# Night flight restrictions and airline responses at major European airports

**Final report**
Delft, September 2012

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# Publication Data

**Bibliographical data:**
Jasper Faber, Linda Brinke, Martine Smit
Night flight restrictions and airline responses at major European airports

Delft, CE Delft, September 2012

Publication code: 12.7621.60

CE publications are available from www.cedelft.eu

Commissioned by: ADVOCNAR.
Further information on this study can be obtained from the contact person, Jasper Faber.



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# Preface

This report has been written for ADVOCNAR. The authors would like to thank Alain Peri and Patric Kruissel for their valuable comments.
The views expressed are those of the authors, not necessarily of the client. All errors are ours.

Jasper Faber

# Contents

# Summary

**The French Government has started a process to assess the positive and negative impacts of night flights on French airports.** Night flights are concentrated very much at Paris Charles de Gaulle Airport (CDG).

**Night flights are often claimed to be essential for airline networks and to provide important economic benefits.** This report has assessed both assertions.

**This report shows that Paris Charles de Gaulle is the least restrictively regulated of the major European hub airports**. While all airports have restricted the number of movements in a part of the night, Charles de Gaulle has only ended further growth of the number of movements beyond the level of 2003, and only during a five-hour period, which is shorter than at the other airports. Moreover, in contrast to e.g. Schiphol and Frankfurt, the total number of flights during the 8-hour night is not restricted. Partly as a result, Paris CDG has about twice more flights during the 8-hour night than its competitors.

**In contrast to other hubs, night flights at CDG are often freight and express flights. Moreover, Air France uses night flights at CDG to allow long-haul travellers to connect to flights to other European destinations, but to a lesser extent than e.g. British Airways.** Based on analysis of passenger night flights in a random week, flight restrictions and local demand appear to influence how night flights are used. At Heathrow, where the number of flights is restricted, they appear to be used to offer passengers connecting early morning flights to European destinations. At Schiphol, where restrictions are less restrictive, charter and low-cost operations use night slots. At CDG, there are relatively fewer early morning flights and hence fewer of the passengers arriving at night appear to travel on to other destinations.

**Network airlines have a significant degree of flexibility to tailor their network to night flight restrictions, while still maintaining a viable network.** The varying degree to which Air France, KLM, British Airways and Lufthansa make use of night flights indicates that networks can be tailored to take night flight restrictions into account, while still maintaining a large number of destinations.

**Economic impacts of airports (and of night flights) are routinely overstated.** A commonly used framework developed by Airports Council International Europe overestimates the economic impacts, mainly for two reasons:

- it includes only positive economic impacts; negative impacts such as tourist expenditures abroad and increased imports are ignored;
- it ignores the external effects of aircraft noise, which include an increased risk of hypertension, cognitive impairment in children and sleep disturbance;
- it ignores the external effects of air pollution, even though these have well documented economic impacts.

**As a result, many reports on economic impacts of airports are misleading.** Particularly, a recent report by BIPE on the economic impact of the Paris airports suffers from a number of shortcomings. First of all, it sums all positive impacts and ignores any negative impact on the economy, e.g. the fact that airports facilitate imports and holidays abroad. Second, it adds forward and backward linkages to the economic impact of airports and compares this to the impact of other sectors without these linkages, thus creating a false impression that airports are responsible for a significant share of France's GDP.

# 1 Introduction

## 1.1 Introduction

The French Government has started a process to assess the positive and negative impacts of night flights on French airports. Night flights are concentrated very much at Paris Charles de Gaulle Airport (CDG).

Night flights are often claimed to be essential for maintaining network operations for airlines. A comparison of the number of night flights for home operators at major European airports may reveal whether networks can be operated with fewer or no night flights, and for which types of networks night flights are essential.

The impacts of night flight restrictions depend to a large extent to the reactions of airlines to these restrictions. Using a cross-section of major hubs in the EU, we are able to analyse how airlines react to a limited number of flights during a part of the night. While in the past, stringent restrictions on the number of night flights have been scarce, the current ban of flights for six hours at Frankfurt Airports provides a good case study of possible reactions.

The objective of this study is to gather, analyse and present factual evidence on the economic impacts of night flights, the relevance of night flights for airline networks and possible reactions to night flight restrictions.

## 1.2 Scope of the study

The study focuses on large European hub airports (Paris Charles de Gaulle, Frankfurt, Amsterdam, and London Heathrow) and on their dominant airlines (Air France, Lufthansa, KLM, and British Airways, respectively).

It was based on published data and a limited number of interviews.

## 1.3 Outline of the report

The report consists of four chapters. Chapter 2 summarizes evidence on the economic costs and benefits of airports in general and analyses how these should be assessed. Chapter 3 identifies current night flight restrictions and recent changes therein for the relevant airports. Chapter 4 analyses the present structure of night flights for each airport, as well as recent adjustments in response to changes in night flight regimes. Chapter 5 analyses how passenger night flights are used in the airline networks at the four hub airports.

On the basis of Chapter 2 to 5, Chapter 6 will draw some conclusions on the economic impact of night flights in general. It will also draw some conclusions on the possible response of airlines to a night flight ban on Charles de Gaulle Airport and on the economic impact that such a ban may have.

# 2 The economic costs and benefits of airports

## 2.1 Introduction

Debates about airport expansion and aviation often focus on the economic benefits of aviation. Data on airport employment and value added is used as an argument in favour of airport expansion and/or as an argument against restrictions on airport capacity (see CE, 2005; CE, 2008 and CE, 2011 for examples). Often, these data are presented in a template that has probably been developed by York Aviation for Airport Council International Europe (York Aviation, 2000). This so-called study kit focuses on jobs and income and distinguishes four categories of impacts:

- **Direct impacts**: economic activity (value added and/or jobs) at the airport.
- **Indirect impacts** denotes economic activity in the aviation sector's supply chain and includes activity in the energy sector that are dependent upon airline purchases of kerosene, in the construction sector related to the construction of additional facilities at airports, and in the production of airline meals and of the goods sold at airport retail outlets.
- **Induced impacts** is the economic activity created by the expenditures on goods and services of those directly and indirectly employed by the aviation sector.
- **Catalytic impacts** is economic activity in other industries caused by the existence of an airport. For example, if an airport provides aviation services to a shoe business that sources its shoes from China and needs to do a regular quality check-in China - so without the airport this business could not have taken place - then the additional employment in the shoe business is catalytic. Catalytic employment is very difficult to quantify in practice, as the counterfactual should also be taken into account; what type of business and employment would have existed if import from China were not possible?

This chapter first analyses the merits of assessing the economic benefits and costs of airports using this template. It finds that the template focuses exclusively on the positive impacts, ignores negative impacts and also ignores other important economic impacts, notably externalities such as noise and pollution.

Second, this chapter evaluates a number of studies into the economic benefits and costs of airports. It finds that these studies are often flawed for a number of reasons. The most prominent are:

- The studies often implicitly assume that all persons employed directly and indirectly would be jobless in the absence of the airport. In reality, it is likely that a large share of them (if not all) would find employment elsewhere.
- Average impacts are confused with marginal impacts. In reality the marginal impacts are likely to be lower so that the expansion of capacity creates fewer aviation-related jobs.

The next section analyses the template for evaluating benefits and costs of aviation. Section 2.3 evaluates a number of studies and data sources.

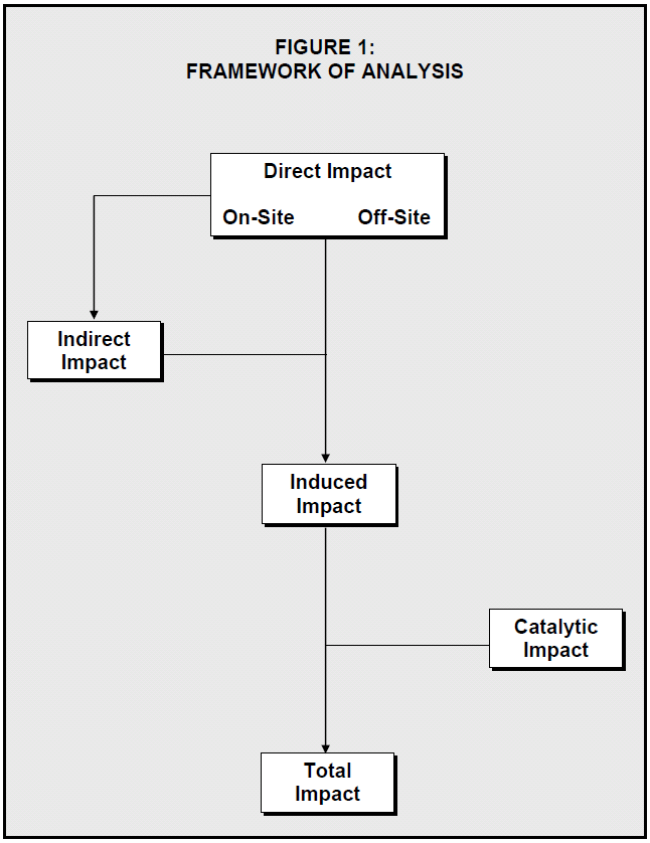
This section also reviews the most recent study on the Paris airports by BIPE (2012). Section 2.4 concludes.

## 2.2 The economic impacts of airports and aviation

The contribution of aviation to the economy is often expressed in jobs and value added. Many studies are based on the ACI-Europe study kit which has been developed by York Aviation and is widely used by airports and NGOs like the Air Transport Action Group (York Aviation, 2004; ATAG, 2005).

The York Aviation framework is simple, as shown in Figure 1. Increased aviation activity at the airport results in direct impacts at the airport and in companies in the aviation sector, indirect impacts in suppliers, induced impacts stemming from purchases of persons directly and indirectly employed, and catalytic impacts in the wider economy. The framework is unidirectional and there are no feedback loops, which would probably reduce the impacts.

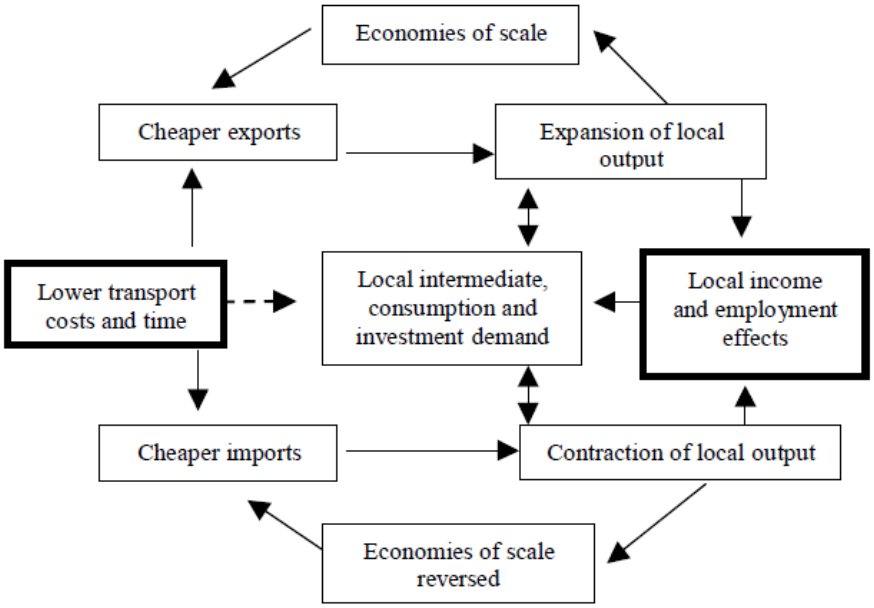
**Figure 1 ATAG Economic Impact Model**




Source: York Aviation, 2000.

In reality, the economy is much more complicated than the framework suggests. A better framework to analyse is a model commonly used for analysing the economic impacts of transport infrastructure investments (see Figure 2). This model shows that transport infrastructure has positive and negative impacts on the local economy, and that an impact assessment needs to take both into account.

**Figure 2 A conceptual model of transport infrastructure impacts**




Source: Oosterhaven & Knaap, 2003.

