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AIRPORT EFFICIENCY IN PAKISTAN – A DATA ENVELOPMENT ANALYSIS

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1. Introduction

Competition between airports is often limited as there exist several sources of market power (see e.g. Starkie, 2002). This lack of competitive pressure may lead to inefficiencies in the provision of airport services. At state-owned airports incentives for efficient operation can be particularly weak if possible losses are covered by public funds.

This paper investigates the airports in Pakistan for potential inefficiencies. In Pakistan almost all of the commercial airports are fully state-owned and are operated by the Pakistan Civil Aviation Authority (CAA). The only exception is the privately owned Sialkot International Airport, which was constructed on build, own and operate (BOO) basis and started its operation in 2007. We assess the extent of inefficiencies at each airport and their causes using Data Envelopment Analysis (DEA).

A common problem in DEA is a lack of discrimination on the performance of decision making units (DMUs). This means that most DMUs may be ranked as efficient even though their performance differs. We suggest the use of weight restrictions in airport DEA models to improve discrimination, while also allowing for an appropriately large number of inputs and outputs.
2. Methodology and Data

Data Envelopment Analysis is used to determine the relative efficiency of airports in Pakistan. The majority of costs of airports is considered in the analysis by including the most important capital and labor inputs. We use the input-orientation in DEA to determine how much inputs, and therefore costs, could be reduced at each airport. Three DEA models are developed to separately analyze (1) the runway system, (2) the passenger terminals, and (3) the employment of staff. DEA allows us to distinguish between technical and scale inefficiencies. Technical inefficiencies imply an excessive use of inputs that could be avoided. In contrast, scale inefficiencies refer to operational disadvantages caused by suboptimal size. The non-decreasing returns to scale (NDRS) model, which is a variant of the BCC model (Banker, Charnes and Cooper, 1984), is used to identify technical inefficiencies. To determine scale inefficiencies, we use the constant returns to scale CCR model (Charnes, Cooper and Rhodes, 1978).

To improve discrimination on the performance of airports, we impose restrictions on the weights of inputs and outputs in DEA. Weight restrictions are defined based on judgements about relative input costs and feasible production trade-offs.

The primary data source is the Pakistan Civil Aviation Authority (CAA). Information on passengers, aircraft movements, cargo and mail are extracted from the publicly available aviation statistics for the financial year 2011-12. The number of employees at each airport has been provided by the CAA on request.

3. Results and Conclusions

The results indicate that inefficiencies exist in the infrastructure of some airports in Pakistan, which are in part a result of overinvestment in capacity in the past. Basing capacity of new airports and expansion projects more strongly on near-to-medium term traffic needs could avoid such inefficiencies in the future. The labor efficiency results suggest that too much personnel is employed at several airports.

In addition, we find that economies of scale are increasing at most airports in Pakistan implying that rising traffic will result in falling unit costs. That many airports operate below their optimal scale size has implications for airport charges and airport development. Instead
of investing in capacity at large, busy airports, nearby underutilized airports could play a
greater role as reliever airports. This could be achieved by stronger differentiation of airport charges. Higher charges at congested airports would create incentives for airlines to shift traffic to underutilized airports. Furthermore, construction of new airports in the vicinity of scale inefficient ones may lead to unnecessary cost duplication.

Finally, our disaggregated approach allows us to draw some general conclusions about scale economies in airport operation. While scale economies in the investment in terminal capacity and in labor employment appear to be exhausted at comparatively low traffic levels, the runway system is found to be an important driver of scale economies resulting from substantial indivisibilities in the provision of takeoff and landing capacities.

**References**

