Locational Determinants of Major U.S. Air Passenger Markets by Metropolitan Area

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Liu, Z. J., Debbage K. G., and B. Blackburn, (2006). "Locational Determinants of Major U.S. Air Passenger Markets by Metropolitan Area" Journal of Air Transport Management 12(6): 331-341.

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Abstract:

The paper examines the influence of metropolitan characteristics in determining the locations of major air traffic markets in the US. In general, the likelihood of a major air passenger market locating in any given metropolitan area is primarily determined by the metropolitan area's population size and overall propensity for air travel. The study shows that on average, a major air passenger market has over 3 million people while a minor market has a population base of about 760,000. The propensity of a population to fly is mainly a function of a number of social and economic indicators, the most important of which was found to be employment in professional–scientific–technical services and management activities.

Keywords: air passenger markets | logistic regression analysis | metropolitan areas | air transportation industry | air transport management

Article:

1. Introduction

The deregulation of domestic airlines by the US government in 1978 has left some far-reaching legacies, including the development of hub and spoke route structures and the domination of some major airports by one or two airlines. The competitive advantages offered by these major air passenger markets and the resulting market dominance can be a key determinant of the success or failure of an airline (Bailey et al., 1985; Bania et al, 1998).

The Federal Aviation Administration (2003) predicts that the number of passengers for large domestic airlines will increase from 498.8 million in 2003 to 738.4 million by 2014. For the same period, regional and commuter (feeder) airlines are expected to increase from 94 million to 169 million. These dramatic increases in air traffic present a challenge for airlines that may need to expand their operations at airports where the infrastructure is saturated.

Although air transportation demand has been an active research topic for years, studies focused on the geography of major air passenger markets are not as abundant in the literature as studies on other aspects of air transportation such as hub-and-spoke structures, air-fares, and overall operational strategies (Oum et al, 1995; Sasaki et al, 1999). Most studies focus on the US, although some have studied operational systems in other countries such as Bowen (2000) and Button and Taylor (2000).

There are many factors that influence the location of a major air passenger market including proximity to existing population centers, specific socio-economic and demographic characteristics, and broader-based climate and weather-related factors (Bania et al., 1998; Brueckner, 2003; Huston and Butler, 1991; Sasaki et al, 1999). Cities that have many point-to-point routes on different carriers and areas that have populations with a high propensity to fly tend to be good candidates for market growth (O'Kelly and Miller, 1994). The propensity for air travel is mainly a function of specific socio-economic and demographic characteristics, including education level, employment mix, income levels, city function, transportation infrastructure levels, plus recreation and cultural attractiveness (Bania et al., 1998; Bauer, 1987; Debbage and Delk, 2001; Graham 2000; Taafe, 1956). Compared to other factors, climate seems to be a less significant determinant of major airport locations (Brueckner, 2003; Huston and Butler, 1991). However, weather is the greatest cause for delay in air traffic (US Department of Transportation, Bureau of Transportation Statistics, 2003) and the types, frequency, and severity of unfavorable weather conditions are broadly related to climate type.

Brueckner (2003) argued that a clear empirical link exists between employment composition and airline traffic in his study of 91 US metropolitan areas (MAs). Brueckner found that employment in service related sectors (wholesale/retail, finance, insurance, real estate, government, transport, and public utilities) had a significant impact on air passenger traffic. In contrast, goods related employment—which encompasses manufacturing, construction, and mining—were not significantly tied to variation in airline traffic. Similar results are reported by others, such as Debbage and Delk (2001).

The purpose here is to disentangle the most influential metropolitan-based characteristics in determining the locations of major air passenger markets in the US. Specifically, we will examine the spatial distribution of major air passenger markets in 2000 by MA; investigate the relationships between market locations and the current socio-economic, demographic, and weather conditions of major MAs; and develop a logistic regression model to determine the most influential metropolitan traits in predicting the locations of likely future air passenger markets.

2. Data and methods

2.1. Air traffic data

Data on air traffic markets were obtained from the US Department of Transportation, Bureau of Transportation Statistics' Airport Activity Statistics of Certificated Air Carriers for year 2000 (US Department of Transportation, Bureau of Transportation Statistics, 2001). The Federal Aviation Administration (FAA) defines an air traffic market as a geographic area based on the percentage of total US passengers enplaned in that area. This definition of a market is different from the definition used by the airlines in describing their hub-and-spoke route structure since it is based on the volume of passengers boarding aircraft in that market, rather than the proportion of connecting flights offered by the dominant carrier (US Department of Transportation, 2001). The FAA classification includes:

• Large markets—1% or more of total US enplaned passengers.

• Medium markets—0.25–0.999% of total US enplaned passengers.

• Small markets—0.05–0.249% of total US enplaned passengers.

To focus on the largest air passenger markets by MA, we define a major air traffic market as any MA with 0.75% or more of US enplaned passengers. We slightly deviate from the established FAA methodology to capture some of the most substantive FAA-defined medium-sized air passenger markets in the country including Cleveland, Kansas City, Memphis, New Orleans, Raleigh/Durham, and San Jose. It should be noted that while the FAA utilizes an arbitrary 1% cut-off to define large air passenger markets, we use a 0.75% cut-off because a natural break exists between this value and MAs with 0.60% or less enplanements for all but two minor markets.

As a result, a total of 36 MAs are selected as major air traffic markets based on this revised definition. By defining air traffic markets this way, it is possible to systematically reveal geographical differences between MAs with significant air passenger markets and those with less significant air passenger market demand. It should also be noted that only MAs with a total population of 350,000 or more are included. Those MAs with a population base less than 350,000 tended to have negligible airport operations that offered largely sporadic commuter airline service.

2.2. Census data

We use the 2000 census data for all metropolitan statistical areas (MSA) and primary metropolitan statistical areas (PMSA) with a population of over 350,000 resulting in 145 MAs as the units of analysis. PMSAs were used instead of the larger Consolidated Metropolitan Statistical Areas (CMSA) to determine if potentially underserved air passenger markets existed within the larger CMSAs. It should also be noted that some of the MAs had more than one major airport, such as Washington, DC with Dulles and Reagan National, New York with JFK and La Guardia, and Chicago with O'Hare and Midway.

