AIRPORT REVENUE MANAGEMENT: DOES AIRPORT SIZE MATTER?

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ABSTRACT
Airports today operate as business entities. Competition between airlines has revolutionized the way airports operate. There is an increasing preference for smaller airports. This has improved the economic and financial viability of small and medium airports from non-aeronautical revenue. An empirical study examines the relationship between airport size and airport profits. There is no statistically significant evidence from the results to suggest that small/medium airports are less profitable than major hub airports as the former reconfigure their activities in response to changing circumstances.

INTRODUCTION
Airports today operate as business centers focusing on revenue and cost management, optimizing yields and profitability. It was estimated that in 2010, $350 billion was required to maintain and upgrade airport infrastructure (Enright and Ng, 2001). Inefficient and publicly operated airports have failed to maintain profitability. As such many airports are in the process of privatization (Oum *et al*., 2002). Airport managers need to understand cost and revenue structures to ensure a viable and sustainable financial return on airport investments and reduce deficits. Airports are directly impacted by the events, deregulation and business cycles which affects passenger traffic (Barrett, 2000). In recent years however, the expansion of the low cost sector has led to a return to the point-to-point system that existed before deregulation, and a preference for secondary airports. Competition between full-service airlines (FSAs) and low-cost carriers (LCCs) has resulted in increasing competition between airports as the latter become part of the competitive strategy of airlines. The development of major hub-gateways and secondary airports has led to the repositioning of airports to meet the needs of airlines operating with new business models (Carney and Mew, 2003).

A key consequence is the innovative optimization of airport revenues on aeronautical activities and non-aeronautical or commercial sources (Doganis 1992). In recent years, airport managers have diversified revenue sources through various strategies including raising existing fees and rental rates, using competitive bidding for concessionaires' contracts and exploiting new or untapped sources of revenue. This has resulted in non-aeronautical revenue (also known as concession revenue) accounting for a high percentage of total revenue in major airports. International Civil Aviation Organization (ICAO) estimates that about 30 percent of airport revenue was from non-aeronautical activities in 1990. Airports Council International's (ACI) suggest that this rose to 51 per cent in 2000, and to 53.5 per cent in 2001 (Duty Free World Council, 2005).

The reasons for business diversification are twofold. First, the slowdown in the rate of increase of airport charges levied on airlines for use of airport facilities. This has remained relatively static at 4% of airline operating costs for the past twenty-five years. This has partly due to concerted government policies to encourage tourism and partly due to the airline authorities operating on limited margins and keeping fares low (Humphries and Francis, 2002). Second, aeronautical revenues have been greatly affected by the volatility of the airline industry, magnified after September 11, 2001. Airports and airlines consequently suffered from fluctuations in passengers and airline traffic. High fuel prices have aggravated the situation. The focus on revenue generation from non-aircraft related commercial activities is well documented (Business Source Premiere, 2005, Suvarnabhumi Airport Thailand, 2006).

As the aviation sector inches towards deregulation and cautious liberalization of routes and regions the dynamic change characterized by hub-and-spokes and point-to-point connections has led to interests in small and medium-sized airports tapping to generate commercial revenue streams. The primary objective of this study is to investigate if airport profits are influenced by airport size or other variables such as the level of business diversification and ownership factors. Regression analysis based on cross-sectional datasets for Asia-Pacific, European and American airports is used to assess these factors.

AIRPORT PERFORMANCE

Several studies have attempted to measure the performance between privatized airports (without distinguishing the extent of privatization) and the publicly owned/operated airports are not conclusive. Gillen and Lall (1997), concluded that privatized airports in the US have significantly lower landing fees and retail prices and higher revenues and argued that government owned and operated airports have significantly inefficient. Parker's (1999) study of British airports concluded no discernible difference. Domney et al., (2005) suggest a negative relationship between privatization and profitability in a study of airports in Australia and New Zealand. The verdict is also mixed on airport size, productivity and performance (Nyshadham and Rao, 2000, Martin and Roman, 2001, Martin-Cejas, 2002, Sarkis, 2000). Bazargan and Vasigh (2003) suggest that small airports consistently outperform the larger airports in terms of efficiency. The point is the extent efficiency translates into revenues and profitability.

