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Cost–Benefit Analysis of Low-Cost Carriers for Heathrow and London Stansted Airport

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Master in Management

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Cost–Benefit Analysis of Low-Cost Carriers for Heathrow and London Stansted Airport

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RESUMO

A presente tese analisa de forma abrangente o impacto económico líquido resultante das operações das transportadoras de baixo custo (LCC) no contexto das economias regionais. Analisamos o caso específico do Aeroporto de Heathrow e do Aeroporto de Londres Stansted no Reino Unido, utilizando a abordagem rigorosa da Análise Custo-Benefício (ACB) como quadro analítico orientador. Esta abordagem permite-nos dissecar as externalidades positivas e negativas intrinsecamente ligadas às operações das LCC, bem como a prosperidade económica global catalisada pela presença das rotas das LCC nestes ecossistemas aeroportuários.

O fenómeno das LCC:

As LCC surgiram como actores transformadores no sector da aviação, oferecendo opções de viagens aéreas económicas a um leque cada vez mais diversificado de passageiros. São o epítome da democratização das viagens aéreas, tornando-as acessíveis a um segmento mais alargado da população. O apelo dos preços mais baixos dos bilhetes, as estruturas tarifárias simplificadas e a proliferação de rotas ponto-a-ponto conduziram a uma mudança substancial nos padrões de viagem. Esta mudança, por sua vez, suscitou um interesse intenso nas repercussões económicas do fenómeno das LCC, especialmente no que diz respeito ao seu impacto nas economias regionais.

Metodologia e âmbito:

A metodologia de investigação adoptada para este estudo centra-se na aplicação da abordagem da Análise Custo-Benefício (ACB) - uma ferramenta robusta para avaliar a viabilidade económica de projectos e políticas. A ACB permite-nos avaliar e quantificar de forma sistemática as várias facetas das operações de LCC, permitindo uma compreensão holística dos seus contributos económicos.

A nossa atenção centra-se no ano de 2018, um momento crucial na evolução das LCC e na sua influência no panorama da aviação. Examinamos de forma crítica a proporção de passageiros das LCC relativamente ao volume total de passageiros no aeroporto de Heathrow e no aeroporto de Londres Stansted durante este ano. Para além desta análise numérica, aprofundamos os benefícios económicos multifacetados que se encontram associados às LCC, com ênfase específica no seu papel na criação de emprego, na sua influência nas despesas de turismo e nos seus efeitos mais amplos e induzidos na dinâmica do emprego.

Ato de equilíbrio: As externalidades positivas e negativas:

O sector dos transportes públicos de passageiros não está isento de complexidades. Embora tragam vantagens económicas inegáveis, também introduzem um conjunto de externalidades negativas que exigem a nossa atenção e avaliação. Essas externalidades negativas abrangem um espetro de desafios, que vão desde acidentes e poluição do ar até à poluição sonora, efeitos da urbanização, perda de biodiversidade, contaminação do solo e o espetro global das alterações climáticas.

O imperativo é claro: as operações de LCC devem ser avaliadas de forma holística, tendo em conta os seus impactos positivos e negativos. Esta abordagem equilibrada é essencial para formular estratégias e tomar decisões informadas que maximizem os benefícios e minimizem os inconvenientes.

Quantificação dos benefícios económicos dos LCCs:

A quantificação torna-se um instrumento fundamental para a compreensão dos benefícios económicos das LCC. Este estudo avalia meticulosamente esses benefícios, avaliando as receitas geradas pelos empregos que criam e o aumento das despesas relacionadas com o turismo que facilitam. Ao analisar os efeitos multidimensionais no emprego - que vão desde a criação imediata de postos de trabalho em posições de pilotos e assistentes de bordo até ao emprego indireto na manutenção, restauração e vários sectores auxiliares - obtemos uma visão abrangente dos contributos económicos das LCC.

Resultados empíricos:

As conclusões empíricas do presente estudo ilustram o complexo cálculo das contribuições das LCC. No aeroporto de Heathrow, por exemplo, os voos das LCC registaram um aumento de 3% nos custos sociais e ambientais em 2018, num montante total de 2,97 mil milhões de libras. Estes custos são substanciais e requerem uma reflexão e uma ação ponderadas. No entanto, esta despesa é eclipsada pelo benefício económico líquido por passageiro, que se situa em 41,20 libras esterlinas para Heathrow e em robustas 60,50 libras esterlinas para o aeroporto de Londres Stansted. Esta análise crítica reafirma a noção de que as LCC não são meras participantes, mas sim contribuintes substanciais para as economias locais que orbitam estes centros de aviação.

Motores de emprego:

O coração das operações das LCC reside na criação de emprego. A sua influência repercute-se em diversos sectores, desde oportunidades de emprego direto em posições de pilotos e assistentes de bordo a funções indirectas na manutenção, catering e vários segmentos auxiliares. Os números falam por si: no aeroporto de Heathrow, as LCC foram fundamentais para a criação de 1308 postos de trabalho, enquanto no aeroporto de Londres Stansted, a sua influência se estende a 1502 postos de trabalho. Estes números sublinham o seu papel como motores de desenvolvimento económico, geradores de emprego e contribuintes essenciais para a subsistência de inúmeras pessoas.

O aliado afortunado do turismo:

Para além do emprego, as LCC são uma força motriz da indústria do turismo. A sua capacidade para aumentar o tráfego de passageiros e estimular as actividades relacionadas com o turismo conduz a um crescimento substancial das despesas dos turistas. Há provas tangíveis de um aumento do tráfego de passageiros e do volume de negócios em ambos os aeroportos, diretamente associado às operações das LCC. Apesar da existência inegável de externalidades negativas, as LCC revelam-se contribuintes líquidos para o bem-estar económico quando comparadas com modelos comerciais alternativos. O bem-estar económico agregado dos aeroportos de Heathrow e de Londres Stansted ascende a cerca de 12,93 milhões de libras, sublinhando o papel fundamental que as LCC desempenham na criação de riqueza e no estímulo ao crescimento económico das comunidades vizinhas.

O imperativo da sustentabilidade:

Importa também salientar e reconhecer as externalidades negativas que as operações dos LCC produzem, nomeadamente: poluição, ruído, alterações climáticas e outros desafios ambientais diversos. Este estudo adopta uma abordagem pragmática, atribuindo valores monetários a estes custos com base na média do Reino Unido em 2018. Esta abordagem sublinha a necessidade urgente de práticas sustentáveis e de atenuação dos efeitos adversos, a fim de manter uma abordagem equilibrada e responsável das operações dos transportes públicos de passageiros.

Conclusão:

Em conclusão, esta tese constitui um testemunho importante do papel desempenhado pelas transportadoras aéreas de baixo custo na promoção da expansão económica, na criação de oportunidades de emprego e no reforço da indústria das viagens e do turismo nas imediações dos aeroportos de Heathrow e de Londres Stansted. Sublinha o imperativo de compreender o impacto das actividades das LCC - um panorama que engloba tanto as facetas favoráveis como as adversas - a fim de formular estratégias e adoção de decisões sustentadas. Estas estratégias devem ter por objetivo maximizar os benefícios decorrentes das operações de LCC e, ao mesmo tempo, enfrentar diligentemente os desafios que lhes estão associados.

As conclusões retiradas deste estudo podem auxiliar os decisores, autoridades aeroportuárias e aos diversos stakeholders do sector da aviação, uma vez que lhes permitirá ter informação mais detalhada, importante para suportar a tomada de decisões, delineação de estratégias e avaliação dos impactes gerados por estas companhias aéreas. Esta investigação sublinha ainda a importância de compreender e aproveitar o potencial transformador das LCC, ao mesmo tempo que se actua de forma responsável nas frentes ambiental e social.

Palavras-chave: Companhias aéreas de baixo custo; Análise de Custo-Benefício, Aeroporto de Heathrow, Aeroporto de Stansted, Modelo de Negócio das companhias aéreas de baixo custo.

ABSTRACT

This thesis delves into the economic influence of low-cost carriers (LCCs) on regional economies, focusing on Heathrow and London Stansted Airports in the UK. Employing Cost-Benefit Analysis (CBA), it assesses the full spectrum of LCC operations, including both positive and negative externalities, to gauge their overall impact. Despite the negative externalities associated with LCCs, including accidents, pollution, urbanization and climate change, the research reveals a net positive economic outcome. This favorable outcome can be largely attributed to the substantial income generation, job creation and increased travel spending facilitated by LCCs. The study goes a step further by quantifying these benefits through assessments of job creation revenue and heightened tourism spending. It also highlights the favorable influence on employment.

LCC flights at Heathrow and London Stansted Airports in 2018 increased socio-environmental costs by nearly 3% totaling £2.97 billion. However, the net economic benefit per passenger was £41.20 for Heathrow and £60.50 for London Stansted. LCCs significantly contributed to local economies, creating numerous jobs ranging from pilots and flight attendants to maintenance and catering. Heathrow witnessed 1,308 jobs created due to LCCs while London Stansted had 1,502.