Data on population, social, and economic indicators are defined as follows:

• Total Population of the MA—it is assumed that total population is a crude surrogate indicator of the 'critical mass' of the MA market and, thus, an accurate predictor of passenger volume. Of course, markets with a significant connecting traffic base may be anomalous given their relative 'detachment' from the local traffic market.

• Percentage of people living in urban areas within the MA. The US Census Bureau classifies as "urban" all territory, population, and housing units located within urbanized areas (UAs). It delineates UA boundaries to encompass densely settled territory, which generally consists of population densities of at least 1000 persons per square mile. MAs with a greater proportion of their population in densely settled, urban areas might generate more sophisticated agglomeration economies that generate higher propensities to fly.

• Per capita income in 1999. Given the high cost of air travel relative to alternative travel modes, it is assumed that more affluent markets may be more likely to opt for air travel than will less affluent markets.

• Unemployment rate. Expressed as a percentage of the labor force that is unemployed, unemployment rate is often used as one of indicators for the conditions of the local economy. It is assumed that a high unemployment rate tends to reduce the propensity to travel by air.

It is also assumed that the composition of the metropolitan workforce can shape propensities to fly in various MA markets particularly in industries requiring significant business travel because of the premium placed on face-to-face contact. These industries include finance, insurance or real estate (FIRE), professional, scientific or technical (PST) services and management activities, and the information technology sector. Also, specific air passenger markets may thrive because they are significant tourism and convention destinations that attract a disproportionate amount of leisure travel. Consequently, the following indicators are included:

• Percentage of the population in the workforce. This variable is defined as the percent of the total population in the workforce who are 16 years of age or older.

• Percentage of employment in finance, insurance, and real estate (FIRE). The North American Standard Industrial Classification System (NAICS) sectors for FIRE include NAICS 52 and NAICS 53. NAICS 52 are defined as firms primarily engaged in financial transactions and/or facilitating financial transactions. NAICS 53 identifies establishments or firms engaged in renting, leasing, or otherwise allowing the use of assets such as real estate, equipment, patents, and trademarks (US Census Bureau, 2000).

• Percentage of employment in professional, scientific and technical (PST) services, and management activities. NAICS 54 and 55 are defined as establishments that specialize in performing PST services, and the management of companies and enterprises. These activities require a high degree of expertise and training. The establishments in these sectors specialize according to expertise and provide services to clients in a variety of industries and, in some cases, to households. Activities performed include: legal occupations; accounting and payroll; architectural, engineering, and specialized design services; computer services; consulting services; research services; advertising services; photographic services; translation and interpretation services; veterinary services; and other PST services (US Census Bureau, 2000).

• Percentage of employment in the information sector. NAICS 51 is comprised of establishments engaged in: (a) producing and distributing information and cultural products, (b) providing the means to transmit or distribute these products as well as data or communications, and (c) processing data. The main components of this sector are the publishing industries, including software publishing, the motion picture and sound recording industries, the broadcasting and telecommunications industries, and the information services and data processing services industries (US Census Bureau, 2000).

• Percentage of employment in tourism. This is the percentage of the total workforce employed in NAICS 71 and 72. NAICS 71 is defined as the arts, entertainment, and recreation sector. Establishments in this category include those engaged in live performances, events, and exhibits, as well as places of historic, cultural and educational interest. In addition, this sector includes recreational, leisure, and amusement activities including gambling, resorts, and general tourist attractions. NAICS 72 is the accommodation and foodservice sector coupled with NAICS 71 (US Census Bureau, 2000).

• Number of convention and trade show organizer establishments. This variable is defined as establishments primarily engaged in organizing, promoting, and/or managing events, such as business and trade shows, conventions, conferences, and meetings. These establishments are grouped under NAICS 56192 and their data are obtained from the US Economic Census for 1997 (US Census Bureau, 1997).

2.3. Other data

In addition to census data, two variables attempted to capture the physical geography of each metropolitan market by differentiating the more ‘weather-friendly’ markets regarding air transportation:

• Frozen precipitation (2002) (mm). Acquired from the National Climatic Data Center (National Oceanic and Atmospheric Administration, 2003a).

• Days of sun (2002). Acquired from the National Climatic Data Center (National Oceanic and Atmospheric Administration, 2003b).

Finally, the concept of proximity to competing major airports is introduced to help weigh the effect of the ‘traffic shadow’ effect cast by competing choices created by alternative major airport operations that are within driving distance of any given market.

• Distance to the nearest major air passenger market. This variable is defined as the distance to the nearest major market from the MA of interest. If the MA has a major airport operation, this is the distance to the nearest alternative major market. MAs with more than one major airport are given a value of 0, since there is not a significant distance to travel to an alternative major airport.

2.4. Logistic regression

Regression methods have been widely used in varied fields to describe the relationship between a dependent variable and a set of independent variables. When the response variable is binary, logistic regression is usually the method of choice (Hosmer and Lemeshow, 2000). We are interested in explaining, through regression analysis, why some MAs have a major air traffic market (i.e. a substantial air passenger market with 0.75% or more of total US enplaned passengers) while others have smaller or minor markets (or a market share of air passengers less than 0.75%). The response variable in the model classifies all the MAs in the analysis as either “major markets” or “minor markets”. The independent variables are socio-economic, demographic, geographic, and weather-related variables.