Attaining financial viability has motivated managers to focus on managing airports as business centers. For example, concession revenue at Hong Kong International Airport in the late 1980s and 1990s accounted for 66–70 per cent of total revenue (Zhang & Zhang, 1997). Jones *et al.* (1993) reported that from 1990–1991, 60 per cent of the British Airports Authority and its agents' total revenue came from commercial activities. Hsu and Chao (2005) suggest a positive relationship between concession revenue, passenger service level and space allocation in international passenger terminals. Appold and Kasarda (2006) demonstrated a significant impact of passenger demography on the volume and nature of US airports retail sales and recommend greater flexibility and reconfiguration of terminal retail expansions. Freathy (2004) suggest that there are however specific factors that constrain and mitigate the commercialization of airports. However, studies on the relationship between airport size and cost seem to be few although it is generally acknowledge that larger firms have an advantage over smaller ones given larger firms can deploy economies of scale and scope hence spend less and extract more value from

investments (Hall and Weiss, 1967; Smyth et al., 1975; Ravenscraft, 1983). The empirical evidence is at best equivocal.

It is suggested that small and medium sized airports experience scale economies (Doganis, 1992; Gillen and Lall, 1997). Expansion of large airports lead to increasing average cost due to difficulty in coordinating activities, resulting in diseconomies of scale (Starkie, 2002). Large hubs are typically plagued by airline congestion which equates to higher marginal costs for the capacity constrained airport. Pels (2000), found that a number of large European airports (Rome Fiumicino, Frankfurt, Munich and Zurich) were experiencing decreasing returns to scale, whilst others (Amsterdam, Brussels, Manchester, Paris Orly and Stockholm) showed partial evidence. Peteraf and Reed (1994) argue that while major airports may enjoy economies of density, smaller airports have lower operating costs.

Prior to the 1990s airports seldom compete and secondary airports were not a threat. Deregulation and the emergence of LCCs promoted competition leading to strong passenger growth at small and medium airports (Dennis and Graham, 2006). Reynolds-Feighan (2001) pointed out that LCCs develop their own network of airports, and integrated small, sometimes developed new regional airports. Barrett (2004) found that newly commercialized and privatized airports are most attractive to passengers and LCCs, as they offered large discounts. The results in the case studies show spectacular increases in traffic at lesser-used airports when served by a low-cost airline. Graham (2003) showed that smaller airports were able to attract some traffic from the dominant airports with discounted airport fees. Francis et al., (2003) however, caution against solely focusing on indiscriminate offers of discounts but rather the ability of airport management in understanding cost structures and revenue streams. Gillen and Lall (2004) prescribe that small and medium-sized airports adopt a proactive approach in expanding its terminal facilities substantially to cater to their primary passenger clientele i.e. budget travelers, so as to enhance the potential of passenger spending. Lyon and Francis (2006) found that even very small airports in New Zealand can be financially viable by adopting innovative concession activities such as parachuting specialization, base for the US's Antarctic operations and running a dairy farm!

Butler and Hudson (1999) define "size" of a production facility using measurements of output and capacity. Output is important as a measure of revenue and profit-generating potential. Transportation terminals are recognized as focal points of economic activity with the primary function of an airport being that of providing an interface between aircraft and passengers, both of which represent an economic function (Comtois et al., 2006). Thus an analysis of airport output would require data on aircraft movements. Commercial aircraft movements however, do not disclose much about an airport's revenue or profit potential since much of both the revenue and costs are generated from handling passengers. Therefore, in discussing output, it is more necessary to evaluate passenger numbers instead (Doganis, 1992). Airport capacity can be classified into airside capacity and landside capacity. An indicator of airside capacity is the number of runways, while the number of gates and the total area of terminals are usually used as an indicator of landside capacity (ATRS, 2005).

