EJTIR

Issue 13(4), 2013
pp. 336-356
ISSN: 1567-7141
www.ejtir.tbm.tudelft.nl

Air passenger traffic and local employment: Evidence from Turkey

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By providing fast and safe transportation opportunities, air transportation plays an important social and economic role in the development of cities and the nation as a whole. Using Census 2000 data from 31 provinces, this study attempts to figure out the possible effects of air passenger traffic on the local composition of employment in Turkey. Its results suggest that employment in many industries and occupations benefits from the existence of scheduled air passenger traffic. More concretely, we found that a 10% point increase in air passenger traffic per capita would generate 15,013 service-related jobs throughout the 31 provinces analysed.

Keywords: Air passenger traffic, economic contribution, job creation, Turkey

1. Introduction

Airports are critical infrastructures that are believed to be essential for economic development because they substantially increase the accessibility of the regions they serve. However, except for several hub airports (e.g., İstanbul Atatürk International Airport and İstanbul Sabiha Gökçen International Airport) and those serving tourist destinations (e.g., Antalya International Airport, Muğla Bodrum-Milas International Airport, and Muğla Dalaman International Airport), airport business is mostly financially unviable in Turkey like the rest of the world. While large airports tend to make profits, smaller and regional airports hardly recover their costs (Doganis, 1992: p.5). The airport industry is characterized by substantial initial infrastructure investment and the operating revenues generally fail to recover annual operating expenses. Therefore, most of the regional and small airports need financial contributions mostly in the form of cross-subsidization from larger profitable airports (Ohta, 1999; Hooper, 2002; Lipovich, 2008; Reinhold et al, 2010).

But airports offer benefits beyond those displayed on simple balance sheets and income statements. Major characteristics of air transportation such as speed, safety, and reliability help sustain critical economic connections. Service industries, where face-to-face interaction is necessary, heavily rely on air transportation to rapidly reach new markets and establish business linkages with customers. In the markets where the life span of the products is too short or the price of the products is relatively

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high when compared to unit logistics costs, manufacturing firms need air cargo services to place their products in the shortest and most reliable manner. For Turkey, the role of air transportation is even bigger. It arises as the only viable option, especially for long-distance intercity passenger trips, given the limited scope of high-speed rail infrastructure and the low-quality pavements in the majority of the road network.

For governmental decision makers, to initiate a new green-field, low-traffic small airport project may be challenging, given the poor financial statements of such airports. To make a proper assessment, decision makers must know the economic contribution of airports, the positive economic effects that we cannot identify solely by analysing the financial statements. In other words, operating an airport should be socially profitable meaning that the decision to launch a new airport project that is a candidate to be financially unprofitable or to keep the operations of an already money-losing one should be justified with the economic contributions of the flights.

The goal of this study is to define the effect of air transportation on the local employment in terms of industries and occupations by using econometric models. In Section 2, we will summarize the existing literature on the linkage between air transportation and its effect on economic development and job creation. In Section 3, we will explain our methodology and data. In Section 4, we will discuss our findings; and in section 5, we will present the conclusions.

2. Literature review

The effect of air transportation on local economies arises in two ways, namely (i) expenditure effects and (ii) transportation effect. Expenditure effects are the benefits that come from wages of employees in the various subsectors of the air transportation industry[2] (for example, air traffic control, airlines, ground handling, maintenance-repair-overhaul, and airport concessions) and expenditures during the construction phase of the airports, such as construction labours' wages and payments to the suppliers of construction materials. However, it is the transportation effect that creates the actual and long-term benefits because the real benefit of transportation investments and services emerge when they are able to reduce the transportation costs, with this reduction in cost originating from the improved accessibility, reliability, and safety and the reduced travel time and emissions (Taylor and Samples, 2002). From the point of view of air transportation, the transportation effect works when the existence of air services reduces the costs of the firms, which eventually increases their competitiveness.

The effect of air traffic on local employment has been attracting considerable academic interest. Hewings et al (1997) calculated that a capacity increase at O'Hare and Midway airports would lead to a total job increase of 522,000 in the Chicago region. Hakfoort et al (2001) estimated Amsterdam Airport Schiphol had a total multiplier of 2, implying that each new airport job would generate an additional job in the form of indirect and induced employment. Using the data from the years 1950 and 1980, Irwin and Kasarda (1991) found that employment growth was stimulated by air passenger traffic in 104 metropolitan areas in the United States (US). Similarly, Goetz (1992) showed that a positive correlation existed between per capita air passenger traffic and both previous and subsequent urban growth in the 50 largest metropolitan areas in US between 1950 and 1987. Button and Taylor (2000) suggested that the number of high-technology jobs (including but not limited to

2 Robertson (1995) suggested that every 1.000 annual passengers to/from an airport would create one airport-related job.

information technology software and services, telecommunication services, and advanced materials) increased as the number of international destinations (European airports in this case) and international passenger traffic increased. Debbage (1999) showed that airports with high traffic growth were more likely to attract parallel growth in administrative and auxiliary jobs in the US Carolinas. Debbage and Delk (2001) tested whether a linkage existed between air passenger traffic and administrative and auxiliary employment and found a high correlation (0.84, 0.83, and 0.83 for 1973, 1983, and 1996, respectively) between them for the 50 largest urban areas in the US. In a similar study on 98 metropolitan areas from the US, Alkaabi and Debbage (2007) documented that a correlation coefficient of 0.90, 0.84, 0.68, and 0.39 existed between air passenger traffic and (i) professional, scientific, and technical establishments; (ii) high-technology establishments; (iii) professional, scientific, and technical employment; and (iv) high-technology employment, respectively. Warren (2007) estimated that counties with commercial air service were more likely to experience higher income, employment, population, dividends, interest, and rent. Rasker et al (2009) found that as counties' distance to a major airport decreased, they tended to have (i) higher per capita income, (ii) more services and professional jobs, (iii) higher mean earning per job, and (iv) lower degree of specialization. The findings of Button et al (2010) suggested that income per capita in the neighbouring area could increase by 0.18–0.4% due to an increase of 10% in air passenger traffic.

One common problem of such comparable studies is that it is difficult to determine the direction of causality between the air traffic and its effect on local employment. On the one hand, the availability of scheduled air service can stimulate local economic growth and employment as it reduces transportation costs because the higher the frequency of flights, the greater the number of destinations served, the greater the transportation benefit. However, increased economic activity, population, and employment, better educational attainment and changes in employment mix can also generate increased air traffic and are able to shape the air traffic concentration as well.

