ACI EUROPE
AIRPORTS COUNCIL INTERNATIONAL

A GUIDE TO THE ACI EUROPE ECONOMIC IMPACT ONLINE CALCULATOR

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BEST PRACTICE & CONDITIONS FOR USE OF THE ECONOMIC IMPACT ONLINE CALCULATOR

The results of this economic impact online calculator, while reflecting the characteristics of individual airports and their surrounding catchment areas, are based upon Europe-wide aggregate relationships. This means that the calculator is NOT a substitute for a full, detailed and tailored assessment of the economic impact of an individual airport or airports. In particular it has not been tailored for airports focused on business or general aviation, or those with a very high proportion of cargo traffic, or for those airports located on small islands, and the results for these airports may therefore be less reliable.

The calculator does not provide estimates as to the marginal impact of activities at the airport (e.g. a new long-haul routes, the potential delivery of a certain number of additional passengers) and cannot be used as a basis to make any such claims.

Care must be taken to ensure that accurate inputs (e.g. traffic volumes, % of transfer passengers, etc.) are supplied when using the calculator. To safeguard the credibility of figures, where results are being used in a public forum (e.g. an airport website, a press release) the inputs which were used to generate those results should also be made publically available.

Any assessment of the economic impact of an airport is potentially an important tool to communicate the importance of the airport to its surrounding economy and society. However these exercises are open to misuse, and will be subject to challenges by third parties. The optimal means of protecting your airport against such challenges is to use accurate data, to inform yourself as to what methodology you are using, and to be transparent, not only about the methodology, but also about what exact impacts the methodology does and does not quantify.

In the context of the ACI EUROPE Economic Impact Calculator, the methodology is underpinned by 2 core economic studies which are presented on Page 4. Users of the calculator are strongly advised to familiarise themselves carefully with both the wider topic of economic impacts, and the methodology underpinning the calculator, prior to publically using any of the results of the calculator.

ACI EUROPE takes no responsibility for the results of the calculator, nor for the consequences of any actions taken on the basis of these results.

The Economic Impact Online Calculator can be found in the Members' Room area of the ACI EUROPE website: **www.aci-europe.org**.

SOURCE DOCUMENTS

The research and analytical work underpinning this calculator is available and is explained in detail in two publications:

'Economic Impact of European Airports – A Critical Catalyst to Economic Growth'
Inter*VISTAS*, January 2015

This publication gives an introduction and comprehensive explanation of the subject of the economic impact of airports, including clear definitions of the different types of economic impacts - direct, indirect, induced and catalytic.

This publication explains in detail the methodology and underlying assumptions which enable the calculator to calculate the direct, indirect and induced impacts of European airports in terms of jobs and absolute euro value of Gross Domestic Product (GDP). In particular see Sections 4, 5 & 6, as well as Appendices C, D, E and F.

This publication also explains in detail the methodology and underlying assumptions which were used to calculate the overall national catalytic impacts of the airport industry in individual countries. In particular see Section 8 and Appendix I.

'Regional Economic Impact of Airports'
SEO Aviation Economics, October 2015

This publication explains in detail the methodology and underlying assumptions which enable the calculator to allocate the national catalytic impacts to each airport within a country. In particular see Sections 3 & 6.

Both documents are available in the Airport Economics, Finance & Ownership section of the ACI EUROPE website.

DIRECT, INDIRECT & INDUCED IMPACTS (JOBS & GDP)

The calculator first of all calculates the number of direct jobs associated with an individual airport.

This estimate is based upon the total number of passengers and freight which pass through the airport annually, as well as the percentage of these transfer passengers and passengers traveling via low cost carrier airlines.

The impact that these factors have on the total number of direct jobs is based upon analysis of the results of an employment survey of European airports. A summary table is provided below. See Appendix E of the Inter*VISTAS* publication for a more detailed description.

Where the number of direct jobs associated with an individual airport is already known, users of the tool can insert this instead of making an estimation.

