

AIRPORT AREA ECONOMIC DEVELOPMENT MODEL

Glen E. Weisbrod, Economic Development Research Group, Boston, MA
John S. Reed and Roanne M. Neuwirth, Cambridge Systematics, Inc.

I. INTRODUCTION AND OVERVIEW

As business markets become national and international in scale, airports are increasingly being viewed as catalysts for local economic development. Their ability to generate jobs and attract new business is being used in many locations as a justification for public investments in new airport construction and expansion. Anticipation of new business activity also calls for appropriate land planning. Yet few types of economic development have been as poorly predicted as development around airports. At some airports, large tracts of surrounding land reserved for development have remained vacant for decades. Unforeseen rapid development around other airports has saturated the area and choked area roads with traffic. In some cases, the area around a new airport has had both situations occur over a period of 25 years.

This paper is intended to help explain these situations by providing a framework for understanding economic impacts and planning for development around new or expanded airports. It is based on studies by Cambridge Systematics of airports in Europe, Japan and North America. Based on the experience in the vicinity of these airports, we have constructed a model system for forecasting economic impact and planning for airport area land development. The model divides impacts in terms of airport facility employment, directly-related business activity, businesses attracted to the surrounding area and spin-off development. This paper describes the basic framework for identifying the nature of economic activities occurring in each of these areas, the variable factors affecting their magnitude, and applications of the model system for airport-related planning. Commercial airports are emphasized here, but general aviation airports are also discussed.

2. GEOGRAPHIC LOCATION OF BUSINESS RELATIVE TO AIRPORT

We can define four categories of location relative to airports: (1) at airport, (2) adjacent to the airport, (3) vicinity of the airport or along a corridor easily accessible to the airport, and (4) elsewhere in the metropolitan area or region. Each has different characteristics of airport-related business and different timing of development. We can relate these characteristics to explanatory factors including airport requirements, the regional economy, local transportation access and land markets.

2.1 At the Airport

Airport employment depends on the volume of aviation activity at an airport, which is determined not only by the population of the region it serves, but also by the airport's air service function. The number of commercial flights and the mix of locations served by them defines whether the airport functions as an: (1) intercontinental gateway, (2) international (same continent) gateway, (3) regional transfer hub, (4) local origin/destination point, (5) specialized air cargo distribution centre, or (6) overnight parcel hub. As a result, the ratio of annual airport passengers to regional population (for N. America and W. Europe) ranges from as high as 11.2 for Charlotte, NC, USA (a regional hub airport) to as low as 0.3 for Cologne, Germany (a local origin/destination airport). The ratio is much lower for developing countries.

Employment associated with airport operations includes the airlines, aircraft support services, passenger services (including restaurants, shops and desks for car rental and ground transport), air freight services and government activities (including immigration). The correlation between passenger volume and airport employment is illustrated in Figure 1.

