Measuring and Understanding the Relationship between Air Service and Regional Economic Development

COMPILATION OF CASE STUDIES

Prepared for
Airports Cooperative Research Board
Transportation Research Board
of the
National Academies of Science, Engineering, and Medicine

Steve Martin
Inter*VISTAS* Consulting Inc.
Washington, DC

Keith Debbage
University of North Carolina at Greensboro
Greensboro, NC

Amy Kvistad
Amy Kvistad Design
Boston, MA

Douglas Bañez
Hubpoint Strategic Advisors LLC
Charlotte, NC

Jan. 3, 2022

The Airport Cooperative Research Program (ACRP) is sponsored by the Federal Aviation Administration. ACRP is administered by the Transportation Research Board (TRB), part of the National Academies of Sciences, Engineering, and Medicine. Any opinions and conclusions expressed or implied in resulting research products are those of the individuals and organizations who performed the research and are not necessarily those of TRB; the National Academies of Sciences, Engineering, and Medicine; or ACRP sponsors.

SUMMARY

This volume is a companion to *ACRP Web-Only Document 53* (the guide), *ACRP WebResource 12*, and the Contractor's Technical Report produced under ACRP Project 03-58, "Measuring and Understanding the Relationship Between Air Service and Regional Economic Development." The project includes 14 case studies that illustrate the connection between air service and regional economic development. One appendix in the guide includes the short versions of the 14 case studies. *ACRP WebResource 12* includes the short versions of those case studies and provides the long versions as downloadable pdfs. This document includes the long versions in one volume.

The guide provides airports and major regional stakeholders concerned with economic development with the information and tools necessary to understand the nexus between air service and regional employment. For years, airports have relied on economic impact evaluations to measure their contributions to the local economy. Those assessments, while extremely valuable, suffer from a critical shortcoming in that they generally do not capture how air service facilitates economic activity "beyond the fence." That is, airport economic impact statements can accurately measure the activity that occurs on airport properties or that is tied directly to airport operations (e.g., off-site parking, hotels that accommodate airline crew that overnight in a location), those studies do not capture how air service is critical for other regional employers or industries.

This compilation includes separate sections for airport regions that illustrate the relationship between passenger air service and regional economic activity and those that illustrate the relationship with air cargo and freight activities.

TABLE OF CONTENTS

SECTION I:

Case Studies of Passenger Air Service and Regional Economic Activity

Atlanta: Aviation and Increasing Employment in Transportation, Warehousing and Logistics

The metropolitan Atlanta region is among the most vibrant in the country and has experienced significant growth in its economy and air service over time. The region is the economic hub of the American southeast.

The region is home to 16 Fortune 500 companies, including Delta Air Lines, Coca-Cola, Home Depot, UPS, and The Southern Company and another 13 companies listed among the Fortune 1000.[1] More than 70 percent of the Fortune 1000 have a presence in greater Atlanta, and the region ranks third nationally for Fortune 1000 headquarters.[2] Metro Atlanta has also become one of the nation's top spots for film and video production. It boasts a growing technology sector and is also one of the nation's most important logistics hubs.

It is also home to what has long been recognized as the world's busiest airport – Hartsfield-Jackson Atlanta International Airport (ATL). The airport is a gateway to the world, offering metro Atlanta residents and businesses nonstop service to more than 150 domestic and 70 international destinations, including major commercial centers in Europe, Asia, the Caribbean, Africa, and South and Central America.[3]

The region was selected as a case study because of its size and the economic strength of employment in two sectors: (1) Transportation, logistics, and warehousing and (2) Information Technology.

Introduction to the Region and its Economy

Greater Atlanta's economic influence extends over a large geographic area and has multiple definitions (See Figure ATL-1).

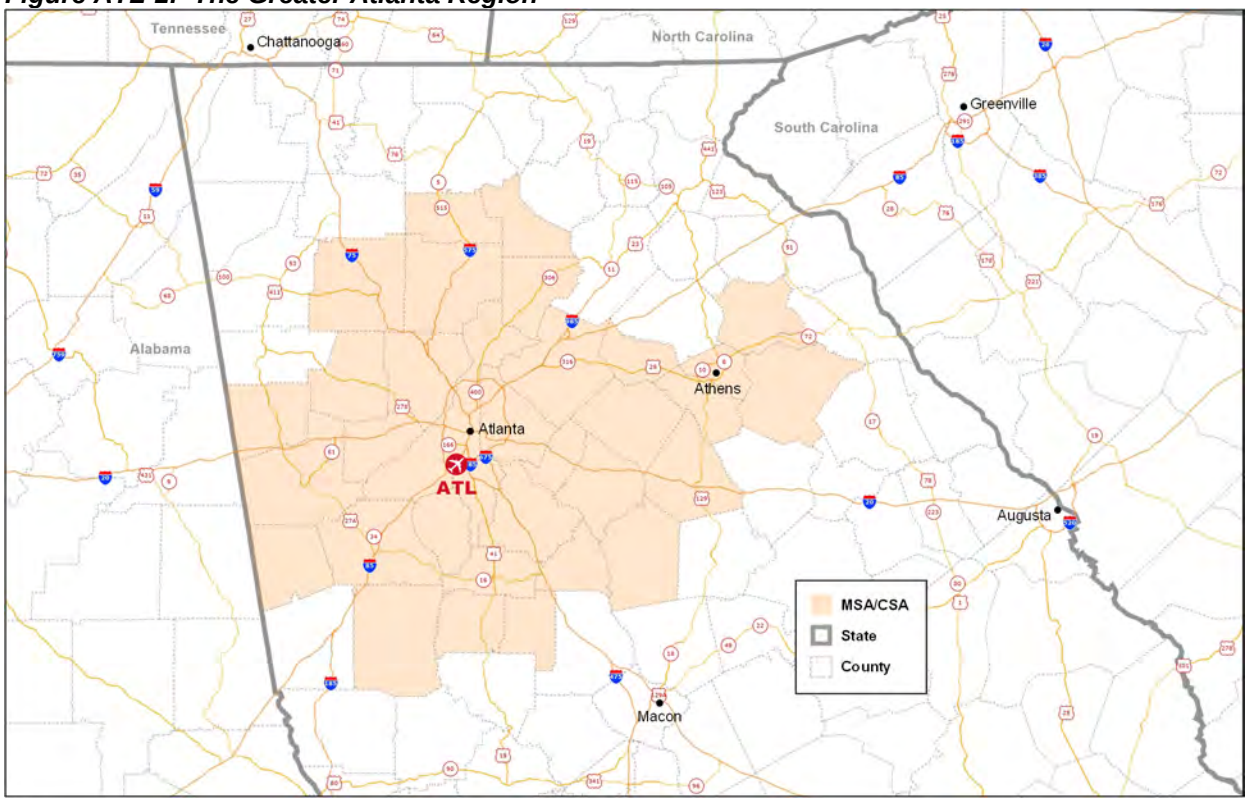
- The City of Atlanta is the capital and most populous city in the state of Georgia, with an estimated 2019 population of over 500,000. The city is the cultural and economic center of the region.

- The Atlanta Regional Commission, which is the federally-designated Metropolitan Planning Organization for the region, covers issues relating to the City of Atlanta and the 10 surrounding counties of Cherokee, Clayton, Cobb, DeKalb, Douglas, Fayette, Fulton, Gwinnett, Henry, and Rockdale.

- The Atlanta–Sandy Springs–Alpharetta, GA Metropolitan Statistical Area (MSA) adds another 19 counties.

- The Atlanta--Athens-Clarke County--Sandy Springs, GA Combined Statistical Area (CSA) extends the boundaries to incorporate two smaller MSAs: Athens-Clarke County, GA and Gainesville, GA -- along with five micropolitan statistical areas.

Figure ATL-1: The Greater Atlanta Region



The Atlanta region is a major hub for the movement and distribution of freight, providing access to the Port of Savannah and major markets across the Southeast and the U.S.

The region has historic routes as a rail terminus. The state of Georgia decided in 1836 to build a railroad to provide a link between the port of Savannah and the Midwest. The plan was to eventually link up with the Georgia Railroad from Augusta, and with the Macon and Western Railroad, which ran between Macon and Savannah. A point was selected ("zero milestone"), and the city began to grow around it. Now, the region is served by two of the seven Class I railroads (CSX and Norfolk Southern). It is one of only five cities served by three interstate highways. Commercial airlines operating at ATL provide cargo capabilities throughout the U.S. and internationally. According to the Atlanta Regional Commission's Atlanta Regional Freight Mobility Plan Update, in terms of tonnage, 83% of Metro Atlanta freight tonnage moves by truck, 17% by rail, and under 1% by air. Goods that move by air tend to be those that are high value and time sensitive.

According to the U.S. Bureau of Economic Analysis (BEA), in 2019, the Atlanta-Sandy Springs-Alpharetta MSA had a population of over 6 million, ranking 9th in the country. The MSA produced $442.1 billion in current-dollar total GDP. This ranked 11th among MSAs (out of 384 total). It represents a slight decline in the region's national ranking from 2009, when it ranked 10th among MSAs.

Table ATL-1 summarizes the changes in the key socio-economic characteristics for Greater Atlanta. Between 2008 and 2019, the population rose by almost one million, or 16 percent. Total area employment increased by over 800,000 (23 percent). In addition, the average per capita income rose by 38 percent (nominal dollars) to nearly $53,000. The total number of business establishments also increased by 20,000 (13 percent). (The BEA uses data from the U.S. Census Bureau, which defines an establishment as "a single physical location at which business is conducted or services or industrial operations are performed. It is not

necessarily identical with a company or enterprise, which may consist of one or more establishments. … Establishment counts represent the number of locations with paid employees any time during the year." The count excludes government establishments except for certain situations, such as state-operated retail liquor stores, local government-owned/operated hospitals, and federally chartered credit unions.)

Table ATL-1: Change in Major Socio-Economic Factors: Greater Atlanta (000s)

	2008	2015	2019	Change 2008-15		Change 2015-19		Change 2008-19	
				#	%	#	%	#	%
Population	5,930	6,481	6,853	550	9%	373	6%	923	16%
Total Employment	3,607	3,967	4,445	360	10%	477	12%	838	23%
Private Non-farm Employment	3,163	3,554	4,014	391	12%	460	13%	851	27%
Gov't Employment	427	398	416	(29)	-7%	17	4%	(12)	-3%
Income per Capita ($)	$38,430	$45,519	$52,898	$7,089	18%	$7,379	16%	$14,468	38%
Number of Establishments	153	176	173	23	15%	(3)	-2%	20	13%

Source: U.S. Bureau of Economic Analysis (BEA)
Note: Data are for the Atlanta--Athens-Clarke County--Sandy Springs, GA-AL CSA. All data are in 1,000 except income per capita.

Metro Atlanta is growing faster than the state of Georgia as a whole. For the same period 2008-2019, the population of the state of Georgia grew by 11.8 percent, and statewide employment increased by 17.8 percent. Statewide average per capita income was $48,188, or 9 percent less than that for Greater Atlanta.