In aviation, for example, more efficient aviation allows for cheaper exports, which have a positive impact on the regional economy, and for cheaper imports, which have a negative impact. Likewise, aviation allows foreign tourists to reach an area and create a positive economic impact, while at the same time it allows inhabitants to spend their vacations abroad thus lowering the amount of money they spend regionally. While negative impacts are disregarded in the York Aviation framework, a proper impact assessment takes both the positive and negative impacts into account and presents the *net* impacts.

Moreover, the York Aviation framework completely ignores external effects such as noise and air pollution, even though these have well documented economic impacts. Noise, for example, depresses property values. It also has negative impacts on health, including an increase in the risk of high blood pressure with its consequences on myocardial infarction and cerebrovascular accident, incognitive impairment in children, and sleep disturbance (WHO, 2011). These impacts not only lower wellbeing of the affected individuals but often also their productivity. Most of these impacts can be monetised and incorporated in an economic framework (Navrud, 2002). The same is true for emissions of greenhouse gases and air pollutants (CE, 2010).

In summary, a common framework used to express the economic impacts of aviation suffers from two shortcomings. First, it ignores negative impacts and thus mistakes the positive impacts for the net impacts. Second, it ignores external costs. Both shortcomings result in an overestimate of the positive impacts of airports.

## 2.3 Analysis of value added and employment figures

This section analyses studies and data on airport and aviation employment because this is often an important justification for further investments in infrastructure, or more importantly, in political discussions on night flight restrictions. Furthermore, expressing the impact of airports in terms of jobs raises more questions than the impact in terms of added value.

Section 2.3.1 presents a number of studies on airport and aviation employment in Europe and specifically at the major European hub airports London Heathrow, Paris Charles de Gaulle, Frankfurt and Amsterdam Schiphol. Section 2.3.2 analyses the significance of these figures.

### 2.3.1 Evidence on airport and aviation employment

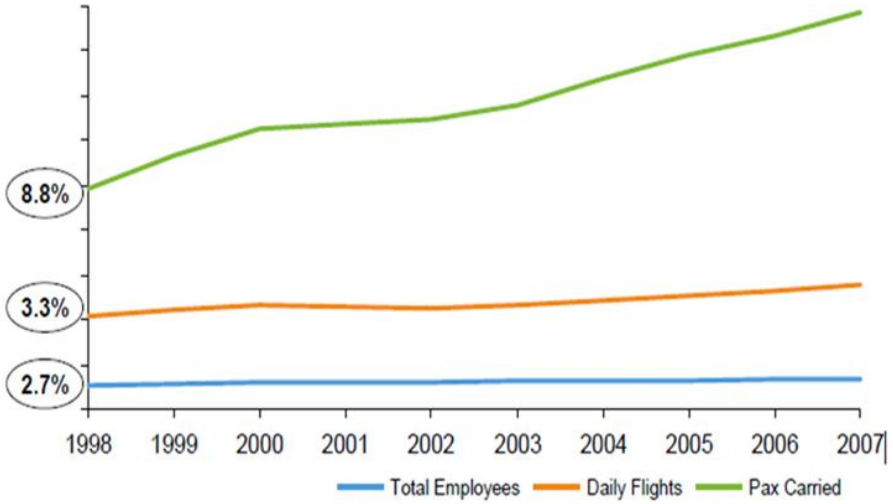
Generally, two drivers of airport and aviation employment can be identified (Booz&Co., 2009). On the one hand, there is the constant pressure to increase productivity, especially during times of recession. The rise of low-cost carriers (LCC) and the increase in competition on the European aviation market have played a major role in this. To some extent technology is replacing labour, e.g. through the use of automatic check-in systems. On the other hand, safety and security systems and other essential services need to be adequately maintained and therefore there is a limit to how far efficiency can improve.

As a rule of thumb, it is often assumed that one million passengers create 1,000 jobs, although MPD (2005) estimates that for every one million passengers, there are 950 on-site jobs and 2,100 indirect/induced jobs on a national scale.

It should always be kept in mind that these employment figures are not static, as becomes clear from Figure 3. This figure shows the trends in employment, number of flights and passenger carried, and on the y-axis the compound annual growth rate (encircled). It shows that for the eight largest markets in the EU, passenger growth has been growing annually at 8.8%, whereas the number of daily flights has risen by 3.3%. The number of employees has only risen by 2.7%, which means that the ratio of employment/million passengers gradually lowers. As a result of the different growth rates, the number of jobs per million passengers in the aviation industry (airports and airlines) has decreased by 56% in ten years. As the examples in the remainder of these sections indicate, the efficiency gains at airports have been lower than in other parts of the industry.

It should be noted though, that ideally employment should be measured in full-time-equivalents, and not in the number of employees.

**Figure 3** **Trends in employment, number of flights and passengers carried in EU-27 (1998-2007)**

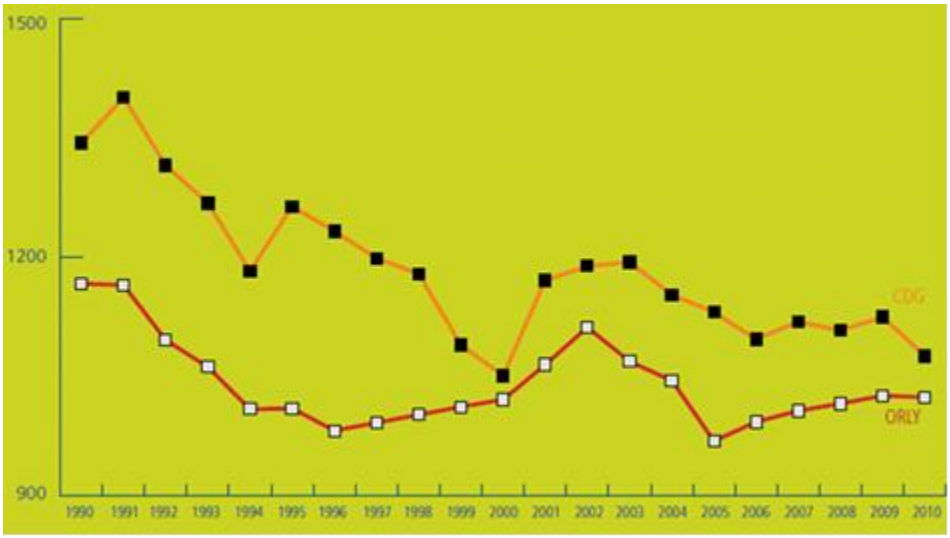



Note: Data include the largest eight markets.
Daily flights refer to Eurocontrol area.
Source: Booz&co (2009).

## Employment at Paris CDG

For Paris Charles de Gaulle, employment figures are provided in Figure 4. Employment per thousand traffic units at Paris CDG has fallen from 1,344 in 1991 to 1,076 in 2010 (Aéroports de Paris, 2011)[1]. This shows that there have been efficiency improvements in this 20-year period.

**Figure 4** **Employment per thousand traffic units for Paris CDG and Paris Orly (1990-2010)**




Source: Aéroports de Paris (2011).

[1] A common ICAO definition of a traffic unit is 1,000 passengers or 100 tonnes of freight or mail (Eurocontrol 2005).

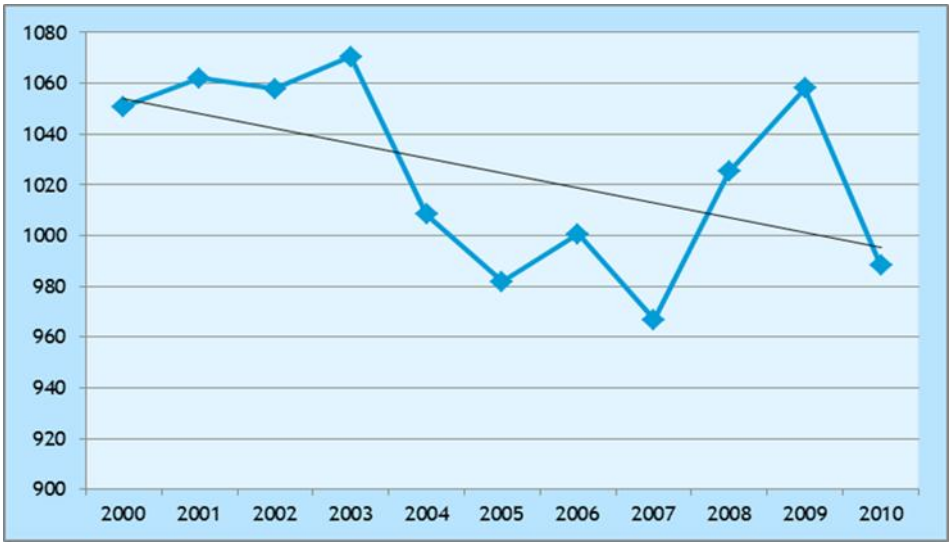
A more detailed overview of employment at the Paris airports is available from BIPE (2012). This study shows a slightly lower number of employees at Paris CDG: 1,050 per thousand traffic units. According to BIPE (2010), the airport creates in addition 1,950 indirect jobs per thousand traffic units, of which slightly less than 600 in suppliers to companies located at the airport, over 700 by the consumption of employees in direct and indirect jobs, and over 600 in tourism. (Note that the indirect figures cannot be compared directly with those of other industries, as hardly any sector includes induced employment in its figures).

BIPE compares the employment and value added (direct, indirect, induced and catalytic) of the Paris airports with value added in France in total, with the GDP of other countries and with value added in a few other sectors. This comparison suggests that the Paris airports add more to the French economy than the power and gas sector, for example, and that the value added of the airports is larger than the GDP of Lithuania. As will be discussed in Section 2.3.2, these claims are misleading because the value added of other sectors and GDP of countries do not include indirect, induced and catalytic impacts.

### Employment at Schiphol

A similar efficiency gain at Schiphol is visible from Figure 5. The employment per thousand traffic units ratio for Amsterdam Schiphol decreased from 1,051 in the year 2000 to 988 in 2010. It is clear that without the current recession, the employment ratio is likely to have been lower than it is now. In a recession, the number of traffic units typically declines strongly, whereas the number of employees remains fairly constant in the short run. In the medium run, the number of employees is usually adjusted to the traffic.

**Figure 5** **Employment per thousand traffic units for Amsterdam Schiphol (2000-2010)**




Source: Employment data: Regioplan (2011). Traffic data: Statistics on Schiphol website.

### Employment at Frankfurt

To our knowledge, there is no publication that shows employment ratios for Frankfurt for a longer (e.g. 10-year) period. According to Klophaus (2008), in 2004 there were 882 direct jobs per thousand traffic units.

### Employment at London Heathrow

Similar to Frankfurt, there is no publication that shows employment ratios for a longer period for London Heathrow. The most recent sustainability report on employment shows that in 2009, the number of jobs was 971 per thousand traffic units (Heathrow, 2011).

### Conclusion

From the available evidence on the EU-27, Paris CDG and Amsterdam Schiphol, it follows that efficiency gains over time have taken place with respect to airport employment. Secondly, the difference between the airports with the lowest employment ratio (Frankfurt[2]) and the highest employment ratio (Paris CDG) is quite significant: 22 percent. However, at least some of this difference can be explained by differences in the year studied and in definitions of airport employment, as will become clear in Section 2.3.2. Therefore, such a comparison is not very informative.

## 2.3.2 Discussion on airport employment

In Section 2.3.1 we have presented evidence on airport employment. This section first comparatively analyses the data and draws conclusions on the comparability of the data. Second, it analyses how the data are presented. Third, it discusses how employment and value added data which follow from the framework should be interpreted.

### Comparative analysis of employment and value added data

As shown in Section 2.3.1, the number of jobs per unit of traffic varies considerably between airports. One should remain cautious when analysing data used in employment studies. Usually, the employment figures are provided by the airport itself, based on a number of surveys. Hence, differences in methodology between airports can exist with respect to:

- Whether transfer passengers are taken into account in the employment ratios presented.
- How the number of employees was calculated. Ideally, one should use full-time-equivalents, but often the figures are based on a head count.
- Which types of businesses are included. For example, manufacturers of aircraft equipment are included in direct employment for Paris CDG, while Klophaus (2008) does not consider this to be direct employment for German airports, even if the aircraft manufacturer is located on the airport premises.

