

SPATIAL ANALYSIS OF AIR PASSENGERS WITH RESPECT TO POPULATION AND EMPLOYMENT

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Abstract

The relationship between air passengers, urbanization and employment growth at the national scale is investigated in order to illustrate its role in the post-war evolution of the Turkish urban system. Theory suggests that major transportation innovations have exhibited profound and prolonged interdependencies with patterns of growth in national or regional urban systems. As the most recent major intercity transportation innovation, it should be expected that utilization of air transportation should bear some relationship to patterns of growth in urban places.

This paper investigates this relationship by using government air transportation data and Turkish Census data to correlate air passengers growth rate with the changes in population and employment for the 24 largest Turkish metropolitan areas and cities. The expectation that higher growth rate of air passengers exhibit a positive correlation with both previous and subsequent growth of employment and urban population is confirmed by the analysis. At the same time, this relationship is investigated at the regional and provincial level.

The results illustrate the importance of balanced airport planning with respect to urbanization and economic development of the provinces and regions. Further, especially increasing importance of Turkey's location as a result of globalisation requires the rapid and efficient development of hierarchical airport system in order to stimulate overall development and balanced urbanization.

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1. Introduction

After 1980's, the importance of Turkey's strategic location between European and Asian countries is increased due to political and economic restructuring in the world. This results in increased international relationships and thus the need to improve the international and national air transportation systems of Turkey. Further, during the same period, Turkey had also its share from the many multi-locational organizations which typify this new economy and decentralization of their manufacturing and office functions in the third world had also contributed to the growth of air flights. At the same time, the growth of tourism has stimulated the growth of air flights in Turkey (Dokmeci and Berkoz 1996).

It is expected that increased use of utilization of air transportation should have an impact on the patterns of urban growth. On the other hand, with respect to airport planning, urban growth is taken as a critical factor in assessing future demand for air travel (Wells 1986). High growth areas would be expected to have more national and international interactions, thus increasing their potential for air transportation. Thus, this study investigates the relationships between the air passengers growth and the growth of urban population and employment in Turkey in order to use it for airport and urban planning in the future.

Usually, the impact of air transportation on urban growth is investigated in developed countries (Goetz 1992). Pred (1977) showed the role of air transportation in contributing to metropolitan growth. Especially, he examined the impacts from external scale economies that results from the concentration of air transportation facilities in larger metropolitan areas, thus providing those cities with growth advantages. Taaffe (1956, 1962) which is a specialist of geography of air transportation used gravity models to define hierarchical patterns of air service areas

of the largest U.S. cities. His model suggested that the larger cities will generally have correspondingly larger air passenger flows. So, larger cities, resort cities and more isolated cities were found to have higher per capita air passengers. O'Kelly (1986) gives other explanations about the relationships between city population size and air passengers with respect to hub locations and network alignments. Markusen, Hall and Glasmeier (1986) have showed that airport access and high quality air service as one of the several factors in high-tech industry location. A survey of executives of the 500 largest American corporations reveals that 80 percent would not locate in an area which did not have reasonably available scheduled airline service (Goetz 1992). Further, a comprehensive work by Goetz (1992) investigates the relationships between the air passenger transportation and growth in the U.S. urban system between 1950 and 1987. The expectation that higher volumes of air passenger flow per capita exhibit a positive correlation with both previous and subsequent growth is confirmed by the analysis.

This present study investigates the relationships between the growth of air passengers and urban population and employment growth in developing countries which is neglected by the previous research, with a case study in Turkey. The organizations of the paper is as follows: The second section explains urban population and employment growth in provinces. The growth of number of airports and air passengers are given in section three. The relationships between the growth of air passengers and the growth of urban population and employment is investigated in section four. The final section is devoted to a conclusion and suggestions for further research.

2. Urban Population and Employment Growth of Provinces with Airports

Since the 1950s', Turkey has been experiencing a rapid urbanization process which is transforming it from a rural to an urban economy. The resulting process of economic restructuring due to predominantly export-oriented growth strategy (Kirim 1990) has multiplied the complexities of the transportation problems that Turkey is now facing. This restructuring is an adaptation of the nation's urban economies to the following factors: The appearance of new technologies and shifts in patterns of demand; the rapid growth of the service sector within cities at the top of the global

hierarchy; the concentration of economic control within multinational firms and financial institutions and decentralization of their manufacturing and routine office functions; and the development of manufacturing in the third world. This process increases national and international interactions and thus the need for air transportation.

