The Economic Impact of Schiphol Airport on the Amsterdam Region

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Abstract

This study is aiming to show the impacts of Schiphol airport on the Amsterdam Region. Previous researches have demonstrated several impacts on the region of Amsterdam but they did not mention the possibility of negative impacts. This research is demonstrating the positive effect on the employment, the benefits coming from tourism and the business attractiveness of the area. Subsequently, three possible negative impacts are illustrated: airport CO2 emission, housing prices and noise pollution. The analysis shows that the CO2 emission and noise pollution are, indeed, negative impacts and shows that the further away is the airport, the higher the housing prices are.

Table of Content

List of Tables and Figures

1- Introduction

Globalization of the world economy and trade have made air traffic the most efficient way of communication. Nowadays, international airports play a national and international economic function, as they are the symbol of a European and international entry point (Bird, 1983). Cross-investment between countries is increasingly a feature of modern business, with mobility of labour as a growing factor (Cristureanu & Bobirca, 2007).

Amsterdam Airport Schiphol is the main airport in The Netherlands, as well as one of the largest airports in Europe (ranked third). In fact, Schiphol is an international airport, which is characterized as an airport offering customs and immigration facilities for passengers travelling between countries. These airports are larger than the domestic airports, usually have more and longer runways and have more efficient accommodation for large aircrafts that are used for international and intercontinental travels (Schiphol, 2017). Additionally, Schiphol is being categorized as an Airport City. By definition, an airport city is an environment that integrates and enhances people and businesses, logistics and shipping, information and entertainment. Moreover, it is a multi-modal hub providing air, rail and road transport (Schiphol Group, 2012).

Schiphol airport stimulates the Dutch economy and provides many employment opportunities, with about 300 000 jobs sustained in 2017 (Saxon, 2017). This airport also links the Netherlands with the rest of the world and therefore makes a contribution to economic growth (Rijksoverheid, 2017). According to an IATA report (Saxon, 2017), North America and Asia-Pacific are the largest sources of arrivals to the Netherlands after Europe, representing about 2.5 million passengers in 2014. In addition, Schiphol Airport provides 13 direct flight connections to the 10 fastest growing countries such as India, China or even Kazakhstan, and 39 direct flights to destinations among the 20 fastest growing countries (IATA, 2017). According to the Schiphol website (2017), Schiphol is the most important airlines hub and second home base for Air France-KLM and other Sky Team airlines, with about 322 direct worldwide destinations. In 2017, Schiphol airport has reported 68.4 million passengers, which is 7.67% more than in 2016 and by looking at the previous numbers, it has not stopped increasing (CBS, 2018). The following is therefore the central question of the thesis:

To what extent does Schiphol Airport affect the economy of the Amsterdam region?

Following the introduction, the study is composed of five sections. The second section is the theoretical framework which is explaining the previous researches as well as explaining what have been added to them. Subsequently, to answer this central question, the paper will elaborate about the positive impacts on the region. The three selected positive impacts are the effect on the employment which is separated in two parts (direct employment and indirect impact of tourism on employment) and the business attractiveness of the area. This paper is also demonstrating that Schiphol is likely to have negative impacts on the region. The airport emission of CO2 is the first adverse effect that will be exhibited followed by the effect on housing prices and the noise pollution. Finally, the conclusion will summarize all the findings and provide the limitations and discussion for future researches.

2- Theoretical framework

2.1- Previous theories and researches

The economic of airports is a topic that has attracted a lot of research in the previous years. Most of the previous academic papers have been conducted on specific regions of the world, especially in Asia and North America. They are mostly demonstrating a statistical positive correlation between airport development and regional economic growth. Chow (2015) demonstrated in an empirical research the positive role of the efficient Chinese airport in stimulating economic growth. The author claims that insufficient air traffic capacity creates constraints on aircraft movement and operational efficiency which then will have unfavourable effect on the future economic growth. Another paper looking at airport development and economic growth has been made by Green (2014) in the US for the Raleigh-Durham International Airport. The author showed that there is a correlation between airport and economic development. A cause-and-effect between airport and economic development has been shown in both directions. This means that an economic expansion can increase airport demand and an increase in airport capacity would raise productivity or demand in other sectors of the economy. In Yao and Yang's research (2008) based on the Chinese economy, the authors demonstrate that a 10% population increase causes a 1.7% increases in air passenger volume and 1.2% increase in air cargo. On the other hand, a Canadian study has demonstrated that to create one-person year of employment, the number of additional passenger should increase by 1126 and these additional passengers add 78.08 dollar in the economy (Benell and Prentice, 1993).

In 1997, the liberalisation of air transport in the European union changes the travel behavior, with the establishment of the low cost airline company and a rise of destinations in European air service (Ribeiro de Almeida, 2011). Accordingly, some researches started to look at the economic impact of tourism on economies. This is the case for Ribeiro de Almeida (2011) which presented a case study about the Portuguese city Faro. The city of Faro's economy has enhanced thanks to the airport creation and development in the mid-nineties. The low cost airlines entry into the market was a challenge for airlines in term of bearing the demands and needs. This airport has two main low cost airline companies: Ryanair and EasyJet. EasyJet is facing a positive evolution in term of airline operation with +56% from 2006 to 2010. Concerning the Ryanair evolution, it represents a more significant increase with +857.6% for the same period.

Only a few studies have been analysing the European airports, mostly on Paris Airport and London Heathrow. Nevertheless, a study about the economic and spatial impact of Schiphol airport has been conducted by Kramer (1988). In his paper, the author demonstrates the significance of Schiphol for the national and regional economy from 1960 to 1988. To show these impacts, Kramer divided the impacts in two: direct and indirect. On one hand, the direct impacts are reflected in the employment in the airport area and on the airport companies' turnovers. On the other hand, the indirect impacts of the airport are reflected by the expenditures of foreigner tourists and approximately the half of the Schiphol airport employees' wages.

The second article that is also analysing the Schiphol airport impact on the Amsterdam region has been written by Hakfoort, Poot and Rietveld (2001). The authors defined two different airport functions: transportation and regional economic impact. This paper is focusing on the link between these two functions. The model used in their research is the backward linkages that shows how much the region of Amsterdam gains when the airport activity increases. The second one is forward linkages refers to the benefits the region obtains due to the proximity with the airport (Hakfoort, Poot, Rietveld, 2001). As well as Kramer's research, they also present the direct impact reflected on the airport and region employment. They measure the economic impact of the airport expansion comparing a baseline scenario and zero growth scenario. The baseline scenario is a data representation of the actual economic development in the Amsterdam region from 1987 to 1998 whereas the zero growth scenario is assumed to be with no growth in the aviation activity for the same period. As a result, comparing these two scenarios enable them to find the backward and forward linkages.

The two papers mentioned earlier are the main articles of this research. However, this paper will have some changes. Both papers are discussing the economic impacts of Schiphol airport on the Amsterdam region, mentioning some positive impacts such as employment but they did not consider any negative impacts. Recently in the Netherlands, a group of people living around the six Dutch airports has been created, aiming to fight on the undesirable growth of aviation industry. The group wants the airline companies to reduce their emission of CO2 (NLtimes, 2018). Due to the current matter, this paper will include a section about the negative impact on the environment and on the housing prices effects on the surroundings of Schiphol airport. Additionally, this study will use tourism as a source of employment and business creation contrary to Kramer's paper (2001) that used expenditure of tourists as indirect economic impact. None of the authors have written about the impact of tourism on the region. Amsterdam is the 13th city with the most yearly visitors in the world and the 10th in Europe with approximately 8.7 million tourists in 2017 (Independent, 2017). Airports are driving the tourism development, a study has been conducted by Cristureanu and Bobirca (2007) on a European scale, showing that tourism represented about 5% of the European total employment and gross domestic product (GDP) in 2007.