Airports have traditionally viewed airlines as their primary customers partly because of the legally binding agreements between the two parties and because airlines pay a variety of charges

such as landing fees and charges per passenger or tonne of freight handled (Barrett, 2004). Under this traditional relationship, the commonsense intuition is that airport profitability would clearly be related to size. Smaller airports tend to have fewer resources than larger airports hence the number of aircrafts that smaller airports can support is limited. Furthermore, until the late 1990s, there was little competitive pressure among airlines as airlines colluded on routes. Smaller airports hence could not compete to attract more carriers even if they wanted to. The world of non-competing airlines was mirrored in non-competing airports. As such, the extent to which small and medium airports could expand their aeronautical revenue stream was greatly limited, resulting in these airports typically operating at a relatively high level of losses with many airports struggling even to cover staff costs.

EMPRICAL EVALUATION, RESULTS AND DISCUSSION

This study includes up to 70 airports worldwide of different sizes, type of ownership and governance structures. The data is compiled from various sources including the ICAO, Airport Council International (ACI), the US Federal Aviation Authority (FAA) and individual airport annual reports and websites. Details on the some of the data are provided in the ATRS (2004, 2005) Global Airport Benchmarking Reports. There are large variations among the sample airports in terms of business and operating environment. Some airports serve mostly international traffic, such as Amsterdam, Brussels, Singapore, and Hong Kong, whereas others serve mostly domestic passengers.

Regression analysis was conducted to examine the effects of size and other variables on airport profits. Panel data techniques were used to account for differences across airports and time. Airports receiving more than 25 million passengers per year are used as the base in the regression. As operating environments differ among Asia, Europe and North America, continental dummys are included with North America as the benchmark. The regression results are reported in Table 6.1 and are discussed in the following sections.

The coefficient for *large* airports is negative and statistically significant, indicating that large airports tend to have lower profits than major airports. See Table 1.

Table 1 Airport revenue regression results (log-log model)

(Base size: Major airports welcoming more than 25 million passengers a year

	Coefficient	t-Statistic
Intercept	3.435182	1.314159
Small/Medium	0.087029	0.487863
Large	-0.370560	-2.128957
Runways	0.000321	0.005409

Runway Utilization	0.365410	1.644318
% Non-aeronautical	0.546819	4.388541
Productivity	0.413802	2.595923
Govt	0.175112	0.966760
Aircraft Size (Pax/ATM)	0.349726	1.851641
Landing Charges	0.041930	0.424673
% International Passengers	0.076643	1.464573
(Asia)	0.101123	1.652613
(Europe)	0.081254	1.185685
% Dominant Carrier	0.136141	1.135275
Income	0.814897	3.735918
R-squared	0.609658	
Adjusted R-squared	0.557112	
Log likelihood	-66.29738	
Observations (n)	144	

Note: [1]All variables including the dependent variables are in logarithmic form except for dummy variables.

This result provides some evidence supporting the claim by Pels et al., (2000) that larger airports are operating under rather weak or even decreasing returns to scale. Similarly, this result also supports the argument that large airports seem to face increasing average costs (Starkie, 2002) as discussed in the literature review section. This finding however disputes that of Salazar (1999) who found constant average costs in the range 3.5-12.5 million passengers per year, but increasing thereafter.

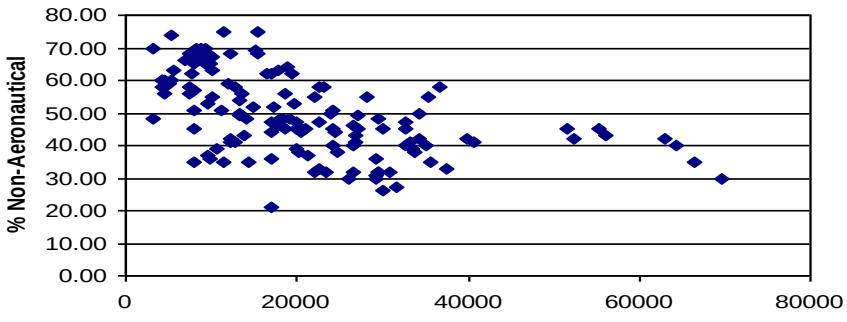
On the other hand, the coefficient for *small/medium* airports is positive but not statistically significant indicating that there is no significant difference in profits between small/medium airports and that of major airports. This result can be looked at from the perspective of the airport's cost or its revenue levels. On one hand, this result provides some support for the