The analysis of Bauer (1987) showed that the greater the population and per capita income, the greater the revenue passenger enplanements would be. Huston and Butler (1991) showed that factors like population, income level, climatic conditions, and being a tourist destination and a business centre were likely to determine whether an airport was a hub or not. In their study to analyse the factors distinguishing between major and minor air traffic markets, Liu et al (2006) found that the population, percentage of workforce in professional, scientific and technical services and management activities, distance to nearest major market, and percentage of workforce in tourism tended to determine whether a metropolitan area was a major air traffic market or not. Fernandes and Pacheco (2010) found that a "unidirectional Granger causal relationship from economic growth to domestic air transport demand" existed in Brazil for the period of 1966-2006. Dobruszkes et al (2011), for example, analysed the factors determining the air traffic volumes of European metropolitan areas. Their analysis revealed that having higher GDP, hosting head-quarters of major companies, being a tourism region, and being farther from the nearest main air market tended to increase air traffic of a European metropolitan area.

Such a chicken-and-egg problem makes econometric estimation of this ambiguous relationship between air passenger traffic and local employment challenging. To overcome this problem, scholars apply different techniques.

Button et al (1999) analysed the impact of a hub airport on the high-technology employment of a metropolitan statistical area (MSA) that it served, using data across 321 MSAs in the US. Their results showed that a region with a hub airport tended to have an added high-technology employment of more than 12,000. Button et al (1999) also controlled for the causality using the Granger causality test, and their further analysis confirmed the direction of causality. The empirical study of Brueckner (2003), using data from 91 US metropolitan areas for the year 1996, showed that a 10% increase in air passenger traffic created approximately a 1% increase in employment in service-related industries. Finally, the findings of Green (2007) suggested that both population and employment growth could be predicted using air passenger traffic. Both Brueckner (2003) and Green (2007) used two-stage least-squares estimation to eliminate any causality problem.

3. Model and data

3.1 Model

The aim of this study is to model the effect of air passenger traffic on local employment. One can assume that the local employment is a function of air traffic, as the existence of air traffic will stimulate local employment through reduced transportation costs. However, it is also expected that the higher employment and the larger the economy of a geographical area (country, state, metropolitan area, province, or city) will lead to higher air traffic figures. So air traffic can also be formulated as a function of local employment. To deal with this problem of causality, this study employed two-stage least-squares (2SLS) estimation, where we used two instrumental variables, *joint-use-airport* and *runway*, where

joint-use-airport is a dummy variable and equal to 1 for provinces whose airports are joint-use airports (military airports used by civilian commercial flights).

runway is the total length of the runway(s), in natural logs, of the provinces' airport(s). If an airport has more than one runway, *runway* equals to the sum of their lengths.

Among 31 Turkish provinces analysed, 12 have joint-use airports. These joint-use airports are military airports owned by either the Turkish Air Force or the Turkish Land Forces. General Directorate of State Airports Authority (GDSAA), the state-owned enterprise responsible for the management of the airports and air navigation systems in Turkey, operates civilian facilities such as passenger terminals within these joint-use airports to enable civilian flights. Due to the facts that civilian flights should share the fundamental infrastructures and services (such as runway, aprons, and air traffic control) with the military flights and that the military imposes some restrictions on the civilian flights (in terms of slots, operation schedules, and cockpit crew), air passenger traffic at joint-use airports mostly fails to achieve its full potential; and we can argue that provinces having a joint-use airport tend to have lower air passenger traffic.

On the other hand, runway lengths determine the type of aircrafts able to use the airports. Airports with longer runways can serve wider-body aircrafts and accordingly can handle more air passenger traffic with the same number of flights. While runways lengths were designed based on the then-current traffic forecasts and aircraft types at the time of the initial investment, factors such as limited financial resources, natural obstacles, lack of necessary land, and growing environmental concerns tend to prevent or delay the necessary rehabilitation investments (for lengthening the existing runways or building a newer higher-capacity runway) which would enable the shift to wider-body aircrafts and eventually help handle the increased air passenger traffic. As a result, airports lacking the needed runway capacity may fail to achieve its full potential as in the case of joint-use airports.

Based on such characteristics, we believe that both joint-use-airports and runway lengths can be suitable instruments.

As a result, we modelled the first-stage of the estimation as[3]:

air passenger traffic = f *(joint-use-airport, runway)* (1)

After running the initial step of the 2SLS estimation, we constructed and ran our model using the following (per capita) specification[4]:

local employment = f (*air passenger traffic, population, labourforce, GDP*) (2)

where

local employment (per capita)	is the ratio of employment figure as of 2000 in each province, in terms of one of the 19 various industry and occupation classifications listed in Table 1, to the population in that province as of 2000,
air passenger traffic (per capita)	is the ratio of total (domestic + international) air passenger traffic to the population in each province in the year 2000,
population	is the population, in natural logs, of each province in the year 2000[5],
labourforce	is the percentage of the population between 15 and 64 years old for the year 2000,
GDP (per capita)	is the per capita GDP, in natural logs, of each province in the year 2000.

3.2 Data

For the *air passenger traffic per capita* variable, we used the total air passenger traffic at each Turkish province in the year 2000[6]. In the year 2000, among 81 Turkish provinces, 35 had air traffic service at 37 airports. However, we excluded three provinces (Çanakkale, Sinop, and Tokat) each having annual air passenger traffic of fewer than 1,000 passengers per year and one province (Tekirdağ)

3 We have checked for multicollinearity using the variance inflation factor (VIF) scores. For the two independent variables, both the highest and the average VIF score is 1.01. To overcome a possible problem of heteroscedasticity, we used robust standard errors in our regression estimations. We used natural logarithms of runway length to obtain a normal distribution.

4 We have checked for multicollinearity using the variance inflation factor (VIF) scores. For the four independent variables, the highest VIF score is 6.89, and the average VIF score is 4.61. To overcome a possible problem of heteroscedasticity, we used robust standard errors in our regression estimations. We used natural logarithms of population and per capita GDP to obtain a normal distribution.

5 The model assumes that provincial borders limit the airport's catchment areas and no passenger leakage exists between the airports of two neighbour provinces.

6 We preferred to use air passenger demand instead of supply-side figures such as the number of passenger flights or the number of seats supplied since these statistics do not exist in Turkey. One drawback of the air passenger traffic statistics for year 2000 is that they lack connecting air passenger traffic figures. Among 33 airports in 31 provinces in 2000, only two airports, İstanbul Atatürk Airport and Ankara Esenboğa Airport, were hub airports with connecting air passenger traffic. One implication of not being able to adjust the traffic data for connecting passengers is that provinces with these hub airports get higher air passenger traffic per capita values than they should.

having only international charter flights from our data set. As a result, our data set consists of 31 provinces. All of these provinces had scheduled domestic air traffic and 17 of them also experienced international flights. For Muğla and Balıkesir provinces, where each province has two separate operating airports, we simply added the annual total passenger traffic of these two airports to get a single aggregate value.