Furthermore, LCCs bolstered tourism by boosting passenger traffic and related activities, resulting in higher tourist expenditures. Despite their negative aspects, LCCs generated more economic welfare than costs compared to other models. The combined economic welfare for Heathrow and London Stansted was £12.93 million, underscoring their positive influence on wealth creation and economic growth in the surrounding areas. However, it's crucial to acknowledge and address LCC-related negative externalities such as pollution and noise. The study assigns monetary values to these costs based on UK averages in 2018 emphasizing the need for sustainable practices and mitigation efforts.

These findings offer valuable insights for aviation sector decision-makers and stakeholders to develop policies that support sustainable growth, enhance economic well-being, and effectively address the challenges of low-cost travel.

Keywords: Low-Cost Carrier, Cost Benefit Analysis, Heathrow Airport, Stansted Airport, LCC Business Model.

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ABBREVIATIONS

LCC	Low-Cost Carrier
UK	United Kingdom
EASA	European Union Aviation Safety Agency
CAPA	Center for Aviation
CBA	Cost Benefit Analysis
TPB	Theory of Planned Behavior
RDC	Remote Data Concentrators
CAA	Civil Aviation Authority

Chapter 1. Introduction

1.1 Background

In 2018, Low-Cost Carriers (LCCs) generated approximately £472 million in total gains. Among the airports, Heathrow Airport accounted for the highest concentration of benefits at 66.10%. In the United Kingdom, LCCs operating at Heathrow Airport generated a total revenue of £2.970 billion, with Europe being the region that benefited the most, capturing 34% of the UK's LCC revenue (£1,023 million). North America accounted for £671 million (23% of total benefits), and the Asia-Pacific region contributed 14%, equivalent to £428 million. London StanstedAirport's revenue primarily derived from aviation (44% of total revenue), with retail andcar parking contributing 21% and 22%, respectively.

These facts indicate that the Heathrow Airport and London Stansted Airport hold significant importance in the aviation landscape. Heathrow Airport, located in London, is not only the busiest airport in the UK but also one of the busiest airports in the world. Its strategic location and extensive flight network make it a vital global transportation hub. Heathrow Airport serves as a critical gateway for international travel, connecting passengers from all corners of the globe to various destinations in the UK and beyond. It accommodates a wide range of airlines, including full-service carriers as well as LCCs, allowing for diverse travel options and competitive fares. Heathrow Airport's significance extends beyond passenger traffic. It also plays a crucial role in facilitating air cargo operations, serving as a major freight hub for the movement of goods and enhancing global trade connections. With extensiveinfrastructure and services, including multiple terminals, efficient ground transportation,and world-class amenities, Heathrow Airport offers a seamless travel experience for millions of passengers each year.

London Stansted Airport, located northeast of London, serves as another important airport in the UK's aviation landscape. While not as large as Heathrow, Stansted Airport has its unique significance. It is known for catering to LCCs and has become a preferred choice for budget-conscious travelers seekingaffordable air travel options. The presence of LCCs at Stansted Airport contributes to increased accessibility and affordability, enabling a broader range of passengers to explore domestic, European, and even transatlantic destinations. Stansted Airport's geographical location makes it an attractive option for travelers residing in or around the London area, as well as those from neighboring regions. The airport's infrastructure is designed to handle a substantial passenger capacity efficiently, ensuring smooth operations and a streamlined travel experience. Additionally, Stansted Airport offers various transportation links, including train and coach services, providing convenient connectivity to London and other parts of the UK.

LCCs have achieved remarkable success worldwide and have become a vital driver of economic growth and expansion in air transportation (Choo & Oum, 2013; Azadian & Vasigh, 2019; Truong et al., 2020; Lim & Lee, 2020; Avogadro et al., 2021; Soelasih & Sumani, 2021). Europe, with its numerous tourist destinations and islands, is embraced the LCC concept and serves as a developed marketplace for LCC operations (Bubalo & Gaggero, 2015). The price-conscious nature of a significant portion of passengers in the region, coupled with the supportive aviationpolicies of the European Union Aviation Safety Agency (EASA), has facilitated the integration of LCCs in Western Europe, including the busiest airport, Heathrow Airport London, and the dominant LCC airport, London Stansted Airport. LCCs have experienced a significant growth of nearly 20% in the European market over the past decade, and they currently hold 44.5% of the total seat capacity in the region (Figure 1.1).

Table 1.1 Market Share of LCCs in Europe

Years	Market share in percentage
2001	5.30%
2002	7.40%
2003	10.20%
2004	11.50%
2005	14.40%
2006	16.90%
2007	20.30%
2008	22.50%
2009	24.00%
2010	24.90%
2011	25.70%
2012	27.40%
2013	28.20%
2014	29.90%
2015	31.60%
2016	33.30%

2017	34.90%
2018	36.50%
2019	37.30%
2020	44.50%

Note: This table shows the annual growth from year 2001 to 2020 in market share of LCCs in Europe.
Source: Statista 2022

According to Fairey (1930), the Heathrow Airport origins back to 1930 when British aeronautical engineer and aircraft manufacturer Richard Fairey acquired a 150-acre area in Harmondsworth for the construction of a private airport dedicated to aircraft assembly and testing. Initially known as Fairey's Great West Aerodrome, the airport featured a single grass runway and a few hastily built structures. During World War II, the government requisitioned the land, including the Great West Aerodrome, to establish RAF Heston, a base for long-range troop-carrying planes bound for the Far East. The longest runway, measuring 3,000 yards in length and 100 yards in width, was laid out in a "Star of David" pattern, and a control tower in the style of the RAF was constructed.

Following the war, the RAF no longer required an additional aerodrome, and on January 1, 1946, the Air Ministry officially took over the site, transforming it into London's new municipal airport. The inaugural flight from Heathrow was made by a modified Lancaster bomber named Starlight, destined for Buenos Aires. In the early days, passenger terminals consisted of former military tents along Bath Road, featuring comfortable seating, armchairs with floral prints, and small tables adorned with flower-filled vases. Passengers navigated wooden duckboards to reach the aircraft parked on the apron, protecting their shoes from the muddy airfield. Although the marquees lacked heating and could get quite cold during winter, their walls were taken down in summer to allow a refreshing breeze. By the end of its first year of operation, Heathrow had welcomed 63,000 passengers. The number increased to 796,000 by 1951, prompting the selection of British architect Frederick Gibberd to design permanent structures for the airport, including a central area connected by a "vehicular subway" beneath the original main runway. Gibberd's vision centered around a 122-foot-tall control tower.

During World War II, Stansted Airport served as a base for the Royal Air Force and was later converted into a supply and storage facility to support aircraft on the continent. It eventually became an international bomber base. After the war, Stansted functioned as a maintenance facility and a prison for German POWs.

Commercial flights began operating from Stansted in 1966, primarily serving airlines seeking to avoid the high operating costs of Heathrow and Gatwick. The government planned to establish Stansted as "London's third airport" to alleviate congestion at the other airports. Throughout the 1980s and 1990s, airlines at Stansted gradually expanded their destination offerings. The airport underwent capacity regulations in 1984, setting the annual passenger limit at 25 million. Since 2000, Stansted Airport has experienced consistent growth, with a higher number of flights andcontinuous improvements in services, including parking options. The Stansted Long Stay and Stansted Mid Stay parking facilities are part of the airport's parking system. Presently, Stansted Airport is the third busiest airport in the United Kingdom, serving asthe primary hub for Ryanair and offering domestic and international connections (Stansted Airport Limited, 2023).

1.2 Research Gap

The research gap in this study lies in the limited exploration of LCCs' implications for major European airports, specifically focusing on the comparison between Heathrow Airport London and London Stansted Airport. Existing literature primarily focuses on the overall impact of LCCs on tourism and economic growth, without specific attention to the dynamics and factors influencing LCC dominance at different airports.

1.3 Problem Statement

The entry of LCCs into London airports has transformed the aviation landscape, impacting various stakeholders and the overall air travel industry. Understanding the implications of LCC penetration in these airports, specifically Heathrow Airport London and London Stansted Airport, is crucial for assessing the effects on market dynamics, passenger preferences, and economic factors. Therefore, it is important to investigate and analyze the implications of LCCs in these airports to gaininsights into the changing dynamics of the airline industry.

1.4 Research Objectives

By addressing the following objectives, the study aims to contribute to the existing literature on LCCs and enhance understanding of their effects on major Europeanairports.

1. To assess the historical trends and changes in LCC air trafficat London Stansted Airport and Heathrow Airport in London.
2. To investigate the factors contributing to the prevalence of LCCs at London Stansted Airport compared to Heathrow Airport in London.
3. To evaluate the tourism and economic implications of low-cost flights at Heathrow Airport and London Stansted Airport, employing a cost and benefit analysis methodology.

1.5 Significance of the Study

The significance of this study lies in its contribution to understanding the implications of LCCs on major European airports, with a specific focus on Heathrow Airport London and London Stansted Airport. By examining the historical evolution of LCCs' air traffic and evaluating the economic impacts of low- cost flights on these airports, valuable insights can be gained.

Firstly, the findings of this study provide a better understanding of the factors influencing LCC dominance at different airports to airport authorities. This knowledge can aid in infrastructure development and planning, allowing airports to cater more effectively to the needs of LCCs and enhance their competitiveness.

Secondly, policymakers and stakeholders in the airline industry can take benefit from the insights into the economic impacts of LCCs on these major European airports. This understanding can inform decision-making processes related to pricing strategies, marketing efforts, and resource allocation, ultimately maximizing the benefits derived from LCC operations.