The logistic regression model takes a general form (Hosmer and Lemeshow, 2000).

$$\ln\left[\frac{\pi(\mathbf{X})}{1-\pi(\mathbf{X})}\right] = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_n x_n,$$

where $\mathbf{X}'=(x_1, x_2,\cdots, x_n)$, and is a set of independent variables; $\boldsymbol{\beta}'=(\beta_0, \beta_1, \beta_2,\cdots, \beta_n)$, and is the corresponding set of regression coefficients; $\boldsymbol{\beta}'\mathbf{x}=\beta_0+\beta_{1x1}+\beta_{2x2}+\cdots+\beta_{nxn}$; π

$(\mathbf{X})=e^{\beta' X}/(1+e^{\beta' X})$, and is the probability for having a major market; $1-\pi(\mathbf{X})$ is the probability of not having a major market; $\pi(X)/(1-\pi(X))$ is the odds for having a major market; and $ln[\pi(X)/(1-\pi(X))]$ is the logarithm of the odds for having a major market and is usually referred to as the logit.

3. Results

3.1. Spatial distribution of major air traffic markets by MA

The major and minor air passenger market MAs selected for this study are shown in Fig. 1. Because of the unusual geographic location of Honolulu, HI relative to the rest of the US, this MA was excluded from data analysis. Of the 36 major air passenger markets identified in this study, six are clustered along the I-95 corridor in the Northeast from Washington to Boston. Another significant clustering of major markets is located in the eastern Midwest and Rustbelt regions stretching from St. Louis to the southern shore of the Great Lakes and terminating in Pittsburgh. On the Pacific coast, a cluster of major markets is located in the San Francisco Bay Area, including San Francisco, Oakland, and San Jose. Other, less significant clusters exist in southern California and southern Florida.

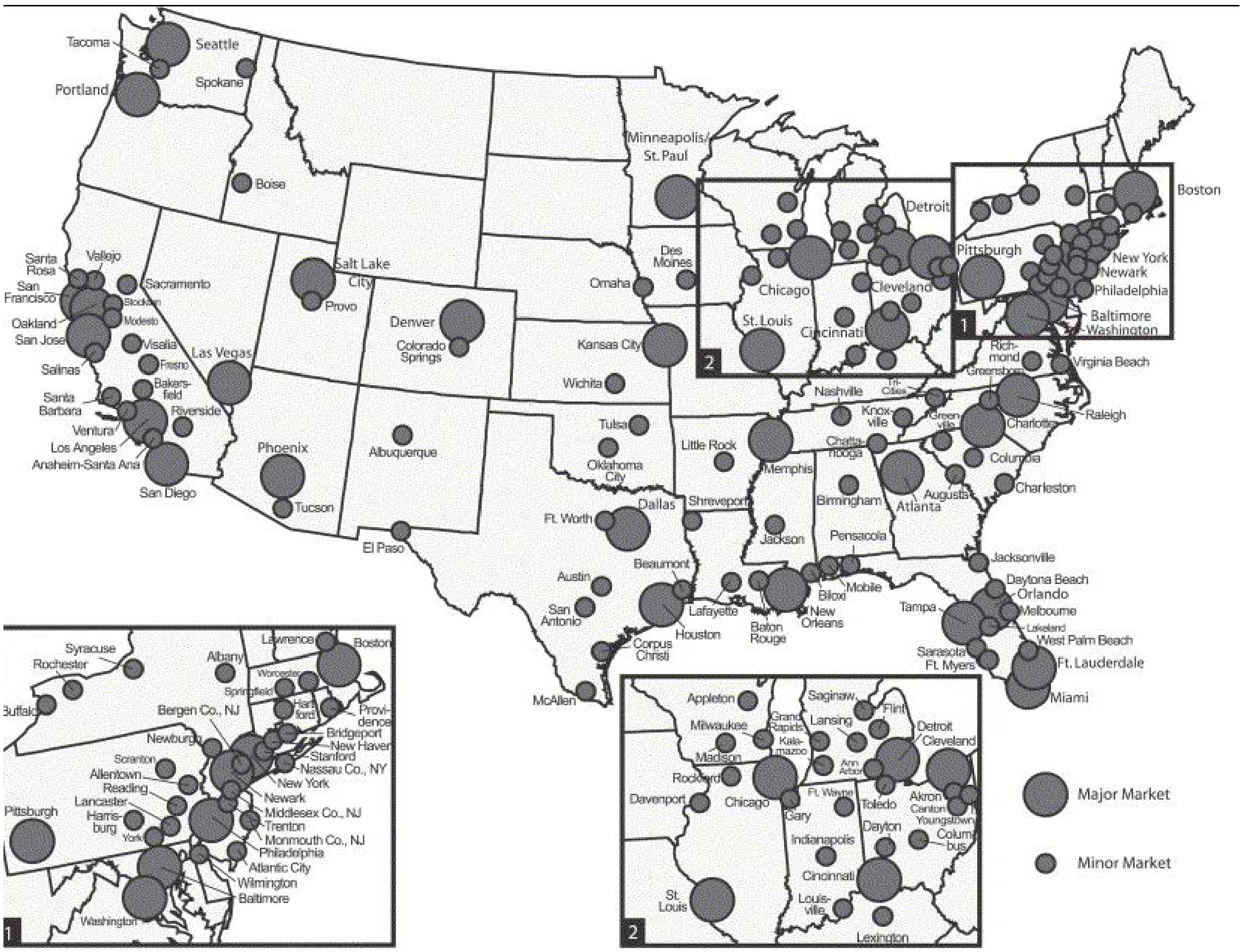

Fig. 1. Major US metropolitan areas (MAs) with a population of over 350,000. Major market MAs are air traffic markets with 0.75% or more of the total US enplaned passengers in 2000. Minor market MAs have a share less than 0.75.

3.2. Spatial distributions of explanatory variables by MA

We examined the spatial distributions of all the socio-economic, demographic, geographic, and weather-related variables by MA. However, we only present the results of those variables that are most significant in the final logistic regression model. Comparison of Figs. 1 and 2 reveals that the spatial distributions of the most populous MAs in the US mimic the spatial pattern of the major air traffic markets—as we might expect. All of the 36 major markets have an MA population of over a million people. Twenty three of them have a population greater than two million. In contrast, only three of the 108 minor markets have a population of over 2 million while 83 of the minor markets have a population less than one million.