Finally, both articles do not mention the fact that Schiphol airport attracts businesses and foreign direct investments (FDI). This paper will, therefore, include these two elements as a source of employment and economic growth in the region. FDI is defined as a capital flow between the enterprise and entities in other economies (UNCTAD). Multinational firms are a source of job creation as well as high wage, increase the level of productivity and stimulate innovation, therefore attracting them is an important goal for governments (Banno, Redondi, 2014). Previous studies have demonstrated that the geography of FDIs is related to the desire of multinational firms to access primary international airports (Banno, Redondi, 2014).

2.2- Explanation of the conducted research

The objective of this thesis is to demonstrate the economic impacts that Schiphol Airport has on the Amsterdam region. This will be illustrated by showing the positive impacts as well as the negative impacts. Firstly, the positive impacts will be illustrated. This research will mainly analyse the effect of three positive impacts: Direct employment, Tourism and Business attractiveness. Accordingly, the hypotheses are the following:

Schiphol is positively impacting the region of Amsterdam through direct employment.

Schiphol is positively impacting the region of Amsterdam through tourism.

Schiphol is positively impacting the region of Amsterdam through its business attractiveness.

The paper will show that all these impacts are a source of job creation and lead to economic growth. Contrary to the paper written by Kramer (1988) and Hakfoort, Poot and Rietveld (2001), this research will also cover negative impacts on the research, especially environmental impact and the negative influences reflected on housing prices in the region. As a result, the following hypotheses will be tested:

Schiphol has a negative impact on the region of Amsterdam through his CO2 emissions.
Schiphol has a negative impact on the region of Amsterdam through the housing prices.
Schiphol has a negative impact on the region of Amsterdam through the noise pollution.

3- Methodology

As explained earlier, this paper will provide the positive and negative impact of Schiphol airport using statistics retrieved from the Centraal Bureau voor de Statistiek (CBS) for the variables such as the number of Hotels in Amsterdam, employment in the hotel & catering and the number of passengers. Most of the other variables concerning the airport itself such as the number of outlets, total employment and net income have been retrieved from the figure and facts published every year by the Schiphol airport. The total employment of Amsterdam, these data have been found on the documents published by the Gemeente of Amsterdam.

The case study of Schiphol airport is done by comparing the evolution of chosen variables. In other words, the evolutions are made by looking at the growth percentages of each variables. It is, then, concluded that there is a relation between these variables when they increase over the studied period. For instance, the first positive impact is the direct employment, so the total employment of the Schiphol area, the airport, Amsterdam and the change in GDP have been collected to measure the impact. By looking at the evolution or change of variables, it helped to investigate whether the impact was positive or not. For the two other positive impacts (Tourism and Business attractiveness), it has been the same methods, the evolutions of variables collected enabled to show that the airport of Amsterdam has a positive impact on the region. Concerning the two negative impacts, the method has been the same as for the positive impacts. The relevant variables have been collected and the

change or evolution of numbers revealed whether the impact was negative or not. Caution is needed in the analysis as the relation between some of the variables is reciprocal.

4- Positive impacts of Schiphol airport on the region of Amsterdam

4.1 - Employment (airport and Amsterdam)

This section will cover the impacts that the airport of Amsterdam has on the employment at the airport and in Amsterdam. The impacts have been divided in two: direct impact and indirect. A direct impact is defined as employment that is related to the operation of an airport. In contrast, indirect impact refers to the employment generated in the economy of the study area in the chain of suppliers of goods and services (Cristureanu and Bobirca, 2007).

4.1.1- Direct employment

Brueckner (2002) demonstrated in an empirical research the positive relationship between airline traffic and employment in the US metropolitan areas. The statistics have shown that a 10% increase in the flow of passengers would lead to an increase of 1% in the employment of the service-related industry. Moreover, Brueckner's paper has also shown that airline traffic does not have any impact on manufacturing and other goods-related employment, meaning that air traffic is more related to service-related businesses. Button and Lall (1999) conducted a research that support Brueckner's finding. The research has shown that the existence of hub airport in regions increases the region's high-technology employment. Indeed, the authors explain that airport jobs are growing as the traffic expand. They have also shown that high level of traffic, reflected in frequent airline service to many destinations, stimulate employment at established firm and attract new employers to the metro area. Another research supporting Brueckner's finding is the article published by Benell and Prentice (1993). The article compares the direct impacts of employment and revenue since they are the most consistent measures of economic impacts. It is demonstrated that the passenger traffic is positively correlated with direct airport employment.

Years	Total Employment Schiphol Area	Number of passengers (in mln)	Number employees Schiphol Airport	Total Employment Amsterdam
2007	62128	47.744	2390	432338
2008	65009	47.391	2738	449331
2009	59986	43.523	2457	461238
2010	59808	45.136	2346	468763
2011	61716	49.68	2183	475277
2012	64061	50.975	2131	482638
2013	64205	52.527	2093	484600
2014	64358	54.94	2039	493379
2015	64392	58.245	2000	509944
2016	64452	63.526	2063	526988
2017	65000	68.4	2180	542375

Table 1.1: Total employment Schiphol area, Amsterdam and employed by the airport, Number of total passengers

Table 1.1 shows the total employment in the Schiphol area, the number of yearly passengers, the total number of employees at the airport and the total employment in Amsterdam from 2007 to 2017. *Appendix A* displays graphs with all the evolutions of each variable. All of them are strongly increasing throughout the past 10 years except for the number of employees at the airport itself, that is fluctuating. Observing the yearly changes for these variables, it seems that the period 2010 to 2011 was the one with the highest changes in the airport as well as in the city of Amsterdam with an +3.9% increase in the total employment in the airport area, a 10.06% increase in the passengers and 1.3% increase in the employment in Amsterdam. Earlier in this section, it was mentioned that Brueckner (2002) showed that air traffic and employment in the service-relate businesses were correlated. The total employment in the Schiphol area has increased from 2010 to 2017 with an employment growth of approximately 8.68%. About the number of passengers, the evolution is more significant with a growth of 51.53% when computing the evolution from 2007 to 2017. Based on Brueckner's method that explains the positive correlation between airport employment and air passengers, a 16.8% increase in the flow of passengers would leads to an 1% increase of employment at the airport.

year	GDP growth
2007	3.70%
2008	1.70%
2009	-3.77%
2010	1.40%
2011	1.66%
2012	-1.06%
2013	-0.19%
2014	1.42%
2015	2.16%
2016	2.21%
2017	3.20%

Table1.2: GDP growth Netherlands (Source: OECD)

Table 1.2 shows the GDP growth in the Netherlands during the studied period. The average of GDP growth for the ten years is around 1.13%. Throughout the period, the GDP is, in general, stable even though a drop is observable in 2009 due to the world financial crisis. As mentioned in the previous paragraph, in term of growth of passenger and employment, the period 2010 to 2012 was the one with the higher changes. In the GDP table, the lowest rate is -3.77% in 2009 and then, in the period 2010-2012, the GDP growth is increasing again. When the GDP grows, nations focus on increasing the air passengers and this will lead to job creations (Neal, 2012). Neal's claim matches with the case of Amsterdam for the 2010 to 2012 period, since the air passengers is increasing by 12.9% and the employment in the Schiphol area and Amsterdam varies by +7.11% and +2.96% respectively. Another interesting period to investigate was from 2014 to 2017. Table 1.2 shows that the growth GDP is strongly increasing in this period and it is also the case for the related variables. The employment in the Schiphol area has increased by less than 1%, the air passengers by 24.50%, the number of employee at the airport 6.92% and an increase of 9.93% in the Amsterdam.