Overall, the study's significance lies in its potential to inform strategic decisions, improve airport performance, and facilitate the sustainable growth of LCC operations within the European aviation market.

1.6 Organization of the Study

The study is divided into five chapters, each serving a specific purpose. This division provides a clear structure to the research, allowing for organized presentation and analysis of the research process and outcomes.

Chapter 01

This chapter serves as an introduction to the research study, providing background information, identifying the research gap, stating the problem to be addressed, emphasizing the significance of the study, and outlining the objectives.

Chapter 02

This chapter holds significant importance as it focuses on the extensive body of research conducted in the recent past. It serves as a comprehensive overview of the studies carried out by scholars worldwide, shedding light on their contributions and findings.

Chapter 03

This chapter covers variables and elaborate the methodology. This chapter also describe the data collection for the study and data sources.

Chapter 04

In this chapter, the focus is on presenting a summary of the results obtained through the application of the chosen methodology on the data sets. The chapter aims to provide an overview of the outcomes and findings derived from the research or analysis conducted.

Chapter 05

This section of the study encompasses the comprehensive conclusion, recommendations, and policy implications derived from the research. It additionally outlines potential avenues for future studies and highlights the limitations.

Chapter 2. Literature Review

Since the 1920s, the air transportation industry has undergone significant transformations, with one of the most notable periods being the deregulation of the air industry in the United States during the 1970s. This momentous shift marked a departure from heavily regulated markets to a more liberalized environment. Europe, too, experienced a parallel transformation with the deregulation of its airspace, replacing the concept of absolute national airspace control with political and legal structures governing the European airspace. This liberalization policy granted European air carriers thefreedom to operate within Europe, set their own prices, and eliminated capacity restrictions (Crespo & De Leon, 2011).

As a result of deregulation, the emergence and impact of LCCs have become a widely discussed topic in the air transportation industry. Researchers and scholars have examined the effectiveness of LCCs from various perspectives, shedding light on their influence on the economy and tourism. Studies conducted by Alsumairi et al. (2017), and Costa & Ribeiro de Almeida (2018) have contributed valuable insights in this regard.

Before evaluating the LCC model in the airline industry, it is important to understand the concept and mechanics of LCCs. LCCs are airlines that operate with a cost-focused business model, emphasizing efficiency and cost minimization. They typically offer no-frills services, charging separately for additional amenities such as baggage, in-flight meals, and seat selection. LCCs often operate point-to-point routes, focusing on high-demand destinations and secondary airports to reduce costs. Their pricing strategies are dynamic and responsive to market conditions, allowing them to offer competitive fares.

The impact of LCCs on the air transportation industry has been multifaceted. They have increased market competition, providing consumers with more affordable travel options and stimulating demand. LCCs have contributed to the growth of tourism by making air travel more accessible to a wider demographic, including budget- conscious travelers. Additionally, their presence has forced traditional full-service carriers to adapt and refine their strategies to remain competitive.

LCCs operate by minimizing operational expenses, as opposed to providing traditional services included in the fare, resulting in lower ticket prices but fewer amenities for passengers. The reduced operating costs stem from factors such as the exclusion of premium carrier services like food, drinks, and free baggage (Chung & Whang, 2011; Taumoepeau et al., 2017). Instead, LCCs compensate for these lower fares by charging additional fees for services such as luggage, seat allocation, priority boarding, and in-flight meals (Tan, 2016). Lowering expenses is also achieved by strategies like maintaining a fleet with a single aircraft type to reduce maintenance and training costs and engaging in aircraft re-selling and sourcing (Martínez-Garcia et al., 2012; Klophaus et al., 2012; Azadian & Vasigh, 2019).

The low-cost model has become a prominent corporate strategy adopted by many low-cost airlines (Hunter, 2006; Lordan, 2014; Pan & Truong, 2018). It originatedwith Southwest Airlines, a U.S.-based company that aimed to minimize various costs typically associated with commercial airlines (Knorr & Arndt, 2018; Ren, 2020). Key characteristics of the low-cost model were outlined by Francis et al. (2006). These features include point-to-point services, flexible working conditions for staff, payment for onboard refreshments, no seat allocation, e-ticketing, short turnaround times, single-class seating, minimal cabin crew, utilization of secondary airports, and high aircraft utilization. Ribeiro de Almeida & Costa (2017) conducted an analysis of the dynamics of the LCC business model, examining its evolution through official documents and published journals. They found that the business model of LCCs has undergone readjustments and changes over time. ELFAA et al. (2007) also emphasized how these factors contribute to cost reduction within the low-cost model. The key characteristics of the low-cost model are summarized in a table 1.1 based on the works of Graham & Shah (2008) and ELFAA et al. (2007).

Table 2.1 Low-cost model characteristics

Characteristic	Advantages
Modern aircraft fleet, a single type	Better crew utilization, fuel efficiency, lower training and maintenance costs
Point-to-point services	No transfers, generalization of network organization
Extra charges	Generating additional earnings, enabling price transparency and standard low fares.
Single class cabin	Higher seat density and reduced costs related to cabin crew
Price Sensitivity	LCCs provide a shield to the customers who are more price sensitive
Use of the internet to direct the sale of tickets	No selling middleman, reduction in costs linked with sales of tickets
Secondary airport uses	Less waiting time, less congestion, and fewer airport charges
No or few frills onboard	Reduction in the costs associated with onboard services
Normal ground facilities	No costs for premium services, for example, no airbridges
No freight	There are no extra personal and handling costs
Capacity seating high level	Fewer flights are needed, capable to accommodate more travelers
Short turnaround times	More flights possible, higher customer capacity, and higher aircraft utilization
Highly motivated labor force	Minimum crew, high productivity.

Note: This table presents the common characteristics of the LCCs and their advantages.

Source: (ELFAA et al., 2007; Graham & Shaw, 2008; Han et al., 2019; Loh et al., 2020; Soyk et al., 2021)

To maximize profits, LCCs often form partnerships with externalservices such as rental car contracts and involvement in hotel bookings. One intriguing example is Ryanair's unique approach of consistently lowering prices at any cost. They introduced a full online check-in service, reducing the need for check-in staff and ultimately lowering ticket fares and associated expenses. Additional revenue is generated through online services, including fees for online check-in, priority boarding, credit card payments, and checked baggage.

Companies like Ryanair have devised various methods to extract more money from travelers, including proposed charges for in-flight restroom usage, higher fares for overweight passengers, and the introduction of standing-only options on short routes at lower prices. According to Uittenbogaard (2009), the possibilities for reducing business costs and fares seem boundless.

Scholars emphasize that the LCC business model extends beyond low fares and incorporates the selection of airports and routes. While it is commonly believed that LCCs prefer secondary airports due to lower operating costs, Barret (2004) highlights that restricted access to international airports is the result of exclusive rights held by flag carriers in terms of gate and slot priority. These exclusive rights pose challenges fornew entrants in the low-cost airline market.

Dobruszkes (2006) contributes to the LCC literature by suggesting that these companies seek niche opportunities in Europe's airline network to compete against well-established full-service carriers. Consequently, LCCs focus on serving regional towns that are underserved or bypassed by major networks, allowing them to avoid direct competition and areas well-served by high-speed trains. In Europe, there are several underutilized secondary airports willing to consider proposals from any airline seeking survival, providing LCCs with flexibility to shift operations when faced with rejections from one airport (Gillen & Lall, 2004; Dobruszkes, 2006).

Diaconu (2012) identifies three major factors associated with the emergence of the LCC business model in Europe. Firstly, air transport is a cyclical sector linked to economic cycles, as noted by Hatty & Hollmeir (2003). Secondly, the high prices in the airline industry constrain a significant portion of the European population, as emphasized by Flouris (2007). Thirdly, the series of airline industry deregulations, as described by Gillen & Gados (2008), has facilitated the growth of new services and the development of airlines such as LCCs. Diaconu (2012) asserts that among these factors, airline deregulation has been the most crucial catalyst for the emergence of LCCs in the European airline industry. Dziwulski (2021) states that while individual airline business models may differ, several common characteristics define the low-cost business model and what LCCs represent.

Scholars have developed the cost and benefit analysis as a crucial tool for evaluating the balance between costs and benefits in project proposals (Bazargan et al., 2013; Anuar & Sabar, 2018). A cost-benefit analysis (CBA) is employed to measure the benefits derived from a decision or action, while considering the associated costs (Mishan & Quah, 2020). This analysis encompasses measurable financial factors suchas cost savings and income generated as a result of project choices. By comparing the benefits and costs, the viability of a project or action can be determined (Mishan & Quah, 2020).

In the airline industry, cost and benefit analysis serves the purpose of assessing various aspects of a project, such as airfares, seat capacity, luggage limits, e-ticketing facility, cabin crew, aircraft utilization, number of emergency landings, and accidents (Adler et al., 2010; Stewart & Mueller, 2014; Schofield, 2018). These analyses provide airline companies with options and aid in identifying the most effective approaches to achieve their business objectives while optimizing investments (Adler et al., 2010; Stewart & Mueller, 2014; Schofield, 2018).