Turkish censuses classify nine industries and seven occupations among all employment data. In addition to these nine industries and seven occupations, we created three aggregate industry variables as *goods-related employment*, *service-related employment,* and *nonagricultural employment* where

- *goods-related employment (GOODS)* is the total employment in mining and quarrying; the manufacturing industry; construction,
- *service-related employment* (*SERVICE*) is the total employment in electricity, gas, and water; wholesale and retail trade, restaurants and hotels; transportation, communication, and storage; finance, insurance, real estate, and business services; community, social, and personnel services,
- *nonagricultural employment* (*NON-AGR*) is the sum of *goods-related employment* and *service-related employment*.

Table 1 describes the 19 employment-related variables, 9 industries, 7 occupations, and 3 aggregate industry variables. Because we use per capita employment as the dependent variable in the second stages of 2SLS estimations, we then divided the employment in each employment classification by the population for each province to get the per capita figures. Table 2 presents the summary statistics of all variables used in our analyses.

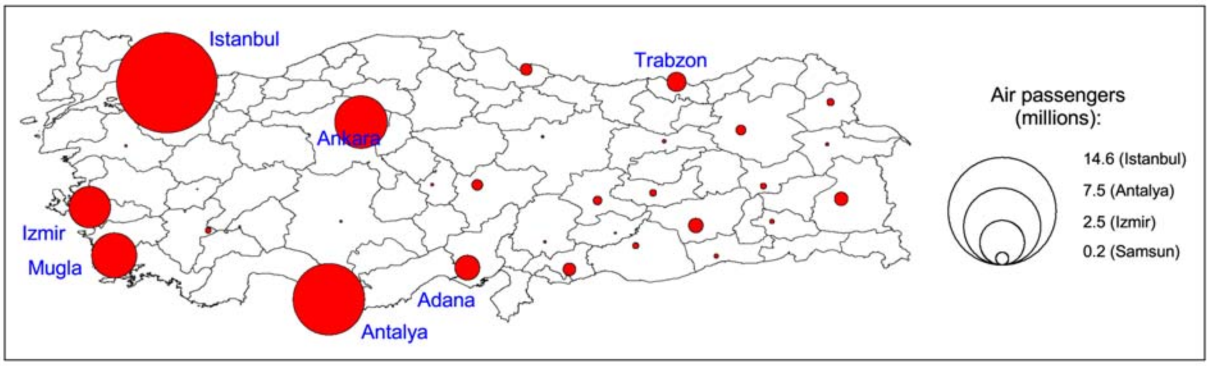

Figure 1. The distribution of total air passenger traffic among Turkish provinces for 2000[7,8]

Figure 1 and Figure 2 show the distribution of total and per capita air passenger traffic among Turkish provinces for 2000, respectively. The air passenger traffic figures, the classification of civilian versus joint-use airports, and the lengths of the runways come from the *Statistics Yearbook of*

7 We would like to thank Dr. Frederic Dobruszkes for his help in preparing the maps.
8 We also calculated the correlation coefficients between the employment in the employment classifications described at Table 1 and the air passenger traffic of the provinces depicted at Figure 1. Our results reveal that a high and statistically significant at the 1% level correlation existed between air passenger traffic and *CONS* (0.65), *WHOLE* (0.83), *TRANS* (0.69), *FINAN* (0.48), *SCI* (0.47), *CLE* (0.48), *COMM* (0.53), *SERV* (0.84), and *SERVICES* (0.64).

General Directorate of State Airports Authority for 2000 (GDSAA, 2001). We gathered data on per capita GDP, employment classifications, population, distribution of population among ages, and educational attainment of Turkish provinces from the Turkish Statistical Institute web site (Turkish Statistical Institute, 2012) providing online statistics of census 2000. Census 2000 data are used because these are the most recent data available.

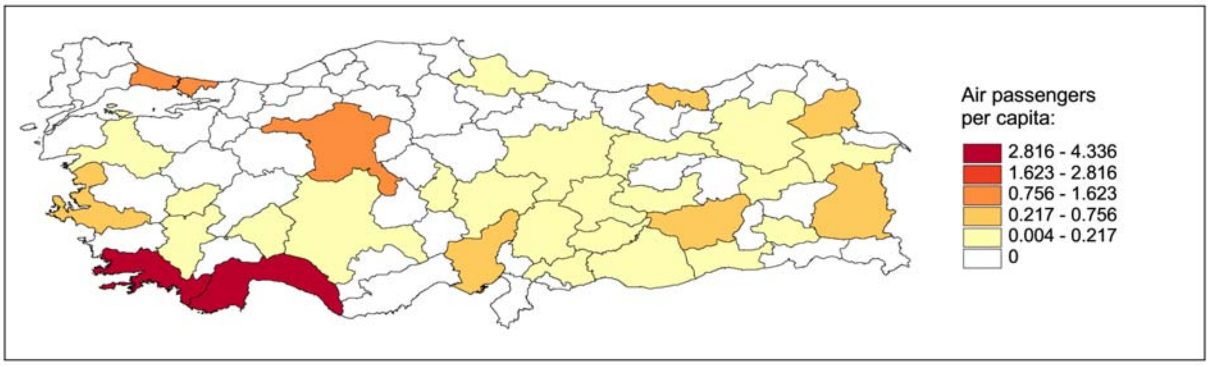

Figure 2. The distribution of per capita air passenger traffic among Turkish provinces for 2000

The major hypothesis of this study is that air passenger traffic can stimulate local employment in most industries and occupations; and accordingly, we suppose *air passenger traffic per capita* should get a positive coefficient. In regards to population, we think that population of a province can change the composition of the local employment, as some rural and low-population provinces may heavily rely on agricultural activities whereas bigger cities can easily attract bigger businesses and accordingly more white-collar workers. So, the independent variable *population* should get both positive and negative coefficients, depending on the employment variable used in the regression estimation. As the percentage of the population able to work will directly affect the employment, we anticipate that *labourforce* should get a positive coefficient. On the other hand, we believe that income levels of the provinces tend to shape their employment mixes and developed provinces are generally more successful in attracting high value-added industries and occupations necessitating qualified human resources; and as a result, we expect that being a high-income province should increase employment in such industries and occupations. The independent variable *per capita GDP* should therefore get a positive coefficient for such industries and occupations.