To conclude, two relationships are discussed in this part that is, Schiphol and direct employment as well as the relation in GDP growth and passenger growth. In other words, it has been shown that the growth of passengers affects the employment at Schiphol, its area and in Amsterdam. Additionally, as Neal (2012) mentioned in his research, when the GDP is growing, nation focuses on increasing the air passengers and this leads to job creations. Therefore, the main relationship that is extracted from the literature is the fact that when the economy grows, people tend to fly more and this leads to more employment. This is mostly true for airport employment and only partly for employment in Amsterdam as GDP growth accounts for most of the employment growth in Amsterdam directly.

4.1.2- Indirect impact of tourism

Tourism is an important source of employment and has been cited as one of the best advantages for nations (Sinclair, 1998). Previous empirical researches have already confirmed that the level of employment in tourism activities is high. In 2016, travel and tourism direct contribution to GDP was around 14.5 billion dollars and the total contribution was 40.1 billion dollars in the Netherlands. The year after, travel and tourism's direct contribution have generated 464 000 jobs which represent 6.2% of the national total employment and 676 800 for the total contribution to employment. Moreover, the total contribution of travel and tourism to employment including effects from investment, the supply chain and induced income impacts was around 705 000 jobs in 2017 which is 9.4% of the total employment of the Netherlands (World Travel & Tourism Council, 2017). In 2017, Amsterdam received around 85% of the 17.6 million tourists visiting the Netherlands (Gemeente Amsterdam, 2017).

Years	Outlet Schiphol	Hotel Amsterdam	Employment Hotel + Food serving Amsterdam
2007	194	356	343000
2008	196	362	344000
2009	197	374	337000
2010	196	375	343000
2011	195	380	355000
2012	197	403	361000
2013	198	418	364000
2014	198	426	376000
2015	202	441	392000
2016	349	464	405000
2017	369	484	409050

Table 1.3: Number of Outlet at Schiphol, Hotel and employment in hotel and catering in Amsterdam (Source: Gemeente Amsterdam & Schiphol Airport)

Table 1.3 is showing the number of outlets located at Schiphol airport, the number of hotels and the number of employment in the hotel and catering sector in Amsterdam from 2007 to 2017. There is an overall increase of the three variables, though at a different speed. The number of outlets at the airport itself is the variable that is increasing the most with an increase of 90.21%: 175 outlets in 10 years. Schiphol airport has been designed to be an airport as well as a mall rolled-up into one (Schiphol). This can explain the reasons of the broad variety of stores present at the airport. As

mentioned in the previous section, the number of air traffic has strongly increased, therefore, the airport is facing a higher demand. This can explain the strong expansion of stores at the airport. It is coherent to infer that an expansion of number of outlets in the airport is impacting positively the number of employment at the airport itself. Moreover, the table is showing an increase in the number of hotel in city of Amsterdam with 128 additional hotels in ten years. Concerning the employment in the hotel & catering sector, it increased by 19.25% the last ten years. Of course, this growth can be only partly attributed to arrivals at Schiphol as increasing wealth (higher GDP) stimulates holiday travelling by all transport modes coming to Amsterdam. In turn, the total growth in tourism induces the growth of the supply of hotels and this increase of accommodation supply also stimulates tourism growth. It is also important to point out that the relationship between tourism and passenger volumes is more complex. In other words, when economies are growing, this leads to more flights and travels and thus, leads to a growth of air passengers which lead to more tourism.

As mentioned in the theoretical framework, the travel behaviour has changed due to the liberalisation of air transport in 1997. The establishment of the low cost airline company raised destinations in European air service. It enabled secondary or third cities to have directly flight to main cities. For instance, it is now possible to flight from Bordeaux (France), Liverpool (UK) or even Florence (Italy) to Amsterdam or other big European cities. Among the 90 airlines at Schiphol, 17 are low-costs and among the 341 destinations, the low-cost airlines cover 196 destinations (Schiphol, 2017). Therefore, lower cost of traveling is one driver of air traffic increase. International Air Transport Association (IATA) have published a research demonstrating that working age population is now traveling more than its older and younger counterparts (2016). Therefore, demographics is considered as another driver of air traffic growth. Indeed, countries with a shift in demographic towards working age population (15-65 years old) have bigger chance to experience an air traffic growth. In other words, countries that have their population entering in this working age range will face higher air traffic. Additionally, a growing population can boost the air traffic since it increases the number of people living in a particular economy. The extension of a middle class increases the air traffic since it leads to more and more people with a sufficient income to afford air travel (Morphet & Bottini). Finally, countries with high living standards enjoy air traffic growth. The same study has demonstrated that high living standards increases the growth in air traffic, especially in developing countries due to the propensity to spend growing faster and that their market have not reached maturity yet (Forbes, 2016).

4.2- Business Attractiveness

This section will cover the business attractiveness of the airport to its surroundings and to the city of Amsterdam. Brueckner (2002) has shown that high level of traffic reflecting frequent airline service to many destinations, stimulate employment at established firms and attract new employers to the metropolitan area. Moreover, since travelling within Europe is easy and fast makes it practical for business meetings. In another study, Button and Lall (1999) demonstrated that being close to a hub airport would lead to higher incomes or more employment for the area; this shows the benefits of travel enjoyed by individuals and companies.

Concerning the city of Amsterdam, there are 15 different business areas throughout the city including Amsterdam Schiphol Business District Centre (Iamsterdam). On one hand, the core activities of Schiphol are concentrated on aviation, consumer products and services, real estate and alliance & participation. These four areas together ensure the management of the airport in an efficient and effective way (Schiphol Airport, 2017). On the other hand, the Central Business district (CBS) of Schiphol, in 2017, hosts 578 different multinationals and start-ups, such as DANONE, Citibank or Microsoft, employing 65 000 people. Strauss-Kahn and Vives (2004) found that headquarters and multinationals firms relocate to metropolitan areas with good airport facilities, low corporate taxes and high level of business services. This could explain the establishment of Samsung headquarter at Schiphol CBD (Samsung, 2016).

Sellner and Nagl's work (2010) looked at the impact of air accessibility on GDP and investment growth in Vienna. They found a GDP elasticity of air accessibility of 0.014 and an investment elasticity of 0.05 from their sample. Meaning that it would lead to additional GDP growth in Austria of accumulated 0.81% based on the values of their restricted scenario (no third runway). One of the major point of this CBD is this accessibility. This area is easily accessible by all mean of transports making companies saving time and money since customers and employees can simply walk to the airport terminals (Schiphol, 2017). Another important asset of this airport is that it is also a train station which link the airport to the mains Dutch cities such as Rotterdam or The Hague and also to important European capital such as Paris and Brussels. It is also a bus station providing bus all around Europe. Moreover, the Nederlandse Spoorwegen provides fast train connecting the airport with the business district areas of Amsterdam. These areas are also attainable by buses.

From a policymaker perspective, regional policies aimed at attracting FDIs must promote the development of transport infrastructure and especially international airports. Investments to improve air transport capacity, strategies to attract both traditional and low-cost airlines, providing legal authorization or financing ground transport are all critical aspects for the success of such policies (Bonno and Redondi, 2014). North American firms pay more attention to the proximity to the airport when it comes to foreign direct investment (FDI), Hoare (1975) showed in its research on the Heathrow airport that North American companies' investments were going to companies that are with a radius of one-hour road trip from the airport. Accordingly, the companies located at the Schiphol CBD are entering in this criteria.

Years	Total Employment Schiphol Area	Outlet Schiphol	Number of Company at airport zone
2007	62128	194	596
2008	65009	196	582
2009	59986	197	544
2010	59808	196	514
2011	61716	195	502
2012	64061	197	497
2013	64205	198	500
2014	64358	198	510
2015	64392	202	527
2016	64452	349	557
2017	65000	369	578

Table 1.4: Employment Schiphol area, Outlet Schiphol and Number of Company Schiphol Business District.

