Is the “Gateway” Concept Useful or Relevant to the Passenger Aviation Market?

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INTRODUCTION

A recent International Conference on Gateways and Corridors held in Vancouver in May 2007 focused for the most part, on the freight market and how marine ports, with well developed corridor services can increase the attractiveness of the port to shippers, increase the throughput of the port and thereby provide additional economic activity in the gateway and corridor region. This paper focuses on the passenger air transport market and asks whether the gateway concept is useful or indeed relevant to an industry unconstrained by the geographic imperatives that the freight market, with its need to tranship goods, is.

Morrison (2007) provides an excellent summary of the Vancouver conference findings and highlighted ten key issues that the papers offered identified. Some of the issues summarised by Morrison are considered here to assess whether they have similar resonance in the passenger aviation market. This paper will therefore evaluate whether congestion is an issue for passenger gateway airports, consider the importance (or otherwise) of airport pricing for competing gateways, discuss border effects and assess the potential impact of regulatory liberalisation and corridor investments on gateway attractiveness.

Are there such things as passenger gateway airports?

The definition of the a gateway freight port was established as being a port situated on the border between in some way fertile land and in some way infertile land or at a barrier to trade (Burghardt, 1971). For most freight markets a gateway is, therefore, a coastal port. The definition of “fertile” in this sense is taken to mean capable of supporting economic activity, but given that fishing, water sports, diving, etc. all occur on or in the ocean, it too can be considered as being capable of supporting economic activity. A more useful definition of a (freight) gateway port may be the point of entry for goods transported via the sea and requiring some transhipment into other forms of transport such as road, rail, air, or inland waterway, or as the point of departure for export goods. Major gateway ports such as Rotterdam, Antwerp, Shanghai, Hong Kong, New York, Los Angeles, Seattle are

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1 The author would like to thank David Gillen for providing the opportunity to develop this paper, my colleague Ian Stockman for assisting with data collection and Dr W. Morrison for useful discussions that helped focus the direction of the paper.
examples of ports, located at the edge of a continent, at which goods are transhipped from ocean going container and bulk vessels onto smaller vehicles/vessels to be distributed onward inland, and *vice versa*.

Freight gateways are taken to differ from freight hubs in terms of the shape of their hinterland - the area, which supports and is supported by the port. While hubs have circular shaped hinterlands serving lands that surround it, gateway hinterlands tend to be cone shaped (Parsons, *et al.*, 2007). The size and economic power of a gateway hinterland is, therefore geographically limited as its hinterland does not fully surrounded it. Of course the historic development of gateways cities tend to make them more economically vibrant than cities further inland - major cities tend to be on or near the edge of continents.

The location of these sea/land interchange ports are often historic in nature and tend to be based on strategic/geographic location, draft of the harbour, tidal currents and effects, and other vessel based considerations. In the aviation business such considerations are largely irrelevant. Being unencumbered by transhipment requirements, with airplanes capable of carrying passengers to whichever location is required, airlines can serve the airport best suited to their economic and strategic needs and also the demands of their travelling customers. In other words passengers can fly to the city they want to go to and airlines can fly directly there as long as it is in their economic interest. The needs of the passenger and the airline are generally mutually inclusive and the cities (and airports) served are those that have a strong “natural” demand for transport services. The restrictions on this freedom are the regulations applicable for services between any two points, the technical capability of aircraft, and the availability of spare capacity at the preferred airports.

The aviation industry’s growth is largely based on bilateral governmental arrangements that have restricted the airlines that can fly between countries, the amount of capacity they can provide, the prices that they can charge, and the points of entry to the countries. Consequently most countries have had designated “international gateway” airports that historically have provided aviation entry points to the country. These airports were invariably selected as the preferred airport gateway for a number of commercial, political and strategic reasons. As aviation has been increasingly liberalised, airlines are faced with a much wider choice of airports they can serve within a country. As commercial aircraft have increased in range, the number of entry points for inter-continental services have also expanded, extending competition between potential entry points. For example, UK airlines now have the freedom to use any US airport under the new “open skies” agreement. Of course, following years of restricted bilateral agreements, the “international gateway” airports have grown into large (commercially) attractive airports that have strong advantages over alternative airports looking to develop gateway strategies.