### Presentation of the data

The BIPE (2012) study is typical in the way the results are represented. For example:

- the direct, indirect, induced and catalytic value added and employment are added;
- this sum only includes the positive impacts and ignores any negative impacts;
- the sum is compared to the gross value added of countries and other sectors, which by definition only include direct value added.

[2] The figure for Frankfurt is from 2004, which makes it difficult to make a comparison, but on the other hand we have seen that there is a downward trend in airport employment ratios in Europe. Therefore, the figure provided is likely to be an overestimate, rather than an underestimate.

There are several shortcomings with this way of presenting data.

- While direct employment is generally agreed as one of the benchmarks for measuring a sector's size (next to value added), indirect employment and value added are a measure of a sector's connectedness of other sectors. Induced employment and value added are rarely used in sector studies.
- Summing direct, indirect, induced and catalytic value added and employment cannot be compared to GDP or total employment since this leads to double counting. By definition, the GDP is the sum of value added in all sectors plus net exports. Since indirect and induced value added are by definition created in other sectors, they are already included in the countries GDP. Adding them to the value added of the aviation sector thus results in double counting. For example, the indirect employment that is associated with the production of kerosene for the aircraft is already counted in the category oil industry. Data on indirect, induced and catalytic employment should therefore be used with caution when comparing aviation with other sectors.
- By only including the positive impacts in the analysis, the impacts are overstated. For example, indirect and induced employment includes spending on goods produced abroad, so the effect on domestic employment is likely to be overestimated. Secondly, tourism jobs impacts should also include what inhabitants of France spend abroad. The same argument holds for inward and outward investment. If the aviation industry facilitates inward investment (as is generally assumed), then the impact on the economy is not necessarily positive since it also facilitates outward investment. We do not have figures for France, but for the UK the balance is negative: more capital flows abroad (Sewill, 2009).

### Interpretation of the results of the impacts analysis based on the ACI framework.

1. **The results of the impacts analysis are higher than the net impacts because they only include the positive impacts and not the negative impacts.** As stated above, the impacts that follow from the ACI framework are only the positive impacts. Negative impacts, e.g. by tourism expenditures and foreign investment abroad, are not included. Hence, the data on employment and value added should not be mistaken for the economic impacts of the airport.
2. **The results of the impacts analysis are higher than the net impacts because they include both forward and backward impacts.** By summing direct, indirect, induced and catalytic employment and value added the aviation sector subsumes activities of other sectors, notably suppliers and clients. However, the method fails to recognize that aviation is a supplier and a client of other sectors. Take for example the inclusion of induced value added. This gives the impression that the expenses of people employed at airport can be ascribed to the aviation sector. If that would be the case, one would have to account for the fact that aviation activity occurs because people who are active in other sectors spend money on aviation. In other words, aviation employment and value added is an induced impact of other sectors. Likewise, aviation supplies transport services to business passengers. In that sense, aviation is a supplier to other sectors. Including both forward (induced) and backward (indirect) impacts in the aviation sector leads to double counting and inflation of the impacts.
3. **The ACI framework cannot be used to assess the impact of expansions or contractions because it shows average impacts, not marginal impacts.** When the data are expressed as the number of jobs or value added per million units of traffic, it should be taken into account that these numbers are averages. It would be wrong to conclude that a marginal expansion of activity (e.g. adding one million units of traffic)

would result in a proportionate increase of the number of jobs. The marginal employment impact of an additional passenger is likely to be lower than the average impact, because a minimum number of staff is necessary to operate an airport or an airplane. This is illustrated by the fact that according to BIPE (2012), the small airport of Paris Bourget had approximately sixteen times as many jobs per million units of traffic as Paris Orly and Paris Charles de Gaulle. Likewise, the British *Airport Operators Association* has forecast that by 2030 an increase of 104% in the number of passengers will only produce a 21% increase in jobs at British airports (Sewill, 2009). One final consideration is that technological developments can enable a future increase in labour productivity as airports become more and more automated (electronic check-in, automatic baggage handling). A good example of this development is Heathrow Terminal 5, which was built as a self-service terminal. Nine out of ten passengers have no need to be in contact with staff until they reach the boarding gates (Sewill, 2009).

4. **The ACI framework cannot be used to estimate the net gain or loss in - employment resulting from a change in activity because it disregards the functioning of the labour market.** The employment effects of airports are always expressed in gross terms, not in net terms. In other words, the replacement of employment elsewhere and alternative spending patterns are not taken into account. For example, direct employment in shops on the airport replaces employment in other shops, since in the absence of the airport people would still consume almost the same amount of cloths, electronic devices, cosmetics, etc. For the net impact on jobs, one should take into account a proper reference scenario. It is possible that in this reference scenario, money is spent in sectors that are more labour intensive than aviation, so employment in the short run could actually be higher without the airport in place.

   Secondly, the airport has no influence on employment in the long run. The functioning of the labour market is something that is difficult to grasp, since it involves a conceptual return to equilibrium in the long run. While it is beyond the scope of this paper to provide an elaborate discussion of labour economics, in short the mechanisms are as follows. In the long run, so without business cycle influences, the labour supply is determined by structural factors such as demography, labour force participation of women, tax rates and the design of the social security system. Employment then equals the labour supply minus the structural rate of unemployment. The labour market always has the tendency to return to equilibrium through wage adjustments and changes in labour demand and/or supply. For example, when a new airport is built, the demand for labour in the area goes up, wages increase due to scarcity of labour, people will move to the area from other parts of the country while at the same time labour-saving investments are made in the area[3]. In that case, at least on a national scale, employment has not changed.

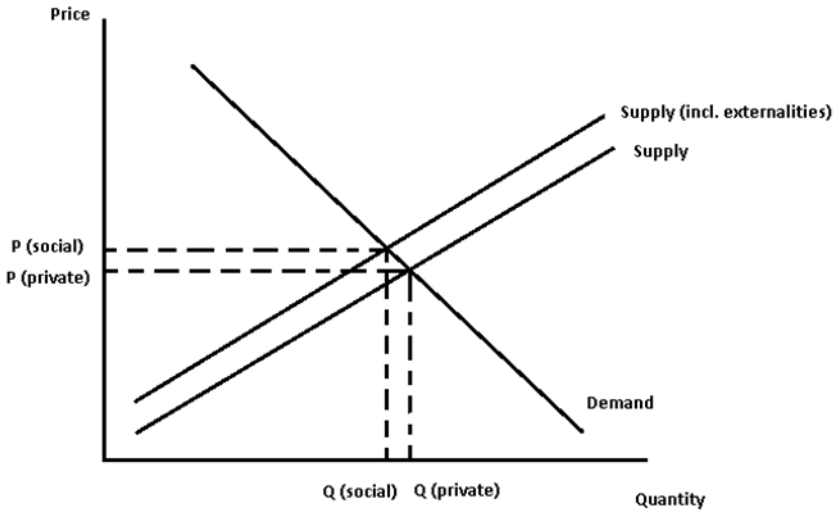
One useful theoretical exercise is to think about possible market or government failures in the aviation sector. One could argue that when consumers demand aviation services, this is the outcome of the market and a restriction of the number of flights would necessarily result in a reduction of social welfare. However, there are two reasons why this is not necessarily the case. The first reason is that prices may not reflect their true cost due to the existence of implicit subsidies. The aviation sector is exempted from paying VAT and fuel taxes, and air passenger duties do not make up for this. The net

[3] Of course, in current times of recession this reasoning does not hold, as there is no scarcity of labour. But taking away influences of the business cycle, the theory holds.

tax subsidy received by air travel as compared to car travel in the UK is around £ 9 billion a year (Sewill, 2009). This means that the prices of aviation are relatively too low when compared to other modes of transport and other consumer goods. Without these implicit subsidies, consumers would have spent more money on other transport modes, as well as on other goods and services. This means that on balance, the aviation sector is currently larger than when there is a level-playing-field.

The second reason as to why flight restrictions may not necessarily reduce welfare is the existence of externalities: $CO_2$ emissions, air pollution and noise. Figure 6 schematically shows the impact of externalities on the market outcome. Since externalities such as air pollution costs are normally not reflected (or 'internalised') in the market price of aviation, the supply curve and the demand curve result in an equilibrium at P(private) and Q(private). When externalities are internalised, for example by charging a tax equal to the total social costs per aviation unit, then the supply curve moves up and the product becomes more expensive. As a result, the supply and demand curves intersect at the equilibrium P(social) and Q(social). At a higher price, less quantity is demanded.

**Figure 6** **Schematic overview of the impact of externalities**




At present, externalities are only partially internalised in the price of aviation. Some attempts have been made at this, such as the introduction of noise charges or the inclusion of aviation in the EU emissions trading scheme. Still, it would be fair to say that the quantity of aviation demanded is currently higher than at the social optimum, and so is the employment in the aviation sector.

## 2.4 Conclusion

The economic impacts of airports are an important argument in discussions about capacity expansion or constraints. York Aviation has developed a methodology for ACI Europe to assess these impacts. This framework has been used amongst others by BIPE (2012) to assess the economic impacts of the Paris airports. However, it does not yield an accurate estimate of the economic impacts for a number of reasons:

- it includes only positive economic impacts; negative impacts such as tourist expenditures abroad and increased imports are ignored;
- it ignores external effects such as noise and air pollution, even though these have well documented economic impacts.

Most airports publish employment figures. The comparison of different airports is complicated by the fact that different airports use different definitions of the system perimeter. As a rule of thumb, it is often assumed that 1 million passengers require 950 jobs at the airport. This figure seems to be outdated, however, because of continuous increases in labour productivity at airports. Consequently the average number of jobs per 1 million passengers has lowered. Moreover, it should be noted that an *additional* million passengers do not result in an increase of the *average* number of jobs but in a lower number due to economies of scale of airports.

BIPE (2012) presents data on airport employment and value added in a misleading way by comparing the sum of direct, indirect, induced and catalytic value added (adding only the positive impacts and ignoring the negative impacts) with the direct impact of other sectors. Moreover, it suggests that the direct value added is injected in the French economy, while a share is spent on imports. In this way, the report grossly overstates the economic importance of the Paris airports.

In sum, the ACI Europe framework is not fit to assess the economic impacts of a change in aviation activity or airport capacity. In order to evaluate economic impacts, a study should include both positive and negative impacts, include externalities, use marginal rather than average figures and take the alternative into account, i.e. the situation that would exist if the airport would not be there or would not be expanded, rather than assume that in that case, all the employment and value added would be lost.

# 3 Current night flight restrictions

## 3.1 Introduction

This chapter will identify the restrictions to which night flights are subject for each of the airports concerned (Charles de Gaulle, Frankfurt, Amsterdam, Heathrow) in terms of:

- times to which the restrictions apply;
- restrictions on the number of slots (permission to land and take-off at a specific date and time);
- noise quota;
- ban on certain aircraft types;
- economic incentives for less noisy aircraft.

Legislation and regulation with respect to night flight restrictions has been studied and summarised for the four main airports. Furthermore a timeline is set up to show the process of night flight restrictions and the reactions of the specific airports to these restrictions.

## 3.2 Legislation and regulation on night flight restrictions

While most legislation on night flights is local or national, competent authorities have to take into account relevant international regulation. There are two important EU directives with respect to aircrafts and noise. In EC Directive 2002/49, the general regulations and standards in the European Union with respect to environment and noise are stated. The directive defines a common approach to avoid, prevent or reduce the harmful effects of noise. It requires competent authorities to develop noise maps and develop action plans where a noise problem exists. The directive also sets a common framework for environmental noise, which defines, among others, that a night lasts eight hours. The default night period is from 23h00 to 07h00, although Member States have freedom use a different time period, as long as it lasts at least eight hours. The 2002/30/EC Directive allows airports to impose operating restrictions of various kinds in order to reduce noise, provided that a number of conditions have been met. In 2011, the European Commission proposed a legislative package, part of which would replace 2002/30/EC. The aim of the new package is to implement the so-called balanced approach of ICAO, which establishes a procedure for implementing policy measures to reduce noise at airports. The approach balances the use of various policy instruments. Note that there are no international rules regarding the level of permissible noise at airports. This is set locally or nationally.

