into account. In terms of measurement issues in airlines impact on economic development, employment was found to be the most commonly used indicator as it is relatively robust and measurable compared with GDP and others. Can we use tourism employment as an indicator for regional tourism development? This issue will be explored in Chapter 4.
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Chapter 4 Methodology

4.1 Introduction

The purpose of this Chapter is to develop a framework for the measurement of the economic effects of LCCs. The remainder of this Chapter is organised as follows. The research objectives are re-stated in Section 2. Section 3 discusses the possible methodologies and justifies the choice of panel data analysis. Section 4 presents the key procedures in panel data analysis. Within this framework, model specification for the Airport and Tourism Employment studies are discussed in Section 5. Data and sample are presented in Section 6. This is followed by a discussion of the limitations of the study in Section 7. Finally, summary is presented in Section 8.

4.2 Research Objectives

The aim of this thesis is to measure the regional economic effects of LCCs. Five research objectives are re-stated as follows:

(1) To review the literature on the relationship between air transport, tourism and regional economic development.

(2) To examine the economic effects of LCCs in the UK, with a particular focus on a regional perspective.

(3) To develop a framework for the measurement of the economic effects of LCCs.

(4) To measure the impact of LCCs on regional airports financial performance
To assess the impact of LCCs on regional tourism employment

4.3 Choice of Methodology

CGE modelling was initially considered. However as data at regional level are unavailable for constructing the CGE model, this approach was then abandoned. Two possible research methods, i.e. panel data econometrics and case study, are considered for the empirical studies. What follows now is a discussion of the two methods and to evaluate which one is more appropriate for the purpose of this research.

Econometric analysis is the most popular method in studying airlines impact on economic development. In terms of the study of airlines impact on airports performance, econometric analysis is also the dominant method as we can see from the discussions in Issues of Measurement (Section 3.4 of Chapter 3). The reasons for using econometric analysis can be roughly summarised as follows. Firstly, it can determine whether the independent variables explain a significant variation in the dependent variable. Secondly, it can determine how much of the variation in the dependent variable can be explained by the independent variables. Thirdly, it can control for other independent variables when evaluating the contributions of a specific variable or set of variables. And finally, it can predict the values of the dependent variable.

However, in the study of the impact of LCCs on airports financial performance, case study is also adopted by some researchers (Francis et al., 2003). According to Yin (1994: 13), "a case study is an empirical enquiry that
investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident (and) where there will be many variables of interest and, as a result, relies on multiple sources of evidence...and benefits from the prior development of theory to guide data collection and analysis”.

Case study is particularly appropriate for inductive study, such as to develop ‘grounded theory’; interpretive research to explore or explain the dynamics of a phenomenon; or interventionist research to tract the effects of an intervention on a particular setting/group. It is primarily conducted in qualitative form and mainly involved with four associated research methods: observation, interview, archival and documentary evidence and physical artefacts (Yin, 1994).

However, there are also a number of problems associated with the case study approach. Firstly, the results of case study cannot be generalised as the study is usually based on single or few cases, often chosen opportunistically or by convenience from restricted frame. Secondly, the outcomes of the case study are always variable as they are heavily dependent on the personal skills of the researcher. Finally, access to case ‘sites’ can be difficult as prior approval is needed and full co-operation from the parties involved is necessary.

The choice between different research methods should depend on the purpose of the research. As the Airport Study endeavours to investigate the
impact of LCCs on regional airports financial performance, this requires the collection of a large amount of financial information from the airports. The key financial data can be obtained from secondary sources, i.e. Airport Statistics. It is unlikely that airports will provide more detailed financial information than these as they are usually considered sensitive and confidential.

Moreover, getting permission from airports authorities for the interview on this issue could be difficult. As a matter of fact, in Francis et al., (2003) study on two European airports, only part revenue data were provided; cost and profit data were not available. This highlights the difficulties of using case study approach.

More importantly, this study aims to provide an overall, rather than individual, picture of LCCs impact on regional airports financial performance and regional tourism employment. This task can only be fulfilled by econometric analysis. Based on these considerations, despite the various merits that case study has, econometric analysis is considered more appropriate for the purpose of this study.

Econometric analysis makes use of three types of data, namely, cross-section, time-series and panel data. It is considered that panel data analysis is the most appropriate method for this study as panel data are better suited to study the dynamics of change by studying the repeated cross-section of
observations. Besides, there are a number of advantages of using panel data\textsuperscript{16}.

Firstly, panel data models can take into account a greater degree of the heterogeneity that characterises individuals, regions, firms, etc. over time (Hsiao, 2003). This can be done by using one-way or two-way analysis to control for the individual- and time-invariant variables (to be discussed in next Section) whereas a time-series study or a cross-section study cannot. Therefore, time-series and cross-section studies not controlling this heterogeneity would run the risk of obtaining biased results. For detailed discussion, please refer to Baltagi (2005).

Secondly, panel data give more informative data, more variability, less collinearity among the variables, more degrees of freedom and more efficiency (Baltagi, 2005). Time-series studies are always suffered from multicollinearity. For example, in a study carried out by Baltagi and Levin (1992) about the demand for cigarettes in the USA for 46 states over the years of 1962-1992, there is high collinearity between price and income in the aggregate time series for the USA. This is less likely with a panel across American states since the cross-section dimension adds a lot of variability, adding more informative data on price and income. In fact, the variation in the data can be decomposed into variation between states of different sizes and characteristics, and variation within states. The former variation is usually bigger. With additional, more informative data one can produce more reliable

\textsuperscript{16} The following discussions on the advantage of panel data draw heavily upon Baltagi (2005)
parameter estimates. Moreover, by combining time-series of cross-section observations, panel data can significantly increase the number of observations. This is particularly important for the study of airlines and airports which are characterised by small cross-section observations or short time-series.

Thirdly, panel data can better detect and measure effects that simply cannot be observed in pure cross-section data (Hsiao, 2003). This can be well illustrated by an example given by Ben-Porath (1973): Suppose in a cross-section of married women 50% are found to work. There are at least two distinct interpretations for this. Either each woman in a homogeneous population has a 50% chance of work in any one year or 50% of women in a heterogeneous population always work and 50% never work. The policy implications are different depending on which phenomenon is correct. In the first case there is considerable labour market turnover among married women, in the second case there is no turnover at all. The availability of individual labour force histories over time can help discriminate between these two distinct explanations. It is in this way, causal effects are better observed from panel data analysis.

Finally, panel data can be used, at least under certain assumptions, to obtain consistent estimators in the presence of omitted variables (Wooldridge, 2002). These omitted or unobserved variables are usually consigned to the error term when using cross-section data. If these omitted or unobservable variables are correlated with dependent variables, then Ordinary Least
Squares (OLS) will provide biased estimates. This is a perennial problem faced by investigators who only have cross-section data. If panel data were available on individuals over time, this may provide a solution to the problem (Details are illustrated in Section 4).

Despite the various advantages of using panel data analysis, it also has certain limitations. Firstly, designing panel surveys as well as data collection and data management could be very expensive and difficult. Secondly, measurement errors may arise because of faulty responses due to unclear questions, memory errors, deliberate distortion of responses, inappropriate informants, misrecording of responses and interviewer effects. Thirdly, there is a selectivity problem including self-selectivity, non-response and attrition. However, these limitations are associated with survey data. Only employment data used in this study are survey data, while the others are actual data. Therefore, it is considered the above mentioned limitations do not have serious impact on the validity of this study.

Another technical problem related with the use of panel data is that the choice of an appropriate model depends *inter alia* on the degree of homogeneity of the intercept and slope coefficients and the extent to which any individual cross-section effects are correlated with the explanatory variables (Song and Witt, 2000). However, this is a testable assumption and one that will be discussed in the next Section.
4.4 Procedures in Panel Data Analysis

Literature on panel data analysis is deep and vast. This Sub-section reviews the conventional procedures in panel data analysis.

4.4.1 One-way VS. Two-way Error Component Model

A panel data regression differs from a regular time-series or cross-section regression in that it has a double subscript on its variables (Baltagi, 2005). This can be illustrated from the classical linear regression model (4.1):

\[ y_{it} = \alpha + X_{it} \beta + u_{it} \quad i = 1, \ldots, N; \quad t = 1, \ldots, T \]  

(4.1)

With \( i \) denoting the cross-section dimension, e.g. regions, countries, and \( t \) denoting time-series dimension, such as years, quarters. \( \alpha \) is a scalar, \( \beta \) is \( K \times 1 \) vector and \( X_{it} \) is the \( it \)th observation on \( K \) explanatory variables. \( u_{it} \) is the disturbance term. Most of the panel data applications utilise a one-way error component model for the disturbance, with

\[ u_{it} = \mu_{i} + v_{it} \]  

(4.2)

Where \( \mu_{i} \) denotes the unobservable individual-specific effect and \( v_{it} \) denotes the remainder disturbance. Here \( \mu_{i} \) is time-invariant and it accounts for any individual–specific effect that is not included in the regression. In this case we could think of it as the individual's unobservable ability. The remainder disturbance \( v_{it} \) varies with individuals and time and can be thought of as the usual disturbance in the regression.
Alternatively, the error term can be treated with two-way error components disturbances:

\[ u_{it} = \mu_i + \lambda_t + \nu_{it} \]  

(4.3)

Where \( \mu_i \) and \( \nu_{it} \) are defined the same as in (4.2). \( \lambda_t \) denotes the unobservable time effect. Here \( \lambda_t \) is individual-invariant and it accounts for any time-specific effect that is not included in the regression.

A Chow F test or Breusch and Pagan LM test can be used to distinguish one-way or two-way effects. The both tests will be discussed in Sub-section 4.4.3.1.

### 4.4.2 Main Types of Panel Data Models

In principle, a panel data model can be estimated in three ways depending on whether the individual cross-section effects are considered to be constant, fixed or random. These will be discussed in turn.

**Pooled OLS**

Let us substitute (4.2) into (4.1), we get the model below:

\[ y_{it} = \alpha + \mu_i + X'_{it}\beta + \nu_{it} \]  

(4.4)

Or in the case of two-way error component model, we get the model:
If we assume the term $\alpha + \mu_i$ in (4.4) or $\alpha + \mu_i + \lambda_t$ in (4.5) is constant, there is neither significant individual nor significant time effects. OLS provides consistent and efficient estimates of the homogenous intercept and slope. Therefore, this model is always called the pooled OLS (POLS). The appealing of the POLS model is that it is easy to estimate and interpret as we could pool all of the data and run an OLS regression model.

However, the unit-specific effects do not differ in POLS is very restrictive and usually unrealistic. Hsiao (2003: 20) warned that "unless both cross-section and time-series analyses of covariance indicate the acceptance of homogeneity of regression coefficients, unconditional pooling (i.e. a single least-squares regression using all observations of cross-sectional units through time) may lead to serious bias".

**Fixed Effects Model**

If $\mu_i$ in model (4.4) or $\mu_i + \lambda_t$ in model (4.5) differ according to the cross-sectional unit but assumed to be fixed parameters to be estimated; the disturbance term $\nu_{it}$ is independent and identically distributed; and the $X'_{it}$ are assumed independent of the $\nu_{it}$ for all $i$ and $t$, it is called the fixed effects (FE) model or least square dummy variable (LSDV) model.

The formulation of the FE model assumes that differences across units can be captured in differences in the constant term (Greene, 2003). Each $\mu_i$ or $\mu_i + \lambda_t$
is treated as an unknown parameter to be estimated. Under those circumstances, OLS estimation of the model will yield biased estimators. But this can be solved by either first-differencing the variables or, differencing them by cross-section-specific means.

Baltagi (2005) argued that the FE model is an appropriate specification if we are focusing on a specific set of N firms or regions and our inference is restricted to the behaviour of these sets of firms or regions. Inference in this case is conditional on the particular firms or regions that are observed.

The advantage of fixed effects inference is that there is no need to assume that the effects are independent of $X_{it}$. It allows the unobserved individual effects to be correlated with the included variables. The disadvantages are that the FE model suffers from a large loss of degree of freedom as we are estimating (N-1) extra parameters, and too many dummies may aggravate the problem of multicollinearity among the regressors. In addition, this FE estimator cannot estimate the effect of any time-invariant variable like location. These time-invariant variables are wiped out by the deviations from means transformation.

**Random Effects Model**

Unlike the fixed effects model where inferences are conditional on the particular cross-sectional units sampled, an alternative formulation is the random effects (RE) model. Under the RE assumptions, $\mu_i$ or $\mu_i + \lambda_i$ is
uncorrelated with $X_{it}$. In that case, OLS is asymptotically unbiased but inefficient compared with feasible generalised least squares (FGLS).

RE model is an appropriate specification if $n$ cross-sectional units are randomly drawn from a large population. Furthermore, it can be shown that a random effects specification implies a homoscedastic disturbances variance, $\text{VAR}(u_{it}) = \sigma_\mu^2 + \sigma_v^2$ for all $i, t$, and serial correlation only for disturbances of the same cross-sectional unit (Hsiao, 2003).

The advantage of random-effects inference is that the number of parameters is fixed and efficient estimation methods can be derived. The disadvantage is that one has to make specific assumptions about the pattern of correlation (or no correlation) between the effects and the included explanatory variables (Hsiao, 2003).

4.4.3 Tests of Hypotheses

Having presented the three types of panel data models, this Sub-section discusses specification tests.

4.4.3.1 Poolability Test

Chow F test can be used to distinguish between the POLS and FE models. Breusich and Pagan LM test can be used to distinguish the POLS and RE models.
Chow Test

Chow test can be used to test the joint significance of the included fixed effects parameters. Under the null hypothesis of equality, the efficient estimator is POLS. Based on Greene (2003), the Chow F ratio used for this test is:

\[ F(n - 1, nT - n - K) = \frac{(R^2_{FE} - R^2_{POLS})/(n-1)}{(1-R^2_{FE})/(nT-n-K)} \]  

(4.6)

Where \( R^2_{FE} \) and \( R^2_{POLS} \) are the residual sums of squares of the FE and POLS models, respectively, \((n-1)\) and \((nT-n-k)\) are the degrees of freedom, the total number of observation is \( NT \). If the calculated value of F is smaller than the critical value, the null hypothesis of equality is accepted. Rejecting the null hypothesis is in favour of either individual specific effect (i.e. \( H_0: \mu_1 = \mu_2 = \ldots = \mu_{N-1} = 0 \), or time-period effect (i.e. \( H_0: \lambda_1 = \lambda_2 = \ldots = \lambda_{N-1} = 0 \).

LM Test

For the random error component model, Breusch and Pagan (1980) devised a Lagrange multiplier (LM) test to test \( H_0: \sigma^2_\mu = 0 \) or \( H_0: \sigma^2_\lambda = 0 \) for one-way or two-way model. Under the null hypothesis \( LM \) is distributed as chi-squared with one degree of freedom. Acceptance of the null hypothesis means the classical regression model with a single constant term is appropriate for the data and the model, i.e. the model can be estimated by POLS. Rejecting the null hypothesis, then, is in favour of RE model. However, even under that
circumstance, we cannot jump to conclusion that the model has random effects as there is another competing model, i.e. FE.

4.4.3.2 Specification Tests

The usual approach to testing between RE and FE is a Hausman test (Hausman, 1978). Let $\hat{\beta}^{FE}$ and $V(\hat{\beta}^{FE})$ denote the FE estimator and its covariance matrix and likewise for the RE estimator, $\hat{\beta}^{RE}$ with $V(\hat{\beta}^{RE})$. If the RE model is correct, $\hat{\beta}^{RE}$ is consistent and efficient so $V(\hat{\beta}^{FE}) > V(\hat{\beta}^{RE})$. Let $q = \hat{\beta}^{FE} - \hat{\beta}^{RE}$. Under the null hypothesis it follows that $cov(\hat{\beta}^{FE} - \hat{\beta}^{RE}) = 0$. This is because if $\hat{\beta}^{RE}$ is efficient its variance cannot be reduced and, if it was correlated with $\hat{\beta}^{FE}$, that could be used to reduce its variance. The variance of the difference is:

$$V(q) = V(\hat{\beta}^{FE}) - V(\hat{\beta}^{RE})$$

(4.7)

If the individual effects are not random but correlated with the $X_{it}$ then the RE estimates are inconsistent, but the FE estimates are still consistent, since the FE model admits any degree of correlation between $a_i$ and $X_{it}$. The Hausman test statistic is:

$$H = q[V(q)]^{-1}q \sim \chi^2(k)$$

(4.8)
The Hausman test examines whether there is significant correlation between the unobserved individual-specific random effects and the regressors. Under the null hypothesis that \( \mu_i \) or \( \lambda_i \) is uncorrelated with \( x_{it} \), the Hausman test statistic is distributed asymptotically as chi-squared with \( K \) degree of freedom. Both the RE and FE models are consistent but the RE model is more efficient. If the calculated value is greater than the critical value, this suggests that the RE model is inconsistent and the FE model would be the model of choice.

However, there are two caveats about the Hausman test. One is that the test might have biased results in small samples (Baltagi, 2005). As a result of that, it is possible to get a statistical rejection of RE with the differences between the RE and FE estimates being practically small. In that case, a typical response is to conclude that the random effects assumptions hold and to focus on the RE estimates (Wooldridge, 2002).

The other caveat is that the Hausman test depends on the difference between two separately estimated covariance matrices being positive definite. In practice, the difference is sometimes not positive definite, which can seriously distort the estimation of Hausman test. This problem can be resolved by applying Mundlak model. Mundlak (1978) criticised the random-effects formulation on the grounds that it neglects the correlation that may exist between unobserved individual effects and the explanatory variables. There are reasons to believe that in many circumstances that unobserved individual effects and the explanatory variables are indeed correlated. Mundlak (1978)
argued that ignoring this correlation can lead to biased estimation. Based on this idea, he developed a model, which is called Mundlak model, below:

\[ y_{it} = \alpha + \beta x_{it} + a\bar{x}_i + \mu_i + \nu_{it} \]  

(4.9)

Mundlak model is also an error component model, with the similar form as model (4.1), but adds the variable \( a\bar{x}_i \), which is the mean of explanatory variables and only varies over individual. A simple F test of the significance of the means can be carried out after the Mundlak model. If the test is significant, exclusion of mean value could cause biased estimation. In other words, the significance of the test is in favour of FE model over RE model as RE model produces inconsistent estimation.

### 4.4.4 Heteroscedasticity and Serial Correlation

There are two critical assumptions associated with disturbance term in the error component model. One is homoskedasticity and the other is no serial correlation. When both assumptions are violated, the estimations of the regression coefficients are still unbiased and consistent, but not efficient (Baltagi, 2005).

According to Baltagi (2005), one approach is to model these variances and/or correlations. But this can be difficult, particularly for short time period, which is typical for panel data. The practical approach is to accept the usual estimates, but to compute robust standard errors correcting for the possible
presence of heteroskedasticity and/or individual autocorrelation. The latter approach is the one adopted in the subsequent studies.

4.4.5 Dynamic Panel Data Models

The most recent development in panel data analysis is the dynamic panel data models. The dynamic relationships are characterised by the presence of a lagged dependent variable among the regressors, i.e.

\[ y_{it}=\alpha + \delta y_{i,t-1} + X'_{it}\beta + u_{it} \quad i=1, \ldots, N; \ t=1, \ldots, T \] (4.10)

Where \( \delta \) is a scalar while the others are the same as those defined in (4.1) and \( u_{it} \) follows one way error component model as defined in (4.2), i.e.

\[ u_{it}=\mu_{i} + \upsilon_{it} \] (4.2)

The dynamic panel data regression described in (4.10) is characterised by two sources of persistence over time: autocorrelation due to the presence of a lagged dependent variable among the regressors and individual effects characterising the heterogeneity among the individuals. Since \( y_{it} \) is a function of \( u_{it} \) it immediately follows that \( y_{i,t-1} \) is also a function of \( u_{it} \). Therefore, \( y_{i,t-1} \), a right-hand regressor in (4.10), is correlated with the error term. This renders the OLS and FE estimators biased and inconsistent even if the \( \upsilon_{it} \) are not serially correlated; and the random effects GLS estimator is also biased (Baltagi, 2005).
To remedy these problems, Arellano and Bond (1991) proposed a generalised method of moments (GMM) procedure. They argued that additional instruments can be obtained in a dynamic panel data model if one utilises the orthogonality conditions that exist between lagged values of \( y_{it} \) and the disturbances \( V_{it} \). For example, using \( y_i, t-2 \) as an instrument for \( \Delta y_i, t-1 \) (\( \Delta y_i, t-1 = y_i, t-1 - y_i, t-2 \)). Better estimates can be obtained by using more instruments (\( y_i, t-3 \), \( y_i, t-4 \), etc.). Although the GMM estimator requires no knowledge concerning the initial conditions or the distributions of \( \mu_i \) and \( \nu_{it} \), it is difficult to determine that how many lagged values of the dependent variable should be used. This is particularly a serious issue if the sample is small. In this Research, there are only 189 and 132 observations for Airport Study and Tourism Employment Study, respectively. Using GMM estimator means a dramatic reduction of the number of observations. This will make it difficult to generate reliable estimations. Given the small datasets, it is considered infeasible to apply Arrellano and Bond modelling to this Research.

4.5 Empirical Studies

Following the adoption of the panel data analysis, methodological issues related with the empirical research are discussed in this Section. In the first Sub-section, airport financial performance is measured from the perspectives of aeronautical revenue, non-aeronautical revenue, operating cost and operating profit. Research design for Tourism Employment Study is presented subsequently. On these grounds, model specification is discussed.

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17 As a matter of fact, GMM estimator was tried. After reducing a few years observations, the sample size became even smaller. As a result of a small number of observations, the majority variables became insignificant and had wrong signs. Hence, it shows inappropriateness of applying GMM estimator to this research.
4.5.1 Airport Study

Profitability is the commonly used indicator for financial performance measurement. However, profitability is difficult to be measured directly as it is a function of revenue and cost, therefore, affected by various factors. The purpose of the Airport Study is to measure the impact of LCCs on airports financial performance. This is done through two complementary approaches. One is to measure the impact of LCCs on airports revenue and cost. The other is to measure operating profit. Results from the two approaches are then compared to see whether consistent estimates can be obtained.