Airports, Traffic Types & the Direct Jobs They Create

Airport Size / Traffic Type	Impact on Direct Jobs
Airports with less than 1 million passengers per annum (mppa)	1000 extra passengers creates **1.2** direct jobs
Airports with 1-10 mppa	1000 extra passengers creates **0.95** direct jobs
Airports with more than 10 mppa	1000 extra passengers creates **0.85** direct jobs
Connecting passengers	Connecting passengers generate **3% less direct jobs** than O/D passengers
Low Cost Carrier passengers (LCC)	LCC passengers generate **20% less direct jobs** than non-LCC passengers

The number of direct jobs was then used as a basis to determine the number of indirect and induced jobs associated with that airport, as well as the direct, indirect and induced impact on GDP.

This was done via analysis of national 'Input-Output' tables – models of how different sectors within an economy interact with and depend upon each other. Input-Output tables are assembled from real economic data, are compiled by national statistical agencies, and are built up for each individual country. This allows the calculation of ratios which quantify the number of indirect and induced jobs associated with each direct job, as well as the corresponding direct, indirect and induced GDP impact.

The calculator applies the appropriate national ratios to the estimate for the number of direct jobs at the airport.

See Appendix F of the Inter*VISTAS* publication for more information.

CATALYTIC IMPACTS

The Economic Impact Online Calculator divides and allocates portions of the national catalytic impact of the airport industry to individual airports with their country, in terms of GDP and number of jobs.

There are 3 key steps involved in this:

STEP 1 **Calculation of the national catalytic impacts of the airport industry within individual countries**

Inter*VISTAS*, via analysis of historical economic data, established a relationship between the connectivity of a country and its GDP per capita. It was found that a 10% increase in a country's air connectivity is associated with a 0.5% increase in that country's GDP per capita. This relationship was applied to historical growth in connectivity in individual countries, to establish the % and therefore absolute volume of a country's GDP which can be attributed to aviation activity, as well as the total number of jobs associated with this proportion of GDP.

See Appendix I of the Inter*VISTAS* publication for more information.

STEP 2 **Calculation of the proportionate catalytic impact of individual airports**

SEO Aviation Economics calculated the regional economic impact in terms of GDP for each airport for which there was sufficient data. For each airport, data on specific airport characteristics was assembled, such as the number of passengers, direct and indirect connectivity, the share of low cost carrier flights, etc. This was supplemented with regional socio-economic data. Data on GDP, employment, population levels etc. was compiled in a 100 km catchment area around each airport based on regional macro-economic data from Eurostat using Geographical Information System (GIS) analysis.

SEO Aviation Economics used all this data to create an econometric model, which uses the pan-European data to establish a statistically significant relationship between the characteristics of an airport and the GDP of its surrounding catchment area. To robustly capture the relationship between an airport's characteristics and the GDP of the surrounding catchment area, the model uses data spanning a number of years, dating up to 2011. To take into account developments since then, the % change in passenger traffic is calculated for each airport, between 2011 and 2014. The economic model shows that there is a positive relationship between passenger traffic growth and growth in the GDP of the airport's catchment area. For each airport, the model can therefore estimate the increase (or decrease) in GDP in each region, which is associated with growth (or decline) in an airport's passenger numbers between 2011 and 2014. This change is factored into the overall catalytic impact of the airport in its catchment area.

As the economic impact differs according to airport size (in terms of passenger numbers) different models were estimated for the following airport groups:

Group Name	Number of direct flights (weekly, summer 2011)*	Average number of annual passengers
A	0-100	219,000
B	100-1000	3,329,000
C	1000+	24,137,000

** The categorisation of the airports was based on the number of weekly direct flights during the summer of 2011. This year was chosen as this is the final year for which socio-economic data was available.*

The relationships are used to estimate the GDP of an airport's locality by feeding the model with actual information about the airport and its locality. This allows SEO Aviation Economics to determine what proportion of the actual local GDP is associated with the presence and characteristics of the airport.

Annex 1 presents the results of the economic models for the various airport groups, alongside a short guide as to how to interpret these results.

Annex 2 provides a working example of how the tool calculates the catalytic impact of an airport within its catchment area.

See the SEO Aviation Economics publication for a more detailed description.