In the next paragraphs, the legislation and policies on national level for the four main airports with respect to night flight restrictions will be represented.

### 3.2.1 Restrictions with respect to night flights on Charles de Gaulle

At Charles de Gaulle Airport there are several restrictions with respect to night flights. The information regarding these restrictions have been retrieved from the Airport Noise and Emissions regulations Charles de Gaulle Airport[4]. The night restrictions for Charles de Gaulle Airport are presented below.

[4] http://www.boeing.com/commercial/noise/degaulle.html#ns

*Restrictions with respect to noisy airplanes*

In order to reduce noise pollution over Paris Charles de Gaulle Airport, the following restrictions have been imposed:

- the noisiest airplanes according to standards of ICAO Annex 16, Chapter 3, are not allowed to operate at the airport;
- aircraft take-off between 00h00 and 04h59 is prohibited from this airport if a departure time slot within this time segment has not been issued;
- airplanes which are certified according to standards of ICAO Annex 16 Chapter 3, with a cumulative margin between 5 and 8 EPNdB are prohibited to land between 23h30 and 06h15 and to take-off between 23h15 and 06h00 local time;
- airplanes with certified noise level exceeding value of 99 EPNdB by standards stated in ICAO Annex 16, are prohibited to take-off between 00h00 and 04h59 local time;
- airplanes with certified noise level exceeding value of 104.5 EPNdB by standards stated in ICAO Annex 16, are prohibited to land at the airport between 00h30 and 05h29 local time.

*Restrictions to number of flights*

The number of slots between 00h00 and 04h59 has been limited since 2003 and slots not being used are lost. It is now below 20,000 per year (an average of 55 in these hours). As a consequence it has been observed a significant increase on the period 22h–24h and 05h00 to 06h00. Actually, on the rest of the night, there is no restriction of the number of slots (other than the restriction of the airport capacity).

*Noise taxes*

Furthermore, Charles de Gaulle Airport applies a tax on take-off in order to finance sound insulation around airport (Taxe sur les nuisances sonores aériennes or TNSA). The tax is based on noise classification groups, the decimal logarithm of maximum take-off weight of the aircraft and time for take-off (Lden system).

### 3.2.2 Restrictions with respect to night flights on Heathrow airport

There have been restrictions on night flights at Heathrow for many years. These night restrictions are made under section 78 of the Civil Aviation Act 1982 and are published in a Notice as a supplement to the UK Aeronautical Information Publication. The night restrictions for Heathrow Airport are presented below.

*Restrictions with respect to noisy airplanes*

In October 1993, a quota system (Quota Count - QC) became effective which restricts the number of flights according to their noise levels. Airplanes are certified by the International Civil Aviation Organisation (ICAO) according to the noise they produce. They are classified separately for both take-off and landing. The night flying restrictions are divided into summer and winter seasons and consist of a movements limit and a quota count system.
Table 1 shows the aircraft quota count (QC) classifications:

Table 1 **Aircraft quota count (QC) classification**

| Certified noise level (EPNdB) | Quota count |
|---|---|
| More than 101.9 | QC/16 |
| 99-101.9 | QC/08 |
| 96-98.9 | QC/04 |
| 93-95.9 | QC/02 |
| 90-92.9 | QC/01 |
| 87-89.9 | QC/0.5 |
| 84-86.9 | QC/0.25 |

Source: Night flights, Heathrow (2011).

This resulted in the following restrictions:

- During the night period (between 23h00 and 07h00), the noisiest types of aircraft (classified as QC/8 or QC/16) may not be scheduled to land or to take-off and they are effectively banned from doing so in the night quota period.
- During the night quota period (between 23h30 and 06h00), aircraft of types (QC/4, QC/8 and QC/16) may not be scheduled to take-off or land.
- During the night quota period, movements by most other types of aircraft (including the new QC/0.25 category) will be restricted by a movements limit and a noise quota, which are set for each season. The aviation seasons coincide with the period of daylight saving time.
- Aircrafts which have a quota count of QC/8 or QC/16 may not take-off in the night period except in the period 23h00 to 23h30 in circumstances where;
  a It was scheduled to take-off prior to 23h00.
  b The take-off was delayed for reasons beyond the control of the aircraft operator. And
  c The airport authority has not given notice to the aircraft operator precluding take-off.

Aircraft are exempt from the movements limits and noise quotas if their noise certification data are less than 84 EPNdB. That is, the very quietest aircraft are not subject to movement and quota limits.

### *Restrictions to number of flights*

Currently, the limit is set at approximately sixteen movements per night (or more precisely, 2,550 flights in the winter season and 3,250 in the summer season) (Night flight restrictions at Heathrow, Gatwick and Stansted)[5].

### *Noise Charges*

Heathrow Airport is levying noise charges in order to put economic incentives for less noisy aircrafts during the night. The charges apply for the time period between 00h00-03h29 (1 April to 31 October) and between 01h00 and 04h29 (1 November to 31 March). Noise charges in the night period are 2.5 times the normal charges (Heathrow Airport Limited Conditions of Use including Airport Charges from 1 April 2011).

[5] Source: http://webarchive.nationalarchives.gov.uk/20060715135117/http:/dft.gov.uk/stellent/groups/dft_aviation/documents/pdf/dft_aviation_pdf_611809.pdf

### 3.2.3 Restrictions with respect to night flights on Schiphol Airport

For Schiphol Airport, legislation and regulations with respect to aviation are stated in the Wet Luchtvaart (Aviation Act). Furthermore, the Schiphol Wet (Schiphol Act) is in force since 2003, which provides that two airport decisions are adopted, of which the 'Luchthavenverkeerbesluit Schiphol' (LVB) (airport traffic decision Schiphol) sets standards and rules for traffic, environment and security at Schiphol.

For Schiphol Airport, the following restrictions concerning night flights apply:

*Noise*

The total volume of noise nuisance in the night (period between 23h00 and 07h00) should not be higher than 54,44 dB(A) (Article 4.2.2 of LVB).

Furthermore, certain aircrafts are not allowed to take-off or land in a specific time period:

- The noisiest airlines in accordance with the noise standards of ICAO Annex 16 Chapter 3 (with engines with bypass ratio > 3), are prohibited to take-off or land between 17h00 and 07h00. Furthermore, these aircraft will not be planned to take-off between 22h00 and 05h00.
- Aircraft classified with the noise standards of Chapter 3 with engines with bypass ratio ≤ 3 take-off and landing is not allowed between 17h00 and 07h00.

Source: Boeing.com/commercial/noise/index.html

*Restriction of use of runways*

Schiphol airport also knows restrictions with respect to the use of runways during the night. In total, Schiphol Airport has six runways. These are not all used at the same time and their use also depends on the wind and time (day or night). Between 23h00 and 06h00, four out of six runways are closed, which means there is 1 departure runway and 1 landing runway. The limitations of the use of the runway of the airport are stated in Article 3.1.5 of the LVB decision. The aim of these restrictions is to reduce the noise over residential areas as much as possible.

*Number of flights*

The total number of night flights is restricted to 32,000 per year, or on average 88 per night (23-7). Moreover, number of slots between 11 pm and 6 am is limited to 49 per hour, of which 25 departures and 24 arrivals. Between 6 am and 7 am a maximum of movements per hour 55 (25 arrivals, 30 departures) is allowed (Stichting Airport Coordination Netherlands, 2012).

*Operational procedures*

Schiphol Airport applies several restrictions to operational procedures during the night, which are the usage of the reverse thrust, altitude and the continuous decent procedure. These are stated in the Airport Noise and Emissions Regulation (Boeing, 2011):

- In the period between 22h00 and 06h00 the reverse thrust above idle shall not be used on any runway after landing, safety permitting.
- The minimum altitude from Schiphol TMA (Termina Maoeuvring Area) border to end approach (vertical) between 6h00 and 23h00 should be 2,000 feet. Minimum altitude between 23h00 and 06h00 should be 3,000 feet.
- The continuous descent procedure is used only at night, for all aircraft landing between 22h00 and 05h30. This implies a flight path without level segments and in a low power and low drag configuration.

*Tariff differentiation traffic day and night*
For every landing and take-off at Schiphol airport a levy is charged, depending on the noise category of the airplane. For the night, these charges are higher than during day time. Between 23h00 and 06h00 fares for landing are increased by 27% (compared to the period from 06h00 am to 23h00 pm) and for departure fares are increased by 50% (Convenant hinderbeperkende maatregelen Schiphol).

### 3.2.4 Restrictions with respect to night flights on Frankfurt Airport

For Frankfurt Airport, legislation and regulation with respect to protection against aircraft noise is stated in the Gesetz zum Schutz gegen Fluglärm. This German law was enacted in October 2007, and aims to protect residents from nuisances caused by aircraft. German law applies to both civil and military airfields.

With respect to night restrictions, the law states the following:

*Noise and noise quota*
With respect to protection against noise, the law has provided certain protection zones, where a maximum amount of volume is allowed. The law distinguished two protection zones for the day (zones 1 and 2) and one for the night. Protection zone 1 is the area where the noise impact is greatest. The maximum level of noise that can be accepted for zone 1 and zone 2 are respectively 60 dB (A) and 55 dB (A). For the night, since January 1st, 2011 a maximum of 50 dB (A) is allowed.

Furthermore, certain aircrafts are not allowed to take-off or land in a specific time period at Frankfurt Airport:

Aircrafts without a noise certificate in accordance with ICAO Annex 16 are not permitted to take-off or land during the entire hours of Frankfurt Airport:
- for aircrafts with noise certificate complying with ICAO Annex 16, Chapter 3, the following restrictions apply:
  - take-offs and landings are not permitted between 19h00 and 07h00.
- the following restrictions apply to aircrafts that marginally comply with ICAO Annex 16, Chapter 3 and Chapter 4:
  - take-offs and landings of flights which have not been coordinated by the Airport Coordinator at least one day in advance are not permitted between 21h00 and 05h00;
  - take-offs and landings to carry out practice, check and training flights are not permitted between 22h00 and 05h00.

*Noise levels*
In Frankfurt, as in many other German airports, are in addition to the conventional airport charges (landing and take-off, calculated based on aircraft weight) also charges for noise. The noise charges are modulated according to acoustic performance of aircraft. The classification used by Frankfurt refers to the ICAO classification and distinguishes twelve categories of aircraft. The fees for the noise during the day vary from € 25 for an aircraft in Category 1 to 19,000 Euros for an aircraft in category 12. At night, for the periods from 22h00 to 23h00 and 05h00 to 06h00, these fees increase sharply. For Category 1 aircraft, they charge € 66 for an aircraft category 12 to 44,000 Euros.

*Flight restrictions with respect to the number of flights*
In Frankfurt, a ban on flights between 11 pm and 5 am was imposed since October 2011 after complaints from residents. In April 2012, the federal court upheld the decision. Exceptions are only allowed in case scheduled flights are delayed which was not caused by the airline itself.

Moreover, the maximum number of flights between 10 pm and 6 am is 133 per night.

*Operational procedures*
Frankfurt Airport applies several restrictions to operational procedures during the night:
- the airports of Frankfurt require pilots to apply a continuous descent procedure between 23h00 and 05h00, and possibly, if traffic conditions permit, outside of these hours;
- the continuous descent procedure is applied from 23h00 until 05h00 regularly. If possible, it begins earlier and ends later, but due to capacity-constrains it is not possible to operate CDA during daytime (between 06h00 and 22h00).

## 3.3 Conclusions

In this section we have presented the current restrictions for the four main airports, Charles de Gaulle, Frankfurt, Schiphol and Heathrow. A summary is presented in Table 2.

