

The cost allocation approach of airport service activities



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ABSTRACT

This study suggests a new allocation approach to the joint costs between airports and airlines and proposes estimates for airport service costs. Using correlation coefficients, data envelopment analysis and regression models, the research measures the relation and efficiency between service activity and airport operation costs. The regression outcomes not only reveal a significant management issue concerning the apron fee measurement, but also show that the airport physical activity cost drivers need to be considered with cost and revenue management. The DEA outcomes reflect the expansion of the terminal areas.

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1. Introduction

Today many airports are increasing their charges and using concession rents to augment their revenues (Forsyth, 1997; Pels et al., 1997; Reynolds-Feighan, 1997; Zhang and Zhang, 2001). However this involves sound and reasonable airport cost management with effective financial control and accounting procedures. Airports are faced with how to measure the air navigation services costs and if the meteorological service costs are included in the basic airport costs. Analysis tools play an important role in airport cost rationalization and standardization. In past studies, researchers have applied a given percentage to explore the joint costs of airport management, whereas this study tries to consider this by means of a regression model (Hamzaee and Vasigh, 2000). The estimation process of past studies is unable to clarify costing fairness between the airport and airlines because it hides airport financial management issues that may arise, which may also affect the airport's ability to charge reasonable fees (such as landing fees). Particularly after privatization of airports that used to be run by governments, airport cost management and cost-sharing issues have been gaining more and more attention and discussion (Europe Economics, 2001).

For this reason, this study tries to define and clarify the costs for passengers, cargo and aircraft service activities which is necessary for the airport in order to discuss the standards and principles for measuring joint costs and address joint cost-sharing issues. It researches airport service costs in Taiwan and suggests more reasonable estimators. Literature related to previous studies of joint costs (Pirttila and Hautaniemi, 1995; Kloock and Schiller, 1997; Tsai

and Kuo, 2004) shows that cost-sharing varies considerably, for example according to the area of space occupied by service activities, the number of employees associated with such services or the revenue generated from the service activities. These are too simple and arbitrary for cost-sharing formulation, because they may neglect potential services and equipment costs which are not measured, which can be misleading and will lead to sub-optimal joint cost allocation and management.

Therefore this study introduces activity-based costing to measure the joint costs of airport services which is a new approach, different from the traditional accounting measure of the cost of airport service activities. It will define the joint costs, review joint cost allocation theory, build the appropriate costs estimation model and undertake an analysis of the applicability of various methods to develop the appropriate cost-sharing mechanism. The current allocation of airport costs not only reflects the activity ratio of the cost factors but also the practical problems related to this process. The research results may assist the airport and airlines in searching for the basis of cost burden and further help in airport cost planning, cost management, process improvement and outcome/output analysis tools.

Therefore the structure of this paper is as follows. First there is a review of airport costs and service classification, and consideration is given to the definition of joint costs and the principles of cost sharing as examined in the literature. Second, the measuring analysis framework of airport services activities of the joint cost factors is divided by the characteristics of passenger activity, characteristics of cargo activity, characteristics of the aircraft, airport air traffic control facilities and the interaction between the activities. In the third part, by means of data envelopment analysis (DEA) and activity based cost concepts, the study attempts to estimate and measure the relation between service activity and operation costs. In the fourth part, the empirical research collects

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information on the airport costs, which includes a survey of airport service activities, the operating costs of the airport and the airlines' operating cost items, so as to understand the actual airport accounting situation and the cost related issues. Finally, the resource requirements of airport activity costs are estimated. Cost reasons or activities based on the use and the cost contribution of airport activities are emphasized in order to provide more accurate estimators of airport service costs.

2. The definition of airport service costs and cost allocation measurement

Activity-based costing, in accordance with Cooper (1987a,b), is a two-stage procedure which uses cost drivers. In the first stage, a company's overhead costs such as administrative salaries, insurance, rent and transportation are traced to activities. In the second stage, costs are traced from activities to cost objectives such as customers, processes, products and services. Through this two-stage methodology and the use of multiple cost drivers, it is easier to measure the relation between the inputs and outputs of activity-based costing. This procedure of activity-based costing involves five steps namely aggregating the activities, reporting the cost of the activity, identifying the activity centers, selecting the first-stage cost drivers and selecting the second-stage cost drivers. According to Cooper the suitable cost drivers must include three cost factors associated with the degree of operation activity, measuring the cost and behavior influence.