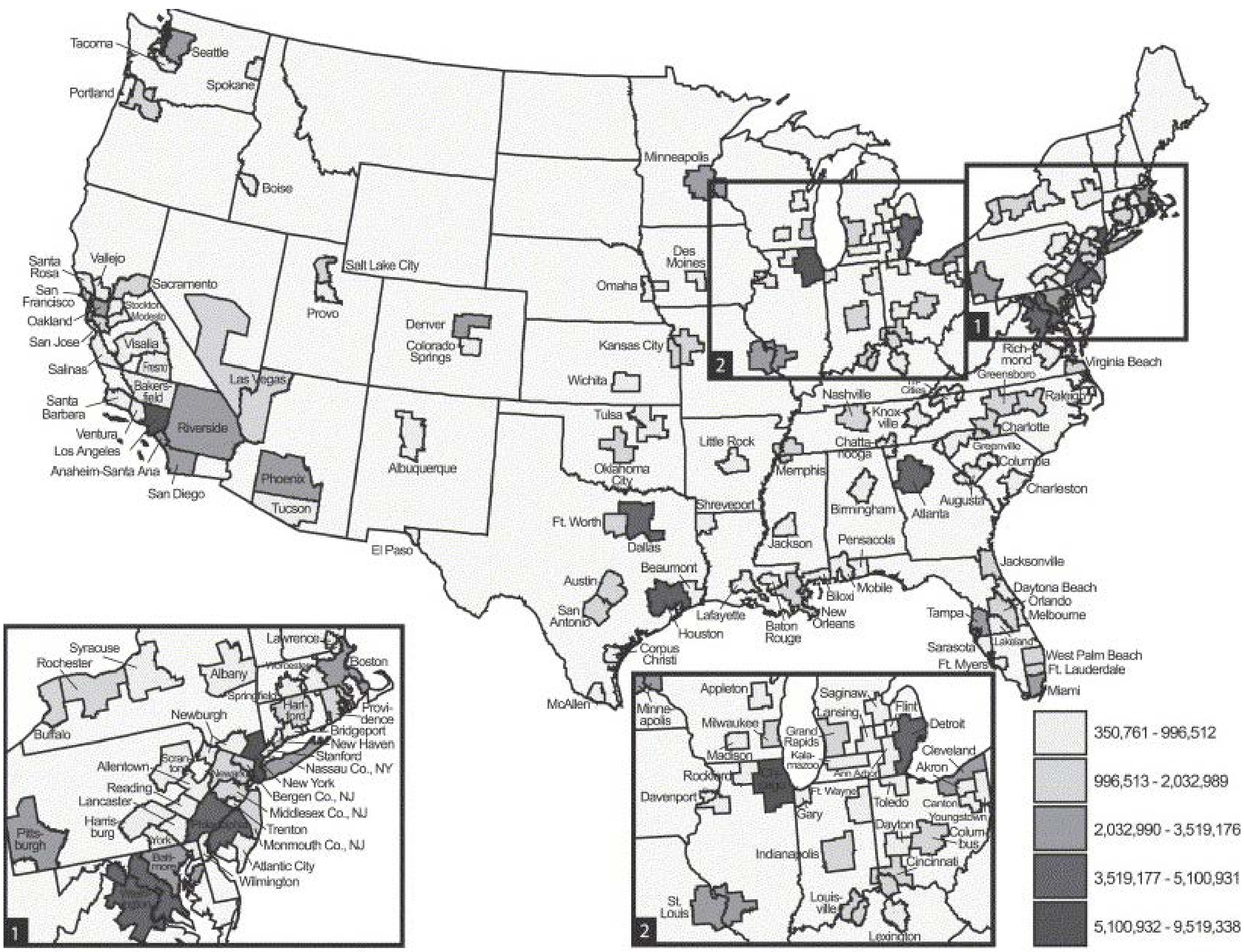

Fig. 2. MA population (in persons) in 2000.

Major airline hub operations in places like Charlotte (US Airways) and Memphis (Northwest Airlines) tended to produce disproportionately large passenger demand relative to their overall MA population totals while lagging economies in places like Buffalo, Cleveland, and New Orleans tended to underachieve in passenger demand. Part of the explanation for these exceptions resides in variations in the composition of each MA's workforce, which, in turn, can substantively influence the overall propensity to fly in each metropolitan market.

The percentage of the total workforce in PST services and management activities (NAICS 54 and 55) is shown in Fig. 3. High employment in this sector is found in the Bo-Wash megalopolis/I-95 corridor, especially in Washington, DC and Boston. Other areas with high employment in NAICS 54 and 55 include the San Francisco/San Jose market, and the Texas and Florida MAs. Overall, the Sunbelt region tended to have the lowest percentages although New Orleans, Atlanta, Birmingham, Knoxville, and Raleigh are exceptions to that trend. Thirty-one of the 36 major market MAs have more than 6% (the average of all the MAs in this study) of their workforce employed in this sector; while only 33 of 108 minor market MAs have more than 6% of the workforce in this sector.