Aerotropolis Atlanta reported that the region is increasingly cosmopolitan, with a rapidly growing international population (the percent of the population born outside the U.S. rose from 8.1 percent 2010 to 13.8 percent in 2019). In addition, foreign investment has increased over time. In 2018, Metro Atlanta was home to more than 2,700 foreign-owned companies.

The US Cluster Mapping project's data show that in 2018, transportation and logistics (including air transportation, trucking, ground transportation and support activities) was the 3rd largest "traded cluster" in the Atlanta-Sandy Springs-Roswell GA metro area in terms of total employment. It trailed only Business Services (e.g., corporate headquarters, computer services, consulting, and engineering) and Distribution and Electronic Commerce (which includes warehousing and storage along with wholesale suppliers of professional and commercial equipment and supplies).

The Census Bureau's County Business Pattern data highlight changes in the largest industry sectors as measured by employment. Table ATL-2 summarizes the changes over time in the largest industry sectors (those with at least 100,000 employees sometime from 2008-2019). Employment in health care and social assistance grew most from 2008 through 2019, rising by over 70,000 jobs (32 percent). Transportation and warehousing grew next fastest, increasing by 28 percent (nearly 32,000 jobs). Other major industry sectors with significant growth included accommodations and food service (25 percent); professional, scientific, and technical services (PST) (25 percent); and Management of companies and enterprises (24 percent).

Table ATL-2: Changes in Employment 2008-2019 for Largest Industry Sectors (ranked by number of employees in 2019)

	Employment			Changes over time			% change
Industry Sector	2008	2015	2019	2008-15	2015-19	2008-19	2008-19
Health care and social assistance	222,024	256,203	293,342	34,179	37,139	71,318	32%
Retail trade	267,444	268,261	275,106	817	6,845	7,662	3%
Accommodation and food services	217,546	243,090	271,980	25,544	28,890	54,434	25%
Professional, scientific, and technical services	182,725	191,475	229,279	8,750	37,804	46,554	25%
Administrative and support and waste management and remediation services	206,408	187,227	184,395	(19,181)	(2,832)	(22,013)	-11%
Manufacturing	155,469	143,591	159,049	(11,878)	15,458	3,580	2%
Transportation and warehousing	115,132	119,529	147,095	4,397	27,566	31,963	28%
Wholesale trade	147,097	147,008	143,004	(89)	(4,004)	(4,093)	-3%
Construction	138,950	112,718	131,615	(26,232)	18,897	(7,335)	-5%
Management of companies and enterprises	100,177	105,327	124,118	5,150	18,791	23,941	24%
Finance and insurance	118,496	116,561	123,466	(1,935)	6,905	4,970	4%
Other services (except public administration)	102,107	99,251	104,645	(2,856)	5,394	2,538	2%
Information	100,956	100,551	99,585	(405)	(966)	(1,371)	-1%

Source: Bureau of the Census, County Business Pattern data, Atlanta-Sandy Springs-Roswell, GA Metro Area only.

The state Department of Economic Development highlights how Georgia's market connectivity contributes to the state's economy:

> Georgia's global connectivity continues to drive the state's competitiveness, delivering another record year for total trade and exports. Georgia exports grew to an all-time high of $41.2 billion in 2019, surpassing the previous record set in 2018. Overall, exports grew by 1.5 percent, even as total U.S. exports contracted slightly. Georgia remains home to a robust international ecosystem and companies across the state enjoy seamless access to the international marketplace. .... With more than 6,600 manufacturing firms in Georgia employing more than 400,000 Georgians, manufactured goods make up 90% of Georgia goods exports. … In total, Georgia businesses exported goods to 214 unique countries and territories in 2019, and the state ranks 12th among the largest exporting states in the nation.[4]

The report also noted that Georgia is home to more than 800 aerospace companies, generating a record-breaking $10.8 billion in exports in 2019. With nearly 2,000 establishments related to the life sciences sector, Georgia exports of medical devices and pharmaceuticals grew to $1.9 billion in 2019, an 8% increase over 2018.

Economic Clusters

The U.S. Cluster Mapping Project's analysis of the Greater Atlanta region also highlights its broad economic strength. Economic clusters are categorized as "local" or "traded." Local clusters include industries that generally serve the regional population, including health care, food services, residential construction, and personal services. Traded clusters include industries that generally make and sell goods or services to those outside the local economy whether domestically or internationally, such as a computer chip manufacturer, financial services or information technology. By definition, "traded" clusters will be more important for air service.[5]

The Greater Atlanta area's economy features multiple traded clusters that are among the top performers in the country, and several are of notable strength. Those include Business Services; Marketing, Design, and Publishing; and Communications Equipment and Services.

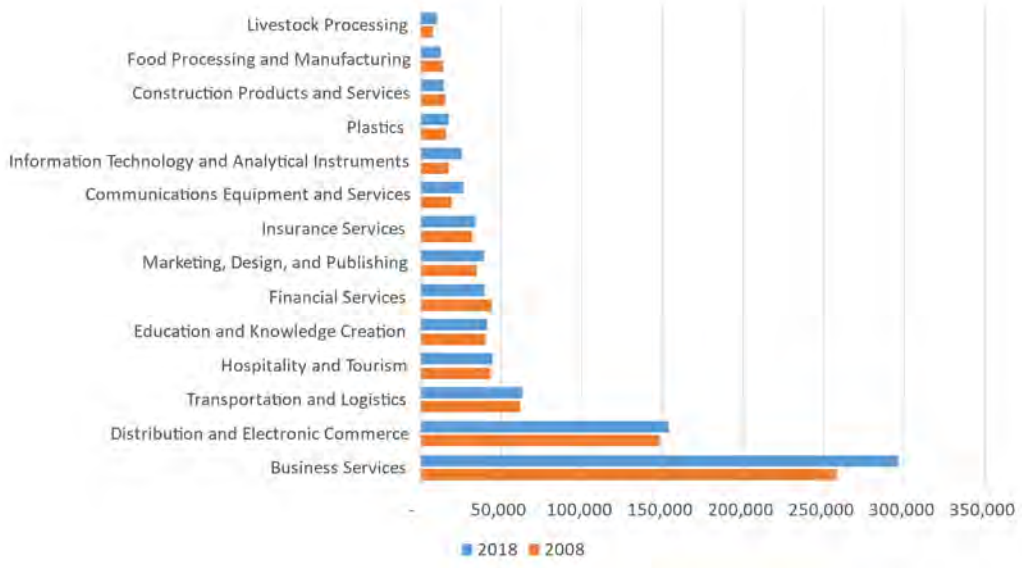
- The Business Services Cluster includes corporate headquarters, computer services, consulting services, and employment placement services. The Atlanta region is ranked among the top 10 in the nation in each of those.

- The Marketing, Design, and Publishing cluster includes publishing (e.g., news syndicates, internet publishing and broadcasting, other information services) and related services (e.g., media buying services and media representatives). The Atlanta region is among the top 10 in the country in both of those subsectors.

- The Communications Equipment and Services sector includes cable networks and satellite communications. Home to CNN, the Atlanta region is among the top in the nation.

Figure ATL-2 shows the strongest tradeable sectors by total employment in 2018 along with employment in each in 2008. It indicates the changes in employment among these sectors. Not all show the significant growth experienced in Business Services (+38,600, or 15 percent) or Information Technology (+8,330 or 49 percent). For example, total employment dropped from 2008 to 2018 in Financial Services (-4,360 or 10 percent).

Figure ATL-2: Changes in Employment in Major Industry Sectors 2008-2018



Source: U.S. Cluster Mapping project for Atlanta MSA

Focus on Regional Transportation, Logistics, and Warehousing

According to the Atlanta Regional Commission (ARC), the metropolitan planning organization for the region, the area's freight and logistics sectors is a key component of the region's economic base, responsible for about $514.8 billion of economic output, or 38% of the total regional output. The ARC reports that jobs in these sectors "can play a role in ladders of opportunity, as many of these jobs provide a livable wage but typically do not require a college education." (ARC Regional Transportation Plan (RTP) pp. 98-99.)

Metro Atlanta's global logistics presence is built in part on its world class airport infrastructure, which is the 14th busiest cargo airport in the US by landed weight. The airport has 1.3 million square feet of total on-airport air cargo warehouse space, and its cargo services features operations by more than 100 licensed

customs brokers, 200 domestic and international freight forwarders, and 100 trucking companies.[6] Goods move to and from the region on its extensive highway and rail systems.

Aerotropolis Atlanta cites:

- Almost 136,000 warehouse/distribution workers within a 45-minute drive of ATL, with forecasted growth of 10.6% in the next decade

- 333 warehouse distribution facilities with almost 42,000 employees within that 45 minute drive

Georgia hosts over 80 cold chain facilities that protect perishables and temperature-sensitive products. Four out of the five top global companies for refrigerated warehousing are located in Georgia, and two are headquartered there. UPS's largest cold chain facility in the U.S. is in suburban Atlanta.

The region benefits from extraordinary market access. From ATL, businesses can reach 80 percent of the United States' population within two hours of flight time. Air carriers serve 150 domestic and 75 international destinations. The region also has ready access to ocean shipping via connections to the Port of Savannah.

Due to infrastructure needs and local zoning laws, manufacturing firms, warehouses, distribution centers, intermodal facilities, and other freight intensive land uses often cluster together. Many – especially those that assign a significant operational and financial benefit to the time-distance factor - are located near the airport. These include agri-business, food processing and logistics, aerospace, and logistics.

