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## The Impact of Airport to the Economy

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*Abstract:* The role of commercial aviation and economy in common perception, having a new airport is a new signal of the development in a region. It brings prosperity and creates development blocks to facilitate the growing aeropolis. At least, 4.5 percent of the world's GDP is contributed by the emergence of airports and aviation industries. However, there are many societal, environmental, and economic drawbacks to be looked upon. This mode of transportation consists many hidden costs and it is a burden for institutions to invest on issues of mending the consequences produced by aviation, largely noise and air pollutions are the main the social costs. Societies are benefitting from the existing of airport but at the same time are they also being deteriorated by it. Nevertheless, preliminary findings from the secondary analysis in this article revealed that there is no clear linkage of negative impact of aviation, and the consequences did not exceed the economic gains as the industry continues to develop along with the technological advances that could have prevailed in the near future.

*Keywords:* Airport, airport economics, aviation, pollution, social cost, green transportation

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The topic may have symbolized modernity but it has been and will continue to be part of our history.

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“Need there a genius to come up with a button?” a teacher once asked. Do we? But whoever did, changed the way we dress, changed the output of textile production. Otherwise, we might still heavily dress like the Romans. A button, something we never questioned, can change the entire economy. People in the next generations, I wonder what would they ask about.

My life and my studies at Lund will always be remembered.

*The role of commercial aviation and economy in common perception, having a new airport is a new signal of the development in a region. It brings prosperity and creates development blocks to facilitate the growing aeropolis. At least, 4.5 percent of the world's GDP is contributed by the emergence of airports and aviation industries. Airline operators created high demand of employment, stimulated trades, import and export, and tourism. But another perspective that many of us do not notice is that those factors may be just an illusion to the growing economy. There are many societal, environmental, and economic drawbacks to be looked upon. This energy intensive transportation consists many hidden costs and it's a burden for institutions in investing on issues of fixing the consequences produced by aviation. The thesis will show more insight and explore the cons and pros of commercial air traveling. It will analyze and try to see whether there are more positive than negative effect or should we encourage other means of transportation until better invention exist otherwise. Can this modern invention of transportation become a new category to the notion of "Creative Destruction"?*

*Due to the variety of factors relevant to the topic, this thesis will only review and discuss on how does aviation activities decelerate long-term economic growth focusing on the regions in the airports' vicinity both socially and economically. It will also seek to elaborate the consequences of noise pollution and carbon dioxide (CO<sub>2</sub>) emissions factors; the methods and cost that the involving institutions have to take actions to reduce the environmental effects and the implementation of policies for sustainable development.*

## **INTRODUCTION**

For several decades, the air travel has become increasingly popular, as it is the quickest way in the mode of transportation while the role of the airport itself also determines the routes and destinations around the world. The airport is inarguably the essential part for air transportation and in some places it serves as the hub for regional locations. Having an airport means a lot either to the community level or up to the national level. It brings economic prosperity and propensity for changes and developments occurring around such large construction. Due to the popularized, widespread of commercial aviation that eventually covered many countries around the

world, we may have cherished the awe and convenience of such travel plans thus ignoring some of the conflicting issues and consequences that are underlying. The beginning of the 21<sup>st</sup> century have revealed the consequences and shown signs that the public has to become aware of when social and environmental effects triggered new concerns leading to immediate holistic changes. This can be seen through many lenses such as, the frequency of flying has increased as the low cost carriers (LCC) have entered the market, or as jet traveling became more affordable, the airlines have to meet the demand by putting in more routes. ***Societies are benefitting from the existing of airport but at the same time are they also being deteriorated by it and so is it worth having?*** At least at the current time and position where technological advancement is in demand and how it would be like if we were to overcome those limitations in the near future.

***The aim of this thesis is to see how much the airport caused damage to the society and whether it can challenge the advantages and positive contributions of having the airport including the emerging aeropolis in several regions.***

## **Theoretical Basis**

Transportation has always been use by every society in the world as part of daily life. The world consists various forms of transportation, such as; animal-powered (cart, chariot), human-powered (bicycle, skate, ski), roads, railroads, waterways, and air. Many of which not only able to carry passenger but mainly goods for trade in exchange for other valuables and earnings. There has always been development in all sorts of such modes to find the most efficient and better transportation system to meet the demand of our dynamic world. One might prevail over another or perhaps develop simultaneously. The air travel may have been one of the most advanced and quickest mode exists, especially true in the case of long-haul transport. Without airport and airplane, the international and intercontinental movement might not be as fluid as it is today. The flow of capital velocity, people, knowledge, and technology may have been limited or delayed, making globalization almost impossible.

A similar thought was raised by Robert William Fogel's concept of social saving on the contribution of railroad in the United States of America. His innovative thought was too see what would the US have been with the absence of vast network

of railways and how American economy growth would be projected. Fogel's *"Railroad and American Economic Growth"* was published in 1964, a completed version of *"A Qualitative Approach to the Study of Railroads in American Economic Growth: A report of Some Preliminary Findings"* appeared first in June 1962 in the *Journal of Economic History*, Vol. XXII, No.2, examining the US economy for the year 1890. The two scenarios were the situation of the nation with and without the railroads in response to trade of four main commodities. The end result showed the estimated costs saved by railroads instead of spending it on other mode of transportation, which he uses the term "social saving"<sup>1</sup>.

Fogel's approach was an argument of counterfactual, "what if..." Although it has been recognized in the field of economic history but still "a very foreign notion in the early 1960s"<sup>2</sup> (Davis, 2000). No one ever tried to make an account for it since no actual data, or method, were to quantify the differences of such numbers but Fogel applied the formal economic model to estimate the costs in the virtual scenario. His counterfactual arguments were greatly controversial and there are still debates among economic historians whether his findings can truly be valid or not.<sup>3</sup> There may not be a precise measurement but the dilemma lies ahead of how good the estimates are. He did in fact degraded the importance of railroads by his calculations but contrastingly, he proved to produce high productivity tools in economic historiography (Nerlove, 1966).

The approach of Fogel is the entirely fit to this research in relation to the impact or airport. It is not the question of "what if there were no airports?" but rather the idea if weighing the costs and benefits of using airport as the frontier to air transport. With the extensive use of air travel, there will always be consequences, and those consequences affect the economy either directly or indirectly.

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<sup>1</sup> Fogel 1962, p170.

<sup>2</sup> Lance E. Davis, *Book review: Railroad and American Economic Growth: Essays in Econometric History*. EH.net

<sup>3</sup> Vorayut Boonchim, 2008.



Having railroads, according to Fogel, proved to enhance the achieved GNP earlier than it would, with the gain in social saving attributable to the railroads in the interregional transport of agriculture products by 1.3 percent.<sup>4</sup>

Having airport and airplane managed 'sustainably' might result in positive gain of social saving attributable to the air traveling instead of having air transport that costs the society in treating negative impacts created.

## Method

The aim of the study will largely be **secondary analysis**, which makes use of the existing data and allow the research to extend the scope of study.<sup>5</sup> It will perform the comparative advantages and disadvantages, cons and pros or the relating issues. It will firstly review on previous researches done by scholars and institutions. The existing researches directly relating to the topic appeared to be small in numbers but other relevant reports, findings, papers, and organizational records are sufficient in broader context, which are published by recognized institutions, either in the form of governmental body, non-government, and private agencies. The **literature review** will depict the relevant data and highlights the information from the sources, which will be the main contributor in allowing secondary analysis from the data collected. The research will be based on variety of sources in order to make comparisons and projecting different perspectives to see a wider picture.

The usefulness of secondary analysis is that it lower the costs and saves time instead of spending on gathering data, especially when the data are collected from many different places in a large-scale points of interests. By re-analyzing the collected data, the secondary analysis approach in this thesis will be gathered from multiple datasets by different data collectors to provide richer basis and the overall assessment of the findings.<sup>6</sup> Thus it is unlikely to be triangulated, as different researches might have used different ways of measurements, and/or pursuing different areas of focus.

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<sup>4</sup> Fogel, 1962.

<sup>5</sup> Jillian Ireland. *Secondary Analysis*. University of Aberdeen

<sup>6</sup> Hakim, C. *Research Design*, 2<sup>nd</sup> Ed., Oxon: Routledge, 2000, p25.



Since comparative is one of the main objectives in this paper and the fact that airports are the linkages of air routes, more importantly linking countries around the globe, it will definitely incorporate the cross-national comparative studies approach<sup>7</sup> in this secondary analysis so that the countries, regions, and trends overtime can be realized. There is little to be concerned about the practices of airport operations as most international and domestic airports follow the similar regulations and yield to serve travelers from anywhere in the world. The true and complete data will assist in shaping the results. Although, it is not appealing to policy-makers, and in this paper it is not the intention, the advantages aspect of qualitative research that can be used in this thesis could be that it eases the accessibility to non-specialists group and less communication or misunderstanding problems<sup>8</sup>, another words, easier to comprehend for public understanding and not too technical in its area of focus.

The study will consider variety of factors such as employment rate, gross domestic product (GDP), increasing of air traffic, community concerns, health concerns, environmental issues, and the carbon offset investments.

The investigation will rely on the statistical secondary data from the relevant organizations and compare to each other to test the hypothesis. However, this is to be noted that there are limited number of information available as most of aviation statistics are partially published since it can be used for commercial purposes. Such data are priced highly that businesses and airlines is most worth purchasing. This research gathered only public data available by the airport authority, the airliner, and specialized journal.

The first part tries to find the ‘pros’ or positive contribution of the airport in general. It explores deeply to how it benefits the society in economic terms. However, it cannot cover the entire contribution when some contributions are difficult to justified whether they came from the effect of airport or not.

The second part will focus on the ‘cons’ or the negative impact of airports, which includes air transportation contribution as well. Such impacts are highly focusing on the current concerning issues of noise and air pollution. These impacts

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<sup>7</sup> Hakim, C. *Research Design*, 2<sup>nd</sup> Ed., Oxon: Routledge, 2000, p29.

<sup>8</sup> Hakim, C. *Research Design*, 2<sup>nd</sup> Ed., Oxon: Routledge, 2000, p37.

may not be a bothersome factor to the traveler but in the long run, it will definitely involve the economy to take part of the harm humans have caused.

The third part will not be looking for the solution leading to any agenda but rather pointing out, from the two contradicting information above, which prevails which, and how will the world economic would be with the future of air travelling predicted by the historical data, the scholars in the relevant fields, and the airplane manufacturer's vision to the evolution of newer and greener technology.

## Literature Review

### Sources of Data

*Airplane Manufacturer:* Most multi-national and large industries like the airplane manufacturer usually produce annual reports to show their progress to the shareholders and the general public for confidence and reliability. The organizational reports contains summary of the past performance, current and prospective plans, which can be very useful. However, as they are one of the beneficiaries of the business and competing with rivals, it is questionable of any undisclosed information or any exaggerations to show betterment for future investments and trusts. For example, the manufacturers may put high hope for low carbon emission from the new airplane and use measurements to show low numbers so that people do not aim their concerns toward the negative outputs, adversely, stimulated demand from passengers, attracting airliners to purchase the highest efficiency aircraft available to serve their customers. Nevertheless, because of the high technological production at hand with emphasis in safety outstanding, they are expected to give precise information that is true and valid.

*Airport Authority and Management:* Nowadays many airports shifted from the government management to private management in order to handle fast and complex tasks as they grow. The airport is still being perceived as public utility for the economy. Although, innately, airports are not built upon the basis of direct competition with other airports but rather to serve the demand of passengers traffic passing through. Yet, lately, they are also well aware of the fact that being the hub brings in economic prosperity of taxation and foreign currency inflow. At the same time, they are also aware of the disturbance they produce to the surrounding areas.

The organizational reports will discuss the improvements of the purpose they hold and the implementation of current social concerns. It is likely that they will be prone to present the datasets in favor of the airports and that their plans in dealing with other negative effects are taking place with betterment to come.

*Airliner:* The airliner will need both the manufacturer and the existing of airports to operate and conduct their business to gain profit. They, too, expect to see the positive perceptions of air travel and the development blocks around the industries. Any and all the attributes of the three key players will compliment each other and likely affect the passengers' choice of travel. Airline business nowadays is highly competitive and good price and image will attract customers. With the current concerns, many airlines adopted the carbon offset compensation and low noise improvements to show their care for the public. One limitation is that, is it visible that they are acting but how far the action took place and information of the progress has not been reveal, as it is new to the users.

*Institutions:* Information from institutions, universities, and independent professional sources are probably the least bias source of data available for this research. They are either academically funded, or by the government agencies. With research conducted in many areas and experts review and peer editing for consistencies of the findings makes the journal or reports more reliable and valid to make arguments. They sometimes provide raw data for clearer understanding and shows transparencies to the readers. Therefore, many reviews of the institutional published data will give accurate information and perhaps share many reasonably strong arguments to explore.