Table 1. Employment Classifications

Industries	Aggregate Industries	Occupations
(AGR): Employment in agriculture, hunting, forestry, and fishing	*(GOODS):* (Employment in mining and quarrying) + (Employment in the manufacturing industry) + (Employment in construction)	*(SCI):* Total number of scientific, technical, professional, and related workers
(MINING): Employment in mining and quarrying	*(SERVICE):* (Employment in electricity, gas and water) + (Employment in wholesale and retail trade; restaurants and hotels)+ (Employment in transportation, communication, and storage) + (Employment in finance, insurance, real estate, and business services) + (Employment in community, social, and personnel services)	*(ADM):* Total number of administrative and managerial workers
(MANUF): Employment in the manufacturing industry	*(NON-AGR): GOODS* + *SERVICE*	*(CLE):* Total number of clerical and related workers
(ELEC): Employment in electricity, gas, and water		*(COMMER):* Total number of commercial and sales workers
(CONS): Employment in construction		*(SERV):* Total number of service workers
(WHOLE): Employment in wholesale and retail trade; restaurants and hotels		*(AGRICU):* Total number of agricultural, animal husbandry, forestry workers, fishers, and hunters
(TRANS): Employment in transportation, communication, and storage		*(NON-AGRICU):* Total number of nonagricultural production and related workers, transportation equipment operators, and labourers
(FINAN): Employment in finance, insurance, real estate, and business services		
(COMMU): Employment in community, social, and personnel services		

Table 2. Summary Statistics

Variable	Mean	Std. Dev.	Min.	Max.	Variable	Mean	Std. Dev.	Min.	Max.
air passenger traffic	1,125,077.258	2,963,904.970	1,936	14,647,810	*population*	1,370,808	1,813,305	263,676	10,018,735
air passenger traffic per capita	0.481	1.052	0.0038	4.3359	*labourforce*	0.6156	0.0638	0.5019	0.6963
joint-use-airport	0.3871	0.4951	0	1	*per capita GDP*	2,202.548	1,031.317	725	4,416
Runway	3,525.968	1,540.373	1,720	7,620	*pcAGRI*	0.2187	0.0716	0.0282	0.3307
AGR	208,256.1	101,080.6	44,215	512,451	*pcMINING*	0.0009	0.0011	0.0000	0.0044
MINING	1,040.903	1,271.54	19	4,906	*pcMANUF*	0.0303	0.0266	0.0044	0.1095
MANUF	71,521.06	197,758.6	1,701	1,097,051	*pcELEC*	0.0014	0.0010	0.0006	0.0046
ELEC	2,142.581	3,495.003	258	14,968	*pcCONS*	0.0151	0.0050	0.0075	0.0270
CONS	24,201.32	40,099.61	1,985	215,925	*pcWHOLE*	0.0296	0.0183	0.0071	0.0798
WHOLE	57,341	1,20128.1	3,141	650,295	*pcTRANS*	0.0101	0.0046	0.0035	0.0221
TRANS	18,979.39	40,554.49	1,580	221,298	*pcFINAN*	0.0078	0.0068	0.0015	0.0302
FINAN	20,286.32	54,023.43	529	283,404	*pcCOMMU*	0.0646	0.0189	0.0371	0.1234
COMMU	94,970.55	144,398.8	16,207	696,033	*pcGOODS*	0.0463	0.0298	0.0129	0.1315
GOODS	96,763.29	237,392.7	3,710	1,317,083	*pcSERVICE*	0.1135	0.0402	0.0498	0.2228
SERVICE	193,719.8	357,063.7	22,579	1,865,998	*pcNON-AGRI*	0.1598	0.0622	0.0626	0.3177
NON-AGRI	290,483.1	589,149.7	28,417	3,183,081	*pcSCI*	0.0239	0.0097	0.0103	0.0547
SCI	42,010.16	77,808.23	3,863	394,578	*pcADM*	0.0040	0.0025	0.0013	0.0132
ADM	8,328.677	18,384.89	477	92,038	*pcCLE*	0.0177	0.0088	0.0081	0.0473
CLE	36,070.68	79,615.07	2,566	417,970	*pcCOMMER*	0.0181	0.0093	0.0049	0.0452
COMMER	36,989.9	82,785.31	2,069	452,964	*pcSERV*	0.0255	0.0112	0.0110	0.0601
SERV	41,372.2	73,521.99	5,843	389,654	*pcAGRICU*	0.2189	0.0716	0.0286	0.3310
AGRICU	208,715.3	101,424.8	44,254	513,016	*pcNON-AGRICU*	0.0706	0.0287	0.0249	0.1432
NON-AGRICU	125,633.3	260,526.6	11,277	1,434,470					

The study might have two possible weaknesses. One weakness may arise due to the fact that the data set is created using the Census 2000, as it is the latest census having the detailed information we needed. It may be relatively old, but we believe that the fundamentals of the relations in the model have remained valid during the years since 2000. Another weakness may stem from the use of relatively fewer observations, as compared with similar studies. Comparable studies focused on US, where (due to its geography, economic activity, and population) one might obtain a considerable number of observations. But we believe that 31 observations from Turkey are adequate to make statistical interpretations.

The most significant advantage of the data set is that it includes so many occupations and industries through which a wide range of analyses and interpretations can be made. Comparable studies focus on specific jobs (like high-technology and managerial jobs) or focus on specific industries (like service industry). In contrast, this paper is able to identify and analyse 19 different groups of occupations and industries, which provides us a large room for conclusions.

4. Empirical results

The regression results for the first stage of 2SLS estimation (R^2= 0.443) are as follows:

air passenger traffic per capita = -0.790 *joint-use-airport* + 1.6574 *runway* - 12.623

where the t-statistics (respectively 2.52**;2.37** and 2.31 ***) are based on robust standard errors. The ***, ** and * stand for significance levels at 1%, 5%, and 10%, respectively. The results of the ordinary least-squares (OLS) and 2SLS regressions using *joint-use-airport* and *runway* as instrumental variables are shown at Table 3, Table 4, and Table 5.

Table 3 presents the results of regressions when local employment per capita in each industry is used as the dependent variable, respectively. In terms of industries, a 1% point increase in air passenger traffic per capita of a province leads to 0.0019% increase in the per capita employment of the construction industry (*pcCONS*), 0.0098% increase in the per capita employment in wholesale and retail trade; restaurants and hotels (*pcWHOLE*), 0.0025% increase in the per capita employment in transportation, communication, and storage (*pcTRANS*), and 0.0026% increase in the per capita employment of finance, insurance, real estate, and business services activities (*pcFINAN*). Regarding aggregate industries (Table 4), on the other hand, a 1% point increase in the air passenger traffic per capita of a province creates a 0.0250% increase in the per capita employment of aggregate service-related industries (*pcSERVICE*) and a 0.0145% increase in the per capita employment of aggregate nonagricultural industries (*pcNON-AGR*), which is the sum of the per capita employment of aggregate goods-related industries (*pcGOODS*) and that of aggregate service-related industries (*pcSERVICE*).

