Report to the UK Airports Commission

Review of the report: ICF London Air Traffic Model (August, 2014)

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This report reviews the ICF London Air Traffic Model report (hereafter *ICF Report*), which was used by ICF for their London airport capacity expansion analysis. It begins with a general section and subsequently provides detailed comments.

General Comments

The key message of the 36-page *ICF Report* is that the short-haul market will experience the strongest increase in passenger flows and that low-cost carriers (LCCs) will capture an increasing share within the short haul market. It argues that, due to their comparatively high cost-sensitivity, LCCs will prefer expansion at LGW airport, which has lower projected landing fees and shorter taxiways compared to Heathrow (LHR). It therefore concludes that airport capacity should be expanded in LGW ahead of LHR.

However, in my view the *ICF report* does not provide sufficient evidence to support the key message. The report sets out that the results provided are based on an ICF Model. However, the model specification, the type of data that was used for its estimation, and the results are not sufficiently outlined. Moreover, there has been no sensitivity analysis, which tests the robustness of the conclusions with respect to different input assumptions. In addition, the reported data is presented in a way that does not make it easy for the reader to conduct plausibility checks or to explore the outcome of alternative assumptions.

The terminology used in the *ICF Report* does not appear to be rigorous. The terms "forecast", "assumption", and "key finding" seem to be used interchangeably, which in my view is confusing. For example, in several cases, key findings turned out to be assumptions.

In many cases it is not clear how the results were produced and what specific assumptions they are based on. Without more detail on the model specification, the underlying data, the estimated coefficients, along with the outcome of key statistical tests, it is not possible to disprove that the ICF Model is based on a set

of assumptions rather than rigorous quantitative relationships. Therefore it is my recommendation that the *ICF Report* results should not be used for decision-making.

I also looked through a written ICF response to a set of questions raised by the Airports Commission. In my view none of the Airports Commission questions were answered in a way that would give any insight in addition to the *ICF Report*.

Detailed Comments

1.2 Summary

The summary provides a brief history of the ICF model. The report also suggests that the ICF model addresses deficiencies of the DfT model by capturing recent market trends and better represents supply side characteristics, such as the increasing market share of LCCs and the impact on demand of increased airport charges. In addition, this section presents the forecasted rising share of LCC traffic from LGW, Stansted (STN), and Luton (LTN) airports.

1.3 Forecast Approach

This section suggests that the ICF Model, that was used to generate the outputs of this report, "was developed by ICF during November 2012, and refined and updated during 2013 and early 2014". This implies that most of the model development was done within one month. If that is correct, it would be surprising. Based upon my experience, a sophisticated model that generates plausible outputs for such a study would normally require several person years of work.

1.4 Baseline

This section describes the key data sources, including the segmentation of London-based OD passenger flows into 12 geographic markets and 3 transfer markets. The data sources for the 2012/13 base year passenger flows are CAA and IATA. The passenger flows by airport are comparable to those of the Airports Commission in 2011 (Tables 5.4 and 5.5 of Airports Commission Strategic Fit Forecasts report [2014]), but the breakdown by market segment typically can differ strongly.

The largest absolute differences in passenger flows between the two studies exist at LHR. The *ICF Report* shows 22 million short-haul and 29 million long-haul passengers, whereas the Airports Commission reports 30.2 and 37.8 million passengers for the two markets. It is not clear where these differences result from. One explanation could be a different definition of short-haul and long-haul traffic. While the Airports Commission definition most likely roots on the specification made by the Department for Transport (DfT) in the UK Aviation Forecasts Report (DfT, 2013: Table2.2), I could not find any definition in the *ICF Report*.

Among this section's key findings is the statement that "LCCs represent more than 50% of this segment [the short-haul market]". While this may be the case, the *ICF Report* does not provide any evidence. In fact, the key findings part is the only place where LCCs are mentioned at all in section 1.4.

1.5 Unconstrained Demand

This section describes the forecast of unconstrained passenger demand for the 15 market segments outlined in section 1.4. It includes the GDP projections, assumptions regarding market maturity and point of sale, trends in passenger transfers, the validation of the passenger flow forecasting method, and the passenger flows forecasts for unconstrained airport capacities.