If passenger aviation is not constrained by the necessity for passenger transhipment at the edge of a continent and not forced to serve governmentally preferred entry points, what is a gateway airport? Airport gateways to regions, be they urban (for business, and visiting friends and relations (VFR)), rural (for farming), mountain, country, beauty or beach (for leisure) can be located at the edge of or indeed the centre of such hinterland regions without the need for long corridors to bring the passengers from the edge of a continental coast to the
geographic point of purpose. What then, if anything makes an aviation gateway different from a hub? In passenger aviation, a hub airport is usually considered to be an interchange, or connection point. Hubs transfer passengers from intercontinental services onto local (corridor/spoke) services. Hubs also connect passengers from a large number of places within a continent to many other places. Given this dual role it would seem more likely that hubs would be located towards the centre of the continent to reduce the total combined distances when connecting passengers. Vancouver International Airport, by contrast, suggests that it "enables British Columbians to welcome the world, pursue their business goals and embrace family and friends. YVR is the closest [Canadian] major West Coast airport to Asia, a region that is emerging as an economic powerhouse. The Airport Authority's vision is to continue to develop YVR as a premier global gateway, connecting the Asia-Pacific region and the Americas." Here the airport authority suggests the airport is a conduit for business development with the Asia Pacific region, and a jumping off point to the state of British Columbia. A gateway airport's specific purpose, would seem therefore, to provide an entry and distribution point for intercontinental passengers.

Direct proximity to the Asia Pacific region might make it a logical entry point to the Pacific Northwest for passengers from that region, however in a fully liberalised market, Seattle might serve the market just as well. Also improvements in aircraft technology have meant the ranges of aircraft have increased; Calgary or indeed Toronto might provide suitable alternative jumping off point for such traffic. Of course, the final destination of the passenger is key. If the final destination is not one of these "gateways" or their hinterland, the quality of passenger connections, and the minimum total elapsed time may be used to attract more traffic.

A SIMPLE ANALYSIS OF PASSENGER GATEWAYS AND HUBS

To investigate the nature of passenger gateways and hubs, various data for a bundle of twenty-three major airports in North America, Europe, the Middle East and Asia were collected. The airports were selected to provide a range of what might be considered hub and gateway airports.

From North America four Canadian and ten US airports were selected. Vancouver, Calgary and Montreal were selected as being close to the edge of the North American continent and Toronto as a main Canadian economic centre within the continental interior (although on the edge of the Great Lakes economic region). Within the US, three west coast (Los Angeles, San Francisco, and Seattle), and five east coast (Washington, Newark, La Guardia, JFK, and Boston) gateways were selected. Atlanta and Chicago O'Hare completed the list as two interior airports.

Within Europe five airports were examined. The three largest airports, Paris CDG, Frankfurt and London Heathrow were included. Madrid Barajas was selected as being a main airport with a limited hinterland and limited competition from nearby airports. The final European airport selected was Amsterdam with a small local population and situated geographically nearby a number of other major airports.

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2 The three New York airports were selected to investigate a multi-airport system.
In the Middle East the case of Dubai was considered. A rapidly growing airport greatly supported by the local government as part of strategy to develop the emirate as destination, an over-night stop-off point for inter-continental travellers, and an engine for economic development. It also is close to Abu Dhabi a close airport where the emirate is attempting to develop its airport in a similar fashion to Dubai.

In Asia three major gateway airports were considered: Hong Kong, Singapore, and Tokyo Narita. All of these airports are situated on the Pacific Rim. Political issues combined with Hong Kong’s location, and economic freedom has provided opportunities to serve as a main South East Asian gateway to China. Singapore has developed a hub and gateway strategy to bring economic activity to this small island state. Tokyo serves as the main entry point to Japan and also as a gateway to North East Asia.

