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Factors influencing European passenger demand for air transport

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Passenger air travel demand is influenced by various factors and is crucial to manufacturers, airlines, airports and wider industry. In order to gain detailed insights into drivers of European air transport demand, five factors are analysed, both quantitatively and qualitatively. Focusing on the European air transport market, a detailed description of factors influencing air transport demand serves as input for a statistical analysis. Data from European countries on the gross domestic product per capita (GDP), urbanisation levels, the geographical location of a country, and the degree of education is used for the model. These explanatory variables are tested using a regression analysis in regard to their influence on the passengers' demand for air transport. Results from the regression analysis reveal that the factors GDP, the geographical location of a country and the level of education are statistically significant, confirming GDP as a demand driver already examined within various studies that also include other factors as explanatory variables. Results also indicate the dynamics between the different factors, such as the positive relationship between income and level of education. Present studies are a good basis to show what drives demand, often focused at a global or country level. This analysis also confirms the essential determinants at a European level.

Keywords: passenger air transport demand, demand drivers, air transport demand model

I. Introduction

Passenger travel behaviour, preferences regarding holiday destinations, travel budget and experiences sought, are influenced by various factors such as gender, country of origin, age, educational level or usage of information and communication technologies (ICT). There are also interdependencies between these factors. For example, the usage of ICT during a journey may be interlinked with a person's age. In particular, passenger air transport demand is of great interest to aircraft manufacturers, airlines, airports, and other institutions interested in aviation-related topics. Carriers, for instance, use passenger demand forecasts to gain a better understanding of potential travel behaviour and expected passenger numbers. These predictions are critical for pricing strategies, fleet utilisation, aircraft orders and hence for an airline's corporate success (BCG, 2006; Grosche et al., 2007; Lyneis, 2010). Airports need reliable demand models as the design of their infrastructure (e.g. parking, terminal buildings, ground service, and airside infrastructure) is adjusted to predicted future demand (Bießlich et al., 2014; Postorino, 2010). In order to gain a better understanding of today's passengers' behaviour, their

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demand for air transport and resulting expectations of the European transport system, a range of factors is analysed, both quantitatively and qualitatively.

The question, which factors influence passenger air transport demand, particularly within Europe, is already being explored within many studies at global, regional and national levels. Within market forecasts, manufacturers analyse drivers of travel demand, both at global and regional levels. Boeing (2016) takes into account different factors including (1) economic drivers (gross domestic product (GDP), income, labour market, trade), (2) ease of travelling (market regulations, emerging business models of airlines such as low cost carriers (LCCs), changing structural travel impediments like visa restrictions), and (3) local market conditions (domestic market growth of airlines). However, little is published on the underlying forecasting methodology. Airbus identifies GDP and market maturity (developing vs. advanced economies) as two determinants but does not provide further insight into its applied methodology (Airbus, 2016). Other organisations within the aviation industry are interested in passenger demand as well. InterVistas (2007), for example, analyses in what way income and changes in airfares affect the demand elasticity of passengers travelling by air, for Europe and other markets. Results reveal that an increase in income will increase air transport demand and an increase in airfare will lead to a decrease in air transport demand. However, the intensity of the demand elasticity also depends on the journey's context, such as the region (e.g. Europe vs. Asia) or flight duration (short vs. long haul). Outcomes also indicate that an increase in the overall population will lead to an increase in air travel as the market of potential customers grows (InterVistas Consulting⁵, 2007).

Chèze, Chevallier, and Gastineau (2011) analyse air transport demand using dynamic panel-data models for eight different regions, both historically and with a future focus on 2025. Identified main drivers of air traffic demand are external shocks, jet-fuel price (taken as proxy for airfare) and GDP, the latter two being already confirmed by the previous studies. The paper also distinguishes between short- and long-haul traffic as well as regions, inter alia, Europe. Looking at different market maturities, the authors conclude by stressing out the importance of taking the regional heterogeneity (e.g. Asia vs. Europe) into account when modelling air transport demand. Within the scope of this paper air travel within Europe and those factors influencing it will be considered.

GDP, airfare, and income are also confirmed as drivers for demand at regional levels. For instance, GDP is explored by Kopsch (2012) using a time series model on Swedish air travel data. Using econometric models, income and airfare are two key drivers affecting air transport demand in the United Kingdom (UK), explored by the Department of Transport (2013). Analysing UK travel data as well and distinguishing between leisure and business travel, Dargay and Hanly (2001) confirmed within their study the demand drivers airfare, exchange rates, relative prices, income and, for business air travel only, economic trade. Within a research project on planning the development of a regional airport in Italy, Andreoni and Postorino (2006) explore income by using a multivariate model and comparing outcomes with historical passenger numbers. This study also confirms that income is statistically significant at a regional level.

As stated above, single events can have an impact on passengers' travel behaviour such as external shocks, which ultimately affect air transport demand (Chèze et al., 2011). For instance, the terrorist attacks on September 11th 2001 influenced passengers' travel behaviour transitory and led to a drop in air travel demand, both in European countries and in the USA (Inglada & Rey, 2004; Lai & Lu, 2005; Kopsch, 2012). Moreover, demand drivers may also differ depending on the main travel purpose. Business travellers have a lower sensitivity to an increase in airfares than leisure travellers do, which was explored for Sweden and for the UK (Dargay & Hanly, 2001; Kopsch, 2012). One reason for that might be the high value of access time, often in line with higher airfares (Hess & Polak, 2005). Other identified possible drivers of air travel demand are the emergence of low cost carriers (LCCs), such as in Spain (Martínez-García et al., 2012), changes in fare of alternative transport modes (Kopsch, 2012), a new infrastructure for alternative transport modes, such as rail and road (Kopsch, 2012), and - according to data retrieved from interviews with aviation experts - demographics (Young, Pilon & Brom, 2009). For instance, 'baby boomers' in Europe possess a high level of disposable income and more spare time for travelling.

Present studies mostly focusing at a global level or on one specific country, such as on the UK, Sweden or Italy, and the factors analysed so far offer a good basis for this paper. This study⁶ assesses different factors influencing air transport demand at a European level (taking the EU28 and EFTA countries as examples), examines the interdependencies between them and provides indications of today's passengers' expectations regarding the European transport system and hence a better understanding of passenger behaviour. In doing so, the analysis also confirms the essential determinants at a European level.

⁵ Report prepared for IATA

⁶ This study was conducted as part of the work package on passenger demand profiles within the 'DATASET2050' project. For more information please refer to <http://www.dataset2050.com>.

Firstly, the paper elaborates the general characteristics of the European air transport market (Section II), followed by a discussion on factors driving passenger demand for air transport (Section III). These drivers are considered within an empirical analysis testing the variables influencing air traffic demand (Section IV). Results will be presented and discussed (Section V).

II. The European air transport market

The European transport market is composed of different modes including rail, road, sea, or air, which enable a high level of connectivity within and between various countries. In this paper, special emphasis is placed on the mobility behaviour of European air passengers. Within this section, the structure and flows of the European air transport market are outlined and described for different European countries.