Observing the statistics related to the airport business attractiveness, it is noticeable that the area has been attracting a lot of businesses in the past years. Table 1.4 displays the relevant variables for this part: Total employment at the CBD, number of outlet at Schiphol and number of companies at CBD. The total employment and number of outlet are both increasing throughout the last ten years, especially the number of outlets inside the airport, however, the number of companies in the Schiphol business district started to rise in 2013. It makes sense to see that all numbers are increasing since the more air passengers, the more business will be attracted to respond the demand of customers and thus, more employment as Brueckner showed (2002). Also, GDP growth leads to more companies

locating in a business area. As explained earlier, GDP growth stimulates air travel and this leads to more air travel which influences companies to locate at the airport.

Another reason for this business attraction of the business district can be related to what is called “agglomeration economies”. Agglomeration economies refers to any effect that increases firms’ and workers’ income when the size of the local economy is growing (Combes & Gobillon, 2015). The source of agglomeration are technological spill overs, labour pooling and intermediate input linkages. In order to identify the sources of economies of agglomeration, localization and urbanization economies have to be distinguished. Localization economies is gained by firms in a single industry whereas urbanization refers to firms in all industries at a single location (Warffemius, 2007). For the case of Amsterdam airport, the 578 are all related to Facility services, Health, Well-being and sport, Hotel & catering, Staff services, Construction, Finance, Real estate, Aviation, Transportation & storage and more (Schiphol, 2018). Therefore, this concentration of firms enjoys agglomeration economies due to the fact that firms from similar or related industries are located at the same place and also because they are several industries at the same place. Thus, they interact with each other.

4.3- Negative impacts of Schiphol airport on the region of Amsterdam

This section will cover the three main negative impacts of Schiphol airport on the region of Amsterdam. The first one has environmental concerns which is the C02 emission of the airport from 2007 to 2016. Secondly, the effect on the housing prices of the studied region will be analysed for the period from 2007 to 2017. Finally, the effect of noise pollution on the region of Amsterdam is demonstrated.

4.3.1- C02 emission

Airport carbon accreditation is a worldwide independent and voluntary programme for airports that assesses and recognises the effort of airport in reducing and managing their CO2 emission. There are four different level of certifications: Mapping, Reduction, Optimisation and Neutrality (Airport Carbon Accreditation, 2018). Concerning Schiphol airport’s certification, it has obtained Neutrality which requires a neutralisation of remaining direct carbon emissions by offsetting (Schiphol).

Reducing the C02 emission is a primordial objective for Schiphol airports. Recently, the Netherlande Organisatie voor Toegeopast Natuurwetenschappelijk Onderzoek (TNO) claimed that the amount of particulate in the residential areas in Amsterdam and Amstelveen is two times higher than when the wind is blowing from the direction of Schiphol. Additionally, an analyses conducted by Milieudefensie demonstrated that air pollution caused by air traffic leads to an average loss of life of four months to more than a year for approximately forty-four thousand residents (NItimes, 2014).

Furthermore, Amsterdam Schiphol is a major source of complaints about aircraft noises and health effects. As explained in the previous paragraph, the concern of the surrounding populations on the exposure of aviation fuels and risk of cancer is strong. A study has been conducted on the incidence of cancer in the area around Amsterdam Airport from 1988 to 2003 (Visser, Wijnen & Leeuwen, 2005). The study has shown that among the resident of the area 13 207 cancer cases were diagnosed which was close to the national incidence rates used as reference. However, in the area near the airport, the result was higher which is mainly due to higher incidence of cancer of the respiratory system (Visser, Wijnen & Leeuwen, 2005).

Years	CO2 Emission in thousands kg	Changes in CO2
2007	720	2.86%
2008	720	0.00%
2009	660	-8.33%
2010	670	1.52%
2011	710	5.97%
2012	700	-1.41%
2013	700	0.00%
2014	710	1.43%
2015	720	1.41%
2016	760	5.56%

Table 1.5: CO2 emission and changes at Schiphol airport from 2007-2016 (Schiphol and CBS)

Table 1.5 shows the airport CO2 emission as well as the change from 2007 to 2016. Over the last ten years the emission of CO2 has increased by 5.56%. Apart from that, the consumption is stable with an average of 707 thousand kg, peaking in 2016 with 760 thousand kg and with a minimum of 660 thousand kg in 2009. As a result, it is concluded that Schiphol has not experienced an evolution in reducing its CO2 emission. This can come from the fact that, during this period of time, Schiphol had a huge increase in travellers and air traffic. As mentioned in the previous sections, the number of passenger has increased by 43.26% from 2007 until now. Since the number of passengers and air traffic has increased, Schiphol had invested a lot buses that transport passengers to and from airplanes

as well as the staff vehicles (Schiphol, 2018). About the increase in air traffic, the C02 emission increases simply due to an increase of flight taking off and landing.

Despite these negative numbers, the airport is putting a lot of effort in this reducing its emission of CO2. As was pointed out in this section, Amsterdam airport is investing a part of its revenue in the environmental programmes of the Airport Carbon Accreditation. Since the airport has a Neutrality accreditation, it must evaluate all its emissions, draw up effective reduction programmes, implement them and compensate for any remaining emissions. The airport has also invested in electric transports to commute passengers and employees (Gowling, 2014).

4.3.2- Housing prices

The literatures related to the impact of airports and the housing price are ambiguous that is, they have often different findings. On one hand, there are articles demonstrating that housing prices are negatively linked with airport due to externalities such as pollution or noises. On the other hand, there are articles about a positive relationship between these two.

Concerning the negative relationships, it has been demonstrated that the impact of aircraft noises on housing has a negative effect on housing prices for the ones near the airport. A study has been conducted taking a sample of houses and apartments from several countries in the world. The authors found that the house prices were lower when properties were close to the airport (Trojanek, Tanas, Raslanas & Banaitis, 2017). Nevertheless, they demonstrated that apartment buyers are less sensitive to these externalities compared with buyers of single family houses. Their statistic research showed that the depreciation index value for single family houses is about 0.87% whereas for an apartment, it is at 0.57% (Trojanek, Tanas, Raslanas & Banaitis, 2017). Furthermore, Jud and Winkler (2006) demonstrated the influence of announcing a new airport in North Carolina. This has a negative impact on the property values. The values decrease by 9.2% for the properties within a radius of 4 km and a decline of 5.7% for the properties within 6.5 km (1.5 km more).

About the positive relationships, the researches demonstrates that airport development leads to an increase of prices in the airport region. Tsui, Tan and Shi (2016) conducted a research in New Zealand, explaining that the air traffic volumes are positively influencing the urban housing prices of the region. This has also been supported by McMillen (2004) for the case of Chicago O'Hare airport. In this paper, the author is showing the effect of the construction of a new runway at O'Hare airport.

He concluded that the construction of a new runway will increase the air traffic and thus, will lead to an increase of housing prices for about 284.6 million dollars in the densely populated areas.

According to the literature, the effect of an airport on the housing price is ambiguous. As shown in the previous paragraph, some research showed that the prices are decreases and some are increases. In the case of Amsterdam region, table 1.6 is showing the Amsterdam region housing price index with 2010 as year of reference along with the percentage change per year. The price index of the Amsterdam region is similar to the one of the Netherlands, in other words, it is represented by a strong drop from 2007. The drop recovery is only occurring on the last quarter of 2013 (Tu, de Haan & Boelhouwer, 2018). The table shows that the housing price are strongly increasing from 2015. Therefore, according to the table, the arguments of previous researches suggesting that the housing prices decreases in the surroundings due to externalities do not seem to be applicable to the region of Amsterdam. However, the arguments suggesting that air traffic increases the housing price of the region would be coherent since it leads to larger concentration of people and then, a higher demand for housing.