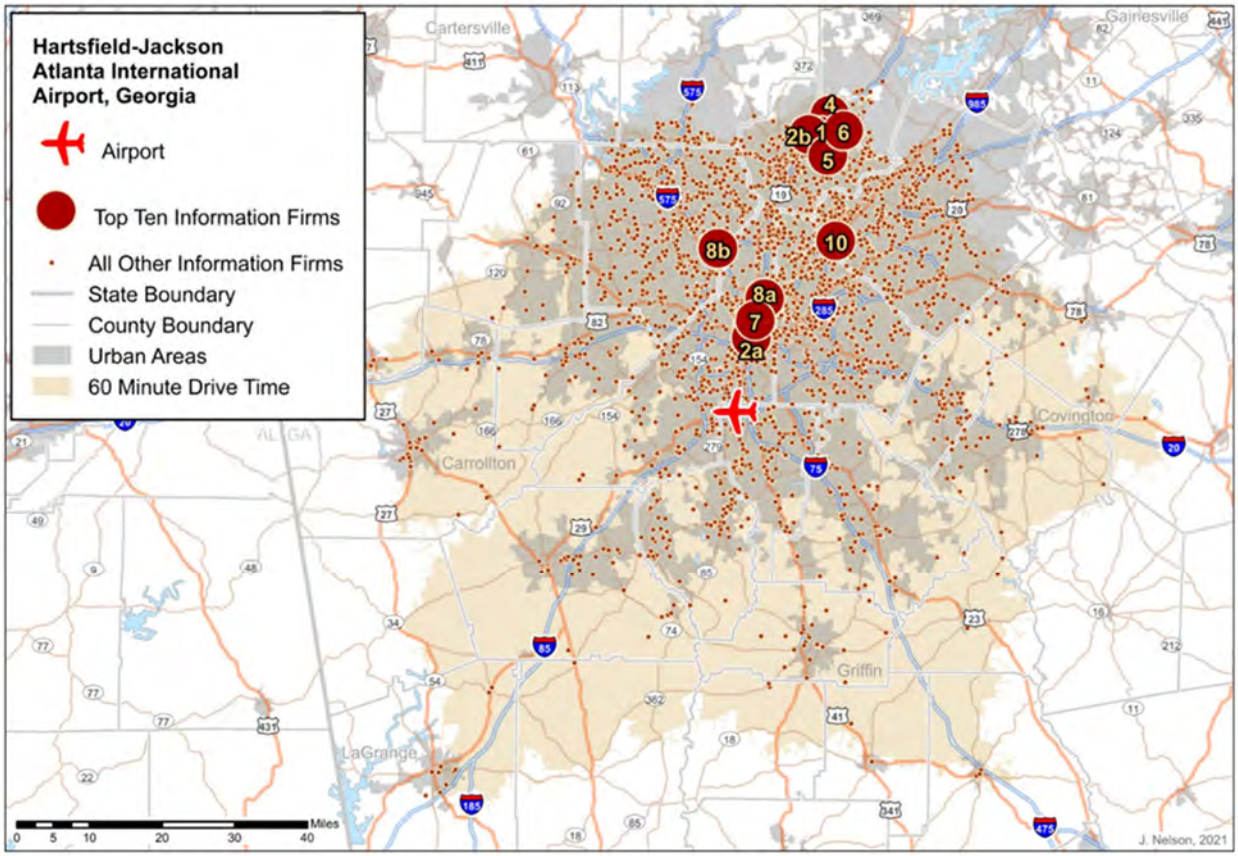
Focus on Information Technology

Another industry sector where Greater Atlanta has a competitive advantage is Information Technology. This assessment is based on analyses of the U.S. BLS Location Quotient data for the host county of each airport. Location quotients (LQs) compare the concentration of an industry within a specific area to the concentration of that industry nationwide. A LQ value of 1.0 indicates that the percentage of employment for that industry is the same as that for the nation. A LQ greater than 1.0 indicates an unusually high proportion of employment in the local economy while an LQ less than 1.0 suggests a disproportionately low share of employment, relative to the national norm or share. For Information Technology, the LQ for the Atlanta region is 3.37.

Economic Activity within Close Proximity to the Airport

Additional insight into the airport's contributions to the local economy can be gained by more closely examining economic activity within a relatively short drive to the facility. Figure ATL-3 illustrates the location of the airport in the region, the bounds of a 60-minute drive from the airport, and the location of the IT firms relative to the airport. It shows that most of the larger firms are located north of the airport in the urban area.

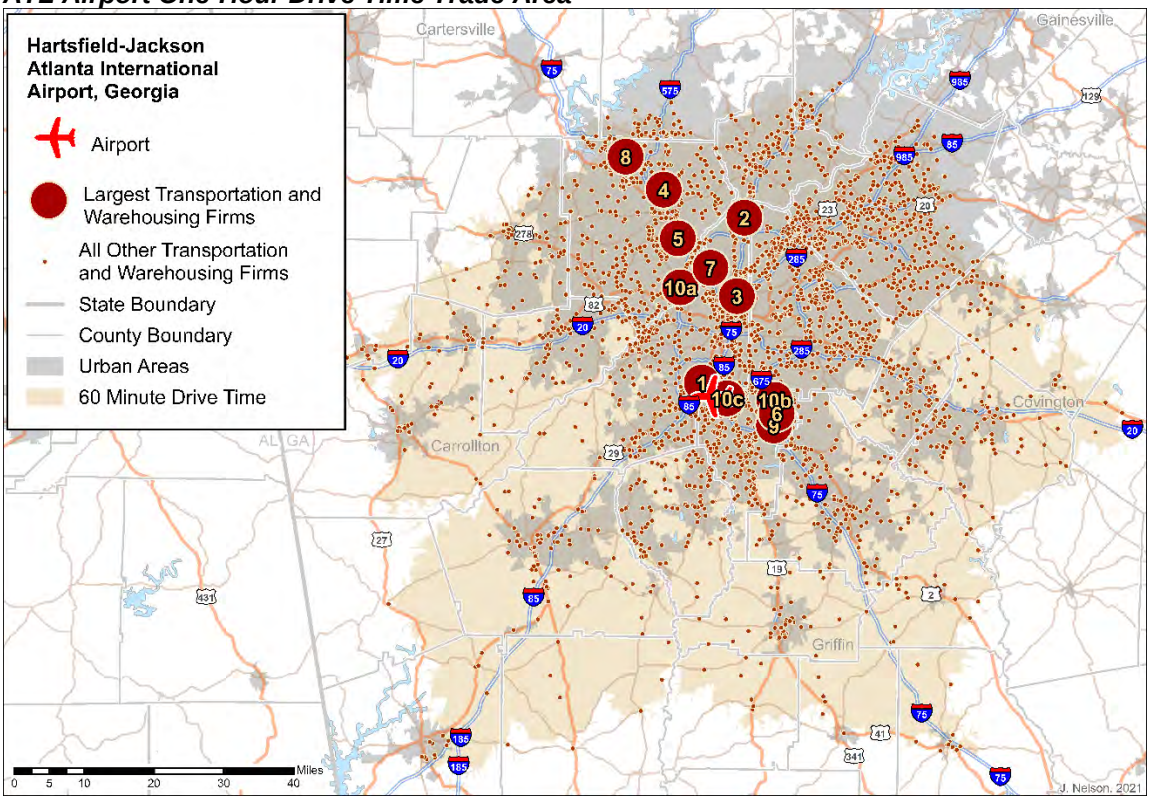
Figure ATL-3: Spatial Distribution of Information Firms (NAICS 51) in the ATL Airport One-Hour Drive Time Trade Area



Source: Esri Arc GIS Business Analyst

Figure ATL-4 illustrates the location of the airport in the region, the bounds of a 60-minute drive from the airport, and the location of the transportation and warehousing (T&W) firms relative to the airport. The larger T&W firms tend to be located either nearby the airport or along I-75, which runs on a diagonal across the metropolitan area between the northwest and southeast quadrants.

Figure ATL-4: Spatial Distribution of Transportation and Warehousing Firms (NAICS 48-49) in the ATL Airport One-Hour Drive Time Trade Area



Source: ESRI ArcGIS Business Analyst

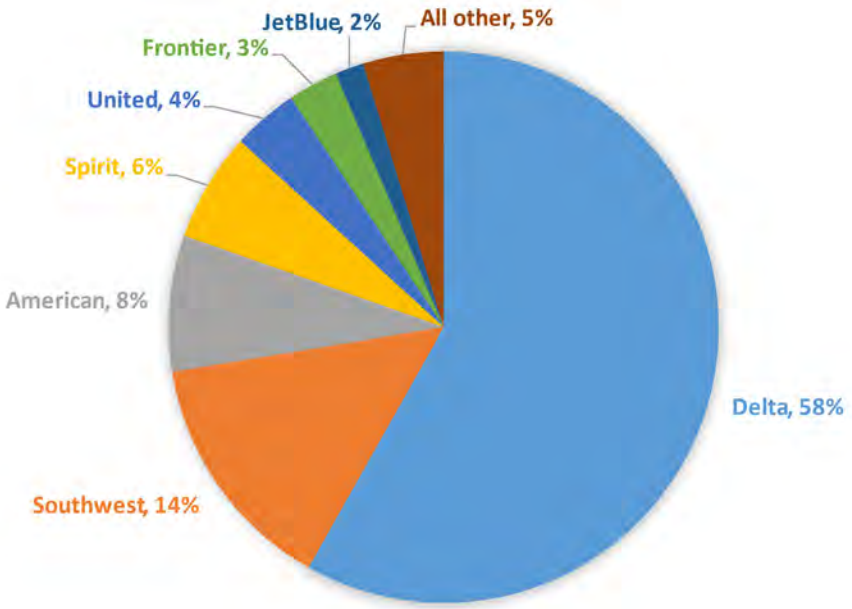
Overview of the Airport and its Air Service

For decades, ATL has commonly recognized as the largest airport in the world based on total aircraft operations and passenger traffic. In general, the airport handles 2,700 arrivals and departures carrying 275,000 passengers on an average day. The airport offered nonstop service to 150 domestic and 75 international destinations in 2019.

The airport is home to Delta Air Lines (Delta), which is the largest carrier by far by flight operations and passenger enplanements. In 2019, Delta carried 74 percent of ATL's total passengers. Including traffic carried by its regional affiliates, the figure rose to 78 percent. Southwest was next largest, with 8 percent, followed by American Airlines (3 percent) and Spirit (2 percent). A total of 28 passenger airlines (17 US and 11 international) served ATL in 2019.

The market for origin and destination traffic is more competitive. In 2019, Delta carried 58 percent of Atlanta's O&D traffic. Southwest accounted for 14 percent, American had 8 percent, and Spirit had 6 percent. No other carrier controlled more than 5 percent of the market. Figure ATL-5 summarizes the share of the origin and destination market captured by the largest carriers, showing data only for those with at least 1 percent of the total. (All airlines with less than that are grouped into the "all other" category.)