Airports revenue can be further divided into aeronautical and non-aeronautical revenues. Both are affected by different sources. Therefore, four models, namely, aeronautical revenue, non-aeronautical revenue, operating cost and operating profit models, are developed and each is discussed in turn in this Sub-section.

4.5.1.1 Aeronautical Revenue Model

The empirical model to measure the impact of LCCs on airports aeronautical revenue is specified below:

\[
\ln AR_{it} = \alpha + \beta_1 \ln Lccppf_{it} + \beta_2 \ln Chapppf_{it} + \beta_3 \ln Fsppf_{it} + \beta_4 \ln Fre_{it} + \beta_5 \text{Locadv}_i + \beta_6 \text{Group}_i + \beta_7 \text{Size}_i + u_{it} \quad (\text{Model 1})
\]

Where the subscript \(i\) denotes the \(i\)th airport \((i = 1, \ldots, 21)\), and the subscript \(t\) denotes the \(t\)th year \((t=1, \ldots, 9)\). \(u_{it}\) is the disturbance term, which is
assumed to follow a one-way (i.e. $u_{it} = \mu_i + v_{it}$) or two-way ($u_{it} = \mu_i + \lambda_t + v_{it}$) error component model. The variables are defined as follows:

- **AR** denotes the real aeronautical revenue (£000) at airport $i$ in year $t$.
- **Lccppf** is average number of LCC passenger per flight (total LCC passengers divided by total LCC flights) at airport $i$ in year $t$.
- **Chappf** is average number of charter passenger per flight (total charter passengers divided by total charter flights) at airport $i$ in year $t$.
- **Fsppf** is average number of full service carrier passengers per flight (total full service carrier passengers divided by total full service carrier flights) at airport $i$ in year $t$.
- **Fre** is total tonnage of freight (air cargo and mail) carried by all carriers at airport $i$ in year $t$.
- **Locadv** is a dummy variable which is unity if the airport $i$ is located in London (i.e. Gatwick, Stansted and Luton airports).
- **Group** is dummy variables which is unity if the airport $i$ belongs to the BAA (i.e. Gatwick, Stansted, Edinburgh, Glasgow, Aberdeen and Southampton airports).
- **Size** is dummy variable which is unity if the airport $i$ belongs to the big airport group (i.e. Belfast, Birmingham, Bristol, Edinburgh, Glasgow, Gatwick, Luton, Stansted, Manchester and Newcastle airports).

It is assumed that there is no time lag between the air service and its transformation into airports aeronautical revenue. Therefore, no time period adjustment is made.
Various functional forms were tried but the form of double logarithm fitted the model best. More importantly, the use of double logarithm functional form has robust theoretical justification. The functional form implies that the marginal effects of each explanatory variable on airports revenue and cost are not constant, but depend on the value of the variable, as well as on the values of all other variables in the function. This assumption is appropriate to measure the relationship between airports aeronautical revenue and the airline traffic. At one extreme of the spectrum, for an empty airport the increase of airline traffic could have significant contribution on airports aeronautical revenue. When the airport's capacity approaches to saturation, the increase of additional airline traffic is unlikely to yield the same significant return. This might be due to operational complexity or extra investments or facilities needed to be put in place to cope with the increased traffic. In other words, the relationship between airports aeronautical revenue and airline traffic is non-linear. The use of double logarithm functional form, which implies the changing marginal relationship, is perhaps more realistic than the constant relationship assumed in the linear model. This is also consistent with established theories concerning such things as product life cycles (Button and Taylor, 2000).

Moreover, the estimated coefficients in the double logarithm form are estimates of elasticities. The elasticity property is useful in that it is easy to understand from a managerial point of view and it allows policymakers to assess the percentage impact on dependent variable resulting from a 1%
change in one of the independent variables, while holding all other explanatory variables constant (Song and Witt, 2000).

Aeronautical revenue is those sources of income that arise directly from the operation of aircraft and the processing of passengers and freight (Graham, 2001). It is obtained from landing fees, passenger fees, aircraft parking fees, gate fees and passenger handling charges (if handling is provided by the airport operator) and other aeronautical fees (air traffic control, lighting, airbridges etc).

As the majority of airports in the UK have been commercialised and privatised, there are no uniformed charges across all UK airports (Gander, 2004). But the UK CAA regulates the maximum amount which the largest four UK airports (Heathrow, Gatwick, Manchester and Stansted) can receive from airport charges to prevent them abusing their dominant position. For the other airports, they are allowed to set their own charges in consultation with their airline users. Most UK airports publish charges which are payable by users but they also have commercial arrangements which are negotiated with individual airlines. These special arrangements are usually not communicated with other airlines (Gander, 2004).

Despite the complexity of airport charges, overall, landing and passenger fees are by far the most important aeronautical revenue sources. Landing charges to airlines vary in different airports. In the UK, most airports have a weight

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18. The CAA’s regulation is on a revenue yield basis, that is it limits the maximum revenue per passenger which the airports can receive from airport charges.
related landing charge based on maximum take-off weight or maximum authorised weight. The BAA airports also adopt movement-related charge, which means charging fixed landing fees for all aircraft. But this policy only applies to peak early morning and evening flights in the summer. Compared with landing fees, passenger fees are much simpler. They are most commonly levied on a per departing passenger basis. At most airports, there tends to be a lower charge for domestic passengers than international passengers to reflect the lower costs associated with domestic passengers (Graham, 2001).

In summary, aeronautical charges are mainly tied directly to aircraft size, passenger number and to some extent, freight. As it is difficult to obtain aircraft size data, air transport movements, i.e. number of flights, are used as a proxy for aircraft size. This is also the method adopted by Gillen and Hinsch (2001) and Papatheodorou and Lei (2006).

In the UK airports, flights can be roughly classified into three categories, namely, LCC flights, charter carrier flights and full service carrier flights. Correspondently, passengers can also be divided into three groups, namely, LCC passengers, charter carrier passengers and full service carrier passengers.

Each type of flight and passenger has a different impact on airlines aeronautical revenue. LCCs are always alleged to pay much less than the standard charge. Under some circumstances, regional airports even provide
subsidies to LCCs. For example, Presswork Airport is said to charge Ryanair nothing for using its airport and even provides free baggage handling service for Ryanair passengers (Bush, 2005). However, the hard evidence regarding this issue is rare as it is considered sensitive and confidential. Although LCCs are difficult to obtain substantial concessions on aeronautical charges in big airports, they try to pay the least possible aeronautical charges by not using air bridge or parking their aircraft at the remotest gate. Therefore, it is very likely that on average, LCCs contribution on airports aeronautical revenue should be much less than full service or charter carriers, holding other things constant.

Although recently, charter carriers are following the strategy used by LCCs to press regional airports to charge less for the use of airports, in most UK airports, in the sample period (1994/5 – 2003/4) charter carriers are believed paying the same rate of aeronautical revenue as full service carriers. However, at regional airports, compared with full service carriers, charter airlines tend to use bigger aircraft and fly longer distance (usually over 2,000 km). Moreover, their load factors (typically, over 90%) are usually much higher than that of full service carriers. As for full service carriers, regional airports are usually at the spoke points of network carriers hub-and-spoke system and served by regional airlines. Regional airlines tend to use small aircraft and mainly fly within the EU. It appears there should be marked contrast between charter and full service carriers in terms of impact on airports' aeronautical revenue.
On these grounds, each group of airlines and passengers is likely to have
different impact on airport's aeronautical revenue. However, from Table 4.1
below, we can see that passenger variables are highly correlated with flight
variables. This is not surprising as the increase in passengers usually leads
to the increase in the number of flights. To avoid the problem of
multicollinearity, Papatheodorou and Lei (2006) dropped passenger variables
from the model. However, in so doing, the estimated results might have an
upward bias. Therefore, instead of taking that approach, the number of
passengers per flight is used to capture the effect of passenger and flight
variables.

Table 4.1 Correlation matrix: passenger and flight variables

<table>
<thead>
<tr>
<th></th>
<th>Lccp</th>
<th>Chap</th>
<th>Fsp</th>
<th>Lccf</th>
<th>Chaf</th>
<th>Fsppf</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lccp</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chap</td>
<td>0.03</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fsp</td>
<td>0.05</td>
<td>0.92</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lccf</td>
<td>0.99</td>
<td>0.04</td>
<td>0.06</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chaf</td>
<td>-0.01</td>
<td>0.86</td>
<td>0.8</td>
<td>-0.01</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Fsppf</td>
<td>0.03</td>
<td>0.9</td>
<td>0.96</td>
<td>0.04</td>
<td>0.81</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 4.2 below presents the correlation matrix of the variables entered in
logs in the estimation for the AR model. All the key variables have low
correlation with others. This justifies the approach of using average
passengers per flight for LCCs, charter and full service carriers. Although
variable, Infre, is correlated with Inchappf and Infspf at over 0.6, it is not
considered very high and thus retained in the model. It is expected that
Lccppf, Chappf, Fsppf and Fre have positive impact on airports aeronautical
revenue and the magnitude of Lccppf is less than that of Chappf or Fsppf.
Apart from the above discussed four variables, three dummies variables, namely, whether an airport has locational advantage, whether it belongs to the BAA group, and the size of an airport, are considered to have effects on airports aeronautical revenue. Gillen and Lall (2004) argued that airports with locational advantages have more ability to raise aeronautical revenue over airlines. Three London airports in the sample, namely, Gatwick, Stansted and Luton airports, are considered as possessing locational advantages. Greater London area covers a significant population and is an important business and tourism destination. GDP per head in this region is the highest in the UK and so is propensity to fly. Therefore, these three airports possess much stronger bargaining power than other regional airports to counteract LCCs demand for low airport charges. However, on the other hand, both Gatwick and Stansted airports are subject to price cap which limits their ability to raise aeronautical revenues. Moreover, during most of the sample period, Luton Airport offered easyJet very low landing charges (e.g. £1.57) per departing passenger when compared with the standard rate (around £7). The combination of these effects makes it difficult to have a prior judgement of its sign.

The BAA airports control the majority of the UK traffic. Being part of the BAA group might provide airports better bargaining power in negotiating
aeronautical charges with airlines. Therefore, it is expected that the dummy variable, \textit{Group}, has positive sign.

The size of an airport has important implications for airports aeronautical revenue. Following Papathedorou and Lei (2006) three million passenger a year in most of the observing years is used as the cutting benchmark and airports in the sample are divided into two groups. Ten airports are included in the large airport group, namely Belfast, Birmingham, Bristol, Edinburgh, Glasgow, London Gatwick, London Luton, London Stansted, Manchester and Newcastle (in alphabetic order). The remaining eleven are classified as small-size airports, namely, Aberdeen, Blackpool, Bournemouth, Cardiff, East Midlands, Exeter, Humberside, Leeds & Bradford, Liverpool, Southampton and Teesside (in alphabetic order). The discussions in Section 3.2 show that small airports have much stronger motivation to grow in order to reach the critical mass of traffic. Hence, they have a tendency to provide airlines, particularly LCCs, lower aeronautical revenue. Therefore, it is expected the variable, \textit{Size}, has a positive sign.

4.5.1.2 Non-aeronautical Revenue Model

The empirical model for measuring the impact of LCCs on airports non-aeronautical revenue is specified below:

\[
\ln NAR_{it} = \alpha + \beta_1 \ln Lccp_{it} + \beta_2 Propchap_{it} + \beta_3 \ln Otherp_{it} + \beta_5 Locadv_{it} + \beta_6 Group_{it} + \beta_7 Size_{it} + u_{it} \quad \text{(Model 2)}
\]
Where the dummy variables *Locadv*, *Group* and *Size*, the subscripts *i* and *t* as well as disturbance term *uₜ* are defined the same as Model 1 above. The remaining variables are defined as follows:

- **NAR** denotes the real non-aeronautical revenue (£000) at airport *i* in year *t*.
- **Lccp** is the total number of terminal passengers carried by LCCs at airport *i* and year *t*.
- **Otherp** is the combined total number of terminal passengers carried by charter and full service carriers at airport *i* and year *t*.
- **Propchap** is the proportion of charter carrier passengers in **Otherp** at airport *i* and year *t*.

Double logarithm is also used as functional form for this model based on the same reason as that in the Aeronautical Revenue Model. No time lag between the air service and its transformation into airports non-aeronautical revenue is assumed as well.

Non-aeronautical revenue is those generated by activities that are not directly related to the operation of aircraft, notably income from commercial activities within the terminal and rents for terminal space and airport land (Doganis et al., 1995). This includes revenue from concessions (food, clothing, other shopping items), car park and rental space to airlines, car rental agencies and other concessionaires. Although meeters, greeters, and airport personnel can also affect the magnitude of non-aeronautical revenues, the primary drive is passengers as the number of meters, greeters and airport personnel increase.
as passenger number goes up. Thus, LCC, charter and full service carrier passengers are expected to have positive impact on airports non-aeronautical revenue. However, as we can see from Table 4.1 in the last Sub-section, \( Lccp \) and \( Chap \) are highly correlated in the sample, the inclusion of the both variable in the same model will cause the problem of multicollinearity. To avoid this problem, the variable, \( Otherp \), is created to represent the combined number of passengers carried by both charter and full service carriers.

However, it can be argued that charter carrier passengers might have different spending patterns from full service carrier passengers at the airport. For example, charter carrier passengers are usually on holiday and have a greater tendency to purchase commodity or service than full service passengers. To capture this effect, another variable, \( Propchap \), is introduced into the model. And \( Propchap \) is expected to have a positive sign as it is reasonable to assume that the increase of the percentage of charter carrier passengers will have a positive impact on airports non-aeronautical revenue. It is expected that both \( Lccp \) and \( Otherp \) have positive impact on airports non-aeronautical revenue.

The three dummy variables, \( Locadv \), \( Group \) and \( Size \) are all expected to have positive sign. In terms of \( Locadv \), as the population in Greater London has the highest per capital of income in the UK, their purchasing power is expected to be higher than other areas. As a leading airport group, the BAA has tradition of exploiting potential from commercial revenue. Being a member of the BAA group, an airport can benefit from its expertise in commercial revenue.
generation. Thus, it is expected that there is a positive sign associated with Group. Discussion in Sub-section 3.3.3 shows that there exist economies of scale in the airport sector. With more diverse retail outlets, big airports should be in a much better position than small airports to reap the non-aeronautical revenue from the increased passenger throughput. Therefore, Size is expected to be positive.

4.5.1.3 Operating Cost Model

After specifying both Aeronautical and Non-aeronautical Revenue models, model 3 below presents the Operating Cost Model:

\[
\ln OPCOST_{it} = \alpha + \beta_1 \ln Lccp_{it} + \beta_2 \ln Propchap_{it} + \beta_3 \ln Otherp_{it} + \beta_4 \ln Wage_{it} + \\
\beta_5 \ln Locadv_{it} + \beta_6 \ln Group_{it} + \beta_7 \ln Size_{it} + u_{it} \\
\text{(Model 3)}
\]

Where all the variables and the subscripts \( i \) and \( t \) as well as disturbance term \( u_{it} \) are defined the same as those in the models above except \( OPCOST \) and \( Wage \). The two variables are defined as follows:

- \( OPCOST \) denotes real operating cost (£000) after deducting depreciation at airport \( i \) in year \( t \).
- \( Wage \) is real wage and social costs (£000) paid to airport employees at airport \( i \) in year \( t \).

Again, double logarithm function form is adopted for the operating cost model and no time lag is assumed. It needs to be pointed out that depreciation is
deducted from the operating cost as different airports have very different accounting practice for depreciation. For example, the depreciation period for runways and aprons in the BAA airports is up to 100 years, while it is 75 years for Manchester Airport Group and 15-30 years for Luton Airport (CRI, 2005). Therefore, to avoid the complexity and make airports operating cost more comparable, depreciation is deducted from the operating cost.

It is expected that $Lccp$ and $Otherp$ have positive impact on airports operating cost as increase in passengers naturally leads to increase in the associated handling cost. In terms of $Propchap$, in Doganis et al. (1995) study, a positive relationship with airports operating cost is reported. Wages are certainly positively related with the operating cost. It is proved positive and significant in Doganis et al. (1995) study. The same three dummy variables are also included in the cost model. The cost in Greater London is much higher than elsewhere in the country. Therefore, it is reasonable to expect that $Locadv$ to have a positive sign. Being a member of the BAA might strengthen an airport's bargaining power against suppliers and third party contractors, thus reducing the cost. It is, therefore, expected that the sign of $Group$ is negative. In terms of size, it is usually the case that an airport's operating cost is positively related with its size.

4.5.1.4 Operating Profit Model

The empirical model to measure the impact of LCCs on airports operating profit is specified below:
The subscripts $i$ and $t$ as well as disturbance term $u_{it}$ are defined the same as the models above. All the variables definition is the same as Model 2 except $OPPROF$, which denotes real operating profit (£000).

Again, no time lag is assumed. However, instead of using double-log functional form, which is employed by the first three models, a linear functional form is used here. This is because a number of observations in the Dependent Variable are negative (i.e. operating losses) which prevent logarithm transformation.

Based on the same argument as that in the Operating Cost Model, depreciation is not taken into account in the operating profit to avoid confusions. Overall, the Operating Profit Model can be regarded as a combination model of the above three. However, profit is a much more complicated issue and affected by various factors. As already mentioned profit is a function of revenue and cost, both of which are affected by different variables, it is debatable whether this model is 'correctly' specified. Therefore, it is better to view this model as a kind of indicator rather than a rigorous measurement.

It is difficult to have prior judgement about the sign of $Lccp$. On the one hand, LCCs make some airports such as Stansted, financially successful. On the
other hand, it is reported that sometimes, LCCs have a detrimental effect on an airport's short-term profit (Francis et al., 2003).

The variable *Otherp* is expected to have positive impact on airports operating profit. The effects of *Propchap, Locadv, Group* and *Size* are unclear as there are few empirical studies in this area. But they are included in the model as control variables because it seems that these variables have certain impact on airports profit.

4.5.1.5 Summary

This Sub-section presents four models used to measure the impact of LCCs on airports financial performance. It is recognised that profitability is difficult to be measured directly. Therefore, apart from using operating profit as a dependent variable, profitability is also measured from the perspectives of aeronautical revenue, non-aeronautical revenue and operating cost.

The key interest variable in the four models is the LCC variable (*Lccppf* in the Aeronautical Revenue Model, while *Lccp* in the other three models). Other carrier variables are used for comparison purposes, while the three dummy variables, namely, *Locadv, Group* and *Size* are introduced as control variables. Other variables considered but not included are domestic, EU and international (i.e. non-EU) passenger variables. Graham (2001) argued these three variables should have substantial different effects on airports profitability. However, as regional airports are the focus of this study, different impacts by
the three types of passengers can be largely captured by Lccp, Otherp and Propchap (in the case of the Aeronautical Revenue Model, it is Lccppf, Chappf and Fsppt). This is because LCC passengers usually fly on domestic or EU routes, while charter passengers tend to travel to EU or international destinations. As for full service carriers, their passengers could cover all the three types, but the majority of them should be domestic or EU passengers. Therefore, it is very likely the inclusion of domestic, EU and international passenger variables could distort the key interest variable and the variable used for comparison.

Moreover, it is expected the shares of domestic, EU and international passenger in regional airports are relatively stable. For example, domestic passengers might persistently dominate one airport while the number of international passengers might be persistently large at another airport. If this assumption holds, which is very likely, even the three types of passengers have certain impact on airports financial performance, these effects can be captured by the use of panel data. Therefore, based on the above consideration, it is decided not to include them into the model.

4.5.2 Tourism Employment Study

This Sub-section justifies the choice of tourism employment as an indicator for regional tourism development. Then difficulties in defining tourism employment and the strategy used in this research are discussed. On these grounds, model specification is presented.
4.5.2.1 Choice of Indicator for Regional Tourism Development

The literature on economic impact of tourism is abundant. Indicators used to measure economic impact usually include visits, visit nights and expenditure. These indicators can be further divided into domestic, inbound and outbound. Inbound tourists are particularly of interest to policy makers as they can bring foreign exchange earnings to the national economy, therefore, most of the tourism economic impact studies focus on inbound tourism (e.g. Archer and Fletcher, 1996). In contrast, outbound travel is usually not encouraged, even suppressed in some developing countries, by national governments as it represents economic leakage out of the nation.

In terms of LCCs, they stimulate not only inbound, but also outbound and domestic tourists. Economically, inbound tourism might be preferred to domestic and outbound tourism. However, in terms of regional tourism development, the three types of visitors all have positive impact. For example, outbound travel might benefit tourism sectors such as tour operator/travel agencies. Therefore, we cannot argue that outbound tourism makes no contribution to regional tourism development. If using inbound, outbound and domestic visitors as indicators for regional tourism development, even the significant relationship between each of them and LCCs was found, it would still be difficult to draw an overall conclusion whether LCCs are beneficial to regional tourism development or not.

The discussion in the previous Chapter shows that the best indicator used to measure regional economic development is employment. In the case of
tourism development, it is considered that tourism employment is superior measurement to visits, visit nights and expenditure. Instead of focusing on the number of inbound, outbound or domestic visitors generated by LCCs, the research can concentrate on tourism employment generation of LCCs. If LCCs can contribute to the growth of tourism jobs, we can then conclude LCCs are beneficial to tourism development.

Another advantage of using tourism employment as an indicator is that sectoral analysis can also be taken into account by studying the impact of LCCs on different tourism sectors. This measurement is more robust than focusing on a certain tourism sectors such as hotels or visitor attraction. Therefore, it is able to provide a more complete picture about tourism development. Finally, employment data is readily available over years at the UK regional level.