Year	Housing price index Amsterdam Region (2010=100)	Percentage change housing price Index
2007	98.6	11.1
2008	106.6	8.1
2009	100.4	-5.8
2010	100	-0.4
2011	99.7	-0.3
2012	94	-5.7
2013	89.1	-5.3
2014	93.7	5.1
2015	102.8	9.7
2016	116.7	13.5
2017	133.1	14

Table 1.6: Price index and % change of housing price in Amsterdam region from 2007 to 2017 (CBS StatLine)

Table 1.6 is displaying the housing price index of Amsterdam region that it includes the properties from neighbourhoods located far away from the airport. It would be interesting to observe

the price variation of neighbourhood closer to Schiphol. Haarlemmermeer is the municipality that where Schiphol is located. In addition, Amstelveen is a city located at 7 kilometres away from the airport. Table 2 (appendix A) displays the average of purchase prices in Amstelveen and Haarlemmermeer. On one hand, Haarlemmermeer's average prices had fluctuated over the past 10 year but it has faced an increase in prices in 2017 with +12.23%. On the other hand, Amstelveen average purchase house prices have increased by +31.94% the last ten years. On account of these numbers, the idea of decreasing housing prices due to externalities is not application for the case of Amsterdam Airport. However, it is noticeable that the further away the house is from the airport, the higher the price. This indicates that the proximity to the airport affects housing price growth: the closer to the airport the lower the growth rate. It could also lead to decreasing housing prices in Haarlemmermeer's neighbourhoods that are the closest to the runways, but detailed data on housing prices were not available to test this.

4.3.3- Noise pollution

Concerning the civil aviation, one of the most important negative impact is the noise. Airplanes landings and taking-offs are causing noise pollution to workers and people living in the surroundings. Region benefits from having an airport but the ones living close to it suffer of noises (Gordijn & Hornis, 2007). Amsterdam airport has six runways with five of them used for all traffic except the ones for small planes. The Schiphol runway system was built decades ago since the Dutch weather is dominated by strong winds from Southwest to Northwest (Buurma & de Groot, 2013). This system is composed of five runways that are used for all the traffic except small planes. Along these five runways, two are located in an area that is less populated and therefore is respecting the Dutch noise reduction. These two runways are called "primary runways". However, the three others are called "secondary runways" because they are located in densely populated areas.

As explained in the previous section "housing prices", noise pollution is seen as a negative externality. Accordingly, it has an impact on the surroundings. People living in the surrounding of Schiphol airport can submit complains about the noise caused by planes on the internet, phone or letter to a Registration Office (BAS) that was created by the Dutch air Traffic Control and Schiphol (Buurma & de Groo, 2013). In 2016, Schiphol airport has received 217 000 noise complaints and approximatively three-quarter of them are related to night and early-morning flights. The number of complaints has increased by 8.5% compared to 2015 (NLtime, 2017).

Previous researches about noise pollutions were conducted mainly on the property value. A research made by Espey and Lopez (2000) investigated the relationship between property value and airport noise and proximity to airport in the Reno-Spark area in West Nevada. The result they found suggested that there is statistically negative relationship between airport noise and property values. They found that the average home in the area where noise levels are 65 decibels or high selling for about 2400 dollars less than a property in a quiet area. Another research made on Dar es Salaam International airport in Tanzania by Mato and Mufuruki (1999) found that noise pollution has negative effects on both workers and surrounding residents and their properties. The result shows that the high noise levels come from the landings and take-offs of planes and that workers are exposed to noise levels that can affect their health. However, for the case of Amsterdam airport, it is apparently not the case. In the previous section, the averages prices of Amstelveen and Haarlemmermeer are displayed and both increasing the past ten years. This suggests that the externalities leading to decrease in housing prices, which includes noise pollutions, might be not applicable for Schiphol surroundings.

5- Conclusion

This article has examined the economic impact of Schiphol airport on the region of Amsterdam. These impacts on the region have been separated in two that is, positive and negative. To answer the research question, "*to what extent does Schiphol Airport affect the economy of the Amsterdam region?"*, it has been illustrated that the airport has a direct impact on employment at the airport itself. The data collected for the past ten years are showing that the number of employee at the airport area is increasing. Indeed, the air traffic to Schiphol have strongly increases during the studied period leading to more job creations at the airport area. Schiphol airport is also likely to affect positively the region of Amsterdam indirectly though tourism. This paper demonstrated that tourism is beneficial for the economy through the creation of new hotels, restaurants or outlets. This effect is positive at the airport which has built more than 150 outlets and for the city of Amsterdam where a lot of Hotels, restaurants or other service related to tourism have been constructed the past ten years. All these creations led to also more employment. Accordingly, it has been concluded that tourism is likely to have an indirect positive impact on the region of Amsterdam. The last positive impact of Schiphol on the Amsterdam region explained in this paper is its business attractiveness. The number of companies at airport zone as well as the outlet have increased the past 5 years. Since the air traffic had increases, the more businesses are attracted by the area and thus, more employments. Moreover,

the companies located at the CBD can enjoy agglomeration economies by being all located at the same place.

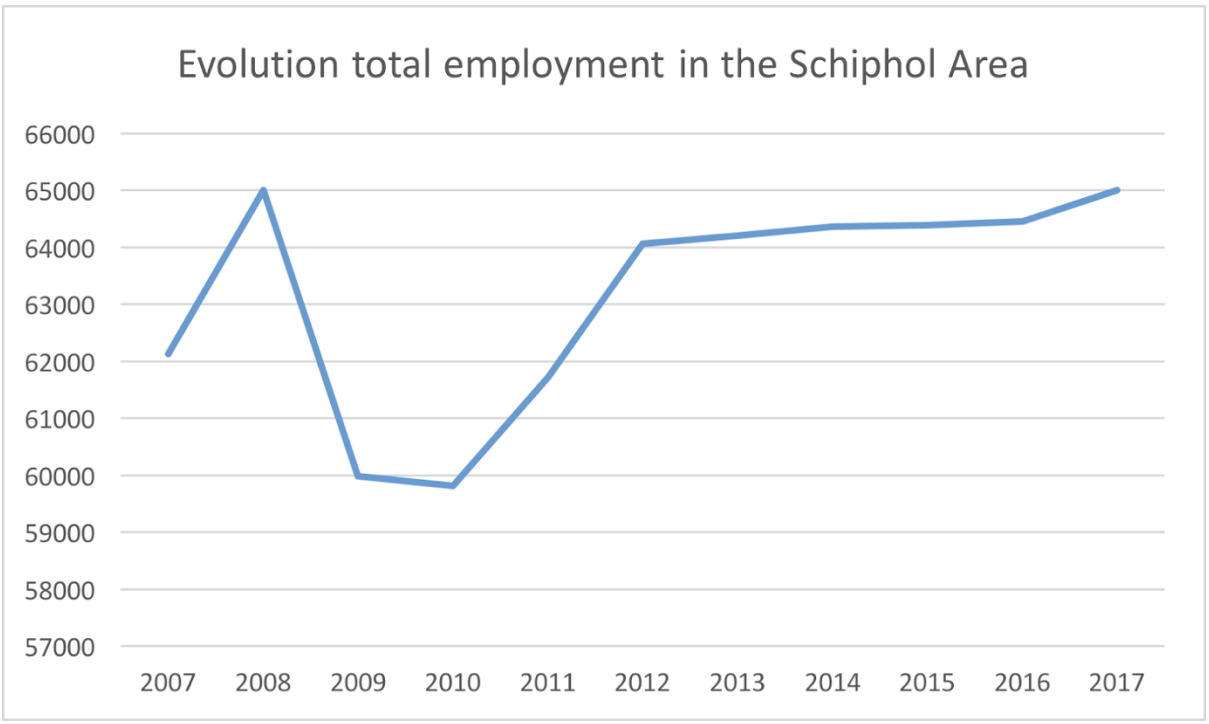
Previous researches have not been analysing the fact that airport could have a negative impact on its region. This paper is suggesting and analysing the effect of three possible negative impacts. The first negative effect is the CO2 emission. The data shows that the airport CO2 emission has been increasing the past ten years. The literature review suggests that the C02 emission is negatively impacting the population in term of health and increases the value of the property near the airports. This is also the case for another negative impact that was developed, noise pollution. The literature also suggests that noise pollution is negatively impacting population's health and property value. However, the decrease of property values in the surrounding of Schiphol airport is apparently not the case. The effect is the contrary, this research has shown that the property values in the region of Amsterdam as well as in two municipalities located relatively close to the airport face an increase of housing prices. Since the city is attracting more and more people, the housing prices are growing fast and it is becoming more expensive to live in this region. To summarise this part, it is likely that Schiphol airport affects the Amsterdam region either by rising the housing prices and with its externalities such as CO2 emission and noise pollution.