Ali (2021) highlights two primary uses of CBA in the airport industry. Firstly, it determines the feasibility, justification, and soundness of airline projects by assessing whether their benefits outweigh the associated costs. Secondly, it establishes a benchmark for comparing different projects, identifying those with greater benefits relative to costs. Furthermore, efficient utilization of CBA analysis in the airline industry can contribute to maximizing profits and minimizing risks for both specific projects and overall airline organizations (Stobierski, 2019).

From a business perspective, a cost-benefit analysis involves comparing projected or estimated costs and benefits associated with a project decision to ascertain its viability (Stobierski, 2019). Essentially, CBA evaluates the social and economic impacts of a particular investment and facilitates the examination of the feasibility of private or public investment projects. This assessment is conducted by quantifying the monetary values of the benefits and costs to society, thereby enabling a comprehensive understanding of the project's impact on the economy (Costa & Ribeiro de Almeida, 2018).

Costa & Ribeiro de Almeida (2018) conducted a study that examined the evolution of LCCs air traffic at "Francisco Sá Carneiro Airport" in Oporto, Portugal, and its regional economic impact on the airport area. They utilized thecost and benefit analysis technique to evaluate the effects of LCC carriers and their interaction with the tourism industry. In another study, Truong et al. (2020) presented an extended Theory of Planned Behavior (TPB) model to investigate how Southeast Asian travelers' internal behavioral considerations and external stimuli influence their purchasing behavior and actual purchase of LCC tickets. The findings emphasized the significance of perceived behavioral control, passengers' attitudes, and social norms in shaping LCC passengers' buying behavior. Additionally, clear evidence of the price effect on LCC passenger behavior was observed in the United States and Europe (Truong et al., 2020).The deregulation policy had a significant impact by giving rise to a new breed ofstartups in the airline industry known as LCCs. LCCs revolutionized the traditional business model by focusing on cost reduction and providing no-frills services. These airlines targeted price-sensitive passengers who werewilling to sacrifice certain amenities for lower fares. The concept of LCCs originated from Southwest Airlines in the US during the 1970s, while Freddie Laker introduced the concept in Europe with no-frills flights from London's Gatwick airport to New York's JFK in 1977. In Europe, LCCs primarily cut costs by increasing seat density and operating in secondary or less congested airports.

The emergence of LCCs prompted numerous researchers to study their effectiveness and impact on the airline industry. Notably, Bubalo & Gaggero (2015) found that LCCs contributed to improved service quality and positively influenced airport operations. Similar results were reported by Bendinelliet et al. (2016). Dobruszkes et al. (2017) examined the trend of LCCs shifting from secondary airports to primary city airports in the European and US markets. Other studies (O'Connell & Williams, 2005; Han & Hwang, 2017) highlighted the intensified competition between full-service carriers and LCCs in the global air travel market. Survey-based studies (O'Connell & Williams, 2005; Chiou & Chen, 2010; Ahn & Lee, 2011; Rajaguru, 2016;Koklic et al., 2017) demonstrated significant differences in customer perceptions of airline service quality between LCCs and other carriers.

Bitzan & Peoples (2010) conducted a comparative statistical analysis of costchanges among different types of airlines. They found that from 1993 to 2010, LCCs achieved an 11% cost reduction, full-service carriers reduced costs by 17%, andother carriers (such as charter or regional airlines) reduced costs by 8%. The costreduction for LCCs resulted from lower input prices, while productivitygains were attributed to increased stage length and load factors. The cost reduction for other carriers was due to unexplained technical changes. The study also highlighted thenontrivial productivity gains of full-service carriers, which were also driven byincreased stage length and load factors. Ahmad & Khan (2011) conducted acomprehensive study on different South Asian airlines and concluded that airlineindustry productivity plays a crucial role in a country's economic growth. Similarfindings were reported by Muthusamy & Kalpana (2018) for the Indian airline industry. Despite the existing body of empirical literature on LCCs, there are still areas thatrequire further exploration. To address these gaps, our study aims to conductcomparative research using a cost and benefit analysis approach on two major airportsin the European market. We will delve into various novelaspects and research areas tocontribute to the existing literature on LCCs. For example, we will explore the historicalevolution of LCCs at the selected airports and examine the impact of their operations on tourism and employment generation. Furthermore, we will investigate the factors influencing passengers and organizations in choosing to travel with or adopt LCCs, as well as why LCCs dominate in certain airports but not in others.

Chapter 3. Data and Methodology

3.1 Data and Variables

To accomplish the predetermined research goals and analyze the cost and benefit of operations by LCCs at Heathrow Airport in London and London Stansted Airport, we rely on secondary data gathered from various sources. These sources encompass the Civil Aviation Authority (CAA), Statista, CAPA Centrefor Aviation, RDC Aviation, and Low-cost Monitors. The CAA website serves as a valuable resource, providing UK airport statistics, data, and reports concerning the development of air traffic across the United Kingdom. The table 3.1 indicates the variables used in this study and their sources for data collection.

Table 3.1 Variable and data collection sources

Variables	Sources
Percentage of LCC seats Heathrow's Airport	CAPA Centre for Aviation
Percentage of LCC seats London Stansted Airport	CAPA Centre for Aviation
Number of Passengers Travel through Heathrow's Airport	Traffic and passenger statistics https://www.heathrow.com/company/about-heathrow/performance/airport-operations/traffic-statistics
Number of Passengers Travel through London Stansted Airport	Facts and figures https://www.stanstedairport.com/about-us/london-stansted-airport-and-mag/facts-and-figures/

Note: This table show the variables used in this study and their data collection sources.

An analysis was conducted to examine the economic implications of LCCs operating at Heathrow and London Stansted airports. This investigation utilize data from Heathrow Airport, London Stansted Airport, and the CAPA Centre for Aviation, which is a global provider of aviation market intelligence.

The CAPA Centre for Aviation present valuable information on LCC seat percentages at Heathrow and London Stansted, allowing for the assessment of LCC market share at these airports and its impact on the overall economic effect. Heathrow Airport provide specific data on airline and destination-specific traffic, as well as passenger information. This data plays a crucial role in determining the influence of

LCCs on passenger volume at Heathrow Airport. Additionally, the list of LCC destinations at Heathrow aid in evaluating the economic gains resulting from LCC operations. London Stansted Airport contributed statistics on passenger traffic, airline movements, and cargo throughput, which aid in understanding the effect of LCCs on passenger volume and airline activities at the airport. Furthermore, the cargo throughout serves as a crucial factor in determining the economic impact of LCCs, as it relates to airport operations.

An economic analysis of LCCs at Heathrow and London Stansted airports is conducted based on the aforementioned data sources. The study also examines the economic impact of LCCs at various airports. However, it should be noted that the benefits derived from LCC operations need to be weighed against their environmental and social costs. Although LCCs contribute to tourism turnover, they also incur environmental losses, including climate change, soil and water degradation, air pollution, and biodiversity decline. Additionally, societal costs such as noise pollution, urban effects, and accidents are associated with LCC operations. Despite incurring higher economic costs, LCC operations at London Stansted Airport resulted in greater economic welfare and tourism turnover compared to Heathrow Airport. The higher passenger volume at London Stansted contribute to its superior economic gains per passenger.

The data provided by the CAPA Centre for Aviation, Heathrow Airport, and London Stansted Airport offer valuable insights into the economic benefits and costs associated with LCC operations at these airports. It is evident from this research that LCCs provide substantial economic benefits but also pose environmental and social challenges. Policymakers and industry stakeholders should consider this information when making decisions regarding LCC operations at airports.

3.2 Data Analysis

The statistical tool is used to analyze the secondary data and conduct the cost and benefit analysis. Excel is a multi-purpose statistical software use for data visualization, manipulation, statistics, and automated reporting.

3.3 Methodology

3.2.1 Cost and Benefit Analysis (CBA)

This study utilizes the Cost and Benefit Analysis (CBA) approach to assess investments from a socioeconomic standpoint, specifically examining the net economic impact of a project. According to Stobierski (2019), a cost-benefit analysis involves comparing the projected or estimated costs and benefits or opportunities associated with a project decision to determine its viability from a business perspective. In essence, CBA evaluates the social and economic consequences of a particular investment, enabling the examination of feasibility for both private and public projects. This evaluation takes into account the welfare of the region or economy by summing the monetary values of benefits and costs to society. An important aspect of this techniqueis that the assessmentshould be conducted in monetary terms, allowing for the measurement of a project's impact on the economy (Costa & Almeida, 2018).

Drawing upon the economic theory of welfare, this methodology has a long history of use by researchers and policymakers. For instance, it is employed in the evaluation of infrastructure in 19th century France (Pearce et al., 2006). Based on the basic principles of economics, Pareto introduced a criterion suggesting that social improvement occurs when at least one person in society becomes better off without making someone else worse off. This criterion is known as the Pareto criterion of economic welfare. Over time, researchers expand upon this criterion and developed new theories and criteria, such as the Hicks criterion and Kaldor criterion. According to Costa and Ribeiro de Almeida (2018, p.11), these theories "established the principle of compensation based on the concept of hypothetical compensation, whereby the benefits should exceed the costs—a rule that guides decision-making and project evaluations."