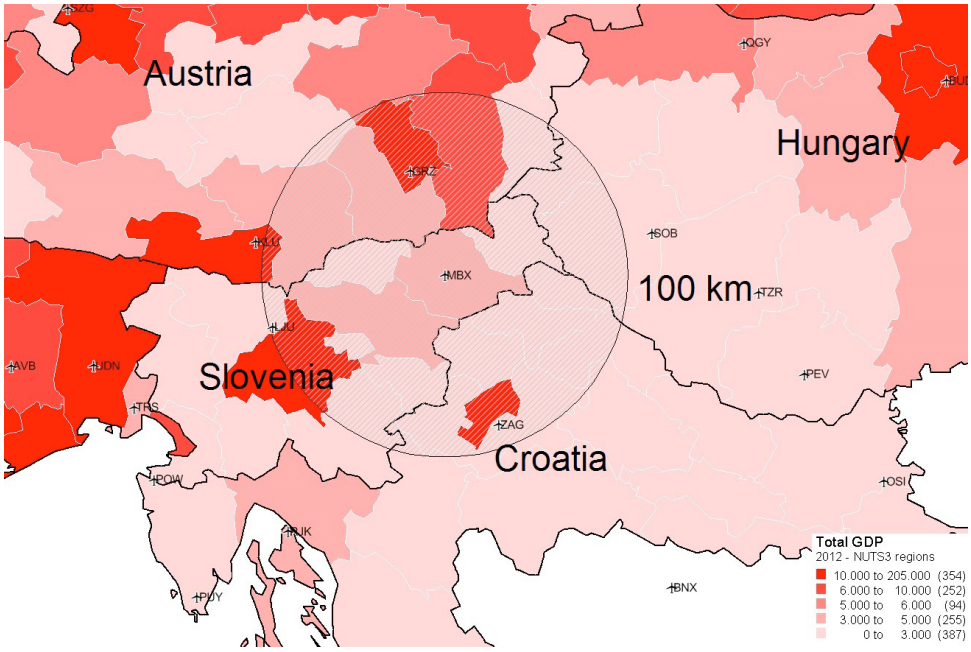
STEP 3 **Allocation of national catalytic impacts amongst individual airports**

Step 2 above provides a standardised approach to estimating the relative catalytic impact of each airport within a 100 km catchment area. This allows the calculation of the proportionate contribution of each airport to the overall national catalytic impact of each country.

However first it is necessary to control for the fact that some airports will have catalytic impacts in countries other than their own. This is the case if an airport is located within 100km of a national border, as some of the airport's catchment area will encompass the territory of another country. In such a case the airport's economic impact is divided between the countries in line with the division of GDP in an airport's catchment area.

To further explain this methodology Maribor (MXB) Airport is used as an example. The 100 km catchment area of the Slovenian airport covers parts of Slovenia, Austria, Croatia and Hungary (see map below). Using GIS-analyses the total GDP within Maribor's catchment area and within each of these countries is calculated. According to these figures, the share of each country in the total GDP within Maribor's catchment area is estimated. The impact of Maribor airport is distributed amongst the various countries within its catchment area according to these shares (see table below).

The 100 km catchment area of Maribor Airport stretches over four countries



Source: SEO Airport Database.

The largest share of total GDP in the catchment area of Maribor (MBX) is located in Austria

Country	Total GDP in 100 km catchment area of MBX (Eur. million)	Share of total
Slovenia	21505	29%
Croatia	20558	27%
Austria	31368	42%
Hungary	1896	3%

Source: SEO Airport Database; Numbers may not add up to 100% due to rounding.

Once this step has been taken, each airport's relative contribution to the GDP of its respective countries is known. These figures are used to calculate the % contribution of each airport towards the overall national catalytic impact of aviation in each county. The table below shows which airports contribute to Switzerland's economy, for example. The Swiss airports contribute most to the country's economy, but airports in Italy, Germany and France also play an important role.

Airports from Switzerland, France, Germany & Italy provide air travel services to Switzerland

Airport	Country	Contribution to Switzerland
Zurich (ZRH)	Switzerland	63.9%
Geneva (GVA)	Switzerland	14.5%
Basel/Mulhouse (BSL)	Switzerland/France	6.9%
Milan Malpensa (MXP)	Italy	4.9%
Friedrichshafen (FDH)	Germany	4.0%
Lyon St. Exupéry (LYS)	France	3.8%
Bern (BRN)	Switzerland	0.5%
Milan Bergamo (BGY)	Italy	0.4%
Milan Linate (LIN)	Italy	0.4%
Annecy (NCY)	France	0.1%
Lugano (LUG)	Switzerland	0.1%
Turin (TRN)	Italy	0.1%

Source: SEO Airport Database; Numbers may not add up to 100% due to rounding.