argument that while major airports may enjoy huge economies of density, the lower operating costs of smaller airports compensates for it (Peteraf and Reed, 1994). It also supports the common conjecture that small airports do operate under increasing returns to scale (Gillen and Lall, 1997). Furthermore, the result also provides some evidence supporting the claim by Peteraf and Reed (1994) that smaller airports exhibit economies of scope where they are not overwhelmed by the market power or differentiation effects of increased market share. On the other hand, this result also suggests that unit revenues increase more than in proportion to the increase in unit costs for small/medium airports. This increase in revenues is likely due to concession activities.

Runway was found to have virtually no effect on airport profits. A possible explanation is offered by Givoni and Rietvelds (2006), who suggest that the number of runways may be a poor indicator for airport capacity since in some airports the effective use of runways is restricted by weather conditions and/or noise regulation. However, r*unway utilization* has a positive coefficient and is just marginally statistically significant. This indicates that airports with a higher number of aircraft movements per runway tend to have higher revenues.

The % non-aeronautical revenue variable is statistically significant with a positive coefficient. This result indicates that business diversification into commercial and other non-aeronautical businesses would help airports to achieve higher revenues. Many airports aim to increase revenues from commercial services and other non-aeronautical activities, in order to reduce aviation user charges thus attracting more airlines. Such business diversification strategies, of course, exploit the well-known demand complementarity between aeronautical services and commercial services (Oum et al., 2004). Indeed, studies have shown that concession operations tend to be more profitable than aviation operations (Jones et al., 1993). Figure 1 below shows the relationship between airport size and the level of business diversification.

Figure 1 Relationship between non-aero-nautical revenue vs airport size



There appears to be a negative relationship between airport size and the percentage of revenue derived from non-aeronautical sources. Small/medium airports seem to derive more of their revenue from commercial sources as compared to large and major airports. This follows from the earlier discussion that these airports often charge less and even offer subsidies to attract traffic, hence limiting their scope in deriving revenue from aeronautical sources.

The result from a one-way ANOVA analysis as provided in Table 2 shows that small and medium airports generally derive a higher proportion of their revenue from non-aeronautical sources than large and major airports. In addition, the F-ratio is larger than the F-critical value, indicating that the difference in business diversification between small/medium airports and large and major ones is statistically significant. This provides further evidence that smaller secondary airports indeed focus their efforts on enhancing their provision of concession activities so as to earn a higher percentage of non-aviation revenue.

Table 2: The effects of size on the share of non-aeronautical revenue

Groups	*Count*	*Sum*	*Average*	*Variance*	
SM	35	1894	**54.11429**	193.2218	
Large	57	2794	49.01754	172.1961	
Major	46	2148	46.69565	122.3942	
Source of Variation	*SS*	*df*	*MS*	*F*	*F crit*
Between Groups	1120.054	2	560.0272	3.48079	3.063204
Within Groups	21720.26	135	160.8908		
Total	22840.32	137			

The *Productivity* variable has a positive coefficient and is statistically significant. This indicates that airports which are better able to utilize their inputs will on average, receive higher profits. Thus, the lower average costs of an efficient small airport could outweigh the economies gained by the less efficient major airport. If so, overall average costs could be lower. This study also shows the relationship between airport size and efficiency. There appears to be a negative relationship between the size of the airport and the level of efficiency, suggesting that small/medium airports tend to use their inputs more efficiently. This relationship is consistent with the findings of Bazargan and Vaseigh (2003), that small airports consistently outperformed large hubs in terms of efficiency.

The coefficient for *Govt* is not statistically significant, indicating that there is no significant difference in profits between airports that have majority or wholly government ownership and those with a private majority ownership. This result is consistent with the empirical findings of Parker (1999) which showed no difference in profitability between airports with different kinds of ownership.