*Journal, papers, and reports:* Many of such are published by the above category. Most of them hold the reliability status of the recognized institutions, agencies, and academic scholars. However, there has been a controversial issue over the reliability of the findings as many has claimed that it was funded by the aviation industries and the result was in favor to them like the infamous "Air Transport White Paper (2003)" report by the reputable Oxford Economic Forecasting (OEF). Infamous as it is, the government did implement those propositions by the OEF. These journals will likely be discussed when using the arguments of how they can be valid.

## Part I: Airport Prosperity

Comparing to all kinds of world transport, aviation has the highest growth rate annually, approximately fifteen to seventeen percent from post-World War II up to the end of the third millennium.<sup>9</sup> Some of the former military airfields were later held to serve commercial airfreight (e.g.: mail delivery) and passenger airline for economic efficiency. The boom of air travel began in the 1960s as the jet aircraft engine became more widespread. The construction of airports began to respond to the increase traffic and demand of new destinations. It is perceived to be public asset that the nation or the local can take the advantage of in terms of promoting economic development.<sup>10</sup> It should be noted that the runway is in fact a public good while the boarding gates are commercial goods. Therefore, it is commonly practiced in the early stage that the government in different levels are the owner of the airport since the construction and the infrastructure within and around the airport needed decision to be made at the agenda level so that all factors would facilitate the efficiency of the airport during operation (e.g.: land, highways, railways connecting to the city, etc.). By the year 2007, airports around the world served over 4.8 billion passengers, an average of 7 percent increase from the previous year with 88.5 million metric tons of cargo and 76.4 million aircraft movements.<sup>11</sup>

## The Economic Impact of Air transport

The **direct economic effect** of air transport can be measured by all the transactions within the aero-facility when performing the operations. This can be seen as the purchase of fuel, services, landing fee, salary of the personnel, air navigation services, and carrier services on-site and surrounding area. Off-site direct effect can be the exception of the airplane industries or other production used by the airline and airport. The International Civil Aviation Organization (ICAO) made an estimation of the year 1998 with approximately 6 million jobs worldwide as a direct economic effect with the value of over \$370 billion.<sup>12</sup> Approximately 1.4 million employments were generated in European airports alone in the year 2001, according to Airports Council

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<sup>9</sup> Whitelegg, 2000.

<sup>10</sup> Gillen, Niemeier, 2006. Airport Economics, Policy and Management: The European Union, 3.

<sup>11</sup> Airports Council International. Media Release, 29 July 2008. Geneva.

<sup>12</sup> Civil Aviation and the Economy. ICAO.

International (ACI EUROPE). Similar to other organizations and firms, it is obvious that removing the existence of airport would definitely remove the direct contribution created by it. “*Direct impact represents economic activities that would not have occurred in the absence of air transportation*” (Vasigh, Fleming, Tacker , 2008)<sup>13</sup>

The second category is the **indirect economic impact** is when other business or organization interacts with the existence of airport and financially benefited from it more than it usually gains. It applies to suppliers providing goods and services within the air transport business chain, for example, hotels, retailers, travel agencies, or even taxi drivers. The airport produces more customers or transactions for them to gain more and it is a causal relationship (A increases, B increases, and vice versa). Tourism and freight business are a *catalytic demand effects* that promotes the air traveling making more indirect economic impact. Such factor was accounted for 8.4 million jobs, created \$390 billion output in 1998.<sup>14</sup> Catalytic impact contributes to wider economy.

The final impact applies to any and all that the second category spends on the consumption of other goods and services, called **induced economic impact**. This type of impact produces the *multiplier effect* where a transaction from direct and indirect impacts leads to other purchase or service, which creates multiple transactions in the process. “*The incomes earned in these direct and indirect activities generate demand for goods and services in the economy, which support further employment.*”<sup>15</sup> Hotel will purchase more limousine services; limousine agency will hire more chauffeurs and purchase more cars to meet higher demand, for example.

For every 1,000 on-site jobs in the European airports, a multiplier value of 2.1 applies to indirect and induced jobs nationally, another words, 2,100 jobs are created, value of 1.1 regionally, and 0.5 sub-regionally.<sup>16</sup>

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<sup>13</sup> Vasigh, Fleming, Tacker, 2008. Introduction to Air Transport Economics: From theory to application., p21.

<sup>14</sup> Civil Aviation and the Economy. ICAO.

<sup>15</sup> The Social and Economic Impact of Airports in Europe. January 2004  
ACI, York Aviation, p8.

<sup>16</sup> Ibid, p40.

The data from ACI EUROPE measured in 1998 showed that there were 1000 jobs per million passengers (workload units) per annum (mppa). In 2001 the same measurement was decreased to 950 on-site jobs mppa but that does not actually indicate the decline of the economy. On the contrary, it was argued in the perspective that cost cuts was successfully put into place by the airports while increase in productivity rises along with higher security measures after the 9/11 incident. When sum up the total economic impacts (direct, indirect, and induced) in the area where an airport operates, an estimation of GDP varies from 1.4-2.5 percent<sup>17</sup> in the European region, this number does not include tourism impact that might have shown more highly significant figures.

Airports can benefit in any level of governance and regarded as economic motors stimulating growth. The Oxford Economic Forecasting (OEF) reported that with the existence of current airports in the UK, it is facilitating at least an output of 550 pounds sterling of which 3 percent of GDP rises in direct contribution.<sup>18</sup>

The ACI uses the companies' expenditure to determine the link between business and air transport services. Their analysis suggested that the business and services involved in the intensive use of air transport are shown in table 1.

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<sup>17</sup> The Social and Economic Impact of Airports in Europe. January 2004  
ACI, York Aviation, p9.

<sup>18</sup> The Social and Economic Impact of Airports in Europe. January 2004  
ACI, York Aviation, p14.

**Table 1: Air intensive economic sectors in the UK**

Economic sectors	Share of Air transport in total transport demand (%)	Expenditure on air transport per employee (1996)
Other means of transport	64	£565
Banking and finance	50	£970
Insurance	36	£1,528
Printing and publishing	35	£454
Other business services	30	£183
Computer activities	24	£114
Research and development	24	£66
Cocke, Petroleum and nuclear fuel	23	£1,044
Communication	23	£478
Precision and optical instrunments	20	£140
Transport	19	£796
Extraction	13	£1,150
Basic Metals	13	£537

Source: ACI Europe, 2004.

### **Airport Strategies**

Airports function as the way they are designed to serve. For example, the Schiphol Airport of Amsterdam developed as an airport city to serve its airline KLM in hope for variety of destinations. At the same time, the primary goal is to facilitate the European port of Rotterdam and become the global hub with global connectivity. The



Netherlands is and always has been the trading nation with concentration of population in the urban area. It is the government agenda to maintain Schiphol as both “air and non-air-related activities.” Because the linkages are great, the Dutch national policy tried to take the advantage of the knowledge economy; an element of what is also known as “Brainport.”<sup>19</sup> The effects were that the economy transitioned into more high-tech, modern industrial structure by companies launching up around it.<sup>20</sup>

This is somewhat a similar pattern to what occurred in the Silicon Valley mentioned by AnnaLee Saxenian<sup>21</sup> that the knowledge concentration area, like University campus, attracts investors and joint ventures to establish companies close by. The movement of employees with exchange of know-how are valuable and worth the clustering of related industries. This pattern provides easy access of produces to new knowledge and vice versa. The same idea goes to airports in Nice, Hamburg, Rostock, and Cork, where producers and service providers gathered to form business park or area adjacent to it so that they have easy access to make business trip and delivery, and in some cases, with additional knowledge factors like the Brainport mentioned above.

Vienna Airport situated in the middle of Europe, acting as the gateway to Eastern Europe. It is evident to see why it became so essential to industries as many multi-national companies locate their regional head offices there, such as, IBM, Coca Cola, Kraft Foods, Hewlett Packard, 3M, and Ericsson.<sup>22</sup>

It is the airport strategic advantage to design and develop along with maximizing the potential to globalization with high technology, electronics businesses, and promote international investors.<sup>23</sup>

Another example for airport strategy is the Copenhagen airport of Denmark. The airport is the gateway to the Scandinavian region where it is one of Scandinavian

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<sup>19</sup> The Social and Economic Impact of Airports in Europe. January 2004  
ACI, York Aviation, p15.

<sup>20</sup> Ibid, p15.

<sup>21</sup> The New Argonauts

<sup>22</sup> The Social and Economic Impact of Airports in Europe. January 2004  
ACI, York Aviation, p17.

<sup>23</sup> Ibid, p15.

Airline hubs. The airport designed to attract passengers with retail shops as it is regarded to be the shopping airport complex. In fact, the charges from retail at Copenhagen airport exceeds the airside charges revenue of over 50 percent, with 20 percent from ground handling fees.<sup>24</sup>

Similarly, other airports are more capable in handling freight and draw high revenue from ground handling more than passenger hauling. The increase of production to meet the increasing demand requires a larger amount of holding space in storage, which would do no good to the companies. Instead, venting out the unproductive stock to customer the quicker the better. The Memphis International Airport became the home of FedEx main hub with largest freight tonnage airport in the world, a flow of 1.5 million packages per day. Their European hub in Paris is highly demanded by large companies with finished goods shipment. Any restraint, even for night shipments would cost the loss of up to 26 million Euros of GDP, with 465,000 jobs at risk in France alone.<sup>25</sup>

Regarding the fact that in most cases, airport and its perimeter are tax-free or tax-exempt partially or in total, for goods and fuel, it cannot avoid the direct income flow for wages and labor costs in that particular sector who will later on spend their earnings to purchase services and goods, at least, in their economy or origin.

### **Factors affecting Air Traffic Growth** (Vasigh, Tacker, Fleming, 2008)<sup>26</sup>

1. Level of prosperity of that region (GDP)
  - Employment lead to business travel
  - More demand in passenger travel more supply available for cargo shipping
2. Decrease unemployment
  - More household income can afford travel trip (eg. The growth of Chinese middle class)

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<sup>24</sup> Gillen, Niemeier, 2006. Airport Economics, Policay and Management: The European Union, 10.

<sup>25</sup> The Social and Economic Impact of Airports in Europe. January 2004  
ACI, York Aviation, p20.

<sup>26</sup> Vasigh, Fleming, Tacker, 2008. Introduction to Air Transport Economics: From theory to application, p19-20.

3. Decrease in real cost of air travel
  - Deregulation in 1970 (USA)
  - Low Cost Carrier (LCC), or No-Frills Carrier
4. Population growth in developing country
  - Such as China and India
  - However, the growth must correlate to the income growth to have a positive effect
5. Economic liberalization
  - Lifted barriers, eliminate obstacles
  - Prices and market access
6. Political Stability
  - Safety
7. Amount of leisure time and tourism promotion
  - More free time more demand for tourism (eg. Northern Europeans)

**Determinant of demand** (Vasigh, Tacker, Fleming, 2008, p54)

- Price
- Passenger income
- Competitor
- Customer loyalty
- Safety
- Technical improvement
- State of economy
- Availability of other mode of transport
- Frequency of service
- Random occurrences (eg. SARS, Swine Flu, Terrorist threat)

### Regional Development and Benefits

Airports shorten the time in making trips in the desired destinations. It integrated many regions within the continent and inter-continent. It connects main cities and makes trips to remote area possible. People living in those remote areas can have access to basic essential services such as universities, hospitals, and governmental

civil services. Airport allows certain groups of work force to have access to the region where their skills are in demand.

Once an airport is in operation, then come other industries relating to the use of air traffic. Thus, it leads to higher employment rate with the boost in shaping the skills and trainings. Therefore, not only unemployment rate decrease, but the remote region population can gain new knowledge and specializations; lifted labor value and may lead to higher wages, perhaps, better standard of living.

In November 2002, SQW Consulting had carried out a study of No-Frills airline service impact to the economy and society, particularly easyJet flight between London and the remote site of Scotland, Inverness. The studies showed that there was a positive effect, with clear increase in incoming tourists and the residents believe that airport makes the town less remote, making it a better place to live (ACI Europe, p26).

As it is the strategy that determines what an airport may become but there are always by-products or an inevitable multiplier effect. Alike the Brainport, linking airport with business parks, the same pattern can apply with universities or academic institution. The tangibility of knowledge economy has been realized to increase innovation and academic advancement. Not only domestically but also internationally, proven otherwise. The welcoming of foreign students, for example lead to cultural exchange and new perspectives, are already a direct economic benefit (ACI Europe, p48). As the world is advancing into the so-called “Globalization” era, it is those with broad range of knowledge win. Further development to economic may be in terms of academic and business collaborations *“arise from the networks and relationships established within the student population”* (ACI Europe, p48).