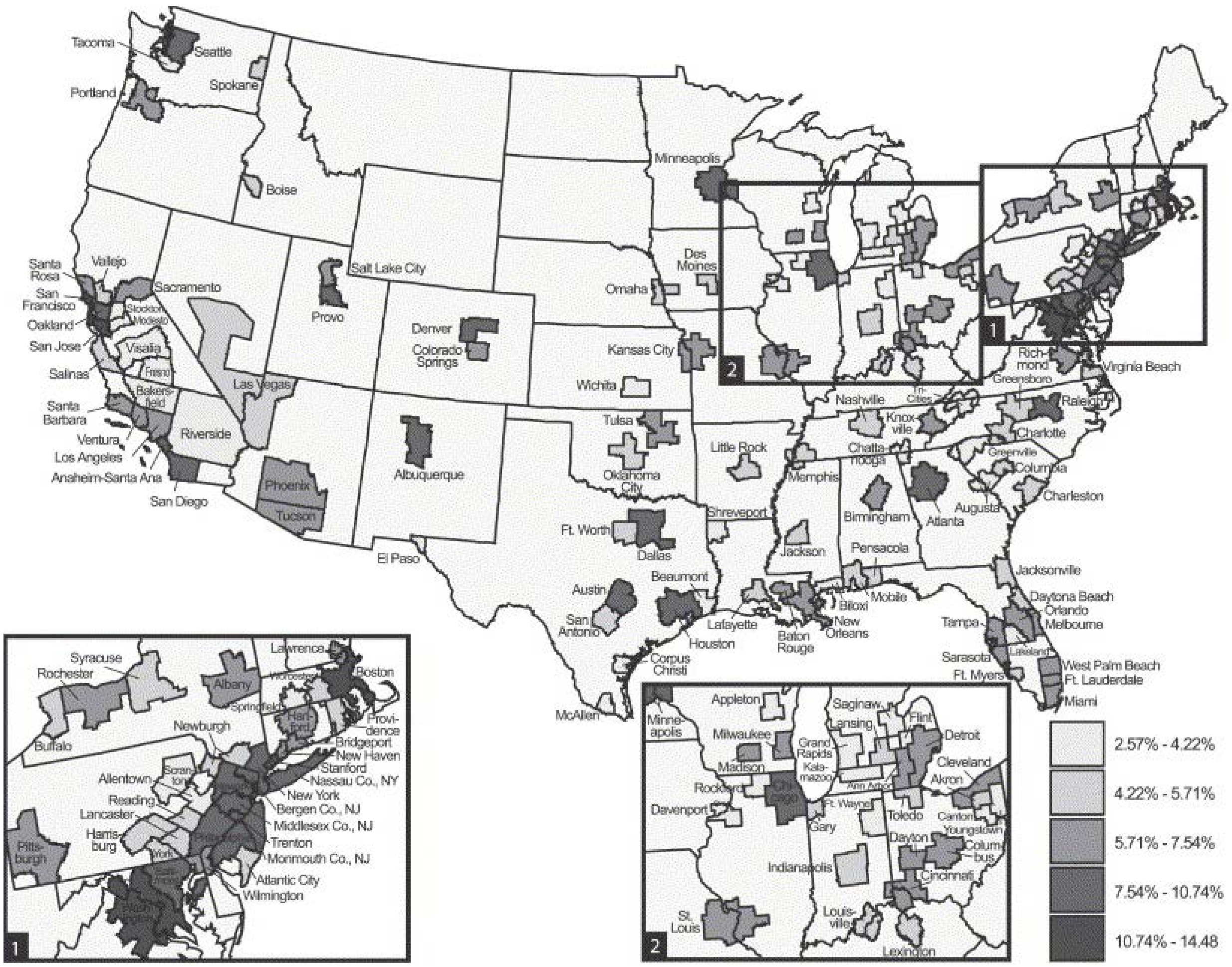

Fig. 3. Percentage of the MAs total workforce in professional, scientific or technical services and management activities.

The secondary air passenger markets that were located significant distances from those MAs with major air passenger markets proliferate in the Gulf Coast region, the upper Great Plains, and the Rocky Mountains states. By contrast, the California and Great Lakes region MAs, and the Bo-Wash megalopolis MAs have much shorter distances between major market MAs resulting from the dense clustering of major air passenger markets in these regions (Fig. 4). A distance of zero is assigned for Chicago, New York, and Washington because these MAs have more than one major airport within the MA.