These shares are applied to the Inter*VISTAS* results for the national catalytic impact of airports in each country (€10.036m in GDP and 78,300 jobs for Switzerland) to calculate each airport's contribution towards the overall national catalytic impact of the airport industry in Switzerland.

The number of jobs is allocated to the airport in the same manner as the allocation of the GDP impacts to individual airports. This assumes that the catalytic employment generated by an airport is proportional to the catalytic GDP impacts.

The value of the airport's national catalytic impact will primarily be influenced by the following main factors:

- The size of the airport;
- The wealth and population of the catchment area the airport is located within;
- The presence of other competing airports in the airport's catchment area;
- The overall catalytic impact of the wider airport sector in the country.

All results are presented in 2013 euros, and are applied to 2013 euro national GDP figures.

ANNEX 1

ECONOMIC MODEL USED TO DETERMINE THE LOCAL CATALYTIC IMPACT OF EUROPEAN AIRPORTS

Note: These models are reproduced from the SEO Aviation Economics report 'Regional Impact of Airports'. For a full explanation of the methodology, data sources and an interpretation of these results, please consult the full report.

Interpretation of model results

When the independent variable has undergone a log transformation the coefficient values should be interpreted as follows: a 1 percent increase in the independent variable yields a x% increase in GDP per capita, where x represents the value in the table. Variables for which the log transformation has not been applied, the interpretation is as follows: a 1 unit increase in the independent variable yields a x% increase in GDP per capita, where x again represents the value in the table. This unit increase is an increase of 1% in case of the independent variables that represent a share, such as the share of low-cost connectivity in total direct connectivity. All year-dummy values are relative with respect to the base year 2005.

Regression results for the different airport groups, GDP per capita vs. passenger number, 100km

	GROUP A	GROUP B	GROUP C
number of passengers (t-1) (log)	**0.0298*** **	**0.1188*** **	**0.1671** **
share of direct connectivity served by LCC (t-1)	0.007	0.0446	0.1228
airport is LCC base (1=yes; 0=no)	0.0108	0	0.0239
direct connectivity offered by airports within 150 km (t-1) (log)	**0.0415*** **	**0.0658*** **	0.0283
population within 100 km (log)	-0.9932***	-0.6795***	-1.4679**
share of employment in knowledge intensive sectors	0.0758	0.0723	-0.03
year dummies - 2006	0.0542***	0.0419***	0.0644***
" - 2007	0.1123***	0.1015***	0.1162***
" - 2008	0.1471***	0.1205***	0.1417***
" - 2009	0.1091***	0.0626***	0.0959***
" - 2010	0.1736***	0.1257***	0.1587***
" - 2011	0.2044***	0.1575***	0.1956***
year dummies*Mediterranean countries - 2006	0.003	-0.0012	-0.0105
" - 2007	-0.0063	-0.0224**	-0.0122
" - 2008	-0.0164	-0.0357**	-0.009
" - 2009	-0.0071	-0.0298**	-0.0001
" - 2010	-0.0720***	-0.0661***	-0.0258
" - 2011	-0.1114***	-0.1036***	-0.0590*
constant (Value reflecting airport & region-specific characteristics)	15.7685***	12.7804***	19.9428***
Number of observations	1947	1120	258
Number of airports	369	183	40
R^2	0.5425	0.6616	0.6237

*legend: * p<.1; ** p<.05; *** p<.01; standard errors corrected for heteroscedasticity*

Breakdown of the airport fixed effects over time invariant variables

Regression of airport-specific constants (ui) on time-invariant variables

	GROUP A	GROUP B	GROUP C
average share of direct connectivity served by LCC	0.2107**	0.2533	-0.4611**
airport is LCC base (average of dummies)	-1.5590***	-0.1933*	0.0518
average connectivity offered by airports within 150km	0.1151***	0.0887***	0.0626**
average population around airport	0.8690***	0.5375***	1.2529***
average share of employment in knowledge intensive sectors	4.5077***	4.2148***	3.0552***
constant	-7.9036***	-5.9738***	-12.3851***
Number of airports	369	183	40
R^2	0.9317	0.8268	0.9600

*legend: * p<.1; ** p<.05; *** p<.01*

ANNEX 2

AN EXAMPLE OF THE CALCULATION OF THE LOCAL CATALYTIC IMPACT OF AN AIRPORT

Note: This example is reproduced from the SEO Aviation Economics report 'Regional Impact of Airports'. For a full explanation of the methodology, data sources and an interpretation of these results, please consult the full report.