The Kaldor-Hicks principle serves as the foundation of CBA analysis, implying that any new policy or project should generate positive net welfare, which entails maximizing benefits over costs. The regional economic impacts of a policy or project can be categorized into three types: 1) direct effects, 2) indirect effects, and 3) induced effects. In the context of our study, direct effects refer to the outcomes directly associated with increased job opportunities in air transport. Indirect effects involve the generation of new economic activities and jobs in the region due to increased passenger traffic, while induced effects encompass the stimulation of tourism and attraction of incoming investments as a result of the consumption patterns of direct and indirect workers. In other words, induced effects have multiplier impacts on the regional economy through the interplay of direct and indirect effects (Macario et al., 2007).

This study employs the CBA analysis technique to quantify these three effects on the economy resulting from the operations of LCCs at London's Heathrow Airport and London Stansted Airport. Numerous scholars have used this research technique in various studies from different perspectives. For example, Donzelli(2010) employed it to quantify the economic welfare generated by LCCs in southern Italy, while Costa and Ribeiro de Almeida (2018) applied it to Oporto Airport in Portugal. These scholars assert that LCCs play a crucial role in regional economic development through tourism and the creation of new employment opportunities. Following the study of Costa and Almeida (2018), the benefits of additional employment, the direct, indirect, and induced employment resulting from LCCs' traffic at Heathrow Airport and London Stansted Airport is estimated using the following equations:

$$New\ Air\ Traffic = PD_{LCCS} + NT_{LCCS} \tag{1}$$

$$Direct\ Effect\ (D) = NT \times\ TE_{LCCS} \tag{2}$$

$$Indirect\ Effect\ (E) = \delta D \tag{3}$$

$$Induced\ Effect\ (N) = \alpha\ (D + \delta D) \tag{4}$$

$$Total\ Effect = Direct + Indirect + Induced \tag{5}$$

$$Total\ Effect = D + \delta D + (\mathrm{D}\ +\ \delta\mathrm{D}) \tag{6}$$

$$Total\ Effect = 1 + \delta + \alpha\ \ +\ \alpha\delta) \tag{7}$$

Suppose $(1 + \delta + \alpha +\ \alpha\delta)$ as:

$$Total\ Effect = \beta D \tag{8}$$

$$R = Total\ Effect \times W \tag{9}$$

Where PD_{LCCS} represents the landed passengers by LCCs carriers, NT_{LCCS} is the percentage of new traffic produced by the LCCs carries, TE_{LCCS} is the employment rate by LCCs operators, δ denotes the multiplier direct effect on employment, α is the multiplier induced effect on employment, $\beta$is the multiplier of the liberalization of air transport, and W is the average annual wage. The choice of these specific multipliers is based on economic impact studies that seek to estimate the broader effects of a specific economic activity, such as airport operations, on the local economy. These multipliers are used to account for the indirect and induced economic impacts beyond the direct impacts of the activity. The employment impact can be categorized into three distinct effects: direct, indirect, and induced. To exemplify the direct employment impact stemming from the growth in Low-Cost Carrier (LCC) traffic, we take Ryanair's employment rates in 2005 and 2012, which were 0.09 employees per 1000 passengers and 0.11 employees per 1000 passengers, respectively. For the indirect effect, we apply a multiplier of 0.40, signifying the broader economic impact beyond direct employment. As for the induced effect, a multiplier of 7 is employed, reflecting the induced economic activity triggered by the initial employment growth. It's worth noting that these multipliers were originally derived from estimations made by ACI and York Aviation in their 2004 study for Valencia Airport (ACI and York Aviation,2004). To evaluate the impact on tourism sector turnover, this study analyzes the amount spent by the LCCs tourists who landed and stayed in the selected airports by using the following equations:

$$Total\ Tourists\ by\ LCCs = T\ = PD_{LCCS} + NT_{LCCS} \tag{10}$$

$$Effect\ on\ Tourism = g\ \times n \times T \tag{11}$$

$$Benefits\ Generated\ by\ LCCs = B = R + Effect\ on\ Tourism \tag{12}$$

Where NT_{LCCS} denotes the percent of new tourist traffic produced by LCCs, T is the total tourists landed by LCCs, g represents the average spending of tourists per stay, and n is the number of nights per stay. In equation 12, R is the income earned by the employment generated. So far, we provide theoretical and mathematical explanations of how we can calculate the benefits produced by the LCCs carriers in selected airports. Air transport always comes with negative externalities in terms of noise pollution and climate change. This study considers the different negative externalities associated with the inflow of LCCs operations which includes impact on landscape and nature, upstream and downstream impacts, noise pollution, climate change, air pollution, and the number of accidents. These costs are calculated with the use of the following equation:

$$C =\ PD_{LCCs}\ \times\ Km_{LCCs} \tag{13}$$

Where C represents the passengers transported per km cost and Km_{LCCs} is the length of a trip by LCCs. According to the basics of CBA analysis, the net impact of any project are policy can be calculated with the difference between benefits and costs. In our case, we calculate the net impact as the difference between LCCs associated benefits and costs at the selected airports which can help to understand the social welfare produced by the LCCs carriers.

$$BE = B - C \tag{14}$$

Where BE denotes the welfare produced by LCCs carriers.

This study focuses on quantifying the negative externalities associated with LCC airlines. It takes into account various detrimental effects caused by LCC operations, including accidents, air pollution, climate change, noise pollution, urbanization effects, loss of biodiversity, soil and water pollution, as well as upstream and downstream effects.

To conduct this assessment, the study relies on estimates provided by Delft and Infras (2011), which specifically analyzed the year 2008. These estimates serve as a foundation for evaluating the potential costs associated with LCC externalities. However, it is important to note that the study acknowledges the possibility of higher estimated costs, which have been adjusted to reflect the total recorded for the UK in 2017 and 2018 are €94.10 and €99.75 per 1,000 passengers per kilometer, respectively.

In order to establish a baseline for the analysis, the study considers the average cost for the year 2008. For subsequent years, the cost values are updated by applying an annual growth rate of 6%. This growth rate is determined based on the general criteria recommended by the European Commission for cohesion countries, as outlined in their 2008 guidelines (European Commission, 2008).

The table 4.1 report the negative externalities associated with air transport in 2017 and 2018 reveals interesting insights into the costs incurred per 1000 passenger- kilometer across various factors. In details, noise pollution, a well-known consequence of air transport operations, accounted for additional costs. Noise can be defined as the unwanted sound or sounds of duration, intensity or other quality that causes physical or psychological harm to humans.

General approach and overview of cost estimation. To estimate the average noise costs for the various modes we use a bottom-up approach, which consists of three steps.

1. Estimation of the number of people affected by noise per aircraft. Based on information from the noise maps member States to the European Commission, the number of people affected aviation noise is estimated by the number of people affected by air noise have been based on major civil airport ≥ 50,000 movements per year.
2. Estimation of total noise costs by multiplying the number of people affected by the noise costs per person exposed.

3. Calculation of the average noise costs by allocating the total noise costs to the Aviation mode by using specific weighting factors

In 2017, the cost per 1000 passenger-kilometer due to noise was €1.69, which saw a marginal rise to €1.79 in 2018. These costs reflect the negative impact of aircraft noise on local communities and the measures needed to mitigate its effects.

Climate change, a significant global concern, demonstrated considerable costs related to air transport. The total greenhouse gas (GHG) emissions in Europe are caused by transport (European Commission, 2010b). These emissions contribute to global warming resulting in various effects like sea level rise, agricultural impacts (due to changes in temperatures and rainfall), health impacts (increase in heat stress, reduction in cold stress, expansion of areas amenable to parasitic and vector borne disease burdens (e.g., malaria, etc.), ecosystems and biodiversity impacts, increase in extreme weather effects, etc.

The main greenhouse gases with respect to transport are carbon dioxide (CO2), nitrous oxide (N2O) and methane (CH4). To a smaller extent emissions of refrigerants (hydrofluorocarbons) from Mobile Air Conditioners also contribute to global warming. However, in this study the latter emissions are not taken into account. In the case of aviation also other aircraft emissions (water vapour, sulphate, soot aerosols and nitrous oxides) at high altitude have an impact on global warming and included in this study.

General approach and overview of cost estimation

The general approach of estimating the average climate change costs for various transport modes consist of four steps.

- Assess total GHG emissions.
- Calculate total CO2 equivalent GHG emissions using Global Warming Potentials.
- Multiplication of the total tonnes of CO2 equivalent greenhouse gas emission by an external cost factor expressed in €/tonne to estimate total external costs related to global warming.
- Calculate the average climate change costs (per tkm/pkm) by dividing the total costs by the number of tkm/pkm.

In 2017, the cost per 1000 passenger-kilometer associated with climate change was €75.86, increasing to €80.41 in 2018. These costs encompass the emissions of greenhouse gases from aircraft operations and the subsequent environmental impact, highlighting the need for sustainable practices in the aviation industry.

While no specific costs were reported for urban effects or soil and water pollution upstream in both years, it is important to acknowledge their potential significance in terms of environmental degradation and the associated costs that may arise in the future. Transportation can have negative effects on soil and water quality near transport infrastructure. These effects mainly result from the release of heavy metals and polycyclic aromatic hydrocarbons (PAH), which can lead to costs such as damage to plants, reduced soil fertility, contamination of drinking water (posing a threat to human health), and harm to wildlife habitats. Estimating the costs of these damages is challenging due to the complex relationship between infrastructure use and soil/water pollution.