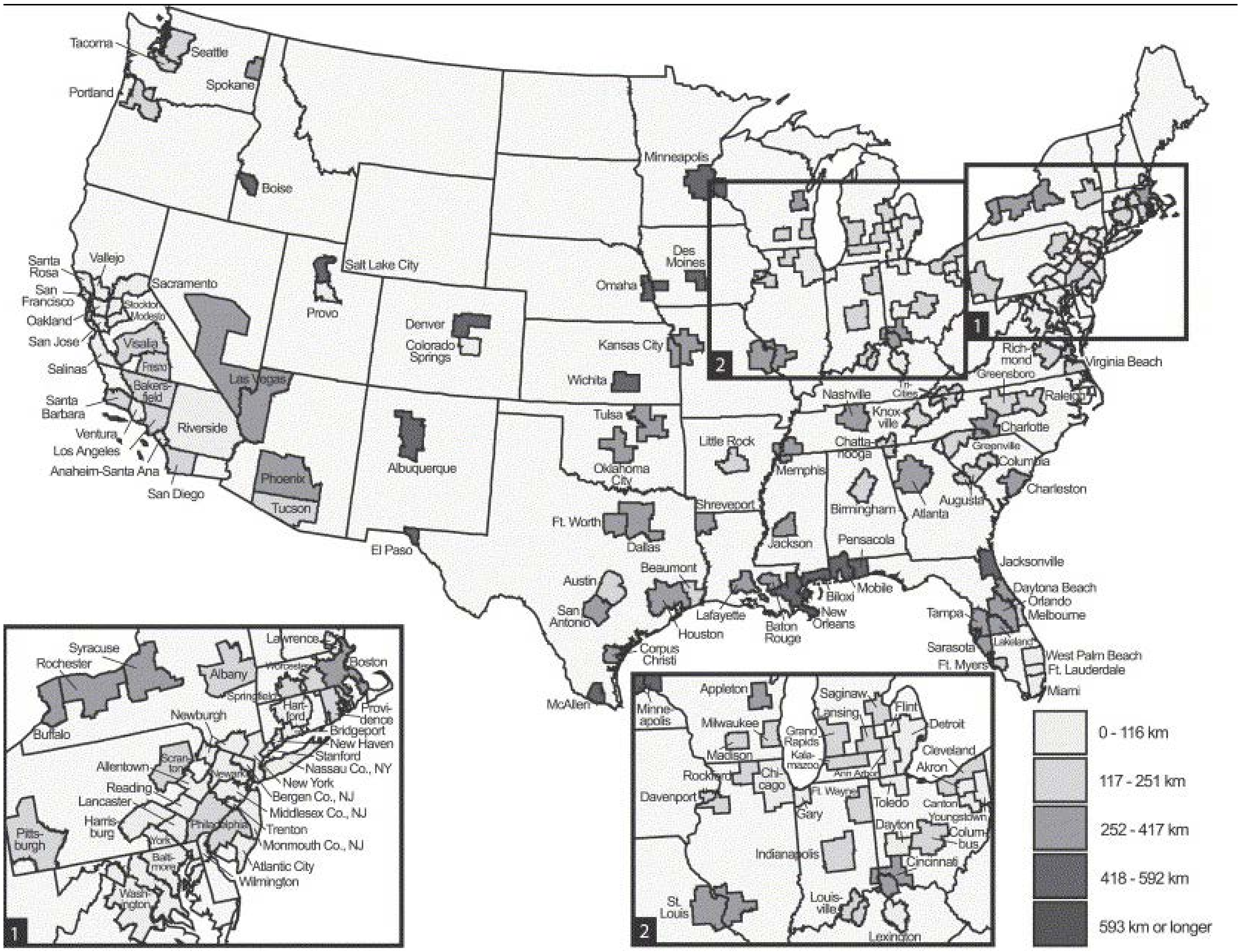

Fig. 4. Distance to the nearest alternative major air passenger market.

The percentage of the workforce in tourism (NAICS 71 and 72) is shown in Fig. 5. Las Vegas has the highest value at 29.7% of the workforce. Other areas with high tourism employment shares include Atlantic City, NJ, Orlando, FL, and the Biloxi-Gulfport, MS MAs. Fifteen of the 36 major market MAs have more than 8% (the average of all the MAs) of their workforce employed in the tourism sector; while 41 of the 108 minor markets have more than 8% of the workforce in the tourism sector.

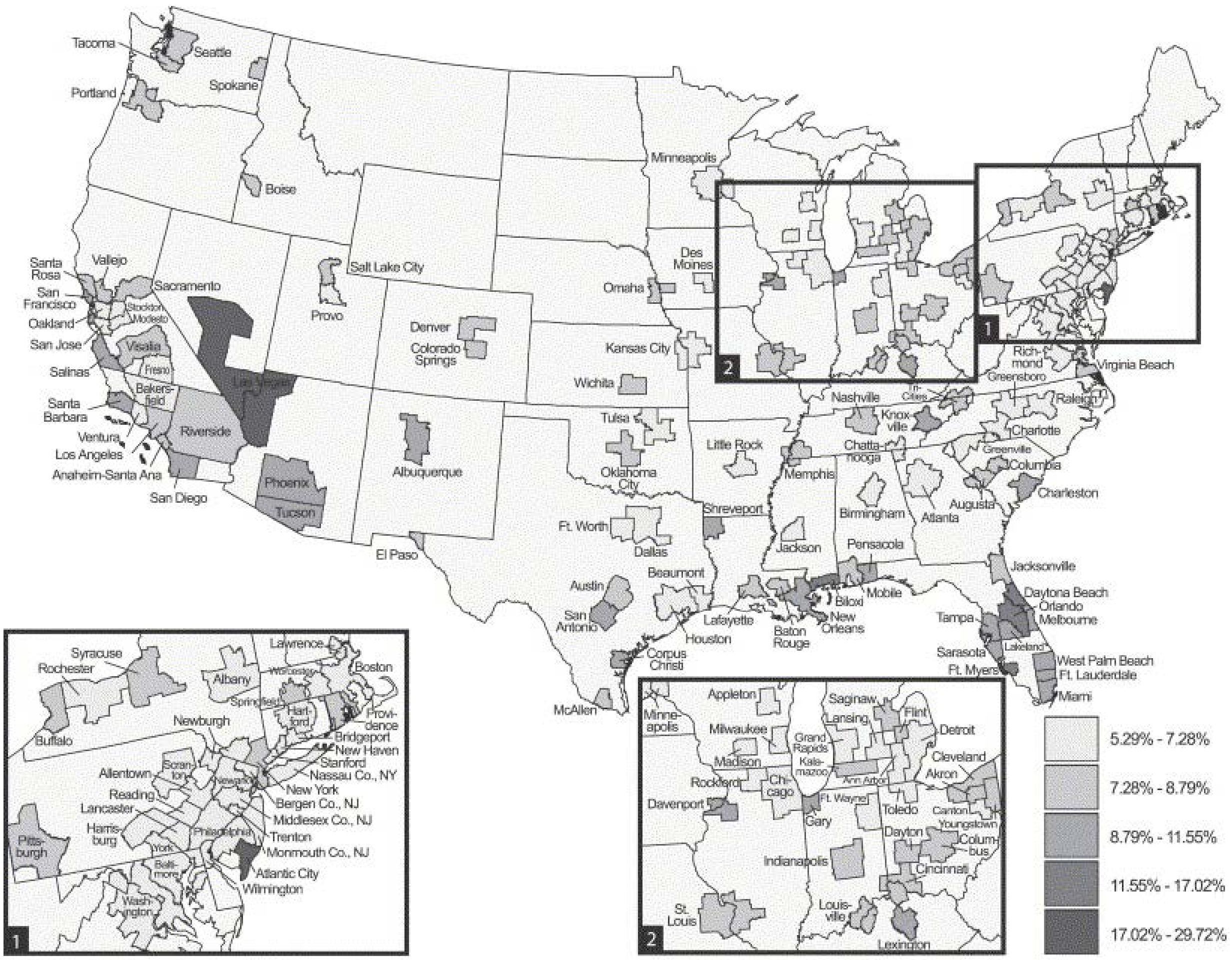

Fig. 5. Percentage of the MAs total workforce in the tourism sector.

