
The effect of congestion at Heathrow Airport

Comments on Frontier and FTI reports

RBB Economics, 19 February 2019

1 Introduction and executive summary

The present note, prepared by RBB Economics at the request of British Airways and International Airlines Group, contributes to the economic analysis on the effect of congestion at London Heathrow Airport (“**Heathrow**”), which is by now a well-established fact. One issue that was brought to the forefront is the extent to which the shortage of slots at Heathrow gives airlines that use these slots the ability to raise ticket prices, thus enabling them to realise so-called *scarcity rents* (i.e. returns earned in excess of normal profits from holding a scarce good).

RBB’s analysis follows on two recent reports, by Frontier Economics (the “**Frontier report**”) and FTI Consulting (the “**FTI report**”), which argue that airport congestion at Heathrow may have led to higher ticket prices. We disagree with the claim of the Frontier report both on theoretical and empirical grounds (see Section 2).

First, Frontier’s conclusions are unreliable as they are based on an overly simplistic framework which omits two crucial economic aspects of the industry: that airlines compete to transport passengers on city-pair markets; and that the shortage of available slots does not imply that airlines cannot offer more seats on city-pairs on which they compete.

Second, Frontier’s conclusions are not supported by its econometric analysis as it is deeply flawed. In Frontier’s econometric analysis, the effect of congestion on ticket prices at Heathrow is not directly estimated but is assumed to correspond to the price difference that is left unexplained by the regression model. By doing so, Frontier’s analysis fails to take into account other factors relevant to ticket prices, mistakenly attributing their impact to the effect

of congestion on prices. Crucially, we consider that the empirical approach that Frontier pursues cannot be adjusted to correct for this flaw, even if it were to adopt the recommendations provided by FTI.

Instead, we consider a relevant economic framework to analyse how the shortage of slots may impact airlines, and we conclude that congestion at Heathrow airport is unlikely to affect passenger ticket prices (see Section 3):

- Even if Heathrow runs at full slot capacity, the supply of seats on a given city-pair market can be increased, by increasing the number of seats per flight; by using or acquiring additional slots to serve that city-pair market; or by using slots at different airports;
- While slot congestion may lead to an increased cost of slots, this increased cost is not expected to be passed on to passengers in the form of higher ticket prices.

2 Frontier's analysis of airport congestion is flawed

The central thesis of the Frontier report is that capacity constraints at airports lead directly to higher ticket prices. This thesis is based on an “*economic theory of capacity constraints*”,¹ and empirically tested through a “*detailed econometric analysis to estimate the cost of the [scarcity rent] today*”. Frontier’s econometric analysis finds that, in 2016, “*ticket fares at Heathrow were on average 23.3% higher than at other London airports and 24.4% higher than at other European hub airports, due to the congestion premium*”.^{2 3} The FTI report provides a detailed critique on Frontier’s econometric analysis, and highlights some key conceptual limitations to Frontier’s analysis. Nevertheless, FTI appears to consider that airport congestion necessarily gives rise to scarcity rents that may well accrue to airlines.

We do not agree with the conclusion of the Frontier report on the impact of congestion on ticket prices, both on theoretical (see Section 2.1) and empirical grounds (see Section 2.2).

2.1 Frontier's analytical framework has fatal shortcomings

The Frontier report introduces a simplistic framework to analyse the impact of airport congestion. The framework finds that when demand for seats exceeds seat capacity, this results in excess profits that would not have been earned by airlines in the absence of the alleged binding constraint on capacity. In Frontier’s view, the shortage of slots at Heathrow would lead directly to a ticket price increase, as airlines would be unable to supply more seats (i.e. more flights) to transport more passengers.

However, Frontier’s framework is too simple, and as a result its prediction that congestion would give rise to a premium on ticket prices at Heathrow is not reliable.

¹ Frontier report, p. 20.

² Frontier report, p. 28, emphasis added.

³ Frontier report, p. 5.