The following data for 2006 were collated for each airport\(^3\) (sources in brackets):

- Annual Air Traffic Movements (rati.com)
- The number of airlines serving the airport (rati.com)
- Annual Passengers split by domestic, international, and connecting (airport websites)
- Passenger splits by domestic, non-domestic continental, and inter-continental origins (rati.com)
- Market share (by seat capacity) of dominant airline (OAG)
- Aeronautical and non-aeronautical revenues (airport websites and personal contact)
- Metropolitan population of airport location (wikipedia)
- Country Size, Population and GDP (World Bank)
- Distance to nearest political border (Google Earth)
- Distance to continental coast (Google Earth)
- Distance to nearest main competing airport (Google Earth)

Figure 1 shows the passenger profile of the selected airports. The vast majority of passengers at Atlanta and Chicago are from continental origins, of which very few are from Canada. Here their role as central continental interchange hubs would seem to be fairly clear. Los Angeles and New York JFK have large intercontinental markets providing major east and west coast entry points for North America. Of the Canadian airports, Toronto has the largest volume of intercontinental traffic. Vancouver and Montreal have very similar profiles while Calgary’s market is dominated by domestic Canadian traffic.

Heathrow is the largest of the European airports with the most intercontinental traffic. Paris and Frankfurt have similar continental markets but Paris has a significantly larger volume of intercontinental passengers. The three Asian airports have similar profiles. Two-thirds of passengers at Hong Kong and Singapore are intercontinental, while this proportion is even higher for Narita. For Tokyo little traffic is domestic with much of the rest of passengers being from other Asia origins/destinations.

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\(^3\) NB: Not every data items were available for every airport.
When looking at the proportional splits (Figure 2) the importance of continental traffic (with the exception of JFK) for the N American airports is clear. The similarity between LHR, CDG, SIN, and HKG becomes obvious.

If a hub airport is principally designed to channel and transfer/connect passengers from one spoke onto another, the proportion of all passengers terminating at the airport will give an indication of whether the airport is mainly a gateway to a particular hinterland or principally a hub/connecting sight.

**Figure 1: Passenger Traffic at selected airports**

![Passenger Traffic at Selected Airports](image1)

**Figure 2: Passenger Segmentation**

![Passenger Segmentation](image2)

A correlation of distance from the continental coast and connecting traffic at 0.712 provides some evidence (although on a small sample) that major airports located
further away from the edge of a continental coast are more likely to have a hubbing role, while airports near the continental coast have more terminating “gateway” passengers.

Figure 3 shows the proportion of all traffic that is connecting over the sample airports and are not terminating passengers. In addition to being the largest airports in the sample, Chicago O’Hare and Atlanta have very large connecting passenger numbers.

**Figure 3: Proportion of connecting traffic at selected airports**

Frankfurt and Amsterdam are the next largest connecting airports. With just under 30% connecting passengers a number of coastal North American carriers are close together in the centre of the chart with the about seven in ten passengers using the airport as a gateway to the local region.

It would seem obvious, therefore, that a main distinction between a passenger hub and a gateway is its location. Clearly a gateway airport needs to be well located to receive passengers from their origins and channel them (intermodally) onto the local destinations. For hub airports the location is less important than for gateway airports as the number of passengers terminating at the hub is proportionately lower.

Hazledine (2007) highlights the argument that the economic size and importance of a city will influence the number of travellers wishing to travel to it and uses gravity models to assess the impact of various limiting factors on passenger numbers. For some airports in the analysis group, the economic activity and location of the airport would not seem “naturally” sufficient to justify the number of passengers that use the airport. Airline hubbing strategies or the strategies of the airport authority and/or local government have the ability to develop the airport as a hub.