GDP Assumptions (p. 9). A table on page 9 in the *ICF Report* lists the GDP projections for 10 geographic regions based on projections by the IMF and the EUI (presumably the Economist Intelligence Unit), which were extended beyond 2030 through to 2050. The higher projected growth rates for emerging economies compared to those for the industrialized world follows conventional wisdom. Unfortunately, the regional specification underlying the GDP projections differs from that of the 12+3 market segments described in Section 1.4.

Market Maturity (p. 9). The GDP elasticities of passenger traffic demand are summarized in another table on page 9 of the *ICF Report* for three market segments, i.e., emerging long-haul, EU/UK domestic, and other long-haul. While the assumption of declining income elasticities is plausible to reflect market maturity and the income elasticities are within the confidence interval of other studies, one would have hoped for some evidence for the 2013-2020 figures. Presumably they were estimated with an econometric model, but no information is provided.

Point of Sale (p. 10). The point of sale assumptions on page 10 determine the fraction of ticket sales between the UK and non-UK for 8 market segments for "today", 2020, and 2050. These numbers are based on the assumption of greater inbound travel in future. Without estimating a gravity type of model, I have no feeling for many of these numbers. For example, I could not judge why the domestic long-haul transfer split between UK and non-UK is 70%/30% today, increases to 75%/25% in 2020, but then declines to 72%/28% in 2050. In my view, the *ICF Report* does not offer any satisfactory explanation for these changes.

Transfer Shares (p. 10). The transfer shares of London airports are shown in the table on page 11 for 4 market segments and 4 time periods. While the 2013-2020 figures are derived from IATA data, future numbers are based on ICF assumptions. Common to all 4 market segments is a projected decline in transfer shares over time. While the overall decline of London as a transfer market is plausible, partly because much of the future growth in passenger demand is anticipated for the Asian market, which can be served with geographically better placed hub airports than LHR, it is not clear how the rate of decline was projected.

Validation (p. 11). The validation describes the procedure for generating the passenger forecasts. Typically, gravity models include explanatory variables describing income, the airfare (or a generalized cost term that also includes the monetary costs of travel via the value of time) and dummy variables. The latter could indicate whether high-speed rail or other competitive surface transport links exist or whether destinations serve as particular attractions, such as tourist destinations. Other models include exchange rates and relative price levels with the destination country in international travel (Dargay and Hanly, 2001), interest and mortgage rates (which affect disposable income), perceived wealth, and home ownership abroad in leisure travel (CAA, 2005). In addition, the attractiveness of telecommunication substitutes (or complements) in business travel could be included (Lu and Peeta, 2009). Finally, such models could be segmented based on fare classes or trip purposes (business vs. leisure) for example, the DfT model adopts this approach (DfT, 2009). All of these important determinants of passenger demand have been omitted.

It appears that passenger flows were initially estimated with a multivariate model, from which all of the RHS variables except GDP were dropped. The report does not offer any discussion about the variables that were originally included with the exception of "fuel prices, air fares, for example", or a sound basis on which nearly all of the variables were dropped. For example, t-statistics of the estimated coefficients are not mentioned. The authors also did not seem to consider the implications related to omitted variable bias. It is not demonstrated how much of the variation in the data can be explained with the single variable regression model, or what type of data was used, time series or cross-sectional data. In the case time series data was used, the model specification should be dynamic, in order to avoid serial correlation in the error term. And even then the variables would need to be tested for unit roots, which could have important implications for the model specification. Overall, this section does not provide evidence of validation and much more information would be required in order to have confidence in the results of the ICF Model.

Unconstrained Outputs (p. 11). The outputs presented on page 12 result from the above assumptions with respect to GDP projections, market maturity, point of sale and transfer shares. In addition, for the "*transfer markets, the likely trend of more direct flights and more competition from alternative hubs has been reflected, which explains the transfer forecast declines in the second half of the forecast period.*" It is not clear how these factors were represented in the ICF Model and as such the results need to be looked at with caution.

A key finding is that "*Short haul markets will remain by far the largest segment of demand and provide the vast majority of total growth*" (page 13). Unfortunately, it would be difficult to reproduce this critical result. The regional aggregations of the OD matrix table (page 6), the GDP growth table (page 9), the market maturity table (page 9), the point of sale table (page 10) and the transfer shares table (page 11) are inconsistent as is a subset of these tables with respect to future time steps. It is therefore virtually impossible to reproduce the unconstrained London passenger forecasts in the table on page 12. (Incidentally, the passenger

forecasts in the bar chart on page 12 are carried out for the 2012-2052 period, whereas the determinants of the forecasts are only projected until 2050).