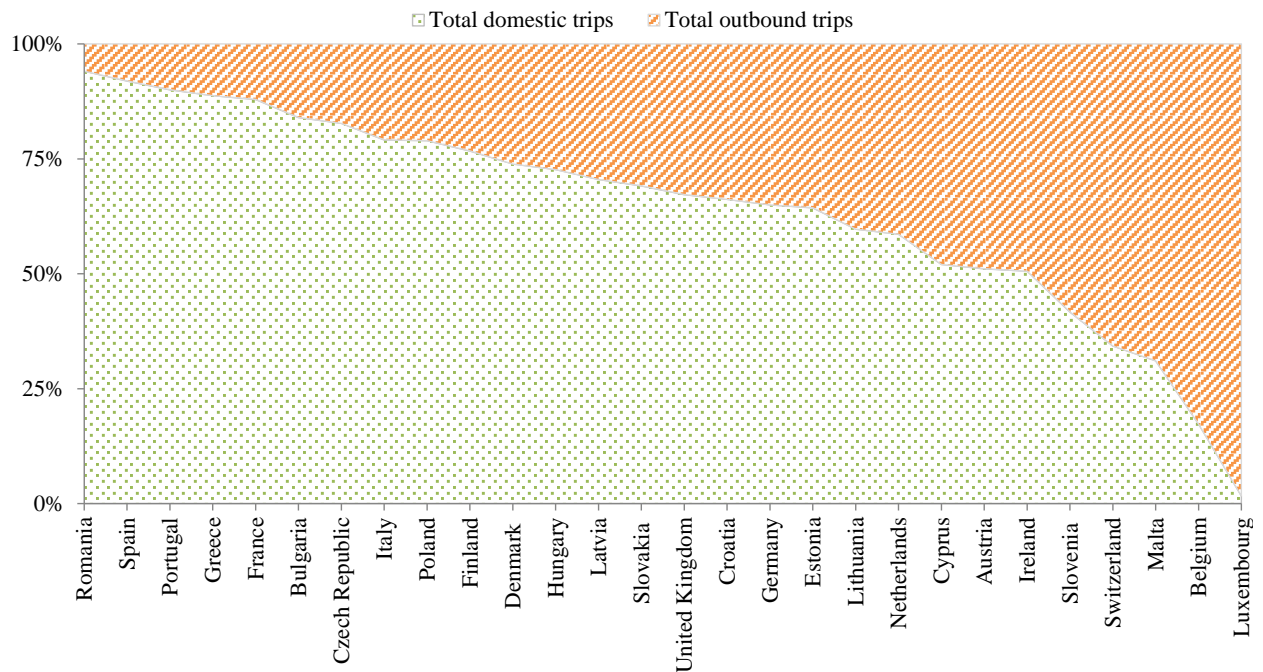


Figure 1: Distribution of domestic and outbound trips (Eurostat, 2014a)

Figure 1 shows the inbound and outbound trips for the EU28 and EFTA countries. These include all transport modes, which include at least one night overstay at the destination. Those countries with a very high share of outbound trips – Luxembourg, Belgium, Malta, Switzerland, or Slovenia – are very small in terms of geographical size, or an island state like Malta. However, these two aspects do not constitute a general rule considering the share of outbound and inbound traffic flows. Other factors such as income level or degree of urbanisation also influence the type of trips taken.

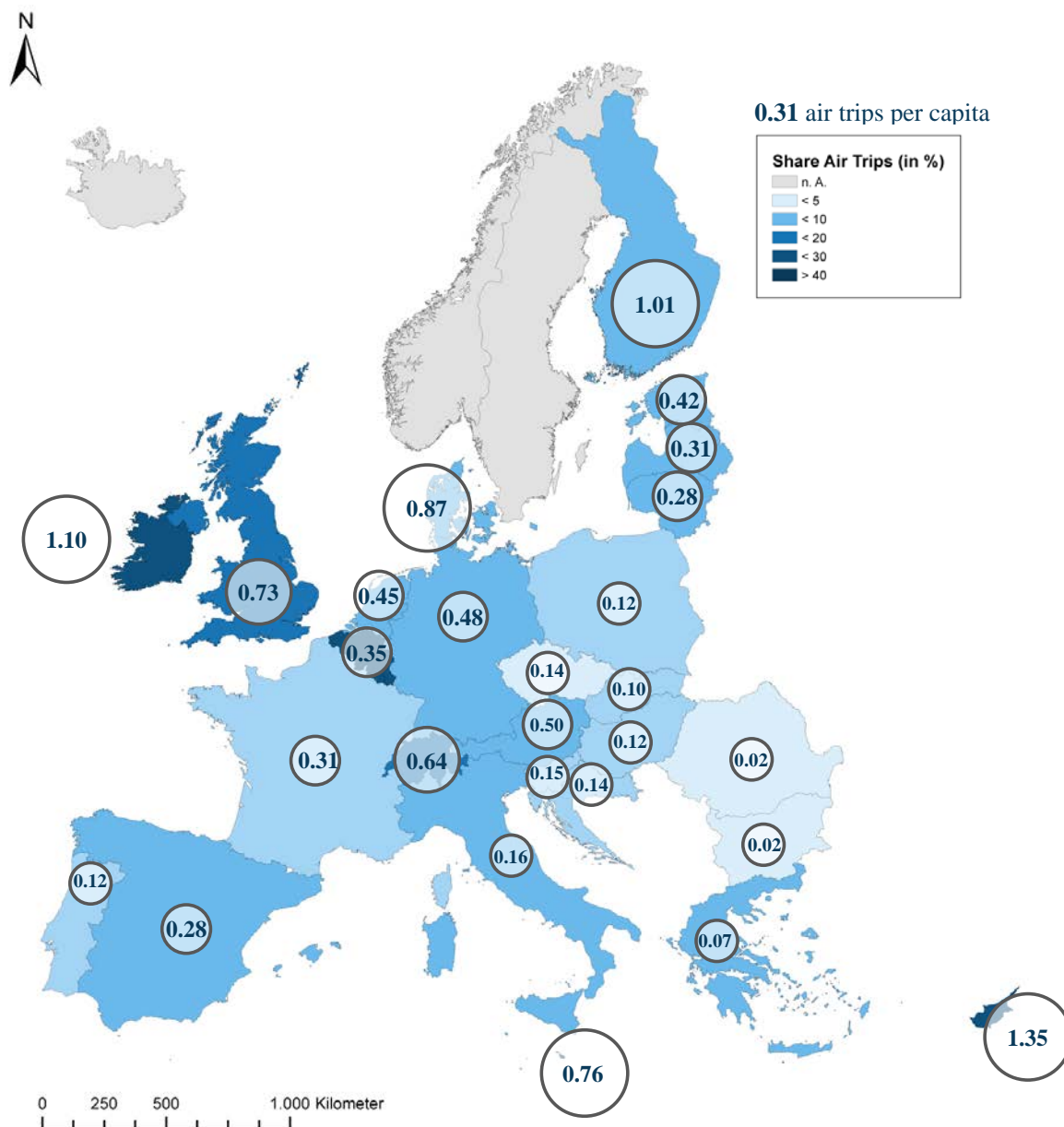


Figure 2: Prevalence of air travel in different European countries (Eurostat, 2014a)

A first overview of the prevalence of air traffic by country is given in Figure 2. Malta, with more than 60 per cent of traffic being air transport, and both Cyprus and Ireland with more than 40 per cent, have the highest share of air trips in total trips taken in 2014, closely followed by the UK with a share of about 30 per cent. One of the main reasons for this might be the countries' geographical size and island nature. All three countries have a high share of overall outbound traffic, as depicted in Figure 1, since air travel is usually the most feasible option to access other European countries. Romania, Bulgaria and the Czech Republic have the lowest share of air trips in total transport trips compared to the other European countries. Portugal, France, Poland, Slovakia, Slovenia, Hungary and Croatia all have a share of less than 10 per cent (see Figure 1).