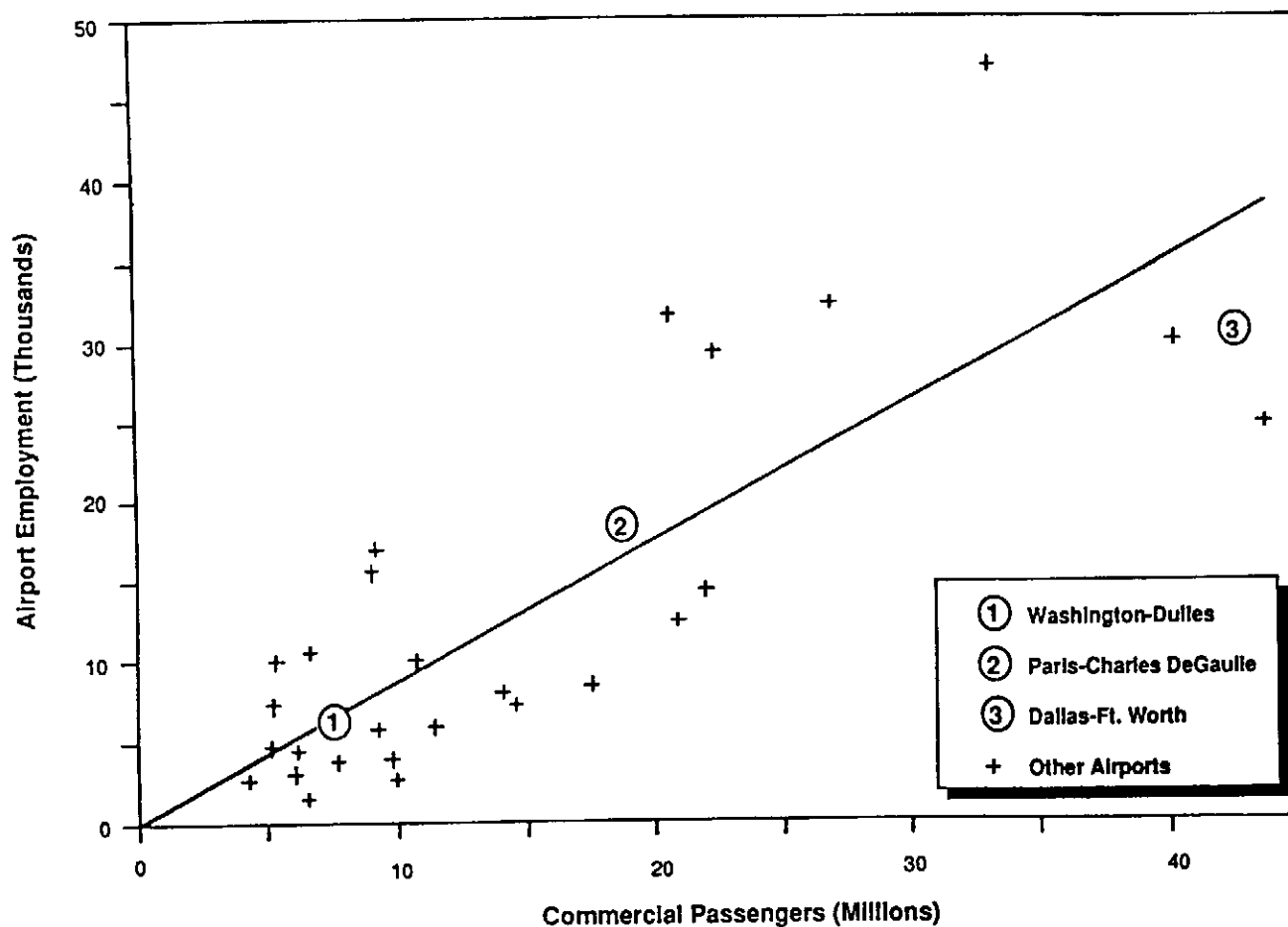
2.2 Adjacent to the Airport

Activities immediately adjacent to commercial airports typically include:

- services directly supporting operation of the airport (flight kitchens, aircraft maintenance services),
- services for airline employees and passengers (hotels, restaurants and additional car rental facilities), and
- airport-related freight services (shipping, freight forwarding, customs and sometimes a foreign trade zone).

These types of activities are often located on adjacent land reserved for such uses. They typically start within a year of airport opening. For each of these three types of activities, the employment level is directly proportional to the corresponding magnitude of the airport function as an aircraft servicing centre, a passenger flight endpoint, or a freight origin or destination.

Figure 1: Relationship of Airport Employment to Passenger Volume



2.3 Vicinity of the Airuort and Airuort Access Corridor

In most cities, we have found that the greatest concentration of business activity around an airport is within 6 km of the airport, or along an access corridor within 15 minutes of the airport. Development in these areas are either “spin-off industries” or “attracted businesses. Spin-off industries include petrol filling stations, lodging and housing for airport workers, and retail serving them. These activities grow directly with airport activity levels, although they often take 5 to 10 years after airport opening to fully develop.

Attracted businesses are businesses that do not rely directly on the airport for their operation, but which value location near an airport because of its prestige, air services and br accessibility of location for visiting customers and employees coming by air. There are some similarities, but also significant differences, in the overall mix of business activity attracted to the areas surrounding specific airports. Detailed profiles of all businesses located within 6 km of airports were compiled by the authors. In common among airports were high concentrations of air transport services, freight forwarding, warehousing and high-tech oriented businesses with products having a high value-to-weight ratio (e.g., electronics, optics and measuring instruments). Figure 2 contrasts the mix of businesses in the areas surrounding three airports. It shows relatively constant proportions of employment in transport and warehousing activities, but wide variation in the relative levels of manufacturing and service industries. These differences can be explained by differences in the regional economy and airport location, as discussed later in Section 4.2.