## **Tourism**

Tourism is one of the main catalytic elements to promote the demand of air transport. In the perspective of air travel, tourism applies to all economic input from the start. Twelve percent of the EU’s GDP was accounted for due to tourism by including spending of traveler and the distribution of goods and services; what is provided and consumed. Nowadays, air travel for leisure purposes is no longer for high-income

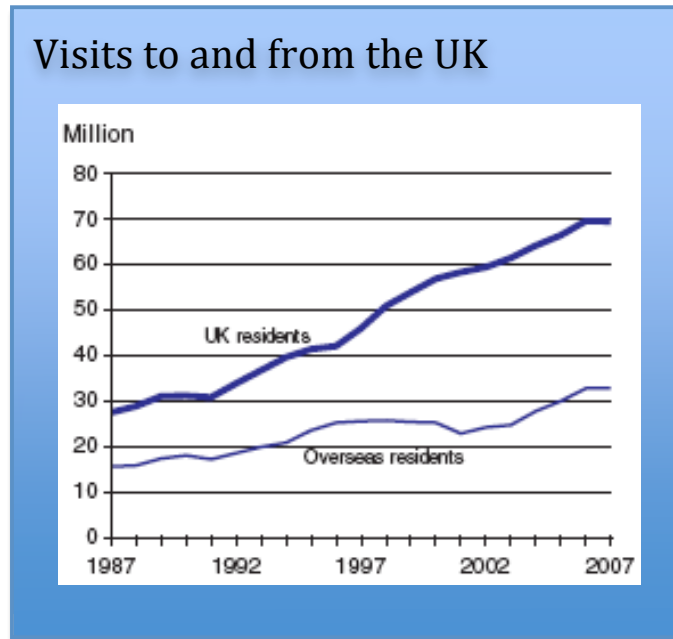
earners but become more affordable to broader population as there are more service providers of low cost airlines (LCCs).

Although, the dilemma lies here is that since more people can travel abroad, some economies may experience the negative balance of payments in terms of tourism, while some others gain positive balance. This is totally judge by the 'winning' economy. Countries with population earning higher income tend to make air travel trip more, either for leisure or business. The United Kingdom is a good example to illustrate the negative balance of payments in tourism as the UK residents visit abroad increasingly for the past 20 years. In 2007, the number of visits has gone up to 69.5 million trips and spending 35 billion pounds sterling, the growth rate of 1.8 compared to previous year. While the visitors from abroad entered the UK at the much lower growth rate of 0.2; 32.8 million trips, spending only 16 billion pounds (Travel Trend 2007)<sup>27</sup>. Both inbound and outbound tourism in the UK was responsible by air transport with an average of 80 percent, the rest were by waterway, and tunnel from mainland Europe.

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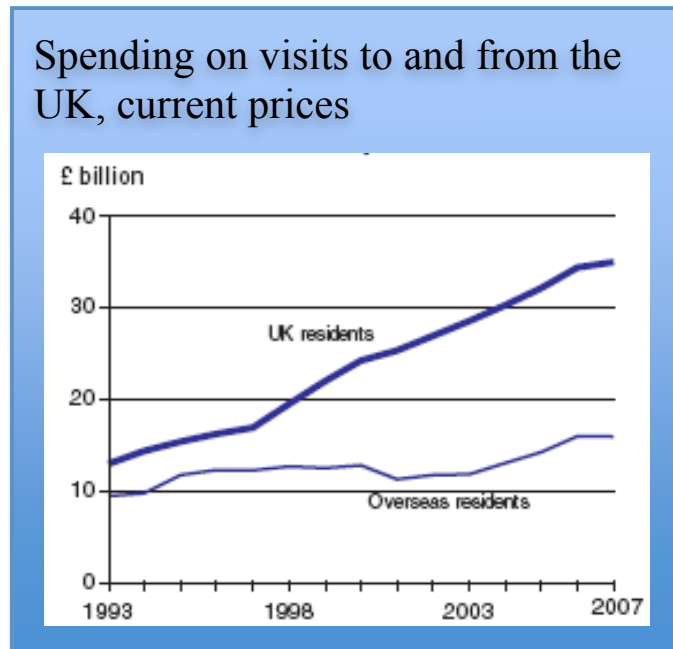
<sup>27</sup> UK Office for National Statistics. Travel Trend 2007.

**Graph 1**



*Source: UK Office for National Statistics.*

**Graph 2:**



*Source: UK Office for National Statistics.*

Nevertheless, there is no clear indication that the negative balance of payments in tourism would slowdown the UK residents from visiting abroad. It is best to gain some than not at all. It is understandable that London is one of the largest and leading economy centers in the world, UK is just an extreme example of experiencing negative balance of payments in tourism. Keep in mind that at the time, beginning of the second-millennium, overseas tourists may have uncertainties after the 9/11 and that the Pound Sterling may have strengthened its value, along with decreased in export and maintain relatively stable of imports to the UK.<sup>28</sup> All of such may be the contributing factors to the deficits in the UK balance of payments.

Other economies may experience divergence or convergence depending on their dependencies and geographical accessibility (for example, Thailand is largely depending on the inbound tourism as the source of their economic income providing tourism attractions and services, while Sweden income came from exports of iron and spend their vacation abroad). Austria, Czech Republic, France, Hungary, Switzerland, and some other EU countries still maintain surplus in balance of payment.

Recently there has been great development in tourism industries to respond with more demand and traveling. The no-frills carrier, low cost carrier, and charter flight services also greatly promote the access to leisure and business travel to broader target market than ever before. The regional and secondary airports support the emergence of such quick growth. The local will gain more access to more destinations and welcome more inbound tourists, bringing development to their economy. No-frills carrier is the factor driven the rapid growth of air travel and so it was accounted for increasing air traffic and passenger traffic in European airport of 25.7 percent in the destinations they provide services to.

### **Communication and Air Travel**

With the development of communication technology such as the internet, it is difficult to capture whether it affect the air travel in relation to economic positively or negatively. On the one hand, internet and telecommunication can replace meetings. On the other hand, it gives access to business with the global market to further developed. But to do business, sometimes need to both parties to be in “corporal

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<sup>28</sup> OEF Report, 2006.



proximity” (ACI Europe, p47) or in the formal relationship, the need to travel by air is required nevertheless.

“It is possible that the internet has and will continue to generate more air traffic that would exist in its absence.” (Green, p6)

The internet gives access to general population in most developed and developing countries. They are able to explore the means for travel and leisure on their own with more flexibility of alternatives and convenience. In fact, after Ryan Air has launched its largest online booking website in the year 2000, after first three months, there were 50,000 bookings made per week.<sup>29</sup>

The similar form of air transport was used by the emergence of electronic commerce websites (eg. Amazon, eBay). Consumers have more choices in selecting merchandises and quick deliveries of goods are likely to be preferred; this is where the shipping companies come into play (eg. FedEx, UPS, TNT, USPS, National Postal Service).

## **PART II: The Concerns**

### **Noise Pollution**

“Noise is not just annoyance. It damages health, it detracts significantly from the quality of life, it stops local residents enjoying their gardens or simply enjoying peace and quiet, it damages wildlife, it damages the learning ability of schoolchildren and it costs a great deal of money through the costs of noise mitigation and noise abatement.” (Whitelegg, 2000)

Recently the use of air transport has increase rapidly and the obvious impact of noise pollution may as well increase. Aircraft noise has been the concern of aviation to the vicinity around the airport and those living under the flight paths. The growth of aviation has shown higher rate in air traffic with airport expansion affecting more and more residential areas, as they are cumulatively concentrated with the growing population. It is interesting to see that airport is the mean to support the carriage of passenger where most people would want to have easy access to, which perhaps the key factor that such region grew in trade of goods and services along with rising

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<sup>29</sup> Ryan Air website. About Ryan Air.

population. Then at some point, the airport that once flourishes the region was to blame for disturbances.

It is not anyone to blame on as human are affected by noise once it reaches at certain level with prolong period of time. The World Health Organization's (WHO) scientific findings described in the "Guidelines for Community Noise" published in 1999 suggested that the following symptoms are the health effect to the exposing to noise disturbances:<sup>30</sup>

- hearing impairment
- speech intelligibility
- sleep disturbance
- physiological functions (eg. hypertension, ischaemic heart disease)
- Performance in cognitive tasks
  - o Increase stress hormones level
  - o Errors at work
  - o May cause accidents due to performance deficits
- Reading acquisition in children
- Social behavior

The situation demonstrated by WHO, "environments with heavy noise (are characterized by) cardiac diseases, doctor's calls and purchase of medicine more frequently than in quiet environment" (WHO, 1993, p83)<sup>31</sup> is an example of the social cost produce by the noise emerged from the existence of airport near the residential area. (Although, how much does it cost is another problem because it is difficult to capture the precise causal relationship. A person might suffer from cardiac disease due to their hereditary trait or poor food intake. Living in the airport vicinity would create an increase illusion, or the fluctuation of the number of cardiac patience admitted to the hospital. On the contrary, it is valid to argue that the condition might have been worsening by the airport activities nonetheless.)

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<sup>30</sup> Berglund, Lindval, Schwela, 1999. Guidelines for Community Noise.

<sup>31</sup> Whitelegg, 2000.

The *Guidelines for Community Noise* is issued by the WHO, concluded by the expert task force meeting in London in March 1999 listed out the following recommendations of noise thresholds in decibel and relation to exposure time.

**Table 2: Guidelines for Community Noise**

Environment	Critical health effect	Sound level dB(A)*	Time hours
Outdoor living areas	Annoyance	50 - 55	16
Indoor dwellings	Speech intelligibility	35	16
Bedrooms	Sleep disturbance	30	8
School classrooms	Disturbance of communication	35	During class
Industrial, commercial and traffic areas	Hearing impairment	70	24
Music through earphones	Hearing impairment	85	1
Ceremonies and entertainment	Hearing impairment	100	4

Source: *World Health Organization Fact Sheets*.<sup>32</sup>

**Table 3: The following are the actual noise measured in general:**

- A car engine at 50 feet away averages 70 dB.
- A power lawnmower at 50 feet away averages 90 dB.
- A diesel truck at 50 feet away averages 80 dB.
- A train at 50 feet away averages is 85 dB.
- A Walkman at 5/10 setting is 94 dB.
- An older Boeing 747-200 series aircraft flying directly over a home two miles away from the airport measures 100 dB outdoors.
- A newer Boeing 757 aircraft flying the same path measures 74 dB.

Source: *Sacramento International Airport Website*<sup>33</sup>

<sup>32</sup> <http://www.who.int/mediacentre/factsheets/fs258/en/>

<sup>33</sup> <http://airports.co.sacramento.ca.us/int/noise/index.html>

Yet, several other studies verified the results of aircraft noise, during take offs and landings, affecting the long-term memory recall particularly to children and students in the school as conducted near Munich Airport, New York LaGuardia, and JFK International Airport. (Whitelegg, 2000)

### What measures do they take?

Although, certificate guaranteeing the aircraft noise was given once an aircraft produced and tested by the manufacturers, the actual noise created by the engines exceeds the maximum thresholds measurement when in operation.

The questionnaire concerning environmental policy, conducted by Friends of The Earth Netherlands (FoEN) was sent out to 140 international airports in Europe, with a reply of 36 responses. Almost half of the responses believe that the environmental impacts are as important as economic benefits, while two third of the total responses agrees that taxes and charges could have a role in reducing environmental effects (Gazzard, p73). They also provided the methods in treating the noise issues, which includes:

- noise monitoring and track keeping system
- pricing policies and charges; fines for exceeding
- set peak noise levels on take off
- operational guidelines for power settings/techniques on take off and approach, and on landing
- consultation during development, and comprehensive reporting, of systems and restrictions;
- the production of noise maps
- legally binding noise contour boundaries
- restrictions on auxiliary power unit use
- engine test pens and mufflers with restrictions on their use
- restrictions on certain types of noisier aircraft
- night flight restrictions
- mitigation packages, involving sound insulation schemes and property buy outs, and noise barrier construction
- noise complaint handling procedures

### Induce of Noise Reduction

The Idea of introducing fines to aircraft is usually challenged by legal actions with the collaboration of airlines and International Air Transport Association (IATA). Only Zurich and Charles de Gaulle were able to maneuver to enact such system with two different approaches. Charles de Gaulle would pose the fine up to FF50,000 (1998) which considered very high and making it unreasonable to the profit margin of such flight. However, the fine was averaged out to FF3,460 according to FoEN (Gazzard, p22). Zurich Airport implemented an economically incentive way to counteract the noise problem by introducing 'noise surcharge' scheme to passenger (CHF5.-) and airline. Class 1 to 5 are categorized by the noise disturbances from high to low respectively.