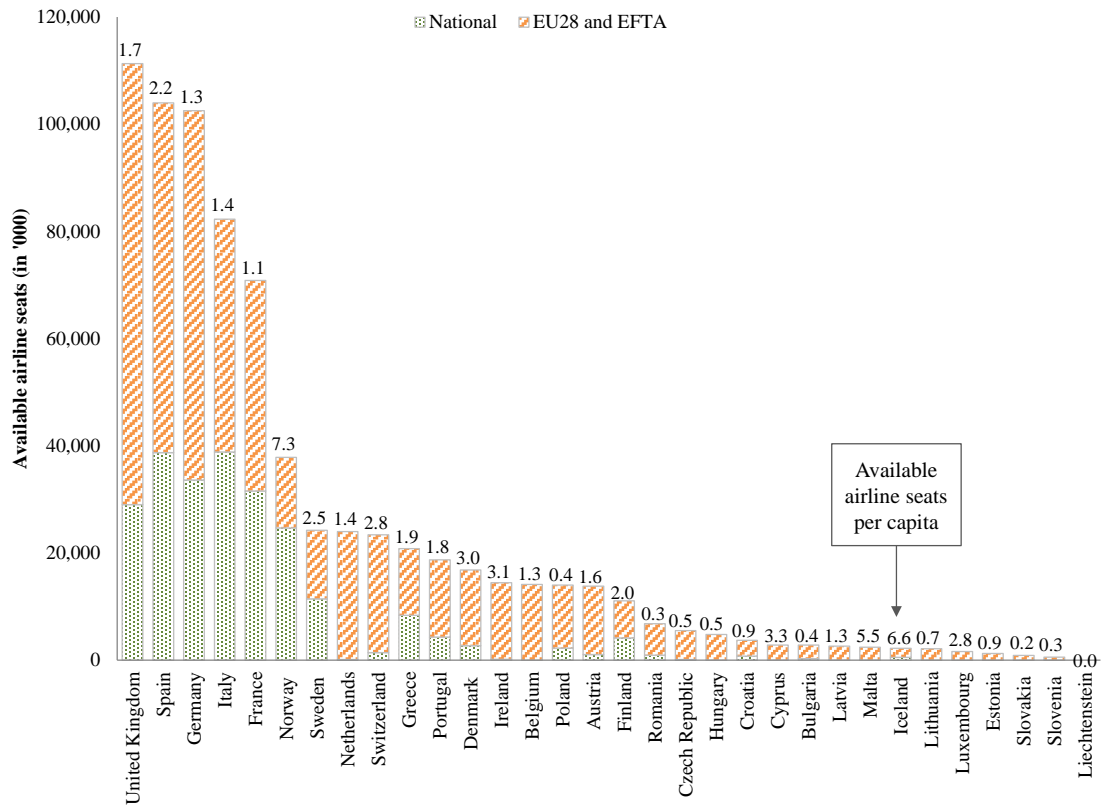


Figure 3: Supplied national and intra-EU airline seats by country (OAG, 2014a)

Figure 3 shows the distribution of supplied airline seats by country, e.g. distinguished by seats provided nationally and to destinations within the EU. Non-EU destinations and corresponding seats are excluded from the analysis since the focus of the study is on the demand for trips within Europe. The supplied airline seats in Figure 3 correlate with the population size of a country, e.g. the more inhabitants in a country, the higher the absolute amount of offered seats to and from that country. Norway is the country with the highest share of national seats offered in relation to total seats, with 65 per cent. This might be due to the geography and shape of this country with long distances and sparse population density. The same applies for Sweden and Finland with national seats accounting for 47 per cent and 37 per cent, respectively. Italy, France and Spain also have high shares of national air traffic with 47 per cent, 45 per cent and 37 per cent, respectively. These three countries also have a high share of domestic transport considering all transport modes (Figure 1). For Spain and France, the large country size and the existence of few but large urban centres contribute to the high level of domestic traffic, which serves as a fast connection alternative. Another correlation can be detected looking at the GDP per capita and the number of air trips per capita. This correlation has already been investigated by different studies and is addressed in Section I. A more detailed focus on the relationship between these factors on a European level will also be outlined in Section IV.