**Table 2 Night flight policies on major European hub airports**

| | Operating ban for noisy aircraft | Noise tax or charge | Restriction on the number of night flights |
|---|---|---|---|
| CDG (Charles de Gaulle) | Yes | Yes | No, but a maximum of 55 between 00h00 and 04h59 |
| LHR (Heathrow) | Yes | Yes | Yes: 16 per night from 23h30-06h00 |
| AMS (Schiphol) | Yes | Yes | Yes: 88 per night (23h00-07h00), maximum of 49 per hour |
| FRA (Frankfurt) | Yes | Yes | Yes: 133 per night, no flights between 23h00 and 05h00 |

Source: This report.

Table 2 shows that all airports ban noisy aircraft during the night and all airports have noise charges or taxes or differentiated landing fees.
A significant difference exists on restrictions of the number of flights. Two airports restrict the number of movements for an 8-hour night: Schiphol and Frankfurt. In addition, Frankfurt has a complete ban on flights between 23h00 and 05h00. Heathrow restricts the number of flights in a 6½-hour period, and Charles de Gaulle does not have restrictions except for the period between 00h00 and 05h00.

Interestingly, but perhaps not surprisingly, Chapter 5 will show that the number of flights per 8-hour night was the highest in Charles de Gaulle, about 30% lower in Frankfurt (even before the ban was imposed) and about 50% lower in Heathrow and Schiphol. This demonstrates that restrictions on the number of night flights have an important impact on night movements.

# 4 Response mechanisms

## 4.1 Introduction

In this chapter, we will discuss possible response mechanisms to night flight restrictions as well as a timeline on the legislative processes in the four countries studied.

## 4.2 The importance of night flights

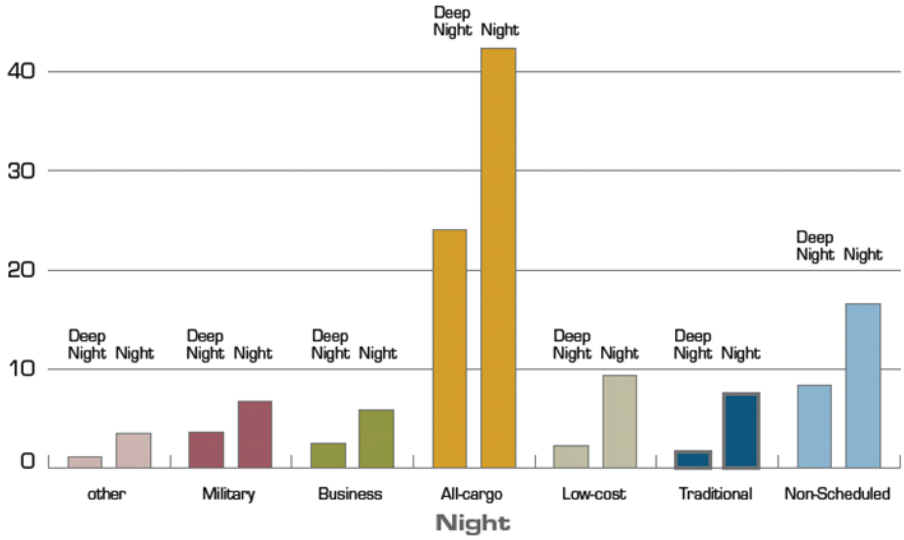
In the discussion on night flights, different definitions as to what constitutes a night are used. The default option, as defined in Directive 2002/49/EC, is the 8-hour period of 23h00-07h00; while Member States may choose a different start and end time, they may not take a shorter period. Nevertheless, many airports and airport regulators have defined a 'core' night for which a special regime applies. The core night can be between 24h00-06h00 (MPD, 2005) or between 24h00-05h00 (Eurocontrol, 2009).

The following considerations have to be taken into account when considering the importance of night flights (MPD, 2005):

- For short-haul scheduled passenger operations holds that the bulk of the flights takes place during the day. To satisfy demand and achieve high aircraft utilisation, this implies a number of departures in the early morning (06h00-07h00) and a number of arrivals in the evening (22h00-24h00).
- Long-haul passenger operations on east-west routes typically involve a flight during the night (at least one-way), whereas take-offs and landings take place during the day. Departures usually wait for 'feeder' flights to arrive in the early morning and take-off later in the morning. Landings are scheduled in such a way that onward connections are possible that same day.
- Charter flights are often scheduled in such a way that at least one turnaround takes place in the night, usually at the tourist destination itself but sometimes also in the country of origin. It follows from the desire to keep costs low (by using the aircraft very intensively).
- For general freight (consisting of 85% of total cargo traffic), the expected delivery time is normally expressed in days, which means that for general freight operations night flights are not critical (Eurocontrol, 2009). It has been estimated that 50% of cargo was flown in the bellies of passenger aircrafts in 2003, which generally is cargo of a lower value.
- Certain express cargo operations promise delivery of a package on the next day, even when picked up at the end of the working day. This type of operations involve high-value goods and have become more important due to the growing importance of just-in-time principles in production (e.g. reducing inventory). For these operations, arriving at a hub at night, being sorted straightaway and being transported further during the day is essential (MPD, 2005).
- For mail operations a similar argument holds as for express cargo operations.

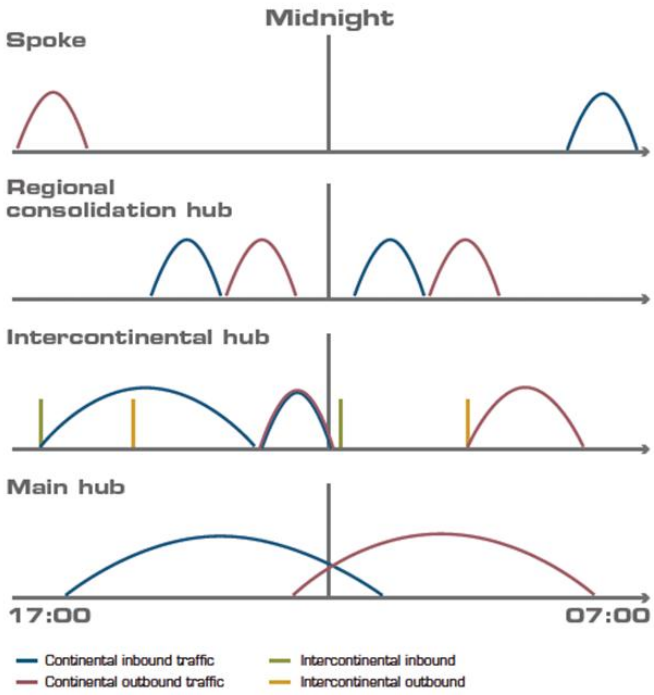
According to Eurocontrol (2009), traffic in the 'margins' of the night (between 23h00-24h00 and 05h00-07h00) has grown very rapidly in the past years. Two drivers for this are achieving high aircraft utilisation and the possibility to cope with accumulated delays. Figure 7 shows the share of each market segments' traffic during the night. Figure 7 shows that a large share of freight flights occurs during night time, while the share of passenger flights during the night is less than 10%.

**Figure 7 Portion of each market segment's traffic during the night**




Given the importance of night flights for cargo operations, we should have a closer look on cargo flights. Figure 8 shows a schematic overview of the typical cargo night flight structure, including both continental and intercontinental traffic.

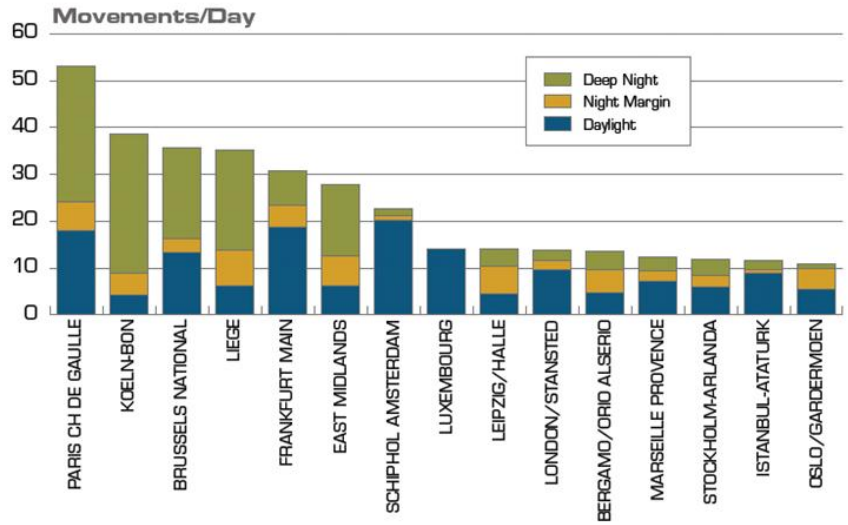
**Figure 8** **Schematic overview of the typical cargo night flight structure**




Source: Eurocontrol (2009).

Although Figure 8 shows a typical cargo night flight structure, that does not mean that the distribution of cargo flights over different times of the day is almost equal for different airports. Figure 9 shows the distribution of cargo flight movements over different times of the day for the fifteen busiest cargo airports in Europe.

**Figure 9** **Cargo flight movements differentiated by time of the day for European airports**




Source: Eurocontrol (2009).

Supported by the evidence in Figure 9, it has been noticed by Eurocontrol (2009) that 'some airports can become 'specialised' in cargo operations in the deep night: at Paris/Charles De Gaulle, cargo movements account for 77% of the traffic in the deep night but only for 4.7% during the day'.

## 4.3 Possible response mechanisms

From the above it follows that night flight restrictions do not only have an influence on night flights, but also on a share of the other flights that take place during the day. In MPD (2005), this mechanism is called 'network effects' or 'domino effects'. It is illustrated by the case of Brussels airport, where night flight restrictions led to the complete abandonment by DHL of Brussels as its main hub, even though part of the operations took place during the day or by truck.

While such domino effects may indeed take place, in the majority of the cases more minor responses may be expected, such as the cancellation of a small number of flights, a rescheduling of flights, the abandonment of certain routes, a reduction in the use of the most noisy aircraft, etc. In the case of noise quotas, the flights with the highest economic value added will be prioritized, e.g. long-haul flights that necessarily need to depart or arrive at night or in the early morning. Other night flights – such as charter flights - will be moved to the day and the extra costs this entails (e.g. more expensive slots, lower aircraft utilization) will at least partly be passed on to the customers. In this way prices of holidays will increase, which leads to a lower demand for holidays until a new equilibrium has been reached[6].

Another possible response to night flight restrictions is setting up a dual hub structure, which is what British Airways has attempted in the 1990s by maintaining two hubs: Gatwick and Heathrow. However, in 2002 it has abandoned this strategy in favour of maintaining one hub at Heathrow. According to Dennis (2005), this is due to the fact that the two hubs were too close to each other (60 km), which meant that they had a very large overlap in their catchment areas. Furthermore, the yields on operations on Heathrow were higher and it was costly to maintain two short-haul feeder networks. Finally, the runway capacity on Gatwick was restricted, so a critical mass of flights could not be reached.

## 4.4 Timeline of legislation concerning night flights

This paragraph shows a timeline of legislation concerning restrictions to night flights for the airports of Charles de Gaulle, Frankfurt, Schiphol and Heathrow. It also shows how the airports responded to the restrictions on night flights that were imposed.

*Charles de Gaulle*

For Charles de Gaulle, legislation on night flights dates back to 2004.
On March 28, 2004 operating restrictions came into effect in order to reduce noise pollution over Paris Charles de Gaulle Airport. Restrictions caused that the noisiest aircrafts were not allowed to take-off or land during the night.

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6 For large airlines that have many slots at their disposal and that provide a variety of flights, this story always holds. For smaller airlines, this only holds when they operate at airports where airports slots are allocated according to a method which takes into account willingness-to-pay (e.g. an auction).

Furthermore, take-off between 00h00 and 04h59 has from then on been prohibited when a departure time slot within this time segment has not been issued. The total number of slots in this period is maximized at 20,000 per year.

*Frankfurt*

In 2009, the government of the State of Hesse decided to allow seventeen movements between the hours of 23h00 and 05h00.