Figure ATL-5: O&D Market Share Held by Different Airlines 2019



Source: Data from Sabre, includes both domestic and international traffic

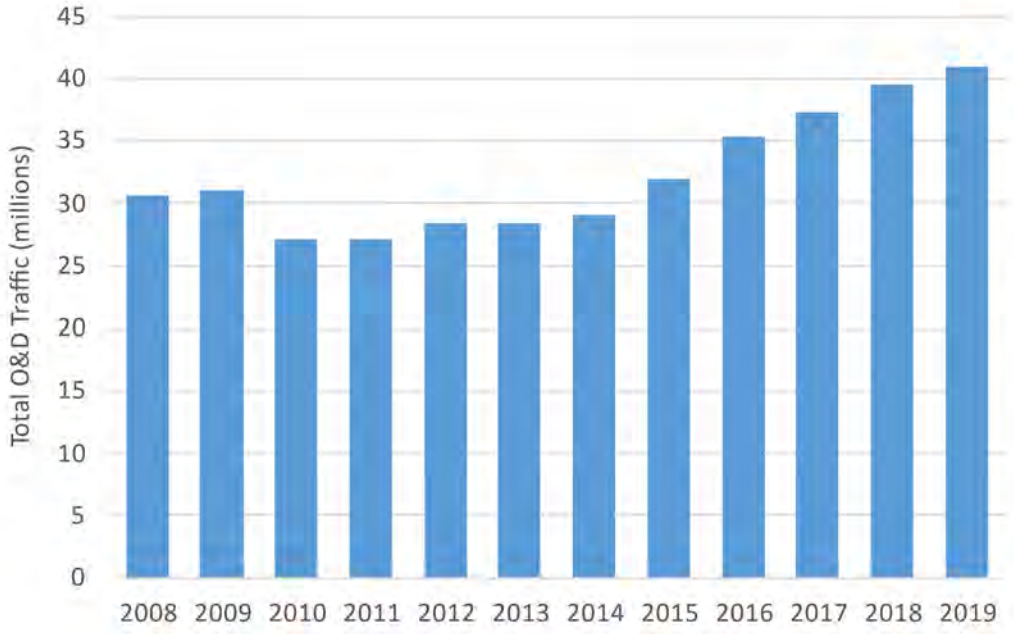
The airport also reported that airlines carried a total of over 600,000 metric tons of cargo in 2019 – 40 percent of which was carried domestically and 60 percent internationally. This includes cargo and freight carried in the belly of passenger aircraft, by express airlines (e.g., FedEx), and on dedicated cargo aircraft (e.g., CargoLux, Polar Air Cargo). In some cases, international airlines may provide only cargo service rather than combined passenger and cargo service (e.g., Asiana Airlines, Cathay Pacific Airlines, China Cargo Airlines, Singapore Airlines Cargo). These operations are indicative of commercial ties between the two points. From 2013 through 2019, total tonnage handled at the airport increased by 37,000 tons (6 percent), with international tonnage increasing more than domestic. (See Figure ATL-6)

Figure ATL-6: Tons of Metric Freight Handled at ATL 2013-2019

Source: Hartsfield Jackson Atlanta International Airport statistics.

Total origin and destination traffic increased since 2008, rising from 31 million to 40 million annually (percent). The increase was not consistent over time. (See Figure ATL-7.) Traffic dropped slightly following the Great Recession, recovered quickly in 2012, before dropping in 2014, when its annual total dropped back to 2009 levels. From that point through 2019, O&D traffic rose again, increasing by nearly 10 million.

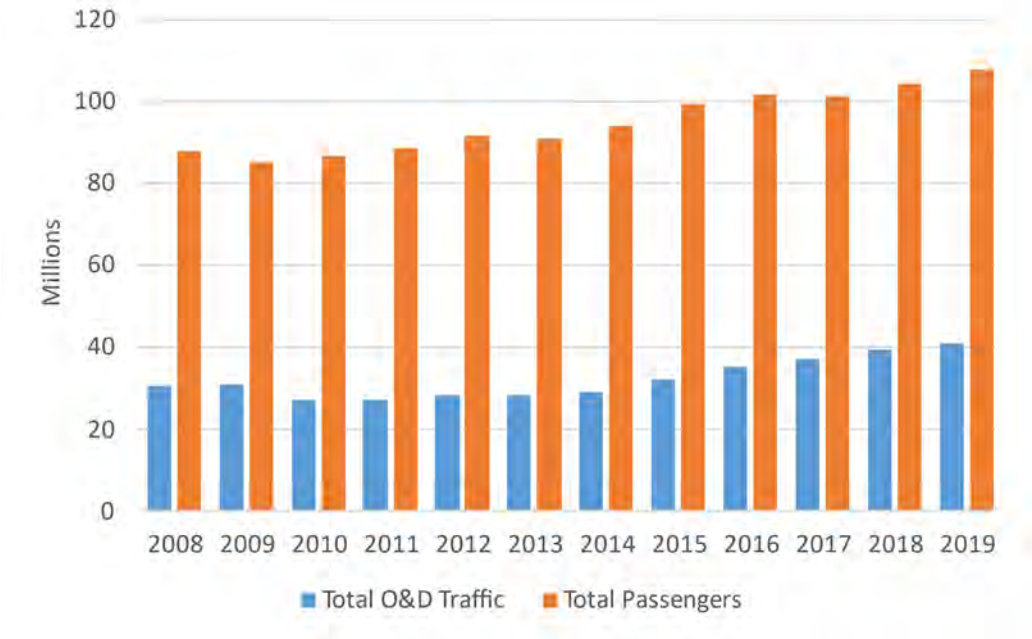
Figure ATL-7: Change in O&D Traffic at ATL, 2008-2019



Source: Diio by Cirium
Note: Data are bidirectional.

By comparison, total passenger activity at the airport increased consistently over the period, indicating the overall strength of the airport as a connection point. Total passenger traffic at ATL rose from 88 million in 2008 to almost 108 million in 2019. Figure ATL-8 shows the changes in both O&D and total passenger traffic at the airport.

Figure ATL-8: Changes in O&D and Total Passenger Traffic at ATL, 2008-2019



Source: Diio by Cirium

However, as passenger activity rose, total flight activity fell over the same period. This is a reflection of the broader industry trend toward upgauging aircraft. From 2008 to 2019, the total number of flights dropped from 475,000 to 436,000 (-8 percent). At the same time, total available (outbound) seating capacity rose from 56 million to 63 million (14 percent). As a result, the average number of available seats per departing aircraft increased from 117 to 145 (24%).

Connectivity

High quality transportation is a prerequisite for sustained economic growth and competitiveness. Specifically, these factors of economic development are driven by productivity growth which is underpinned by trade, foreign investment, and innovative activity – all of which are facilitated by connectivity.

"Connectivity" generally means the ability to reach a wide range of places in a short amount of time. Connectivity is not simply a matter of the number of routes or number of frequencies operated. Connectivity is fundamentally about access to markets and regions. This can have a real impact on the competitiveness and appeal of a regional economy to a business. For instance, a country or region that has continental and intercontinental linkages only to a limited number of destinations will be a less desirable place to do business. Travel costs for staff and for goods will be higher due to the need to purchase multiple flight legs to move people and goods, as well as added time spend in-transit. On the other hand, a community with direct access to a broad range of markets, especially the fastest growing markets, will have a lower cost of doing business. It will also enhance customer servicing, as goods and support staff can easily and quickly reach a range of destinations.

There are several ways of measuring air service connectivity. One such method has been developed by the International Air Transport Association (IATA) and seeks to estimate the relative quality of an airport's network based on the degree of air service to airports with the largest and most diverse route networks, as a proxy for how accessible the local economy is to the rest of the nation and world. This IATA index recognizes that connections to major global gateways provide greater global connectivity than connections to the same number of spoke ends. For example, direct service to 40 small regional destinations does not have the same importance as direct service to 40 major global markets.

Figure ATL-9 summarizes the formula for the IATA connectivity index. Using airline schedule data for passenger service, the index measures the number of frequencies and available seats to a particular destination. It then weights the number of available seats by the size of the destination airport (in terms of total capacity handled each year). This weighting reflects both the size and economic importance of the destination and the potential for convenient onward connections.

Figure ATL-9: IATA Connectivity Index Formula

$$\frac{\text{[Number of destinations x Weekly Frequency x Seats per flight]}\ \textit{Weighted by the Size of the Destination Airport}}{\text{Scalar factor of 1000}}$$

As the world's largest airport, ATL is a national connectivity hub that offers the most onward air service for passengers who depart or connect through it. Because ATL tops all airports in total scheduled seat capacity, all air service to/from ATL is given a weighting of one when calculating the IATA connectivity index for a given airport. For comparison, all air service to London Heathrow (LHR), which handled roughly 81% of the seat capacity handled by ATL in 2019, would instead be given a weight of 0.90. Therefore, if an airport has 1,000 seats available to Atlanta it is given a weighted total of 1000. But if it also has 1,000 seats available to London Heathrow, these are only given a weighted total of 900. In this manner, ATL is a critical connectivity enabler to not only its own regional economy but all regional economies in the nation that link to it.

The weighted totals are then summed for all destinations (and divided by a scalar factor of 1,000) to determine the connectivity indicator. A higher figure for the connectivity index denotes a greater degree of access to the global air transport network.

Unsurprisingly, the volume and variety of air service out of ATL places the airport itself among one of the most connected in the world. In 2019, ATL ranked 12th in the world and 3rd in the U.S. in terms of total connectivity (including both domestic and international service), see Table ATL-3. Although ATL has the highest total seat capacity of any airport, its connectivity lags 11 other major global airports that scored higher because: 1) they served a higher number of destinations; 2) they offered more capacity to major global gateways (rather than smaller spoke or regional airports); or 3) some combination thereof. ATL's high degree of connectivity is driven largely by its extensive domestic air network, although it is also among the leading U.S. airports for international service as well.

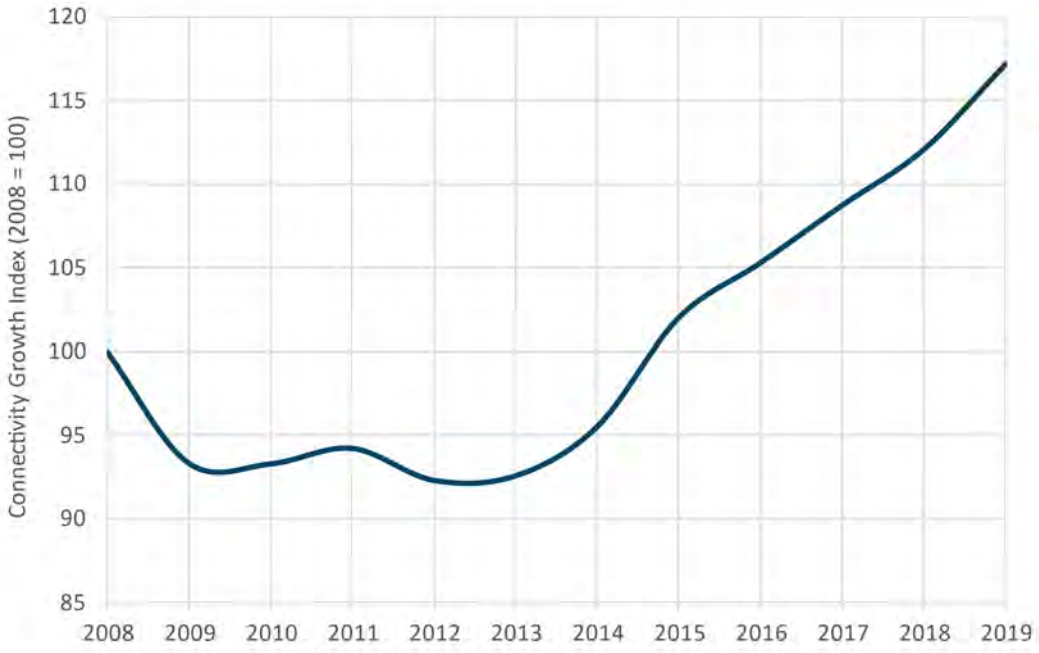
Table ATL-3: Top 20 Airports Based on the IATA Connectivity Index, 2019

Airport Code	Airport Name	Number of Destinations	Total Seats (Millions)	Connectivity Index	Connectivity Rank
PEK	Beijing Capital Int'l	265	62.9	431	1
HKG	Hong Kong Int'l	167	44.8	402	2
LAX	Los Angeles Int'l	204	51.4	387	3
LHR	London Heathrow	222	51.1	378	4
SIN	Singapore Changi Int'l	159	42.5	353	5
PVG	Shanghai Pudong Int'l	238	46.5	323	6
CAN	Guangzhou Baiyun Int'l	195	44.6	312	7
DXB	Dubai Int'l	230	55.2	309	8
ICN	Seoul Incheon Int'l	171	42.2	305	9
ORD	Chicago O'Hare Int'l	267	50.5	300	10
BKK	Bangkok Suvarnabhumi	184	40.9	299	11
ATL	Atlanta Hartsfield Jackson Int'l	247	63.3	292	12
SFO	San Francisco Int'l	144	34.3	287	13
JFK	New York John F Kennedy Int'l	202	37.6	280	14
CDG	Paris Charles De Gaulle	342	44.6	271	15
FRA	Frankfurt Int'l	322	45.5	265	16
TPE	Taiwan Taoyuan Int'l	139	30	258	17
SHA	Shanghai Hongqiao Int'l Airport	75	27.5	241	18
DFW	Dallas/Fort Worth Int'l	257	43.8	237	19
AMS	Amsterdam Airport Schiphol	279	41	237	20

Source: Inter*VISTAS* analysis of Innovata schedule data from Diio Mii.