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4 Unfortunately connecting passenger proportions were not available for Dubai and the Asian airports and thus are excluded from this analysis.
Figure 4 shows the number of passengers that use the airports per member of the local metropolitan population. Assuming a similar propensity to travel irrespective of wealth (Swan, 2002)\(^5\) we can look at the airports for which we did not have connecting traffic proportions to assess whether they are more likely to be hubs or gateways. For airports that have a large proportion of travellers connecting the number of passengers brought to the airport are likely to be higher than gravity models would suggest due to the size and economic activity of the local area. It can be seen that Amsterdam is by some degree the airport that has most passengers per metropolitan population. However, in Amsterdam’s case the definition of the metropolitan area is somewhat tricky.

**Figure 4: Passengers per metropolitan population**

The figure we have used is the official metropolitan region of Amsterdam (some 1.5m), although if we had counted the population of the Randstad region figure - a region that includes three other local cities: The Hague; Utrecht; and Rotterdam - the population figure of 6m would have considerably deflated Amsterdam’s position on this chart. Dubai has a high number of passengers per local population suggesting this airport is acting as a hub to bring connecting passengers to its city. Atlanta and Chicago also are in the left of the chart, further supporting the view that these airports’ main role are as hubs. Calgary with its small population and location on the edge of the Rocky Mountains brings more travellers than might otherwise be expected to visit this airport. The three New York airports are situated together at the far right of the chart, however, had these been treated together as a system New York would be placed slightly higher than the median airport, Montreal.

The role of the major airline at the airport was considered to see whether it had influence over the proportion of passengers were connecting. A correlation of

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\(^5\) In fact for the basket of cities in this study, a correlation between passengers and GDP/capita has a correlation coefficient of 0.59.
only 0.334 was found suggesting the dominance of an airline at an airport did not influence the hub role of the airport. In Figure 5 we see that hubs at Atlanta, Chicago, Paris and Frankfurt are dominated by the main carrier, however in Amsterdam and Dubai we find a much lower dominance of the major carrier. Both countries have pursued liberal markets for air transport and encouraged foreign carriers to operate to the city to develop inbound traffic and the hub role for its airport.

Figure 6 shows the size of the sample airports by passenger numbers (size of the bubble), the distance the airport is from the continental coast (x axis) and the size of the metropolitan population (y axis). Up to 200 km from the edge of their respective continents are the New York airports, Los Angeles, Tokyo, Hong Kong, Singapore, San Francisco, Boston, Vancouver, Seattle and Washington.

When we consider all the New York airports together there is a clear relationship between metropolitan size and passenger numbers for these gateway airports (correlation coeff 0.890).

**Figure 5: Share of seats held by the dominant carrier**

Montreal, Atlanta, Heathrow, Madrid and Paris are located between 200 and 550 km from the continental coast. With the exception of Atlanta these airports may be perceived as being a hybrid of gateway and hub. Atlanta with its significantly higher proportion of connecting traffic marks it out as a hub. The remainder of the airports in the sample would be considered as hubs. The correlation between local population and passenger numbers for these airports is only 0.570 indicating the significantly higher proportion of connecting passengers. But the dominance of the main carrier at the airport does not influence its status as a hub or gateway.
Table 1 summarises the difference between the airports in our sample in respect of distance from continental coasts, proportion of connecting passengers, number of airlines serving the different airports types, and the relationship between local population and passenger numbers.