4.5.2.2 Defining Tourism Employment

After deciding to use tourism employment as an indicator for regional tourism development, a major difficulty arises. There is a lack of a universally accepted definition for tourism employment. Firstly, there has not been a commonly accepted definition for tourism either from the supply or demand side. This makes defining tourism employment difficult (Riley et al., 2002). Secondly, most tourist facilities are shared between the tourists and the locals (Riley et al., 2002). Thirdly, multiple occupations and a large proportion of part-time employment in tourism easily lead to misleading employment data.
Finally, there is also the problem of the prevalence of the informal economy in the tourism sector.

Therefore, the difficulties discussed above pose serious problems in defining tourism employment. To overcome this problem, it has become the common practice for researchers to use the hotel and restaurant sector as a proxy for tourism industries as it provides consistent and coherent statistics. However tourism is much broader than the hotel and restaurant sector. It is clear that using the latter as a proxy for tourism employment in the analysis would cause serious bias.

Over the past two decades, the Tourism Satellite Account (TSA) has emerged as the recommended way of measuring tourism's economic significance for nations. The construction of a Satellite Account is crucially dependent upon the System of National Accounts, which contributes to the TSA conceptual framework and much of the data underpinning the TSA (Bryan et al., 2006). Theoretically, a TSA can account for impacts across all industries, not just those traditionally thought to be tourist-related. The methodology has the approval of the UNWTO, OECD and EUROSTAT. It was developed initially in Canada in the 1980s and many countries are now moving towards the construction of a full TSA account (Bryan et al., 2006).

The TSA consists of ten tables, with Table 7 explicitly related to “tourism employment”. However, the structure for Table 7 has not yet been fully agreed because of several reasons (UKDCMS, 2004; Bryan et al., 2006).
First, employment is not reported in most Systems of National Accounts and thus this essential link (in most cases) is broken in the estimation of employment and labour in tourism industries. Second, there are difficulties with the nature of tourism-related employment itself as it is far more likely to be seasonal and/or part-time than for other types of employment.

In the UK progress toward the development of a TSA has been slow (UKDCMS, 2004). An experimental TSA, entitled UK TSA – First Steps Project, was only completed in September 2004 (UKDCMS, 2004). Due to data limitation, it is acknowledged in the report: "All the tables and results are indicative and illustrative only" (UKDCMS, 2004: 55). In this project, Table 7 (employment and labour use) is also compiled. However, it is considered that these results are inappropriate to be used for this Study. First, accuracy and reliability of the results cannot be assessed. Second, the UK TSA First Steps Project is only based on the data from the year of 2000, which do not provide enough insights into the changes of tourism employment over the past few years. Finally, the results are at the UK level, while the focus of this Study is at the regional level.

From the supply side, the UNWTO adopted pragmatic criteria by using the concept - tourism specific products - which include tourism characteristic and

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19 Indeed, a widely recognised drawback of the TSA as a policy tool is there is long delay between the reference year and the actual production of the TSA (UKDCMS, 2004). This is because full TSAs are relatively expensive to construct and require a high level of involvement by stakeholders to maintain accuracy over time, hence, they are unlikely to be fully updated every year, but rather be on a rolling basis as resources and data allow. This means that the TSA will never completely reflect the 'current' context, which causes significant problems for policymakers and the industry, who require timely information to aid decision making (UKDCMS, 2004).
tourism connected products, to identify tourism-related industries. Tourism characteristic products are defined as "those products, which, in most countries, it is considered, would cease to exist in meaningful quantity or those for which the level of consumption would be significantly reduced in the absence of visitors, and for which statistical information seems possible to obtain (UNWTO, 2005d:1)." Seven categories are classified as tourism characteristic product. The key broad sectors are as follows:

(1) Accommodation services
(2) Food and beverage-serving services
(3) Passenger transport services
(4) Travel agency, tour operator and tourist guide services
(5) Cultural services
(6) Recreation and other entertainment services
(7) Miscellaneous tourism services

Tourism connected products are "a residual category including those products that have been identified as tourism specific in a given country, but for which this attribute has not been acknowledged on a world wide basis (UNWTO, 2005c:1)." A notable feature is that in the total 74 six-digit codes sectors, 44 of them belong to the retail trade, ranging from non-specialised stores to specialised stores. However, it is argued that although retail trade is important in terms of tourists' expenditure, they should not be classed as tourism-related industries due to their extremely large size and mainly consumed by local residents (UKDCMS, 2004).
As the aim of the UNWTO's classification of tourism specific products is for universal use, it is advised that individual states should adjust accordingly based on their own circumstances (UNWTO, 2005d). In the UK, tourism-related industries are defined by the Office of National Statistics (ONS) as comprising of the following eight categories:

- hotels (551)
- camping site etc (552)
- restaurants (553)
- bars (554)
- activities of travel agencies etc (633)
- library archives, museums etc (925)
- sport activities (926)
- Other recreational activities (927)

All these sectors are consistent with those identified by the UNWTO as tourism characteristic products. A major difference is that the ONS's definition does not include passenger transport services. It is a debatable issue whether passenger transport should be included in the tourism-related industries. Compared with other means of transportation, air transport has high tourism ratio. Employment in the air transport sector usually includes jobs in airports, airlines, air traffic control, etc. with airports being the largest employer. However, there is no separate category for airport jobs in the UK Standard Industrial Classification (SIC). To make things more complicated, outsourcing has been pervasive in the airport sector. Therefore, airport jobs
are likely to be classified into the following 4-digit SIC: cargo handling (63.11), other supporting air transport activities (62.23) or activities of other transport agencies (63.40). There is no possibility to disentangle airport jobs from other types of employment.

Given the above considerations, it is decided to follow the ONS' definition on tourism-related industries and not to take either transportation or air transport into account. There are also some other reasons to use the official definition. First, it is widely used by government agencies in the UK. Second, employment data for tourism-related industries are readily available and reliable at the regional level. Finally, the data are well-tested and used extensively by researchers in studying tourism employment (e.g. Thomas and Townsend, 2001).

However, a distinction between tourism-related employment and employment in tourism-related sectors need to be made clear here. Not all employees in tourism-related industries rely upon tourism for employment. For example, a portion of accommodation services are purchased by local residents (e.g. for wedding functions). If we need to measure tourism-related employment, this portion should properly be discounted from employment totals. In practice, this discounting is extremely difficult. As rightly pointed out by UKDCMS (2004), the economic consequences of the activity of visitors to a particularly region has never been easy to measure. A visitor will demand products obviously associated with 'tourism' including accommodation and travel services and also will demand other services, whether purchased directly or
not. For example, a newspaper bought by a visitor is part of tourism 'impact'. For pragmatic purpose, this study focuses on employment in tourism-related industries rather than tourism-related employment.

In the UK, the employment data are collected by the Annual Business Inquiry (ABI). The ABI is an annual sample survey undertaken by the ONS. The sample size is over 70,000 enterprises and the sampling frame is the Inter Departmental Business Register, which includes all UK businesses registered for VAT and/or which operate a PAYE scheme. The ABI is introduced in 1998 and brings a new set of procedures for generating estimates of employee jobs by industry and geography. The ABI estimates employee jobs down to ward and postcode sector level, by detailed industry and by full-/part-time. In addition, the ABI estimation procedures make it possible, for the first time, to produce estimates of the precision of the data (for details, see Partington, 2001).

Another major source for employment data in the UK is the Labour Force Survey (LFS) conducted by the ONS. However, the local area LFS does not have a detailed breakdown of industrial sectors. Only nine broad categories are included, namely, agriculture and fishing; energy and water; manufacturing; construction; distribution, hotels and restaurants; transport and communications; banking, finance and insurance; public admin., education and health; and other services. It can be seen that these categories are so broad that it is inappropriate to be used for the analysis of tourism-related
industries. Therefore, data for employment in tourism-related sectors are based on the ABI dataset and details are discussed in Section 4.6.

4.5.2.3 Model Specification

The empirical model to measure the impact of LCCs on employment in tourism-related industries is specified below:

\[
\ln \text{TEM}_{it} = \alpha + \beta_1 \ln Lccp_{it} + \beta_2 \ln \text{Otherp}_{it} + \beta_3 \ln \text{Pop}_{it} + \beta_4 \text{Colggrad}_{it} + u_{it}
\]

Where the subscript \( i \) denotes the \( i \)th region \((i = 1, \ldots, 22)\), and the subscript \( t \) denotes the \( t \)th year \((t = 1, \ldots, 6)\). \( u_{it} \) is the disturbance term, which is assumed to follow a one-way (i.e. \( u_{it} = \mu_t + v_{it} \)) or two-way \( (u_{it} = \mu_t + \lambda_t + v_{it}) \) error component model. The variables are defined as follows:

- **TEM** denotes employment in tourism-related sectors in region \( i \) in year \( t \).
- **Lccp** is the total number of terminal passengers carried by LCCs at airport \( i \) in year \( t \).
- **Otherp** is the combined total number of terminal passengers carried by charter and full service carriers at airport \( i \) in year \( t \).
- **Pop** is the local population in region \( i \) in year \( t \).
- **Colggrad** is the percentage of population who are of working age with a college degree in region \( i \) in year \( t \).
Anecdotal evidence suggests that LCCs could generate employment within a relative short period, while it might take some time for the traffic generated by major airlines to translate into employment opportunities. In a study of airline traffic and urban economic development, Brueckner (2003) assumed that there is no time lag between the provision of the air service and its integration into the economic parameters of a region. To simplify the issues examined, this assumption is also adopted by the author.

Double logarithm functional form is used for this model as it appears there is non-linear relationship between tourism employment and airline traffic. When air links just establish in a local area, a relatively small number of airline traffic would seem to have a very large impact on local employment in tourism-related sectors. This may be partly directly related to the air services offered but may also reflect a psychological view that the area now has air links which improve the level of accessibility and open the door to attracting international tourists. However, when extensive air services are established, additional airline traffic would seem unlikely to have the same significant impact on local tourism employment as it had previously. Therefore, the changing marginal relationship seems more appropriate than the constant relationship assumed in the linear model. It is probably because of these reasons that double logarithm functional form has been extensively used by researchers in measuring the impact of air traffic on employment (Button, et al, 1999; Brueckner, 2003). Moreover, in the estimation process, a number of alternative specifications were tried and double logarithm functional form had the best fit.
It is expected that growth of LCCs will lead to lower fares and more inbound tourists, which will increase expenditure in the region around the airport and this will lead to additional employment in the tourism-related sectors. Thus, the effect of LCCs is through visitor number and expenditure and the impact will depend on the size and attractions of the region. On the other hand, lower fares and more air services mean more outbound travel. The effects on tourism employment depend on whether outbound tourism is a complement or substitute for tourism services in the region. In the case of complement, people from the region use travel and accommodation services linked to their outbound trips. In the case of substitute, people from the region switch from within region trips to outbound trips; the effect on tourism employment in the region could be negative.

Which effect is stronger is also affected by the geographical scale of the region. If the region is large the effect is more likely to be complementary, as people need to travel longer distance to airports and tourism-related services are more likely to be consumed. Thus the inbound effect on tourism employment will be positive, and the outbound effect on tourism employment could be positive or negative.

*Otherp* is the combination of the full service and charter carrier passengers. The reason why not to use them separately is because the both variables are highly correlated (0.9). Thus, both cannot enter into the model simultaneously and use either of them would cause bias. In the dataset, excluding LCCs,
charter carriers had dominant presence at 15 out of 22 airports. For example, at East Midlands, Blackpool, Bournemouth, Cardiff, Exeter and Prestwick airports, charter carriers controlled over 80% of the combination of charter and full service traffic. In the UK, charter carriers usually serve outbound inclusive tour market and are owned by vertically integrated tour operators (UK CAA, 2006). Therefore, it is likely that their impact on tourism employment is mainly reflected in the travel intermediaries sector.

A breakdown of inbound and outbound passengers would be ideal for this study. However, the data, collected and provided by the UK CAA, have no breakdown of the inbound and outbound passengers. Although some survey data for passenger types are available, the sample is rather small, only including London airports and a few regional airports. While every regional airport is different, the results from survey cannot be applied to other regional airports. However, this study is not intended to measure the separate impact of inbound and outbound passengers, but the aggregate impact of air passengers on tourism employment. Hence, this limitation is not considered a serious issue.

Local population is another important variable in determining employment in tourism-related industries as previously discussed that many tourist facilities are shared between tourists and locals. Moreover, the size of the population determines labour supply (Borjas, 2005). The variable population has consistently been found having positively significant impact on employment in
a number of studies (e.g. Button, et al., 1999; Button and Taylor, 2000; Buckner, 2003). It is expected that Pop has positive impact on employment in tourism-related sectors.

According to labour economics literature, there is strong positive correlation between labour supply and educational attainment (Borjas, 2005). In the US, the labour force participation rate of persons who lack a high school diploma is only 64%, as compared to 87% for college graduates (Borjas, 2005). There are several reasons for the positive correlation (Kaufman and Hotchkiss, 2003). First, higher education is often undertaken as an investment in the sense that a person willingly suffers the large direct costs (tuition) and opportunity cost of a college education with the anticipation that these costs will be recouped in the form of higher earnings and occupational attainment after graduation. To reap this return on education, however, requires a sustained period of participation in the labour force. Second, earnings from work progressively rise with educational attainment, increasing the cost of time spent in nonmarket activities. And finally, education may increase the probability of participation as it changes an individual's tastes or attitudes with respect to the desirability of home work versus market work.

It is also plausible that education may enhance people's desire for leisure travel. Moreover, college graduates, in general, have higher disposable personal income than non college graduates. Consequently, high education may increase the propensity for leisure travel. As a result, this will generate
tourism employment. For these reasons, the sign of Colggrad is expected to be positive. College graduate is also included in Brueckner (2003) study. It is found that this variable is positive and has significant impact on service-related employment.

Another explanatory variable considered is wage. Wage is usually regarded as a determinant for employment in labour economics. However, data for industry-specific average wage is not available at regional level, therefore, this variable has to be dropped. Some social demographical variables, namely, percentage of the population in the workforce, percentage of male and female who are of working age, were tried as they might affect labour supply. But no significant relationships between them and tourism employment have been found, thus, these variables are excluded from the final model. It should be pointed out that a few other variables, such as tax rate, social security, which often appear to have significant impact on employment in labour economics literature, have not been included in the study. This is because there is no regional variation of these variables in Britain; and these region invariant effects on employment can be picked up by the use of panel data analysis.

Having discussed the explanatory variables in the model, the dependent variable, i.e. TEM, deserves more explanation. TEM is analysed at two levels, namely, aggregate and disaggregate. In the aggregate analysis, the total number of employment in the tourism-related industries is used. In the
disaggregate analysis, tourism-related industries are broken down to four sub-sectors; each sector is modelled against the same set of explanatory variable.

Part-time employees are defined by the ONS as those working 30 hours or fewer hours per week. In the ABI dataset, only total number of part-time employment is available. To convert part-time employment to full-time equivalent (FTE), the exact workings hours of those part-timers are needed. For example, if a FTE job is defined as one person working 30 hours a week over 12 months. A person working 15 hours a week over 12 months provides 0.5 FTE. Since data for working hours are unavailable, simple addition of full-time and part-time employment would lead to misleading employment data. Therefore, employment in the aggregate and disaggregate analysis is further divided into full-time and part-time. Although this approach seems a bit cumbersome, it is deemed necessary as tourism employment is characterised by high proportion of part-time workers, ignoring them could make biased estimation.

4.6 Data and Sample
The computer package used for the estimation of the various models in this Study is STATA 9.0. Two datasets, corresponding to airport and tourism employment studies, are used in this Research. Data sources and the sample for each dataset are discussed in turn.
The LCC traffic data were provided by the Economic Regulation Group of CAA. A clear definition of LCCs is difficult. LCCs, in the dataset, were defined by the UK CAA, as comprising Ryanair, easyJet, easyJet Switzerland, Bmibaby, Go, MyTravelLite, Jet2, FlyGlobespan, Flybe, Astraeus (Iceland Express), Air Berlin, Deutsche BA, Norwegian Air Shuttle, Sky Europe, Basiq Air, Hapag-Lloyd Express.

Other traffic and freight data were obtained from UK Airport Statistics series published by the UK CAA. Full service carriers' data were calculated by the author, which were the differences between scheduled airlines and LCCs. All the traffic and freight data were adjusted to financial years, i.e. from 1 April to next year's 31 March, to make them consistent with the financial data.

Airport financial data, including aeronautical revenue, non-aeronautical revenue, operating cost, depreciation, wage and operating profit, were taken from annual Airport Statistics published by the Centre for the Studies of Regulated Industries (CRI), UK. The data were provided by individual airport under the Airport Act 1986, which require that airports subject to economic regulation must disclose the income and expenditure attributable to airport charges, other operational activities and non-operational activities. All the financial data were deflated using the UK Consumer Price Index to make data in different years comparable.
A total of 28 airports are included in the CRI’s Airport Statistics\textsuperscript{20}. Among these airports, five of them (i.e. Heathrow, London Biggin Hill, London City, Norwich and Southend) had no LCCs operations during the observation period (i.e. from 1995/96 to 2003/04). Therefore, these airports were excluded from the analysis, reducing samples to 23 airports. Two airports, namely, Highlands & Islands and Prestwick, had considerable missing data in the sample period and had to be dropped. The usable sample is thus 21 airports. As panel data is used, the total observation in the dataset is 189. Compared to previously published research, this Study has the largest ever sample size for the study of airlines and airports in a single country by any standard such as the number of LCCs studied (16), the number of airports included (21), sample period (9 years) and total observation numbers (189). Moreover, it is worth pointing out that the sample period starts from 1995/96, when LCCs just emerged in Europe, and ends in 2003/04, when the latest CRI Airport Statistics was just published. Thus, it covers virtually all the activities of LCCs in the UK airports. It is considered the sample size for the airport study is very satisfactory.

In terms of the dataset for tourism employment study, the college graduate data were extracted from local area LFS. It is defined as percentage of population who are of working age with NVQ4, which includes HND, degree and higher degree level qualifications or equivalent. Employment in tourism-related sectors and local population data were extracted from the ABI

published by the ONS. Full-time employment was separated from part-time in the dataset. As the ABI is a survey of employers, self-employed are not included in the dataset.

In order to get detailed disaggregate employment data, Chancellor of Exchequer Notice\textsuperscript{21} was obtained from the ONS. All the data were collected at the county/unitary level. A major concern arises when the airports for an area are located in a suburb where the chosen county does not completely capture the local labour market. As a result, additional counties were added to the data set where deemed necessary to more accurately reflect the employment composition of the local economy. However, defining of the airport-region is still somewhat arbitrary. For example, East Sussex and West Sussex were used to capture the impact of airline traffic at Gatwick Airport on tourism employment. However, it might be argued that tourism employment in Kent or Brighton & Hove was also affected by airline traffic at Gatwick Airport. Ideally, airport’s catchment area should be used. However, such types of data are unavailable in the UK as airport catchment area itself is always changing and difficult to define. Nevertheless, the intention of this study is only to measure the impact of LCCs and other airlines on tourism employment in the airport surrounding areas. Therefore, only those regions near to the airports are counted. For details of the geographical coverage of the airport-region, please refer to Appendix 2.

\textsuperscript{21}According to Statistics of Trade Act 1947 some data at local authority level are deemed confidential as it might lead to identify individuals undertaking. Under Section 9 of the Act, these data are not allowed to be disclosed. However, section 4 (3) (f) of the Employment and Training Act 1973 allows the Secretary of State (Chancellor of the Exchequer) the discretion to disclose such information to bodies who can demonstrate a need. But these figures must NOT be passed onto a third party.
Annual data ranging from 1998 to 2003 are used for the tourism study. The reason why it does not cover the period of 1995 to 1998, as that of Airport Study, is that the ABI was only introduced in 1998. The number of airport-regions covered in this study is 22. 20 of them are the same as those in the airport study. Belfast, appeared in the Airport Study, dropped from tourism employment analysis due to unavailability of data. Two more regions were then added in Tourism Employment Study, namely, Inverness and Prestwick, to maximise the number of observations. Together the total number of observations in the Tourism Employment Study is 132 (6*22). Given the purpose of this study, this sample size is the largest possible.

4.7 Limitations

Although every care has been taken, inevitably, there are some limitations associated with this Research. In the Airport Study, the model specification of Aeronautical Revenue Model and Operating Profit Model needs to be improved. In the Aeronautical Revenue Model, it is debatable whether $Lccppf$, $Chappf$ and $Fsppf$ can satisfactorily capture the effect of passengers and aircraft on airports aeronautical revenue. As discussed, aeronautical revenue is difficult to be measured. To make it worse, in the dataset, the passenger data are highly correlated with the flight data. The study conducted by Gillen and Hinsch (2001) on German airports is the only published paper found using the two variables simultaneously in the model. But the authors did not provide any explanation about the correlation matrix of the explanatory variables. In another study of LCCs impact on airports aeronautical revenue, Papatheodorou and Lei (2006) dropped passenger variable. Although flights
variables were significant, undoubtedly, this would cause upward bias for the estimations. The use of number of passengers per flight is considered a better approach than dropping either passenger or flight variables. Although this approach seems sensible, it lacks solid theoretical justification.

There are also a few problems associated with the Operating Profit Model. Firstly, the functional form is linear which assumes the constant relationship between the explanatory variables and the dependent variable. However, it appears there is a non-linear relationship between passengers and airports operating profit. As operating profit is a function of revenue and cost. The initial increase in passenger number might significantly contribute to airports revenue. But when passenger numbers reach a certain level, its contribution will be less. In terms of cost, there are both economies of scale and diseconomies of scale in the airport industry (see Section 3.2.3 in Chapter 3 for details). Therefore, a double logarithm functional form should be more appropriate. However, as a number of observations in the operating profit are negative, logarithm transformation cannot be made. Other methods such as revenue/cost ratio were tried. But their explanatory power was very poor and the results were difficult to be interpreted. Therefore, those approaches have to be given up. Another problem related with the Operating Profit Model is that model specification is not very well theoretically justified. As previously mentioned, operating profit is complicated, involving revenue and cost. Although unobservable variables, such as managerial ability, quality of facilities, have been taken into account by using panel data approach, the specification of this model is still questionable.
In Tourism Employment Study, there are also some limitations associated with model specification. First, there are potential simultaneity problems in the model. The increased employment in tourism-related sectors stimulated by airline traffic implies increase in people's disposable income. When people become more affluent, the propensity to fly would increase and more outward air traffic would be generated. In other words, the increase in tourism employment could also stimulate more airline traffic. This simultaneity is a problem that plagues the study of air traffic and employment. It is acknowledged that this is a weakness of the Research.