The local catalytic impact of Rome Fiumicino (FCO)

VARIABLE	VALUE
GDP per capita (2011)	30453.59 (log = 10.3239)
Pax 2010	36227778 (log = 17.4053)
Share LCC 2010	13.80%
Airport is LCC base (2010)	1
Direct cnx airports within 150km (2010)	125.85 (log = 4.8430)
Population (x 1000)	5403.43 (log = 8.5948)
Share employment in KIS	41.23%
Average share of direct LCC cnx	15.38%
Airport is LCC base (average of dummies)	0.5455
Average cnx offered by airports within 150km (log)	4.8805
Average population around the airport (log)	8.5516
Average share of employment in knowledge intensive sectors	39.15%

Rome Fiumicino is a large airport, therefore the coefficients for Group C are applied. The estimated logarithm of the GDP is given by:

$$\ln(GDP_{2011}) = 19.94 + \mathbf{0.1671} * \mathbf{17.4053} + 0.1228 * 0.1380 + 0.0239 * 1 - 1.4679 * 8.5948 - 0.0300 * 0.4123 + u_i$$

And u_i is given by:

$$u_i = -12.3851 - \mathbf{0.4611} * \mathbf{0.1538} + 0.0518 * 0.5455 + 0.0625 * 4.8805 + 1.2529 * 8.5516 + 3.055 * 0.3915 + \epsilon$$

Hence the estimated GDP per capita equals $e^{10.3251} = 30489$, which is very close to the actual GDP per capita around Rome, which is €30454.

Only the statistically significant airport related variables are used to estimate the proportional impact of the airport on the regional GDP. For Group C this is the passenger number variable and the average share of LCC connectivity, which are printed in bold in the above formulas. These two variables add up to a value of 2.8373. The relative contribution of these to variables is given by:

$$\frac{\frac{e^{2.8373}}{e^{10.3251}}}{\frac{e^{2.8373}}{e^{10.3251}} + \frac{e^{7.4878}}{e^{10.3251}}} = 0.947\%$$

We apply this factor to the actual GDP per capita in the region, which results in a local GDP contribution of the airport of 0.947%*30454 = €288.33 per capita, or €288.33*5403430 = €1.55 billion.

In the final step the results are converted to 2013 price level. The results for all airports are updated according to the inflation rates in the Euro zone. The inflation rate was 2.5% in 2012 and 1.4% in 2013, therefore the GDP impacts are increased by 102.5%*101.4% = 103.9%. This results in an impact of €299.67 per capita or a total impact of €1.62 billion for Rome Fiumicino.

Between 2010 and 2013 the total number of passengers for Rome Fiumicino has decreased by 0.17%. Hence, the estimated economic impact for 2014 decreases by 0.0017*0.1671 = 0.03%.

The same procedure is followed to estimate the local catalytic economic impact for other Italian airports, as well as airports in the border region contribution to the Italian economy. Following the methodology described above we can estimate the sum of the local impacts of air travel within Italy, which is €10.03 billion. Hence the proportional contribution of Rome Fiumicino to the catalytic impacts of air travel in Italy is 1.62/10.03 = 16.1%.

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ACI EUROPE is the European region of Airports Council International, the only worldwide professional association of airport operators. We represent close to 500 airports in 45 European countries. In 2014, our member airports handled over 90% of commercial air traffic in Europe, welcoming more than 1.8 billion passengers, 18.4 million tonnes of freight and 21.2 million aircraft movements. These airports contribute to the employment of 12.3 million people, generating €675 billion each year (4.1%) of GDP in Europe. Based in Brussels, we lead and serve the European airport industry and maintain strong links with other ACI regions throughout the world.

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