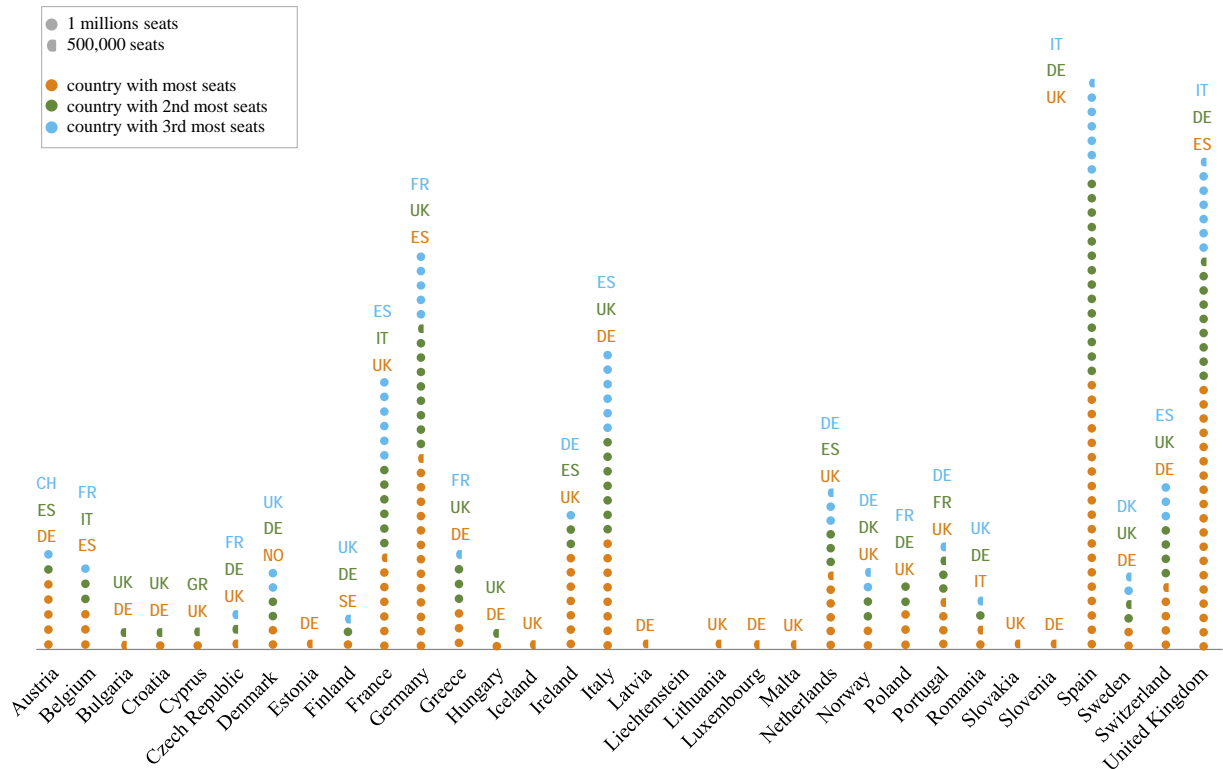


Figure 4: Top three air traffic flows for EU28 and EFTA countries (OAG, 2014a)

When considering the European air transport market and related passenger demand, the top destination regions for each of the EU28 and EFTA countries give a first indication to the main air traffic flows within Europe. With regard to this, Figure 4 shows the top three air traffic flows for all of these countries in terms of departing seats, e.g. only one-way seat capacity between countries is depicted. If seat capacities do not exceed 500 000 only the main air traffic flow is depicted as in the case of Estonia or Luxembourg, for example. It is apparent, that the countries receiving the majority of traffic are Spain, Germany, the United Kingdom, France, and Italy. This correlates with the respective population figures outlined in Section III. Furthermore, some flows can be ascribed to geographical proximity of countries and resulting interrelations, such as Denmark and Norway, Cyprus and Greece, or Finland and Sweden.

The data and analysis depicted in this section will serve as input for the empirical analysis in Section IV. In addition to this, different factors that might influence passenger air transport demand are outlined in the following section and integrated in the empirical analysis.

III. Factors influencing passenger demand for air transport

The diverging prevalence level of air transport across the considered EU and EFTA countries can be due to several reasons. Some of these are described in more detail in the following section and incorporated in the empirical analysis.

A. Population and age structure

Population size affects the demand for air travel since a larger demand basis increases the demand for mobility. Hence, the population of a country has to be taken into consideration when estimating and differentiating the demand for air travel. The six largest countries – Germany, France, the United Kingdom, Italy, Spain and Poland – already make up almost 70 per cent of the population within the country sample of the EU28 and EFTA countries (Figure 5). Hence, a high share of mobility demand will be generated within these countries alone.

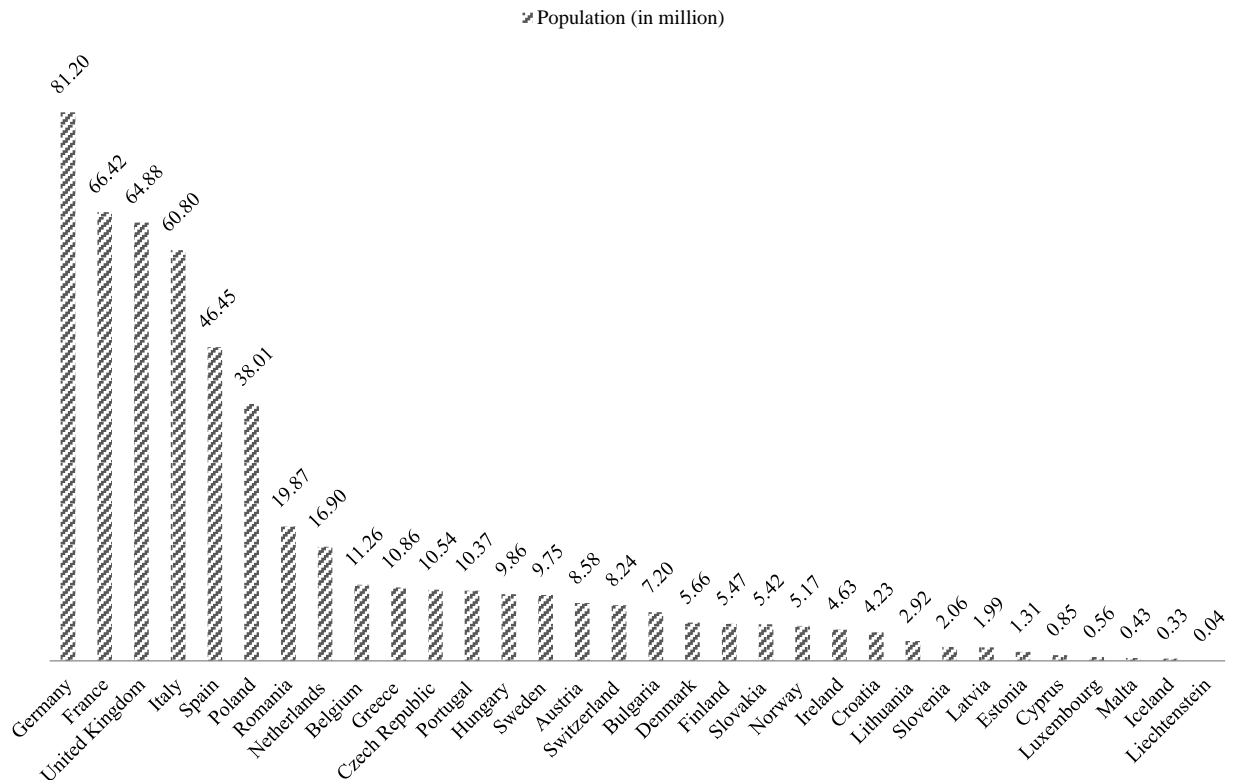


Figure 5: Population across selected European countries (Eurostat, 2014b)

Another factor potentially influencing the demand for air transport is the age of a passenger. Figure 6 outlines the accumulated distribution of different age groups within Europe. More than 50 per cent of Europeans belong to the age groups between 25 and 44 years as well as 45 and 64 years. These two groups also reflect the majority of the working age population. The relationship between age cohort and demand for travel has been investigated in different studies. Alsnih and Hensher (2003) analyse the travel behaviour of the elderly population with particular focus on private car use versus public transportation. They find that retired people are likely to conduct trip chains, meaning they combine multiple purposes and destinations within one trip in order to minimise the effort of driving. Public transportation is increasing among those 75 years old and above, in densely populated urban areas. Reasons for this might be the mere availability of respective infrastructure and frequencies of public transport services within these areas compared to rural ones.