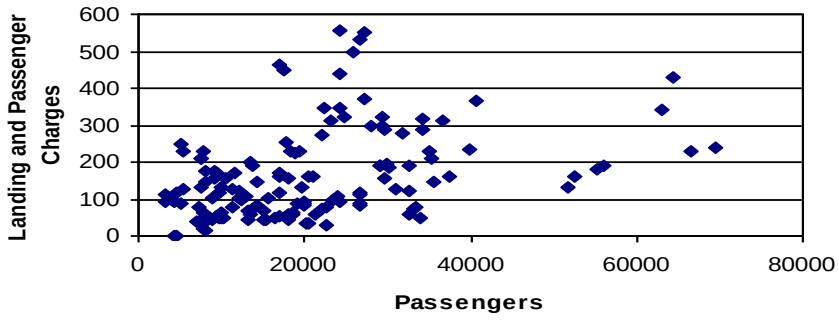
Average Aircraft Size has a positive coefficient and is statistically significant. This indicates that the larger the aircraft size used, the higher the level of profits for the airport. This is probably due

to the fact that in many airports, airport charges relate to the weight of the aircraft which means that larger aircrafts pay more, hence increasing airport profits.

The *Landing charges* variable has a statistically significant positive coefficient in the first order term, but statistically negative coefficients for the cross terms with Asia and Europe regional dummy variables.

Figure 2 shows the relationship between airport charges and airport size as measured by passenger numbers. There appears to be a positive relationship between airport charges and number of passenger numbers. This provides some evidence that small/medium airports tend to offer lower airport charges in order to attract more airlines to utilize its facilities, in particular low-cost-carriers.

Figure 2 Relationship between landing and passenger vs. airport size



The *% International* variable has a positive coefficient in its first order term but is not statistically significant. The cross term with the Europe regional dummy also has a positive coefficient that is not statistically significant. This result provides some evidence that while international passengers usually generate more revenue for airports than domestic passengers, there is no significant difference between airports with a heavy reliance on international passengers and airports without, in North America and Europe. On the other hand, the cross term with the Asia regional dummy is statistically significant with a positive coefficient. This suggests that in Asia, airports with a higher proportion of international traffic will have significantly higher revenues than airports without a heavy reliance on international traffic.

% Dominant carrier has a positive coefficient that is not statistically significant. This indicates that there is no significant difference in revenues between airports with a high reliance on a dominant carrier and those with a lower reliance.

The coefficient on *Income* is positive and significant, reflecting the increased profitability of airports in cities where ridership is enhanced due to the higher income of their inhabitants.

CONCLUSION

This study examined the trends in airport revenue development as well as recent airline trends, in particular the impact of low-cost airlines on small/medium airports. On the supply side, contrary to intuition, small/medium airports appear to enjoy decreasing costs as compared to increasing costs for larger airports. Competition between airlines has by default, revolutionized airport competition. Small and medium airports are able to compete effectively with large hubs, thus improving their commercial viability. The study draws upon the literature developed on the interactions between airlines and airports.

The results suggest that there is no statistical difference in profits between small/medium airports and major airports. This provides some indication that smaller airports enjoy a certain amount of economies of scale or that even if these economies have run out, unit revenues for small/medium airports increase more than in proportion to the increase in unit costs. This increase in revenues is most likely to have come from non-aeronautical sources, underscoring the fact that commercial activities are central to their future economic viability and are a pre-requisite for growth. It is accurate then to suggest that, to successfully compete in a highly competitive environment requires a flexible response from airports to undertake proactive initiatives such as a continued development of management contracts and a strategy of diversification.

Changes in the airline industry been driven by exogenous factors. It appears that small/medium airports have displayed resilience in responding to the dynamic circumstances. The lowering of their aeronautical charges to attract more carriers so as to earn from the more profitable non-aeronautical revenue sources represents one such method. There is little to suggest that these changes have abated. Thus, as airports become more competitive, the challenge for the airport authorities will be to continue to develop coherent and flexible strategies that provide the direction and growth required in order for smaller airports to remain commercially viable, while at the same time dealing with turbulence and uncertainty in the aviation industry.

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