Class/Type	Surcharge (CHF)	Aircraft (Typical Example)
1	800.-	B727-200AD, TU-154-B2, DC9-20
2	400.-	B707-300B, B737-200, DC9-40, IL-76, BAC111-500
3	200.-	B747-400, DC10-30ER, MD11, TU-154-M
4	100.-	A300, MD80, L1011-500
5	No surcharge	A320, B737-500, B757, B767, RJ85, CL60, F100

Source: Zurich Environmental Report 1998

The revenue is used for improving the performance and fixing problems due to noise disturbances such as building noise insulation, purchases and support of innovations in capturing the noise disturbances. In general, these charges are used to compensate for the social impacts, benefiting directly and indirectly to the neighborhood and the airport of operation as the source of fund to the continuous development.

**Table 5: Noise-related income and expense at Zurich Airport (in Million CHF)**

	2005	2006	2007
Total revenue from noise charges	50.3	46.1	57.7
Revenue from noise-related landing charges	2.9	2.9	2.8
Expenses for implementation of sound insulation concept and other measures	10.9	9.7	7.7

Source: Unique (Flughafen Zürich AG) Environmental Report 2007

In other countries, the Noise Abatement programs implemented by many airports share the common goal of reducing the disturbances and keep the maximum benchmark at 90 to 95 decibel. Although they are not the mandatory rules but rather being regarded as a set of guidelines that operators should follow.

### **Air Pollution**

It is undoubtedly true that in this era, air transport generates significant level of pollution. Not only the aircraft itself that polluted the air but also anything relevant to the facilitation of airport operation and its realm: the electricity generator, auxiliary power, baggage and catering services, etc. It should be remembered that trip takers are to take ground transportation to get to the airport: buses, cars, and rail. When all these add up, air transport becomes the major factor contributing to air pollution.

The global climate change is the big picture which consists of multiple concerning issues around the world. Such changes affect all living things including those initiated the changes: human. The air pollution caused by the use of air transport, in this case, with all the supporting elements generated by the airport, has turn the awe and amazement of flying into concerns of potential consequences.

From take off to landing, from one airport to another, the jet engine has unbalanced the proportionate of gases in the atmosphere including carbon monoxide (CO), nitrogen oxides (NO<sub>x</sub>), sulphur dioxide (SO<sub>2</sub>), the ozone gases, particulate matter, and volatile organic compound or known as VOC.<sup>34</sup> These gases and matters

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<sup>34</sup> The health impact of these gasses and matters are elaborated in the *Appendix* section under 'Facts and Abbreviations'.

has proven to pose potentially danger health threats, which may lead to respiratory sickness, internal abnormality, mental incapacitation, and death.

The US Environmental Protection Agency (EPA) conducted a study of air pollution at Midway Airport, southwest of Chicago in 1993. The study concluded that air pollutants are contributed to the increase of cancer patients in the area surrounding the airport.<sup>35</sup> The increase number of EPA's estimation revealed that pollution by aircraft engines shares about 10.5 percent of the total cancer cases in Southwest Chicago. Surprisingly, the 16-square-mile study area of Midway airport, shown higher level of toxic pollutants than in some other industrialized zones.

### **Incentive to Emission Reduction: Zurich Airport**

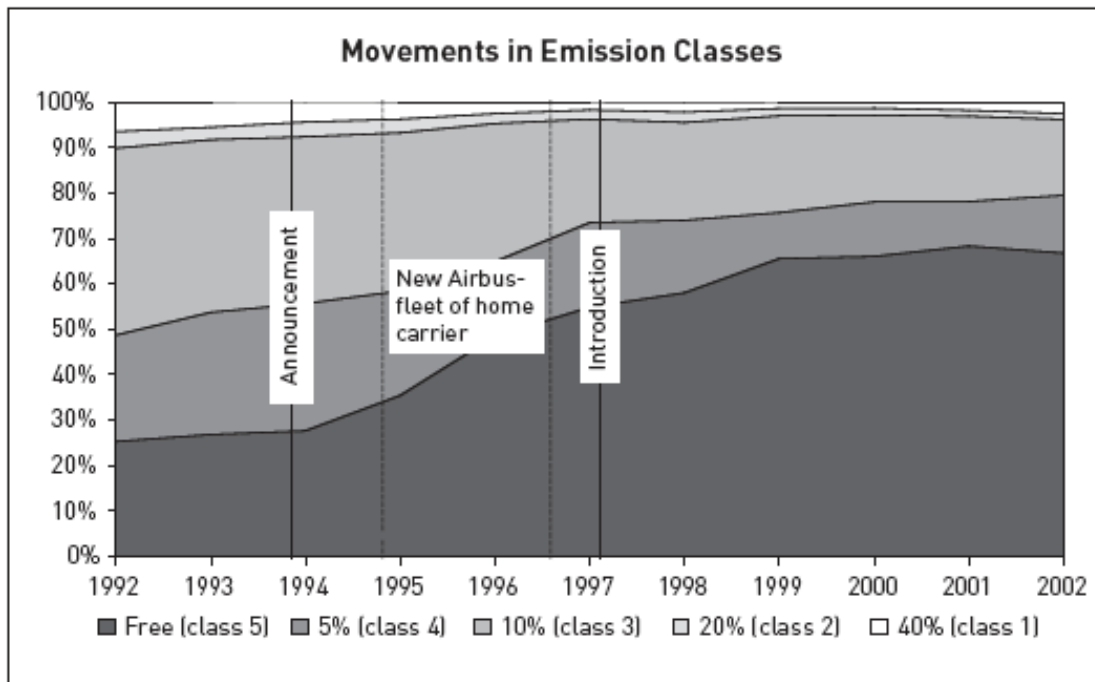
From the provision of noise charges by Zurich cantonal government, it also concern of the air pollution as well. The graph below shows the emission of aircrafts at Zurich Airport. The timeline and the aircraft class are relating to the Zurich Airport 'noise surcharge' scheme above but this graph shows the 'emission charges' where class 1 are charged at 40 percent of the emission, class 2 are charged at 20 percent, and so on. From the announcement of implementing such scheme in the late 1993, airlines have adjusted their use of aircrafts to class four and five, which the airlines will not be charged by the airport for the polluted of emission or try to keep it as low as possible. The adaptation adjusted quickly until the formal introduction of the program so that it is economically efficient in the long run.

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<sup>35</sup> Whitelegg, 2000, sec 3.2.



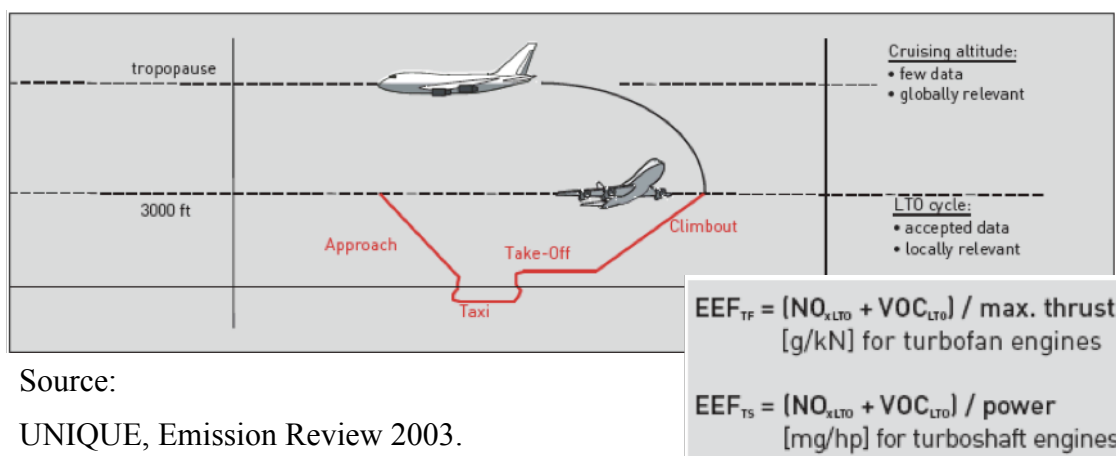
**Graph 3: Movements in Emission Classes**



Source: UNIQUE, Emission Review 2003.

The limitation of charges posed by Zurich Airport is at the level of locally concern since the real effects can be captured at the lower altitude. The diagram below shows the perimeter of charges, involving landing, taxi, take-off, and climbout procedures. All movements at ground level up to three thousand feet above are being calculated.

**Diagram 1: The Emission & Noise Charging Scheme**



Source:

UNIQUE, Emission Review 2003.

Thus, the aims of the noise and emission charges scheme of the cantonal government in Zurich is to accelerate the introduction of new technology by the manufacturer and at the same time, stimulate airliner to foster and welcome new innovations to its fleet. Zurich is the first airport in the world to introduce market-based incentives to counteract the current concerns.<sup>36</sup>

### **PART III: Social Cost**

“The case for expanding airports and supporting the growth of aviation is frequently supported by evidence on the economic gains (especially jobs) associated with this growth... Traditional economic arguments also fail to include a consideration of the economic impacts of environmental deterioration, health damage and climate change. If these considerations are factored in it may well be the case that a reduction in the demand for air travel will have positive economic benefits.” (Whitelegg, 2000)

The restriction of growth in aviation and expansion of airport is assumed to pose significant damage to the economy through the services sector and the job arena. On the contrary, many evidences have altered such linkages, claiming that it is unlikely to have significant effect. Whitelegg (2000) suggests that in the long run, such restriction may as well benefit the environment in general including the gains in quality of life, which lead to the ideal usage of air transport and its positive-impact sustainability.

#### **The contradicting arguments**

Controversial as it may be, airport is a big challenge for the government to carefully plan and build with consideration of necessity and its future efficiency. Many international airports and continental hubs building and/or expansion are largely controlled and oversight by the national government. It is possible that, studies of such may or may not be in favor for the expansion, can largely be influenced by the researchers and the accountable agency.

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<sup>36</sup> Emission Charges Zurich Airport Review 2003 by UNIQUE.

London, as one of the world's economic centers, once faced the challenge of Heathrow Terminal 5 expansion and the third runway. Despite the fact that the UK government voted in favor of the T5 in 2001 and voted against the third runway, the papers published earlier by concerning agencies may not totally agree otherwise. This section will discuss the two controversial reports by two different agencies with two different perspectives. Both reports were first published in the same year, 1999.

### *The Contribution of the Aviation Industry to the UK Economy*

The Oxford Economic Forecasting (OEF) published this paper in 1999 and reconfirmed once again in October 2006.<sup>37</sup> The report is totally in favor for the support of air travel and airport as the main driver for the growth of the UK economy. The report discussed in-depth detail of the following headlines:<sup>38</sup>

- Aviation is a substantial industry;
  - £11.4 billion contributed to GDP, which represents about 1.1 percent of the total economy. 186,000 direct employment along with supporting employees of over 520,000 people.
- Aviation supports tourism and trade;
  - International visitors spending generated 170,000 jobs in the UK alone while exports are taken by airfreight by 55 percent of the total exporting mode of transportation. Air services are vital for passenger services oriented airlines to take advantages of marketing and sales, at the same time it helps UK economy to catch up over time as the growing economies like China and India are emerging rapidly.
- Aviation influences where companies invest and is particularly important for key growth sectors;
  - The UK economy structure became more dependent upon air service gradually as it evolves. The allocation and clustering of industries weigh highly on the air service capability. It also serves as the gateway to 'respond to globalization' and linkage to knowledge.
- Users depend on network connectivity;

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<sup>37</sup> From this point on it will be easier to refer as the OEF Report.

<sup>38</sup> OEF Report, 2006, p 5.