Additional empirical studies of US airports by the authors have shown that employment growth within 6 km of airports can be two to five times faster than in the suburban ring of the metropolitan area in which they are located. From that data, we can classify business activities by the extent to which they are disproportionately attracted to, and concentrated in, the vicinity of airports. These findings are summarised in Table I.

The attraction of business activity and land development to the vicinity of airports may take 5 to 20 years (or more) to develop. The timing and magnitude depend not only on airport and air service attributes, but also on factors of local access, metropolitan economic characteristics and land development patterns (discussed later in this paper).

2.4 Elsewhere in the Metropolitan Area

New or expanded airports can have several different types of effects on business activity in the rest of the metropolitan area or region, each of which must be appropriately handled in any accounting of overall regional impacts.

Figure 2:
Airport Region Employment -- Selected Industries

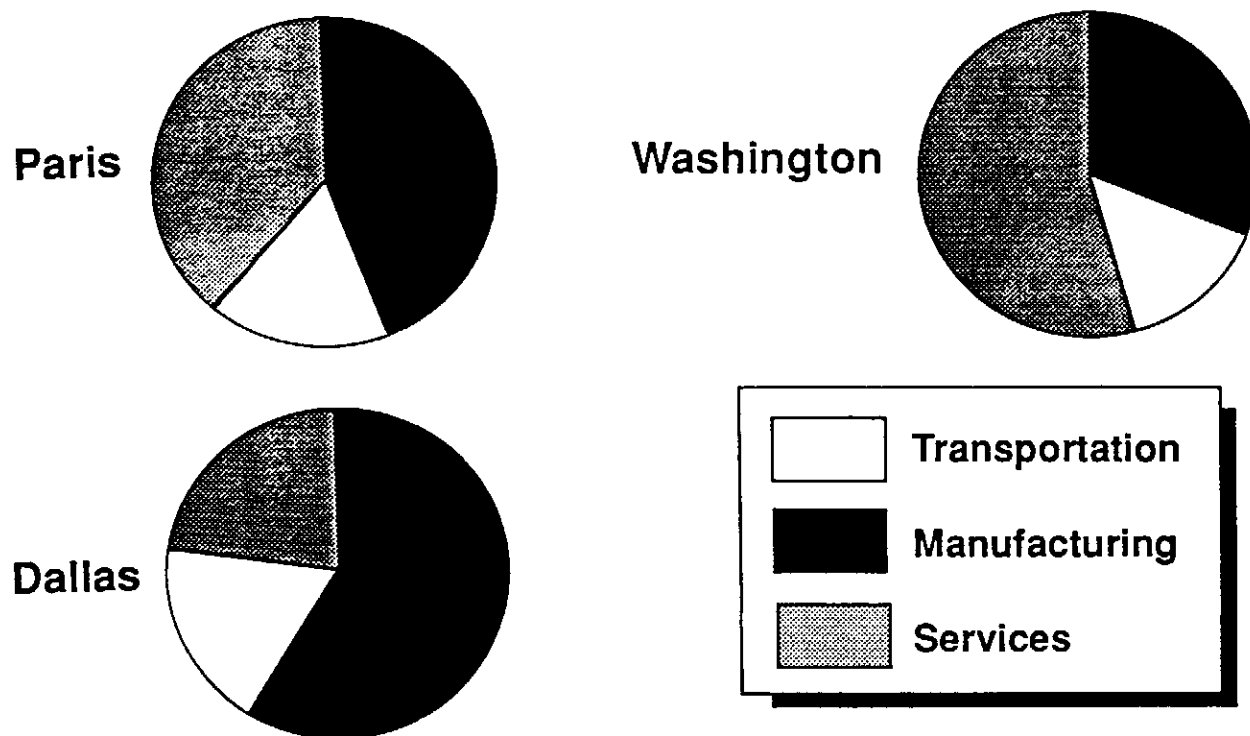


Table 1: Types of Business Activity, Ranked by Degree of Attraction to the Vicinity of Airports