This section shows the transformation of labour force with respect to urbanization at the provincial level in Turkey between 1980 and 1990. Most certainly, national and world wide economic restructuring will continue to play a role in shaping Turkey's employment and residential distribution pattern in the future. As Turkey's production and consumption become increasingly linked to global economic activities, the 1990's will likely bring further vitality to the nations major coastal cities, Istanbul, Izmir, Antalya and Mersin. The increased population pressure on already densely settled coastal areas will probably spur the spread of population growth inland.

The degree of urbanization and employment growth of the provinces which include airports are given below. The province of Istanbul has the largest amount of population and employment in Turkey. It is the most urbanized (92%) and industrialized (42%) province in the country. Ankara is the capital of the country and it is the second province with respect to urbanization and the amount of employment. Its urbanization ratio increased from 78% in 1980 to 87% in 1990. Izmir is the third province with respect to urbanization and employment. Urban ratio increased from 53% in 1980 to 79 in 1990. It has a very rich agricultural hinterland and it is the most important export port of the country. Although Adana is the fourth province with respect to population and employment, its urbanization ratio degree of industrialization fall below this rank. Despite its rapid industrialization based on agricultural products, agricultural sector still occupies almost 50% of employment. On the other hand, Bursa is the sixth province with respect to population and employment, its urbanization and industrialization ratio are above this level. While its urbanization ratio is increased from 5% in 1980 to 72% in 1990, its industrialization from 18% to 37%, respectively. Other rapidly urbanizing and industrializing provinces are Kayseri and Gaziantep. Urbanization ratio of Kayseri is 57% in 1990. Meanwhile, urbanization ratio of Gaziantep is 49%. On the Mediterranean coast,

Antalya is growing very rapidly based on the tourism sector. The urbanization and industrialization levels of the rest of the provinces with airports are below the levels given above.

Thus, while the agricultural sector is decreasing, industrial and service sectors are increasing in the metropolitan areas and large cities. Services such as transportation and communications make up the infrastructure of modern industry. The existence of the infrastructure in the core region constitutes a powerful attraction for a company planning to make industrial investments. Also, existing market forces attract the industry to the metropolitan areas. Hence, industry gravitates in the core (Vining 1985).

Industry is not the only source of work in the expanding core. The growing bureaucracy needed to administer public investment provides many jobs, as does the semiliberal service economy found in almost all large cities of developing countries. In addition, producer services are also increasing in large cities throughout Turkey. Technological changes based on informatics are penetrating through many segments of the service sector, such as telecommunications, banking and finance, and transport, and are radically restructuring these service industries. Further, as Turkey's production and consumption become increasingly linked to global economic activities, it is expected more increase in service and industrial sectors throughout the country in the future as the necessary infrastructure such as transportation is provided.

3. Analysis of Relationships between the Growth of Air Passengers and Growth of Urban Population and Employment

The main objective of this paper is to investigate the relationships between air passengers growth and the growth of urban population and employment. The hypothesis is that the growth of air passengers is positively related to urban population and employment in Turkey.

The mutual interdependence in these relationships is already illustrated by the previous research on transportation and economic development as an important element of development (Goetz, 1992). Although urban growth is essential for

transportation utilization, there are also other related factors which are important, such as urban functional differentiation, international socio-economic relationships and location of airports.

In 1980, there were 16 airports in Turkey. The number of airports increased to 24 in 1995 (See Table 1). The major increase in the number of airports has occurred in two regions: The number of airports increased from 2 in 1980 to 4 in 1995 in the Blacksea Region and from 4 to 7 in the East Anatolia Region. Air transportation is more convenient for these regions because of their mountainous characteristics which make it difficult and expensive to develop efficient highway systems (See Table 2).