- The range of destinations and frequency of air services are vital to organizations both for large hubs and small airports. People have more option to make trips and able to spend less time during flight period. Regional airports allows travelers to use local and/or no-frill carriers and make short-haul flights.
- Aviation supports business efficiency;
  - It improves the organizations' operations such as sales, logistics, inventory management, and production. The ease of air services stimulate channel of making profits, "allow exploitation in economies of scale and enhances competition," (OEF, 2006). Econometric calculation estimated that a restriction of 1 percentage point a year over a thirty year period would have a negative impact to the loss of GDP 1.8 percent per annum.
- Airport development would have wider GDP benefits and reduce congestion costs;
  - Huge number of GDP increases showed in the model calculated by OEF if the implementation of the White Paper is successful especially for the third runway. The result revealed that airport development would increase GDP of 0.3 to 0.6 percent per annum up to the end of 2030. Larger airport and higher capacity will reduce congestion and the costs the follow. Currently, it costs the airline and the passenger £1.7 billion to cover the cost of resolving congestion management. *Lastly, the report concluded that;*
- Environmental impacts are smaller than GDP benefits.
  - The OEF recognizes three main environmental impacts, which includes noise, local air quality and climate. The OEF emphasize the importance of climate since they claim that it is the most quantifiable terms. The cost of CO2 offset and other climate impacts estimated to capture at £1.4 billion in 2000 and may reach £4 by 2030. Full implementations of the White Paper would greatly reduce such cost to only £700 million in 2030. **Nevertheless, any environmental impacts would not exceed the UK GDP benefits in air transport.**

### *The SACTRA Report*

The second report as mentioned was published by the UK Department of Transport. The SACTRA report or the Standing Advisory Committee for Trunk Road Assessment (SACTRA), commissioned in 1996, did not focus on the aviation transport in particular but the concerns can be generalized in terms of overall transportation. The committee used the general approach to consider all transportation system so that the results would equally balance out in terms of transport investment and policy provision for further decision-making. The findings of SACTRA report contradicted with the OEF report to some extent.

From the evidence and empirical data, the SACTRA report concluded that although it is expected that improved transportation infrastructure would be a positively link to the growth of economy and economic activity, such assumption is unlikely to be true since there are weakness of supporting evidences.<sup>39</sup> The impact of transport outside the transport sector is not significant; therefore, it does not necessary mean that restricting transportation growth would lower economic activity.<sup>40</sup> *“The increased levels of travel could be a consequence of economic growth rather than the other way round.”*<sup>41</sup> In fact, it is the local circumstances that matter, as concluded by the committee. A point was made, giving the situation of winners and losers regions of economy when the competitive areas having improved access to transportation, the larger quantity of labor shift may occur, employee moving from one location to another, creating regional phenomena.

Imperfections of the economy are to be included when considering costs and benefits. For air transport, the congestion and environmental impacts are external costs, which may have been distorted by the competition in the industry. Air tickets are sometimes are so cheap that people have the urge to travel when there are other alternatives which they could have taken.

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<sup>39</sup> Department of Transport, UK.

<http://www.dft.gov.uk/pgr/economics/sactra/transportandtheconomygovern3149?page=2>

<sup>40</sup> Whitelegg, 2000.

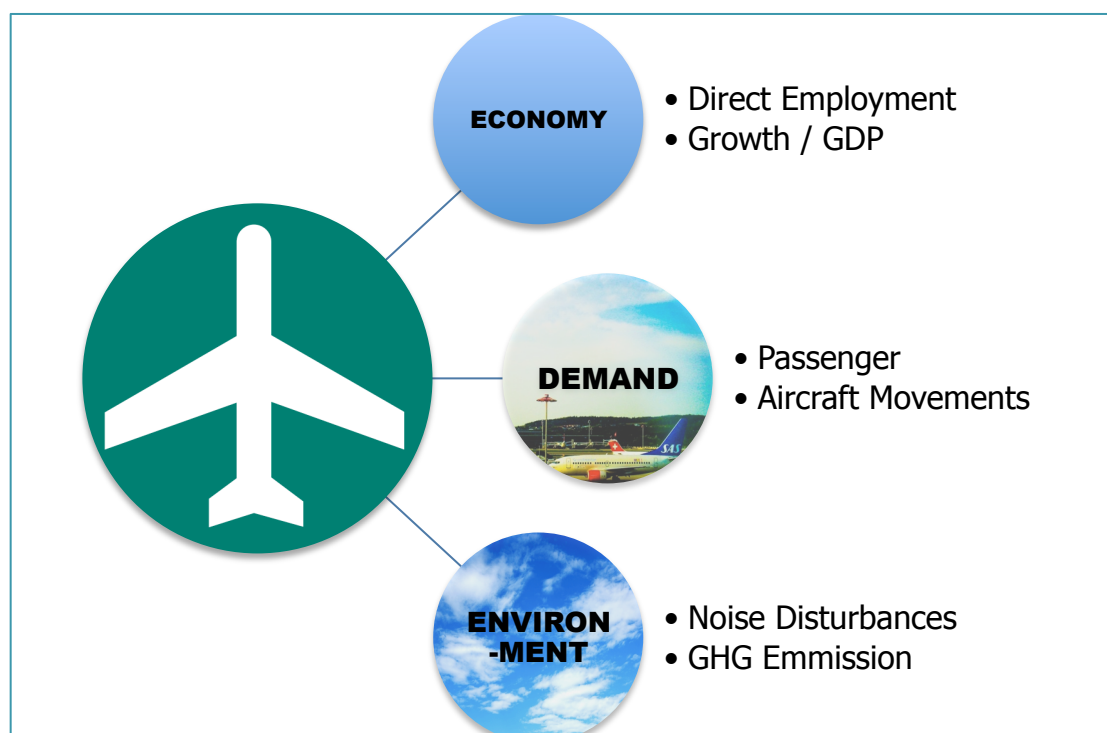
<sup>41</sup> Whitelegg, 2000.

## Testing of what has been claimed

### *Statistical Data and Tests: Sweden*

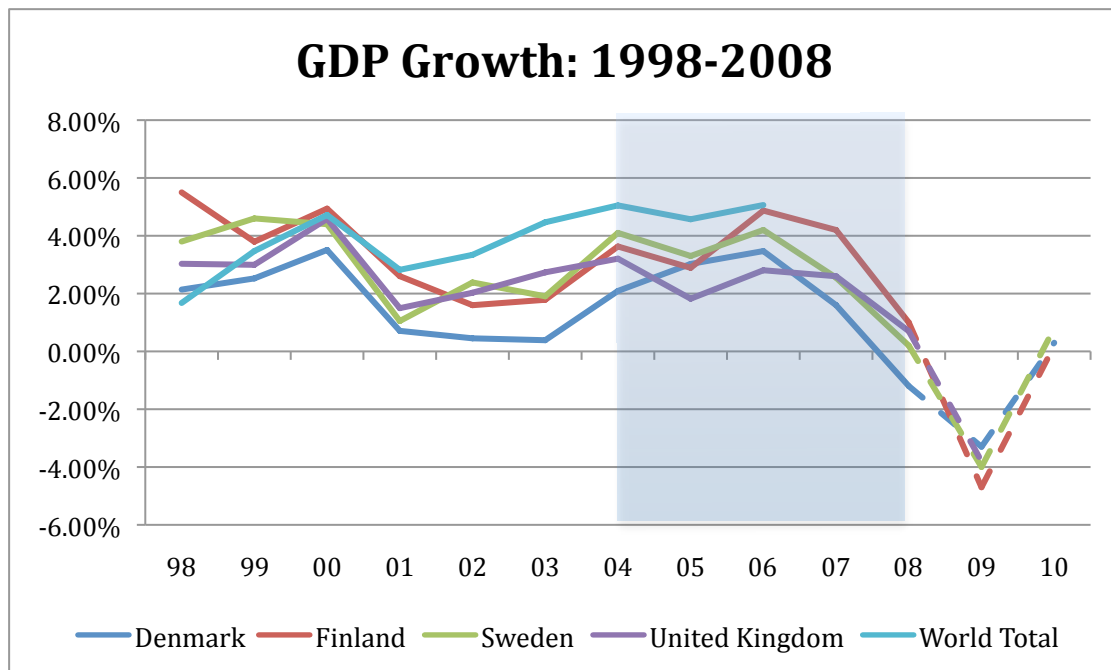
As there are claims of health-threatening concerns, environmental degradation, and exploit of aviation market, accountable to the location of airports, aircraft movement, and this part is trying to test the above issues. Sweden and some European countries were chosen as samples because of the rich and organized data of statistical collection. *Statistiska centralbyrån* or Statistics Sweden and affiliated agencies have been keeping continual and detailed survey in variety of aspects, which cover most relevant issues. Although, Sweden may not be the world airport hub center but it hosts one of the world mainstream airline, Scandinavian Airline (SAS). Incomparable to Germany and United Kingdom, Sweden will present the situation of a developed country that does not have the extremity of air traffic as it may appear in the data of the busy Frankfurt and Heathrow that may offer.

## Diaphram 2



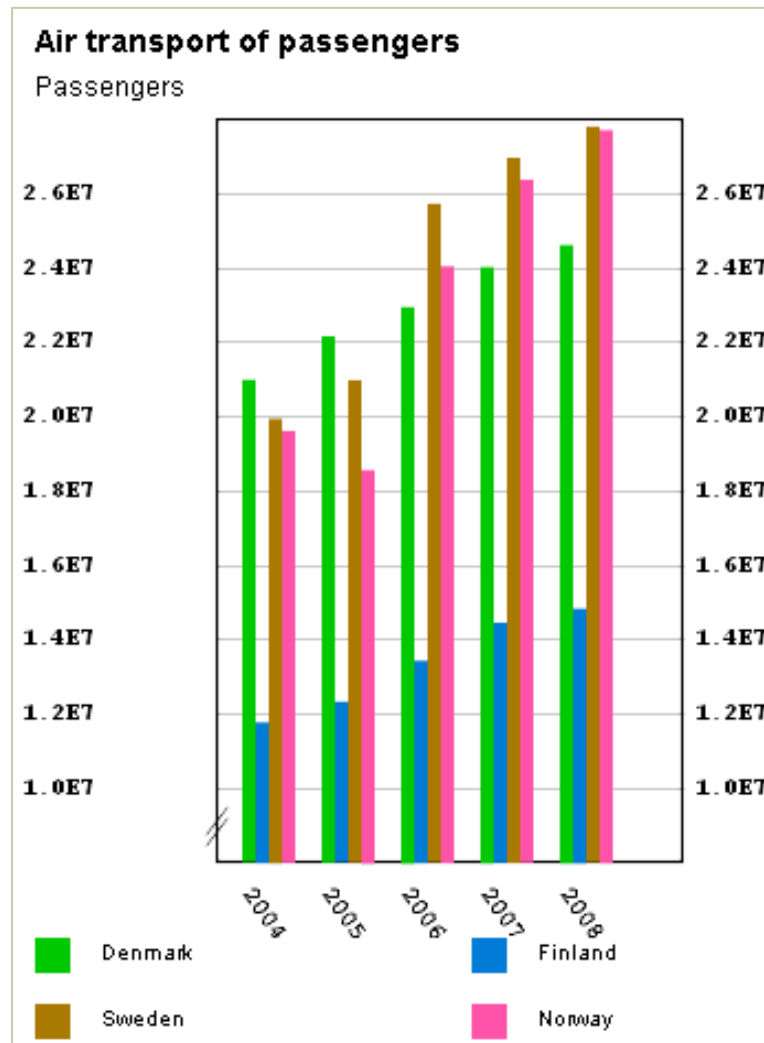
## The Economic Growth vs Demand

Graph 4



Source: Eurostat, Statistiska centralbyrån (Statistics Sweden)

Graph 5



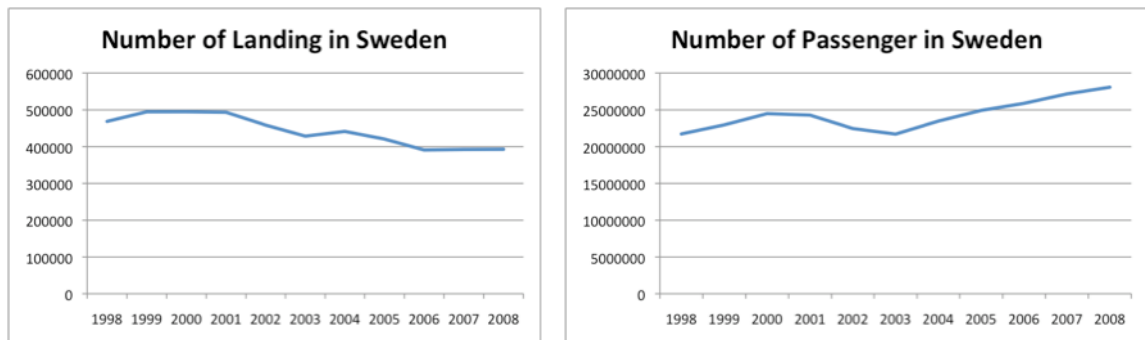
Source: Eurostat

Although, the economic growth shown in the percentage change of annual GDP rate may have decreased in several years but it does not affect the growth of passenger demand and the number of passenger kept growing steadily in Denmark and rapidly in Sweden. The incident of September 11, 2001 did in fact decrease the number of traveler by 2 percent from the previous year. The rapid growth after the mid decade shows more confident of passengers and the reliable security measures. Sweden high growth of passenger may have due to more unscheduled flights (charter flights) and the growing of no-frill airlines that offer people at lower costs in shorter flights.