Very High Concentration Near Airport

- Air transportation services
- Aerospace equipment
- Manufacturers of optical instruments and lenses
- Manufacturers of communications equipment
- Manufacturers of electrical distribution equipment
- Freight forwarding

High Concentration Near Airport

- Manufacturers of electric and electronic equipment
- Manufacturers of specialty chemical products
- Public warehousing
- Manufacturers of instruments, measuring and control
- Air transportation services
- Mailing and delivery services
- Specialty fabricated metal products
- Wholesaling of pharmaceutical products

Moderate Concentration Near Airport

- Automobile rentals
- Printing and publishing
- Manufacturers of converted paper products
- Manufacturers of electronic components and accessories
- Construction
- Buses and taxis
- Building services
- Hotels/motels
- Automobile parking
- Manufacturers of medical instruments and supplies
- Automotive services
- Manufacturers of specialty plastics parts

Increasing Concentration Near Airport

- Travel Agent
- Public warehousing
- Specialty machinery
- Mailing and related services
- Computer data processing services

- Some business activities may shift away from elsewhere in the metropolitan area to relocate in the airport vicinity. This represents neither net growth nor net loss for the region as a whole.
- Some businesses may be attracted to locate in the metropolitan area, but not specifically in the airport vicinity, because of the improved quality of life and upgraded air service for the region. It is overstatement to attribute this economic growth solely to the airport, as it is but one contributing factor among many affecting such business locations.
- Some business growth occurs elsewhere in the metropolitan area as an **indirect effect** of net regional growth in airport-related businesses, as those businesses in turn increase demand for other local goods and services supplied to them. Other business growth occurs as an **induced effect** of the additional consumer spending by workers hired at airport-related businesses and their suppliers.

3. ECONOMIC MARKET ORIENTATION OF ATTRACTED BUSINESSES

In general, we can identify business activities attracted to airport areas as either new activities attracted to the area or expansion of existing activities of a type already occurring in the metropolitan area.

New Activities may be attracted from outside of the area because of the prestige and improved customer access provided by enhanced national and international air service. For large commercial airports, these new activities may include: (a) regional or national corporate headquarters of large national and multi-national companies; (b) trade and merchandise centres marketing retail or industrial products; (c) service companies that are dependent on air service to reach their markets; and/or (d) airlines and related activities.

Expansion of activities in the metropolitan area occur for types of businesses that are users of airport services, suppliers to markets generated by the airport, or businesses that can take advantage of the local transport and other supporting infrastructure developed primarily to serve the airport. These are typically: (a) high-tech electronics and specialised equipment manufacturers, (b) communications companies, (c) warehouse and delivery services, and (d) a variety of specialised business services.

In specific situations, specialisation of the regional economy or specialisation of the airport may also attract business activities concentrated in other categories, such as: membership organization headquarters (near Washington/Dulles airport) or exporters (in Amsterdam and Paris).

Hotel and convention facilities are another rapidly expanding type of business. The magnitude of these developments is not closely related to the passenger volume of airport activity. The ratio of hotel rooms (within 6 km of the airport) per thousand airport passengers (annually) ranges in Europe from .06 (Paris/Orly) to .13 (London/Gatwick),

while in North America it ranges from .10 (Dallas/Ft. Worth) to .21 (Chicago/OHare). The supportable number of hotel rooms is predictable based on four factors: (1) extent of hub versus destination travel, (2) airport location relative to office activity centres, (3) hotel agglomeration at conference centres, and (4) land use restrictions.

Retail is yet another rapidly growing type of business activity. Shopping facilities are being expanded and upgraded at many airports. Airport vicinity shopping centres are also increasing, following nearby population growth.

4. CRITICAL FACTORS AFFECTING BUSINESS ATTRACTION AND LAND DEVELOPMENT

There are three key factors that affect the timing, magnitude and character of airport vicinity land development. They are: (a) airport market orientation, (b) transportation access, and (c) urban land development patterns.

4.1 Airport Market Orientation

The mix of airport activity -- transfer hub versus origin/destination traffic, passengers versus freight, and destinations served -- all affect the nature of business attraction and land development. Selected examples are described here.

Hub airport status brings a higher proportion of transfer passengers and a lower proportion of destination passengers. This can generate a high level of on-premises and adjacent airport employment, but generate less demand for passenger services and hotels.