**Table 1: Gateways, Hyrbids, and Hubs**

<table>
<thead>
<tr>
<th></th>
<th><strong>Gateway</strong></th>
<th><strong>Hybrid</strong></th>
<th><strong>Hub</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance from continental coast</td>
<td>&lt; 200 km</td>
<td>200 – 550 km</td>
<td>&gt; 550 km</td>
</tr>
<tr>
<td>Passenger numbers</td>
<td>Large proportion terminating passengers. Mainly dependent on metro population</td>
<td>Combination of connecting and terminating passengers</td>
<td>Large proportion of connecting traffic. Less dependent on metro population</td>
</tr>
<tr>
<td>Connecting passengers (average of sample in brackets)</td>
<td>&lt; 25% (ave. 20.6%)</td>
<td>25 – 40% (ave. 27.3%)</td>
<td>&gt; 40% (ave. 51.4%)</td>
</tr>
<tr>
<td>No of airlines serving airport</td>
<td>Ave. 52</td>
<td>Ave. 89</td>
<td>Ave. 79</td>
</tr>
<tr>
<td>Correlation coefficient between population size and total passenger numbers</td>
<td>0.89</td>
<td>N/A due to too small sample</td>
<td>0.57</td>
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</tbody>
</table>
CONGESTION

At the beginning of this paper we highlighted four or Morrison’s ten issues regarding gateways and corridors that may hold relevance for the passenger market. Certainly capacity in terms of air traffic movements (ATM), terminal capacity, and availability of infrastructure for onward travel for terminal passengers will all influence how effectively a gateway passenger airport can operate. Unfortunately capacity measures were not available for sample airports for any of these three measures. The BAA argues that Heathrow is virtually full in terms of annual ATMs (BAA, 2006) indicating that both Paris and Frankfurt’s available annual ATMs are 76% and 74% utilised respectively. It argues this lack of capacity will limit the ability of the airport to grow with only more extensive use of larger aircraft a means by which the airport can increase its throughput. Certainly BA has argued that its recent decision to purchase the high capacity A380 aircraft was in no small part aimed at overcoming the capacity restrictions it faces (Walsh, 2007). Terminal capacity at Heathrow will shortly not be a problem with the imminent opening of Terminal 5. However, Heathrow also has access problems due to congestion with severe road congestion around the airport, and under-developed rail services. With over 30% of traffic connecting at Heathrow should the airport be concerned about the possibility of that traffic diverting to less congested airports if it can replace the traffic with terminating traffic? This will largely depend on the profitability of terminating passengers compared to connecting passengers. London has such a large catchment area that this should not be an issue, however when looking at the number of passengers per metropolitan population, Heathrow’s figure was a little low compared with the other European airports, suggesting that the airport is impacted by the presence of the other London airports.

Frankfurt, Paris and Dubai by contrast do not face the level of congestion problems with spare terminal and runway capacity and with excellent road and rail connections. Dubai is currently developing a brand new airport for future developments and with unused land in the desert beyond Dubai, can build infrastructure according to the needs of the airport, passengers and to meet governmental policies to develop the emirate as a tourist destination and economic centre.

Without free capacity and the ability to handle passengers quickly and effectively, a hub type airport will always struggle to provide the connections that it bases its business model on. This can be seen at the main US intra-continental hubs that have had found passenger handling much harder in the post 9/11 security environment and this has lead airlines “de-hubbing”, “de-peakng” and building greater slack into their hub operations. Restricted capacity will be a problem for gateway airports mainly if there is a local competing airport.

AIRPORT PRICING

The charges made by the airport may impact the attractiveness of that airport to airline customers. Low cost airlines such as Ryanair have demonstrated that a price effect may be enough to alter the passengers’ favoured airport demand (Morrison and Mason, 2006) and is certainly enough to influence its airport
selection choice. Ryanair uses secondary airports to reduce cost and offer lower airfares. The airline has found a significant market that is prepared to fly to an inconvenient airport to get lower fares. In considering the gateway concept for air transport the impact of aeronautical charges may, therefore, influence airport choice for airlines. For a gateway that has both terminating and connecting passengers it makes sense to consider these passengers separately. Most gateways do not compete with suitable secondary airports alternatives, particularly long haul services, and few long haul low cost airlines. For terminating passengers the airport cost, as passed on to them in airfares, is therefore not particularly important. Passengers that want to travel to the gateway city or hinterland tend to have limited alternatives. However, occasionally the passenger demand to fly to a particular airport is tempered by the airline’s desire to find lower cost airport charges at a nearby alternative. Where there is a reasonably local alternative gateway airport pricing may influence airlines and then passengers. For example, Vancouver’s aeronautical revenues per passenger are about 50% higher than its close rival Seattle. Does this higher charging regime affect the popularity of the airport with airlines (or passengers)? As an entry point to the Pacific Northwest the border effects (see below) may be more important but to attract greater throughput and local economic development the airport authority, local government and chambers of commerce might further evaluate this area.