In terms of occupations (Table 5), a 1% point increase in air passenger traffic per capita of a province leads to a 0.0031% increase in the per capita number of clerical and related workers (*pcCLE*), a 0.0016% increase in the per capita number of commercial and sales workers (*pcCOMME*), and a 0.0084 increase in the per capita number of service workers (*pcSERV*).

Table 3. Regression Results for Industries

Indep. Vars	pc AGR (OLS)	pc AGR (2SLS)	pc MINING (OLS)	pc MINING (2SLS)	pc MANUF (OLS)	pc MANUF (2SLS)	pc ELEC (OLS)	pc ELEC (2SLS)	pc CONS (OLS)	pc CONS (2SLS)	pc WHOLE (OLS)	pc WHOLE (2SLS)	pc TRANS (OLS)	pc TRANS (2SLS)	pc FINAN (OLS)	pc FINAN (2SLS)	pc COMMU (OLS)	pc COMMU (2SLS)
Inter-cept	1.3034***	1.2776***	-0.0006	-0.0021	-0.3542***	-0.3753***	-0.0028	-0.0021	-0.0285**	-0.0285***	-0.1500***	-0.1600***	-0.0423***	-0.0390***	-0.0906***	-0.0804***	-0.0017	0.0567
	(8.14)	(8.02)	(0.25)	(0.72)	(4.31)	(4.56)	(0.95)	(0.94)	(4.10)	(3.45)	(9.48)	(5.80)	(4.70)	(4.13)	(4.65)	(5.84)	(0.02)	(0.85)
Air pass. traffic per capita	0.0110	0.0090	0.0002	0.0001	-0.0075***	-0.0123	0.0002	0.0003	0.0016***	0.0019**	0.0096***	0.0098**	0.0016***	0.0025***	0.0007	0.0026**	0.0003	0.0098
	(1.37)	(0.55)	(0.50)	(0.12)	(3.46)	(1.70)	(0.64)	(0.91)	(3.55)	(2.26)	(14.84)	(2.50)	(3.08)	(4.09)	(1.63)	(2.21)	(0.16)	(1.49)
Pop-ula-tion	-0.0570***	-0.0595***	-0.0005	-0.0005	0.0098	0.0137**	-0.0002	-0.0003	0.0008	0.0002	0.0029**	0.0000	0.0009	0.0001	0.0041***	0.0032***	-0.0035	-0.0069
	(3.04)	(2.88)	(1.69)	(1.22)	(1.46)	(2.29)	(0.71)	(0.93)	(1.55)	(0.21)	(2.66)	(0.01)	(1.29)	(0.15)	(3.13)	(2.98)	(0.50)	(1.00)
Labour-force	0.5681	0.5638	0.0030	0.0034	0.0935	0.1135	0.0000	-0.0005	0.0460***	0.0436***	0.0535***	0.0442	0.0130	0.0092	0.0324*	0.0268	0.0965	0.0702
	(1.70)	(1.63)	(0.61)	(0.65)	(1.37)	(1.47)	(0.00)	(0.14)	(3.99)	(3.21)	(3.18)	(1.13)	(1.28)	(0.83)	(1.85)	(1.58)	(0.70)	(0.51)
Per capita GDP	-0.0866	-0.0782	0.0009	0.0011	0.0258**	0.0202*	0.0009	0.0010	0.0005	0.0017	0.0135***	0.0207**	0.0041**	0.0053***	0.0030	0.0035	0.0071	0.0072
	(1.66)	(1.46)	(1.06)	(1.02)	(2.22)	(1.87)	(1.33)	(1.38)	(0.24)	(0.63)	(4.72)	(2.78)	(2.73)	(3.01)	(1.10)	(1.36)	(0.35)	(0.35)
R^2	0.642	0.627	0.305	0.287	0.585	0.589	0.207	0.215	0.799	0.759	0.959	0.821	0.849	0.840	0.786	0.822	0.198	0.288

Notes: (1) Population figures in natural logs; (2) t-statistics in parenthesis based on robust regressions; (3) ***, **, and * stand for significance levels at 1%, 5%, and 10%, respectively; (4) number of observations = 31.

Table 4. Regression Results for Aggregate Industries

Independent Variables	pc GOODS (OLS)	pc GOODS (2SLS)	pc SERVICE (OLS)	pc SERVICE (2SLS)	pc NON-AGR (OLS)	pc NON-AGR (2SLS)
Intercept	-0.3833 ***	-0.4059 ***	-0.2875 **	-0.2248 ***	-0.6708 ***	-0.6308 ***
	(4.73)	(4.98)	(2.69)	(2.98)	(5.29)	(5.02)
Air passenger traffic per capita	-0.0057 **	-0.0104	0.0125 ***	0.0250 ***	0.0068 *	0.0145 **
	(2.47)	(1.46)	(4.58)	(3.89)	(1.75)	(2.06)
Population	0.0101	0.0134 **	0.0042	-0.0039	0.0143	0.0095
	(1.50)	(2.31)	(0.54)	(0.45)	(1.29)	(0.78)
Labourforce	0.1425 *	0.1605 *	0.1952	0.1498	0.3377 *	0.3104
	(2.01)	(2.06)	(1.25)	(0.95)	(1.84)	(1.69)
Per capita GDP	0.0272 **	0.0230 **	0.0285	0.0378	0.0557 *	0.0608 **
	(2.17)	(2.12)	(1.28)	(1.56)	(1.96)	(2.09)
R^2	0.649	0.659	0.757	0.804	0.828	0.836

Notes: (1) Population figures in natural logs; (2) *t*-statistics in parenthesis based on robust regressions; (3) ***, **, and * stand for significance levels at 1%, 5%, and 10%, respectively; (4) number of observations = 31.