Moreover, it is questionable whether the same set of explanatory variables should be used in the sectoral analysis. Although these four sectors share some similarities, it is plausible that each sector has its own explanatory variables affecting the employment. If each sector needs to be modelled accurately, ideally, a separate model should be developed. However, when the employment of those sectors put together, it would be unrealistic to have all the explanatory variables together as some variables might be appropriate for this sector, but not for others. Therefore, only those explanatory variables which appear to have impact on all the sectors are retained in the model. By using the same set of variables, the impact of LCCs on total tourism employment and employment in different sectors could be estimated consistently. But it is recognised by the author that this compromise might affect the explanatory power of some models in sectoral analysis. This can be regarded as a weakness of the Study. But, it is considered a necessary trade-off for the sake of consistency and comparison purposes.
As can be seen the above discussed limitations are all associated with model specification. As a pioneering research, model specification cannot be learnt from previous studies. To minimise the limitations, extensive review of the literature was carried out, all the possible variables which are likely to affect airports financial performance and tourism employment have been tried and the most plausible ones are included in the model.

Apart from the above discussed limitations associated with model specification, there are also some weaknesses arising from the data. First, in Tourism Employment Study, those self-employed are not included in the tourism employment data as the ABI is a survey of employers and the data disseminated from this survey includes only employees. Although the LFS contains self-employed data, these are only at the UK level, therefore, cannot be applied to a study at the regional level. Given a significant proportion of employment in the tourism sector is self-employed, without taking this into analysis is a weakness\(^{22}\). Another weakness is associated with the definition of the airport-region. Although the best possible effort has been made to define airport's surrounding areas, inevitably, the definition of the airport-region is somewhat arbitrary. Hence, the airport-regions defined might not be able to fully capture tourism employment impact of LCCs. Consequently, this measurement error might affect the study of LCCs impact on local tourism employment.

\(^{22}\) The proportion of self-employed workers in tourism-related industries in June 1999 was 8.6% (Labour market Trends, November 1999, Table B. 17) compared with 13.3% for 'All Sectors' (LFS Quarterly Supplement, No 7, 1999).
The above limitations are due to data constraint. Although they are recognised by the author and taken into account in model estimation, they could not be eliminated.

4.8 Summary

This Chapter started by re-stating the research objectives. Then, the choice of panel data analysis against case study approach was discussed. As its distinctive advantages, panel data analysis was adopted for this Research. A review of the main procedure in panel data analysis was presented afterwards. Based on this method, model specification for the two empirical studies was discussed in Section 5. It is also in this Section that using tourism employment as an indicator for regional tourism development was justified. Subsequently, data and sample for the empirical studies were presented followed by a discussion of the limitations of the research.
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5.1 Introduction
This Chapter presents the empirical findings of the study of LCCs impact on regional airports financial performance. The remainder of this Chapter is organised as follows. Section 2 is descriptive statistics for the dataset. Sections 3-6 present the findings from the four empirical models, while Section 7 summaries.

5.2 Descriptive Statistics
Table 5.1 shows descriptive statistics for the Dependent Variables. As the dataset is panel, variables can be decomposed into between \((\bar{x}_i)\) and within \((x_i - \bar{x}_i + \bar{x})\)\(^{23}\) (STATA, 2003: 226-227). The Within number refers to the deviation from each individual's average, and naturally, some of those deviations could be negative. The Overall and Within are calculated over 189 airport-years of data. The Between is calculated over 21 airports. As the panel is balanced, the number of years an airport was observed in the dataset is 9.

As can be seen from Table 5.1 below, on average, an airport's income from aeronautical revenue was more or less similar as that from non-aeronautical revenue (£26.5 million and £25.4 million, respectively). The mean operating cost was £31.2 million and mean operating profit was £20.7 million. But, it

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\(^{23}\) \(\bar{x}\) is the so called "global mean" in STATA; it is the mean for the overall data.
should be borne in mind that depreciation has not been taken into account in operating cost and operating profit.

Table 5.1 Descriptive Statistics for financial variables

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<th>Std. Dev.</th>
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<th>Max</th>
<th>Observations</th>
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<td>1.34E+08</td>
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<td>N=189</td>
</tr>
<tr>
<td></td>
<td>4.25E+07</td>
<td>2963949</td>
<td>1.68E+08</td>
<td></td>
<td>n=21</td>
</tr>
<tr>
<td></td>
<td>5.32E+06</td>
<td>1.51E+07</td>
<td>5.29E+07</td>
<td></td>
<td>T=9</td>
</tr>
<tr>
<td>OPPROF</td>
<td>2.07E+07</td>
<td>3.22E+07</td>
<td>-6586769</td>
<td>1.50E+08</td>
<td>N=189</td>
</tr>
<tr>
<td></td>
<td>3.22E+07</td>
<td>-120796</td>
<td>1.30E+08</td>
<td></td>
<td>n=21</td>
</tr>
<tr>
<td></td>
<td>6.66E+06</td>
<td>-8469878</td>
<td>4.69E+07</td>
<td></td>
<td>T=9</td>
</tr>
</tbody>
</table>

In terms of aeronautical revenue, the minimum value for the overall data was only £819,000 (i.e. Blackpool Airport in 1995/96), with marked contrast to the maximum value of £134m in the dataset (i.e. Manchester Airport in 2000/01). Average aeronautical revenue for each airport varied between £946,565 and £123m. Aeronautical revenue within an airport varied between £3.23m to £48.5m (The Within variation looks very large and it is because that in the definition of Within, the overall average of £26.5m is added back. The actual figure was, thus, £22m (i.e. £48.5m-26.5m=£22m), which is still quite large.) Data for non-aeronautical revenue, operating cost and operating profit also had very large variation as that in the aeronautical revenue data. This justifies the need to take the size of airport into account in the modelling exercise.
The reported standard deviations show that the variation in aeronautical revenue over the whole dataset was very nearly equal to that observed across airports. Similar patterns also exist in non-aeronautical revenue, operating cost and operating profit.

Table 5.2 below shows descriptive statistics for the explanatory variables. In the sample airports, the mean passengers carried by full service carriers is the highest (2,286,030), followed by passengers carried by charter airlines (1,683,323), with passengers carried by LCCs being the lowest (830,953).

The above statistics is not surprising as the first European LCC (i.e. Ryanair) only emerged in 1995. As a matter of fact, in some airports, there were no operations of LCCs in the first few observation years. A small value '1' is assigned to allow logarithm transformation. The greatest number of passengers carried by LCCs in the dataset is 17.5m recorded at Stansted Airport in 2003/04. Average LCC passengers for each airport varied between 14 and 6.67m. It is interesting that LCC passengers within an airport varied between -4.78m to 11.7m. As the calculation of the Within variation is based on \((x_{ii} - \bar{x}_i + \bar{x})\), negative figure does not mean that some airport has negative number of LCC passengers. It shows the variation that LCC passengers in an airport deviate from its mean to each individual. In terms of Chap, its variation is 483986 to 2.29m. As for Fsp, the variation is bigger, ranging from -2.12m to 6.14m. The comparison shows that passengers carried by LCCs had the most variation than charter and full service carriers during the observation periods.
Table 5.2 Descriptive statistics for explanatory variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lccp</td>
<td>830953</td>
<td>2036772</td>
<td>1</td>
<td>1.75E+07</td>
<td>N=189</td>
</tr>
<tr>
<td>between</td>
<td>1493910</td>
<td>14</td>
<td>6.67E+06</td>
<td>n=21</td>
<td></td>
</tr>
<tr>
<td>within</td>
<td>1418324</td>
<td>-477628</td>
<td>1.17E+07</td>
<td>T=9</td>
<td></td>
</tr>
<tr>
<td>Chap</td>
<td>1683323</td>
<td>2762957</td>
<td>16762</td>
<td>1.11E+07</td>
<td>N=189</td>
</tr>
<tr>
<td>between</td>
<td>2816570</td>
<td>40422</td>
<td>1.07E+07</td>
<td>n=21</td>
<td></td>
</tr>
<tr>
<td>within</td>
<td>196059</td>
<td>-2120125</td>
<td>8.17E+06</td>
<td>T=9</td>
<td></td>
</tr>
<tr>
<td>Fsp</td>
<td>2286030</td>
<td>3859344</td>
<td>725</td>
<td>6.67E+07</td>
<td>N=189</td>
</tr>
<tr>
<td>between</td>
<td>3859344</td>
<td>725</td>
<td>1.11E+07</td>
<td>n=21</td>
<td></td>
</tr>
<tr>
<td>within</td>
<td>670350</td>
<td>-2120125</td>
<td>6.14E+06</td>
<td>T=9</td>
<td></td>
</tr>
<tr>
<td>Otherp</td>
<td>3969353</td>
<td>6483263</td>
<td>66182</td>
<td>3.17E+07</td>
<td>N=189</td>
</tr>
<tr>
<td>between</td>
<td>6555351</td>
<td>85843</td>
<td>2.75E+07</td>
<td>n=21</td>
<td></td>
</tr>
<tr>
<td>within</td>
<td>793574</td>
<td>-804036</td>
<td>8.17E+06</td>
<td>T=9</td>
<td></td>
</tr>
<tr>
<td>Propchap</td>
<td>0.49</td>
<td>0.22</td>
<td>0.03</td>
<td>0.99</td>
<td>N=189</td>
</tr>
<tr>
<td>between</td>
<td>0.21</td>
<td>0.06</td>
<td>0.92</td>
<td>N=21</td>
<td></td>
</tr>
<tr>
<td>within</td>
<td>0.09</td>
<td>0.21</td>
<td>1.05</td>
<td>T=9</td>
<td></td>
</tr>
<tr>
<td>Lccppf</td>
<td>77</td>
<td>42.68</td>
<td>1</td>
<td>128</td>
<td>N=189</td>
</tr>
<tr>
<td>between</td>
<td>32.82</td>
<td>8</td>
<td>105</td>
<td>n=21</td>
<td></td>
</tr>
<tr>
<td>within</td>
<td>28.11</td>
<td>-21</td>
<td>155</td>
<td>T=9</td>
<td></td>
</tr>
<tr>
<td>Chappf</td>
<td>135</td>
<td>62.07</td>
<td>7</td>
<td>220</td>
<td>N=189</td>
</tr>
<tr>
<td>between</td>
<td>58.95</td>
<td>9.36</td>
<td>207</td>
<td>n=21</td>
<td></td>
</tr>
<tr>
<td>within</td>
<td>22.92</td>
<td>55</td>
<td>208</td>
<td>T=9</td>
<td></td>
</tr>
<tr>
<td>Fspf</td>
<td>45</td>
<td>22.45</td>
<td>3</td>
<td>113</td>
<td>N=189</td>
</tr>
<tr>
<td>between</td>
<td>21.59</td>
<td>12</td>
<td>100</td>
<td>n=21</td>
<td></td>
</tr>
<tr>
<td>within</td>
<td>7.60</td>
<td>11</td>
<td>82</td>
<td>T=9</td>
<td></td>
</tr>
<tr>
<td>Fre</td>
<td>45398</td>
<td>75482</td>
<td>1</td>
<td>335690</td>
<td>N=189</td>
</tr>
<tr>
<td>between</td>
<td>74736</td>
<td>75</td>
<td>284173</td>
<td>n=21</td>
<td></td>
</tr>
<tr>
<td>within</td>
<td>18704</td>
<td>-96463</td>
<td>131343</td>
<td>T=9</td>
<td></td>
</tr>
<tr>
<td>Wage</td>
<td>1.19E+7</td>
<td>1.43E+07</td>
<td>232195</td>
<td>6.76E+07</td>
<td>N=189</td>
</tr>
<tr>
<td>between</td>
<td>1.43E+07</td>
<td>1276542</td>
<td>5.43E+07</td>
<td>n=21</td>
<td></td>
</tr>
<tr>
<td>within</td>
<td>2.85E+06</td>
<td>-5061139</td>
<td>2.52E+07</td>
<td>T=9</td>
<td></td>
</tr>
</tbody>
</table>

The standard deviations of Lccp also show something interesting. The variation in passengers carried by LCCs across airports was very nearly equal to that observed within an airport over time. That is, if two airports were
randomly drawn from the data, the difference in passengers carried by LCCs is expected to be nearly equal to the difference for the same airport in two randomly selected years. In terms of variables Chap and Fsp, it is the standard deviations in Overall variation that are similar as that of Between variation.

Variable Otherp is simply the addition of Chap and Fsp. Propchap represents the share of Chap in Otherp. The mean Propchap is 0.49, which means, on average, charter carriers were responsible for almost same amount of the traffic as that carried by full service carriers in the 21 airports over the 9 years period.

As expected, charter carriers had the highest number of passengers per flight (135) as they tend to use large aircraft with high load factors. The average number of passengers per flight carried by LCCs ranked the second (77) while average passengers per flight carried by full service carriers is the lowest (45).

In line with other traffic variables, variable Fre varied a lot with its Within variation ranging from -96463 to 131363. The Within variation of Wage also ranged from -£5m to £25m. This is probably because airports increased outsourcing non-core business activities (e.g. baggage handling) to the third parties, which reduced its labour cost.
5.3 Aeronautical Revenue Model

Model 1 is used to measure the impact of LCCs on airports aeronautical revenue and is reproduced below:

\[
\ln AR_{it} = \alpha + \beta_1 \ln Lccppf_{it} + \beta_2 \ln Chappf_{it} + \beta_3 \ln Fsppf_{it} + \beta_4 \ln Fre_{it} + \beta_5 \text{Locadv}_{i} + \\
\beta_6 \text{Group}_{i} + \beta_7 \text{Size}_{i} + u_{it} \quad (\text{Model 1})
\]

A series of tests are applied to the model. The first test is to examine whether the error component has one-way or two-way effects. In other words, it is to examine whether there exist significant individual-airport effects and/or time-period effects. Under the two-way model, the error term in model 1 becomes

\[
u_{it} = \mu_i + \lambda_t + \nu_{it}
\]

Where \( \mu_i \) denotes the individual-airport effects, \( \lambda_t \) represents time-period effects and \( \nu_{it} \) is the disturbance term. All three satisfy the conditions explained in Section 4.4.1. Breusch and Pagan LM test is performed based on the null hypotheses below:

\[
H_A: \sigma_\mu^2 = 0;
\]
\[
H_B: \sigma_\lambda^2 = 0,
\]

Where \( \sigma_\mu^2 \) and \( \sigma_\lambda^2 \) denote the variances of the individual-airport effects and the time-period effects, respectively. The Breusch and Pagan LM test produces the test statistics of 401.8 and 1.13 respectively. \( H_A \) is rejected at
the 1% significance level but $H_0$ cannot be rejected, indicating that there are significant individual-airport effects but not time-specific effects.

Following Moulton (1986), a simple F test is also constructed to test the significance of individual-airport effects. The value of F test is 61.86, which is highly significant at the 1% level, meaning there are significant airport-specific effects. The F test for time-effect yields the results of 0.60 which is insignificant, indicating there are no significant time-specific effects in Model 1.

The both LM and F tests produce strong evidence that there are individual-airport effects in the Aeronautical Revenue Model, but not time-period effects. Therefore, a one-way error-components model rather than a two-way error-components model should be used. Examples of such airport specific effects are managerial ability, the quality of airport facility, quality of public infrastructure (e.g. highway, railway links to the airport), whether there is substitute airport nearby and attractiveness of airport’s catchment areas.

The POLS, FE and RE models are estimated based on the one-way error component model. All models are estimated with robust standard error to take into account of possible heteroscedasticity and serial correlation. The results are presented in Table 5.3 below.
Table 5.3 Regression results for the Aeronautical Revenue Model

<table>
<thead>
<tr>
<th>Dependent variable: lnar (real aeronautical revenue)</th>
<th>POLS (with robust S.E.)</th>
<th>FE (with robust S.E.)</th>
<th>RE (with robust S.E.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>11.16 (0.31)</td>
<td>14.75 (0.30)</td>
<td>13.72 (0.27)</td>
</tr>
<tr>
<td></td>
<td>[35.92]**</td>
<td>[48.97]**</td>
<td>[49.99]**</td>
</tr>
<tr>
<td>InLccppf</td>
<td>0.03 (0.02)</td>
<td>0.02 (0.01)</td>
<td>0.02 (0.01)</td>
</tr>
<tr>
<td></td>
<td>[1.75]*</td>
<td>[1.84]*</td>
<td>[1.67]*</td>
</tr>
<tr>
<td>InChappf</td>
<td>0.32 (0.06)</td>
<td>0.29 (0.04)</td>
<td>0.31 (0.04)</td>
</tr>
<tr>
<td></td>
<td>[4.94]*****</td>
<td>[6.90]*****</td>
<td>[7.20]*****</td>
</tr>
<tr>
<td>InFsppf</td>
<td>0.62 (0.10)</td>
<td>0.01 (0.06)</td>
<td>0.04 (0.06)</td>
</tr>
<tr>
<td></td>
<td>[6.32]</td>
<td>[0.21]</td>
<td>[0.56]</td>
</tr>
<tr>
<td>InFre</td>
<td>0.11 (0.03)</td>
<td>0.03 (0.01)</td>
<td>0.04 (0.01)</td>
</tr>
<tr>
<td></td>
<td>[4.30]*****</td>
<td>[2.80]*****</td>
<td>[3.57]*****</td>
</tr>
<tr>
<td>Locadv</td>
<td>-0.36 (0.12)</td>
<td>-0.07 (0.51)</td>
<td>-0.07 (0.14)</td>
</tr>
<tr>
<td></td>
<td>[3.10]*****</td>
<td>[0.14]</td>
<td>[0.14]</td>
</tr>
<tr>
<td>Group</td>
<td>0.48 (0.09)</td>
<td>0.6 (0.25)</td>
<td>0.6 (0.25)</td>
</tr>
<tr>
<td></td>
<td>[5.52]*****</td>
<td>[2.44]**</td>
<td>[2.44]**</td>
</tr>
<tr>
<td>Size</td>
<td>0.73 (0.11)</td>
<td>1.3 (0.25)</td>
<td>1.3 (0.25)</td>
</tr>
<tr>
<td></td>
<td>[6.84]*****</td>
<td>[5.27]*****</td>
<td>[5.27]*****</td>
</tr>
<tr>
<td>No. of observations</td>
<td>189</td>
<td>189</td>
<td>189</td>
</tr>
<tr>
<td>Within R^2</td>
<td>0.21</td>
<td>0.21</td>
<td>0.21</td>
</tr>
<tr>
<td>Between R^2</td>
<td>0.56</td>
<td>0.75</td>
<td>0.74</td>
</tr>
<tr>
<td>Overall R^2</td>
<td>0.53</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R^2</td>
<td>0.82</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F test of airport effects</td>
<td></td>
<td>F(20,164)=61.86</td>
<td>0.01</td>
</tr>
<tr>
<td>Prob&gt;F</td>
<td></td>
<td>401.8</td>
<td>0.01</td>
</tr>
<tr>
<td>LM Test</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prob&gt;chi2</td>
<td></td>
<td>6.51</td>
<td>(0.16)</td>
</tr>
<tr>
<td>Hausman Test</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(p-value)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: (1) Figures in parentheses are standard errors
(2) Figures in brackets are t values
(3) *, **, and *** indicate the significance of t values at the 10%, 5% and 1% levels respectively

The F test can be further used to compare POLS model over FE model. The null hypothesis of the F test is that there are no unobserved airport-specific factors that significantly affect airports aeronautical revenue. As we can see the computed F value is 61.86 which is significant at the 1% level. Thus the
null hypothesis is unequivocally rejected. The Breusch and Pagan LM test is also further used to compare POLS over RE model with the null hypothesis that the individual components of $\sigma^2_{\mu} = 0$ do not exist. The test statistic of $\chi^2_{(I)} = 401.8$ profoundly rejects the null hypothesis.

The forgoing tests show that the POLS model is rejected in turn by both the FE and RE models. The remaining relevant question is whether it is reasonable to assume that the $\mu_i$ are fixed or whether they are the consequences of some other random process. Hausman test is performed to choose RE over FE models. The test statistic is $\chi^2_{(I)} = 6.51$ which is insignificant, meaning the unobservable airport effects are uncorrelated with the exogenous variables, RE model is more efficient estimator than FE model. On these grounds, the RE model is preferred for the Aeronautical Revenue Model.

In line with the Within, Between and Overall variation, there are three corresponding $R^2$ in the fixed and random effects models. For the FE model, the relevant $R^2$ to examine is the Within $R^2$, while Overall $R^2$ is relevant for the RE model. In terms of the POLS model, as it simply pools the data, ignoring the cross-sectional and time-series dimension of the data, the $R^2$ associated with it is conventional $R^2$.

Therefore, in the RE model, relevant $R^2$ is Overall $R^2$, which is 0.74. The overall fitness of the RE model is quite good, explaining 74% of the variation in airports aeronautical revenue over the 9 year period. It is worth pointing out
that in either FE or RE model, the Between $R^2$ and Overall $R^2$ are similar, but Within $R^2$ is far less. This is probably due to the fact that the Within variation of the explanatory variables is generally larger than that of Overall and Between variation, thus reducing explanatory power of the Within (i.e. FE) estimator.

In the RE model, all variables have the expected signs. Most are statistically significant except the variables, Locadv and Fsppf. The centre focus of the model is the LCC variable. $Lccppf$ is significant at the 10% level in all the three models. The magnitudes of its estimated effects are very consistent ranging from 0.02 to 0.03. As expected, the magnitude of the coefficient of $Chappf$ (0.31) in the RE model is much larger than that of $Lccppf$. It is also highly consistent with the coefficient of $Chappf$ in the FE and POLS models (0.32 and 0.29, respectively). The results show that charter airlines have much higher contribution to airports aeronautical revenue than LCCs. A 10% increase in charter carrier passengers per flight leads to 3.1% increase in aeronautical revenue, while the same percentage increase in LCC passenger per flight only raises aeronautical revenue by 0.15%. One explanation is that charter carriers tend to use larger aircraft and have more passengers per flight than LCCs. Another reason, which is more appealing, might due to the previous assumption that LCCs had obtained substantial concessions on aeronautical charges from the airport authorities.