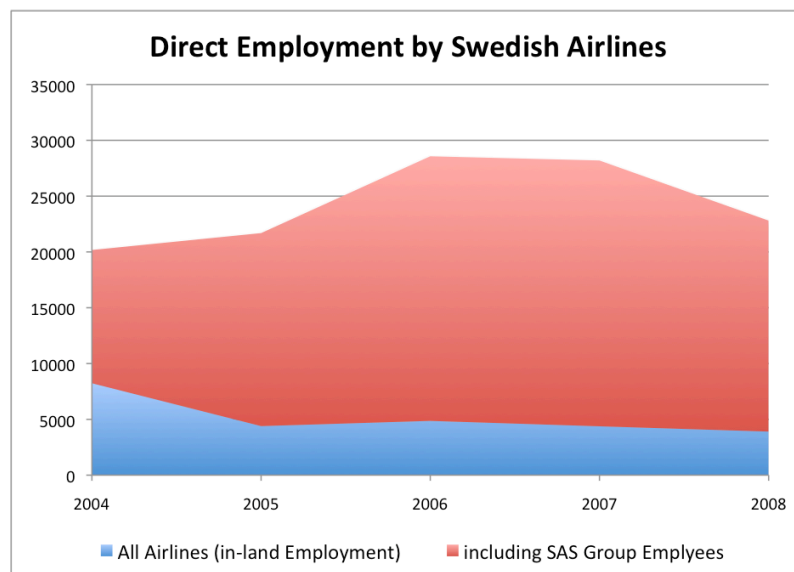


The graphs below show the number of landing and passenger in Sweden. It appears that even though the number of landing decreased, the number of passenger still increases. This is because airliners have been changing the flight plan and switch from smaller plane to larger capacity that can carry more customers.

**Graph 6:** Number of Landing in Sweden    **Graph 7:** Number of Passenger in Sweden



**Graph 8**



Source: SIK A Statistik

### Employment

The direct employment by Swedish airlines consists of national, regional, local, and private airline but the large proportion of the employee are taken by Scandinavian Airline Group with the total of almost 30,000 employees. The large increase from 2005 was due to the adjustment of organization restructure; Scandinavian Airlines

System and other subdivisions are grouped together. The increased number also includes employees outside of Sweden that was not counted earlier.

The sharp drop of employment after 2007 had shown sign of stagnation since 2006. Although the number of passengers did not correlate with Direct Employment graph but it certainly correlated with the economic growth. The GDP has slowed and dropped since 2006 and continues to degrade in most economies in Europe.

The indirect employment are not discussed in here is obvious. It is difficult to measure and that there are uncertainties to what is the underlying effect of deviation. Although, there is a strong expectation that, for example, tourism could increase the indirect employment but such data are not available in detail since it would have to measure all sector of the economy, rather looking at the employment/unemployment rate of the economy to see the different, nevertheless, it is hard to detect the changes when looking at the whole economy.

## **Environmental Concerns**

### **Noise Disturbances**


There is no clear indication of how noise disturbances they can be. No official survey is published of the level of noise that could have serious health effect. However, many airports keep track of their own faults and measure the high level of noise decibel in the airport vicinity and estimate the residential area such noise may affect the well being of nearby community.

Sweden official statistics measured the share of noise created by different type of aircraft. The levels of noise are contributed by the size of aircraft, the number of engines, and the air routes of landing and take off.

**Table 6**

Allotment of noise groups <sup>1</sup> percent share 2005, 2007 and 2008.			
	2005	2007	2008
Klass A Group A	16,5	16,6	18,0
Klass B Group B	22,7	20,1	17,1
Klass C Group C	10,4	14,6	16,7
Klass D Group D	22,2	24,8	24,9
Klass E Group E	12,8	7,7	7,8
Klass F Group F	15,5	16,2	16,9

<sup>1</sup> I klass A ingår de tystaste och i klass F de mest bullrande flygplanen, med hänsyn tagen till flygplanets storlek.  
Group A contains the most quiet and group F the most noisy aircrafts, considering the aircraft weight.

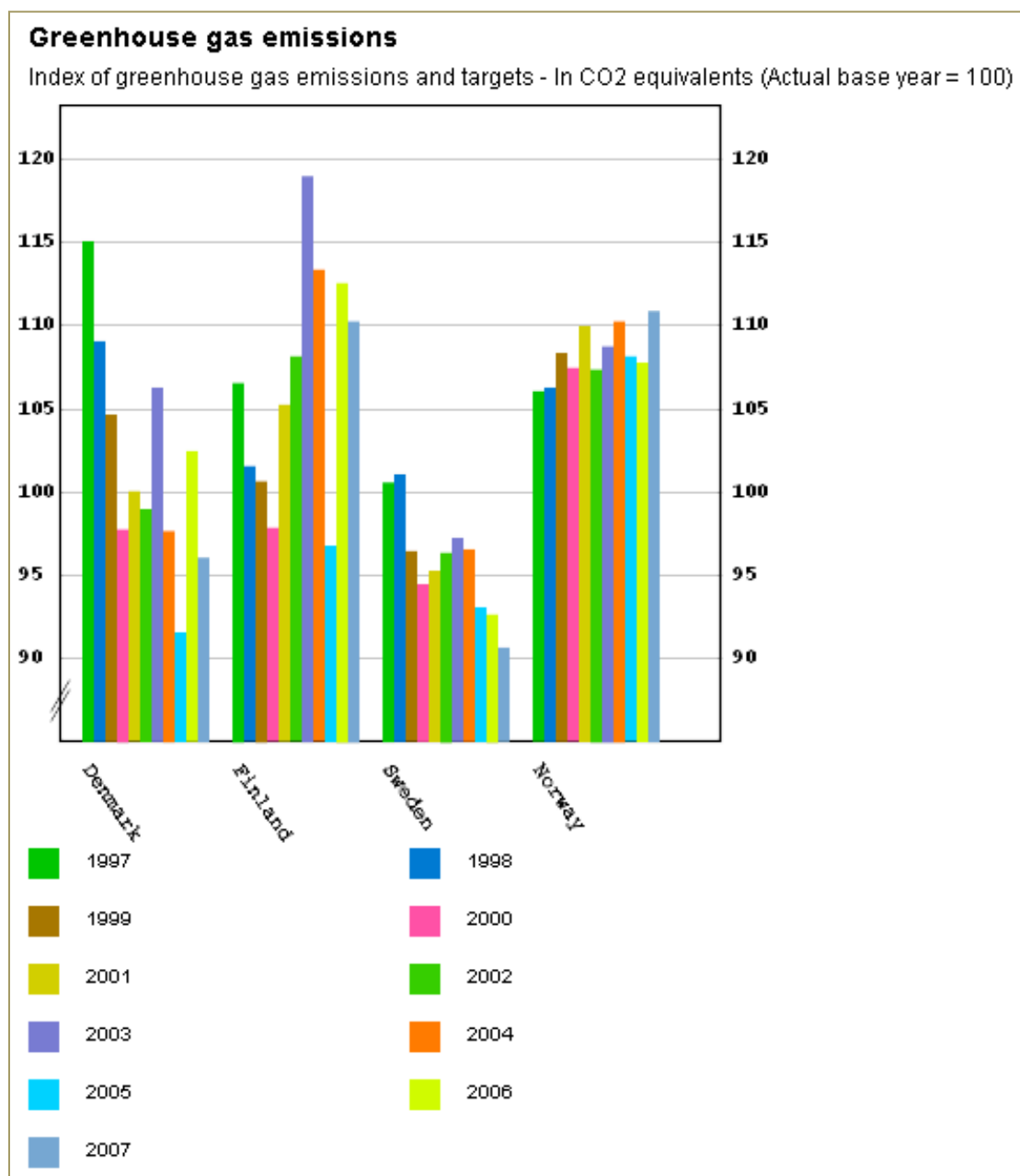
 Sveriges officiella statistik

**Source: SIKA Statistik**

### Emission to Air

The GHG or the greenhouse gas emissions and the particulate matter (PM) are displayed in the graphs below, comparing Scandinavian countries for the total emission from all sources. The data are presented over time of ten year. Keep in mind that these data are not emission only from aircraft.

**Graph 9**

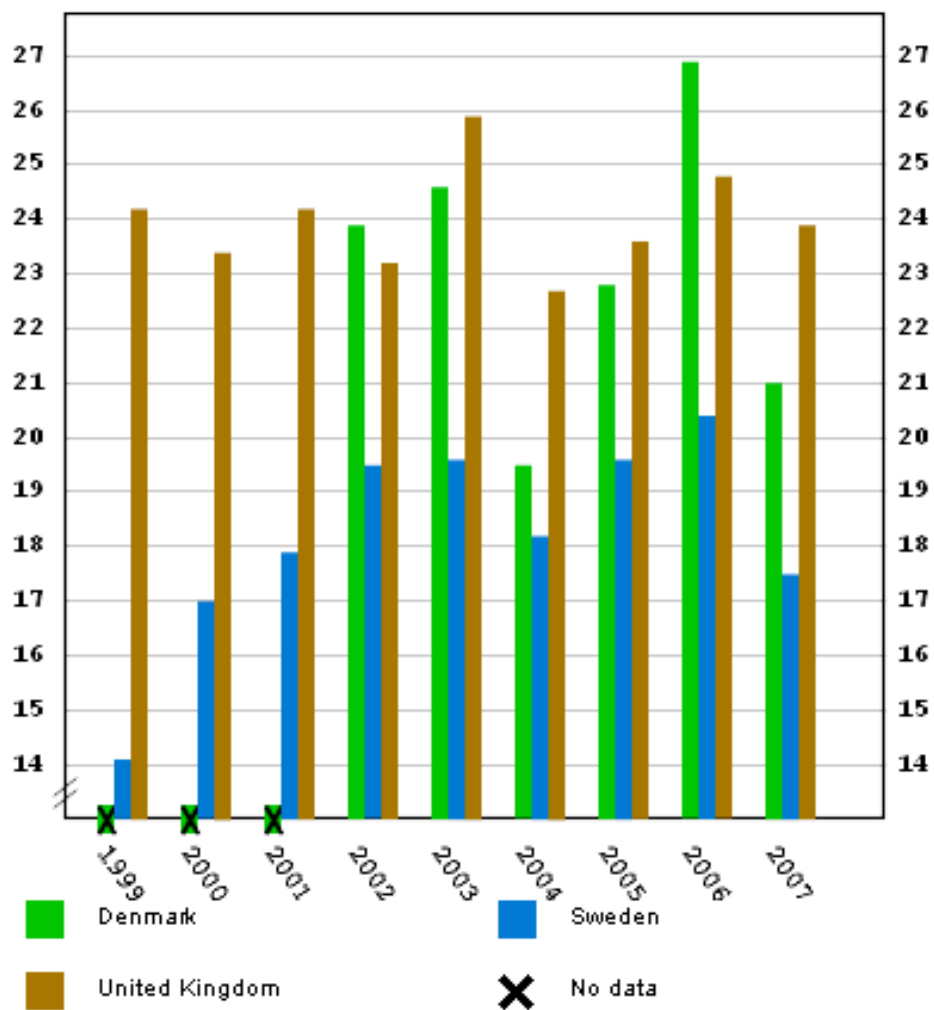


Source: Eurostat

Graph 10

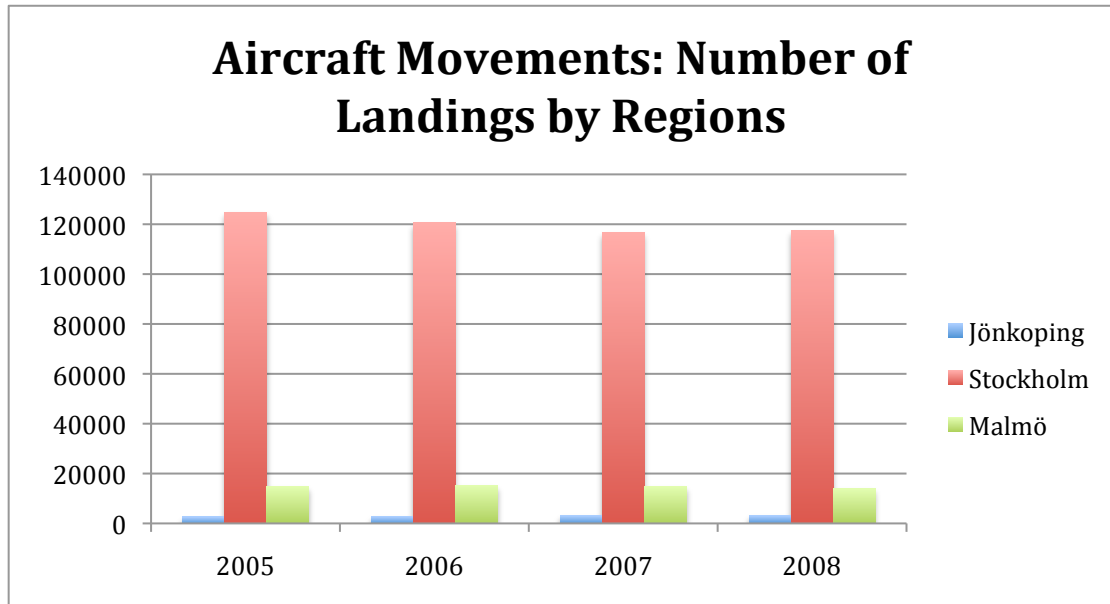
### Urban population exposure to air pollution by particulate matter