Table 5. Regression Results for Occupations

Indep. Vars	pc SCI (OLS)	pc SCI (2SLS)	pc ADM (OLS)	pc ADM (2SLS)	pc CLE (OLS)	pc CLE (2SLS)	pc COMME (OLS)	pc COMME (2SLS)	pc SERV (OLS)	pc SERV (2SLS)	pc AGRICU (OLS)	pc AGRICU (2SLS)	pc NON-AGRICU (OLS)	pc NON-AGRICU (2SLS)
Intercept	-0.096***	-0.0833***	-0.0308***	-0.0260***	-0.1084***	-0.0962***	-0.1245***	-0.1225***	-0.0276	-0.0311	1.3027***	1.2769***	-0.2818***	-0.2704***
	(4.18)	(6.88)	(3.88)	(5.93)	(4.49)	(6.21)	(8.44)	(7.91)	(1.47)	(1.34)	(8.15)	(8.01)	(3.55)	(3.02)
Air pass. traffic per capita	0.0005	0.0028	-0.0000	0.0008	0.0010	0.0031*	0.0011**	0.0016*	0.0075***	0.0084**	0.0112	0.0092	-0.0033	-0.0021
	(1.14)	(1.61)	(0.13)	(1.30)	(1.46)	(1.85)	(2.55)	(1.72)	(14.07)	(2.75)	(1.39)	(0.57)	(1.21)	(0.32)
Population	0.0025	0.0016	0.0009*	0.0006*	0.0052***	0.0041***	0.0045***	0.0040***	-0.0036*	-0.0061*	-0.0569***	-0.0595***	0.0047	0.0052
	(1.70)	(1.25)	(2.05)	(1.99)	(3.44)	(3.39)	(3.83)	(3.47)	(1.74)	(1.76)	(3.03)	(2.88)	(0.67)	(0.74)
Labourforce	0.0933***	0.0866***	0.0138**	0.0117**	0.0442**	0.0374*	0.0400**	0.0376**	-0.0554	-0.0645	0.5679	0.5633	0.1987*	0.1983*
	(4.21)	(4.03)	(2.39)	(2.13)	(2.07)	(1.83)	(2.55)	(2.44)	(1.27)	(1.19)	(1.70)	(1.63)	(1.98)	(1.92)
Per capita GDP	0.0037	0.0041	0.0018*	0.0018*	0.0036	0.0043	0.0073***	0.0081***	0.0176***	0.0233**	-0.0865	-0.0780	0.0220	0.0200
	(1.20)	(1.26)	(1.98)	(2.03)	(1.15)	(1.41)	(3.18)	(3.70)	(2.85)	(2.52)	(1.66)	(1.46)	(1.24)	(1.19)
R^2	0.839	0.865	0.723	0.753	0.785	0.816	0.903	0.902	0.841	0.646	0.641	0.626	0.633	0.623

Notes: (1) Population figures in natural logs; (2) *t*-statistics in parenthesis based on robust regressions; (3) ***, **, and * stand for significance levels at 1%, 5%, and 10%, respectively; (4) number of observations = 31

These results support the expectation that air traffic plays a positive role in creating new jobs in many industries and occupations. In addition to the *air passenger traffic per capita* variable, which is the focus of this study, we have also obtained interesting results about our control variables. Regarding population, we found that increasing population tends to decrease local employment per capita in (i) agriculture, hunting, forestry, and fishing activities *(pcAGR);* (ii) service workers *(pcSERV);* and (iii) agricultural, animal husbandry, forestry workers, fishers, and hunters *(pcAGRICU)*. Although the negative effect of *population* on *pcAGR* and *pcAGRICU* (as smaller and rural provinces may rely more on agricultural activities and occupations) is quite predictable, our finding that increasing *population* decreases *pc*SERVICE is surprising. Though higher *population* decreases *pcAGR, pcSERVICE,* and *pcAGRICU*, it stimulates *pcMANUF, pcFINAN, pcGOODS, pcADM, pcCLE,* and *pcCOMME*—implying that bigger and more populous provinces demand more employment at these industries and occupations. As for *labourforce*, which is a proxy for the percentage of the population able to work, our results reveal that *pcCONS, pcGOODS, pcSCI, pcADM, pcCLE, pcCOMME,* and *pcNON-AGRICU* tend to increase with increasing *air passenger traffic per capita* as we predicted before. Finally, *per capita GDP*, which controls the regional disparities, had statistically significant and positive coefficients, in parallel with our previous predictions, for *pcMANUF, pcWHOLE, pcTRANS, pcGOODS, pcNON-AGR, pcADM, pcCOMME,* and *pcSERV*—meaning that in developed provinces the ratios of total employment in these industries and occupations to total population tend to increase.

So far, we have talked about increases and decreases of employment (and per capita employment) in terms of percentages, which may seem a little abstract. To put our findings in a more concrete way, we also made a basic scenario analysis involving three scenarios. We simply tried to figure out, holding our control variables *(population, labourforce,* and *per capita GDP)* constant, how the employment in *CONS, WHOLE, TRANS, FINAN, SERVICE, NON-AGR, CLE, COMME,* and *SERV* (the employment classifications affected statistically significantly by *air passenger traffic per capita*) would change if the *air passenger traffic per capita* would increase by 3%, 5%, and 10% points, respectively. Table 6, which is divided into four panels, shows the results of our scenario analysis. Panel A represents the base scenario with zero growth in *air passenger traffic per capita,* while Panel B, Panel C, and Panel D represent 3% point growth, 5% point growth, and 10% point growth scenarios, respectively. In addition to the aggregate statistics of the total of 31 provinces forming our data set, we have also analysed 3 individual provinces (those having the maximum, median, and minimum *air passenger traffic per capita)* to better understand how individual provinces could be affected by the changes in *air passenger traffic per capita*.

The statistics presented in Panel A belong to year 2000 and come from Census 2000 and the *Statistics Yearbook of General Directorate of State Airports Authority for 2000* (GDSAA, 2001). In Panel B, we took the case in which *air passenger traffic per capita* increased by 3% point, holding the control variables used in our estimations constant. We first revised *pcCONS, pcWHOLE, pcTRANS, pcFINAN, pcSERVICE, pcNON-AGR, pcCLE, pcCOMME,* and *pcSERV* based on increased *air passenger traffic per capita.* We then recalculated the employment figures for *CONS, WHOLE, TRANS, FINAN, SERVICE, NON-AGR, CLE, COMME,* and *SERV* based on the changes in *pcCONS, pcWHOLE, pcTRANS pcFINAN, pcSERVICE, pcNON-AGR, pcCLE, pcCOMME,* and *pcSERV*, respectively. Last, we calculated the differences between the original *CONS, WHOLE, TRANS, FINAN, SERVICE, NON-AGR, CLE, COMME,* and *SERV* listed in Panel A and those revised in Panel B. The numbers in parenthesis in Panel B stand for the generated or lost employment in each of the employment classification due to the increase in *air passenger traffic per capita*. For example, the number 49 at the last row of the eighth column of Panel B means that the employment in finance, insurance, real estate, and business services is expected to increase by 49 in the 31 provinces analysed if the *air passenger traffic per capita* increases by 3% point. We then repeated this methodology for Panel C and Panel D as well.