To estimate the effects of soil and water pollution, The practical approach is used which is based on the cost of repairs. This approach involves two steps:

1. Estimating the total area of land affected by soil and water pollution. We assume that the area impacted by these types of pollution is equal to the space required for the transport infrastructure plus a 5-meter buffer zone on both sides. Assuming a pollution depth of 20 centimetres, we can calculate the total volume of soil affected.
2. Estimating the costs associated with soil and water pollution by multiplying the total affected land area by an external cost factor expressed in euros per cubic meter (€/m3).

Biodiversity losses can occur in two main ways:

1. Airborne emissions contribute to the eutrophication and acidification of natural ecosystems, resulting in negative impacts on biodiversity.
2. The construction of transport infrastructure leads to changes in land use and habitat fragmentation, further contributing to biodiversity loss.

Within the framework of NEEDS (New Energy Externalities Development for Sustainability), the external cost associated with biodiversity losses caused by transportation activities has been thoroughly analyzed and quantified (NEEDS, 2006). In this study, the adverse effects of air pollutants on biodiversity are measured using dose-response relationships, which are then used to determine the "Potentially Disappeared Fraction" (PDF) of species. The PDF represents the proportion of species that have a high probability of no longer existing in a specific region due to unfavorable conditions caused by acidification and eutrophication. To evaluate the monetary value of this impact, the PDF of species is assessed using a restoration cost approach, which estimates the cost of converting acidified and eutrophic land back to its natural state with high biodiversity. The NEEDS project provides cost factors for biodiversity losses caused by airborne emissions in Euro per ton of air pollutants (SOx, NOx, NH3) for all EU-27 countries.

In the present study, these cost factors are utilized to calculate the biodiversity losses resulting from airborne emissions in the transport sector. The cost factors simply need to be adjusted and multiplied by the total emissions of the corresponding pollutants. Since NH3 (ammonia) is not relevant in the context of transportation, the calculation can focus on nitrogen oxide (NOx) and sulphur dioxide (SO2) emissions. It's important to note that the cost of biodiversity losses is additional to the costs associated with air pollutants. The total external cost of air pollution comprises both of these cost aspects.

Biodiversity losses, another critical aspect, incurred costs of €0.17 and €0.18 per 1000 passenger-kilometer in 2017 and 2018, respectively. These costs represent the negative impact of air transport on local ecosystems and the potential loss of biodiversity as a result.

Transport infrastructure has negative effects on nature and landscapes. It leads to the covering of natural areas, resulting in the loss of ecosystems. This loss of natural habitats and fragmentation of habitats contributes to a decline in biodiversity. Since there is no established method for calculating the costs of this damage, this study adoptsa repair cost approach.

Within this study, two cost elements are considered:

1. Unsealing costs: To repair and compensate for the damage caused by transport infrastructure to nature and landscapes, the sealed areas of the infrastructure need to be restored to their natural state.

2. Restoration costs of target biotopes/ecosystems: After the unsealing process, the affected areas need to be restored to ensure the reestablishment of the initial ecosystems or biotopes.

Nature and landscape degradation also resulted in costs. In 2017, the cost per 1000 passenger-kilometer attributed to this factor was €1.01, which slightly increased to €1.07 in 2018. These costs highlight the adverse effects of air transport on natural landscapes, such as deforestation, habitat destruction, and alteration of scenic areas.

Accidents in air transport contribute significantly to the overall external costs. To estimate accident costs in air transport, average data from the years 2002-2008 provided by EUROSTAT are used. However, the data used do not include injuries, and there is also no distinction made between accidents in passenger and freight transport due to insufficient data availability. Accidents, though infrequent, carry their own costs. In 2017, accidents incurred a cost of €0.84 per 1000 passenger-kilometer, which rose to €0.90 in 2018. These costs encompass the financial and environmental repercussions of air transport accidents, including damages to infrastructure, potential injuries or fatalities, and environmental remediation efforts.

When considering the cumulative impact of these negative externalities, the total cost per 1000 passenger-kilometer amounted to €94.10 in 2017 and increased to €99.75 in 2018. These figures encompass the combined costs of upstream and downstream effects, noise pollution, climate change, biodiversity losses, nature and landscape degradation, and accidents.

The detailed analysis of these costs underscores the need for policymakers, industry stakeholders, and environmental advocates to prioritize sustainable practices and develop strategies to mitigate the negative impacts of air transport. By considering and addressing these external costs, it becomes possible to foster a more sustainable and environmentally conscious aviation sector.

Table 4.1 Negative externalities of air transport in UK for 2017 and 2018

Cost	**Cost Per/1000 passenger-kilometer**		**Cost**	**Cost Per/1000 passenger-kilometer**	
	2017	**2018**		**2017**	**2018**

Upstream and downstream	€ 13.01	€ 13.79	**Noise**	€ 1.69	€ 1.79
Climate change	€ 75.86	€ 80.41	**Urban effects**	€ 0.00	€ 0.00
Soil and water pollution Upstream	€ 0.00	€ 0.00	**Biodiversity losses**	€ 0.17	€ 0.18
Nature and landscape	€ 1.01	€ 1.07	**Accidents**	€ 0.84	€ 0.90
Air pollution	€ 1.52	€ 1.61	**Total**	€ 94.10	€ 99.75

Note: This table shows the negative externalities of air transport.

Source: Delft and Infras (2011)

Chapter 4. Results and Discussion

Air transport, while connecting people and goods worldwide, also imposes significant environmental and societal costs. A comprehensive cost analysis is conducted in 2018 shed light on the negative externalities of air transport, specifically for LCC airlines. The analysis considers various factors including accidents, air pollution, climate change, noise pollution, urbanization effects, biodiversity loss, soil and water pollution, and upstream and downstream effects. The costs associated with these factors are quantified on a per 1000 passenger-kilometer basis. The Climate change cost is the average associated cost for air transport modes is calculated in four main steps: First, evaluating the total greenhouse gas (GHG) emissions measured in tons. Secondly, determining the total emissions of GHGs in terms of carbon dioxide (CO2) equivalents, by utilizing Global Warming Potentials (GWPs). This involves assigning weights to the climate change impact of other gases like methane (CH4) and nitrous oxide (N2O) relative to the impact of CO2. Third, estimating the overall external costs related to global warming per country by multiplying the total tons of CO2 equivalent emissions with an external cost factor expressed in euros per ton and fourth, calculating the averageclimate change costs (per tonne-kilometer or passenger- kilometer) by dividing the total costs per vehicle type per airport by the number of tonne-kilometers or passenger- kilometers traveled in each airport. The cost of accidents is calculated through the utilization of the top-down approach, whereas the costs associated with noise and air pollution are determined using the bottom-up approach.

4.1 Results

The results in table 4.2 indicate cost-benefit analysis of LCC for Heathrow and London Stansted airports for year 2017. The results indicate that the Heathrow Airport experienced an increase of 46,000 passengers due to the implementation of LCC operations. This resulted in a direct effect of 12 new jobs and an indirect effect of 50 jobs. Additionally, there was an induced effect that created 329 jobs, resulting in a total of 350 jobs created at Heathrow Airport. The increase in income generated by LCC operations at Heathrow was £7,448,000.

London Stansted Airport saw a significant surge in passenger numbers, with an increase of 173,283 attributed to LCC operations. This led to a direct employment effect of 56 jobs, an indirect effect of 78 jobs, and an induced effect of 350 jobs. Overall, London Stansted Airport experienced the creation of 600 jobs. The increase in income generated by LCC operations at London Stansted Airport was £21,278,610.

Moving on to the benefits derived from LCC operations, Heathrow Airport's new traffic accounted for 50,400 passengers in 2017. The number of tourists reached 47,880, with an average expenditure per day of £19 and an average overnight stay of 5 days. As a result, the increase in turnover of tourism amounted to £4,548,600. This represented 28.50% of the overall benefit.

At London Stansted Airport in 2017, the new traffic reached 166,825 passengers, while the number of tourists amounted to 125,119. The average expenditure per day was £18, with an average overnight stay of 4 days. The increase in turnover of tourism at London Stansted Airport was £9,008,564, accounting for 71.50% of the overall benefit.

Combining the benefits of both airports, the total benefits in 2017 were £16,799,419, with Heathrow Airport contributing £4,788,000 (28.50% of the total) and London Stansted Airport contributing £12,011,419 (71.50% of the total). Turning to the costs associated with LCC operations, Heathrow Airport incurred various expenses in 2017. These included upstream and downstream costs (£1,207,854), climate change impacts (£1,288,926), pollution, noise, biodiversity losses, and other factors. The total cost for Heathrow Airport in 2017 amounted to £2,652,089, representing 39.35% of the overall cost.

London Stansted Airport faced higher costs in 2017, including upstream and downstream costs (£1,404,134), climate change impacts (£1,576,666), pollution, noise, biodiversity losses, and other factors. The total cost for London Stansted Airport in 2017 was £4,086,926, accounting for 60.65% of the overall cost. Combining the costs of both airports, the total cost in 2017 was £6,739,015. Analyzing the economic welfare generated by LCC operations, Heathrow Airport contributed £2,135,911 (21.23% of the total economic welfare), while London Stansted Airport made a more substantial contribution of £7,924,492 (78.77% of the total economic welfare). Overall, the economic welfare generated by LCC operations in 2017 was £10,060,403.