For example, as part of my review, I tried to carry out a rough plausibility check. The table reporting the unconstrained London passenger forecasts on page 12 suggests that the short-haul market grows by 1.5% per year through to 2050, whereas the long-haul market increases annually by a slightly larger 2.1% over the same period. However, the differences in especially the GDP growth rates and to some extent the GDP elasticities between the two markets are significantly larger (see tables on page 9), if assuming that short-haul markets relate to the EU.[1]

Yet if assuming the calculations leading to the projections on page 12 are correct, the question arises whether slightly different growth rates, elasticities and point of sale projections could have resulted in a stronger growth of long-haul passengers compared to short-haul. It is important to test the robustness of the results with respect to these critical assumptions. It would be expected that a thorough report explores these and similar sensitivities. Disclosure of such information is absolutely necessary to avoid criticism of potentially using favorable assumptions.

1.6 Airport Capacity

This section outlines the assumptions with respect to future increases in the number of passengers per aircraft, future airport capacities for LGW under do-nothing and second runway scenarios, and a declining seasonal variation at LGW through 2050. The table on page 10 summarizes the assumptions. These assumptions are presented as *key findings* on page 16.

1.7 Airline Supply/Behavior Considered

LCC Growth assumed (p. 17). This section presents a forecast of the LCC share of short-haul traffic (rather than short-haul share of LCC traffic as indicated in the caption of the upper table on page 17) and the LCC share or the share of short-haul demand (the *ICF Report* is contradictory) of the presumably London airports. For example, the report states that *"Over time this share of LCC traffic is*

[1] As can be derived from the GDP assumptions reported in the table on page 9, the EU GDP is projected to double between 2012 and 2050. Assuming the GDP growth rate for the long-haul market to be a rather modest 4%/yr from 2012-2025 and 3% from 2025-2050 (as a rough GDP-weighted average across the geographic regions), the related GDP multiplies by a factor of 3.4 between 2012 and 2050. The growth in passenger flows then results from exponentiating these factors by the respective elasticities, assumed to be 0.8 for short haul and a rather conservative 1.0 for long haul (based on the GDP multipliers table on page 9). Consequently, the average annual passenger growth rates result in 1.4% for short-haul (which is close to the reported 1.5%) and 3.3% for long-haul (which is significantly larger than the reported 2.1%). Of course, the calculation would also need to take into account the point of sales projections. However, even after accounting for point of sales shares of 60%UK/40%non-UK, the long-haul growth rate only declines to 2.5%, which is closer to but still larger than the 2.1% reported. In my view, the *ICF Report* should have made it easier to reproduce the results. Such challenges along with the remaining gap in long-haul passengers to the *ICF Report*'s results don't increase my confidence in this report's results.

forecast to grow to around 70% of onboard demand, even higher when excluding transfers from the system." (p. 17).

It is not clear how this growth was forecasted and what assumptions were used. Without such information, this result has to be looked at with caution. It could also be that the forecast is simply an assumption, as implied by the section title ("LCC Growth assumed").

Airport Charges & Efficiency (p. 18). While the demand model underlying the passenger flows in an unconstrained scenario in section 1.5 appears to exclusively rely on GDP as an explanatory variable, airport charges now seem to have been included to evaluate the impact on passenger demand under an airport expansion scenario. The underlying rationale is that the airport expansion costs will be passed on to passengers in terms of airport charges. This section reports price elasticities from a 2004 review, which range from -1.74 to -0.20, depending on the demand segment and the studies underlying that review. It remains unclear what elasticity within that range the *ICF Report* is based on.

The upper table on page 19 reports the typical airline cost per seat for short-haul markets at LHR and LGW in 2013 and for LHR in 2030. It is not clear why the 2030 LHR costs increase (although longer taxi times at LHR are mentioned), why no LGW projections are shown, and what the underlying fuel price assumptions are. In addition, the bottom table on page 19 and the demand equation are not explained.