In terms of $Fsppf$, it is insignificant in all the three models. This is probably due to its collinearity with the variable $Fre$. However the signs of $Fsppf$ in all
the three models are correct. Moreover, the magnitude of its coefficient in the RE model is 0.04. In line with expectation, it is larger than that of \textit{Lccpf} but smaller than \textit{Chappf}. However, this should be interpreted with caution as the magnitude of its estimated effects in the RE model is very different to that in the POLS and FE models.

Variable \textit{Fre} is highly significant at the 1\% level across all the three models. The magnitude of its estimated effect in the RE model (0.04) is also quite consistent with that in the POLS and RE models (0.11 and 0.03, respectively). It can be interpreted that holding other things constant, a 10\% increase in freight leads airports aeronautical revenue to rise by 0.4\%.

It is not surprising to find the coefficient of \textit{Locadv} not significantly different from zero. As already discussed, Gatwick and Stansted airports are subject to price cap, which limit their ability to raise aeronautical charges. As for Luton Airport, during the sample period, heavy discounts were offered to easyJet.

Another two interesting variables are \textit{Group} and \textit{Size}. Holding other things constant, being part of the BAA group do give airports more power to raise aeronautical charges. Large airports have more ability to generate aeronautical revenue than small airports. This is probably because such airports are more reluctant to offer concessions to airlines, including LCCs, than their smaller counterparts.
5.4 Non-aeronautical Revenue Model

Model 2 is used to measure the impact of LCCs on airports non-aeronautical revenue and is reproduced below:

\[
\ln NAR_{it} = \alpha + \beta_1 \ln Lccp_{it} + \beta_2 \text{Propchap}_{it} + \beta_3 \ln Otherp_{it} + \beta_4 \text{Locadv}_i + \beta_5 \text{Group}_i + \beta_6 \text{Size}_i + u_{it} \quad \text{(Model 2)}
\]

Table 5.4 below presents the correlation matrix. It can be seen all variables have low correlation with the others.

<table>
<thead>
<tr>
<th></th>
<th>InLccp</th>
<th>Propchap</th>
<th>InOtherp</th>
</tr>
</thead>
<tbody>
<tr>
<td>InLccp</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Propchap</td>
<td>0.01</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>InOtherp</td>
<td>0.4</td>
<td>-0.35</td>
<td>1</td>
</tr>
</tbody>
</table>

Following the same procedures as previous Sub-section, tests to examine whether the error component has one-way or two-way effects are conducted first. The Breusch and Pagan LM test is carried out. The test statistic for \( H_A: \sigma^2_\mu = 0 \) is \( \chi^2(1) = 369.77 \), which is highly significant at the 1% level and rejects \( H_A \). However, Breusch and Pagan LM test for \( H_B: \sigma^2_\lambda = 0 \) produces the results of 0.10, which is insignificant and \( H_B \) thus cannot be rejected. The above results are further confirmed by the F tests with the values of 22.93 (Prob>F=0.01) for airport-specific effects and 1.19 (Prob>0.31) for time-specific effects, meaning there are significant airport-specific effects in the model but not time-specific effects. Therefore, the POLS, FE and RE models
are estimated with robust standard errors based on the one-way error component model. The results are presented in Table 5.5 below.

Table 5.5 Regression results for the Non-aeronautical Revenue Model

<table>
<thead>
<tr>
<th>Dependent variable: InNAR (real Non-aeronautical revenue)</th>
<th>POLS (with robust S.E.)</th>
<th>FE (with robust S.E.)</th>
<th>RE (with robust S.E.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>6.72 (0.51)</td>
<td>7.11 (1.79)</td>
<td>6.68 (1.08)</td>
</tr>
<tr>
<td></td>
<td>[13.22]***</td>
<td>[3.97]***</td>
<td>[6.18]***</td>
</tr>
<tr>
<td>InLccp</td>
<td>0.01 (0.005)</td>
<td>0.02 (0.005)</td>
<td>0.02 (0.004)</td>
</tr>
<tr>
<td></td>
<td>[1.94]**</td>
<td>[3.12]**</td>
<td>[3.38]**</td>
</tr>
<tr>
<td>Propchap</td>
<td>1.48 (0.18)</td>
<td>1.46 (0.25)</td>
<td>1.46 (0.21)</td>
</tr>
<tr>
<td></td>
<td>[8.46]***</td>
<td>[5.84]***</td>
<td>[6.88]***</td>
</tr>
<tr>
<td>InOtherp</td>
<td>0.57 (0.04)</td>
<td>0.58 (0.12)</td>
<td>0.57 (0.08)</td>
</tr>
<tr>
<td></td>
<td>[15.75]***</td>
<td>[4.76]***</td>
<td>[7.45]***</td>
</tr>
<tr>
<td>Locadv</td>
<td>0.63 (0.09)</td>
<td>0.62 (0.32)</td>
<td>0.62 (1.93)**</td>
</tr>
<tr>
<td></td>
<td>[7.21]***</td>
<td></td>
<td>[2.76]***</td>
</tr>
<tr>
<td>Group</td>
<td>0.59 (0.09)</td>
<td>0.58 (0.21)</td>
<td>0.58 (2.76)**</td>
</tr>
<tr>
<td></td>
<td>[6.67]***</td>
<td></td>
<td>[2.44]**</td>
</tr>
<tr>
<td>Size</td>
<td>0.52 (0.07)</td>
<td>0.5 (0.21)</td>
<td>0.5 (2.44)**</td>
</tr>
<tr>
<td></td>
<td>[7.15]***</td>
<td></td>
<td>[2.44]**</td>
</tr>
<tr>
<td>No. of observations</td>
<td>189</td>
<td>189</td>
<td>189</td>
</tr>
<tr>
<td>Within R^2</td>
<td>0.44</td>
<td>0.44</td>
<td>0.44</td>
</tr>
<tr>
<td>Between R^2</td>
<td>0.80</td>
<td>0.93</td>
<td>0.93</td>
</tr>
<tr>
<td>Overall R^2</td>
<td>0.78</td>
<td>0.91</td>
<td>0.91</td>
</tr>
<tr>
<td>R^2</td>
<td>0.91</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F test of airport effects</td>
<td>F(20, 165)=22.93</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td>Prob&gt;F</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LM Test</td>
<td></td>
<td>369.77</td>
<td>0.01</td>
</tr>
<tr>
<td>Prob&gt;chi2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hausman Test</td>
<td></td>
<td>0.10</td>
<td>(0.99)</td>
</tr>
<tr>
<td>(p-value)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes (1) Figures in parentheses are standard errors  
(2) Figures in brackets are t values  
(3) *, **, and *** indicate the significance of t values at the 10%, 5% and 1% levels respectively
As previously stated, the highly significant F test and LM test statistics reject the hypothesis that POLS is the appropriate model. The Hausman test statistics is 0.10, which is insignificant, indicating that both FE and RE models are consistent but RE model is more efficient in estimation. Thus RE model is preferred to the FE model. The RE model performs very well with Overall $R^2$ of 91% and all variables have the expected signs. All variables are statistically significant and most of them are significant at the 1% level.

The first important finding is that contrary to the conventional perception that LCC passengers spend more at airport. The regression results indicate that holding other things constant, LCC passengers contribute much less to airports non-aeronautical revenue than other passengers. A 10% increase in LCC passengers only raises commercial revenue by 0.2%, while the same percentage increase in other passengers leads commercial revenue to rise by 5.7%.

In terms of the comparison between charter carrier and full service carrier passengers, the result indicates that charter carrier passengers spend more at the airport than full service carrier passengers as a 10% increase in the proportion of charter carrier passengers leads to a 14.6% increase in commercial revenue.

Although the above discussion is based on the results in the RE model, the magnitudes of the estimated effects of $Lccp$, $Propchap$ and $Otherp$ are almost identical in the POLS and FE models. This provides strong evidence that
charter carrier passengers make the biggest contribution to airports commercial revenue, followed by full service airlines and LCCs. The results are not surprising as charter carrier passengers usually travel for leisure purposes and have a greater desire to purchase goods and/or services at airports. Moreover, they usually stay longer at airports, thus, providing more commercial revenue opportunities for airports. Similarly, full service carrier passengers may belong to higher-expenditure groups than their low-cost counterparts; alternatively, they may travel on business and wish to make some last-minute purchases (for personal use or gifts) from the airport.

The three dummy variables all perform well across the three models. As expected, airports located in London have more ability to reap the benefits of commercial revenue than airports elsewhere, holding other things constant. The BAA airports are in a stronger position than other airports in commercial revenue generation. The bigger an airport, the more commercial revenue it gains, everything else being equal. This is very plausible as big airports have more traffic flow which provides retailers, restaurants, car park etc. more opportunities to generate commercial revenue.

5.5 Operating Cost Model

The Operating Cost Model is reproduced below for convenience:

\[
\ln \text{OPCOST}_{it} = \alpha + \beta_1 \ln \text{Lccp}_{it} + \beta_2 \text{Propchap}_{it} + \beta_3 \ln \text{Otherp}_{it} + \beta_4 \ln \text{ Wage}_{it} + \\
\beta_5 \text{ Locadv}_{i} + \beta_6 \text{Group}_{i} + \beta_7 \text{ Size}_{i} + u_{it} \quad \text{(Model 3)}
\]
Table 5.6 presents the correlation matrix for the Operating Cost Model. The correlation between all variables appears low except In Wage, which is highly correlated with In Otherp. This might cause problem of multicollinearity. Therefore, two models with and without In Wage are estimated. However, differences are minor. Thus In Wage is retained in the model.

Table 5.6 Correlation matrix: Operating Cost Model

<table>
<thead>
<tr>
<th></th>
<th>InLccp</th>
<th>Propchap</th>
<th>In Otherp</th>
<th>In Wage</th>
</tr>
</thead>
<tbody>
<tr>
<td>InLccp</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Propchap</td>
<td>0.01</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In Otherp</td>
<td>0.4</td>
<td>-0.35</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>In Wage</td>
<td>0.37</td>
<td>-0.21</td>
<td>0.87</td>
<td>1</td>
</tr>
</tbody>
</table>

The Breusch and Pagan LM test also rejects $H_A: \sigma^2_\mu = 0$ with $\chi^2_{(1)} = 326.26$, but cannot reject $H_B: \sigma^2_\lambda = 0$ with $\chi^2_{(1)} = 0.80$. F tests further confirms that there is strong airport specific effects ($F(20, 164) = 24.76$ with $\text{Prob}>F = 0.01$) but not time-specific-effects ($F(8, 173) = 0.64$ with $\text{Prob}>F = 0.74$). Therefore, one-way error component model is adopted and the POLS, FE and RE models are estimated. The results are presented in Table 5.7 below.

The LM and F tests conducted above show that the POLS model is inappropriate. Insignificant Hausman test statistic (i.e. $\chi^2_{(1)} = 5.49$, with $\text{Prob}>\chi^2_{(1)} = 0.24$) indicates that RE is the preferred model. The model has very high Overall $R^2$, explaining 95% of variation. All variables have the expected signs. All, except Group, are statistically significant. The insignificance of Group indicates that being part of the BAA Group has no significant effect on an airports operating cost.
Table 5.7: Regression results for the Operation Cost Model

<table>
<thead>
<tr>
<th>Dependent variable: lnOPCOST (real operation cost)</th>
<th>Independent Variables</th>
<th>POLS (with robust S.E.)</th>
<th>FE (with robust S.E.)</th>
<th>RE (with robust S.E.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>6.19 (0.75) [8.31]**</td>
<td>9.12 (0.78) [11.67]**</td>
<td>7.70 (0.62) [12.32]**</td>
<td></td>
</tr>
<tr>
<td>lnLcpp</td>
<td>0.02 (0.003) [5.80]**</td>
<td>0.01 (0.003) [3.31]**</td>
<td>0.01 (0.003) [3.49]**</td>
<td></td>
</tr>
<tr>
<td>Propchap</td>
<td>0.47 (0.10) [4.82]**</td>
<td>0.73 (0.11) [6.81]**</td>
<td>0.75 (0.10) [7.44]**</td>
<td></td>
</tr>
<tr>
<td>lnOtherp</td>
<td>0.41 (0.04) [9.69]**</td>
<td>0.31 (0.06) [5.50]**</td>
<td>0.38 (0.42) [9.14]**</td>
<td></td>
</tr>
<tr>
<td>lnWage</td>
<td>0.25 (0.81) [3.12]**</td>
<td>0.17 (0.03) [6.01]**</td>
<td>0.17 (0.03) [4.97]**</td>
<td></td>
</tr>
<tr>
<td>Locadv</td>
<td>0.40 (0.07) [5.75]**</td>
<td></td>
<td>0.42 (0.23) [1.78]*</td>
<td></td>
</tr>
<tr>
<td>Group</td>
<td>0.07 (0.06) [1.17]</td>
<td></td>
<td>0.22 (0.13) [1.61]</td>
<td></td>
</tr>
<tr>
<td>Size</td>
<td>0.21 (0.05) [4.07]**</td>
<td></td>
<td>0.43 (0.14) [3.19]**</td>
<td></td>
</tr>
<tr>
<td>No. of observations</td>
<td>189</td>
<td>189</td>
<td>189</td>
<td></td>
</tr>
<tr>
<td>Within R^2</td>
<td>0.55</td>
<td></td>
<td>0.54</td>
<td></td>
</tr>
<tr>
<td>Between R^2</td>
<td>0.92</td>
<td></td>
<td>0.96</td>
<td></td>
</tr>
<tr>
<td>Overall R^2</td>
<td>0.90</td>
<td></td>
<td>0.95</td>
<td></td>
</tr>
<tr>
<td>R^2</td>
<td>0.95</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F test of airport effects</td>
<td>F(20, 164) = 24.76</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prob&gt;F</td>
<td>0.01</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LM Test</td>
<td></td>
<td></td>
<td>326.26</td>
<td></td>
</tr>
<tr>
<td>Prob&gt;chi2</td>
<td></td>
<td></td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td>Hausman Test (p-value)</td>
<td></td>
<td></td>
<td>5.49</td>
<td></td>
</tr>
</tbody>
</table>
| Notes (1) Figures in parentheses are standard errors (2) Figures in brackets are t values (3) *, **, and *** indicate the significance of t values at the 10%, 5% and 1% levels respectively
The most striking finding is that LCC passengers impose much less cost pressure on the airport than other passengers. Everything else being equal, a 10% increase in LCC passenger only raises airports operating cost by 0.1%, while the same percentage increase in other passengers raises the operating cost by 3.8%. The difference is very substantial. Furthermore, full service carrier passengers are found incurring more costs than their charter counterparts as the results indicate that a 10% increase in charter carrier passengers only raises operating cost by 7.5%. Although the above interpretation is based on the results from the RE model, in the POLS and FE models, the estimated effects of Lccp, Propchap and Otherp are very consistent with that in the RE model, suggesting the estimates are highly robust and stable.

The above findings are very important as it supports the arguments put forward by LCCs that they cause less cost burden to airports operations than full service or charter airlines. The reasons might due to the fact that airports always have to build and run airport lounge for full service carriers. This significantly increases airports costs and is difficult to gain return on investment in the short term. In terms of charter airlines, although airport lounges are not essential, their passengers usually have far more luggage needed to be handled than LCC passengers. Moreover, as previously discussed, charter carrier passengers usually spend more time at airports. In so doing, although it provides more commercial revenue opportunities to airports, it also increases airports operating costs.
In terms of other variables, InWage is significant at the 1% level and as expected that the increase in employees' wages raises operating cost. Holding other factors constant, a 10% increase in wage raises operating cost by 1.7%.

Finally, the two dummy variables Locadv and Size, both are significant and have predicted positive signs. The results can be interpreted that located in London area increases airports operating cost. And, naturally, the bigger an airport, the more operating cost it will incur.

5.6 Operating Profit Model

The model used to measure the impact of LCCs on airports operating profit is reproduced below:

$$OPPROF_i = \alpha + \beta_1 L ccp_{it} + \beta_2 Propchap_{it} + \beta_3 Otherp_{it} + \beta_4 Locadv_i + \beta_5 Group_i + \beta_6 Size_i + u_{it}$$

(Model 4)

Table 5.8 below presents the correlation matrix for the Operating Profit Model. All variables have low correlation with each other.

<table>
<thead>
<tr>
<th></th>
<th>Lccp</th>
<th>Propchap</th>
<th>InOtherp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lccp</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Propchap</td>
<td>-0.02</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>InOtherp</td>
<td>0.18</td>
<td>-0.35</td>
<td>1</td>
</tr>
</tbody>
</table>
The first test to carry out is to examine whether the error component has one-way or two-way effects. In line with the previous three models, the Breusch and Pagan LM test also rejects $H_A: \sigma^2_{\mu} = 0$ with $\chi^2(1) = 5.48$ (Prob > $\chi^2(1) = 0.02$), but cannot reject $H_B: \sigma^2_{\lambda} = 0$ with $\chi^2(1) = 0.40$ (Prob > $\chi^2(1) = 0.53$). The above results are confirmed by F tests that there are strong airport-specific effects ($F(20, 165) = 2.46$ with Prob > $F = 0.01$) but not time-specific effects ($F(8, 174) = 1.71$ with Prob > $F = 0.10$). Therefore, one-way error component model is used rather than the two-way model. Table 5.9 below shows the estimated results for the POLS, FE and RE models.

As the LM and F tests show that there are strong airport-specific effects, POLS is considered inappropriate. Hausman test is carried out to compare the FE and RE models. Unlike the tests in the previous three models, Hausman test in the Operating Profit Model yields significant test statistic (i.e. $\chi^2(1) = 12.71$, with Prob > $\chi^2(1) = 0.01$). As discussed in Chapter 4, there is possibility to get a statistical rejection of RE with the differences between the RE and FE estimates being practically small as a result of small-sample biases (Wooldridge, 2002). As a matter of fact, the magnitudes of the coefficients of $Lccp$ and $Otherp$ in the RE and FE models are more or less similar. Under these circumstances, it is recommended to accept the random effects assumptions and focus on the RE estimates (Wooldridge, 2002). In addition, RE estimates are preferred in the previous models; to maintain a form of consistence, it is decided to choose the RE estimates for the Operating Profit model.
Table 5.9 Regression results for the Operating Profit Model

<table>
<thead>
<tr>
<th>Dependent variable: OPPROF (real operating profit)</th>
<th>POLS (with robust S.E.)</th>
<th>FE (with robust S.E.)</th>
<th>RE (with robust S.E.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-1500388 (1003479)</td>
<td>5548612 (3612458)</td>
<td>-218376 (1208945)</td>
</tr>
<tr>
<td></td>
<td>(1.50)</td>
<td>(1.54)</td>
<td>(1.98)</td>
</tr>
<tr>
<td>Lccp</td>
<td>3.25 (0.28)</td>
<td>3.16 (0.29)</td>
<td>3.17 (0.27)</td>
</tr>
<tr>
<td>Propchap</td>
<td>1726303 (1585064)</td>
<td>-6622030 (2644452)</td>
<td>-357514 (1976409)</td>
</tr>
<tr>
<td></td>
<td>(1.09)</td>
<td>(2.50)***</td>
<td>(1.18)***</td>
</tr>
<tr>
<td>Otherp</td>
<td>5.01 (0.16)</td>
<td>3.96 (0.77)</td>
<td>4.97 (0.23)</td>
</tr>
<tr>
<td></td>
<td>[32.19]***</td>
<td>[5.18]***</td>
<td>[21.86]***</td>
</tr>
<tr>
<td>Locadv</td>
<td>-7084067 (1959086)</td>
<td>-6340034 (2678807)</td>
<td>-1898660 (1530924)</td>
</tr>
<tr>
<td></td>
<td>(3.62)***</td>
<td>(2.37)**</td>
<td>(1.24)</td>
</tr>
<tr>
<td>Group</td>
<td>-1275918 (1121321)</td>
<td>-1898660 (1530924)</td>
<td>(1.24)</td>
</tr>
<tr>
<td></td>
<td>[1.14]</td>
<td>[1.24]</td>
<td></td>
</tr>
<tr>
<td>Size</td>
<td>308969 (861502)</td>
<td>315668 (1226104)</td>
<td>0.98</td>
</tr>
<tr>
<td></td>
<td>(0.36)</td>
<td>(0.26)</td>
<td></td>
</tr>
<tr>
<td>No. of observations</td>
<td>189</td>
<td>189</td>
<td>189</td>
</tr>
<tr>
<td>Within R^2</td>
<td>0.57</td>
<td>0.56</td>
<td>0.56</td>
</tr>
<tr>
<td>Between R^2</td>
<td>0.98</td>
<td>0.99</td>
<td>0.99</td>
</tr>
<tr>
<td>Overall R^2</td>
<td>0.96</td>
<td>0.98</td>
<td>0.98</td>
</tr>
<tr>
<td>R^2</td>
<td>0.98</td>
<td>0.98</td>
<td>0.98</td>
</tr>
<tr>
<td>F test of airport effects</td>
<td>2.46</td>
<td>5.48</td>
<td>0.02</td>
</tr>
<tr>
<td>Prob&gt;F</td>
<td>0.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LM Test</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prob&gt;chi2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hausman Test</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(p-value)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes (1) Figures in parentheses are standard errors
(2) Figures in brackets are t values
(3) *, **, and *** indicate the significance of t values at the 10%, 5% and 1% levels respectively

As mentioned in Section 4.5 of Chapter 4, operating profit is the surplus (or loss) between operating income (i.e. aeronautical revenue and non-aeronautical revenue) and operating cost. To measure operating profit...
directly without taking into account of revenue and cost might cause unreliable results. Therefore, the results are indicative only and caution must be taken in the interpretation.