6- Limitation

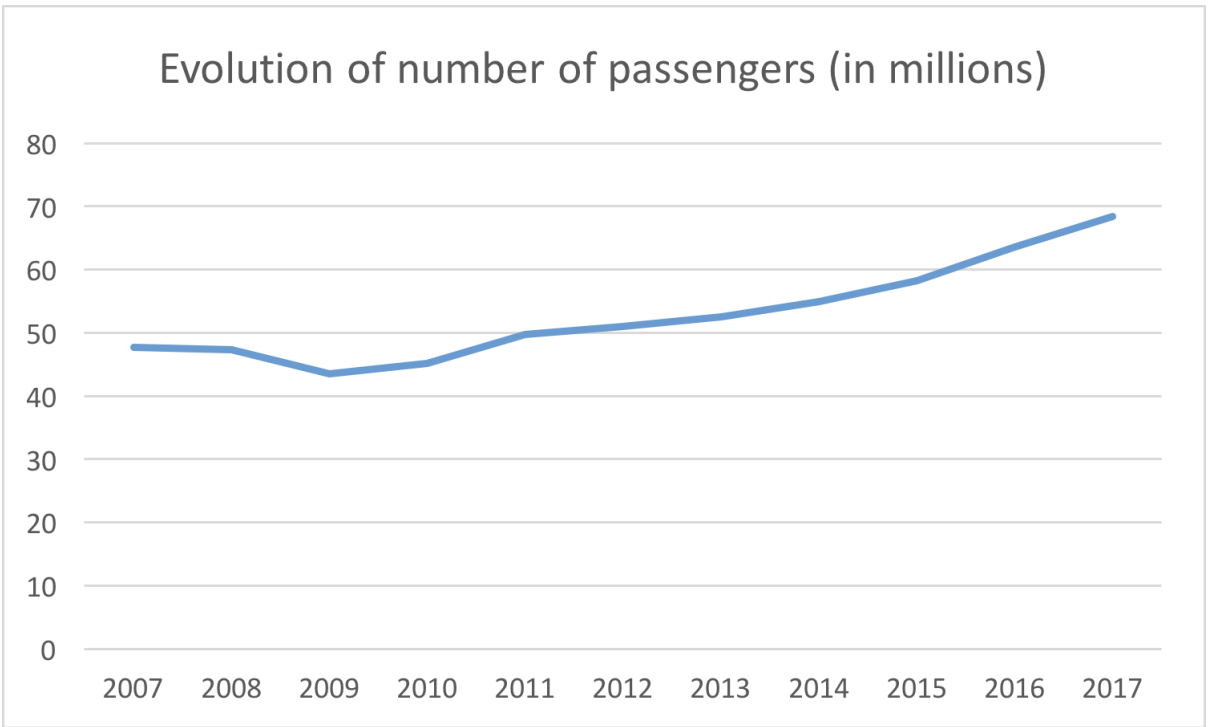
Aircraft are often charged for noise nuisance to support the sustainable development of the air industry. The thesis, in the negative impact section, does not engage with aircraft noise cost and charge mechanism. It would be interesting to investigate or evaluate the social costs of such externalities. This is usually done by estimating the social cost by observing the decrease in property values of houses around the airports (Morrell & Lu, 2000). However, as demonstrated in part 4.3.2, the housing pricing of Haarlemmermeer and Amstelveen do not have drop in housing prices. Accordingly, it would be interesting for future research to investigate more neighbourhoods around the airport. Also, the paper investigates the effect of Schiphol on the housing prices, however, the housing prices are also linked to economic development which might have a stronger influence that the effect of Schiphol. Moreover, the economic impact of Schiphol has a broader impact. This study has been conducted on the Region of Amsterdam but, in reality, Schiphol is the national airport. It is highly connected by road or trains with Utrecht, The Hague and Rotterdam. Consequently, future researches should consider the fact that the airport economic activity is wider and should broaden the radius of the region including the three agglomerations mentioned previously. It would be

interested for future studies to run a regression. This research had too few observations to reach data saturation for statistical analysis. Finally, future researches need to pay attention to reverse causality, for instance in this paper, GDP growth leads to more travel, but also more travel can lead to a higher GDP.

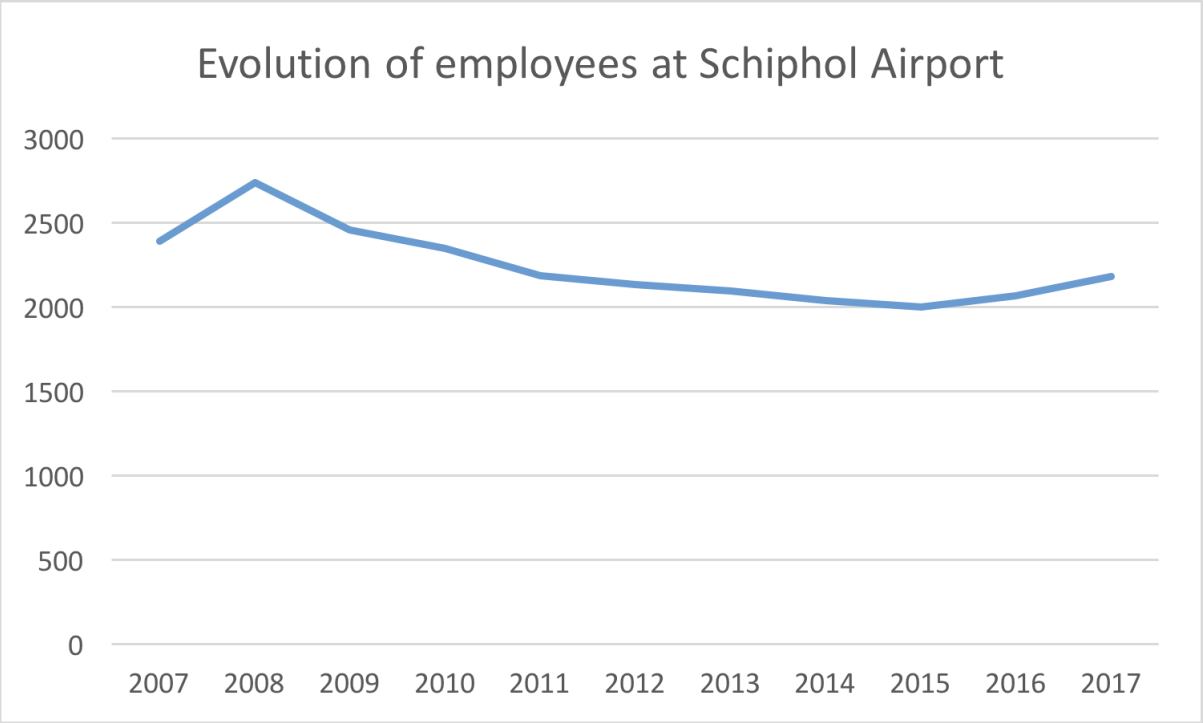
Appendix A:



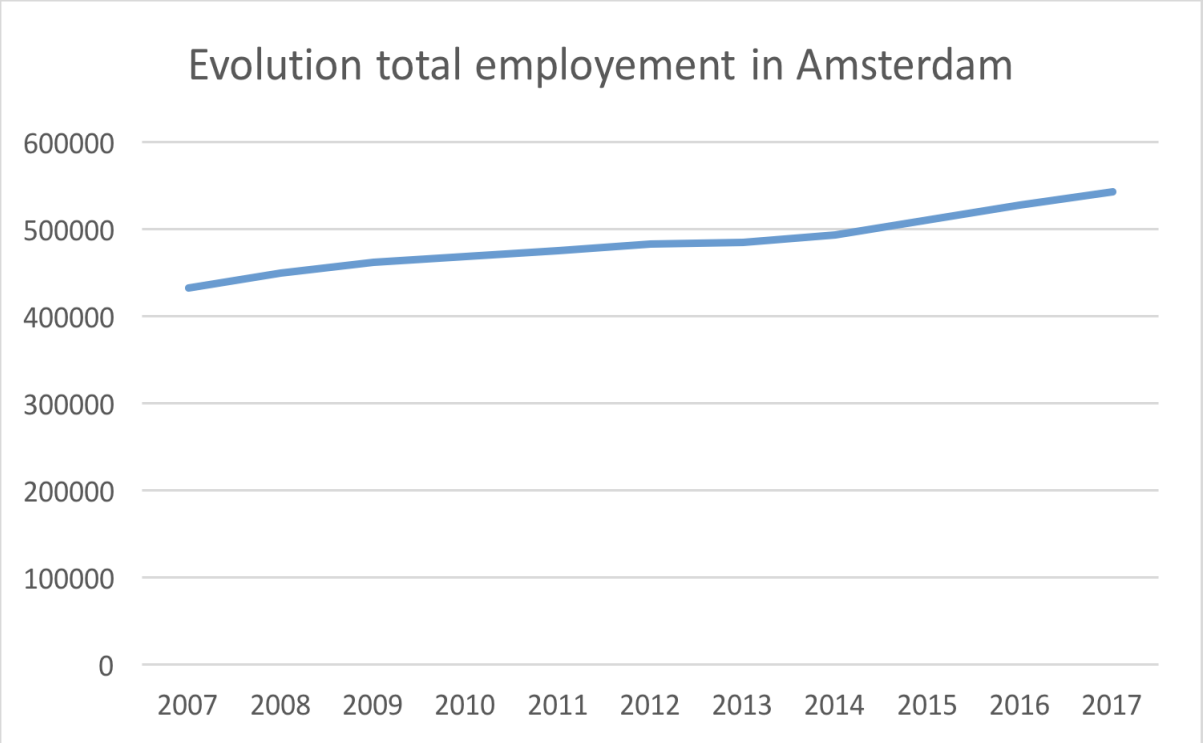
Graph 1: Evolution of the total employment in the Schiphol Area



Graph 2: Evolution of number of passengers (in millions)



Graph 3: Evolution of employees at Schiphol airport



Graph 4: Evolution total employment in Amsterdam

Years	Percentage change employment Schiphol	Percentage change in passenger	Percentage employed by Schiphol airport	Percentage employed Schiphol area with Amsterdam
2007	6.40%	3.82%	3.85%	14.37%
2008	4.64%	-0.74%	4.21%	14.47%
2009	-7.73%	-8.16%	4.10%	13.01%
2010	-0.30%	3.71%	3.92%	12.76%
2011	3.19%	10.07%	3.54%	12.99%
2012	3.80%	2.61%	3.33%	13.27%
2013	0.22%	3.04%	3.26%	13.25%
2014	0.24%	4.59%	3.17%	13.04%
2015	0.05%	6.02%	3.11%	12.63%
2016	0.09%	9.07%	3.20%	12.23%
2017	0.85%	7.67%	3.35%	11.98%

Table 1: Percentage changes of employment at Schiphol, change in passengers, Schiphol employees and employee in Schiphol area.

Years	Haarlemmermeer – Average purchase prices	Amstelveen - Average purchase prices	Percentage Change Haarlemmermeer	Percentage Change Amstelveen
2007	289 091	318682	11.29%	7.78%
2008	295 233	337305	2.12%	5.84%
2009	274 434	308892	-7.04%	-8.42%
2010	270 473	312791	-1.44%	1.26%
2011	259 999	318466	-3.87%	1.81%
2012	250 768	306621	-3.55%	-3.72%
2013	240 351	280407	-4.15%	-8.55%
2014	239 844	305619	-0.21%	8.99%
2015	252 111	331763	5.11%	8.55%
2016	276 861	363088	9.82%	9.44%
2017	310 708	420478	12.23%	15.81%

Table 2: Average purchase price in Amstelveen and Haarlemmermeer and percentage changes.

Reference

Amsterdam, G. (2018). Property Value - Sale price per m2. Retrieved from https://maps.amsterdam.nl/woningwaarde/?LANG=en

Annual accounts. (n.d.). Retrieved from https://www.heathrow.com/company/investor-centre/document-centre/annual-accounts

Bannò, M., & Redondi, R. (2014). Air connectivity and foreign direct investments: economiceffects of the introduction of new routes. *European Transport Research Review*, *6*(4), 355-363.

Berk, J. B., & DeMarzo, P. M. (2014). *Corporate finance*. Boston: Pearson.

Benell, D. W., & Prentice, B. E. (1993). A regression model for predicting the economic impacts of Canadian airports. *Logistics and transportation review*, *29*(2), 139.

BIRD, J. (1983). Gateways: Slow recognition but irresistible rise. Tijdschriyt voor Economische en Sociale Geografie 74, pp. 196-202.

Brueckner, J. K. (2003). Airline traffic and urban economic development. *Urban Studies*, *40*(8), 1455-1469.

Buurma, H., & De Groot, J. (2013). Noise reduction at Schiphol. *Www.aviationandclimate.com*. Retrieved from http://hacan.org.uk/blog/wp-content/uploads/2015/04/Noise-reduction-Schiphol-.pdf

Business areas. (2017). Retrieved from https://www.schiphol.nl/en/schiphol-group/page/business-areas/

Business locations and areas | I amsterdam. (n.d.). Retrieved from https://www.iamsterdam.com/en/business/setting-up/business-locations

CBS StatLine - Emissions of greenhouse gases according to IPCC guide-lines. (n.d.). Retrieved from http://statline.cbs.nl/Statweb/publication/?DM=SLEN&PA=70946ENG&D1=0&D2=20&D3=9-18&LA=EN&VW=T

CBS StatLine - Existing own homes; average purchase prices, region. (n.d.). Retrieved from http://statline.cbs.nl/Statweb/publication/?DM=SLEN&PA=83625ENG&D1=0&D2=41&D3=12-22&LA=EN&VW=T

CBS StatLine - House Price Index by region; existing own homes; 2010 = 100 1995-2017. (n.d.). Retrieved from http://statline.cbs.nl/Statweb/publication/?DM=SLEN&PA=81885ENG&D1=0,2&D2=17&D3=64,69,74,79,84,89,94,99,104,109,l&LA=EN&HDR=T,G1&STB=G2&VW=T

Chow, W. (2015). Airports and Economic Growth.