Table 1. Number of Air Passengers

	1980	1985	1990	1995
Adana	189360	255985	420476	776415
Ankara	709060	1320040	1972618	3596111
Antalya	44060	208693	2107096	4727669
Bursa	29509	12894	13441	26839
Canakkale	---	---	---	1919
Denizli	---	---	---	14980
Diyarbakir	59855	71038	116303	296833
Elazig	7583	11815	5948	23209
Erzincan	---	---	2201	16521
Erzurum	36772	62873	58193	131029
Gaziantep	18281	2893	46907	127170
Istanbul	1938309	3505409	6232618	11942418
Izmir	349791	674112	1716013	2989647
Kars	---	---	3009	84049
Kayseri	3531	4441	---	---
Malatya	8177	16397	36540	87769
Mugla	---	82100	705295	2081705
Mus	---	---	---	46048
Samsun	13781	10391	9134	60101
Sinop	---	---	---	336
Sivas	2075	1846	2525	6307
Trabzon	22617	54602	124333	446242
Tokat	---	---	---	185
Sanliurfa	---	---	7503	31293
Van	25404	32360	49812	269884

Table 2. Distribution of the Airports According to Regions in Turkey

	1980	1985	1990	1995
Marmara	2	2	2	3
Aegean	1	2	2	3
Mediterranean	2	2	2	2
Blacksea	2	2	2	4
Inner Anatolia	3	3	2	2
East Anatolia	4	4	6	7
Southeast Anatolia	2	2	3	3

During the last 15 years, generally, there has been an increase in the number of air passengers for every province which has an airport with few exceptions. Air passenger flow data as well as urban population and employment data were collected for the 24 provinces with an airport or more (See Table 3 and Table 4).

The total number of air passengers from 3.458.165 in 1980 to 27.784.679 in 1995 which shows 803.45% increased in fifteen years. This rapid increase in the number of air passengers is the result of growth in tourism, the impact of globalization on Turkey's production and consumption systems and international economic and politic restructuring. The high growth rate of the air passenger volume is especially observed in the coastal cities, such as Istanbul, Antalya, Izmir and the capital Ankara. A large portion of air passengers at the country level is attracted to Istanbul since it is the international and national business center, tourism and cultural center of Turkey. Although air passengers of Istanbul is 43% of total air passengers of Turkey, its growth rate (616.1%) between 1980 and 1995 is lower than Antalya's air passengers' growth rate (10730.1%) which is a resort area on the Mediterranean coast. As a result of Antalya's attraction of air passengers, the percentage of Istanbul's air passengers decreased from 56% to 43% during the same period. However, air passengers' growth rate of Istanbul is still higher than its urban population growth rate which is 182.6%. The reason of Antalya's tremendous growth rate of air passengers is booming of national and international tourism in this region due to its wonderful natural beauties, rare historical remnants, social environment and nice climate. Decentralization of the Istanbul's share of air passengers at the expense of other

growth patterns is a natural process for decentralization of tourism investments and industrialization as the economic situation of the country is improved.

Table 3. Population of Provinces, Urban Population, Number of Passengers

	1980			1985			1990		
	Population of Province	Urban Population	Number of Passengers	Population of Province	Urban Population	Number of Passengers	Population of Province	Urban Population	Number of Passengers
Adana	1485743	842845	189360	1725940	1150529	255985	1934907	1350339	420476
Ankara	2854689	2238967	709060	2909946	2512036	1320040	3236626	2836719	1972618
Antalya	748706	280837	44060	891149	417162	208693	1132211	602194	2107096
Bursa	1148495	636910	29509	1324015	911591	12894	1603137	1157805	13441
Canakkale	391568	126703	---	417121	148150	---	432263	168529	---
Denizli	603338	205938	---	667478	288665	---	750882	337793	---
Diyarbakır	778150	374264	59855	934505	480964	71038	1094996	600640	116303
Elazığ	440808	187025	7583	483715	248984	11815	498225	272790	5948
Erzincan	282022	95228	---	300072	125077	---	299251	144144	2201
Erzurum	801809	285182	36772	856175	368357	62873	848201	400348	58193
Gaziantep	808697	512745	18281	966918	651713	2893	1140594	821127	46907
Istanbul	4741890	2909455	1938309	5842985	5572218	3505409	7309190	6753929	6232618
Izmir	1976763	1059183	349791	2317829	1809924	674112	2694770	2134816	1716013
Kars	700238	172119	---	722431	199935	---	662155	209463	3009
Kayseri	778383	380352	3531	864060	530375	4441	943484	604072	---
Malatya	606996	241560	8177	665809	324672	16397	702055	379188	36540
Mugla	438145	100314	---	486066	149788	82100	562809	186397	705295
Mus	302406	71077	---	339492	90178	---	376543	101154	---
Samsun	1008113	345200	13781	1106219	470617	10391	1158400	525305	9134
Sivas	750144	273215	2075	771555	329043	1846	767481	381947	2525
Tokat	624508	200231	---	679638	260766	---	719251	308304	---
Trabzon	731045	186580	22617	786194	273794	54602	795849	303612	124333
Sanliurfa	602736	282419	---	795034	407184	---	1001455	551124	7503
Van	468646	156852	25404	547216	201162	32360	637433	258967	49812