The coefficients of Lccp are positive in all the three models and all of them are highly significant at the 1% level. In the RE model, the coefficient of Lccp is 3.17, which is consistent to those in the FE and POLS models (3.16 and 3.25 respectively). Variable Otherp is also highly significant at the 1% level across the three models. As expected, their signs are all positive. The estimated effects of Otherp range from 3.96 in the FE model to 5.01 in the POLS. As the model is linear, the interpretation is straightforward. Based on the RE model, holding all other factors constant, on average, every additional LCC passenger contributes £3.17 to the sample airports operating profit, which is less than the other carrier passenger (£4.97).

In terms of Propchap, this variable does not perform very well in the Operating Profit Model. Although Propchap is highly significant in the FE model, it is not significant in the POLS and RE models. Moreover, the variable has positive sign in the POLS model but negative signs in the both FE and RE models. Its estimated effects also have extreme large variation, ranging from -6622030 to 1726303. Therefore, it appears Propchap is very unstable and sensitive to changes. In the Aeronautical and Non-aeronautical Revenue models, it is found that charter carriers make bigger contribution to an airport's revenue than full service carriers. In the Operating Cost Model, charter airlines are also found imposing less cost pressure to the airports than full service carriers.
Therefore, it is expected that charter carriers should have a larger or at least, similar impact on an airports operating profit than full service carriers. The counter-intuitive sign of Propchap in the RE model suggests the interpretation on this variable should be treated with caution.

5.7 Summary

This study is the first attempt in the literature to measure the impact of LCCs on regional airports financial performance from the perspectives of aeronautical revenue, non-aeronautical revenue, operating cost and operating profit after controlling unmeasured airport specific effects by using a panel data on 21 airports over the periods of 1995/96 to 2003/2004.

The four models applied all exhibited the pattern of one-way error components. Based on the relevant hypothesis testing, the RE model was considered the most appropriate form. Each model presented interesting findings. In short it can be summarised that LCCs make less contribution to an airport's aeronautical and non-aeronautical revenue than other airlines, however, they also impose much less pressure on an airport's operating cost. The results from the Aeronautical Revenue, Non-aeronautical Revenue and Operating Cost models were further supported by the findings from the Operating Profit Model.

The results in the four models are highly consistent and there is strong evidence that LCCs have significantly positive impact on airports financial
performance. These findings have profound policy implications which will be discussed in Chapter 7.
References


Chapter 6 Findings 2: Tourism Employment Study

6.1 Introduction

This Chapter presents the empirical findings of LCCs impact on employment in tourism-related sectors. The remainder of this Chapter is organised as follows. Section 2 is descriptive statistics for the dataset. Section 3 deals with choice of one-way over two-way error component models. After that, Section 4 presents the findings for the aggregate analysis on employment in tourism-related sectors. Then, in Section 5 tourism employment is broken down to four sub-sectors and the impact of LCCs on each sub-sector is investigated. Summary for this Chapter is presented in Section 6.

6.2 Descriptive Statistics

Table 6.1 below shows descriptive statistics for full-time and part-time employment in tourism-related sectors. The first three rows present the statistics for all tourism employment. It can be seen, on average, there were more part-time than full-time jobs (9,246, and 7,728, respectively). However, the full-time and part-time employment was not evenly distributed across different sub-sectors. The restaurant sector saw many more part-timers than full-timers (5,656 and 3,175, respectively), whereas the majority of the employment in the travel intermediaries sector was full-time (860 full-timers vs. 183 full-timers). The remaining two sectors, i.e. the accommodation and recreation sectors had slightly more full-timers than part-timers.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Full-time</th>
<th></th>
<th></th>
<th>Part-time</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Std. Dev.</td>
<td>Min</td>
<td>Max</td>
<td>Mean</td>
<td>Std. Dev.</td>
<td>Min</td>
<td>Max</td>
<td>Obs.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Tourism</td>
<td>overall</td>
<td>7728</td>
<td>5331</td>
<td>1096</td>
<td>21720</td>
<td>9246</td>
<td>6029</td>
<td>1829</td>
<td>24113</td>
<td>N=132</td>
<td></td>
<td></td>
</tr>
<tr>
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<td>1220</td>
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<td>882</td>
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<td>10618</td>
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<td>6061</td>
<td>12709</td>
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<tr>
<td>Accommodation</td>
<td>overall</td>
<td>1573</td>
<td>1133</td>
<td>121</td>
<td>4901</td>
<td>1488</td>
<td>1028</td>
<td>123</td>
<td>4545</td>
<td>N=132</td>
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<tr>
<td></td>
<td>between</td>
<td>1127</td>
<td>146</td>
<td>4427</td>
<td>1019</td>
<td>151</td>
<td>4131</td>
<td>n=6</td>
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<td></td>
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<tr>
<td></td>
<td>within</td>
<td>250</td>
<td>576</td>
<td>2637</td>
<td>241</td>
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<td>2481</td>
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<tr>
<td>Restaurant</td>
<td>overall</td>
<td>3175</td>
<td>2271</td>
<td>429</td>
<td>10240</td>
<td>5656</td>
<td>3924</td>
<td>1148</td>
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<td>2256</td>
<td>507</td>
<td>7694</td>
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<td>13610</td>
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<tr>
<td></td>
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<td>512</td>
<td>906</td>
<td>5721</td>
<td>696</td>
<td>3394</td>
<td>8406</td>
<td>T=22</td>
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<tr>
<td>Travel Intermediaries</td>
<td>overall</td>
<td>850</td>
<td>970</td>
<td>56</td>
<td>5238</td>
<td>183</td>
<td>185</td>
<td>12</td>
<td>1109</td>
<td>N=132</td>
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<td></td>
</tr>
<tr>
<td></td>
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</tr>
<tr>
<td></td>
<td>within</td>
<td>278</td>
<td>-571</td>
<td>1965</td>
<td>66</td>
<td>-229</td>
<td>507</td>
<td>T=22</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Recreation</td>
<td>overall</td>
<td>2121</td>
<td>1619</td>
<td>278</td>
<td>7495</td>
<td>1919</td>
<td>1458</td>
<td>243</td>
<td>6168</td>
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</tr>
<tr>
<td></td>
<td>between</td>
<td>1621</td>
<td>346</td>
<td>6196</td>
<td>1410</td>
<td>381</td>
<td>5089</td>
<td>n=6</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>within</td>
<td>306</td>
<td>819</td>
<td>3420</td>
<td>461</td>
<td>379</td>
<td>3770</td>
<td>T=22</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

In all tourism employment, the number of full-time employees for the overall data ranged from 1,096 (Teesside airport-region in 2003) to 21,720 (Gatwick airport-region in 2000), while the number of part-time staff varied between 1,829 (Exeter airport-region in 1999) to 24,113 (Stansted airport-region in 2003). In the 22 regions, the smallest area in terms of full-time employment only recorded an average of 1,220 tourism-related jobs (Teesside airport-region) during the period of 1998-2003, whereas the largest area had an average of 19,696 employees (Gatwick airport-region) during the same period. The between variation is equally large for part-time employment, which varied between 2,107 (Exeter airport-region) and 21,028 (Leeds Bradford airport-region). The above statistics indicate that the regions in the sample had quite large variations in tourism employment. Employment within a region varied between 3,907 and 10,618 for full-timers and 6,061 and 12,709 for part-timers.
Both variations are considerably large. Similar patterns are also found in the four sub-sectors.

The reported standard deviations show that the variation in all tourism employment over the whole dataset is very close to that observed across regions. In contrast, the variation within a region over time is relatively small. Employment in the sub-sectors also had similar pattern of variation.

Table 6.2 below shows descriptive statistics for the explanatory variables. On average, LCCs carried one million passengers a year at airports in the observation period, while the number of passengers carried by other carriers was nearly four million. The Within variation of $Lccp$ is between -5m and 8.74m. As previously explained, the negative figure does not mean any LCC actually carried negative passengers. The within number refers to the deviation from each individual's average, and naturally, some of those deviations are negative. The within variation of $Lccp$ is much larger than that of $Otherp$, which varied between 849,589 and 6.45m. This shows that LCCs had more rapid expansion in terms of the number of passengers carried in the sample period. Again at a few airports, there were no LCC passengers in some observation periods. A small value ‘1’ is assigned to make logarithm transformation possible.
Table 6.2 Descriptive statistics for explanatory variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lccp</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>overall</td>
<td>1023415</td>
<td>2228560</td>
<td>1</td>
<td>1.64E+07</td>
<td>N=132</td>
</tr>
<tr>
<td>between</td>
<td>1937351</td>
<td>1</td>
<td>8727735</td>
<td></td>
<td>n=22</td>
</tr>
<tr>
<td>within</td>
<td>1164650</td>
<td>-5175373</td>
<td>8736853</td>
<td></td>
<td>T=6</td>
</tr>
<tr>
<td>Otherp</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>overall</td>
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<td>6736688</td>
<td>62086</td>
<td>3.16E+07</td>
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<tr>
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<td>6849966</td>
<td>87452</td>
<td>2.90E+07</td>
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<td>n=22</td>
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<tr>
<td>within</td>
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<td>849589</td>
<td>6454145</td>
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<td>T=6</td>
</tr>
<tr>
<td>Pop</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>overall</td>
<td>463906</td>
<td>376784</td>
<td>97900</td>
<td>1324100</td>
<td>N=132</td>
</tr>
<tr>
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<td>98300</td>
<td>1306400</td>
<td></td>
<td>n=22</td>
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<tr>
<td>within</td>
<td>4424</td>
<td>441706</td>
<td>481606</td>
<td></td>
<td>T=6</td>
</tr>
<tr>
<td>Colggrad</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>overall</td>
<td>0.27</td>
<td>0.07</td>
<td>0.14</td>
<td>0.48</td>
<td>N=132</td>
</tr>
<tr>
<td>between</td>
<td>0.07</td>
<td>0.16</td>
<td>0.43</td>
<td></td>
<td>n=22</td>
</tr>
<tr>
<td>within</td>
<td>0.02</td>
<td>0.21</td>
<td>0.34</td>
<td></td>
<td>T=6</td>
</tr>
</tbody>
</table>

The average population in a region in the dataset was 463,906. But the smallest region only had a population of 97,900 (Teesside airport-region in 2001), whereas the largest area recorded 1,324,100 (Stansted airport-region in 2003). Although there was a wide variation of population size between different regions, the population within a region over years was highly stable and only varied between 441,706 and 481,606.

On average, 27 per cent of the total population who are of working age in a region was college graduates. Edinburgh airport-region had the highest percentage of college graduates (i.e. 43% during 1998-2003) while the share of college graduates in Blackpool airport-region was the lowest (16% during the same period). The Within variation is also relatively large (i.e. between 21% to 34%).
Correlation between the explanatory variables is examined and the correlation matrix is presented in Table 6.3 below. The results show that almost all variables have low correlation with the others. The highest level of correlation between the two variables, i.e. InOtherp and InPop, is 0.64, and it is considered acceptable.

<table>
<thead>
<tr>
<th></th>
<th>InLcpc</th>
<th>InOtherp</th>
<th>InPop</th>
<th>Colggrad</th>
</tr>
</thead>
<tbody>
<tr>
<td>InLcpc</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>InOtherp</td>
<td>0.34</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>InPop</td>
<td>0.43</td>
<td>0.64</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Colggrad</td>
<td>0.26</td>
<td>0.34</td>
<td>0.10</td>
<td>1</td>
</tr>
</tbody>
</table>

6.3 One-way or Two-way Error Component Model?

Following the procedure in Chapter 5, Breusch and Pagan LM test and F test are applied to examine whether the error component model has one-way or two-way effects for the aggregate and disaggregate analysis. Table 6.4 below presents the results for full-time employment.

The Breusch and Pagan LM test of null hypothesis that the individual components of \( \sigma^2_\nu = 0 \) do not exist is carried out first. The results are shown in the second column of Table 6.4. The test statistics for employment in all tourism-related sectors and the four sub-sectors (i.e. the accommodation, restaurant, travel intermediaries and recreation sectors) are 245.01, 263.80, 130.90, 155.59 and 151.76, respectively. All are highly significant at the 1%
level, profoundly rejecting the null hypothesis, meaning there are significant region-specific effects.

**Table 6.4 Results of region/time effects for full-time employment**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Breusch and Pagan LM Test</th>
<th>F Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Region-specific Effects</td>
<td>Time-period Effects</td>
</tr>
<tr>
<td>All Tourism Employment</td>
<td>245.01</td>
<td>2.26</td>
</tr>
<tr>
<td></td>
<td>(0.01)</td>
<td>(0.13)</td>
</tr>
<tr>
<td>Accommodation</td>
<td>263.80</td>
<td>1.37</td>
</tr>
<tr>
<td></td>
<td>(0.01)</td>
<td>(0.24)</td>
</tr>
<tr>
<td>Restaurant</td>
<td>130.90</td>
<td>1.62</td>
</tr>
<tr>
<td></td>
<td>(0.01)</td>
<td>(0.20)</td>
</tr>
<tr>
<td>Travel Intermediaries</td>
<td>155.59</td>
<td>2.24</td>
</tr>
<tr>
<td></td>
<td>(0.01)</td>
<td>(0.13)</td>
</tr>
<tr>
<td>Recreation</td>
<td>151.76</td>
<td>0.21</td>
</tr>
<tr>
<td></td>
<td>(0.01)</td>
<td>(0.65)</td>
</tr>
</tbody>
</table>

**Notes**
(1) Figures in parentheses are prob>chi2.
(2) Figures in brackets are prob>F

The null hypothesis that time components of \( \sigma^2_A = 0 \) do not exist is also conducted based on the Breusch Pagan LM test for all tourism employment and employment in the four sub-sectors. From the third column of Table 6.4 above, it can be seen the test statistics are 2.26, 1.37, 1.62, 2.24 and 0.21, respectively. None of them can reject the null hypothesis, meaning there are no significant time-period effects in the data.

The results of the F tests are tabulated in the last two columns of Table 6.4. The first F tests to be carried out are to examine whether there are significant region-specific effects for all tourism employment and employment in the four sub-sectors. The tests yield the value of 64.99, 114.19, 13.94, 16.04 and 17.24, respectively. All are significant at the 1% level. F tests are also
conducted to examine whether there are significant time-period effects. The values are 0.17, 0.40, 0.33, 0.18 and 0.86, respectively. None of them are significant. It confirms the results produced by the Breusch Pagan LM test that there is strong evidence of region-specific effects, but not time-period effects. Therefore, one-way, rather than two way, error component model should be used for the full-time tourism employment and employment in its four sub-sectors.

Following the same procedure, the Breusch and Pagan LM test and F test are applied to part-time data. The results are reported in Table 6.5 below. The Breusch and Pagan LM test statistics of null hypothesis that the individual components of $\sigma^2_\mu = 0$ do not exist is carried out first. The test statistics for all tourism employment and the employment in the four sub-sectors are 212.92, 277.84, 157.48, 90.41 and 33.10 respectively. All of them are significant at the 1% level, therefore, the null hypothesis is rejected as well.

Table 6.5 Results of region/time effects for part-time employment

<table>
<thead>
<tr>
<th>Variable</th>
<th>Breusch and Pagan LM Test</th>
<th>F Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Region-specific Effects</td>
<td>Time-period</td>
</tr>
<tr>
<td></td>
<td>Effects</td>
<td>Effects</td>
</tr>
<tr>
<td>All Tourism Employment</td>
<td>212.92</td>
<td>30.95</td>
</tr>
<tr>
<td></td>
<td>(0.01)</td>
<td>(0.01)</td>
</tr>
<tr>
<td>Accommodation</td>
<td>277.84</td>
<td>96.38</td>
</tr>
<tr>
<td></td>
<td>(0.01)</td>
<td>(0.01)</td>
</tr>
<tr>
<td>Restaurant</td>
<td>157.48</td>
<td>16.61</td>
</tr>
<tr>
<td></td>
<td>(0.01)</td>
<td>(0.01)</td>
</tr>
<tr>
<td>Travel Intermediaries</td>
<td>90.41</td>
<td>8.00</td>
</tr>
<tr>
<td></td>
<td>(0.01)</td>
<td>(0.01)</td>
</tr>
<tr>
<td>Recreation</td>
<td>33.10</td>
<td>4.83</td>
</tr>
<tr>
<td></td>
<td>(0.01)</td>
<td>(0.01)</td>
</tr>
</tbody>
</table>

Notes (1) Figures in parentheses are prob>chi2.  
(2) Figures in brackets are prob>F
F tests are also constructed to test the significance of region-specific effects in the part-time employment data. As can be seen from Table 6.5 above, the values of F-tests are 30.95, 96.38, 16.61, 8.00 and 4.83, respectively. Again, all are significant at the 1% level. Therefore, there is strong evidence of region-specific effects in the data.

The final analysis is to test whether there are significant time-period effects in the part-time employment data. The Breusch Pagan LM test statistics for tourism employment and employment in its four sub-sectors are 2.39, 1.74, 1.82, 12.02 and 2.34, respectively. Except the travel intermediaries sector, null hypothesis for all the other sectors cannot be rejected.

F test for the significance of time-effects is also performed for all tourism employment and employment in the four sub-sectors for the part-time data. The values are 0.15, 0.31, 0.28, 3.81 and 2.39 respectively. Except the travel intermediaries and recreation sectors, the other sectors and all tourism employment appear not to have time-period effects.

In the case of the recreation sector, the result in the F test contradicts with that in the Breusch Pagan LM test. As can be seen from Table 6.5 above, the Breusch Pagan LM test statistic is 2.34 with prob>chi2=0.13, whereas the F test value is only significant at the 5% level. Therefore, it appears safer to reject time-period effects. Moreover, in the full-time employment data, time-period effects for all the sectors are unequivocally rejected. Therefore, it is
considered appropriate to reject time-period effect for part-time employment in the recreation sector.

In terms of the travel intermediaries sector, although it appears to have two-way effects in the part-time data, it only has one-way effects in the full-time data. Moreover, tourism employment and all the other sectors in either full-time or part-time data only have region-specific effects. To maintain the consistency of estimation, it is decided to use one-way error component for the estimation of all the models. Examples of such region-specific effects are attractiveness of a particular region to tourists, quality of tourist facilities, quality marketing promotion; favourable destination image and persistent high proportion of certain tourist flows (e.g. visit friends and relatives).

6.4 Aggregate Analysis

The model used to measure the impact of LCCs on employment in tourism-related sectors is reproduced below:

\[
\ln TEM_t = \alpha + \beta_1 \ln Lccp_t + \beta_2 \ln Otherp_t + \beta_3 \ln Pop_t + \beta_4 Colggrad_t + u_t
\]

Analysis at the aggregate level is discussed in this Section, while the next Section presents findings at the disaggregate level. The POLS, FE and RE models are estimated based on the one-way error component model. All the models are estimated with robust standard error to take into account of possible heteroscedasticity and serial correlation. The results are presented in Table 6.6 below.
Table 6.6 Regression results for employment in tourism-related sectors

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Full-time Employment</th>
<th>Part-time Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>POLS (with robust S.E.)</td>
<td>FE (with robust S.E.)</td>
</tr>
<tr>
<td></td>
<td>POLS (with robust S.E.)</td>
<td>FE (with robust S.E.)</td>
</tr>
<tr>
<td></td>
<td>(0.577)***</td>
<td>(15.435)***</td>
</tr>
<tr>
<td>InLcpp</td>
<td>0.015</td>
<td>0.005</td>
</tr>
<tr>
<td></td>
<td>(0.007)***</td>
<td>(0.002)***</td>
</tr>
<tr>
<td>lnOtherp</td>
<td>-0.055</td>
<td>0.106</td>
</tr>
<tr>
<td></td>
<td>(0.028)***</td>
<td>(0.084)***</td>
</tr>
<tr>
<td>lnPop</td>
<td>0.930</td>
<td>4.582</td>
</tr>
<tr>
<td></td>
<td>(0.052)***</td>
<td>(1.214)***</td>
</tr>
<tr>
<td>Colgrad</td>
<td>2.507</td>
<td>0.275</td>
</tr>
<tr>
<td></td>
<td>(0.458)***</td>
<td>(0.334)***</td>
</tr>
<tr>
<td>No. of obs.</td>
<td>132</td>
<td>132</td>
</tr>
<tr>
<td>Within R²2</td>
<td>0.19</td>
<td>0.10</td>
</tr>
<tr>
<td>Between R²2</td>
<td>0.80</td>
<td>0.82</td>
</tr>
<tr>
<td>Overall R²2</td>
<td>0.79</td>
<td>0.81</td>
</tr>
</tbody>
</table>

F test of region effects
Prob>F 0.01 0.01
LM test 245.01 212.92
Prob>chi² 0.01 0.01
Hausman test 8.94 -
Prob>chi² 0.06 -
Test for exclusion of mean value - 5.46
Prob>chi² - 0.24

Notes (1) Figures in parentheses are standard errors
(2) Figures in brackets are t values
(3) *, **, and *** indicate the significance of t values at the 10%, 5% and 1% levels respectively

The second to the fourth columns present the results of the POLS, FE and RE models for full-time tourism employment. The significant F test of region-specific effects and LM test strongly reject the POLS model and in favour of the RE or FE models. This means simply pooling the data without taking into account of heterogeneity will cause biased results. The FE estimation
assumes that region-specific effects are fixed. Alternatively, region-specific effects can be treated as random. Then the RE model will be more efficient than FE estimation if the random effects are not correlated with other regressors.

Hausman test statistic yields the result of 8.94, which is significant at the 10% but not 5% level. As previously discussed, small sample can lead to biased Hausman test statistic. An examination of the coefficients of $Lccp$, $Otherp$, and $Colgrad$ in the FE and RE models shows that the results produced by the both models are quite close, implying the actual differences between the FE and RE estimates are small. But the coefficient of $Pop$ in the FE model is abnormally high. This might due to the fact that the Within variation of $Pop$ exhibits a very different pattern from that of the other explanatory variables (See Table 6.2 for details). This different structure of the data might have distorted Within estimation (i.e. FE model) of $Pop$. A further noteworthy point is that the Within $R^2$ in the FE model (the relevant $R^2$ to look at for the FE model) is only 0.19, while the Overall $R^2$ in the RE model (the relevant $R^2$ for the RE model) is much higher, i.e. 0.81, indicating 81% of the variation in employment in tourism-related sectors over the 6-year period can be explained by this model. On these grounds, it appears more appropriate to choose the RE estimates as a preferred model for the full-time employment.