Population weighted annual mean concentration of particulate matter



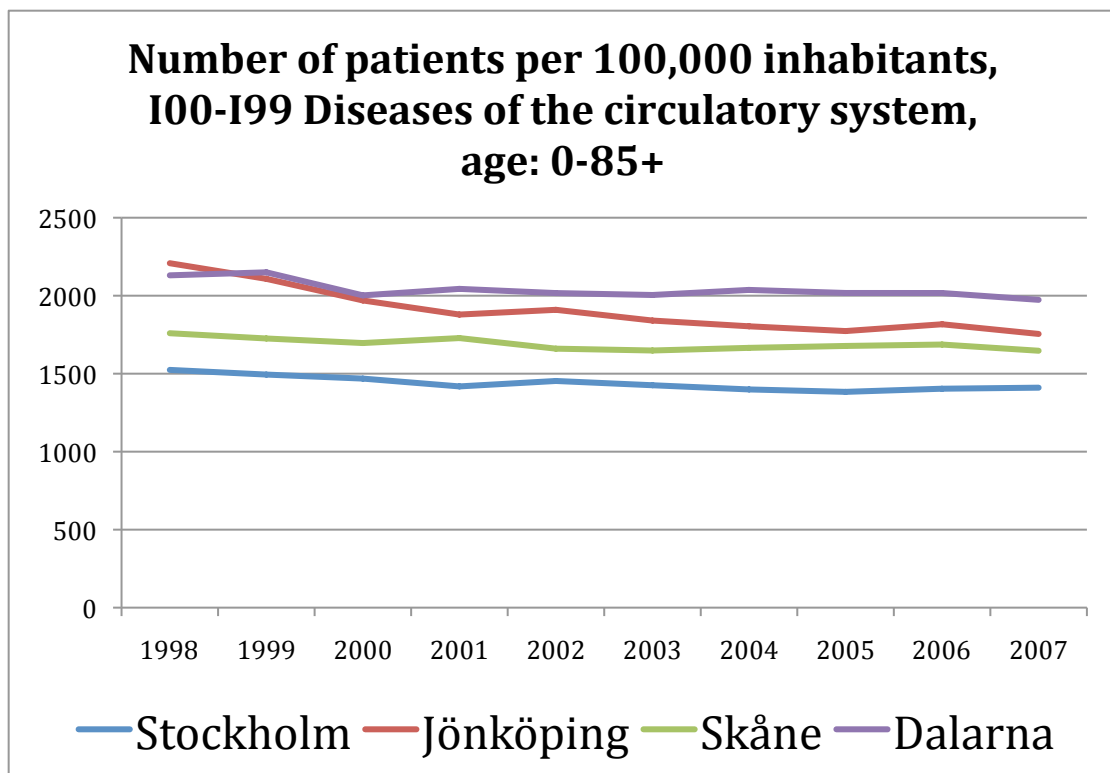
Source: Eurostat

**Graph 11**



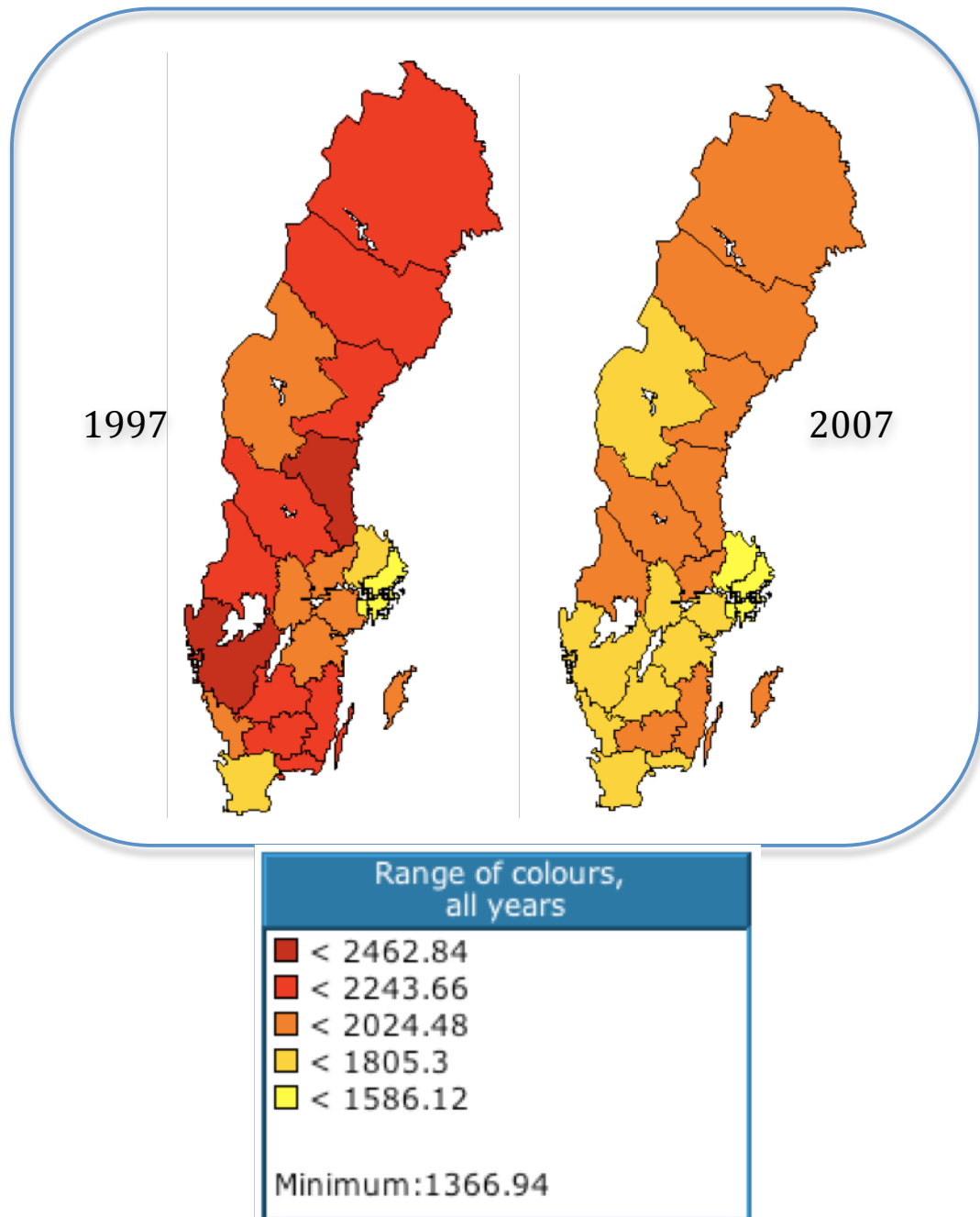
Source: LfV

**Graph 12**



Source: Statistiska centralbyrån (Statistics Sweden)

**Picture 1: Number of patient per 100,000 inhabitants with diseases of the circularatory system in Sweden, age 0-85+ by region**



*Source: Socialstyrelsen*

The diseases of circulatory and cardiac related issues appeared to decrease along with the fact that less landing occurred in the past few years. However, there is no clear linkage whether the aircraft movements is the key factor to that since air traffic concentrated region of Stockholm seems to be unaffected in any time period. The same situation in Skåne area (the very bottom of the map), densely populated with the gateway to neighbor country like Denmark. The town of Malmö has its own airport, Sturup, with Copenhagen International just on the other side of the sea. Other explanation assumes that because Stockholm and Malmö are among the top largest cities in Sweden, it could be that people have more and easier access to medical care and routine medical check up. In addition, the survey revealed that medical advances improved in the methods and procedure of diagnostic prevented symptoms thus reducing the number of patients. The share of patients may have well reduced due to the increase of population in each region.

The same situation applies to the diseases of respiratory system. The number of patients has decreased in the past ten years with Stockholm and Skåne area stands out from other regions of the country. From the evidents, gases from air traffic as shown in the table below, appeared to gradually decreasing. The European Union and the Kyoto protocol were the factors contributing to the changes in Europe as well as Sweden. Most of the restricted gases have been achieved under the target amount. Another word, the emission are far below what was expected.

Yet, other old industrialized countries and the former Soviet union countries are among the largest emission nations in Europe after entered the European Union. "A tonne of carbon emissions will cause the same damage no matter where it is emitted on the globe."<sup>42</sup> A close cooperative among countries will be the most effective way to help reduce GHG emissions.

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<sup>42</sup> Estimating the Social Cost of Carbon Emissions, p.18.



**Table 7**

Exhaust gases from domestic, international and national air traffic 2004-2008.

	2004	2005 <sup>1</sup>	2006 <sup>1</sup>	2007 <sup>1</sup>	2008 <sup>1</sup>
Koldioxid (CO <sub>2</sub> ), tusen ton Carbon dioxide, thousand tonnes					
Inrikes Domestic	555	545	514	491	503
Utrikes International	1 474	1 524	1 624	1 758	1 821
Nationellt National	1 439	1 443	1 439	1 449	1 485
Kväveoxider (NO <sub>x</sub> ), ton Nitrogen oxides, tonnes					
Inrikes Domestic	2 238	2 275	2 085	1 990	2 053
Utrikes International	6 745	7 213	7 684	8 488	8 755
Nationellt National	6 172	6 411	6 334	6 402	6 507
Svaveldioxid (SO <sub>2</sub> ), ton Sulphur dioxide, tonnes					
Inrikes Domestic	176	172	163	156	159
Utrikes International	466	482	514	556	576
Nationellt National	456	457	455	459	470
Kolmonoxid(CO), ton Carbon monoxide, tonnes					
Inrikes Domestic	1 952	1 775	1 573	1 058	1 034
Utrikes International	2 538	2 629	2 832	2 674	2 753
Nationellt National	3 833	3 669	3 574	2 942	2 976
Ofullständigt förbrända kolväten (HC), ton Unburned hydrocarbons, tonnes					
Inrikes Domestic	316	317	260	232	228
Utrikes International	325	323	364	354	366
Nationellt National	576	575	541	507	514

<sup>1</sup> Avser utsläpp från flygtrafik vid de svenska flygplatser som var statliga år 2004.  
Applies to exhaust gases from air traffic at the airports that were governmental year 2004.

 Sveriges officiella statistik

Source: SIK A Statistik

**Table 8**

Ratio domestic flights 2004-2008, grams per passenger kilometers.