Beyond the level or scale of connectivity, growth in connectivity over time can also be associated with improving the competitiveness or attractiveness of a regional economy. Figure ATL-10 indexes the change in connectivity at ATL between 2008 and 2019. ATL was not immune to the impact of the Great Recession and the resulting industry-wide consolidation of air operations, as its connectivity dipped below 2008 levels for several years due to decreased capacity overall and fewer destinations served. However, the airport returned to its pre-recession levels by 2015 and maintained moderate incremental growth in connectivity each year through 2019, with 15% total growth in connectivity between 2015 and 2019. The airport's ability to resume positive connectivity growth, even as one of the world's most connected airports already, alludes to an air service development strategy focused not only on growth but also improved quality of service that can enhance the value of air transport for all passengers who rely on ATL.

Figure ATL-10: ATL Connectivity Growth Index (2008 = 100)



Note: Chart shows the IATA Connectivity Index for ATL, indexed against 2008 (2008 = 100).
Source: Inter*VISTAS* analysis of Innovata schedule data from Diio Mii.

The improvement in the airport's connectivity is a reflection the work of its staff, which focused not only on its largest airline tenant (Delta) and partners but also on domestic and international airlines who are not one of Delta's partners. The airport's approach to attract unaligned and/or foreign carriers, in addition to support a strong hometown hub carrier, should enhance the airport's air service levels and international reach.

Change in Air Service and Economic Activity

The total amount of O&D traffic at ATL is highly correlated with total local employment. Figure ATL-11 summarizes how changes in total O&D traffic have aligned with changes in regional employment. The line summarizes the strong positive relationship between the two. As total employment increases, total O&D increases. The correlation coefficient between the two is 0.931. But correlation does not establish causation. That is, just because the two concepts are correlated does not mean that rising total employment levels leads to or causes more air traffic. It is equally possible that more air traffic leads to or causes more employment.

At the same time, it is important that readers recall that much recent academic research shows that improvements in air service and connectivity in fact do lead to increases in employment and economic activity, especially in several industry sectors that are reliant on air transportation such as Business Services (e.g., corporate headquarters, computer services, consulting, and engineering), Transportation and Warehousing, PST, and Management of companies and enterprises. The issue is discussed in greater depth in the *ACRP Web-Only Document 53.*

Figure ATL-11: Relationship between Total Regional Employment and Total O&D Traffic

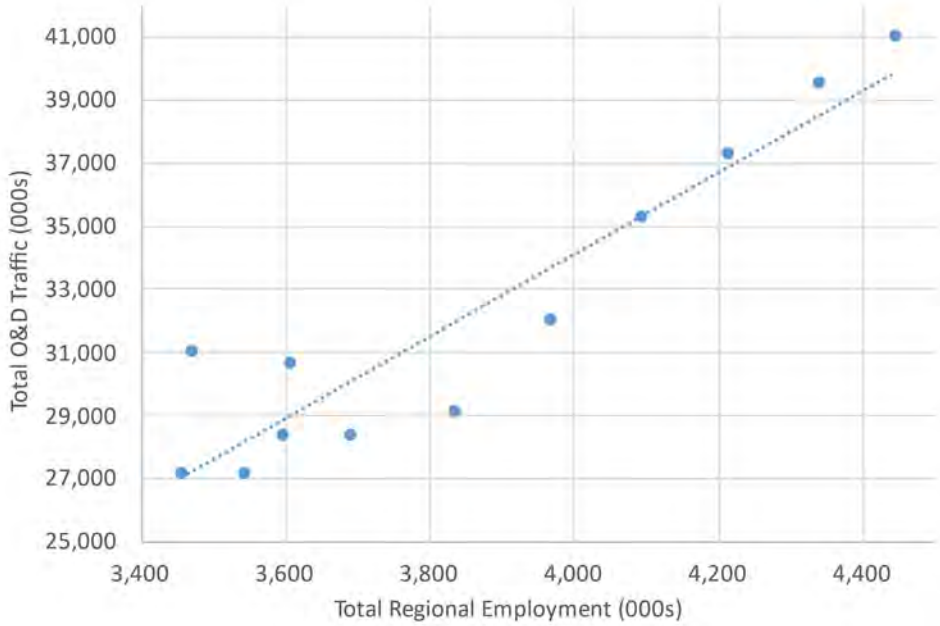
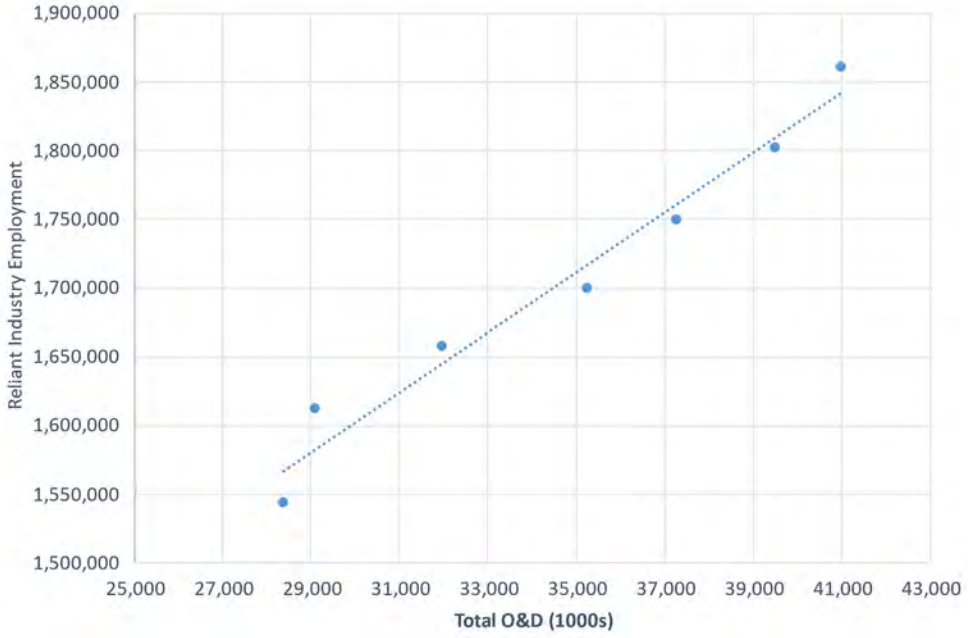


Figure ATL-12 isolates changes in O&D traffic against changes in employment in industry sectors that have a relatively higher propensity to fly than others. Those sectors include manufacturing; wholesale; information technology; FIRE; PST; management of companies; and administrative and support and waste management and remediation services. As with the analysis of air traffic and total employment, the correlation of changes in air service and these "aviation-reliant" industries is a near-perfect 0.983. Data are available only for the years 2013-2019 because those for prior years were suppressed to protect confidentiality. Again, the two variables move together: Increases in one correspond with increases in the other.

Figure ATL-12: Relationship between Regional Employment in Aviation-Reliant Industries and Total O&D Traffic



Finally, we examined the relationship between changes in O&D traffic and changes in employment in the Information sector only. As before, the correlation of changes in air service and PST employment is very high, but less than when combined with other aviation-reliant industries: 0.953. Data are available only for the years 2013-2019 because those for prior years were suppressed to protect confidentiality. Again, the two variables move together: Increases in one correspond with increases in the other.

The Airport's Connections with Regional Economic Stakeholders

The greater Atlanta region has an extensive array of community and business stakeholders that are involved with air service and economic development concerns. These include private organizations, government institutions, and public-private partnerships, such as those shown in Table ATL-4.

Table ATL-4: ATL and its Major Air Service and Economic Development Stakeholder Organizations

Public Institutions	Private Organizations	Public-Private Partnerships
Hartsfield-Jackson Atlanta International Airport	Airlines (most notably Delta Air Lines)	Aerotropolis Atlanta Allianc
Atlanta Regional Commission (10 counties + City of Atlanta)	Metropolitan Atlanta Chamber of Commerce	Atlanta Convention and Visitors Bureau
GA Dept of Economic Development		

- The Atlanta Regional Commission (ARC) includes members from all 10 regional counties and the City of Atlanta. The ARC is responsible for developing and updating the Atlanta Region's Plan, a

long-range blueprint that details the investments needed to ensure metro Atlanta's future success and improve the region's quality of life. A key part of that plan is the Regional Transportation Plan (RTP), which prioritizes spending on transportation projects in the 20-county Atlanta region. The RTP covers not just aviation, highways, and rail, but all modes of transportation. It recognizes that ATL is "…the largest economic asset in the region and its continued success will require regional coordination of land use, transportation, and economic development in the surrounding communities."

- The Aerotropolis Atlanta Alliance is a public-private partnership working to improve the regional economic competitiveness of the area around Hartsfield-Jackson Atlanta International Airport (ATL). The organization has three broad areas of focus: workforce development, education, and economic development. The Aerotropolis Blueprint, first published in 2016 and due to be updated, lays out a strategy that leverages the airport as a major asset to drive economic investment, job growth, and quality of life. Aerotropolis Atlanta focuses on the area within 20 miles of the airport.