Freight activity is greatest for airports with international and long-distance services. For cities with new second airports, the newer airport usually takes nearly all of the freight activity, while the closer-in, older airport concentrates on shorter-distance passenger travel. Warehousing and distribution facilities are concentrated where the cargo freight traffic is. Overnight parcel hubs generate much less spin-off business, compared to cargo hubs which support trucking and warehousing services.

There is a strong relationship between the opening of air service to other countries, and the subsequent opening of business offices of firms from those nations. For instance, offices of foreign business located near Paris/CDG include: Bull (Germany), Hewlett Packard, General Electric and Converse Shoes (USA), Sharp Electronics (Japan) and Unilever (Netherlands).

The function of major national and international airports is continuing to shift as business markets are increasingly becoming global in scale. As a result, many of the larger airports are moving toward increased services to business travelers for trade, conference, meetings and layovers (for example, Chicago/O'Hare). At the same time, many airports are becoming more important as cargo centres with adjacent development of activities such as freight transshipment, logistics management and distribution tracking control facilities (for example, Amsterdam/Schiphol). As these airport and related development activities expand, it becomes increasingly important for there to be good access between the airport facility and these other nearby activities.

4.2 Transport Access and Land Development Patterns

The pace and scale of business attraction in the vicinity of airports is defined by constraints of both the local pattern of ground transport and the region's land development pattern. These constraints have often been poorly anticipated, but can be overcome. This is illustrated by three examples:

- In Montreal, the Mirabel Airport was opened in 1975 with a large amount of land reserved for development. To date, the airport has not attracted the anticipated level of air traffic or business activity. Its distance and long travel time from existing office and industrial areas, and its geographic location away from the direction of dominant urban growth are all factors that have so far limited business attraction there.
- In Paris, the growth of airport activity and land development around Roissy/Charles de Gaulle (CDG) in its first 18 years has been slower and different than originally anticipated. The airport's distance from existing commercial centres and its location in a lower prestige side of the metropolitan areas have limited office attraction and favoured the concentration of manufacturing and distribution activities. This is in contrast to the area around Orly Airport, which has been a centre for high tech office, educational and research facilities. However, plans for development at CDG now anticipate future development of office, international trade and high tech industry there as the land around Orly airport reaches capacity.
- In Washington, D.C., the opening of Dulles Airport failed to attract the anticipated level of air traffic or business activity, as it was considered too far out. In fact, its turnaround did not occur until 20 years later. The dramatic growth of high density office development along the Dulles Access Corridor since the mid 1980's is associated with four factors that started at that time: (1) opening of access to the local Reston area land from the Dulles Access highway, (2) expansion of the Washington area office market in the direction of the airport, (3) deregulation -induced congestion at Washington National Airport, and (4) initiation of active marketing of Dulles airport to businesses and airlines. While the initial development activity around the airport was industrial/office "flex space", this has since transitioned to more upscale office activities.

Several newer forms of development in the vicinity of airports are particularly notable from the viewpoint of local transportation and land use planning. The development of new tourism and major theme amusement parks is increasingly becoming dependent on airport accessibility. These include Orlando and Dallas/Ft. Worth (USA), Tokyo/Narita and Paris/CDG airports. Plans for rapid transit connections are emerging in each case.

5. GENERAL AVIATION AIRPORT FACILITIES

Facilities for charter aircraft and private corporate aircraft may or may not attract businesses beyond those directly associated with the airport itself (which includes aircraft maintenance, flight schools and charter aircraft companies). Surveys of business aircraft owners in the US, conducted by the authors, indicate that the ownership and use of private airplanes is associated with specific types of businesses, which do indeed value their use. The principal uses of private aircraft and key businesses relying on them were found to include:

- aerial surveying -- agriculture, forestry, fishing and utilities
- delivering products -- electronics and machinery parts manufacturing, utilities and wholesale distributors
- receiving supplies -- wholesale distributors
- transporting clients -- air taxi services, miscellaneous manufacturing, banking, and land development
- transporting key corporate staff -- retail, banking, manufacturing, land development and specialised services
- transporting supply contractors -- utilities and construction flight training -- flight training schools.