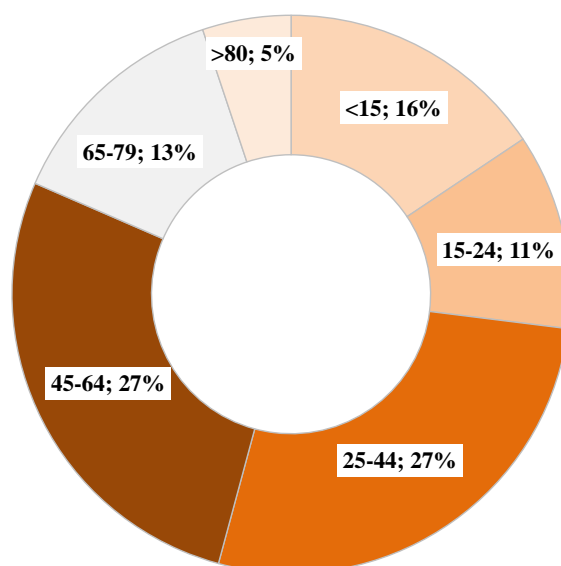


Figure 6: Accumulated distribution of different age groups within Europe (Eurostat, 2014b)

Möller, Weiermair, and Wintersberger (2007) gave a good overview of different studies and outline factors that drive the demand for travel among seniors including higher life expectancy, high disposable income (also due to savings) or good state of health. The study considers three different groups of senior travellers: (1) 'empty nesters' including the age group 55 to 64, (2) 'young seniors' with adults from 65 to 79, and (3) 'seniors' including the age group 80 and over. The number of trips per year is higher for the empty nesters since these citizens are still in employment whereas trip volume is decreasing for the latter two groups. However, trip duration is increasing with age. Reasons for not travelling include the lack of financial means as well as deteriorated health status. The authors also use a focus group method in order to get a more detailed insight of the travel behaviour of elderly passengers in Austria. Both approaches imply that elderly passengers tend to travel during off-peak seasons and prefer longer stays. Sakai et al. (2000) focus on the travel demand among older Japanese citizens taking into account different effects including age and time. All studies show that the group of senior travellers is very prone to travel, a development continuing in the future since travel behaviour is likely to manifest over time, e.g. travelling can be considered as "learned behaviour" (Möller et al., 2007). This means that today's 30 year olds, for example, pursue their particular travel patterns to a high degree when they get older.

Regarding the behaviour of young travellers, studies by the World Tourism Organization (UNWTO) (2016) as well as a report by the International Student Travel Confederation (ISTC) together with the Association of Tourism and Leisure Education (2003) investigate the travel planning, expectations and trip duration, amongst others, of this particular group. The UNWTO report looks at travellers between the ages 15 to 29 which account for approximately 23 per cent of all global travellers. The major motivation for this group is the experience of new cultures, getting to know local people and to "live local". Furthermore, with more students enrolling in higher education, studying abroad becomes increasingly important. Although student or young travellers often only have a low budget, e.g. being money poor but time rich, their travel expenditures within a country or region are not necessarily lower than those of a tourist with a higher income. This can be accrued to the longer trips young travellers often conduct; their expenditures accumulate to a high level as well. In addition, some of these travellers combine their travelling with work in the respective destination in order to maximise their use of budget. The ISTC (2003) report is based on a detailed survey among global travellers aged mostly below 26 and confirms many aspects of the UNWTO study. The main reasons for travelling are getting to know new cultures, the pleasure of travelling itself as well as enhancing one's knowledge. Already in 2002, the year of the survey, the internet was the predominant mode for young travellers to plan and book their trip. Considering that a high share of this group travels to long-distance destinations, air transport is the mode used mostly. Furthermore, as stated in the studies about senior travellers, young travellers also experience some kind of travel learning or "travel career", which means building up experience and accumulating knowledge regarding travel itself and different destinations. In addition, the group of young travellers is not homogeneous but differs according to travel destinations, age, income level, or experience sought.

B. Urban agglomerations

As already addressed in the previous section, the origin and destination of traffic flows are also important to understand air travel demand. A high share of European citizens live in urban agglomerations. According to World Bank (2016) data, this urban population accumulates to more than 70 per cent of the total population across the considered European countries. These all have an urbanisation degree of at least 50 per cent and the majority of countries have a share of above 65 per cent. This high degree of urbanisation gives a first indication that a high share of (air) transport within Europe takes place between these urban centres. Passengers might also expect (air) traffic connections between urban areas. In order to depict respective flows the geographical distribution of urban agglomerations gives a further indication. Population density is usually highest in the areas surrounding European capitals and large cities (e.g. Paris, London, Rome, Berlin) or large urban agglomerations (e.g. German Ruhrgebiet).

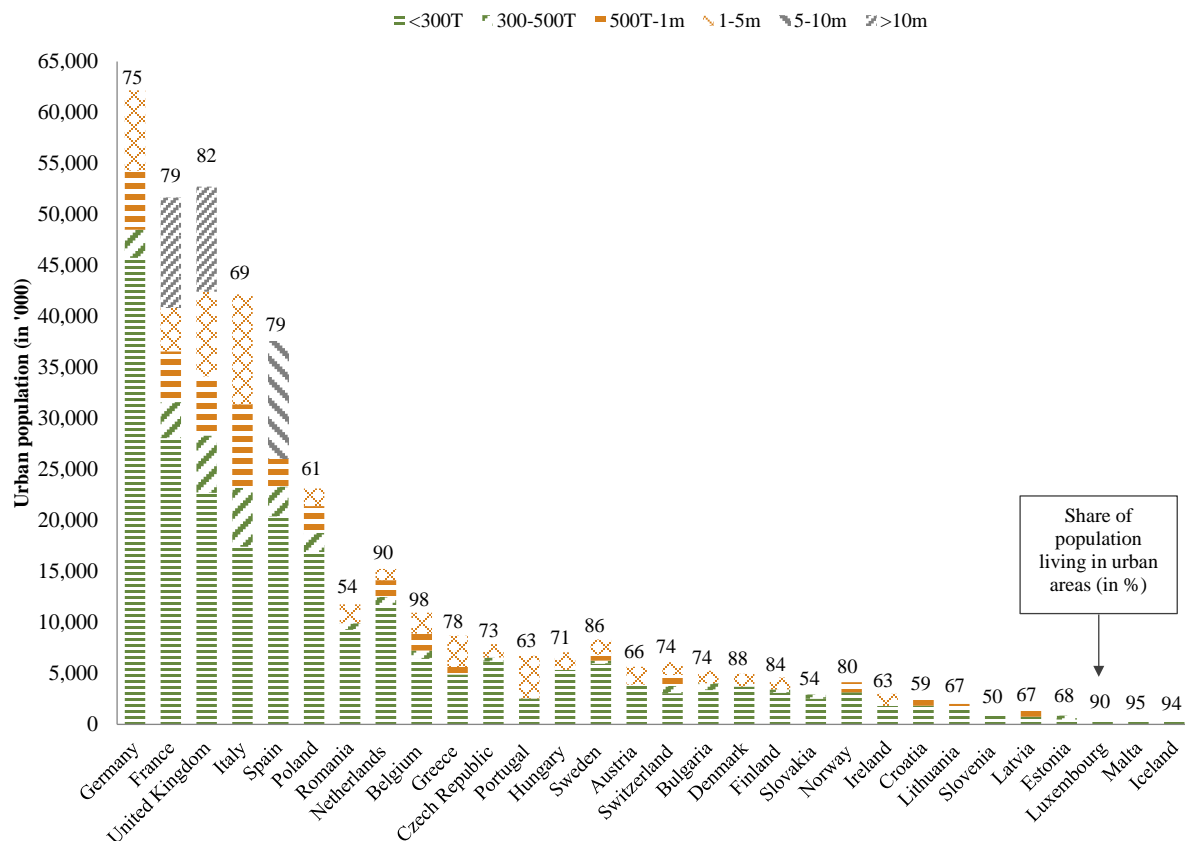


Figure 7: Urban agglomerations across European countries (The World Bank Group, 2016)