3.3. Comparison of explanatory variables between major and minor air passenger markets by MA

In addition to investigating the spatial distributions of socio-economic, demographic, and geographic variables, we compared the average values of these variables between major and minor MA air passenger markets. These values and the results of the t-test for differences between the two groups are given in Table 1. On average, major air passenger markets have a larger population, more people in the workforce, a higher percent of people living in urban areas, more convention facilities, and a higher percent of the workforce in information technology, FIRE, and PST services and management activities. In addition, per capita income is also higher in the major MAs. Differences also exist between these two groups of MAs in terms of population in workforce, percentage of workforce in tourism sector, and the distance to the nearest alternate major market although these differences are not statistically significant at the 5% level. Minor market MAs, on average, have higher values—though not statistically significant—than their major market counterparts in only three variables: unemployment rate, number of sunny days in a year, and frozen precipitation.

Table 1. Comparison of social, economic, demographic, and geographic variables between major and minor market MAs (*t*-test of the two group means)

Variables	Major market MAs	Minor market MAs	*p*-value for the *t*-test
Population (1000)	3035	763	<0.0001
People in the workforce (1000)	1407	351	<0.0001
Percent of population in urban area	92	84	<0.0001
Percent of population in workforce	47	46	0.07
Percent of workforce in IT sector	3.90	2.80	<0.0001
Percent of workforce in PST services and management activities	7.90	5.40	<0.0001
Percent of workforce in FIRE sector	8.10	6.90	0.0007
Percent of workforce in tourism sector	8.60	8.00	0.41
Per capita income ($)	24,248	21,483	0.001
Distance to a nearest major market (km)	243	200	0.19
Frozen precipitation (mm)	428	577	0.19
Days of Sun	109	123	0.08
Unemployment rate (%)	3.50	3.70	0.24
Convention facilities	67	7	<0.0001

3.4. The logistic regression analysis

All the statistical analyses in this study, including the logistic regression analysis, are performed using the statistical analysis system (Allison, 1999; SAS, 1999). Some independent variables in this study are highly correlated with each other, such as total population by MA with people in the workforce (r=0.99), total population with the number of convention facilities (r=0.91) and workforce population with the number of convention facilities (r=0.93). These high correlations between the independent variables can cause a multicollinearity (MC) problem in the estimation of the regression coefficients. Therefore, we performed a diagnosis of MC among the independent variables and, based on the diagnostic results, excluded some independent variables from the logistic regression analysis including workforce population, the number of convention facilities, and unemployment rate.

All the remaining explanatory variables were included in the logit analysis. The resulting final model consisted of five explanatory variables that are statistically significant at the 5% level (Table 2). The influences of these variables on the probability of an MA being a major air traffic market are explained by the odds ratio. The odds ratio for total MA population is 1.49 per 100,000 which means that for an increase of 100,000 people in a given MA, the odds of that MA having a major air traffic market will increase by 49%. If the proportion of the workforce employed in PST services and management activities increases by 1%, the odds of an MA of having a major air traffic market will increase by 194% (the odds ratio=2.94). A higher percentage of the workforce in the tourism sector can also increase the odds of having a major air traffic market. The odds will increase 45% for an increase of 1% of the workforce in tourism employment (e.g. from 5% to 6%). A longer distance to the nearest major market can also increase the odds of an MA becoming a major market. For every 100 km, the odds will increase 279%. Interestingly, more sunny days reduce the odds of having a major market, which decreases by 4% for each extra sunny day. Much of the explanation for this may be that some of the more 'weather-friendly' MAs are located in the southwest where air passenger markets are relatively limited compared to the more densely settled northeast region. The negative relationship between this variable and the chance of becoming a major traffic market is more an artifact than a true relationship.

Table 2. The logistic regression model of major air traffic markets

Independent variables	Estimated coefficient	*p*-value	Odds ratio	Change in odds (%)
Population(100,000)	0.3982	<0.0001	1.49	49% increase
Percentage of workforce in PST services and management activities	1.0789	0.0005	2.94	194% increase
Distance to nearest major market (100 km)	1.3335	0.0011	3.79	279% increase
Percentage of workforce in tourism	0.3681	0.0081	1.44	44% increase
Days of sun	−0.0409	0.0217	0.96	4% decrease

R-square=0.57 and Max-rescaled R-square=0.84.

The model is used to predict the probability of having a major air traffic market for each of the 144 MAs included in this study. A cut-off probability value of 0.5 is used, which is equivalent to the odds value of 1, to determine the likelihood of a major air passenger market (Allison 1999; Huston and Butler, 1991). MAs with an estimated probability of 0.5 or higher are likely to have a major air passenger market; while those MAs with a predicted probability less than 0.5 are not likely to have a major market. The logit model correctly predicted the status of 31 of the 36 major markets and 105 of the 108 minor markets.

Five of the MAs that currently have a major air traffic market received a predicted probability less than 0.5 (Table 3). These MAs included Memphis, Fort Lauderdale, Charlotte, San Jose, and Newark. By contrast, three minor market MAs have a predicted probability greater than 0.5 including: Albuquerque, Anaheim-Santa Ana, and Nassau-Suffolk (Table 4).

Table 3. Predictions of the logistic regression model where the predicted probability is less than 0.5 for an existing major air traffic market

Currently major market MAs	Predicted probability	MA population (persons)	Workforce in PST services and management	Workforce in tourism	Distance to nearest major market (km)	Sunny days
Memphis, TN	0.036	1,135,614	4.60%	8.10%	389	118
Fort Lauderdale, FL	0.15	1,623,018	6.50%	9.50%	40	74
Charlotte, NC	0.24	1,499,293	5.70%	7.00%	229	109
San Jose, CA	0.45	1,682,585	11.80%	5.90%	61	160
Newark, NJ	0.46	2,032,989	8.70%	5.60%	16	93

Table 4. Predictions of the logistic regression model where the predicted probability is greater than 0.5 for an MA that is not a major air traffic market

Currently minor market MAs	Predicted probability	MA population (persons)	Workforce in PST services and management	Workforce in tourism	Distance to nearest major market (km)	Sunny days
Nassau-Suffolk, NY	0.86	2,753,913	7.60%	5.70%	38	96
Anaheim-Santa Ana, CA	0.85	2,846,289	8.20%	8.50%	42	147
Albuquerque, NM	0.51	712,738	8.80%	9.60%	528	167

Three of the five major markets not predicted by the model are important functional hubs for airlines—these include Charlotte (US Airways), Memphis (Northwest Airlines) and Newark (Continental Airlines). Based on the predictions, the Charlotte MA is an unlikely location for a major air passenger market given the small MA population size (just under 1.5 million) and low employment share in PST services and management activities. However, Charlotte is host to a major hub and spoke system and is heavily reliant on connecting flights—local originating traffic is a small proportion of the air traffic market.