- The Metro Atlanta Chamber (MAC) represents businesses, colleges and universities, and nonprofits across the 29-county region that makes up the nation's ninth largest market. MAC works to position metro Atlanta as a top-tier global region by focusing on three key areas: economic development, public policy and promotion. MAC's economic development efforts focus on recruiting new companies to the region and retaining and growing the innovative businesses.[7] The key industry segments it identifies include bioscience, financial technology, and global logistics. "From highways to rails to the frequency of flights, combined with an outstanding capital ecosystem, Atlanta is uniquely positioned for supply chain technology innovation and talent acquisition."[8]

- The Georgia Department of Economic Development is the state's sales and marketing arm. It is the lead agency for attracting new business investment, encouraging the expansion of existing industry and small businesses, aligning workforce education and training with in-demand jobs, locating new markets for Georgia products, attracting tourists to Georgia, and promoting the state.

The City of Atlanta alone has its own economic development arm and office of international affairs. The City's economic development and workforce development efforts are aligned under one organization.

Other public agencies and other organizations are also involved in economic development activities. These often match transportation-related issues with considerations of other issues, such as affordable housing, assistance to small businesses, financial support to groups that have historically been disadvantaged, business retention and expansion, and support for technology, innovation and entrepreneurship.

Stakeholders meet regularly with airport officials and discuss related economic development matters. These can vary depending on the perspectives and missions of the different organizations, although the broad mission of all is to enhance economic activity and the quality of life in the region. Representatives from each one contacted cited the significance of the airport and its air services in facilitating economic development, increasing market access, attracting foreign investment, and creating opportunities for broadly improving the overall quality of life.

Stakeholders emphasize the contribution that developing employment opportunities for people relative to their skills and experience levels makes toward the broader quality of life. The City of Atlanta's "One Atlanta: Economic Mobility, Recovery & Resiliency Plan" defines "good jobs" as those that provide stable employment, middle class wages and benefits. "Promising jobs" are entry-level positions from which most workers can reach a good job within 10 years.

Invest Atlanta plays an important role in improving opportunities for residents, especially those without an undergraduate degree. Specifically, it can attract, retain and support businesses that have a large share of good and promising jobs that do not require a bachelor's degree. These businesses are likely to be in industry sectors ranging from IT, utilities and construction to transportation and logistics, manufacturing and food processing and marketing and design.

Invest Atlanta can also support residents by continuing to attract, retain and support businesses that offer good and promising jobs to college graduates. These businesses are likely to be in professional, scientific and technical industries, public administration, (e.g., urban planning, environmental quality programs, and public health), finance and insurance and company headquarter functions.

Because the airport and air service support employment and economic activity in these sectors, support for the airport and air service further contributes to the region's overall development goals.

Many of the stakeholders have developed interests in particular industries and occupations that rely heavily on commercial aviation. That the region is home to one of the world's largest airports and commercial airlines obviously create economic assets that provide significant leverage for such employment opportunities. For example, Aerotropolis Atlanta's "Blueprint" identified a number of targeted industries with strong airport, airport city or aerotropolis positioning:

- Logistics, freight forwarding and distribution
- Aerospace, aviation and advanced manufacturing
- Bio-life sciences and medical devices
- Perishables and agri-business
- Information communication technology
- Education, skills training and apprenticeships
- E-commerce and fulfillment
- Tourism and entertainment

BLS projects that employment in the transportation and logistics sector will grow by over 325,000 jobs between 2019 and 2019, a compounded annual rate of growth of 0.6 percent (50% faster than total national employment). BLS projects warehousing and storage employment to rise by 8.8 percent and employment for logisticians to increase by 4 percent by 2029.

Communicating the Airport's Economic Impact

The airport itself does not highlight its economic impact. There is no link on the website to the most recent analysis. Instead, there is only a single sentence reference: "ATL is the economic jewel of Georgia, generating a $34.8 billion economic impact for metro Atlanta."[9]

Without question, all stakeholders referenced the economic impact of the airport in terms of total employment supported and overall economic activity. They also agreed that the broad community includes a spectrum of different audiences that have varying levels of interest in how commercial aviation supports employment and economic activity. The general media or public tends to focus only on the "big numbers" whereas economic development professionals, planners, and corporate developers may have more interest in specific details on market access and questions of available capacity. Market access is a common concern, especially for businesses that desire nonstop service, since such operations reduce time in flight and possible interruptions of the flow or people and goods.

Several noted the challenges of conveying economic concepts to the general public. Some suggested using individual stories to personalize how an individual's employment or business is tied to the airport or airlines.

The stakeholders have their own metrics used to gauge performance, and these do not generally tie to the airport. Some of the metrics used may use measures that are often applied to airport economic impacts – such as jobs supported and associated GDP.

Greater Austin: An Example of Significant Growth in Economic Activity and Air Service

The Greater Austin area includes five counties in the central part of the state anchored by Austin, the capital of Texas. The region has a diverse economy heavily anchored by government activities and education. High-tech firms, particularly related to semiconductors and software, are also important economic pillars. The region is also known for its arts and music. The region is among the faster growing areas of the country. According to the Census Bureau, from 2010 through 2019, the Greater Austin area was the third fastest growing urban area in the country.

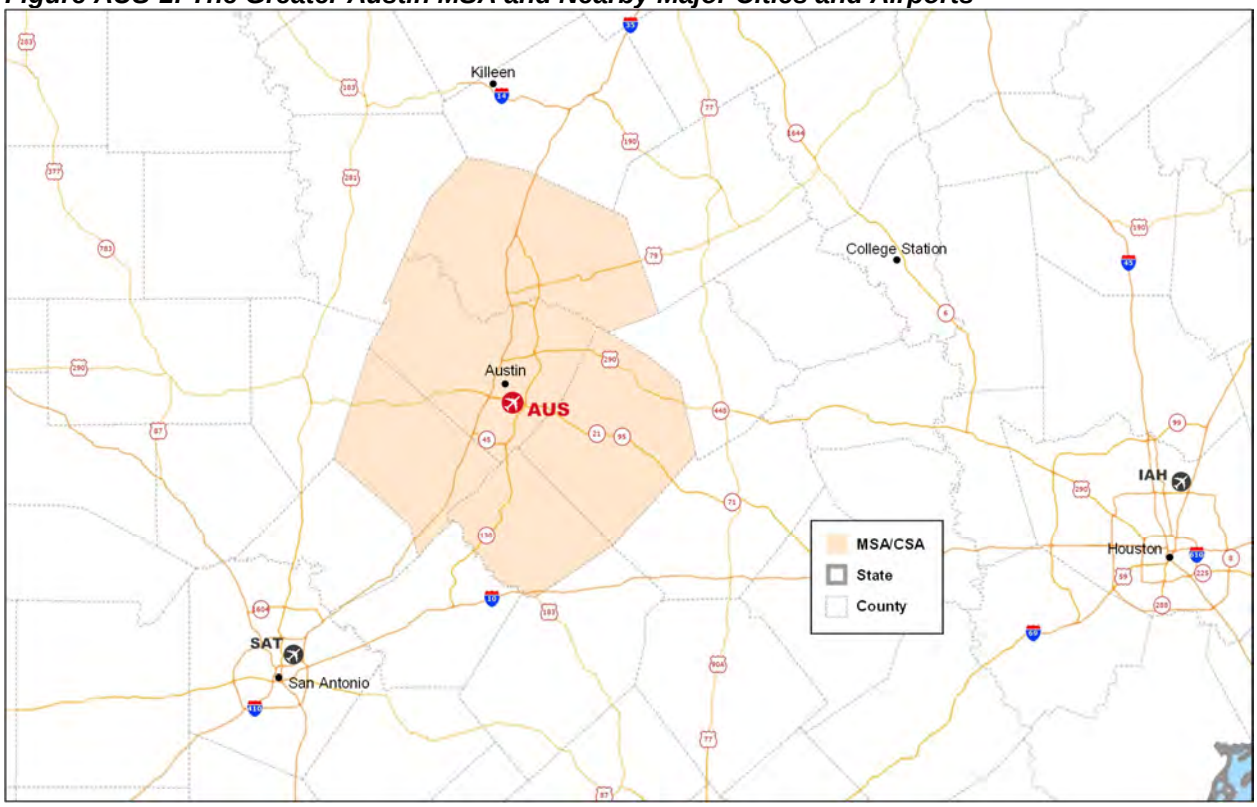
The region is served by Austin-Bergstrom International Airport (AUS or ABIA), which is owned by the City of Austin. Operations and passenger traffic at AUS have grown faster than the region's population. According to FAA enplanement data, passenger traffic at AUS nearly doubled from 2008 to 2019, rising from 4.3 million in 2008 to 8.5 million in 2019.

The Austin region is included as a case study because of its significant growth since 2008.

Introduction to the Region and its Economy

The Austin-Round Rock-San Marcos Metropolitan Statistical Area (MSA or Greater Austin) includes the city of Austin and the counties of Bastrop, Caldwell, Hays, Travis, and Williamson. The region is in central Texas, with the San Antonio metropolitan area immediately to the west. It is roughly 200 miles south of the Dallas-Ft. Worth area and 150 miles west of the Houston area, see Figure AUS-1.

Figure AUS-1: The Greater Austin MSA and Nearby Major Cities and Airports



According to the U.S. Bureau of Economic Analysis (BEA), in 2019, the Austin-Round Rock-Georgetown MSA had a 2019 population of 2,227,083, making it the 29th ranked in the nation (out of 384 total). The region produced $159.4 billion in current-dollar total GDP, making it the 26th ranked.[10]

The region has undergone significant growth in population and employment since 2008. Table AUS-1 summarizes the changes in key socio-economic characteristics for the period. As shown, from 2008 through 2019:

- Total population rose by nearly 600,000 (36 percent). That was a faster increase than realized for the entire state of Texas, which rose by 19 percent.

- Total employment increased by almost 500,000 (46 percent). By contrast, employment for the state rose by 25 percent.

- Average per capita income (nominal dollars) rose from $41,500 to $62,000 (49 percent). For all of Texas, the increase was 35 percent. In constant dollars, average per capita income rose 22 percent.

- The number of businesses operating in the region increased by over 20,000 (54 percent). (The BEA uses data from the U.S. Census Bureau, which defines an establishment as "a single physical location at which business is conducted or services or industrial operations are performed. It is not necessarily identical with a company or enterprise, which may consist of one or more establishments. … Establishment counts represent the number of locations with paid employees any time during the year." The count excludes government establishments except for certain situations, such as state-operated retail liquor stores, local government-owned/operated hospitals, and federally chartered credit unions.)

Table AUS-1: Change in Major Socio-Economic Variables, Greater Austin 2008-2019 (data in 1,000s)

	2008	2015	2019	Change 2008-15		Change 2015-19		Change 2008-19	
				#	%	#	%	#	%
Population	1,634	2,002	2,227	368	23%	225	11%	593	36%
Total Employment	1,072	1,325	1,566	253	24%	241	18%	494	46%
Private Non-farm Employment	897	1,145	1,377	248	28%	232	20%	480	53%
Gov't Employment	166	170	180	4	3%	10	6%	14	9%
Income per Capita - Nominal $	$41,509	$51,484	$61,977	$9,975	24%	$10,493	20%	$20,468	49%
Income per Capita - Constant 2019 $	$50,739	$55,935	$61,977	$5,196	10%	$6,042	11%	$11,238	22%
Number of Establishments	40	52	62	12	29%	10	20%	22	54%

Source: U.S. Bureau of Economic Analysis (BEA)
Note: All data are in 1,000s except for per capita income, which is shown in nominal dollars. Constant dollar estimates generated from U.S. Bureau of Labor Statistics.