Combes, P. P., & Gobillon, L. (2015). The empirics of agglomeration economies. In *Handbook of regional and urban economics* (Vol. 5, pp. 247-348). Elsevier.

Country Reports. (2017). Retrieved from https://www.wttc.org/economic-impact/country-analysis/country-reports/

Cristureanu, C., & Bobircă, A. (2007). Airports driving economic and tourism development. The Romanian Economic Journal, Year X, (25), 31-44.

Doing business at Amsterdam Airport Schiphol. (2017). Retrieved from https://www.schiphol.nl/en/route-development/airport-facts/intercontinental-destinations/

Domestic product - Gross domestic product (GDP) - OECD Data. (n.d.). Retrieved from https://data.oecd.org/gdp/gross-domestic-product-gdp.htm

Espey, M., & Lopez, H. (2000). The impact of airport noise and proximity on residential property values. Growth and Change, 31(3), 408-419.

Feitelson, E. I., Hurd, R. E., & Mudge, R. R. (1996). The impact of airport noise on willingness to pay for residences. Transportation Research Part D: Transport and Environment, 1(1), 1-14.

Financial Information. (n.d.). Retrieved from http://www.parisaeroport.fr/en/group/finance/investor-relations/financial-information/annual-reports

Gemeente Amsterdam. (2018, May 28). Home. Retrieved from https://www.amsterdam.nl/

Gordijn, H., & Hornis, W. (2007, November). Noise around airports. In GARS-Workshop on Aviation and the Environment (Nov. 28–29, 2007, Cologne) (pp. 1-14).

Gowling, A. (2014). Huge increase in travellers through Dutch airports. Retrieved from https://www.iamexpat.nl/expat-info/dutch-expat-news/huge-increase-travellers-through-dutch-airports

Green, M. (2014). The impact of airport development on economic development.

Hakfoort, J., Poot, T., & Rietveld, P. (2001). The regional economic impact of an airport: The case of Amsterdam Schiphol Airport. Regional Studies, 35(7), 595-604.

Hoare, A. G. (1975). Foreign firms and air transport: the geographical effect of Heathrow Airport. *Regional Studies*, *9*(4), 349-367.

Insider, A. M. (2017, September 26). The 30 most visited cities around the world in 2017. Retrieved from https://www.independent.co.uk/travel/thirty-most-visited-cities-world-a7967901.html

Jud, G. D., & Winkler, D. T. (2006). The announcement effect of an airport expansion on housing prices. *The Journal of Real Estate Finance and Economics*, *33*(2), 91-103.

Kramer, J. H. T. (1988). The airport of Schiphol: economic and spatial impact. Tijdschrift voor economische en sociale geografie, 79(4), 297-303.

Mato, R. R., & Mufuruki, T. S. (1999). Noise pollution associated with the operation of the Dar es Salaam International Airport. *Transportation Research Part D: Transport and Environment*, *4*(2), 81-89.

McMillen, D. P. (2004). Airport expansions and property values: the case of Chicago O'Hare Airport. *Journal of urban economics*, *55*(3), 627-640.

Morrell, P., & Lu, C. H. Y. (2000). Aircraft noise social cost and charge mechanisms–a case study of Amsterdam Airport Schiphol. *Transportation Research Part D: Transport and Environment*, *5*(4), 305-320.

Morris, H. (2017, February 17). Three of Europe's fastest growing airports are all in the same country. Retrieved from https://www.telegraph.co.uk/travel/news/fastest-growing-european-airports-passenger-numbers-two-billion/

Neal, Z. (2012). Creative employment and jet set cities: disentangling causal effects. *Urban Studies*, *49*(12), 2693-2709.

Netherlands, S. (2016, July 13). Statistics Netherlands. Retrieved from https://www.cbs.nl/en-gb

Onze ambitie is een CO2 neutrale luchthaven. (n.d.). Retrieved from https://www.schiphol.nl/en/schiphol-group/page/a-co2-neutral-airport/

Pieters, J. (2018, May 15). Residents around Dutch airports start new interest group. Retrieved from https://nltimes.nl/2018/05/15/residents-around-dutch-airports-start-new-interest-group

Practical info about shopping. (n.d.). Retrieved from https://www.schiphol.nl/en/what-to-do-at-schiphol/practical-info-shopping/

Rebelo, I. (2018). About. Retrieved from http://www.airportcarbonaccreditation.org/about.html

Ribeiro de Almeida, C. (2011). Low cost airlines, airports and tourism. The case of Faro airport. In *2011 European Regional Science Association Congress, Barcelona*.

Samsung Establishes New European Sales Office for Air Conditioner in Amsterdam. (2016). Retrieved from https://news.samsung.com/global/samsung-establishes-new-european-sales-office-for-air-conditioner-in-amsterdam

Saxon, I. (2017). The Importance of Air Transport To The Netherlands(pp. 1-4, Rep.). Oxford Economics.

Schiphol Group (Ed.). (2012, February 12). AirportCity concept. Retrieved from https://web.archive.org/web/20110912012055/http://www.schiphol.nl/SchipholGroup/Company1/Strategy/AirportCityConcept.htm

Sellner, R., & Nagl, P. (2010). Air accessibility and growth–The economic effects of a capacity expansion at Vienna International Airport. *Journal of Air Transport Management*, *16*(6), 325-329.

Sinclair, M. T. (1998). Tourism and economic development: A survey. *Journal of Development Studies,34*(5), 1-51. doi:10.1080/00220389808422535

Site internet de la Bibliothèque nationale de France. (n.d.). Retrieved from http://www.bnf.fr/fr/acc/x.accueil.html

Some 158,000 Schiphol noise complaints received from 35 people. (2017, March 06). Retrieved from https://nltimes.nl/2017/03/06/158000-schiphol-noise-complaints-received-35-people

Strauss-Kahn, V., & Vives, X. (2009). Why and where do headquarters move?. *Regional Science and Urban Economics*, *39*(2), 168-186.

Team, T. (2016, August 30). What Are The Factors Behind Soaring Air Travel Growth? Retrieved from https://www.forbes.com/sites/greatspeculations/2016/08/30/what-are-the-factors-behind-soaring-air-travel-growth/#3b7b0a86258d

Trojanek, R., Tanas, J., Raslanas, S., & Banaitis, A. (2017). The impact of aircraft noise on housing prices in Poznan. *Sustainability*, *9*(11), 2088.

Tsui, W. H. K., Tan, D. T. W., & Shi, S. (2017). Impacts of airport traffic volumes on house prices of New Zealand's major regions: A panel data approach. *Urban Studies*, *54*(12), 2800-2817.

Tu, Q., de Haan, J., & Boelhouwer, P. (2018). House prices and long-term equilibrium in the regulated market of the Netherlands. *Housing Studies*, *33*(3), 408-432.

UNCTAD | Foreign Direct Investment (FDI). (n.d.). Retrieved from http://unctad.org/en/Pages/DIAE/Foreign-Direct-Investment-(FDI).aspx

Visser, O., Van Wijnen, J. H., & Van Leeuwen, F. E. (2005). Incidence of cancer in the area around Amsterdam Airport Schiphol in 1988–2003: a population-based ecological study. *BMC Public Health*, *5*(1), 127.

Warffemius, P.M.J. (2007, September 27). Modeling the Clustering of Distribution Centers around Amsterdam Airport Schiphol: location endowments, economies of agglomeration, locked-in logistics and policy implications. Trail Research School, Delft. Retrieved from http://hdl.handle.net/1765/10531

Yao, S., & Yang, X. (2008). Airport development and regional economic growth in China