First, airlines compete to transport passengers in city-pair markets. FTI notes that the “*Frontier report inherently considers Heathrow airport to be a single market*”.⁴ FTI further remarks that “*with numerous airlines operating out of Heathrow, and not all airlines serving the same routes, air travel to and from Heathrow is perhaps more accurately represented as a collection of individual markets*”.⁵

This implies that the assessment of airport congestion should focus on airline competition on city-pair markets. This also implies that such an assessment should take into account the extent of congestion in the greater London area, as airlines are able to add seats from other London airports.

Second, the shortage of available slots does not imply that airlines cannot offer more seats on city-pairs on which they compete. Indeed, the FTI report notes that “*passengers purchase seats, whereas the direct constraint in the market is on the slots available to airlines*”.⁶ In its report, Frontier fails to establish a clear link between the shortage of slots and a shortage of seats on a given city-pair market, nor does it explain how such a link could work in theory.

As will be discussed in Section 3, taking into account that the capacity constraint is on slots and not on seats has important implications on (i) the extent to which airlines’ seat capacity on city-pair markets is constrained; and (ii) the extent to which airport congestion gives rise to higher ticket prices to passengers.

2.2 Frontier’s empirical approach is unreliable

We agree with FTI that the results of Frontier’s econometric analysis are unreliable. Crucially, unlike FTI, we consider that the empirical approach that Frontier pursues cannot be improved to provide evidence for the existence of scarcity rents, even if it were to adopt the recommendations provided by FTI.

The Frontier report develops an econometric analysis to quantify the impact of congestion at London Heathrow on ticket prices. In a nutshell, the regression model compares average ticket prices in 2016 using a sample of flights from the different London airports, namely Heathrow, Gatwick, Luton, Stansted and City airports controlling for other factors which may determine the difference in prices between airports.⁷⁸ Importantly, the regression model includes a Heathrow dummy variable, which indicates by how much on average ticket prices of flights from Heathrow differ from ticket prices of flights from other airports. The analysis finds that, in 2016, “*ticket fares at Heathrow were on average 23.3% higher than at other London airports [(implying a one-way mark-up of circa £59)], due to the congestion premium*”.⁹

In its report, FTI lists a number of valid concerns with Frontier’s econometric approach.

⁴ FTI report, paragraph 4.24

⁵ Ibid.

⁶ FTI report, paragraph 3.12

⁷ The Frontier report presents another, similar analysis that compares ticket prices at Heathrow with that at other major European airports.

⁸ The regression analysis controls among other things for distance, whether it is a long-haul flight, and the number of flights (frequency).

⁹ Frontier report, p. 28, emphasis added.

The main critique offered is that the Frontier econometric analysis is based on a *residual approach* to estimate the congestion premium, in which the effect of congestion on ticket prices at Heathrow is not directly estimated but is assumed to correspond to the price difference that is left unexplained by the regression. However, Frontier's econometric analysis fails to take into account other important factors, which may affect the difference in ticket prices. For example, their analysis does not account for (perceived) quality differences between airports; for the effect of competition on the price levels in city-pair markets; and for (non-passenger-related) airport charges, which may differ between airports and can explain a significant part of the observed difference in ticket price between Heathrow and other airports. Frontier's analysis attributes the impact of these important factors to the effect of congestion on prices, yet this is clearly wrong.¹⁰

In any event, we consider that Frontier's regression analysis cannot be improved due to the inherent flaws in its set-up, as it is not possible to account for all Heathrow-specific variables separately. In a cross-section analysis such as the one presented by Frontier, this implies that the only conceivable way to guarantee that all Heathrow-specific factors are accounted for, is to introduce in the model a dummy variable for Heathrow. This is exactly what Frontier does, but it makes the mistake of interpreting this variable as capturing only the effect of Heathrow congestion on prices.

It should also be noted that, as will be shown below, there is no theoretical basis to assume that congestion would lead to higher ticket prices. It is, therefore, highly likely that any ticket price premium measured by Frontier reflects Heathrow-specific factors that are unrelated to congestion.