Employment growth in the region is especially noteworthy. According to data from the U.S. Cluster Mapping project, for the period 1998 – 2018, private non-agricultural employment growth in the region averaged 2.92 percent annually – second only to the Miami area for fastest growth in the country. By comparison, the U.S. national average was 0.96 percent.[11]

The region is a major center of higher education. Austin is the home of the University of Texas at Austin (the flagship campus of the University of Texas System, with an enrollment of nearly 52,000)[12] and Texas State University (flagship of the Texas State University System, with over 38,000 enrolled students). Several other colleges and universities are located in the area.

In part due to the presence of those schools, the area has a high percentage of the adult population aged 25 or over with college degrees: 46.2 percent. This makes the Greater Austin area the 6th highest in the U.S. By comparison, the figures for Texas and the entire U.S. are 29.9 percent and 32.1 percent, respectively.[13]

Regional Economic Strengths

The region's economy is anchored by several large employment sectors. As the capital of Texas, the region has a significant public sector presence, including local, state, and federal employees. This also takes into account the large number of staff associated with education, especially because the major universities in the region are public rather than private. The other major sectors are illustrated in Table AUS-2. Outside of accommodations, food service, and retail, the other large sectors (based on total employment in 2019) are professional, scientific, and technological (PST); health care; construction; administrative and support; and information technology. The table also highlights the extraordinary growth in employment in PST, information, and transportation and warehousing.

Table AUS-2: Changes in Employment by Major Sector 2008-2019

Industry	2008	2019	Change	
			#	%
Accommodation and food services	77,869	123,576	45,707	59%
Retail trade	89,474	113,573	24,099	27%
Professional, scientific, and technical services	64,167	111,535	47,368	74%
Health care and social assistance	70,732	110,121	39,389	56%
Construction	46,991	61,740	14,749	31%
Administrative and support and waste management and remediation services	51,901	59,798	7,897	15%
Information	25,837	48,001	22,164	86%
Manufacturing	45,819	43,912	(1,907)	-4%
Other services (except public administration)	33,283	42,233	8,950	27%
Finance and insurance	33,540	41,483	7,943	24%
Wholesale trade	44,213	38,279	(5,934)	-13%
Real estate and rental and leasing	15,976	22,021	6,045	38%
Transportation and warehousing	11,075	21,578	10,503	95%
Educational services	11,887	21,139	9,252	78%
Management of companies and enterprises	19,269	16,657	(2,612)	-14%
Arts, entertainment, and recreation	10,100	15,933	5,833	58%
Mining, quarrying, and oil and gas extraction	1,864	2,544	680	36%
Utilities	1,936	2,488	552	29%
Agriculture, forestry, fishing and hunting	86	120	34	40%
Industries not classified	38	113	75	197%
Total for all sectors	**656,057**	**896,844**	**240,787**	**37%**

Source: BEA

The strength of the regional economy is also reflected in large increases in the number of business establishments.[14] Table AUS-3 summarizes the changes in the number of establishments between 2008 and 2019.

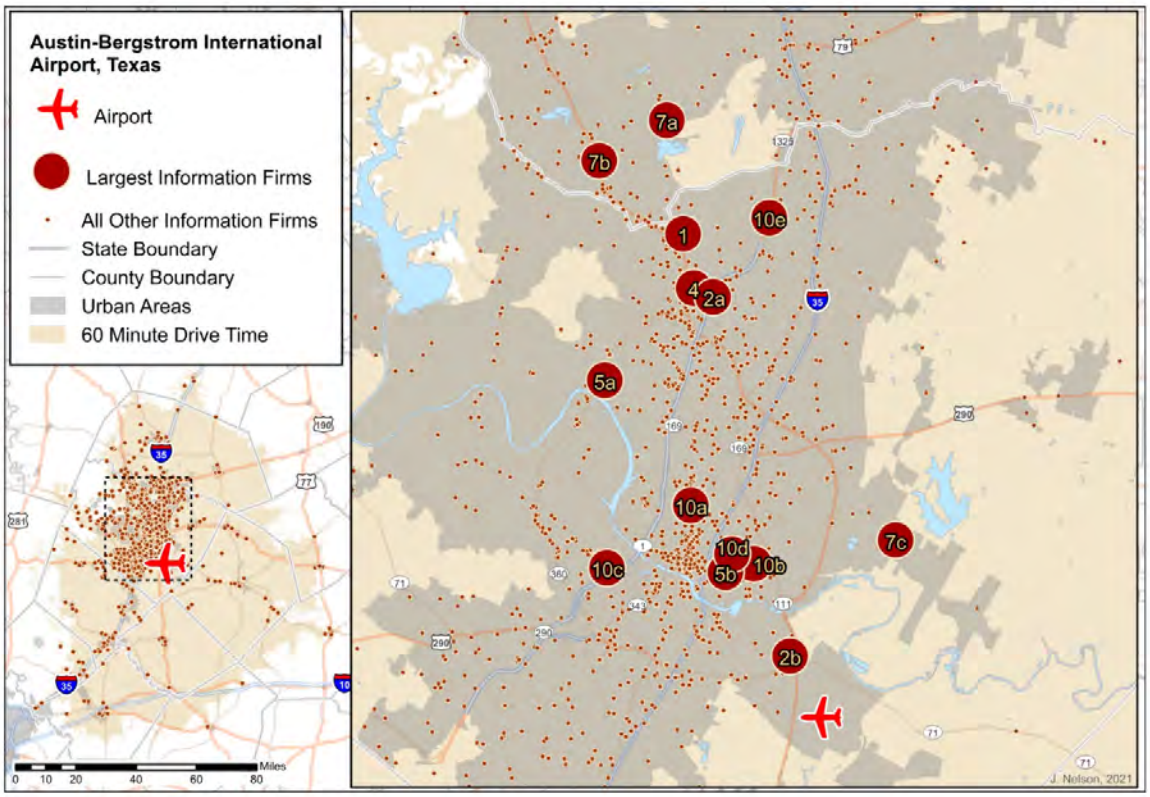
Table AUS-3: Change in Establishments 2008-2019

Industry	2008	2019	Change	
			#	%
Accommodation and food services	3,459	5,216	1,757	51%
Retail trade	5,328	6,210	882	17%
Professional, scientific, and technical services	6,293	9,771	3,478	55%
Health care and social assistance	3,793	5,979	2,186	58%
Construction	3,574	4,931	1,357	38%
Administrative and support and waste management and remediation services	2,172	2,889	717	33%
Information	981	1,538	557	57%
Manufacturing	1,266	1,468	202	16%
Other services (except public administration)	3,521	4,885	1,364	39%
Finance and insurance	2,876	3,606	730	25%
Wholesale trade	1,858	2,100	242	13%
Real estate and rental and leasing	2,418	3,637	1,219	50%
Transportation and warehousing	687	959	272	40%
Educational services	656	1,087	431	66%
Management of companies and enterprises	288	373	85	30%
Arts, entertainment, and recreation	615	1,077	462	75%
Mining, quarrying, and oil and gas extraction	180	158	(22)	-12%
Utilities	91	115	24	26%
Agriculture, forestry, fishing and hunting	30	42	12	40%
Industries not classified	48	96	48	100%
Total for all sectors	**40,134**	**56,137**	**16,003**	**40%**

Source: BEA

Figure AUS-2 illustrates a 60-minute drive time around AUS and the location of IT businesses within that area. The largest are all within the urban area.

Figure AUS-2: Spatial Distribution of Information Firms (NAICS 51) in the AUS Airport One-Hour Drive Time Trade Area



Source: Esri Business Analyst

Economic Clusters

The U.S. Cluster Mapping Project's analysis of the Greater Austin region also highlights its broad economic strength. A cluster is a concentration of related industries in a particular region. Clusters consist of companies, suppliers, and service providers, as well as government agencies and other institutions that provide specialized training and education, information, research, and technical support. Traded clusters are groups of related industries that serve markets beyond the region in which they are located and therefore require some form of transport connectivity. Examples include financial service or information technology. By contrast, local clusters consist of industries that serve the local market. Examples include local grocery stores or restaurants.[15]

The area's economy features multiple tradeable clusters that are among the top performers in the country, and several are of notable strength. Those include Business Services; Information Technology and Analytical Instruments; and Marketing, Design, and Publishing.

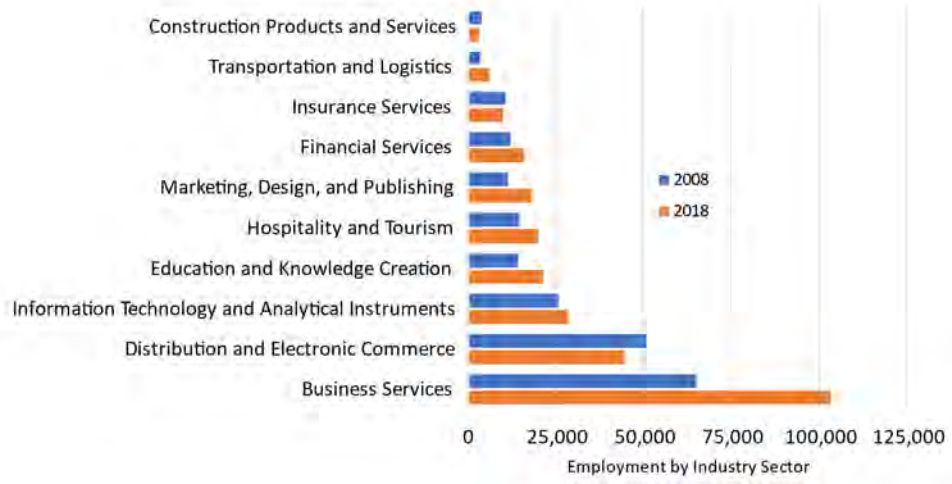
- Within the Business Services, the region shows significant economic strength in terms of computer services (data processing, hosting programming, etc.), corporate headquarters, and consulting services. The region's LQ for this sector was 1.25.

- Information Technology and Analytical Instruments (IT) includes software publishing, semiconductor manufacturing and machinery, and computer and peripherals manufacturing. The region's LQ for this sector was 3.52.

- Marketing, Design, and Publishing includes internet publishing and broadcasting; web search portals; information services; marketing consulting services; advertising; and industrial, graphic, interior, and other specialty design services. The region's LQ for this sector was 1.98.

Figure AUS-3 shows the strongest tradeable sectors by total employment in 2018 along with employment in each in 2008. It indicates the changes in employment among these sectors. Not all show the significant growth experienced in Business Services (+38,000, or 59 percent) or Marketing, Design, and Publishing (+6,600 or 58 percent). For example, total employment dropped from 2008 to 2018 in Distribution and Electronic Commerce (-6,200 or 12 percent).