Figure 7 shows the distribution of urban population across differently sized urban agglomerations, ranging from cities with less than 300 000 inhabitants (<300T) to megacities such as London and Paris with more than ten million people (>10m). Within all countries, more than 50 per cent of the population lives in urban agglomerations. Another aspect is the geographical distribution of the population, with Portugal's urban population, for example, being concentrated within two large centers. More than 60 per cent of the urban population lives within two large urban centres and the remaining share is distributed across smaller urban agglomerations with less than 300 000 inhabitants. Compared to other European countries, Spain, France, and the United Kingdom are characterised by very large urban agglomerations with at least more than five million inhabitants.

C. GDP

The income level of a country or a region is usually applied as another explanatory factor in the determination of air travel demand. Different studies (some of them already explored in Section I) reveal that a higher GDP per capita, which is often used as a proxy for income, is usually associated with higher levels of air travel (CAPA, 2014). For instance, an analysis by IATA (2008) indicates that increased income has been explaining a large share of air traffic growth in the past. However, within the considered region, GDP differs between the countries. Eastern European countries like Romania, Bulgaria or Lithuania have the lowest GDP per capita; Lichtenstein, Luxembourg and Norway have the highest GDP per capita (Eurostat, 2014c).

Exogenous factors and global crises can have an impact on the GDP development - on both a country level and European level - and some of these factors might not be foreseeable (PWC, 2015). A recent example is the outcome of the UK referendum (“Brexit”) resulting in increased economic uncertainty, which has affected GDP short-term forecasts for the UK as well as for the Euro-area (Goldman Sachs, 2016). Moreover, such events might impact passenger demand directly, as Brexit could also influence outbound and inbound traffic between the UK and the rest of the EU.

D. Education status

The level of tertiary education differs significantly across considered countries, as can be seen in Figure 8, with Luxembourg having the highest share of population with tertiary education (40 per cent) and Romania at the lowest end with 14 per cent.

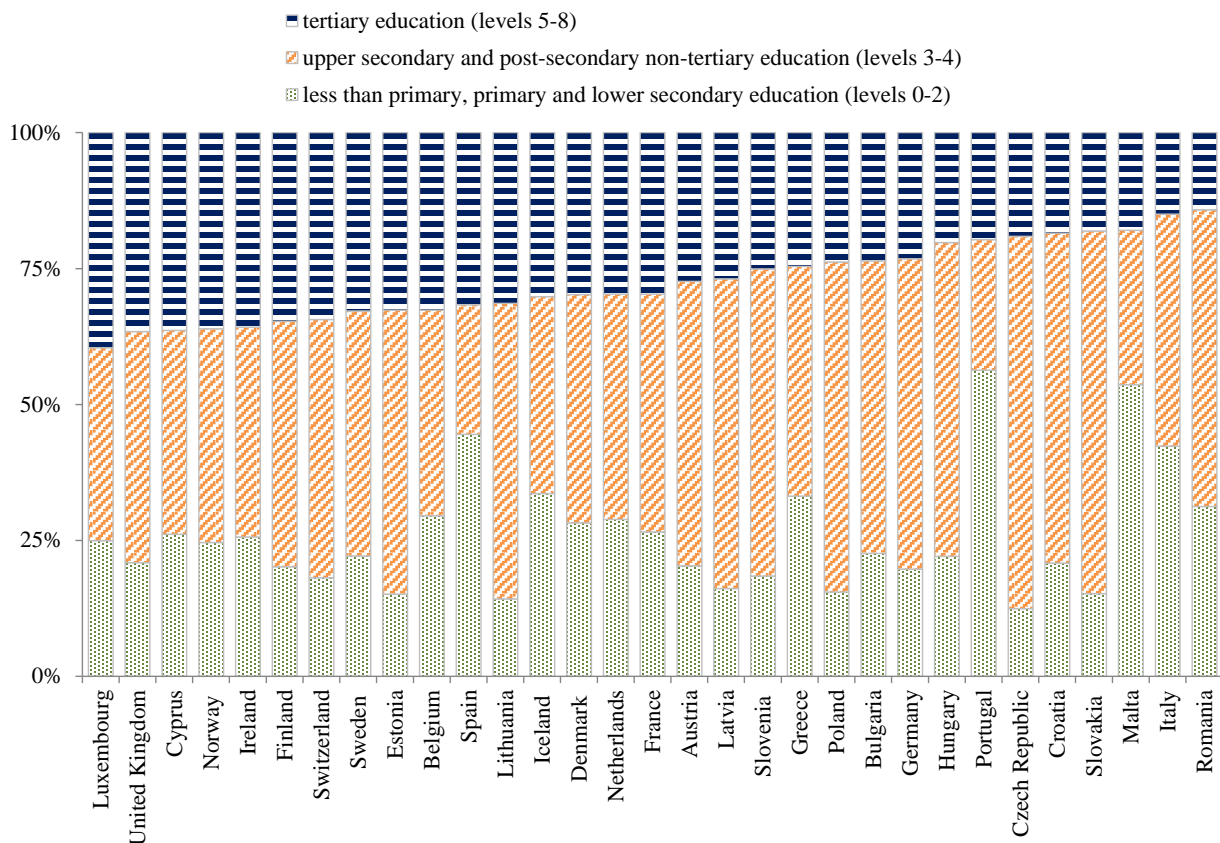


Figure 8: Educational attainment level by country (Eurostat, 2014d)

A study by the Global Business Travel Association (GBTA) (2011) reveals that a high share of business travellers has a college education (71 per cent). In Luxembourg, for example, 17 per cent of all trips are business trips compared to only 3 per cent in Romania. Education and type of employment activity, however, are not the only determinants of business travel. Furthermore, a higher education level often correlates with a higher income level and hence a higher propensity to use air transport for leisure purposes as well. The current trend towards combining business and private or leisure trips (= bleisure trips) might also change passengers expectations toward the transport system within one trip. Outward flights might be for business purposes and hence, as already explored in Section I, passengers might be less sensitive to an increase in airfares as time saving and travel comfort have a higher priority. Combining business and private lives, passengers could extend their business trips to stay additional days privately. In doing so, passengers’ preferences might change, such as price sensitivity.