Very little literature regarding an airport's cost allocation measurement can be found. The existing airport performance studies have failed to take full activities of airports into consideration, to thoroughly analyze the balance between the revenues and cost expenditure, and to objectively reflect the relation between real airport activities and airport costs. This means that airport activities fail to reflect their contributions. In order to clarify the relation between the airport services and the traditional cost accounting system, this paper proposes an approach of cost allocation for airport service activities which employs the concepts and principles of activity-based costing and airport service costs.

An activity-based cost system applied to airports is shown in Fig. 1. The cost system includes two input resources, one is the airport, and the other is the airline and airport activities. The output is the airport service performance. The objectives of the airport activity-based cost system can be used to evaluate the system cost and efficiency.

The airport activities can be classified as the counter activities, loading and unloading of baggage, cargo handling activities, the services in the terminal and aircraft ground handling activities (runways, taxiway, apron). Airport cost items can be categorized according to activity, with the accounting system of personnel costs, capital costs, construction equipment and maintenance costs attributable to different activities and service costs. The service costs can be classified as follows:

- Counter activities: the costs arising from the handling of passengers and luggage in the terminal building, including the rent of the counters, the construction prices, the rented equipment and the number of service personnel.
- Baggage loading and unloading: this includes the number of rotations of the baggage carousel, the use of an area, the construction prices and the number of service personnel.

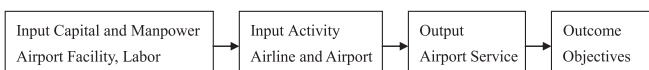


Fig. 1. The relation between airport service and airline and airport activities.

- Cargo handling activity: this cost includes the rent of the space, the construction prices, the rented equipment and the number of service personnel.
- The services in the terminal: this includes the cleaning of the terminal building and surrounding area equipment maintenance, the use of common equipment, the construction prices, rented equipment and the number of service personnel.
- Aircraft ground handling activities: this includes runways, taxis and apron construction prices, rental of the apron and the number of ground crew.

Airport costs may be allocated by the contribution approach, activities, standard allocation formulas, or by a number of methods. Airport cost measuring is based on an activity and the cost analysis method to understand and find the real and major cost drivers. In order to measure the relation between airport activities, the cost driver factors and airport costs, this study will apply correlation coefficients. Moreover, in order to measure the efficiency relationship between airport activities, cost driver factors and airport costs, this study uses regression and data envelopment analysis with the activity-based costing variables to measure airport service costs. These approaches are different from the traditional accounting cost of service activities. By using an appropriate cost estimation model, the research discusses the applicability of various methods to build the appropriate cost-sharing formula for each airport activity. This cannot only reflect the current allocation of airport cost and the activity ratio of the cost factors, but it can also reflect the cost burden for the airport.

3. Correlation coefficients and DEA of airport service cost allocation

Thus the methodology employs correlation coefficients to identify the important variables of airport service costs, applies regression analysis to find the contribution of the important variables of airport service costs (Martin and Voltes-Dorta, 2011) and data envelopment analysis to find the optimal variable compositions. The research aims to improve on the basic calculations in past studies and put forward a more causal association which could explain the relation between service activity and operation costs.

3.1. Correlation coefficients

Based on the above assumptions, the research establishes the composition of the airport activities costs using the correlation coefficients. This covers construction equipment of ground handling projects, various activities regarding personnel and funding, and maintenance costs. The study concept is based on the cost of services being related to impact factors and activity-based costing. In resource projects, it refers to the total activities of resource service costs and resource driver motives, with the former being the number of units, such as the labor number, and the latter arising from the activity cost drivers, such as number of the scheduled flights. The operation center is the airport activities, such as customs and quarantine activities.

3.2. DEA

DEA (Chang, 1991) is a well-known technique to estimate the relative efficiencies of decision making units with common inputs and outputs. It is applied to produce the optimal efficiency of the decision-making unit, and then the dual problems approach is used to produce the inefficient decision-making unit to improve the input and output direction and range. In practice, the linear

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