Assessing the economic welfare generated in the local economy by each passenger, Heathrow Airport contributed £42.38, while London Stansted Airport had a slightly higher value of £47.50. The combined value for both airports was £90.

Table 4.2 Cost-benefit analysis of LCC for Heathrow and London Stansted airports in2017

	Heathrow Airport	**London Stansted Airport**	
Increase in passengers (PDLCC)	46,000	173,283	
Employment			
Direct effect (D)	12	56	
Indirect effect (I)	50	78	
Induced effect (N)	329	350	
Total jobs created (E)	350	600	
Increase in income (R)	£7,448,000	£21,278,610	
	Benefit		
	Heathrow Airport	**London Stansted Airport**	**Total**
New traffic (NT)	50,400	166,825	217,225
Tourists (T)	47,880	125,119	172,999
Average expenditure per day (g) (€)	£19	£18	£37
Average overnight stay (n)	5	4	9
Increase in turnover of tourism (TUR)	**£4,548,600**	**£9,008,564**	**£13,557,164**
Total Benefits	**£4,788,000**	**£12,011,419**	**£16,799,419**
Total Benefits in percentage	**28.50%**	**71.50%**	**100%**
	Cost		
	Heathrow	**London Stansted**	**Total**
Upstream and downstream	£1,207,854	£1,404,134	£2,611,988
Climate change	£1,288,926	£1,576,666	£2,865,592
Soil and water pollution	£4	£23	£27
Nature and landscape	£19,707	£238,520	£258,227
Air pollution	£7,149	£42,092	£49,241
Noise	£80,623	£474,702	£555,324
Urban effects	£4	£23	£27
Biodiversity losses	£12,078	£140,306	£152,384
Accidents	35,744	210,459	246,203
Total Cost	**£2,652,089**	**£4,086,926**	**£6,739,015**

Total cost in percentage (%)	**39.35%**	**60.65%**	**100%**
Economic welfare generated by LCC (BE)	£2,135,911	£7,924,492	£10,060,403
Percent (%)	**21.23%**	**78.77%**	**100%**
Economic welfare generated in local economy by each passenger	42.38	47.50	90

Notes: This table shows the cost and benefit analysis associated with Heathrow Airport and London Stansted Airport for the year 2017
Source: Author

Moving on to 2018, Heathrow Airport observed an increase of 50,400 passengers due to LCC operations (Table 4.3). This led to a direct employment effect of240 jobs and an indirect effect of 128 jobs. Additionally, there was an induced effect that created 530 jobs, resulting in a total of 1,308 jobs created at Heathrow Airport. The increase in income generated by LCC operations at Heathrow in 2018 was £7,832,000.

London Stansted Airport experienced a more significant increase in passenger numbers in 2018, with an increase of 179,382 attributed to LCC operations. This led to a direct employment effect of 300 jobs and an indirect effect of 160 jobs. The induced effect resulted in the creation of 621 jobs, bringing the total jobs created at London Stansted Airport to 1,502. The increase in income generated by LCC operations at London Stansted Airport in 2018 was £43,501,536.

Moving on to the benefits derived from LCC operations in 2018, Heathrow Airport had a new traffic of 30,100 passengers, with 28,595 tourists visiting. The average expenditure per day was £23, and the average overnight stay was 8 days. This resulted in an increase in turnover of tourism amounting to £5,261,480. This represented 26.65% of the overall benefit.

At London Stansted Airport in 2018, the new traffic reached 179,382 passengers, with 157,856 tourists visiting. The average expenditure per day was £17, and the average overnight stay was 5 days. The increase in turnover of tourism at London Stansted Airport in 2018 was £13,417,774, accounting for 73.35% of the overall benefit. Combining the benefits of both airports, the total benefits in 2018 were £20,785,870, with Heathrow Airport contributing £5,538,400 (26.65% of the total) and London Stansted Airport contributing £15,247,470 (73.35% of the total).

In terms of costs in 2018, Heathrow Airport incurred various expenses, including upstream and downstream costs (£1,235,025), climate change impacts (£1,317,920), pollution, noise, biodiversity losses, and other factors. The total cost for Heathrow Airport in 2018 amounted to £2,711,747, representing 38.16% of the overall cost. London Stansted Airport faced higher costs in 2018, including upstream and downstream costs (£1,509,822), climate change impacts (£1,695,340), pollution, noise, biodiversity losses, and other factors. The total cost for London Stansted Airport in 2018 was £4,394,544, accounting for 61.84% of the overall cost.

Combining the costs of both airports, the total cost in 2018 was £7,106,291. Analyzing the economic welfare generated by LCC operations, Heathrow Airport contributed £2,826,653 (20.66% of the total economic welfare), while London Stansted Airport made a more substantial contribution of £10,852,926 (79.34% of the total economic welfare). Overall, the economic welfare generated by LCC operations in 2018 was £13,679,579.

Comparing the findings of both airports for the years 2017 and 2018, it is evident that London Stansted Airport consistently outperform Heathrow Airport in terms of total benefits, costs, and economic welfare generated by the LCC. London Stansted Airport experience a larger increase in passengers, resulting in higher job creation and income generation. Additionally, the percentage of total benefits attributes to London Stansted is higher than that of Heathrow, indicating a greater positive impact on the local economy.

However, it is worth noting that the economic welfare generated per passenger is higher at London Stansted in both years, suggesting that each passenger at that airport contributes more to the local economy compared to Heathrow. This could be attributes to factors such as average expenditure per day and the duration of stay.

In conclusion, the cost-benefit analysis of Heathrow and London Stansted airports in 2017 and 2018 highlights the positive impacts of increased passenger traffic on employment, income, and economic welfare. London Stansted consistently demonstrates higher total benefits, costs, and economic welfare generated by the LCC. The findings emphasize the importance of considering various factors such as job creation, income generation, and expenditure patterns when assessing the overall economic impact of airports.

Table 4.3 Cost-benefit analysis of LCC for Heathrow and London Stanstedairports in 2018

	Heathrow Airport	London Stansted Airport	
Increase in passengers (PDLCC)	50400	179,382	
Employment			
Direct effect (D)	240	300	
Indirect effect (I)	128	160	
Induced effect (N)	530	621	
Total jobs created (E)	1308	1502	
Increase in income (R)	£7,832,000	£ £ 43,501,536	
	BENEFIT		
	Heathrow Airport	**London Stansted Airport**	**Total**
New traffic (NT)	30100	179,382	209,482
Tourists (T)	28595	157,856	186,451
Average expenditure per day (g) (€)	23	17	40
Average overnight stay (n)	8	5	13
Increase in turnover of tourism (TUR)	5,261,480	13,417,774	18,679,254
Total Benefits	5,538,400	15,247,470	20,785,870
Total benefit in percentage (%)	**26.65%**	**73.35%**	**100.00%**
	COST		
	Heathrow	**London Stansted**	**Total**
Upstream and downstream	1235025	1509822	2,744,847
Climate change	1317920	1695340	3,013,260
Soil and water pollution	4	25	29
Nature and landscape	20150	256473	276,623
Air pollution	7310	45260	52,570
Noise	82436	510432	592,868
Urban effects	4	25	29
Biodiversity losses	12350	150867	163,217
Accidents	36548	226300	262,848
Total Cost	**2,711,747**	**4,394,544**	7,106,291
Total cost in percentage (%)	**38.16%**	**61.84%**	**100.00%**
Economic welfare generated by LCC (BE)	**2,826,653**	**10,852,926**	**13,679,579**
Percent (%)	**20.66%**	**79.34%**	**100.00%**

Economic welfare generated in local economy by each passenger	93.91	60.50	154.41

Notes: This table shows the cost and benefit analysis associated with Heathrow Airport and London Stansted Airport for the year 2018.
Source: Author

4.2 Discussion

The findings derived from the cost-benefit analysis of Heathrow and London Stansted airports in 2017 and 2018 provide valuable insights into the economic implications of increased passenger traffic and the role of LCCs in driving growth. These findings offer a basis for discussing the strengths and weaknesses of each airport and the potential implications for their respective local economies, drawing upon relevant theoretical frameworks.

One notable observation is the significant disparity in the growth of passenger numbers between Heathrow and London Stansted. While Heathrow experienced a modest increase in passengers in both years, London Stansted witnessed a substantial surge, indicating higher demand for air travel at the latter airport. This finding suggests that London Stansted has effectively attracted more passengers, potentially due to factors such as competitive pricing, diverse destination options, or efficient operational practices. This aligns with theories of demand elasticity, such as the theory outlined by Smith and Johnson (2009) where price sensitivity and product differentiation influence consumer behavior and market share, suggesting that London Stansted's competitive pricing, diverse destination options, or operational efficiency may be attracting more passengers.

Employment figures further highlight the divergent impacts of the two airports. London Stansted consistently generates a higher number of direct, indirect, and induced jobs compared to Heathrow. This implies that London Stansted's growth has a stronger positive effect on employment, promoting local job creation and income generation. Theoretical perspectives on labor market dynamics, such as the multiplier effect and input-output models, can aid in understanding the underlying factors affecting employment disparities between the two airports.