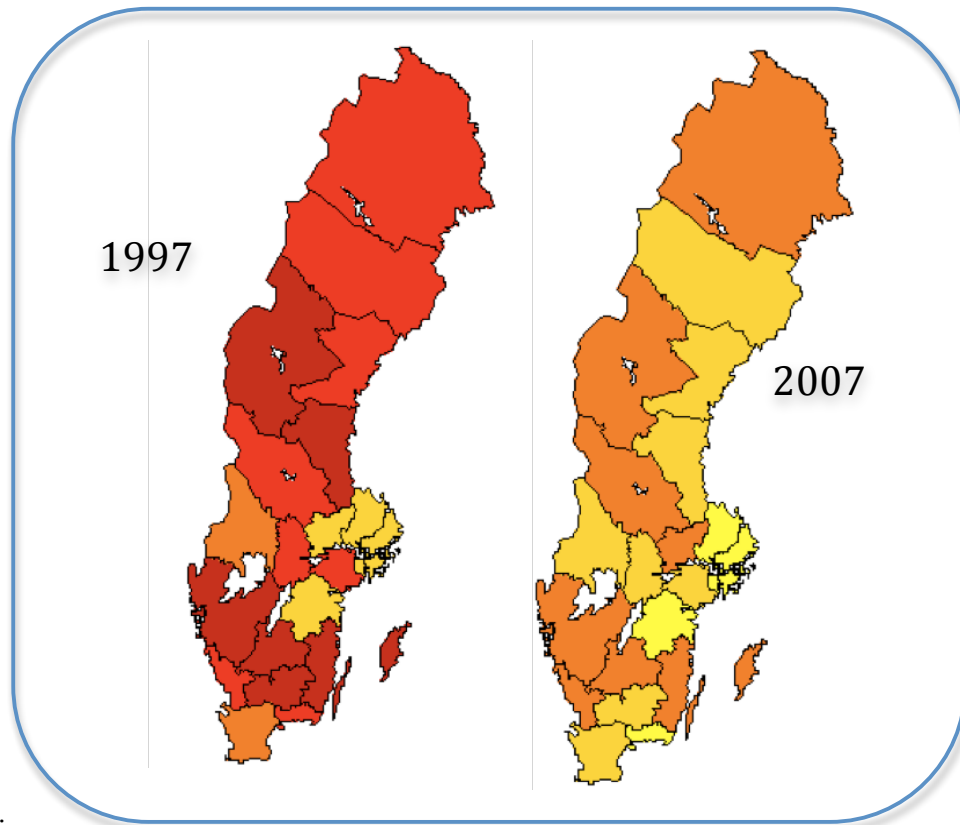
	2004	2005 <sup>1</sup>	2006 <sup>1</sup>	2007 <sup>1</sup>	2008 <sup>1</sup>
Koldioxid (CO <sub>2</sub> ) Carbon dioxide	179	170	162	157	161
Kväveoxider (NO <sub>x</sub> ), Nitrogen oxides	0,72	0,71	0,66	0,64	0,66
Svaveldioxid (SO <sub>2</sub> ), Sulphur dioxide	0,057	0,054	0,051	0,050	0,051

<sup>1</sup> Avser utsläpp från flygtrafik vid de svenska flygplatser som var statliga år 2004.  
Applies to exhaust gases from air traffic at the airports that were governmental year 2004.

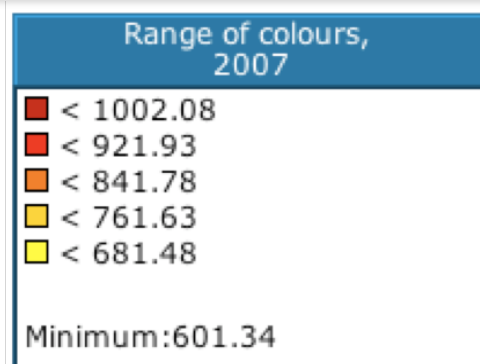
 Sveriges officiella statistik

Source: SIK A Statistik

**Picture 2: Number of patient per 100,000 inhabitants with diseases of the respiratory system in Sweden, age 0-85+ by region**



Source:  
Socialstyrelsen

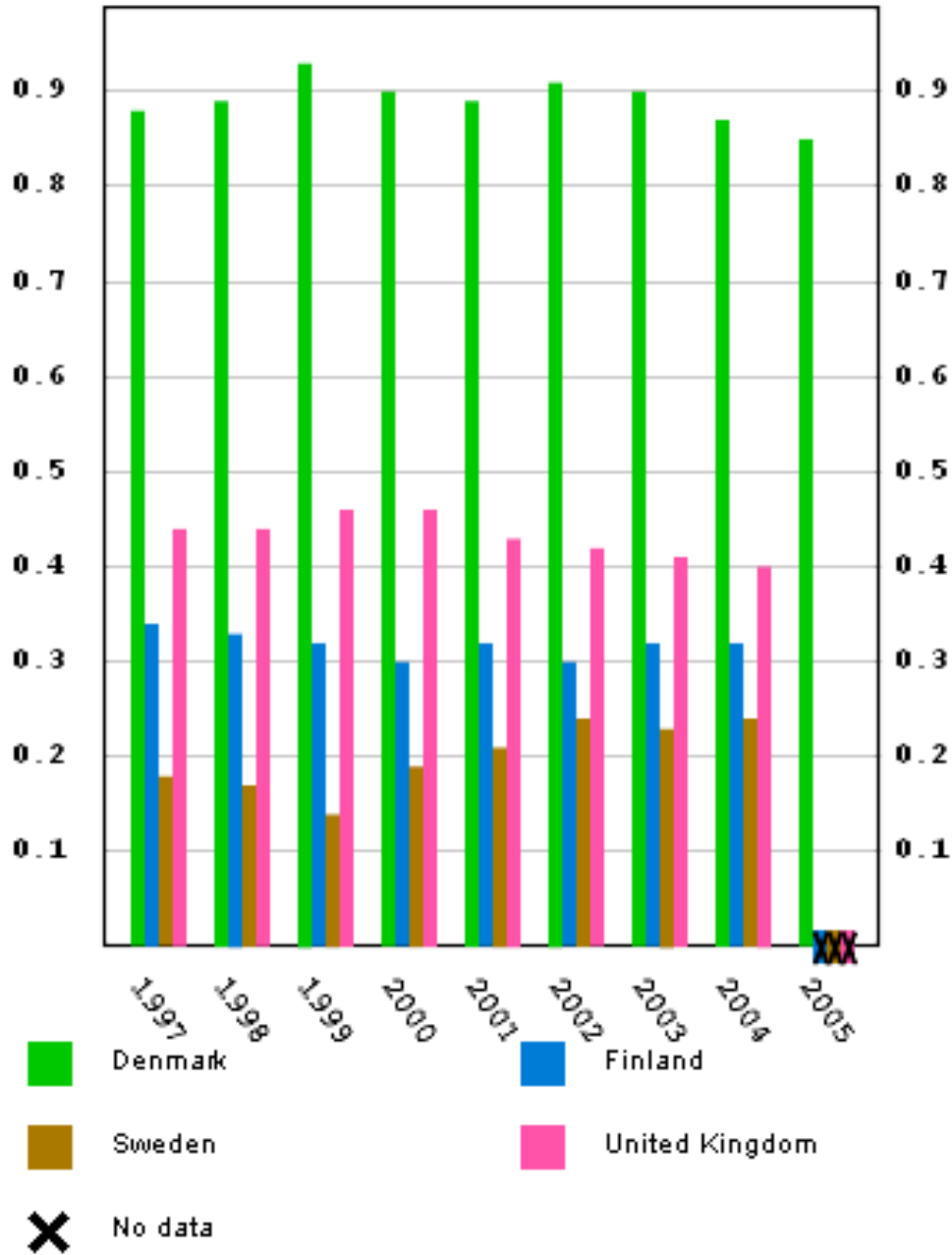


## Environmental Expenditure

The costs to cover the environmental effects are tremendously high in terms of investment in research and development, innovation, production, and awareness. People are those who produce the emission and it is people who sought to capture and offset them, but until then, the problems are being resolved in the higher levels of national agencies to protect and preserve the nature. Such action of course needs capital injection to make it effective. These capital sources are expenditures by the tax payers and the organizations involving to the emissions such as the airliners or the non governmental organizations. The graph below shows the environmental expenditure of the public sector in different countries. United Kingdom, the lowest contributor of all but emitted more than the rest. While Denmark put much of the expenditures to help the environment as much as almost 1 percent of their GDP.

Graph 13

**Current environmental expenditure by the public sector**  
(% of GDP)



Source: Eurostat

## CONCLUSION & RECOMMENDATIONS

The question whether airport and aviation caused damage to the society is largely inconclusive as there are many uncertainties in what are the affects produced by flying and that it is still growing. However, as evidences have shown by far, airports bring much of the prosperity to the region and the acceleration of globalization. The OEF Report may have been criticized as biased, being paid by air transport benefiteres, but the report collected reliable data with detailed explanations that might have not come about in the issues of aviation and airport expansion. The restriction of airport might have created the loss of potential gains, so the question “what if there is no growth” as counterfactual is succeeded by the outcome of the leap frogging of many economies around the world.

Considering of what has been gained from the air traffic growth is uncountable. The GDP and capital investment may be recorded but the indirect employment and knowledge sharing is too great. The environmental effects does occur and it does consume part of the growing economy but it in a way stimulate the on going innovation and adaptation of the society. Now that we know what it damages, we innovate to fix and change those negative impacts, building large-scale outdoor noise meters, different type of air measurements, and different approaches to prevent the future impacts like building aeropolis. Aeropolis is turning airport into a town with its own infrastructure and urban planning so that the construction can be controlled and no growth of residential area may occur and lives will not be damaged by aviation.<sup>43</sup>

The industry of airplane manufacturer is also changing to become environmental friendly. The provision and the future action will be worth investing for the less costs of environmenatal therapy. The costs are not exceeding, if we take action early on, as it is happening now today. It might costs more to take action later.

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<sup>43</sup> Environmental Concerns for Suvarnabhumi Airport and Aeropolis.

## Appendix

### Facts and abbreviations

#### **Auxiliary Power Unit (APU)**

(1) a device used on aircraft to provide power while on the ground and to start the main engines.<sup>44</sup> (2) a device on a vehicle whose purpose is to provide energy for functions other than propulsion, the primary purpose is to provide power to main engine.

#### **Carbon monoxide (CO)**

At high levels this causes headaches, drowsiness, nausea and slowed reflexes, and at very high levels it causes death. At low levels it can impair concentration and nervous system function and may cause exercise-related heart pain in people with coronary heart disease. It may increase susceptibility to infection and aggravates asthma. In children exposure may result in coughs, colds, phlegm, shortness of breath, chronic wheezing and respiratory diseases including bronchitis.<sup>45</sup>

**IATA:** International Air Transport Association

**ICAO:** International Civil Aviation Organization

#### **Contrails**

When modern jet aircraft burn fuel at altitudes of 10-12 km the water vapor that is produced is injected into the atmosphere where temperatures are approximately -40 C. The water vapor then freezes to produce tiny ice particle (sometimes in association with particulates), which form the familiar trails behind aircraft when viewed from the ground. These are known as "contrails". They can be long lasting depending on weather conditions and spread to a width of tens of kilometres. In frequently flown flight corridors (eg Europe and the North Atlantic) contrails can cover 5% of the sky area annually. Below the flight corridors where air traffic is concentrated, contrails could have a greater

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<sup>44</sup> Apple Inc., software: Dictionary.

<sup>45</sup> Whitelegg, 2000.

greenhouse effect than all greenhouse gas emissions together (T&E, 1999).<sup>46</sup>

### **Nitrogen oxides (NO<sub>x</sub>)**

Impairs respiratory cell function and damages blood capillaries and cells of the immune system.<sup>47</sup>

### **Ozone (O<sub>3</sub>)**

Ground-level ozone reduces lung function in healthy people as well as those with asthma. It may increase susceptibility to infection and responsiveness to allergens such as pollens and house dust mites. It may cause coughs, irritation of the eyes, nose and throat, headaches, nausea, chest pain and loss of lung efficiency, and increases in the likelihood of asthma attacks.<sup>48</sup>

### **Particulate matter (PM)**

Strongly associated with a wide range of symptoms such as coughs, colds, phlegm, sinusitis, shortness of breath, chronic wheezing, chest pain, asthma, bronchitis, emphysema and loss of lung efficiency. As many as 15% of asthma and 7% of Chronic Obstructive Pulmonary Disease cases in the urban population are estimated to be possibly related to prolonged exposure to high concentrations of PM. Long term exposure is associated with increased risk of death from heart and lung diseases. PM may carry carcinogens such as polycyclic aromatic hydrocarbons (PAHs), and hence may increase the risk of developing cancer.<sup>49</sup>

### **Sulphur Dioxide (SO<sub>2</sub>)**

SO<sub>2</sub> irritates the lungs and is associated with chronic bronchitis. People with asthma are particularly vulnerable and a few minutes' exposure to the pollutant may trigger an attack. The most serious effect occurs when SO<sub>2</sub> is absorbed by particulate matter and then inhaled into the lungs. At high doses it can release sulphuric acid on reaction

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<sup>46</sup> Whitelegg, 2000.

<sup>47</sup> Whitelegg, 2000.

<sup>48</sup> Whitelegg, 2000.

<sup>49</sup> Whitelegg, 2000.

with moisture in the lungs.<sup>50</sup> This can result in widespread death and illness - for example, it is likely to have been the main cause of the 4,000 deaths during the notorious 1952 London smog.<sup>51</sup>

### **Volatile Organic Compounds (VOCs)**

This category of pollutant includes thousands of different chemicals, many of which are hydrocarbons (HC). They may cause skin irritation and breathing difficulties. Long-term exposure may impair lung function. Many individual compounds are carcinogenic, including benzene, which is added to unleaded petrol. Benzene can cause leukaemia. Those most at risk are people exposed to benzene at work or who live or work in the vicinity of petrol filling stations or general vehicle activity.<sup>52</sup>

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<sup>50</sup> Whitelegg, 2000.

<sup>51</sup> British Lung Foundation (1998) *Transport and Pollution: the health costs*.

<sup>52</sup> Whitelegg, 2000.



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