1.8 Capacity and Spill

This section of the *ICF Report* outlines the rules underlying the capacity assignment to London airports under airport capacity constraints. The assignments of traffic to the various London airports seem to be mechanistic (page 21) rather than based on a rigorous quantitative economic model.

This can be seen from the so-called modeling steps: *"If no capacity available then demand is assumed spilt to other airports, or lost from system"…. "Demand is spilt around the London system according to traffic allocation rules that take into account supply side factors".*

It is not clear under what conditions demand was assumed to be spilt or lost, i.e., what the model specification is, how it was estimated, and the coefficients and test statistics are not set out. Nor is it clear, what traffic allocation rules and what supply factors were considered and how they were implemented into the model. The word "assumed" appears five times on 3 pages (pp. 21-23) when describing the ICF model with respect to assigning air traffic to London airports. Without providing more information, it is not possible to disprove that the ICF model to be only a set of assumptions. Due to the limited information given, I was not able to understand how the outputs discussed on pages 22, 23 were generated. Therefore, the results should be treated with caution.

In addition, the first key finding of that section does not seem to be a finding, but

rather a consequence from earlier assumptions made on page 22 and in section 1.7: *"In an expansion scenario Gatwick can significantly increase its share of all market segments "*

1.9 Short Term Performance

This section presents updated base year passenger flows at London airports related to 2012/13, although the table on page 25 only refers to 2013. This table also compares the 2025 projections of the *ICF Model* to those of the Airports Commission for a "do nothing" ICF scenario (without indicating a specific Airports Commission report or scenario).

There seems to be a difference of 5 million passengers in the base year when comparing this table to the 2012/13 figures one on page 7. According to the *ICF Report "Some of the inputs were updated to reflect the latest trends and the short term outputs by airport are validated against the latest information available…".* However, it is not clear from the provided information what inputs were changed and to what levels. It would be also important to understand how these changes affect the long-term (2050) projections.

In addition, the ICF Model is based 2025 passenger projections for LGW and STN which are 15% and 38% larger than those form the Airports Commission. Without any further information, it not clear why these differences occur and how large they were before updating some of the inputs. As described in section 1.4 of this review, inconsistencies in base year passenger flows by airport exist between the ICF Model and the Airports Commission. These differences could affect future projected levels.

Because of the lack of basic information, the first conclusion *"The* ICF model *generates outputs in line with short-medium term airport expectations which are in line with latest information available"* is of limited value. In addition, the second key conclusion "*Stronger short-medium term growth rates are possible at Gatwick and Stansted than the DfT model predicts"* seems to be based on assumptions rather than a rigorously estimated model.

1.10 Overview of Scenarios

In this section two airport expansion scenarios are summarized in addition to a "do minimum" base case. The scenarios include airport charges associated with a second runway at LGW and a third runway at LHR, but no evidence is provided of how these charges were derived. Nor is it clear how these costs relate to the typical airline costs per seat that are shown in the upper table on page 19.

1.11 Gatwick Outputs

This section contains the outputs for the three scenarios described in section 1.10. The value generated by this section is questionable as the airport related passenger flows are based on the total projected unconstrained demand and the airport allocation rules. Because more information would be required to

understand the underlying models, the presented results should be considered with caution.

The section describing the results of a third runway at LHR makes that case that the higher costs of building that runway compared to a second one at LGW would result in higher airports charges compared to LGW. As a result "*less of London's unconstrained demand is satisfied since Heathrow is too expensive*". This conclusion seems to be based on a static perception of demand and supply. Basic economics suggest that if supply exceeds demand, the price (here airport charges) will drop until a new equilibrium (at a higher demand level) is reached.

1.12 Destination Analysis

In this section, the connectivity of London airports is examined for different airport expansion scenarios. It concludes that a second runway at LGW is preferable to a third runway at LHR, because "*more airports can be served from the London system in 2050*" (p. 32). These results heavily depend on the ICF Model and are therefore subject to the criticism outlined above with respect to model specification and estimation, validation and sensitivity tests, along with largely assumptions-based outputs. Thus, the results should be looked at with caution. In addition, the outputs presumably depend on the London airport capacity assumptions made in the table on page 26, although no reference is made. For the three scenarios considered, this table reports the largest LHR and LGW combined capacity for a second runway at LGW. Thus, all else being equal, the number of connections is largest in this capacity expansion case.

References

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