The analysis of income generation also demonstrates contrasting performances between the two airports. London Stansted Airport records substantial increases in income, surpassing Heathrow in both absolute figures and percentage growth. This indicates that London Stansted has been successful in attracting higher-spending passengers or capturing a larger share of the tourism market. Theories of revenue generation, such as the tourism area life cycle (Butler, 1980) or the tourist expenditure model (Var, 1995), can provide insights into the factors influencing income growth at London Stansted. Conversely, the comparatively lower income growth at Heathrow suggests potential challenges in generating higher revenues or capturing a larger portion of passenger spending. Theoretical frameworks relating to revenue management and market positioning, such as the concept of value creation or revenue management strategies, can offer insights into strategies that could enhance revenue streams at Heathrow.

Considering the benefits in relation to tourism, both airports exhibit positive impacts. The substantial increase in tourism turnover at both Heathrow and London Stansted indicates the potential for increased economic activity in the surrounding areas. However, London Stansted consistently outperforms Heathrow in terms of total benefits generated, reflecting its higher percentage contribution to the local economy. This suggests that London Stansted's growth has a more significant positive effect on the tourism sector and related industries. Theories of tourism economics, such as the destination competitiveness framework or the tourism multiplier effect, can provide a deeper understanding of the factors driving divergent tourism impacts between the two airports.

Examining the economic welfare generated by LCCs at both airports is a crucial aspect to consider. While London Stansted Airport generates a higher proportion of the total economic welfare in both years, it is important to note that Heathrow also makes a significant contribution. The higher economic welfare generated per passenger at London Stansted suggests that each passenger's expenditure has a greater impact on the local economy. Theoretical perspectives on labor market dynamics, including concepts such as the multiplier effect (Keynes, J. M., 1936) and input-output models ((Leontief, 1936), can provide valuable insights into the factors contributing to employment disparities between the two airports.

In conclusion, the findings of the cost-benefit analysis shed light on the strengthsand weaknesses of Heathrow and London Stansted airports in terms of passenger growth, employment, income generation, and economic welfare. London Stansted Airport demonstrates stronger performance across various indicators, including higher increases in passenger traffic, greater job creation, and higher income growth. These findings suggest that London Stansted has been more successful in capitalizing. on the opportunities presented by the LCC model, drawing upon theories of demand elasticity, labor market dynamics, revenue generation, and tourism economics. However, it is important for both airports to continually assess and adapt their strategies to remain competitive, attract passengers, and maximize their economic impact, considering theoretical frameworks related to market positioning, revenue management, and destination competitiveness.

Chapter 5. Conclusion

5.1 Summary

In conclusion, the cost-benefit analysis of Heathrow and London Stansted airports in 2017 and 2018 provides valuable insights into the economic impact of these airports. The findings highlight the varying performance and strengths of each airport,as well as the role of LCCs in driving growth. London Stansted Airport demonstrates strong growth in passenger numbers, employment, and income generation, outperforming Heathrow in several key indicators. However, both airports have areas for improvement and opportunities to maximize their economic impact.

Heathrow Airport should focus on strategies to attract and retain more passengers, including enhancing connectivity, expanding destination options, and improving affordability. Efforts to create more job opportunities and diversify employment sectors are crucial for both airports, but particularly for Heathrow, to maximize their contribution to local employment. Additionally, exploring avenues for increasing revenues, such as expanding commercial offerings and attracting high-value passengers, will be important for Heathrow to enhance its income generation.

The success of London Stansted in capturing a larger share of the tourism market indicates the potential for Heathrow to refine its tourism strategy. Strengthening partnerships with local tourism organizations and leveraging its location can help attract international visitors and increase tourist spending. Furthermore, recognizing the significant contribution of LCCs to economic welfare, both airports should consider incentivizing the presence of LCCs to increase competition and benefit passengers and the local economy.

In conclusion, the cost-benefit analysis underscores the importance of strategic decision-making, collaboration with stakeholders, and targeted interventions to maximize the economic impact of Heathrow and London Stansted airports. By capitalizing on their respective strengths, addressing areas for improvement, and considering the policy implications highlights in the analysis, both airports can contribute to the growth and prosperity of their local economies, create employment opportunities, and enhance the overall travel experience for passengers.

5.2 Recommendation and Policy Implications

The findings of the cost-benefit analysis for Heathrow and London Stansted airports in 2017 and 2018 have several recommendation and policy implications that can guide decision-making and strategies for maximizing the economic impact of these airports. These implications relate to areas such as passenger growth, employment, income generation, and the role of LCCs.

Firstly, the substantial difference in passenger growth between the two airports suggests the need for Heathrow to explore strategies to attract and retain more passengers. This could involve efforts to enhance connectivity, expand destination options, and improve affordability. Implementing targeted marketing campaigns to promote the airport's strengths and unique offerings could also help increase passenger numbers. Additionally, investing in infrastructure and facilities to handle increased passenger capacity would be vital to accommodate future growth.

Secondly, the employment figures highlight the importance of creating job opportunities associated with airport operations and related industries. London Stansted Airport's success in generating more direct, indirect, and induced jobs indicates the potential for Heathrow to develop strategies that focus on job creation. This could involvefostering partnerships with local businesses, supporting training programs for local residents, and exploring opportunities for diversifying employment sectors beyond traditional airport roles. Collaborating with regional authorities and economic development agencies could facilitate the implementation of targeted initiatives aimed at generating employment opportunities.

Furthermore, the income generation disparities between the two airports underscore the need for Heathrow to explore avenues for increasing revenues. This could include expanding and diversifying the airport's commercial offerings, attracting high-value passengers, and fostering partnerships with local businesses to enhance the overall customer experience. By developing a comprehensive revenue generation strategy, Heathrow can optimize its economic impact and contribute to the growth of the surrounding area.

The success of London Stansted in capturing a larger share of the tourism market suggests that Heathrow could benefit from refining its tourism strategy. This may involve developing partnerships with local tourism organizations, promoting the airport as a gateway to popular tourist destinations, and leveraging its location to attract international visitors. Collaborative efforts to enhance the overall tourism experience, such as offering customized travel packages and facilitating seamless transportation options, can contribute to increased tourist spending and broader economic benefits.

Additionally, recognizing the significant contribution of LCCs to economic welfare generation, both airports could further leverage this segment for sustainable growth. Encouraging the presence of LCCs through incentives, such as reduced landing fees or dedicated infrastructure, could attract more LCCs and increase competition, ultimately benefiting passengers and the local economy. However, careful consideration must be given to environmental and social impacts associated with increased air traffic, ensuring that growth is balanced with sustainability goals.

In conclusion, the policy implications arising from the cost-benefit analysis emphasize the need for strategic decision-making and targeted interventions to maximize the economic impact of Heathrow and London Stansted airports. Strategies should focus on passenger growth, employment creation, income generation, and fostering collaboration with stakeholders such as tourism organizations and local businesses. By implementing these policies, both airports can further enhance their contributions to the local economy, creating a sustainable and thriving aviation sector thatbenefits passengers, businesses, and the wider community.

5.3 Limitation and Future Research

While the cost-benefit analysis provides valuable insights into the economic impact of Heathrow and London Stansted airports, it is important to acknowledge several limitations that may affect the interpretation and generalizability of the findings.

Firstly, the analysis is based on data from only two years, 2017 and 2018. This limited timeframe may not fully capture long-term trends and fluctuations in passenger traffic, employment, and income generation. To obtain a more comprehensive understanding of the airports' economic performance, it would be beneficial to include data from additional years and conduct a longitudinal analysis.

Secondly, the study primarily focuses on the economic aspects of the airports' performance and does not consider other important dimensions such as environmental sustainability, social impacts, or infrastructure development. These factors play a crucial role in assessing the overall impact of airports on the local community and need to be taken into account for a more holistic analysis.

Another limitation is the reliance on aggregated data and assumptions. The analysis assumes average expenditure per day, duration of stay, and other variables, which may not accurately represent the behavior and spending patterns of all passengers. Individual variations in spending habits, preferences, and travel purposes may not be fully captured by the aggregated data, potentially leading to discrepancies between the estimated benefits and the actual impact on the local economy.

Furthermore, the analysis does not consider external factors that may influence the airports' performance, such as changes in government policies, economic conditions, or competition from other airports. These factors can significantly impact passenger demand, employment opportunities, and income generation, and should be taken into consideration for a more comprehensive analysis.

Additionally, the study focuses on the specific context of Heathrow and London Stansted airports and may not be directly applicable to other airports or regions. Factors such as airport size, geographic location, market dynamics, and regional economic characteristics can vary widely, affecting the generalizability of the findings. Therefore, caution should be exercised when extrapolating the results to different contexts.

Lastly, the cost-benefit analysis does not consider potential negative externalities associated with airport operations, such as noise pollution, air pollution, or congestion. While these factors are mentioned briefly in the analysis, they are not quantified or included in the cost-benefit calculations. The omission of these negative impacts limits the overall assessment of the airports' economic and environmental sustainability.

In conclusion, while the cost-benefit analysis provides valuable insights into the economic impact of Heathrow and London Stansted airports, it is crucial to consider the limitations of the study. These limitations include the limited timeframe, focus on economic aspects, reliance on aggregated data, exclusion of external factors, limited generalizability, and omission of negative externalities. Future research should aim to address these limitations and provide a more comprehensive understanding of the airports' overall impact.

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