Connecting passengers are largely indifferent to their transit point as long as the elapsed time is minimised and the connection process is effectively handled. This can have an influence on pricing strategy. We see that the two continental North American hubs have the lowest revenues per passenger (Figure 7). And although the charges for the European airports are much higher, it is interesting to note that Amsterdam with its focus on connecting passengers due to its smaller home market, has significantly lower charges than its rivals; Heathrow, CDG, and Frankfurt.

BORDER EFFECTS

Where competing gateway airports are geographically close but straddle a country boundary, a border effect might then be relevant. Hazledine provides a useful analysis of five Canadian airports and considers the impact of border effects on the demand for international services (Hazledine, 2007). Without border effects the development of certain airports may be less likely. For example, as Dubai gets larger and stronger, one must question the feasibility of developing Abu Dhabi’s airport infrastructure and airline network. These two airports have close geographical proximity both with large amounts of spare capacity. Without inter-emirate competition and prestige the necessity to have both airports seem unjustified by demand. One might also question whether both Seattle and Vancouver would be needed as Pacific Northwest gateways if there were no border between them.

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6 European airports have a significantly different charging environment which is discussed in the annual ATRS airport benchmarking studies (http://www.atrsworld.org/airportwards.html)
Morrison (2007) highlighted that small infrastructure investments, particularly in access to corridors, can lead to step changes in attractiveness to the ports. Ensuring easy egress and onward transport links is key in developing a gateway airport, especially where suitable alternative entry points are available. Intermodal interchanges at the airport terminal with direct train or other public transit services to downtown city locations can help a gateway serve its purpose. One area which Canadian airports have worked to make their gateways more attractive is in customs pre-clearance (Kaduk and Fitzgerald, 2004).

Certainly as markets are liberalised the border effect is likely to diminish and consequently the competition to become the main gateway to a region is likely to intensify. Amsterdam benefited from the Dutch government’s first mover strategy towards more liberal air transport arrangements. With open skies agreements with many countries the local airline was able to pursue a hub strategy overcame the limitations of its small home market. However, as markets have freed within the EU and increasingly with third countries (not least the newly signed “open skies” deal with the US), Amsterdam will need to work harder to maintain its hub status. Certainly this has been achieved in the short term by KLMs acquisition by Air France as part of the deal that ensured hub activities at the airport in the mid-term. Whether this is likely to continue in the long term is less certain.
CONCLUSION

At the outset of this paper we sought to investigate whether the gateway concept is useful or indeed relevant to an industry unconstrained by the geographic imperatives in the same way that freight markets are. By investigating a bundle of airports, differences between gateways airports and hub airports, and a type we have called hybrid have been identified making their investigation relevant. Gateway airports have higher proportions of terminating passengers than hubs. Hub airports, however, seem to have a higher proportion of intercontinental traffic suggesting that these airports also act as intercontinental gateways although their prime role is intra-continental connections. The airline designation rules under bilateral agreements may well partially explain this. Depending on the passenger’s final destination gateway airports have a potential to capture a larger share of this traffic and, as markets continue to liberalise, this may be possible. The concept of a “gateway” may, therefore, be useful to help airport planners and marketers to develop their airports to better serve their potential markets. Working with local and national governments, airlines and inter-modal partners, gateway airports may well improve their offering, increase customer satisfaction, and win throughput from hub competitors and less well performing alternative gateways.

REFERENCES

Walsh, W., (2007), “BA’s current and future prospects”, Presentation to Department of Air Transport, Cranfield University, 22nd Oct