3 Heathrow's congestion is unlikely to cause ticket prices to increase

Slots are a necessary input for airlines to serve passengers on city-pair markets. Airlines have to obtain slots for landings and take-offs in advance (at least at slot-controlled airports). This is particularly the case for city-pair markets involving London, where airlines have to use a slot that they may request from slot coordinators at the various London airports.¹¹

When slots are in shortage, this may affect airlines' operations, but this would not give rise to a ticket price increase, contrary to what Frontier, and to a lesser extent FTI, predict. There are several reasons why Heathrow congestion is unlikely to cause ticket prices to go up:

- Even if Heathrow runs at full slot capacity, the supply of seats on a given city-pair market can be increased, by increasing the number of seats per flight; by using or acquiring additional slots to serve that city-pair market; or by using slots at other airports (see Section 3.1);

¹⁰ On a technical level, the residual approach also leads to omitted variable bias, which implies that the estimation methodology applied by Frontier leads to inconsistent, biased, and hence unreliable results.

¹¹ Five London airports, City, Gatwick, Heathrow, Luton and Stansted are slot-coordinated airports. London Southend is not.

- While slot congestion may lead to an increased cost of slots, this increased cost is not expected to be passed on to passengers in the form of higher ticket prices (see Section 3.2);

3.1 Seat capacity may be increased even if there is a shortage of slots at Heathrow

A shortage of slots does not automatically imply that airlines cannot offer more seats to transport passengers. Indeed, the supply of seats on a given city-pair market can be expanded through a number of ways.

First, airlines can alleviate the impact of congestion and transport more passengers per flight by using larger aircraft (*up-gauging*), improved yield management and higher seat density of existing aircraft. The available evidence indeed suggests a significant increase in the number of passengers per air traffic movement between 2011 and 2018, a period during which congestion further increased.

Second, airlines can also increase seat capacity by either re-directing slots from another city-pair market served from the same airport, or by trading slots. Slot trading was approved by the UK High Court in a ruling over a slot deal between British Airways and KLM in 1999, and has since taken place on numerous occasions, in particular at Heathrow.¹²

Third, airlines can increase seat capacity by flying from other (non-congested) London airports. Indeed, as competition for passengers takes place on city-pair markets, airlines operating from Heathrow are competing with airlines that fly from other London airports on the same city-pair markets. As such, the supply of seats on city-pair markets involving London can be expanded by increasing seat capacity at other London airports, not just Heathrow.

That airlines that fly from different London airports compete with each other is evidenced by two sets of econometric analyses, which show that rival airlines operating from other London airports exert a significant competitive constraint on British Airways (“BA”) at Heathrow.

The first econometric analysis examines the extent to which entry or exit on a city-pair at another London airport would significantly affect BA’s ticket price on flights operated from Heathrow. Specifically, this analysis tests whether entry (exit) by a competitor at another London airport has a significant negative (positive) impact on BA’s ticket price on flights operated from Heathrow, by comparing the evolution of BA ticket prices on city-pair markets where entry or exit occurred against the evolution of BA ticket prices on markets where neither entry nor exit took place. The results show that entry (exit) on a city-pair by a competitor at another London airport leads to a statistically significant reduction (increase) in BA’s ticket price at Heathrow.

The second econometric analysis examines how a change in the share of seat capacity held by competing airlines that operate from other London airports affects BA’s ticket price at Heathrow on the same city-pair markets. Specifically, this analysis tests whether an increase

¹² House of Commons Airport slots briefing paper, page 6.

(decrease) in the share of seats held by BA's competitors at other London airports, has a significant negative (positive) impact on BA's ticket price on flights operated from Heathrow. The model finds that a 20%-point increase (decrease) in seat share in the hands of all competitors at other London airports leads to a statistically significant reduction (increase) in BA's ticket price at Heathrow.

The results of these econometric analyses thus confirm that airlines operating from other London airports exert a significant constraint on airlines operating from Heathrow on the same city-pair market.

3.2 The cost of congestion is unlikely to be passed on to passengers in the form of higher ticket prices

While slot congestion may raise the cost to airlines of using slots, this cost increase is not expected to be borne by passengers through higher ticket prices.