The Memphis MA has the smallest population base (about 1,135,600) among the 36 major market MAs. It also has a low employment share in PST services and management activities. The relatively long distance to another major air traffic market (389 km) is likely a contributing factor in its selection as a hub location for Northwest Airlines but the hub has struggled to maintain a healthy passenger yield, in part, because of the limited propensity to fly in the local market.

Unlike Charlotte and Memphis, the remaining three major markets not predicted by the model—Fort Lauderdale, Newark, and San Jose—are not ‘stand-alone’ MAs with large catchment areas but part of much larger urban systems that include the greater Miami, New York, and San Francisco MAs, respectively. Theoretically, Fort Lauderdale, Newark and San Jose should serve constrained local catchment areas given the proximity of alternative major air passenger markets nearby. However, Miami, New York, and San Francisco's larger total passenger numbers are, in part, the result of their role as international gateways while domestic traffic at Fort Lauderdale, Newark and San Jose is more significant than expected. Additionally, Fort Lauderdale hosted a significant Delta Airlines operation in 2000, Continental Airlines hubbed out of Newark, and San Jose was a significant operation for both Southwest Airlines and American Airlines.

San Jose has a population about the same size as Fort Lauderdale's but San Jose's percentage of the workforce in PST services and management activities is much higher than Fort Lauderdale's. As a result, the probability of San Jose having a major market is higher than that of Fort Lauderdale's although it is still below 0.5. It is likely that the local propensity to fly in San Jose is substantially higher than in Fort Lauderdale given the preponderance of white collar, skilled professionals in the San Jose MA, including Silicon Valley, where demand for business travel and face-to-face contact may be higher. Since 2000, however, American Airlines has reduced operations at San Jose by 50% while more than doubling its base at Fort Lauderdale, although Southwest Airlines has continued to maintain a substantial market share at San Jose Airport (US Department of Transportation, Bureau of Transportation Statistics, on-line database).

By contrast, the logistic regression model identified three MAs that seemed likely to generate significant passenger volume, but instead are not currently major air passenger markets. The predicted probability for Albuquerque, NM was just over 0.5, which most likely results from the large percentage of its workforce in both PST services and management activities and tourism, and the long distance to the nearest major market (528 km). It is likely that its relatively small population (over 710,000) and remote location have hindered its chances of becoming a major air traffic market.

The predicted probability of becoming a major air traffic market was significantly higher for Nassau-Suffolk, NY and Anaheim-Santa Ana, CA suggesting that both MAs are highly likely to emerge as major air passenger markets in the near future even though current passenger demand is lower than expected based on the logit model findings. More than 2.7 million people live in the Nassau-Suffolk MA and over 2.8 million people in the Anaheim-Santa Ana MA. In addition, both MAs are located in much bigger population centers with the Nassau-Suffolk MA embedded in the greater New York area and Anaheim-Santa Ana in the southern California, Los Angeles basin. The percentage of the workforce in PST services and management activities in both MAs is also high, which also increases their chances of becoming a major air traffic market. The large consumer markets and the high propensity to fly favor the development of additional traffic. However, the Long Island/MacArthur Airport in the Nassau-Suffolk MA is a relatively small airport with just over one million enplanements in 2005 (US Department of Transportation, Bureau of Transportation Statistics, on-line database). By contrast, Orange County Airport in the Anaheim-Santa Ana MA is a significant airport but it has only experienced modest passenger growth rates over the past 10 years because of a lack of land and restrictive noise controls. Despite this, Southwest Airlines has already effectively acted on the empirical findings in the logit model regarding both Long Island/MacArthur and Orange County airports where the airline has long been the dominant carrier in both markets (US Department of Transportation, Bureau of Transportation Statistics, on-line database).

4. Conclusion

The analysis shows that in general the likelihood of a major air passenger market is primarily determined by a MAs population size and related propensities for air travel. On average, a major air passenger market has over 3 million people while a minor market MA has a population of about 760,000. The propensity to fly in a given MA market is a function of a number of social and economic indicators, including employment share in the information sector, PST services and management activities, and the FIRE sector. On average, a major market has a significantly higher percentage of the total workforce in these three sectors than does a minor market. Our study shows that employment in PST services and management activities appears to be the most significant indicator of propensity to travel by air. A 1% increase of the total workforce employed in this sector will increase the odds of the MA becoming a major market by the same amount (194%) as adding more than 395,000 people to the MA's population.

Most major markets will retain their status in the near future based on the MAs’ characteristics examined in this study, although those major markets not predicted by the logistic regression model, such as Charlotte and Memphis, may be vulnerable since their passenger demand is largely a function of connecting traffic not indigenous market conditions. Some minor markets may also rapidly emerge as major markets in the near future. Based on their metropolitan characteristics, Nassau-Suffolk and Anaheim-Santa Ana are the most likely locales to develop substantive air passenger markets. However, factors other than metropolitan characteristics must also be considered, such as the potential competition for passengers with long-established markets in the same area. In the Nassau-Suffolk case, it will have to compete with at least three nearby airports including JFK, La Guardia, and Newark International. For Anaheim-Santa Ana, the competing airports include LAX, Long Beach airport, Hollywood-Burbank Airport, and San Diego. Studies show that competition with established airports does not necessarily negate the possibility of the placement of an alternative airport in the same area. Hotelling's model of competition is often used in providing an explanation for the likelihood of airport clustering to take advantage of established markets (e.g. Huston and Butler, 1991).

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