All variables in the RE model have the expected signs. In the preferred RE model, the coefficient of $Lccp$ is significant at the 5% level. The point estimate
shows the elasticity of this effect is 0.006, meaning holding other determinants constant, a 10% increase in LCC passengers leads full-time tourism employment to rise by 0.06%.

Variable Otherp in the RE model has the expected sign and the magnitude of its coefficient, i.e. 0.020, is much larger than that of Lccp. However, it is insignificant, indicating other carrier passengers do not have significant impact on full-time employment in tourism-related industries.

In terms of other variables, local population has highly significant impact on tourism employment. The coefficient estimate of 0.90 in the RE model indicates that a 10% increase in Pop raises employment in tourism-related sectors by 9.0%. This is consistent with 8.6% reported in Brueckner’s (2003) study. The variable Colgrad has the expected sign and the magnitude of its coefficients is reasonable, however, it has no significant effect on tourism employment. The result is contrary to expectations. This is probably because the prevalence of low pay in tourism-related sectors might not make these sectors attractive to college graduates.

The results of the part-time employment are tabulated in the last three columns of Table 6.6. Based on the F test of region-specific effects, LM and Mundlak model24, RE is also considered the most appropriate model. The coefficients of Lccp in the FE and RE models are very close (0.014 and 0.012, respectively) and both are highly significant at the 1% level. The point

24 Hausman test cannot be executed in the part-time employment data as the difference between the covariate matrices of FE and RE is not positive definite. Therefore, Mundlak model is used as alternative to Hausman test.
estimate of $Lccp$ in the RE model shows that the elasticity of this effect is 0.012, indicating a 10% increase in LCC passengers raises part-time employment in tourism-related sectors by 0.12%. This estimated effect is higher than LCCs impact on full-time employment.

Despite having the expected sign and larger magnitude of the estimated coefficient than $Lccp$, the coefficient of $Otherp$ in the RE model is insignificant, indicating $Otherp$ has no significant impact on part-time employment.

The above results show that LCC passengers have significant impact on both full-time and part-time employment, whereas the impact of other carrier passengers is insignificant in the both cases. These results are interesting and it is probably because among other carrier passengers the percentage of outbound travellers is much higher than that of among LCC passengers. As previously discussed, in the dataset, charter carrier passengers accounted for over 50% of the combination traffic of charter and full service airlines at 15 out of 22 airports, while, in the UK, the majority of charter passengers are outbound travellers.

Although, $Lccp$'s impact is significant, the magnitudes of the coefficients are rather small when compared with Brueckner's study of airline traffic and employment in US metropolitan areas, in which he found a traffic increase translate into employment in a 10:1 ratio (Brueckner, 2003). Such a large difference is probably due to the fact that most of the LCC passengers from the UK to continental Europe are outbound travellers (Doganis, 2001). As
discussed in Chapter 4, the inbound effect on tourism employment is expected to be positive and the outbound effect could be positive or negative depending on whether the effect is a complement or substitute for tourism services in the region. The combination of these effects, thus, determines the small magnitude of $Lccp$ and insignificant $Otherp$.

In terms of $Pop$, its coefficient has the expected sign in the RE model and the magnitude of its estimated effect is very similar to that estimated in the full-time employment (0.804 and 0.903, respectively). This demonstrates that $Pop$ is a very consistent and significant control variable in both types of employment. However, in either full-time or part-time employment, the coefficients of $Pop$ in the FE models are abnormally high (1.732 and 4.582, respectively) due to the fact that the Within variation of $Pop$ exhibits a very different structure from that of other explanatory variables.

Finally, in the part-time employment, the variable $Colggrad$ is insignificant in the preferred RE model, despite having the expected sign and relatively consistent coefficients. The results indicate that $Colggrad$ do not have significant impact on part-time tourism employment as well.

6.5 Sectoral Analysis

Employment in tourism-related sectors is further broken down to four sectors. The impact of LCCs on employment in each sector is analysed and findings are presented. As previously discussed, all the results in the analysis are estimated based on one-way error component model. Possible
heteroscedasticity and serial correlation are taken into account by using robust standard error estimation.

6.5.1 The Accommodation Sector

The results of the POLS, FE and RE models for full-time and part-time employment in the accommodation sector are presented in Table 6.7 below.

Table 6.7: Regression results for employment in the accommodation sector

<table>
<thead>
<tr>
<th>Dependent variable: InAccom (employment in the accommodation sector)</th>
<th>Full-time Employment</th>
<th>Part-time Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Independent variables</strong></td>
<td><strong>POLS (with robust S.E.)</strong></td>
<td><strong>FE (with robust S.E.)</strong></td>
</tr>
<tr>
<td>Constant</td>
<td>-3.087 (1.229)</td>
<td>-44.063 (21.014)</td>
</tr>
<tr>
<td><strong>InLccp</strong></td>
<td>0.039 (0.015)</td>
<td>0.013 (0.006)</td>
</tr>
<tr>
<td><strong>InOtherp</strong></td>
<td>-0.215 (0.062)</td>
<td>0.027 (0.098)</td>
</tr>
<tr>
<td><strong>InPop</strong></td>
<td>0.908 (0.110)</td>
<td>3.984 (1.627)</td>
</tr>
<tr>
<td><strong>Colggrad</strong></td>
<td>4.162 (1.033)</td>
<td>-0.870 (0.590)</td>
</tr>
<tr>
<td>No. of obs.</td>
<td>132</td>
<td>132</td>
</tr>
<tr>
<td>Within R^2</td>
<td>0.10</td>
<td>0.07</td>
</tr>
<tr>
<td>Between R^2</td>
<td>0.38</td>
<td>0.40</td>
</tr>
<tr>
<td>Overall R^2</td>
<td>0.37</td>
<td>0.40</td>
</tr>
<tr>
<td>R^2</td>
<td>0.52</td>
<td></td>
</tr>
<tr>
<td>F test of region effects</td>
<td>F(21, 106)=114.19</td>
<td></td>
</tr>
<tr>
<td>Prob&gt;F</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td>LM test</td>
<td>263.80</td>
<td></td>
</tr>
<tr>
<td>Prob&gt;chi2</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td>Hausman test</td>
<td>2.25</td>
<td></td>
</tr>
<tr>
<td>Prob&gt;chi2</td>
<td>0.69</td>
<td></td>
</tr>
<tr>
<td>Test for exclusion of mean value</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Prob&gt;chi2</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

Notes: (1) Figures in parentheses are standard errors
(2) Figures in brackets are t values
(3) *, **, and *** indicate the significance of t values at the 10%, 5% and 1% levels respectively.
Relevant tests suggest that RE is the most appropriate model for both full-time and part-time employment data. In the full-time data, the results show that LCC traffic exerts a significantly positive effect on the accommodation sector employment in a region. The point estimate shows the elasticity of this effect is 0.014, indicating that a 10% increase in LCC passengers raises accommodation sector employment by 0.14%. This figure is much larger than 0.06% for all tourism employment, suggesting the accommodation sector benefits more from traffic generated by LCCs. The coefficient of $Lccp$ in the RE model is very similar to its estimated effect in the FE model (0.013). In the POLS model, $Lccp$'s coefficient is 0.039, which is very large and this is because the POLS model causes upward bias.

However, the sign of $Otherp$ in the RE model is negative and the effect is insignificant. The negative sign seems a bit counter-intuitive. It is probably because, as discussed in Chapter 4, the majority of other carrier passengers are outbound travellers and it is very plausible that those travellers do not require accommodation at their local areas. In addition, it is partly due to the substitute effect that people switch from within region trips to outbound trips, hence reducing the demand for accommodation services. Therefore, this explains the negative sign of $Otherp$ and why it is insignificant in the accommodation sector employment.

Turning to the part-time employment data, the coefficient of $Lccp$ in the preferred RE model is 0.011, which is pretty close to that reported in the full-time RE model. However, the effect of $Lccp$ is insignificant. The coefficient of
Otherp in the RE model is also consistent with that in the full-time RE model. The variable is insignificant and has negative sign. The results indicate that both variables Lccp and Otherp do not have significant impact on part-time employment in the accommodation sector.

In terms of other variables in the preferred RE models, Pop is significant in both full-time and part-time employment; the magnitudes of its coefficient are 0.850 and 0.728 respectively. These figures are very similar to the estimated effects of Pop in overall tourism employment. The variable Colgrad is negative and insignificant in the two RE models indicating college graduates do not have significant impact on either full-time or part-time employment in the accommodation sector. This is probably due to the same reason as that in the aggregate analysis.

6.5.2 The Restaurant Sector

The Table 6.8 below shows the results of POLS, FE and RE estimation for employment in the restaurant sector.

In the full-time employment, although Hausman test statistic is significant, due to the same reasons as explained in the aggregate analysis, from a theoretical perspective, it is considered the RE model is a more appropriate specification. In the part-time employment, Hausman test cannot be executed. Mundlak model suggests that the RE model is preferred. R² for the both models are the same, explaining 88% of variations in the full-time and part-time employment in the restaurant sector over the 6-year period, respectively.
Table 6.8 Regression results for employment in the restaurant sector

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Full-time Employment</th>
<th>Part-time Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>POLS (with robust S.E.)</td>
<td>FE (with robust S.E.)</td>
</tr>
<tr>
<td>InLccp</td>
<td>-0.001 (0.006)</td>
<td>0.007 (0.004)</td>
</tr>
<tr>
<td>InOtherp</td>
<td>-0.003 (0.025)</td>
<td>0.057 (0.139)</td>
</tr>
<tr>
<td>InPop</td>
<td>0.942 (0.053)***</td>
<td>4.392 (1.509)***</td>
</tr>
<tr>
<td>Colgrad</td>
<td>2.616 (0.417)***</td>
<td>0.279 (0.600)</td>
</tr>
<tr>
<td>No. of obs.</td>
<td>132</td>
<td>132</td>
</tr>
<tr>
<td>F test of region effects</td>
<td>F(21, 106)=13.94</td>
<td></td>
</tr>
<tr>
<td>Prob&gt;F</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td>LM test</td>
<td></td>
<td>130.9</td>
</tr>
<tr>
<td>Prob&gt;chi2</td>
<td></td>
<td>0.01</td>
</tr>
<tr>
<td>Hausman test</td>
<td></td>
<td>100.23</td>
</tr>
<tr>
<td>Prob&gt;chi2</td>
<td></td>
<td>0.01</td>
</tr>
<tr>
<td>Test for exclusion of mean value</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Prob&gt;chi2</td>
<td></td>
<td>-</td>
</tr>
</tbody>
</table>

Notes (1) Figures in parentheses are standard errors
(2) Figures in brackets are t values
(3) , ** and *** indicate the significance of t values at the 10%, 5% and 1% levels respectively

In either full-time or part-time employment, the coefficient of Lccp in the preferred RE model is insignificant and it is the same case for Otherp, indicating LCCs and other carrier passengers do not have significant impact on employment in the restaurant sector.
In terms of other variables, as expected, the size of local population has significant impact on both full-time and part-time restaurant employment. In the preferred RE models, the variable Colggrad is positive and has significant impact on full-time restaurant employment. This result reflects the fact that Colggrad captures the effect of high-income group. Everything else being equal, people in the high-income group are more likely to eat out than low-income people, hence explaining the significant impact. However, Colggrad's impact on part-time employment is not significant, suggesting the increase in college graduates has no significant effect on part-time employment in the restaurant sector.

6.5.3 The Travel Intermediaries Sector

The Travel intermediaries sector is dominated by full-time employment. Table 6.9 below shows the results of the POLS, FE and RE models estimated for full-time and part-time employment.

The F-test, LM, Hausman and Mundlak tests indicate that the RE model is preferred for both full-time and part-time employment. Variable Lccp does not have any significant impact on travel intermediaries employment, either full-time or part-time. Moreover, the sign is negative in some specifications. This is not surprising as LCCs usually bypass travel agencies and sell their tickets directly to passengers. Therefore, its effects on travel agencies should be insignificant. Moreover, the rise of LCCs also poses challenges over tour operators as tourists are encouraged to take advantage of the flexibility provided by LCCs to package their own holidays. Full service airlines are also
forced to cut commissions paid to travel agents. The combination of these factors might have driven some travel agencies out of business, hence explaining the negative signs of \( Lccp \).

Table 6.9 Regression results for employment in the travel Intermediaries sector

<table>
<thead>
<tr>
<th>Dependent variable: InAgent (employment in the travel intermediaries sector)</th>
<th>Full-time Employment</th>
<th>Part-time Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Independent variables</strong></td>
<td><strong>POLS (with robust S.E.)</strong></td>
<td><strong>FE (with robust S.E.)</strong></td>
</tr>
<tr>
<td></td>
<td>(0.930)</td>
<td>(42.909)</td>
</tr>
<tr>
<td><strong>InLccp</strong></td>
<td>0.004</td>
<td>-0.008</td>
</tr>
<tr>
<td></td>
<td>(0.010)</td>
<td>(0.012)</td>
</tr>
<tr>
<td><strong>InOtherp</strong></td>
<td>0.198</td>
<td>0.119</td>
</tr>
<tr>
<td></td>
<td>(0.044)</td>
<td>(0.195)</td>
</tr>
<tr>
<td><strong>InPop</strong></td>
<td>0.782</td>
<td>7.486</td>
</tr>
<tr>
<td></td>
<td>(0.085)</td>
<td>(3.321)</td>
</tr>
<tr>
<td><strong>Colgrad</strong></td>
<td>1.732</td>
<td>-0.218</td>
</tr>
<tr>
<td></td>
<td>(0.634)</td>
<td>(1.057)</td>
</tr>
<tr>
<td><strong>No. of obs.</strong></td>
<td>132</td>
<td>132</td>
</tr>
<tr>
<td><strong>F test of region effects</strong></td>
<td>F(21, 106)=16.04</td>
<td>F(21, 106)=8.00</td>
</tr>
<tr>
<td><strong>Prob&gt;F</strong></td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td><strong>LM test</strong></td>
<td>155.59</td>
<td>90.41</td>
</tr>
<tr>
<td><strong>Prob&gt;chi2</strong></td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td><strong>Hausman test</strong></td>
<td>-</td>
<td>2.87</td>
</tr>
<tr>
<td><strong>Prob&gt;chi2</strong></td>
<td>-</td>
<td>0.58</td>
</tr>
<tr>
<td><strong>Test for exclusion of mean value</strong></td>
<td>5.34</td>
<td>-</td>
</tr>
<tr>
<td><strong>Prob&gt;chi2</strong></td>
<td>0.25</td>
<td>-</td>
</tr>
</tbody>
</table>

Notes (1) Figures in parentheses are standard errors
(2) Figures in brackets are \( t \) values
(3) *, **, and *** indicate the significance of \( t \) values at the 10%, 5% and 1% levels respectively

As expected, \( Otherp \) has significant impact on full-time employment in the travel intermediaries sector. The coefficient estimate of 0.198 indicates a 10%
increase in Otherp boosts full-time travel intermediaries employment by 1.98%. This is plausible as full service carriers have a long tradition of working with travel agents for tickets distribution, while charter airlines are part of the tour operating business in most of the cases. Nevertheless, the impact of Otherp on part-time employment in this sector has appeared insignificant. The result is no surprise as part-time employment in the travel intermediaries sector is negligible.

In line with other estimations, the coefficient of Pop is positive and significant. In the preferred RE models, the coefficient is 0.826 for full-time and 0.880 for part-time employment. Both are pretty close to those obtained in the other sectors and the aggregate analysis.

In the preferred RE models, variable Colggrad is positive and has significant impact on part-time employment. This is probably because high education increases propensity for leisure travel, thus, benefiting the travel intermediaries sector. However, its impact is only reflected in the part-time, not full-time employment. As previously stated, full-time employment dominated this sector; therefore, Colggrad's effect seems to be trivial.

6.5.5 The Recreation Sector

Table 6.10 below presents the results of POLS, FE and RE estimation for both full-time and part-time employment in the recreation sector. The relevant tests suggest that the POLS model is an inappropriate specification, while the both
Hausman test statistics (i.e. 8.85 and 9.08) are significant at the 10% but not the 5% level.

### Table 6.10 Regression results for employment in the recreation sector

<table>
<thead>
<tr>
<th>Dependent variable: InRecre (employment in the recreation sector)</th>
<th>Full-time Employment</th>
<th>Part-time Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Independent variables</strong></td>
<td>POLS (with robust S.E.)</td>
<td>FE (with robust S.E.)</td>
</tr>
<tr>
<td>Constant</td>
<td>-5.554 (0.376)</td>
<td>-38.303 (25.281)</td>
</tr>
<tr>
<td></td>
<td>[14.78]**</td>
<td>[1.52]**</td>
</tr>
<tr>
<td>InLccp</td>
<td>0.016 (0.005)</td>
<td>0.006 (0.004)</td>
</tr>
<tr>
<td></td>
<td>[14.78]**</td>
<td>[1.34]**</td>
</tr>
<tr>
<td>InOtherp</td>
<td>-0.084 (0.018)</td>
<td>0.281 (0.111)</td>
</tr>
<tr>
<td></td>
<td>[4.56]**</td>
<td>[2.52]**</td>
</tr>
<tr>
<td>InPop</td>
<td>1.045 (0.033)</td>
<td>3.241 (1.951)</td>
</tr>
<tr>
<td></td>
<td>[32.00]**</td>
<td>[1.66]**</td>
</tr>
<tr>
<td>Colgrad</td>
<td>2.148 (0.394)</td>
<td>1.173 (0.698)</td>
</tr>
<tr>
<td></td>
<td>[5.45]**</td>
<td>[1.68]**</td>
</tr>
<tr>
<td>No. of obs.</td>
<td>132</td>
<td>132</td>
</tr>
<tr>
<td>Within R²</td>
<td>0.13</td>
<td>0.07</td>
</tr>
<tr>
<td>Between R²</td>
<td>0.85</td>
<td>0.90</td>
</tr>
<tr>
<td>Overall R²</td>
<td>0.83</td>
<td>0.88</td>
</tr>
<tr>
<td>RA²</td>
<td>0.89</td>
<td>0.89</td>
</tr>
<tr>
<td>F test of region effects</td>
<td>F(21, 106)=17.24</td>
<td></td>
</tr>
<tr>
<td>Prob&gt;F</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td>LM test</td>
<td>151.76</td>
<td></td>
</tr>
<tr>
<td>Prob&gt;chi²</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td>Hausman test</td>
<td>8.85</td>
<td></td>
</tr>
<tr>
<td>Prob&gt;chi²</td>
<td>0.06</td>
<td></td>
</tr>
</tbody>
</table>

Notes (1) Figures in parentheses are standard errors
(2) Figures in brackets are t values
(3) *, **, and *** indicate the significance of t values at the 10%, 5% and 1% levels respectively

A close examination of the results found that the sign of Lccp and Colgrad is the same in the FE and RE models and the magnitudes of their coefficients are very close. Again, the coefficient of Pop is distorted in the FE estimates. However, the sign of Otherp is positive in the FE models but negative in the RE models. Under these circumstances, care must be taken in choosing the
preferred model. The first consideration is that the marginal significance of the Hausman statistics implies that the actual difference between the FE and RE models is likely to be very small. In that case, it is recommended to choose the RE model (Wooldridge, 2002). Moreover, the $R^2$ for the FE models are rather small (0.13 and 0.20 for full-time and part-time employment, respectively) compared with that for the RE models (0.88 for the two types of employment). Furthermore, the exogeneity assumption of the explanatory variables was accepted in the analysis of other sub-sectors and the all tourism employment analysis. As the same set of explanatory variables is used in the recreation sector analysis, there is a need to maintain a form of consistence. Based on these considerations, it is concluded that the RE models are preferred to the FE models for full-time and part-time employment in the recreation sector.

Having decided the preferred model, as can be seen from Table 6.10 above, $Lccp$ has significant impact on part-time, but not full-time employment in the recreation sector. The point estimate in the RE model shows that the elasticity of this effect is 0.022, indicating a 10% increase in LCC passengers raises part-time recreation sector employment by 0.22%.

Why does $Lccp$ have significant impact on part-time, rather than full-time, recreation sector employment? A possible explanation is that LCCs have the ability to generate a large volume of inbound traffic within a short period. For example tourists come to Britain to participate sporting events. The volume of these types of traffic is not likely to be evenly distributed across whole year.
Therefore, it is better to recruit part-timers to cope with the sudden increased demand for labour. As it is usually more expensive to lay off full-time workers, managers tend not to recruit full-timers unless tourists are evenly distributed across the year or favourable conditions persist.

In the preferred RE models, the coefficient of Otherp is negative and insignificant in either full-time or part-time employment. This might be due to the fact that charter and full service carrier passengers are outbound dominated; money and leisure time spent outside of the region might reduce the consumption of leisure activities in their local areas, hence, reducing employment in the recreation sector.

In terms of other variables, the coefficient of Pop in the two RE models are 0.996 and 0.980, respectively, which are consistent with estimations in the other sectors. As expected, the sign of COlgrad is positive and the variable has significant impact on both full-time and part-time employment in the recreation sector. The positive correlation again reflects the fact that COlgrad partly captures the effect of high-income group. People who have higher disposable income are more likely to spend money and time in visitor attractions and leisure facilities.

6.6 Summary
This Chapter started by analysing descriptive statistics of the data. Then tests for ascertaining the one-way or two-way error component formation of the models were carried out subsequently. It was concluded that one-way error
component is more appropriate for the estimation. After that, aggregate and sectoral analyses based on the one-way error component estimation were conducted.