IV. Empirical analysis

As outlined in the previous sections, different factors have an effect on the level of air transport demand within a country or region. Leaving supply-side aspects aside such as available airport infrastructure or regulatory constraints, the analysis focused so far on demand-side issues such as available income, age structure, or level of education. The question to be addressed with the empirical analysis is whether the outlined factors have a statistically significant influence on passenger demand in the EU28 and EFTA countries. A high share of

the studies outlined in Section I finds that the income per capita or household, often expressed by using gross domestic product per capita, is one of the main factors determining the amount of air trips conducted per person. Therefore, this result is expected to be reflected in the European air transport data as well. This factor, as well as others discussed in the previous sections, is included in a regression analysis to determine their respective influence on the number of air trips per capita in Europe. Table 1 gives an overview of these factors.

Table 1: Overview of variables used in regression analysis

Variable	Definition	Reference
airtripscap	The number of air trips per capita per country in 2014; dependent variable	Eurostat (2014a)
GDP	The gross domestic product (GDP) per capita in 2014, purchasing power parity in USD, logged variable	The World Bank Group (2014)
geo	A dummy variable indicating whether a country is an island (1 if country is an island)	N/A
educ	The share of population having a tertiary education degree	Eurostat (2014d)
urbanpop	The share of people living in urban agglomerations	The World Bank Group (2016)

In the regression analysis, applying an ordinary least squares (OLS) model, the number of air trips per capita in a given year (2014) represents the dependent variable (airtripscap). This indicator serves as a proxy for the level of air transport demand within a country and depends on several factors whose influence is estimated in the following section. The choice of the independent variables in this section is based on the discussion in the previous sections. Gross domestic product per capita (GDP) is expected to have a positive impact on the number of air trips per capita, as is the level of tertiary education (educ). Furthermore, within the analysis it is controlled for geographical location (geo), e.g. whether a country is an island state, since air transport might represent the only feasible transport alternative in many cases. Furthermore, the share of people living in urban agglomerations (urbanpop) can affect the level of air transport demand since traffic between urban centres within Europe might contribute to an increase in air traffic between these and hence increasing number of air trips per capita.

Table 2: Descriptive statistics

Variable	Observations	Mean	Standard deviation	Minimum	Maximum
airtripscap	28	0.437	0.382	0.020	1.353
GDP	31	10.473	0.373	9.753	11.497
geo	32	0.156	0.369	0	1
educ	30	0.274	0.072	0.142	0.396
urbanpop	32	72.186	16.385	14.305	97.818

As outlined in Section II, the EU28 as well as EFTA countries and their ranking have been investigated with respect to each analysed factor. As can be seen in Table 2, data on the different variables are not available for all countries. For example, air trips per capita are not reported for Iceland, Liechtenstein, Norway, and Sweden in the Eurostat database for 2014. These countries are excluded from the regression analysis, leaving a total of 28 observations.

Table 3: Correlation coefficients for variables

	airtripscap	GDP	geo	educ	urbanpop
airtripscap	1.00				
GDP	0.65	1.00			
geo	0.60	0.08	1.00		
educ	0.72	0.65	0.24	1.00	
urbanpop	0.41	0.52	0.23	0.43	1.00

Air trips per capita show a high divergence across these countries with Romania having the lowest number of trips per capita (0.02) and Cyprus the highest (1.35). The gross domestic product per capita ranges from a minimum of USD 17 207 (~16 000 EUR) in Bulgaria to USD 98 459 (~90 000 EUR) in Luxembourg and the share of citizens with tertiary education is highest in the United Kingdom (~37 per cent) as well as Luxembourg (~40 per cent) and lowest in Romania with 14 per cent. The degree of urbanisation also differs strongly with about 98 per cent in Belgium and 14 per cent in Liechtenstein. Including these variables, the specification of the model is as follows:

$$airtrips_{cap} = \beta_0 + \beta_1 GDP + \beta_2 geo + \beta_3 educ + \beta_4 urbanpop + \varepsilon \quad (1)$$

The results of the regression analysis applying a linear-log OLS model are summarised in Table 4.

Table 4: Impact of different factors on *airtrips_{cap}*

Variable	OLS
GDP	0.4181*** (0.0976)
geo	0.5031** (0.1485)
educ	0.0178** (0.6160)
urbanpop	0.0004 (0.0031)
const	-4.502*** (0.9148)
N	28
R ²	0.7872

Notes. Standard errors are in parentheses.

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

As expected, GDP has a positive effect on the number of air trips per capita and is statistically significant at the 99.9 per cent level. Since *GDP* is a logged variable, a 1 per cent increase in GDP leads to an increase in average air trips per capita of 0.0042⁷. The geographical location of a country also has a positive influence on *airtrips_{cap}*: a country being an island leads to increase in air trips per capita of 0.5 with a statistical significance at the 99 per cent level. This confirms previous expectations, since the geographical isolation of an island country often prohibits the use of other transport modes besides air. A high share of the population having tertiary education (*educ*) also has a positive effect on the number of air trips per capita and is statistically significant at the 99 per cent level. In terms of the variable *educ*, the coefficient β_3 represents the marginal effect of *educ* on *airtrips_{cap}*, hence an increase in the share of population with tertiary education has a positive effect on the amount of air trips per capita in a country, i.e. an increase in *educ* by one unit leads to an increase of *airtrips_{cap}* by 0.018 units. Evidence from other studies (see Section III) points towards a positive relationship between the level of education and the demand for air travel, e.g. due to more business trips by air being conducted in knowledge-based firms. The variable *urbanpop* is not statistically significant in this example.

The sample size in this analysis is relatively small and only includes data for 2014 (N=28). The results obtained are, however, statistically significant and hence support the discussion from the previous sections. The R² represents the goodness-of-fit of the regression, e.g. how much of the variation in the data is explained by the considered variables.

V. Conclusion

The aim of this study was to assess different factors influencing air transport demand at a European level, to examine the interdependencies between them and provide indications of today's passengers' expectations regarding the European transport system and hence a better understanding of passenger behaviour. Within a comprehensive analysis, a range of factors has been explored, both quantitatively and qualitatively. General characteristics of the European air transport market have been presented, showing indications of the main air traffic flows within the EU28 and EFTA countries. Furthermore, the paper elaborated a range of factors driving the demand for air transport. Using data from 28 European countries in an OLS regression model, the parameters (1) GDP, (2) tertiary education, and (3) the geography of a country have been proven statistically

⁷ See Wooldridge (2009), p.46 for the interpretation of level-log form.

significant demand drivers. The results of the empirical analysis match factors also observed by several other studies and confirmed essential determinants at a European level.

Further research has to concentrate on using panel data for these selected European countries, e.g. considering developments over time. As revealed by other studies, it might also be valuable to consider the wider context when discussing demand drivers. For instance, to distinguish between short- and long-haul traffic can provide further insights as passengers can substitute other modes of transport for short-haul flights. The main travel purpose is also essential, as passengers travelling for business reasons are less price sensitive than leisure travellers do. Hence, airfare does not seem to be the main demand driver for business (purpose) passengers but could influence the demand of passengers travelling for private (or leisure) purposes.