The growth patterns of air passengers according to the regions show the same trend of the provinces which dominate these regions. While the air passengers of the Marmara Region decrease from 58% to 50% and that of Inner Anatolia from 20% to 15%, air passengers of Aegean Region from 7% to 19% between 1980 and 1990.

Meanwhile, air passengers of the other regions varies only between 1-2% during the same period.

Table 4. Estimated Population, Number of Passengers

	1995	
	Population (Estimated)	Number of Passengers
Adana	1718922	189360
Ankara	3524992	709060
Antalya	1378397	44060
Bursa	1872048	29509
Canakkale	438311	---
Denizli	826695	---
Diyarbakır	1251507	59855
Elazığ	501831	7583
Erzincan	290510	---
Erzurum	816967	36772
Gaziantep	1159683	18281
Istanbul	8658556	1938309
Izmir	3055623	349791
Kars	312311	---
Kayseri	1010060	3531
Malatya	725206	8177
Mugla	635907	---
Mus	409101	---
Samsun	1189327	13781
Sivas	741977	2075
Tokat	746303	---
Trabzon	786142	22617
Sanliurfa	1211431	---
Van	723996	25404

Further, the relationships between the growth of air passengers and growth of population, urban population and employment. According to the results, the impact of the growth of employment is the most important factor on the growth of air passengers between 1985 and 1990 and $R^2=0,91$. The growth of urban population is the second most important factor to effect air passengers and $R^2=0,89$. The growth of population is the third factor to effect air passengers and $R^2=0,60$.

4. Conclusion

This study investigates the relationships between the growth of air passengers and the growth of population, urban population and employment. According to the results, there is a positive relationship between utilization of air transportation and both growth of urban population, employment and population with a lesser degree. Although Istanbul has the highest share of air passengers due to its national and international business ties and reputation in tourism, the growth of air passengers is greatest in Antalya which is a resort town on the Mediterranean coast. The growth pattern of air passengers also illustrates the decentralization of industry and tourism from metropolitan areas which is observed after a certain degree of economic development.

The results of the study are useful to determine the most efficient location and timing of new airports to be constructed in the future based on the growth of urban population and employment of provinces. Further research is suggested on the optimum location of hubs in a hierarchical organization of air passengers system (Dokmeci 1973).

References

1. Dokmeci, V. (1973) ‘‘An Optimization Model for a Hierarchical Spatial System’’ Journal of Regional Science, 13, 439-451.
2. Dokmeci, V. and L.Berkoz, (1996) ‘‘International Telecommunications in Turkey’’ Telecommunications Policy, 20, 2, 125-136.
3. Goetz, A.R. (1992) ‘‘Air Passengers Transportation and Growth in the U.S. Urban System, 1950-1987’’, Growth and Change 23, 2, 217-238.
4. Kirim, A. (1990) ‘‘Technology and Exports: The Case of the Turkish Manufacturing Industries’’, World Development 18.
5. Markusen, A.R., P.Hall and A.Glasmeir (1986) High-Tech America: The What, How, Where and Why of The Sunrise Industries, Boston: Allen & Unwin
6. O’Kelly, M.E. (1986) ‘‘The location of Interacting Hub Facilities’’, Transportation Science 20, 92-106.
7. Pred, A. (1977) City-Systems in Advanced Economies, New York: John Wiley & Sons.
8. Taaffe, E.J. (1962) ‘‘The Urban Hierarchy: An Air Passenger Definition’’, Economic Geography 38, 1-14.
9. Taaffe, E.J. (1956) ‘‘Air Transportation and United States Urban Distribution’’ Geographical Review 46, 219-238.
10. Vining, D.R.Jr. (1985) ‘‘The Growth of Core Regions in the Third World’’, Scientific American 252, 4, 24-31.
11. State Institute of Statistics Prime Ministry Republic of Turkey (1980-1995).

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