Aggregate analysis found that $Lccp$ had significant impact on both full-time and part-time employment in tourism-related sectors, while the impact of $Otherp$ is insignificant in the both cases. The results from the sectoral analysis demonstrate that the accommodation sector benefits from LCCs in full-time employment generation, while the increased LCC traffic provides part-time employment opportunities for the recreation sector. The restaurant and travel intermediaries sectors do not see significant impact of LCCs in either full-time or part-time employment. In terms of $Otherp$, its impact is only reflected in the travel intermediaries sector. Policy implications of these findings will be discussed in Chapter 7.
References:


Chapter 7 Discussions and Conclusions

7.1 Introduction
This research measures regional economic effects of LCCs in the UK. The focus is on regional airports and tourism employment. Based on the analytical framework proposed in Chapter 1, it was argued understanding the interplay of LCCs, airports and regional tourism is the key to measuring LCCs regional economic effects. By using the panel data econometric approach, empirical studies on LCCs impact on regional airports financial performance and LCCs impact on tourism employment were carried out. The remainder of this Chapter is organised as follows. Section 2 presents the key findings and Section 3 reviews the research. Policy implications and the contribution of this study are discussed in Sections 4 and 5, respectively. Finally, Section 6 concludes the Thesis by calling for further research.

7.2 Key Findings
The impact of LCCs on regional airports financial performance was measured from the perspectives of aeronautical revenue, non-aeronautical revenue, operating cost and operating profit. The key findings are presented as follows:

- Both LCCs and charter carriers have significant impact on airports aeronautical revenue. But LCCs impact is much smaller than that of charter carriers. The results indicate a 10% increase in charter carrier passengers per flight raises airports aeronautical revenue by 3.1%,
while the same percentage increase in LCC passengers per flight only raises aeronautical revenue by 0.15%. In terms of full service carriers, their impact on airports aeronautical revenue is insignificant.

- Again, LCCs contribution to airports non-aeronautical revenue is much smaller than that of other carriers. A 10% increase in LCC passengers only boosts airports commercial revenue by 0.2%, while the same percentage increase in other carrier passengers raises commercial revenue by 5.7%. It is further found that charter carrier passengers spend more at the airport than full service carriers' passengers as the result indicates that a 10% increase in the proportion of charter carrier passengers leads commercial revenue to rise by 14.6%.

- However, LCCs impose much less pressure on airports operating cost than other carriers. The results indicate that a 10% increase in LCC passengers only raises airports operating cost by 0.1%, while the same percentage increase in other carrier passengers leads operating cost to rise by 3.8%. The difference is very substantial. Furthermore, full service carrier passengers are found incurring more operating cost to the airport than charter carrier passengers.

- Linear functional form is used in the Operating Profit Model. It is found that, on average, every additional LCC passenger contributes £3.16 to the sample airports operating profit, which is slightly lower than that of other carrier passengers (£4.97).
The impact of LCCs on regional tourism employment was measured at two levels, namely, aggregate and disaggregate. Each level is further separated by full-time and part-time employment. After controlling the effects of local population and college graduates, it is found that:

- A 10% increase in LCC passengers raises full-time and part-time tourism employment by 0.06% and 0.12%, respectively. Other carriers do not have significant impact on either full-time or part-time tourism employment.

- Other carriers do not have significant impact on either full-time or part-time accommodation sector employment, whereas LCCs have significant impact on full-time, but not part-time employment in this sector. The results show a 10% increase in LCC passengers raises full-time accommodation sector employment by 0.14%.

- Both LCCs and other carriers do not have significant impact on either full-time or part-time employment in the restaurant sector.

- LCCs do not have significant impact on either full-time or part-time employment in the travel intermediaries sector. Other carriers have significant impact on full-time employment and a 10% increase in other carrier passengers raises full-time employment in this sector by 1.98%.
• LCCs have significant impact on part-time, but not full-time, employment in the recreation sector. A 10% increase in LCC passengers raises part-time employment by 0.22%. Other carriers do not have significant impact on either full-time or part-time employment in this sector and the coefficients have negative sign.

7.3 Overview of the Research

Panel data analysis was used as the methodology for the empirical studies. This method has proved very successful. Although the advantages of using panel data were presented in Chapter 4, there are still a few points which are noteworthy as they are particularly relevant to the datasets used. Firstly, the two datasets used exhibit great degree of heterogeneity that characterises airports, regions, airlines, etc. over time. The use of panel data can take this into account and make estimation more efficient.

Moreover, although the sample sizes for the airport and tourism employment studies are all the largest possible, they are still small in terms of cross-section (21 airports and 22 airport-regions, respectively) or time-series observations (9 and 6 years, respectively). If only pure cross-section or time-series analysis is used, it would be difficult to generate valid results based on such small samples. This is the case observed in some airport studies. By using panel data approach, the number of observations in the two studies dramatically expands to 189 and 132, respectively. This makes the estimation more efficient and the results obtained are more robust.
After highlighting the successful application of panel data analysis to the research, the remainder of this Section is to discuss the findings from the two empirical studies. The first Sub-section reviews the findings in the Airport Study followed by a discussion of the findings in the Tourism Employment Study.

7.3.1 Overview of the Airport Study

The impact of LCCs on airports financial performance was measured from two different approaches. One approach measured LCCs impact on regional airports aeronautical revenue, non-aeronautical revenue and operating cost. The other approach directly measured LCCs impact on airports operating profit. The reason to use the two approaches to measure the same phenomenon is that findings from different approaches can be compared against each other. In so doing, the validity and robustness of the findings can be better evaluated.

Individual-specific effects were found significant in the four models, but not time-period effects. Therefore, a one-way error component model was adopted. Examples of such airport-specific effects are managerial ability, the quality of airport facilities, quality of public infrastructure (e.g. highway, railway links to the airport), whether there is substitute airport nearby and attractiveness of airport's catchment areas. By using one-way error component model, these unobserved variables can be taken into account, hence making estimation more efficient.
The double logarithm functional form was used for the Aeronautical Revenue, Non-aeronautical Revenue and Operating Cost models as it implies the changing marginal relationship between the explanatory and dependent variables and it can also estimate elasticities of explanatory variables. POLS, FE and RE are estimated for each model. The RE model was proved superior to the FE and POLS models in all the cases. This means the assumption that unobservable airport-specific effects are uncorrelated with the exogenous variables cannot be rejected. Under that circumstance, the RE model is both consistent and efficient.

In the Aeronautical Revenue Model, it was found that LCCs have significant impact on airports aeronautical revenue, but its impact is far less than that of charter airlines. As for full service carriers, its estimated effect is between charter carriers and LCCs, but insignificant. The differences between LCCs and charter airlines can be attributed to the fact that charter airlines tend to use larger aircraft and are packed with more passengers. However, another more appealing explanation is that LCCs are very likely to pay much less airport charges than charter airlines. This is particularly the case in small airports as Size is significant at the 1% level with a strong magnitude. Although it is sometimes reported that small airports are using concessions to lure LCCs custom, this is the first time to be observed in an econometric study.

In the literature, there is a prevailing view that LCC passengers tend to spend more at airports than full service and charter carrier passengers as LCCs do not provide free food/drinks on board (Barrett, 2004). LCCs always use this
argument to press airports for low airport charges. However, this claim is not supported in this Study. LCC passengers' contribution to airports commercial revenue is much smaller than that of charter and full service carriers. The results are very robust as estimates in the RE, FE and POLS models are highly consistent. Moreover, all the variables in the three models are significant and most are at the 1% level.

Nevertheless, a striking finding emerges in the Operation Cost Model. The results show that LCCs passengers have much less impact on airports operating cost than that of full service and charter airlines. This finding supports the argument put forward by LCCs managers that LCC passengers only require basic airports facilities (O'Leary, 2003, cited in Barrett, 2004). Again the estimates are robust and consistent in different model specifications.

Based on the results from Aeronautical Revenue, Non-aeronautical Revenue and Operating Cost models, a tentative conclusion can be drawn. Although LCC passengers make less contribution to airports aeronautical and non-aeronautical revenue than that of charter and full service carrier passengers, in the meantime, they also incur much less pressure on airports operating cost than their charter and full service counterparts. Overall, LCCs should have positive impact on airports financial performance.

Linear functional form was used for Operating Profit Model as some observations in the dependent variables are negative and cannot be transferred to logarithm. The RE model was preferred to the FE model.
Although the model cannot well explain the impact of charter carrier passengers on airports operating profit, the coefficients of variables Lccp and Otherp are highly significant at the 1% level. Moreover, the estimated effects of the both variables are highly consistent over the POLS, FE and RE models, indicating the robustness of the estimates. The results show that every additional LCC passenger contributes £3.16 to airports operating profit, while every other carrier passenger adds £4.97 to the airport. The results in the Operating Profit Model are plausible and consistent with that obtained from the first approach.

By measuring airports financial performance from two different perspectives, similar conclusions have been reached. It can be confidently concluded that LCCs do have a positive contribution to airports financial performance, albeit probably smaller than that of other carriers.

### 7.3.2 Overview of the Tourism Employment Study

The study on the impact of LCCs on tourism employment was conducted at two levels: aggregate and disaggregate. At each level, there is very strong evidence of the existence of region-specific effects but not time-period effects. Therefore, same as the Airport Study, a one-way error component model was adopted for model estimation. Region-specific effects, such as attractiveness of a particular region to tourists, quality of tourist facilities, quality marketing promotion, favourable destination image and persistent high proportion of certain tourist flows (e.g. visit friends and relatives, domestic) are all taken into account in model estimation.
Double logarithm functional form was also used in the Tourism Employment model. Variables in the aggregate analysis perform well. All the variables have the expected sign and most are significant. The study found that LCCs have significant impact on both full-time and part-time employment in the tourism-related industries. By contrast, other carrier passengers neither have significant impact on full-time nor part-time tourism employment. This is probably because among other carrier passengers, the percentage of outbound travellers is higher than that of among LCC passengers. Although $L_{ccp}$'s impact is significant, the magnitudes of the coefficients are rather small.

In the disaggregate analysis, tourism employment was broken down to four sectors, namely, accommodation, restaurant, travel intermediaries and recreation. The same set of explanatory variables was employed to measure the impact of LCCs on each sector's employment. Sectoral analysis showed that accommodation and recreation are the main sectors benefiting from the increased LCC traffic. Other carrier passenger's impact is only reflected on employment in the travel intermediaries sector. The restaurant sector is the only sector which has not seen significant impact by airline traffic.

7.4 Policy Implications of the Research
The findings in the empirical studies have important policy implications. The consistent results obtained in the Airport Study from the two different perspectives strongly suggest that there exist mutually beneficial relationships between LCCs and the regional airport. The findings in the Tourism Employment Study show that LCCs impact on regional tourism employment is
significant but the magnitudes of the coefficients are rather small. This further suggests that the cost paid by regional authorities to attract LCCs might not be able to generate substantial tourism employment benefit for the region. Under these circumstances, as suggested by the analytical framework, there is no need for regional authorities’ intervention. What regions should do is to work closely with the airports and LCCs to promote the region more effectively and maximise tourism benefit.

As most of the regional airports in the UK have been commercialised or privatised, these airports have strong motivation to embrace LCCs to reach critical mass of traffic and improve their financial performance. It is the airport, rather than the regional authority, that should be in the driving seat to negotiate deals with LCCs. Airports, therefore, should be given full autonomy in deciding terms and conditions that they can offer to attract LCCs.

However, in the recent European Commission’s verdict on the case of Ryanair and Charleroi, preferential treatment of landing charges and ground handling was ruled illegal on the basis of non-discrimination (European Commission, 2004). Although Charleroi is a state-owned airport, there is a threat that the principle could be applied to the privatised airport. But, as business entities, what concerns commercialised or privatised airports is not only aeronautical revenue but also how to maximise the overall profit. The study in the UK has shown that there is strong evidence that substantial aeronautical concessions have been offered by regional airports to attract LCCs. The results show that,
as a whole, this strategy has been successful as LCCs have positively significant impact on airports financial performance.

On these grounds, it proves inappropriate for the European Commission to regulate commercialised or privatised airports on the basis of non-discrimination. Guided by the private market investor principle, those airports calculate cost and benefit when signing contracts with LCCs. Only when mutual beneficial relationship is reached, their cooperation could sustain. Public body's intervention on this issue seems to be unnecessary.

Having said that, regional airports often face a less favourable situation when developing their services than major hubs. They may not have reached the critical size needed to be sufficiently attractive. Without appropriate incentives, LCCs might not be prepared to run the risk of opening routes from unknown and untested airports. These airports might not have adequate resources to provide proper financial incentives to attract LCCs. Under these circumstances, public aid paid to LCCs to create new routes or new schedules from regional airports should be allowed. When LCCs reach breakeven point or the airport has an attractive catchment area, the government can then withdraw its aid. Triggered by the initial aid, self-sustained relationship between LCCs and the airport could be formed. The aid paid can be subsequently recouped after the benefits of tourism are spillovered to the whole region.
However, in taking this approach, regional authorities must bear in mind that these types of aid may increase the corporate mobility of LCCs and accelerate their movement through the profit cycle. Aiding LCCs is not equivalent to aiding regional tourism development. LCCs are in constant search of profit and increasing their competitive advantages. Once their demand for more financial support has not been met, they might threat to fly elsewhere. From region's perspective, to tackle the fundamental problem, the best way is to give full autonomy to regional airports. Regional authorities should not interfere in the case unless a deal between LCCs and airport cannot be reached. In the longer term, in order for regions not to be undermined by LCCs, they need to develop a strong brand in the tourism market and build an attractive catchment area. In so doing, more LCCs or other airlines could be attracted, thus further contributing to the regional tourism development and increasing the bargaining power of the region.

7.5 The Contribution of the Research
This research examines a phenomenon for which very little empirical evidence is available from previous studies. Apart from its important policy implications, the findings enrich the body of knowledge in the field of air transport and tourism development.

The biggest contribution this study made is to apply panel data analysis to tourism research. Although panel data analysis is gaining popularity in the mainstream econometric literature, in tourism research, very few published papers explicitly use this method. This study has successfully demonstrated
how the distinctive advantages of panel data analysis can be incorporated into a research characterised by short time periods and small cross-section observations.

Another contribution of this study is to bring regional airports into the study of LCCs impact on regional tourism through the analytical framework developed in this thesis. Although the analytical framework is illustrated in the context of the UK, it can be readily applicable to other countries. Moreover, the framework can be extended to studying airlines and tourism in general.

This study takes an interdisciplinary approach combining theories from air transport economics, competitive strategy, tourism and regional economic development. Apart from providing factual information, this research also makes contribution to the above disciplines.

Firstly, the models developed in the Airport Study are the first of its kind to measure the impact of LCCs on airports financial performance from two complementary perspectives. While the models themselves need testing in other countries, it can be readily applied to measure airlines impact on airports financial performance in the field of air transport economics.

Secondly, based on the standard strategic management theories, cost leadership strategy can either be built upon economies of scale or relying on non-scale barriers such as differentiated product, capital requirements, buyer switching costs, limited access to distribution channels, entrant costs
disadvantages and government policies favouring the incumbent (Porter, 1980). This study illustrates how LCCs can build their sustainable competitive advantages upon regional airports based on a mutual beneficial relationship. Moreover, economic viability of this relationship was tested empirically.

Thirdly, this study enriches the literature of regional economic development. It shows the interaction among different sectors (i.e. LCCs and airports) and the aggregate consequences of corporate behaviour of this interaction can have profoundly effect on regional tourism development.

Finally, this study provides an alternative approach, i.e. tourism employment, as an indicator to measure regional tourism development. The weaknesses of the conventional indicators such as visits, expenditure, were highlighted.

7.6 Further Research

This Research measures regional economic effects of LCCs in the UK. Given the scarcity of the study into this issue, further research is needed.

Firstly, a research on the impact of LCCs on other economic activities should be carried out. The framework developed in this Study focuses on regional airports and tourism employment. Although airports and tourism appear to be impacted most by LCCs, direct air access provided by LCCs also facilitates efficient business links and provides companies in a region with more competitive advantages. For regional policy makers, wide economic benefits derived from LCCs might be more important in policy formulation. In terms of
the methodology, panel data analysis would be appropriate. Employment can also be used as an indicator for regional economic development.

Secondly, a study of LCCs impact on regional airport and tourism employment based on structural equation modelling is likely to provide good insights into the interactive relationships of LCCs, airports and regional tourism. As the first step, this study utilises single equation approach. However, it would be naïve if we assume that only uni-direction relationship exists between LCCs, regional airports and tourism employment. Development of tourism in a region can also attract LCCs to choose that region as its destination. In terms of airports, it also takes initiative to attract LCCs. Therefore, further study by using structural equation modelling approach based on panel data would be able to advance our understanding on the interactive relationships between LCCs, airports and regional tourism and strengthen the explanatory power of the analytical framework.

Thirdly, econometric analysis based on panel data uses different model specification in the context of the UK should be very useful. Particularly, there is a need to improve model specifications on measuring the impact of LCCs on airports aeronautical revenue and operating profit as well as tourism employment. A replication of the present econometric exercise is required to test the robustness of these conclusions.

Alternatively, the models developed in this study can be applied to other countries. In the UK, most regional airports have been commercialised or
privatised. In other European countries, many small regional airports are still owned by states. It would be very interesting to see whether the win-win situation that happened in the UK could be replicated in other countries. If regional airports in other European countries could not make profit from dealing with LCCs, interesting policy recommendations, such as commercialisation/privatisation of the regional airport, could be made. To ensure the comparability of the data, airports in the same country should be chosen. Whenever possible, panel data should be used as its distinctive advantages compared with pure cross-section or time-series data.

Fourthly, this Study argues that the most sustainable competitive advantages that LCCs possess derive from point-to-point operation based on regional airports. As more and more airlines adopt the low cost, no-frills model, LCCs operation became extensive at a number of regional airports. When those airports approach to saturation, the bargaining power will be shifting from LCCs to airports. How will this affect the interrelationship between changes in market structure within which LCCs operate and changes in the distribution of passengers? A research into this topic is important to furthering our understanding about the relationship between LCCs, airports and regional tourism.

Finally, a case study approach based on the analytical framework would be able to provide in-depth understanding on the interplays of LCCs, airports and regional tourism development in a region. The current econometric study provides an overall picture. However, every region and every LCC are
different. The effect of LCCs on those regional airports and tourism employment could have different patterns. In the case study, two contrasting airport-regions could be chosen to investigate the effect of LCCs on airports and regional tourism employment. Detailed financial data at airports might be difficult to obtain. But, interviews with airport managers regarding less sensitive issues could be carried out. Moreover, interview with officials at local tourist boards and local governments would be useful to facilitate the understanding of the issues from different perspectives.
References


Appendix 1: Freedoms of the Air

Negotiated in bilateral air services agreements

First Freedom: the right to fly over another country without landing.

Second Freedom: the right to make a landing for technical reasons (e.g. refuelling) in another country without picking up/setting down revenue traffic.

Third Freedom: the right to carry revenue traffic from your own country (A) to the country (B) of your treaty partner.

Fourth Freedom: the right to carry traffic from country B back to your own country A.

Fifth Freedom: the right of an airline from country A to carry revenues traffic between country B and other countries such as C or D on services starting or ending in its home country A (this freedom cannot be used unless countries C or D also agree).

Supplementary rights:

Sixth ‘Freedom’: the use by an airline of country A of two sets of Third and Fourth Freedom rights to carry traffic between two other countries but using its base at A as a transit point.

Seventh ‘Freedom’: the right of an airline to carry revenue traffic between points in two countries on services which lie entirely outside its own home country.

Eighth ‘freedom’ or cabotage rights: the right for an airline to pick up and set down passengers or freight between two domestic points in another country on a service originating in its own home country.
Sixth Freedom rights are rarely dealt with explicitly in air services agreements but may be referred to implicitly in memoranda of understanding attached to the agreement. In the application of many bilaterals there is also de facto acceptance of such rights. Seventh and Eighth Freedom rights are granted only in very rare cases.

Appendix 2: Geographical coverage of airport-regions

<table>
<thead>
<tr>
<th>Number</th>
<th>Airport</th>
<th>Surrounding Area</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Aberdeen</td>
<td>Aberdeen</td>
</tr>
<tr>
<td>2</td>
<td>Birmingham</td>
<td>Birmingham</td>
</tr>
<tr>
<td>3</td>
<td>Blackpool</td>
<td>Blackpool</td>
</tr>
<tr>
<td>4</td>
<td>Bournemouth</td>
<td>Bournemouth</td>
</tr>
<tr>
<td>5</td>
<td>Bristol</td>
<td>Bristol</td>
</tr>
<tr>
<td>6</td>
<td>Cardiff</td>
<td>Cardiff</td>
</tr>
<tr>
<td>7</td>
<td>East Midlands</td>
<td>Nottinghamshire</td>
</tr>
<tr>
<td>8</td>
<td>Edinburgh</td>
<td>Edinburgh City</td>
</tr>
<tr>
<td>9</td>
<td>Exeter</td>
<td>Exeter</td>
</tr>
<tr>
<td>10</td>
<td>Gatwick</td>
<td>East &amp; West Sussex</td>
</tr>
<tr>
<td>11</td>
<td>Glasgow</td>
<td>Glasgow City</td>
</tr>
<tr>
<td>12</td>
<td>Humberside</td>
<td>Northeast Lincolnshire</td>
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<tr>
<td>13</td>
<td>Inverness</td>
<td>Highlands</td>
</tr>
<tr>
<td>14</td>
<td>Leeds Bradford</td>
<td>Leeds &amp; Bradford</td>
</tr>
<tr>
<td>15</td>
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<td>Liverpool</td>
</tr>
<tr>
<td>16</td>
<td>Luton</td>
<td>Luton</td>
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<td>17</td>
<td>Manchester</td>
<td>Manchester</td>
</tr>
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<td>Newcastle</td>
<td>Newcastle-Upon-Tyne</td>
</tr>
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<td>19</td>
<td>Prestwick</td>
<td>East &amp; South &amp; North Ayrshire</td>
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<td>Southampton</td>
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<td>22</td>
<td>Teesside</td>
<td>Darlington</td>
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