For these types of businesses, the ability of local airports to handle corporate jets and provide reliable service for night and inclement weather conditions can indeed be an important business location factor. Failure to provide adequate airport service for such uses can indeed diminish a community's ability to attract and retain those kinds of businesses. More specific findings on this issue are discussed in another published paper (Weisbrod, G.E., "Economic Impacts of Improving General Aviation Airports", Transportation Quarterly, v.45, n.1, January 1991, pp.67-83).

6. AIRPORT ECONOMIC DEVELOPMENT MODEL

6.1 Model Objectives

Local governments and airport authorities around the world have commissioned studies to document the economic importance of the local airport in terms of jobs, or in terms of the number of businesses which rely on the airport. These studies may have public relations value, but they are not necessarily helpful for identifying economic development potential or for guiding infrastructure investment decisions.

The Airport Economic Development Model is a computer model which estimates airport employment and related off-airport business activity and employment. It has been used in three ways:

1. To identify unmet potentials for business attraction associated with an existing airport, by comparing actual airport area business activity with the model forecasted potentials for business attraction;
2. To plan for future needs by forecasting the potential level of future business attraction and demand for land development associated with expanded or new airport facilities; and
3. For benefit-cost analysis, by comparing the future stream of local income that can be generated as a result of investment in airport facilities.

6.2 Model Inputs

The key inputs into the model, necessary to generate the results, are current and future year scenarios describing:

- **Economic Characteristics of the Airport Area and Metropolitan Region** – in terms of population, employment (by Standard Industrial Classification), Gross Domestic Product, rate of employment and population growth and vacancy rates for commercial and industrial buildings;
- **Air Service Functional Characteristics** defining gateway/hub/destination status -- including domestic, international and inter-continental services, in terms of number of daily flights, number of cities served, passenger and cargo volumes;
- **Other Airport Functions** -- extent of commuter, charter, military, reliever and maintenance functions;
- **Airport Area Land Characteristics** -- local ratings compared to other city airports concerning: regional motorway access, regional rail connections, extent of nearby business space, land control, access to prime office centres, proximity to prestige

locations, and proximity to existing visitor attractors;

- **City and Metropolitan Market Orientation** -- ratings of the local area, compared to other cities, as a; convention centre, tourism attractor, centre for trade/distribution headquarters, finance and service centre, concentration of high tech specialization, communications/teleport centre, aerospace/aviation specialisation, regional or national corporate office centre, low cost location for operating a business, and high quality of life for executives.

6.3 Model Results

The model estimates normally-expected levels of business activity and employment at the airport, adjacent to it and within a 6 km vicinity of the airport, as well as impacts on the rest of the metropolitan region. These estimates are based on the volume of airport activity and mix of air services provided, with further adjustment based on the local and regional economic profile and ratings of: airport area land characteristics, city and regional development patterns and economic market orientation or specialisation.

Results are:

- Employment by location -- at airport, adjacent to airport, vicinity of airport, elsewhere in metropolitan area;
- Airport and vicinity employment by standard industrial classification (32 categories);
- Total employment in terms of direct, indirect and induced impacts, distinguishing new jobs and intra-regional shifts;
- Gross and net regional and local income and value added;
- Gross and net building floor space demand, in terms of industrial, warehouse, office, restaurant, retail, hotel and transport activities.

6.4 Model Applications

No computer model can, by itself, predict future economic growth and development. The best that can be done, for the evaluation of any specific airport, is to:

1. Compile a base of data on what has been achieved at comparable airports and cities elsewhere,
2. Identify the local economic, transport and land development factors which constrain or modify what can be achieved locally, and

3. Provide an appropriate accounting framework for estimating the existing and potential levels of jobs and income generated by existing and new airport facilities and expansions.

The intent of the model described here is to provide a framework to help address these needs and improve local understanding. There have been a variety of different applications, each of which has required substantial local modification and continued evolution of the analysis system to meet local needs. For Glasgow, Scotland, the airport impact model was utilised to identify opportunities for business attraction and to guide planning for new development in the vicinity of the airport under scenarios of expected expansion. For Osaka, Japan, the data base of airports elsewhere was used to help identify development opportunities and needs associated with the new island airport facility (under construction) and the planned Rinku New Town nearby. For the State of Wisconsin, the airport model system was used to assess benefits and costs of alternative investments for both general aviation airports in small towns and large commercial airports in cities. There is much to learn about economic impacts of airports; the model system described here represents a framework for analysis applications.