In October 2011, the Hesse Administrative High Court banned night flights at Frankfurt Airport after complaints from residents. This verdict was upheld by the Federal Court in April 2012. The decision is based on a 2008 lawsuit filed to push through a complete curfew. The ban, which runs from 23h00 to 05h00 will affect seventeen flights nightly; most are LHC flights. Lufthansa Cargo until then had operated between eight and ten movements each night and had hoped to increase that to eleven once the new runway was opened.

The ban was unexpected by the airline companies since a new runway had just opened, which would increase the airport's capacity from 82 movements per hour to 126. The ban on night flight prevents this and forces LHC to cancel two to three flights per week and moving some flights to daytime hours. Also, some flights to China will now stop for several hours at Cologne/Bonn (CGN) after leaving FRA in the evening. On routes to east Asia (China) they lose five hours of delivery time and CGN night time slots are very limited. Night cargo flights to New York JFK and Chicago O'Hare may operate starting in January from CGN. Regarding cargo, LH Cargo could shift operations to nearby Frankfurt-Hahn Airport but to do so would require to operate an additional 30,000 annual truck movements to make the 120-kilometer connection between the two airports, which are not linked by autobahn.

*Heathrow*

In 1993, the system of quota came into effect. It provides mainly that between 23h00 and 07h00 the noisiest aircrafts can neither land nor take-off. Between 23h30 and 06h00 am (night period) aircraft movements are limited in number.

In 1999, a new movement limit and noise limit was enacted at Heathrow Airport. Propeller driven airplanes registered in the United Kingdom are required to have a noise certification according to the standards of ICAO. Without this certificate, no plane can take-off or land on territory. Furthermore, the new regulation reduces growth in night movements. In the period 06h00-07h00 and 23h00-23h30 no space slots are available due to limited runway capacity and to prevent delayed traffic to run in the night quota period (23h30-06h00).

In 2004, the consultation on the new night flight regime was carried out in two stages commencing in July 2004. Night time restrictions are set for a period of five years. The old restrictions were extended for another year to 2005.

In 2005, it was proposed to allow a small increase in the movements limits over the course of the regime. However, the Secretary of State decided to retain the current movements limits at Heathrow during the summer at 2,250 movements and during the winter at 3,250 movements till 2012. Also the proposal to extend the night quota period to 07h00 was rejected since it would not outweigh the possible costs to the airline industry and local community.

### Future developments

A ban on night flights at Heathrow is being considered. The airport operator has proposed that from 2013, latest at 2015, night flights on cargo are prohibited between 23h00 and 07h00. Furthermore, the operator has suggested that scheduled arrivals before 04h30 am should also be prohibited (all types of flights: passengers, cargo, etc.). It remains to be seen whether this makes a difference. There are hardly any cargo night flights from Heathrow and most movements during the restricted time period are arrivals between 04h30 and 06h00.

*Schiphol*

At Amsterdam-Schiphol, special measures for the night time operations have already been used since 1979.

In 1996, together with the introduction of the noise zone, a set of legal night time restrictions for the period 23h00-6h00 was implemented. During the night regime period, special landing procedures, take-off routes and runway combinations would be in use. The aviation sector voluntarily extended the night regime period until 07h00, until February 2003. In addition, a night time noise exposure zone was in force for the period 23h00-6h00.

In 2003, the 5th runway became operational and a new set of night time restrictions was introduced. New noise quota were set, which allowed for growth from 23,500 movements in 2002 till about 34,500 aircraft movements in the night time period (23h00-07h00). The night regime period (23h00-06h00) differs from the period with noise load limits (23h00-07h00). Legal night time restrictions are still in effect between 23h00-6h00, but are no longer voluntarily extended until 07h00 by the aviation sector. During the night regime period, runway use, take-off routes, landing procedures, runway combinations and others, differ from the period 06h00-07h00. Because the noise load limits in control points are set for the complete period, it is hardly possible to shift traffic from the night regime period to the period of 06h00-07h00 and vice versa (Night time restrictions at Amsterdam-Schiphol, 2004).

In 2007, the maximum number of night flights was 34,000 (between 23h00 and 07h00). Since March 13, 2008, the nocturnal departure and approach routes and procedures have been extended to 06h30 am instead of 06h00.

For 2012, the expected number of flights in the night period (between 23h00-06h00) is estimated at 18,800 movements, of which 13,000 arrivals and 5,800 departures (Schiphol Group, Gebruiksprognose 2012).

### Future developments (2010-2020)

Schiphol Airport and the airlines perform experiments to reduce air pollution and noise at Schiphol area. In the year 2012 it is expected that the night procedures will also apply for the period between 06h00 and 6h30. Furthermore, a maximum of 510,000 flight movements is set for Schiphol in 2020, with a maximum number of 32,000 at night (between 23h00 and 07h00). However, based on current flight statistics, growth expectations in 2020 will be around 580,000 flight movements in 2020. To meet this demand the government considers a relocation of 70,000 flights to regional airports like Eindhoven and Lelystad.

### 4.4.1 Conclusions

In this section a timeline with the legislation and regulation regarding night flight restrictions has been presented. It shows how the changes in the aviation legislation have affected the different airports and how they have responded to these changes.

The unexpected ban on night flights at Frankfurt airport forced the local carrier to find alternative routes and to reduce the number of flights during the night. Also Schiphol airport is foreseeing capacity problems in the future, since growth will exceed the maximum number of flights established in 2020. At Heathrow, the discussion on restrictions or a ban on night flights is continuing. It is clear that Schiphol, Heathrow and Frankfurt airport are trying to find a way to meet demand for economic growth and expansion while they have to reduce the negative side effects, such as noise on the same time.

Charles de Gaulle airport does not have night flight restrictions, except for the period between 00h00 and 04h59.

In the next chapter we will analyse the flight data of the four main airports.

# 5 Analysis of passenger flight data

## 5.1 Introduction

In this chapter, we identify passenger night flights for each of the four major European hubs (Paris Charles de Gaulle, Frankfurt, Heathrow and Schiphol) and analyse how they are used in the network of the home carrier (Air France, Lufthansa, British Airways and KLM, respectively). On other types of night flights (freight, express and mail), no detailed information is available from public sources.

## 5.2 Overview

Heathrow is Europe's busiest airport in terms of passengers, as is shown in Table 3. Frankfurt and Paris Charles de Gaulle have more movements. Schiphol and Heathrow have approximately the same number of flights during the 8-hour night, while Paris CDG has over twice as many.

**Table 3 Overview of passengers and movements at the four major European hubs**

| | 2009 | 2010 | 2011 |
|---|---|---|---|
| **Heathrow** | | | |
| Passengers | 66,165,021 | 66,015,300 | 69,475,746 |
| Cargo+mail/mt | 1,348,914 | 1,551,308 | 1,569,303 |
| Movements | 460,147 | 449,233 | 476,293 |
| Of which night 23h-7h* | n.a. | 27,200 | 27,400 |
| **Paris CDG** | | | |
| Passagers | 57,688,772 | 59,000,770 | 60,970,551 *** |
| Cargo+mail/mt**** | n.a. | 2,399,067 | 2,300,064 |
| Movements | 541,407 | 491,893 | 514,059 *** |
| Of which night 22h-6h **** | 59,290 | 61,255 | 59,210 |
| **Schiphol** | | | |
| Passengers | 43,620,093 | 45,286,976 | 49,838,392 |
| Cargo+mail/mt | 1,316,848 | 1,538,034 | 1,549,489 |
| Movements | 396,143 | 390,378 | 425,189 |
| Of which night 23-7** | n.a. | 28,096 | 30,314 |
| **Frankfurt** | | | |
| Passengers | 51,230,043 | 53,283,191 | 56,561,629 |
| Cargo+mail/mt | 1,946,035 | 2,339,030 | 2,287,705 |
| Movements | 455,094 | 455,993 | 480,871 |
| Of which night 22h-6h **** | n.a. | 40,515 | n.a. |

Source: Eurostat (* - BAA; ** - Schiphol; *** - Aéroports de Paris; **** - local authorities).

## 5.3 Passenger flights

For the scheduled passenger flights, and especially for the flights of the home carrier, we have analysed in detail their origin and/or destination, connecting flights and alternative times on the main routes. Sources for this have been the airlines and regulators websites, and flight information websites such as www.flightstats.com. These data have been used to analyse the relevance of night flights for the airline's network, e.g. its long-haul operations or freight operations. The data have been collected for one week, from 19 to 26th of January 2012, using information from Flightstats.com.[7] Comparison of this data with e.g. published timetables reveals that it covers all passenger flights but not all freight, express and mail flights.

From the data we identified how many passenger flights arrive and depart at night. For the scheduled passenger flights, and especially for the flights of the home carrier, we have analysed in detail their origin and/or destination, connecting flights and alternative times on the main routes. For each airport an overview of the summary statistics is presented, which shows us more detailed information on the pattern and structure of the night flight regime airport. Furthermore, it gives us information on the airline's network.

Table 4 gives an overview of the number of departures and arrivals during the night for the four main airports.

**Table 4 Passenger night flights overview during one week in 2012**

| Airport | Night period | Total night departures | Total night arrivals | Total early morning departures (06h00-7h00) | Total early morning arrivals (06h00 - 07h00) |
|---|---|---|---|---|---|
| Schiphol | 23h00-06h00 | 31 | 142 | 98 | 65 |
| Frankfurt | 23h00-05h00 | 15 | 2 | 198* | n.a. |
| Heathrow | 23h30-06h00 | 39 | 95 | 217 | n.a. |
| Charles de Gaulle | 23h00-06h00 | 106 | 156 | 74 | 85 |

Source: flightstat.com.

Note: * from 05h00-07h00.

Table 4 clearly shows that there is a clear difference in passenger flight patterns between Charles de Gaulle (which is less constrained by night flight restrictions) and the other airports. Charles de Gaulle has the largest number of departures and arrivals during the night and a comparably much smaller number of early morning departures.

In the next sections and in Annex A, we will show data on the scheduled passenger flights, and especially for the flights of the home carrier. In the Annex, we have analysed in detail their origin and/or destination, connecting flights and alternative times on the main routes. By analysing the data we will try to find a pattern in the departures and arrivals at night, to find out how airports react on restrictions during the night time. Furthermore, the consequences of night flight restrictions on the airlines network will be discussed.

[7] www.flightstats.com

### 5.3.1 Heathrow

For Heathrow we have analysed departures and arrivals in the night quota period (between 23h30 and 06h00) for which night time restrictions apply. Furthermore we analysed the early morning departures between 06h00 and 07h00, which will give us more insight in the connecting flights and alternative times.

#### Departures

For Heathrow we have observed a total of 39 departures during the night, of which all passenger flights. Most of the flights were heading to a destination in Europe (49%), the Indian subcontinent (13%) or in the Far East (total 13%). 26% of the flights were carried out by the home carrier, British Airways. However, in the night period considered, British Airways did not have any flights departing to Europe, only to Africa (30%), the Indian subcontinent (20%) and North America (20%). Furthermore, the data show that all departures in the night time only took place between 05h00 and 06h00.

#### Arrivals

We observed a total of 95 arrivals at Heathrow airport during the night. Most of the flights were arriving from the Indian subcontinent (29%), the Far East (24%) and Africa (22%). This shows that in the case of Heathrow the night time is mostly used for long distance flights. Half of all arrivals was carried out by the home carrier. Also arrivals in the night took only place in the time period between 05h00 and 06h00.

#### Early departures

Out of 217 early morning departures on Heathrow (between 06h00 and 07h00), 179 had Europe as destination (82%).

An estimated 19,837 passengers departed to their destination in the early morning. The home carrier, British Airways performed 93 of the early morning departures with destination Europe, carrying a total number of 9,002 passengers. Although we have no data on transfer passengers, British Airways appears to use the night flights as a way to support its hub operations and to offer passengers from non-European origins the possibility to connect to early morning flights to European destinations.

### 5.3.2 Frankfurt

For Frankfurt Airport we have analysed flights between 23h00 and 05h00, the time period for which a ban was imposed. Furthermore we analysed the early morning departures after the ban, between 05h00 and 07h00.