First, the direct impact of congestion is to raise the cost of using slots to airlines. If slots are widely available (and the supply of slots exceeds demand), the cost of slots would be zero since they have no alternative use. However, as slots become scarce (i.e. the supply of slots is not sufficient to satisfy demand), their value increases, as a slot used for one frequency cannot be used to operate another one. Slot scarcity therefore raises the opportunity cost of using them, and naturally, airlines become more selective, choosing to operate only frequencies that earn sufficient profits to justify the increased *opportunity cost*. Following congestion, airlines will therefore reshuffle the slots they currently have to optimise their operations, enabling them to earn enough to compensate the opportunity cost of the slot. Alternatively, they may simply trade slots to other airlines, if these would use the slots more effectively.

The above mechanism also applies when network effects are taken in consideration. When taking a decision on which frequency to allocate a slot to, airlines take into account the impact of that choice on overall profitability, i.e. considering the impact of operating a frequency on their performance on other (complementary) city-pair markets.

Further, the mechanism by which slot congestion pushes airlines towards operating more profitable frequencies works under the assumption that the airport is slot congested. Contrary to what the FTI report claims, there is no obvious connection between airport congestion and a restriction on the supply of seats on city-pair markets.¹³ Capacity on a city-pair market can always be increased by increasing the seats per flight; by acquiring or re-directing slots; or by using slots at other airports. Slot congestion does not lead to capacity constraints at the city-pair level; rather it raises the cost of using slots. Although this might lead airlines to abandon some frequencies (as the slots may be more profitably used elsewhere), and possibly withdraw from some city-pair markets, the shortage of slots does not automatically restrict the supply of seats on city-pair markets.

¹³ FTI report, paragraph 6.14 and following.

Second, the increase in the cost of using slots, which accompanies congestion, is, however, unlikely to be passed on to passengers. This is because, slots, if valuable to airlines, are fixed cost investments. To see this, consider the following two scenarios:

- An airline acquires a slot from another airline to operate a new frequency at a congested airport. To do so, the airline in question will have to compensate the airline holding the slot. This payment represents the cost of the slot, which constitutes an upfront, fixed investment. In other words, irrespective of the number of passengers that the airline in question will eventually transport on this new frequency, the acquisition cost of the slot will not change. As that expense will be incurred before operating the new frequency and will be the same irrespective of the number of passengers, this cost is not expected to determine prices.¹⁴ In principle, only changes in the cost that vary with the number of passengers transported are expected to affect prices.¹⁵ This is also acknowledged by the CMA's latest report on airport slot allocation, stating that "*it is [...] not clear that airlines would pass on the costs [of higher prices for slots at constrained airports], because [...] if slot payments were required to be paid upfront, [they] would represent a fixed (sunk) cost rather than a variable cost*".¹⁶ In summary, even if an airline must pay for slots, this should not directly affect ticket prices.
- An airline already holds and uses slots, but congestion at the airport in question has grown such that slots are no longer available for free. In this case, the use of slots gives rise to an opportunity cost. By using these slots whilst they could be employed elsewhere more profitably, the airline foregoes revenue either for its own use on another city-pair market, or from a potential trade. As congestion increases, the opportunity cost may increase. However, this too represents a fixed cost such that it is unlikely to alter an airline's pricing decision.

¹⁴ Clearly, airlines will pay this cost only if they expect that they would earn sufficient revenue to cover that expense. This means that they will ensure that sufficient passengers are transported using the slot.

¹⁵ This is because when a profit maximising firm raises prices, its output declines, yet this will not result in any fixed cost saving. Fixed costs do not vary with output. That implies that fixed costs are not taken into account by firms when they set prices to maximise profit. For more details, see RBB report for the Office of Fair Trading on Cost pass-through - https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/320912/Cost_Pass-Through_Report.pdf

¹⁶ Advice for DfT on competition impacts of airport slot allocation, CMA, paragraph 5.