The changes in various employment classifications are striking. The last row of Panel D shows the employment generated in the 31 provinces when *air passenger traffic per capita* increases by 10% point. In terms of industries, the employment in the construction industry (*CONS*), wholesale and retail trade; restaurants and hotels (*WHOLE*), transportation, communication, and storage (*TRANS*) and the employment in finance, insurance, real estate, and business services (*FINAN*) are expected to increase by 143, 1,742, 147, and 164. Although these figures are big, the generated employment for aggregate industries is even bigger. We predicted that growth in employment for SERVICE and *NON-AGR,* as a result of 10% point increase in *air passenger traffic per capita*, would be 15,013 and 13,057, respectively.

The last three columns of the last row of PANEL D exhibit the generated employment in three different occupations in the 31 provinces. According to Panel D, a 10% point increase in *air passenger traffic per capita,* holding the population constant, leads to an increase of 347 in the total number of clerical and related workers (*CLE*), 183 increase in the total number of commercial and sales workers (*COMME*), and 1,077 increase in the total number of service workers (*SERV*).

5. Conclusion

This paper attempts to find the linkage between air passenger traffic and its possible effects on local employment in Turkey, in terms of both industries and occupations. We used 2SLS estimation to handle the problem of two-way causality between the air passenger traffic and its effect on local employment. The data used in the analyses are from the year 2000, but we think some interpretations can still be derived.[9] The results of this paper support the expectation that air passenger traffic stimulates employment in many industries and occupations. More specifically, the findings here suggest that air passenger traffic per capita raises local employment per capita in industries such as (i) construction industry (*pcCONS*); (ii) wholesale and retail trade; restaurants and hotels (*pcWHOLE*); (iii) transportation, communication, and storage (*pcTRANS*); (iv) finance, insurance, real estate, and business services (*pcFINAN*); (iii) aggregate service-related industries (*pcSERVICE*); and (iv) aggregate nonagricultural industries (*pcNON-AGR*) and occupations such as (i) clerical and related workers (*pcCLE*); and (ii) commercial and sales workers (*pcCOMME*); and (iii) service workers (*pcSERV*). More concretely, a 10% point increase in air passenger traffic per capita, holding population and other variables constant, is likely to generate 15,013 service jobs throughout the 31 provinces analysed.

Whether such an expected job creation justifies the public financing of airports may arise as a policy question. To include the cost of job creation in Turkey within our analysis may help respond to this question.

[9] The results are similar to those presented in Ozcan (2012), who documented that increasing air cargo traffic is expected to raise employment in finance, insurance, real estate, and business services (FINAN) and the number of clerical and related workers (CLE) in Turkey.

Table 6. Scenario Analysis – Panel A

				Industries				Aggregate Industries		Occupations		
Province	Air passenger traffic per capita	Air passenger traffic	Population	pc CONS	pc WHOLE	pc TRANS	pc FINAN	pc SERVICE	pc NON-AGR	pc CLE	pc COMME	pc SERV
Antalya	4.3359	7,456,658	1,719,751	0.0233	0.0798	0.0162	0.0143	0.1750	0.2217	0.0257	0.0310	0.0538
Elazığ	0.1159	66,023	569,616	0.0122	0.0200	0.0082	0.0052	0.1103	0.1406	0.0174	0.0128	0.0288
Konya	0.0038	8,236	2,192,166	0.0144	0.0257	0.0086	0.0071	0.0934	0.1406	0.0155	0.0178	0.0173
Total of 31 provinces	0.8207	34,877,395	42,495,055	0.0177	0.0418	0.0138	0.0148	0.1413	0.2119	0.0263	0.0270	0.0302

Province	Air passenger traffic per capita	Air passenger traffic	Population	CONS	WHOLE	TRANS	FINAN	SERVICE	NON-AGR	CLE	COMME	SERV
Antalya	4.3359	7,456,658	1,719,751	40,151	137,276	27,806	24,651	300,937	381,202	44,132	53,334	92,521
Elazığ	0.1159	66,023	569,616	6,932	11,393	4,673	2,942	62,817	80,066	9,888	7,305	16,431
Konya	0.0038	8,236	2,192,166	31,597	56,411	18,902	15,602	204,741	308,111	34,066	39,052	37,845
Total of 31 provinces	0.8207	34,877,395	42,495,055	750,241	1,777,571	588,361	628,876	6,005,315	9,004,977	1,118,191	1,146,687	1,282,548

Table 6. Scenario Analysis – Panel B (%3 point increase)

				Industries				Aggregate Industries		Occupations		
Province	Air passenger traffic per capita	Air passenger traffic	Population	pc CONS	pc WHOLE	pc TRANS	pc FINAN	pc SERVICE	pc NON-AGR	pc CLE	pc COMME	pc SERV
Antalya	4.46597	7,680,358	1,719,751	0.02335	0.07985	0.01617	0.01434	0.17512	0.22176	0.02566	0.03101	0.05381
Elazığ	0.11939	68,004	569,616	0.01217	0.02001	0.00820	0.00517	0.11036	0.14062	0.01736	0.01283	0.02885
Konya	0.00387	8,483	2,192,166	0.01441	0.02574	0.00862	0.00712	0.09347	0.14061	0.01554	0.01782	0.01727
Total of 31 provinces	0.84536	35,923,717	42,495,055	0.01766	0.04184	0.01385	0.01480	0.14142	0.21200	0.02632	0.02699	0.03019

Province	Air passenger traffic per capita	Air passenger traffic	Population	CONS	WHOLE	TRANS	FINAN	SERVICE	NON-AGR	CLE	COMME	SERV
Antalya	4.46597	7,680,358	715,328	40,153	137,316	27,808	24,653	301,163	381,368	44,136	53,337	92,544
				(2)	(40)	(2)	(2)	(226)	(166)	(4)	(3)	(23)
Elazığ	0.11939	68,004	453,654	6,932	11,396	4,673	2,942	62,864	80,101	9,889	7,305	16,435
				(0)	(3)	(0)	(0)	(47)	(35)	(1)	(0)	(4)
Konya	0.00387	8,483	2,192,166	31,599	56,428	18,903	15,603	204,895	308,245	34,069	39,054	37,854
				(2)	(17)	(1)	(1)	(154)	(134)	(3)	(2)	(9)
Total of 31 provinces	0.84536	35,923,717	42,495,055	750,284	1,778,094	588,405	628,925	6,009,819	9,008,894	1,118,295	1,146,742	1,282,871
				(43)	(523)	(44)	(49)	(4,504)	(3,917)	(104)	(55)	(323)

Note: The numbers in the parentheses are rounded and represent the changes in each employment classification according to base scenario when air passenger traffic per capita increases by 3% point.