Despite the fact that the ban restricts flights till 5 am, the data show that also between 05h00 and 06h00 the number of departures (5) is very small. Between 06h00 and 07h00 we observed 196 departures from Frankfurt, of which 188 had Europe as destination (96%). Lufthansa carried out 122 of these flights to Europe. The total number of passengers equalled 21,226.

It is hard to draw conclusions on how airports operating from Frankfurt use night flights because of the uncertain situation following the night flight ban in which the data have been collected.

### 5.3.3 Schiphol

For Schiphol Airport we have analysed flights scheduled to depart or arrive between 23h00 and 06h00, which is referred to as night time for this airport. Furthermore we analysed the early morning departures between 06h00 and 07h00, which will give us more insight in the connecting flights and alternative times.

#### Departures

In the week of 19 to 26th of January, 2012, we observed in total 31 departures during the night period, of passenger flights . Most of the flights were heading to their destination in Europe (39%), Africa (39%) and destinations in North, Middle and South America (total 16%). For flights carried out by the home carrier (only 5%), all flights had North America as destination. Most flights departed between 23h00 and 00h00 or between 05h00 and 06h00.

#### Arrivals

In the same week and time period we also observed a total of 124 arrivals at Schiphol airport. Most of the flights were arriving from Europe (27%), Africa (22%) and the Near East (18%). In total, 42% of all arrivals was carried out by the home carrier KLM. Also arrivals in the night period took mostly place between 23h00 and 00h00 and between 05h00 and 06h00 at Schiphol Airport.

#### Early departures

Data show that out of 122 departures on Schiphol between 06h00 and 07h00, 117 had destination Europe (96%). The estimated total number of passengers was 16,678.

All in all, The data show that for Schiphol, the night time is not solely used for long distance flights. Most flights were actually arriving from or departing to Europe. Most of these flights in the night took place between 23h00 and 00h00 and between 05h00 and 06h00.

Operators at Schiphol use night flights for different purposes than Heathrow. A relatively large number of low-cost and charter flights arrive and depart at night. Still, a pattern is distinguishable in which long-haul operations arriving at night feed early morning flights to European destinations.

### 5.3.4 Charles de Gaulle

For Charles de Gaulle Airport we have analysed flights scheduled to depart or arrive between 23h00 and 06h00, which is the most common definition of night time. Furthermore we analyse the departures in the early morning (between 06h00 and 07h00), which will give us more insight in the connecting flights and alternative times. Note that the source, flightstats.com, is complete for passenger flights but not for express, mail and freight flights which make up a large share of the night flights at CDG.

#### Departures

In the week of 19 to 26th of January, 2012, we observed in total 106 departures of passenger flights at night time. Most of the flights were heading to a destination in South America (26%) or Africa (22%). 82% of the flights were carried out by the home carrier. However, the flights that were performed by Air France with destination Europe were only cargo flights.

### Arrivals

In the same week and time period we also observed a total of 156 arrivals of passenger flights. Most of the flights were arriving from Africa (45%), and the near east (14%). In the time frame that we observed, arrivals on Charles de Gaulle took mostly place between 23h00 and 00h00 and between 05h00-06h00. Furthermore, it showed that from the 62% of the arrivals that were performed by Air France, the flights arriving from Europe were all cargo flights.

### Early departures

Data show that out of 81 departures on Charles de Gaulle between 06h00 and 07h00, 85% had destination Europe. The estimated total number of passengers was 9,259, of which 8,520 passengers had destination Europe. Only 10% of these early morning flights were carried out by the home carrier.

These data show clearly that most of the arrivals in the night arrive from long distance (mostly Africa, 45%) and that most early morning departures have destination Europe (85%). However, in contrast to London Heathrow the number of early morning flights is low compared to the number of night flights. This suggests that only a small share of passengers arriving at night take a connecting flight in the morning.

## 5.4 Conclusions

Analysis of the data leads to the conclusion that the main airports use night flights for different purposes.

Heathrow is using night flights for arrivals of long distance flights, where transfers to other European destinations take place in the early morning. Schiphol is using night flights mainly for arrivals, for long distance flights but also from other European destinations. The early morning departures are almost all heading to other destinations in Europe. Schiphol and Heathrow reflect the ‘standard’ pattern of long-haul passenger flights arriving at night in order to fill the connecting flights in the morning. Especially for Schiphol, arrivals are dominant in the night.

The difference between Schiphol and Heathrow is that at Schiphol there is a relatively large share of charter and low-cost carrier flights to and from European destinations at night. Presumably because of the scarcity of night flights at Heathrow, these types of flights are absent and night flights are predominantly used by the network carrier.

Frankfurt Airport has limited opportunities to accommodate flights during the night due to the night ban. In this time period, mostly cargo flights are performed. Even the first hour after the ban (between 05h00 and 06h00) a very small number of flights is performed.

Compared to the other airports, Charles de Gaulle has the largest number of departures and arrivals during the night and a comparably small number of early morning departures, of which a relatively small share is carried out by Air France. This suggests that night flights are less important for filling the early morning flights and hence less important for the network. For passengers whose destination is Paris, a night time arrival is less attractive.

# 6 Conclusions

What are the economic benefits of airports, and do night flights at Paris Charles de Gaulle contribute to the French economy or not? This report has tried to answer these questions on the basis of existing evidence.

Unfortunately, there is insufficient evidence to draw firm conclusions because the available studies focus on the benefits and ignore the costs. While several studies show the economic benefits of the Paris airports in terms of employment and value added, these studies do not take into account any negative impacts and therefore overestimate the contribution of the airports. Still, it is clear that improved transport links not only result in more opportunities for businesses to export, more tourists coming to France, et cetera, but also in more opportunities for foreign firms to do business in France, more inhabitants of France taking foreign vacations, et cetera. In addition, airports have external effects such as noise, air pollution with consequences on health and climate impacts as well. A proper analysis of the contribution of airports to the economy requires an analysis of the net impacts, i.e. the sum of positive and negative impacts.

Studies into the economic benefits of airports in general focus on the average benefits, e.g. the value added per million passengers. Even if these would be calculated properly, taking the balance of positive and negative impacts, such figures cannot be used to assess changes in airport capacity. The reason is that marginal effects are likely to be smaller than average effects because of economies of scale.

What is clear from the evidence is that the number of direct jobs at the airport per million passengers decline steadily over time. Airports, like many other economic sectors, show an increasing labour productivity.

Night flights at Paris Charles de Gaulle are the least restricted among the European hubs. While all hubs ban noisy aircraft during the night and have noise charges or taxes or differentiated landing fees, a significant difference exists on restrictions of the number of flights. Frankfurt has a complete ban on night flights on six hours, while 16 flights per six and a half hour night are allowed at Heathrow on average. Schiphol has a limit of 88 flights per eight hour night, and Charles de Gaulle has only a slot limitation on the period from 00h00 to 05h00.As a result, there are twice as many flights during the 8-hour night from Paris CDG than from the other major hubs.

As a result, the carriers at these airports, and especially the home carriers, use night flights for different purposes. The different uses of night flights in airline networks strongly suggests that airlines and airports have the capacity to adapt to different night flight regimes, while at the same time maintaining a good network.

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# Annex A Detailed analysis of passenger night flights

This annex provides details on passenger night flights to and from the four major hub airports in Europe in the week starting 19 January 2012 at 23h00 and ending 26 January 2012 at 07h00. The data are analysed and discussed in Chapter 5.

**Table 5 Overview Heathrow flights at night time**

| Heathrow | Departures (23h30-06h00) | | | Arrivals (23h30-06h00) | | | Early departures (06h00-07h00) | | |
|---|---|---|---|---|---|---|---|---|---|
| **Destination** | **# Flights** | **% Flights** | **# Passengers** | **# Flights** | **% Flights** | **# Passengers** | **# Flights** | **% Flights** | **# Passengers** |
| - Europe | 19 | 49% | 2,512 | 1 | 1% | 0 | 179 | 82% | 22,918 |
| - Africa | 4 | 10% | 1,303 | 21 | 22% | 6,798 | 8 | 4% | 2,524 |
| - North America | 3 | 8% | 871 | 10 | 10% | 2,536 | 17 | 8% | 4,488 |
| - Middle America | 0 | 0% | 0 | 0 | 0% | 0 | 0 | 0% | 0 |
| - South America | 0 | 0% | 0 | 0 | 0% | 0 | 1 | 0% | 287 |
| - Near East | 3 | 8% | 786 | 13 | 14% | 3,204 | 6 | 3% | 1,739 |
| - Indian subcontinent | 5 | 13% | 1,674 | 28 | 29% | 9,465 | 5 | 2% | 1,876 |
| - Far East | 5 | 13% | 1,831 | 23 | 24% | 8,426 | 1 | 0% | 408 |
| - Other | 0 | 0% | 0 | 0 | 0% | 0 | 0 | 0% | 0 |
| Total departures | 39 | 100% | 8,977 | 96 | 100% | 30,429 | 217 | | 34,239 |
| # Freight flights | 0 | | | 1 | | | 0 | | |
| # Passenger flights | 39 | | | 95 | | | 217 | | |
| **Flights carried out by home carrier** | **# Flights** | **% Flights** | **# Passengers** | **# Flights** | **% Flights** | **# Passengers** | **# Flights** | **% Flights** | **# Passengers** |
| - Europe | 0 | 0% | 0 | 1 | 2% | 0 | 77 | 83% | 10,400 |
| - Africa | 3 | 30% | 1,016 | 16 | 33% | 5,362 | 3 | 3% | 1,016 |
| - North America | 2 | 20% | 651 | 5 | 10% | 1,436 | 9 | 10% | 0 |
| - Middle America | 0 | 0% | 0 | 0 | 0% | 0 | 0 | 0% | 0 |
| - South America | 0 | 0% | 0 | 0 | 0% | 0 | 1 | 1% | 287 |
| - Near East | 0 | 0% | 0 | 0 | 0% | 0 | 3 | 3% | 939 |
| - Indian subcontinent | 3 | 30% | 1,016 | 18 | 38% | 6,171 | 0 | 0% | 0 |
| - Far East | 2 | 20% | 651 | 8 | 17% | 2,528 | 0 | 0% | 0 |
| - Other | 0 | 0% | 0 | 0 | 0% | 0 | 0 | 0% | 0 |
| BA departures | 10 | 100% | 3,334 | 48 | 100% | 15,497 | 93 | 43% | 12,641 |
| **Flights carried out by other airlines** | **# Flights** | **% Flights** | **# Passengers** | **# Flights** | **% Flights** | **# Passengers** | **# Flights** | **% Flights** | **# Passengers** |
| Europe | 19 | | 2,512 | 0 | | 0 | 102 | | 12,518 |
| Total | 29 | | 5,643 | 48 | | 14 932 | 124 | | 21,598 |

Note: The number of passengers was estimated using standard 2-class or 3-class seating arrangements for the aircraft concerned and average AEA passenger load factors.