References

- Airbus. (2016). *Mapping Demand Global Market Forecast 2016: Highlights*. Retrieved from [http://www.airbus.com/company/market/global-market-forecast-2016-2035/?eID=maglisting_push&tx_maglisting_pi1\[docID\]=109228](http://www.airbus.com/company/market/global-market-forecast-2016-2035/?eID=maglisting_push&tx_maglisting_pi1[docID]=109228).
- Alsnih, R., & Hensher, D. A. (2003). The mobility and accessibility expectations of seniors in an aging population. *Transportation Research Part A: Policy and Practice*, 37(10), 903-916.
- Andreoni, A., & Postorino, M. N. (2006). A Multivariate Arima Model To Forecast. *Proceedings of Association for European Transport and Contributors 2006*. Retrieved from http://dandelion-patch.mit.edu/afs/athena/course/11/11.951/oldstuff/albacete/Other_Documents/Europe_Transport_Conference/applied_methods_in_tra/a_multivariate_ari1399.pdf.
- Bosten Consulting Group (BCG). (2006). Understanding the Demand for Air Travel: How to Compete More Effectively. Retrieved from <https://www.bcg.com/documents/file14820.pdf>.
- Bießlich, P., Schroeder, M. R., Gollnick, V., & Lütjens, K. (2014). A System Dynamics Approach to Airport Modeling. 14th AIAA Aviation Technology, Integration, and Operations Conference, (June), 1–13. <http://doi.org/doi:10.2514/6.2014-2159>.
- Boeing. (2016). Current Market Outlook 2016-2035. Retrieved from http://www.boeing.com/resources/boeingdotcom/commercial/about-our-market/assets/downloads/Boeing_Current_Market_Outlook_2015.pdf.
- Centre for Aviation (CAPA). (2014). Air travel rises with a country's wealth. Law of nature, or can government policy make a difference?. Retrieved from <http://centreforaviation.com/analysis/air-travel-rises-with-a-countrys-wealth-law-of-nature-or-can-government-policy-make-a-difference-170674>.
- Chèze, B., Chevallier, J., & Gastineau, P. (2011). Forecasting world and regional air traffic in the mid-term (2025): An econometric analysis of air traffic determinants using dynamic panel-data models, working paper from Université Paris-Dauphine: Paris.
- Dargay, J., & Hanly, M. (2001). The Determinants of the Demand for International Air Travel to and from the UK. ESRC Transport Studies Unit, Centre for Transport Studies, University College: London, 59, 1-14.
- Department of Transport (DfT). (2013). UK Aviation Forecasts, (January 2013).
- Eurostat (2014a) Database, Tourism [tour]. Retrieved from <http://ec.europa.eu/eurostat/de/data/database>.
- Eurostat (2014b) Database, Population [t_demo_pop]. Retrieved from <http://ec.europa.eu/eurostat/de/data/database>.
- Eurostat (2014c) Database, Annual national accounts [nama_10]. Retrieved from <http://ec.europa.eu/eurostat/de/data/database>.
- Eurostat (2014d) Database, Education and training [iedtr]. Retrieved from <http://ec.europa.eu/eurostat/de/data/database>.
- Global Business Travel Association. (2011). The business traveler of today: New study profiles corporate travelers and their needs while in transit. Retrieved from <http://www.gbta.org/foundation/pressreleases/Pages/rls072611.aspx>.
- Goldman Sachs. (2016). Briefly . . . After the Brexit Vote, Where Do We Go From Here?. Retrieved from http://www.goldmansachs.com/our-thinking/pages/from_briefings_27-june-2016.html.
- Grosche, T., Rothlauf, F., & Heinzl, A. (2007). Gravity models for airline passenger volume estimation. *Journal of Air Transport Management*, 13(4), 175-183. <http://doi.org/10.1016/j.jairtraman.2007.02.001>.
- Hess, S., & Polak, J.W. (2005). Mixed logit modelling of airport choice in multi- airport regions. *Journal of Air Transport Management*, 11(2), 59–68.
- IATA. (2008). Air Travel Demand, IATA Economics Briefing No. 9, IATA, (April 2008).
- Inglada, V., & Rey, B. (2004). Spanish air travel and the September 11 terrorist attacks: a note. *Journal of Air Transport Management*, 10(6), 441-443.

- International Student Travel Confederation together with the Association of Tourism and Leisure Education. (2003). *Today's Youth Traveller: Tomorrow's Global Nomads*. Retrieved from http://www.atlas-euro.org/pages/pdf/FINAL_Industry_Report.pdf.
- InterVISTAS Consulting Inc. (2007). *Estimating Air Travel Demand Elasticities*. Final Report, Prepared for IATA, (December 2007). 58.
- Kopsch, F. (2012). A demand model for domestic air travel in Sweden. *Journal of Air Transport Management*, 20, 46-48. <http://doi.org/10.1016/j.jairtraman.2011.11.006>.
- Lai, S. L., & Lu, W.-L. (2005). Impact analysis of September 11 on air travel demand in the USA. *Journal of Air Transport Management*, 11(6), 455-458. <http://dx.doi.org/10.1016/j.jairtraman.2005.06.001>.
- Lyneis, J. M. (2000). System dynamics for market forecasting and structural analysis. *System Dynamics Review*, 16(1), 3-25. [http://doi.org/10.1002/\(SICI\)1099-1727\(200021\)16:1<3::AID-SDR183>3.0.CO;2-5](http://doi.org/10.1002/(SICI)1099-1727(200021)16:1<3::AID-SDR183>3.0.CO;2-5).
- Martínez-García, E., Ferrer-Rosell, B., & Coenders, G. (2012). Profile of business and leisure travelers on low cost carriers in Europe. *Journal of Air Transport Management*, 20, 12-14. doi:10.1016/j.jairtraman.2011.09.002.
- Möller, C., Weiermair, C., & Wintersberger E. (2007). The changing travel behaviour of Austria's ageing population and its impact on tourism. *Tourism Review*, 62(3/4), 15-20.
- OAG. (2014a). *Official Airline Guide Schedules Data, 2014*.
- Postorino, M. N. (2010). *Development of regional airports: theoretical analyses and case studies (Vol. 47)*. WIT Press.
- PricewaterhouseCoopers (PWC). (2015). *The World in 2050. Will the shift in global economic power continue?*. Retrieved from <http://www.pwc.com/gx/en/issues/the-economy/assets/world-in-2050-february-2015.pdf>.
- Sakai, M., Brown, J., & Mak, J. (2000). Population aging and Japanese international travel in the 21st century. *Journal of Travel Research*, 38(3), February 2000, 212-220.
- The World Bank Group. (2014). *Doing business: Economy Rankings*. Retrieved from <http://www.doingbusiness.org/rankings>.
- The World Bank Group. (2016). *World DataBank: World Development Indicators*. Retrieved from <http://databank.worldbank.org/data/reports.aspx?source=2&Topic=16>.
- Wooldridge, J. M. (2009). *Introductory Econometrics, A Modern Approach, Fourth Edition*, ISBN-13:978-0-324-58548-3.
- World Tourism Organization (UNWTO). (2016). *Affiliate Members Global Reports, Volume thirteen – The Power of Youth Travel*, UNWTO, Madrid.
- Young, D., Pilon, N., & Brom, L. (2009). *Challenges of Air Transport 2030 in transport system*, Eurocontrol report. <http://doi.org/10.1533/9781845695224>.