Table 6. Scenario Analysis – Panel C (%5 point increase)

				Industries				Aggregate Industries		Occupations		
Province	Air passenger traffic per capita	Air passenger traffic	Population	pc CONS	pc WHOLE	pc TRANS	pc FINAN	pc SER-VICE	pc NON-AGR	pc CLE	pc COMME	pc SERV
Antalya	4.55269	7,829,491	1,719,751	0.02335	0.07986	0.01617	0.01434	0.17521	0.22182	0.02567	0.03102	0.05382
Elazığ	0.12170	69,324	569,616	0.01217	0.02001	0.00820	0.00517	0.11042	0.14066	0.01736	0.01283	0.02886
Konya	0.00394	8,648	2,192,166	0.01441	0.02575	0.00862	0.00712	0.09351	0.14065	0.01554	0.01782	0.01727
Total of 31 provinces	0.86178	36,621,265	42,495,055	0.01766	0.04185	0.01385	0.01480	0.14149	0.21206	0.02632	0.02699	0.03019

Province	Air passenger traffic per capita	Air passenger traffic	Population	CONS	WHOLE	TRANS	FINAN	SER-VİCE	NON-AGR	CLE	COMME	SERV
Antalya	4.55269	7,829,491	715,328	40,155 (4)	137,343 (67)	27,809 (3)	24,654 (3)	301,313 (376)	381,478 (276)	44,139 (7)	53,338 (4)	92,560 (39)
Elazığ	0.12170	69,324	453,654	6,933 (1)	11,399 (6)	4,674 (1)	2,942 (0)	62,896 (79)	80,124 (58)	9,890 (2)	7,306 (1)	16,438 (7)
Konya	0.00394	8,648	2,192,166	31,600 (3)	56,439 (28)	18,904 (2)	15,604 (2)	204,997 (256)	308,334 (223)	34,071 (5)	39,055 (3)	37,861 (16)
Totalof 31 provinces	0.86178	36,621,265	42,495,055	750,312 (71)	1,778,442 (871)	588,435 (74)	628,958 (82)	6,012,822 (7,507)	9,011,506 (6,529)	1,118,364 (173)	1,146,779 (92)	1,283,087 (539)

Note: The numbers in the parentheses are rounded and represent the changes in each employment classification according to base scenario when air passenger traffic per capita increases by 5% point.

Table 6. Scenario Analysis – Panel D (%10 point increase)

				Industries				Aggregate Industries		Occupations		
Province	Air passenger traffic per capita	Air passenger traffic	Population	pc CONS	pc WHOLE	pc TRANS	pc FINAN	pc SERVICE	pc NON-AGR	pc CLE	pc COMME	pc SERV
Antalya	4.76948	8,202,324	1,719,751	0.02335	0.07990	0.01617	0.01434	0.17543	0.22198	0.02567	0.03102	0.05384
Elazığ	0.12750	72,625	569,616	0.01217	0.02002	0.00821	0.00517	0.11056	0.14077	0.01736	0.01283	0.02887
Konya	0.00413	9,060	2,192,166	0.01442	0.02576	0.00862	0.00712	0.09363	0.14075	0.01554	0.01782	0.01728
Total of 31 provinces	0.90281	38,365,135	42,495,055	0.01766	0.04187	0.01385	0.01480	0.14167	0.21221	0.02632	0.02699	0.03021

Province	Air passenger traffic per capita	Air passenger traffic	Population	CONS	WHOLE	TRANS	FINAN	SER-VICE	NON-AGR	CLE	COMME	SERV
Antalya	4.76948	8,202,324	715,328	40,159 (8)	137,411 (135)	27,813 (7)	24,657 (6)	301,689 (752)	381,755 (553)	44,146 (14)	53,342 (8)	92,599 (78)
Elazığ	0.12750	72,625	453,654	6,933 (1)	11,404 (11)	4,674 (1)	2,943 (1)	62,974 (157)	80,182 (116)	9,891 (3)	7,306 (1)	16,445 (14)
Konya	0.00413	9,060	2,192,166	31,603 (6)	56,466 (55)	18,907 (5)	15,606 (4)	205,253 (512)	308,558 (447)	34,077 (11)	39,058 (6)	37,877 (32)
Total of 31 provinces	0.90281	38,365,135	42,495,055	750,384 (143)	1,779,313 (1,742)	588,508 (147)	629,040 (164)	6,020,328 (15,013)	9,018,034 (13,057)	1,118,538 (347)	1,146,870 (183)	1,283,625 (1,077)

Note: The numbers in the parentheses are rounded and represent the changes in each employment classification according to base scenario when air passenger traffic per capita increases by 10% point.

In Turkey, the major proxy on cost of job creation comes from investments incentives provided by Ministry of Economy. In 2001, investment incentives were provided in aggregates services industry for a total investment of 4,065 million Turkish Liras and it was reported that a total of 31,698 service jobs would be created as a result of these investments (Ministry of Economy, 2013). According to these statistics, one service job would cost approximately 128,242 Turkish Liras in 2001.

Among 33 airports operated by SAA in 2001, 26 airports in 25 provinces incurred financial losses (i.e. their total revenues (excluding aeronautical revenues) fell below their total expenses). Their total financial losses were 27,799,349 Turkish Liras. So, just looking at employment effect of air passenger traffic, we can conclude that the financial losses of the airports would be justified if 27,799,349/128,242=216.6 jobs were to be created as a result of air passenger traffic increase. Assuming that our regression results are valid, such an increase in service employment corresponded to 0.83% increase in air passenger traffic holding our control variables constant.

In 2010, according to the GDSAA budget report, only 5 airports (İstanbul Atatürk, İzmir Adnan Menderes, Antalya, Muğla Dalaman and Muğla Milas-Bodrum) among 43 operated by GDSAA made profits, while the remaining 38 were being subsidized by the 5 profitable airports and revenues of air navigation services. However, evaluating the airport system based on such financial results may be misleading and can obscure the economic benefits, which are hard to quantify, of the air transportation system. This paper tries to fill this gap. Its findings may help the public policy makers and implementers to better judge the benefits and costs of the air transportation system as a whole.

Acknowledgements

A previous version of this study has been awarded TURKONFED Regional Development Program Award and presented at the 2. Symposium on Regional Dynamics in Development held on November 1-2, 2012 in Adana, Turkey. We would like to thank Dr. Frederic Dobruszkes and the anonymous referees for their valuable comments. The views expressed in this article are those of ours and do not necessarily represent the views of the Ministry of Development of Turkey.

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