**Table 6 Overview Frankfurt flights at night time**

| Frankfurt | Departures (23h00-05h00) | | | Arrivals (23h00-05h00) | | | Early departures (05h00-06h00) | | | Early departures (06h00-07h00) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Destination** | **# Flights** | **% Flights** | **# Passengers** | **# Flights** | **% Flights** | **# Passengers** | **# Flights** | **% Flights** | **# Passengers** | **# Flights** | **% Flights** | **# Passengers** |
| - Europe | 9 | 28% | 760 | 14 | 61% | 0 | 0 | 0% | 0 | 188 | 96% | 19,754 |
| - Africa | 8 | 25% | 136 | 5 | 22% | 273 | 4 | 80% | 409 | 7 | 4% | 1,064 |
| - North America | 3 | 9% | 802 | 0 | 0% | 0 | 0 | 0% | 0 | 0 | 0% | 0 |
| - Middle America | 3 | 9% | 440 | 0 | 0% | 0 | 0 | 0% | 0 | 1 | 1% | 0 |
| - South America | 2 | 6% | 0 | 0 | 0% | 0 | 0 | 0% | 0 | 0 | 0% | 0 |
| - Near East | 1 | 3% | 0 | 1 | 4% | 0 | 1 | 20% | 0 | 0 | 0% | 0 |
| - Indian subcontinent | 2 | 6% | 0 | 1 | 4% | 0 | 0 | 0% | 0 | 0 | 0% | 0 |
| - Far East | 4 | 13% | 0 | 2 | 9% | 0 | 0 | 0% | 0 | 0 | 0% | 0 |
| - Other | 0 | 0% | 0 | 0 | 0% | 0 | 0 | 0% | 0 | 0 | 0% | 0 |
| Total departures | 32 | 100% | 2,138 | 23 | 100% | 273 | 4 | 100% | 409 | 196 | 1 | 20,818 |
| # Freight flights | 17 | | | 21 | | | 1 | | | 1 | | |
| # Passenger flights | 15 | | | 2 | | | 3 | | | 195 | | |
| **Flights carried out by home carrier** | **# Flights** | **% Flights** | **# Passengers** | **# Flights** | **% Flights** | **# Passengers** | **# Flights** | **% Flights** | **# Passengers** | **# Flights** | **% Flights** | **# Passengers** |
| - Europe | 2 | 25% | 0 | 0 | 0% | 0 | 0 | 0% | 0 | 122 | 100% | 15,612 |
| - Africa | 6 | 75% | 0 | 1 | 100% | 0 | 1 | 100% | 0 | 0 | 0% | 0 |
| - North America | 0 | 0% | 0 | 0 | 0% | 0 | 0 | 0% | 0 | 0 | 0% | 0 |
| - Middle America | 0 | 0% | 0 | 0 | 0% | 0 | 0 | 0% | 0 | 0 | 0% | 0 |
| - South America | 0 | 0% | 0 | 0 | 0% | 0 | 0 | 0% | 0 | 0 | 0% | 0 |
| - Near East | 0 | 0% | 0 | 0 | 0% | 0 | 0 | 0% | 0 | 0 | 0% | 0 |
| - Indian subcontinent | 0 | 0% | 0 | 0 | 0% | 0 | 0 | 0% | 0 | 0 | 0% | 0 |
| - Far East | 0 | 0% | 0 | 0 | 0% | 0 | 0 | 0% | 0 | 0 | 0% | 0 |
| - Other- | 0 | 0% | 0 | 0 | 0% | 0 | 0 | 0% | 0 | 0 | 0% | 0 |
| Lufthansa departures | 8 | 25% | 0 | 1 | 100% | 0 | 1 | 100% | 0 | 122 | 1 | 0 |
| **Flights carried out by other airlines** | **# Flights** | **% Flights** | **# Passengers** | **# Flights** | **% Flights** | **# Passengers** | **# Flights** | **% Flights** | **# Passengers** | **# Flights** | **% Flights** | **# Passengers** |
| - Europe | 7 | | 760 | 16 | | 0 | 0 | | 0 | 9 | | 4,141 |
| Total | 25 | | 2,138 | 26 | | 273 | 3 | | 409 | 74 | | 5,205 |

Note: The number of passengers was estimated using standard 2-class or 3-class seating arrangements for the aircraft concerned and average AEA passenger load factors for intercontinental routes.

**Table 7 Overview Schiphol flights at night time**

| Schiphol | Departures (23h00-06h00) | | | Arrivals (23h00-06h00) | | | Early departures (06h00-07h00) | | | Early arrivals (06h00-07h00) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Destination** | **# Flights** | **% Flights** | **# Passengers** | **# Flights** | **% Flights** | **# Passengers** | **# Flights** | **% Flights** | **# Passengers** | **# Flights** | **% Flights** | **# Passengers** |
| - Europe | 15 | 39% | 1,603 | 45 | 27% | 7,785 | 117 | 96% | 16,134 | 7 | 10% | 434 |
| - Africa | 15 | 39% | 1,496 | 36 | 22% | 6,436 | 4 | 3% | 544 | 15 | 22% | 3,076 |
| - North America | 3 | 8% | 574 | 15 | 9% | 2,785 | 0 | 0 | 0 | 8 | 12% | 1,221 |
| - Middle America | 2 | 5% | 220 | 2 | 1% | 0 | 0 | 0 | 0 | 3 | 4% | 1,093 |
| - South America | 1 | 3% | 0 | 0 | 0% | 0 | 0 | 0 | 0 | 0 | 0% | 0 |
| - Near East | 2 | 5% | 136 | 30 | 18% | 5,008 | 1 | 1% | 0 | 11 | 16% | 2,754 |
| - Indian subcontinent | 0 | 0% | 0 | 13 | 8% | 4,735 | 0 | 0 | 0 | 15 | 22% | 5,203 |
| - Far East | 0 | 0% | 0 | 25 | 15% | 3,813 | 0 | 0 | 0 | 10 | 14% | 3,258 |
| - Other | 0 | 0% | 0 | 0 | 0% | 0 | 0 | 0 | 0 | 0 | 0% | 0 |
| Total departures | 38 | | 4,029 | 166 | | 30,562 | 122 | 100% | 16,678 | 69 | | 17,039 |
| # Freight flights | 7 | | | 24 | | | 24 | | | 24 | | |
| # Passenger flights | 31 | | | 142 | | | 98 | | | 45 | | |
| **Flights carried out by home carrier** | **# Flights** | **% Flights** | **# Passengers** | **# Flights** | **% Flights** | **# Passengers** | **# Flights** | **% Flights** | **# Passengers** | **# Flights** | **% Flights** | **# Passengers** |
| - Europe | 0 | 0% | 0 | 8 | 11% | 1,532 | 35 | 100% | 6,702 | 0 | 0 | 0 |
| - Africa | 0 | 0% | 0 | 17 | 24% | 4,260 | 0 | 0 | 0 | 4 | 40% | 1,538 |
| - North America | 2 | 100% | 574 | 0 | 0% | 0 | 0 | 0 | 0 | 0 | 0% | 0 |
| - Middle America | 0 | 0% | 0 | 0 | 0% | 0 | 0 | 0 | 0 | 3 | 9% | 364 |
| - South America | 0 | 0% | 0 | 0 | 0% | 0 | 0 | 0 | 0 | 0 | 0% | 0 |
| - Near East | 0 | 0% | 0 | 21 | 30% | 4,872 | 0 | 0 | 0 | 11 | 31% | 1, 740 |
| - Indian subcontinent | 0 | 0% | 0 | 13 | 19% | 4,735 | 0 | 0 | 0 | 7 | 20% | 1, 457 |
| - Far East | 0 | 0% | 0 | 11 | 16% | 3,390 | 0 | 0 | 0 | 0 | 0 | 0 |
| - Other | 0 | 0% | 0 | 0 | 0% | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| KLM departures | 2 | 100% | 574 | 70 | 100% | 18,789 | 35 | 100% | 6,702 | 35 | 100% | 5,100 |
| **Flights carried out by other airlines** | **# Flights** | **% Flights** | **# Passengers** | **# Flights** | **% Flights** | **# Passengers** | **# Flights** | **% Flights** | **# Passengers** | **# Flights** | **% Flights** | **# Passengers** |
| Europe | 14 | | 1,603 | 37 | | 6,253 | 82 | | 9,432 | 7 | | 434 |
| Total | 36 | | 3,455 | 96 | | 11,773 | 87 | | 9,976 | 34 | | 11,939 |

Note: The number of passengers was estimated using standard 2-class or 3-class seating arrangements for the aircraft concerned and average AEA passenger load factors for intercontinental routes.

**Table 8 Overview Charles de Gaulle flights at night time**

| Charles de Gaulle | Departures (23h00-06h00) | | | Arrivals (23h00-06h00) | | | Early departures (06h00-07h00) | | | Early arrivals (06h00-07h00) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Destination** | **# Flights** | **% Flights** | **# Passengers** | **# Flights** | **% Flights** | **# Passengers** | **# Flights** | **% Flights** | **# Passengers** | **# Flights** | **% Flights** | **# Passengers** |
| - Europe | 18 | 15% | 1,904 | 19 | 12% | 1,903 | 69 | 85% | 8,520 | 1 | 1% | 0 |
| - Africa | 27 | 22% | 8,054 | 73 | 45% | 18,033 | 5 | 6% | 562 | 32 | 38% | 8,182 |
| - North America | 8 | 7% | 0 | 11 | 7% | 2,934 | 6 | 7% | 0 | 20 | 24% | 5,225 |
| - Middle America | 0 | 0% | 0 | 2 | 1% | 0 | 0 | 0% | 0 | 5 | 6% | 2,015 |
| - South America | 32 | 26% | 11,165 | 0 | 0% | 0 | 0 | 0% | 0 | 0 | 0% | 0 |
| - Near East | 1 | 1% | 0 | 22 | 14% | 3,853 | 1 | 1% | 0 | 27 | 32% | 8,099 |
| - Indian subcontinent | 14 | 11% | 4,652 | 19 | 12% | 5,720 | 0 | 0% | 0 | 22 | 26% | 7,647 |
| - Far East | 22 | 18% | 7,740 | 16 | 10% | 4,562 | 0 | 0% | 0 | 34 | 40% | 10,393 |
| - Other | 0 | 0% | 0 | 0 | 0% | 0 | 0 | 0% | 0 | 0 | 0% | 0 |
| Total departures | 122 | 100% | 33,515 | 162 | 100% | 37,005 | 81 | 100% | 9,082 | 85 | 100% | 41,561 |
| # Freight flights | 8 | | | 6 | | | 2 | | | 11 | | |
| # Mail and express | 8 | | | 0 | | | 5 | | | 0 | | |
| # Passenger flights | 106 | | 33,515 | 156 | | 37,005 | 74 | | 9,295 | 74 | | 41,561 |
| **Flight carried out by home carrier** | **# Flights** | **% Flights** | **# Passengers** | **# Flights** | **% Flights** | **# Passengers** | **# Flights** | **% Flights** | **# Passengers** | **# Flights** | **% Flights** | **# Passengers** |
| - Europe | 6 | 6% | 0 | 3 | 3% | 0 | 6 | 75% | 777 | 1 | 2% | 0 |
| - Africa | 25 | 25% | 7,746 | 51 | 50% | 13,897 | 0 | 0% | 0 | 27 | 42% | 4,087 |
| - North America | 0 | 0% | 0 | 10 | 10% | 2,934 | 1 | 13% | 0 | 8 | 13% | 1,421 |
| - Middle America | 0 | 0% | 0 | 2 | 2% | 0 | 0 | 0% | 0 | 5 | 8% | 1,209 |
| - South America | 32 | 32% | 11,165 | 0 | 0% | 0 | 0 | 0% | 0 | 0 | 0% | 0 |
| - Near East | 1 | 1% | 0 | 9 | 9% | 1,467 | 1 | 13% | 0 | 11 | 17% | 2,224 |
| - Indian subcontinent | 14 | 14% | 4,652 | 15 | 15% | 4,415 | 0 | 0% | 0 | 7 | 11% | 1,821 |
| - Far East | 22 | 22% | 7,740 | 11 | 11% | 3,504 | 0 | 0% | 0 | 5 | 8% | 1,099 |
| - Other | 0 | 0% | 0 | 0 | 0% | 0 | 0 | 0% | 0 | 0 | 0% | 0 |
| Air France | 100 | 100% | 31,302 | 101 | 100% | 26,217 | 8 | 100% | 777 | 64 | 100% | 11,860 |
| **Flights carried out by other airlines** | **# Flights** | **% Flights** | **# Passengers** | **# Flights** | **% Flights** | **# Passengers** | **# Flights** | **% Flights** | **# Passengers** | **# Flights** | **% Flights** | **# Passengers** |
| - Europe | 12 | | 1,904 | 16 | | 1,903 | 0 | | 7,744 | | | 0 |
| - Other | 22 | | 2,212 | 61 | | 10,788 | 73 | | 8,305 | | | 29,700 |

Note: The number of passengers was estimated using standard 2-class or 3-class seating arrangements for the aircraft concerned and average AEA passenger load factors for intercontinental routes.