Figure AUS-3: Changes in Employment in Major Industry Sectors 2008-2018



Note: 2018 was the latest year for which data were available.
Source: U.S. Cluster Mapping Project (http://clustermapping.us/), Institute for Strategy and Competitiveness, Harvard Business School. Data Sources (http://clustermapping.us/content/data-sources-and-limitations)

Foreign Direct Investment

The Greater Austin Chamber of Commerce (Chamber) reports that more than 85 international companies have relocated or expanded in the Austin region since 2004. Market access is certainly one of many factors that firms consider when making site selection decisions. That AUS has established nonstop international service to countries outside of North America must be a significant positive aspect.

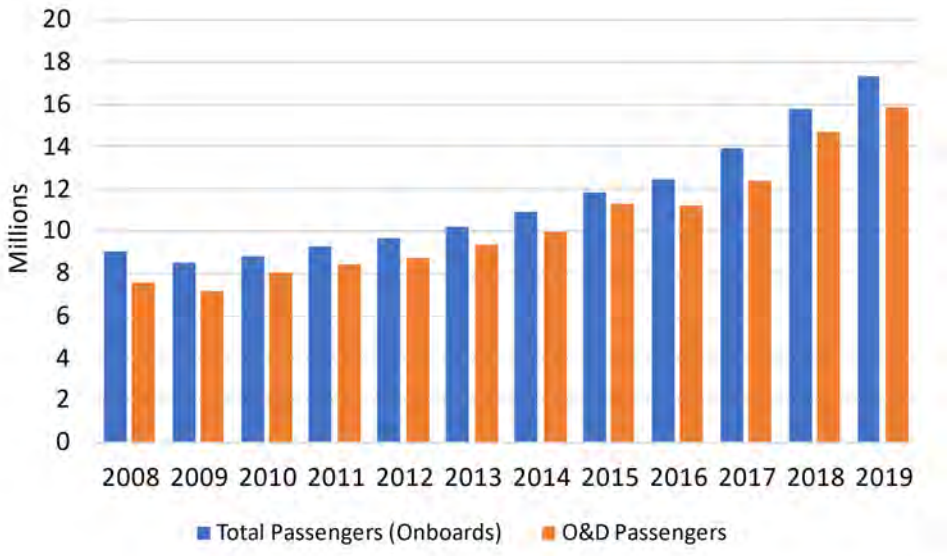
Since AUS gained nonstop service to Europe, the amount of foreign investment in the region rose significantly. In the 4-year period 2010-2013, the region gained an average of 2 new foreign-based firms supporting 190 jobs annually. Since 2014, when nonstop flights to London's Heathrow Airport launched, the annual average rose to 8 firms supporting 560 jobs. The region is now home to 14 firms based in the United Kingdom alone.

Overview of the Airport and its Air Service

Austin-Bergstrom International Airport is owned and operated by the City of Austin. Due to its proximity to San Antonio (approximately 80 miles away), ABIA's greater catchment area encompasses both the city of Austin and the city of San Antonio. As a result, AUS serves an overlapping catchment area with San Antonio International Airport (SAT).

The airport's website touts it as "the second-fastest growing, mid-sized airport in the United States." That growth accompanies the increases in the region's population and employment. In 2019, the airport set a new annual passenger record: 17.3 million people traveled through the airport-- the tenth record-breaking year in a row. Since opening in 1999, AUS passenger traffic has tripled. Figure AUS-4 summarizes the change in total and Origin & Destination passenger activity. Not surprisingly, while connecting itineraries are possible given the overall volume of aircraft operations, the airport is principally a facility that serves local traffic, so O&D traffic represents the majority of total traffic.

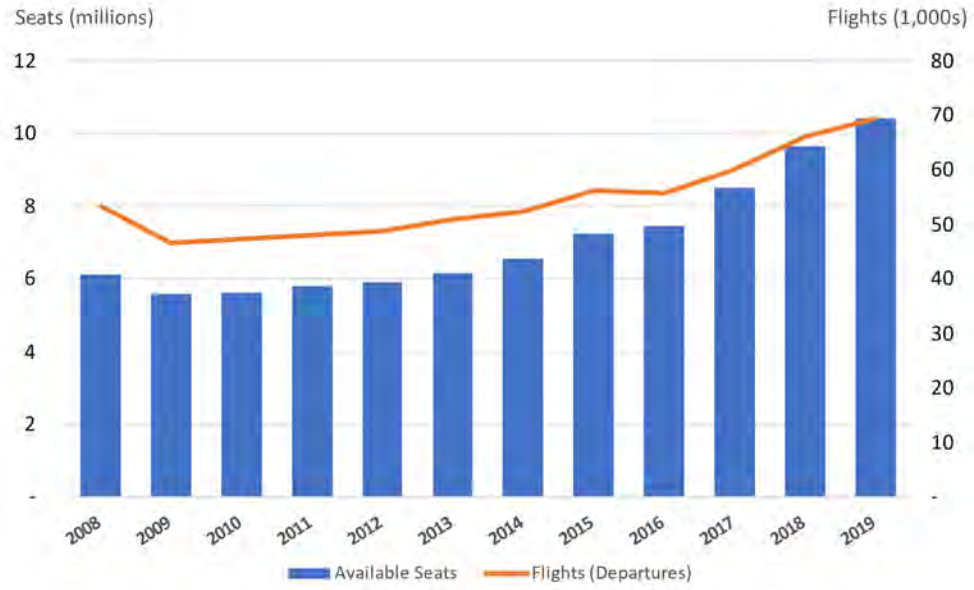
Figure AUS-4: Growth in Total and O&D Passenger Activity 2008-2019 (millions of passengers)



Source: T-100 data from Diio by Cirium

Figure AUS-5 shows the growth in the amount of capacity offered at AUS, in terms of both total flights and seats available for sale. From 2008 to 2019, the number of available seats rose by 4.3 million (70 percent), equivalent to an extra 12,000 seats per day. The number of flights rose by nearly 16,000 (30 percent), or almost 45 additional flights per day. Average aircraft size (seats per departure) rose from 115 to 150.

Figure AUS-5: Changes in Flights and Capacity Offered 2008-2019



Source: T-100 data from Diio by Cirium

The number of nonstop markets served grew, as did the number of flights to major markets. In 2009, AUS had service (defined as 50 flights in a year or more) to 40 destinations. In 2019, it had service to 60. It gained service Miami (over 1,000 flights) and daily service to Reagan Washington National (DCA) via an exemption to the DCA perimeter rule. In addition, the number of flights to major markets rose significantly from 2009 to 2019:

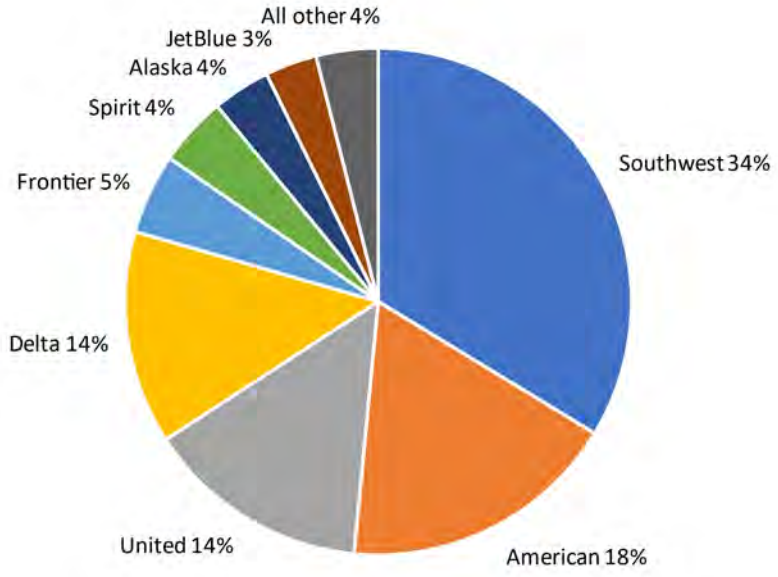
- Atlanta: +1700
- Boston: +735
- Baltimore-Washington: +520
- Detroit: +950
- New York – Newark Liberty: +800
- Washington Dulles: +590
- Los Angeles International: +2300
- Chicago Midway: +520
- Minneapolis-St. Paul: +330
- Chicago O'Hare: +390
- San Diego: +800
- Seattle: +980
- San Jose, CA: +980
- Salt Lake City: +535

The airport also expanded its international service. AUS had service to Canadian and Mexican airports in 2008, but added new destinations over time, including Calgary and Guadalajara. AUS also added nonstop service to three European airports – London Heathrow, London Gatwick, and Frankfurt. Before the pandemic, carriers had announced plans to add service to Paris and Amsterdam.

Figure AUS-6 highlights the relative balance of the passenger market share among carriers based on 2019 passenger traffic. Southwest is the largest carrier at AUS, with slightly more than one-third of the total. American, United and Delta hold roughly the same share, followed by the other U.S. carriers. As a result,

those major U.S. carriers carry almost 80 percent of the AUS market. The international airlines that operated there in 2019 – including British Airlines, Lufthansa, Norwegian, SAS, Air Canada, and WestJet -- carried 2.6 percent of passengers.

Figure AUS-6: Passenger Market Share 2019



Source: AUS

In May 2019, Lufthansa arrived in Austin as the German carrier's only new North American nonstop announced in 2019, connecting the capital of Texas to the airline's main hub in Frankfurt, Germany. Fall brought the announcement of two more transatlantic routes to begin in 2020: nonstop service to Paris aboard Norwegian, and to Amsterdam on KLM. In 2019, international travel increased by 21%.

Cargo and freight operations totaled roughly 150,000 pounds in 2019, with about 130,000 lbs. in the domestic market and the remaining 20,000 lbs. in the international market. The integrated carriers FedEx and UPS carried approximately 85 percent of total cargo and freight tonnage.

Connectivity

High quality transportation – of all modes -- is a prerequisite for sustained economic growth and for maintaining economic competitiveness. International competitiveness is driven by productivity growth which is underpinned by trade, foreign investment and innovative activity, all of which are facilitated by connectivity via commercial aviation.

"Connectivity" generally means the ability to reach a wide range of places in a short amount of time. Connectivity creates efficiencies that make firms more productive, which in turn attracts more high-flying businesses that have their choice of locations and starts a virtuous cycle of economic growth.

The growth in new destinations as well as increased capacity to major markets have manifested into a robust, continuous improvement in air connectivity provided by AUS to the regional economy over the past decade. Connectivity can be quantitatively measured in a variety of ways. One is a method developed by the International Air Transport Association (IATA). The IATA connectivity index estimates the quality of

air service at an airport based on the degree of service to other airports with the largest and most diverse route networks, as a proxy for how accessible the local economy is to the rest of the world.

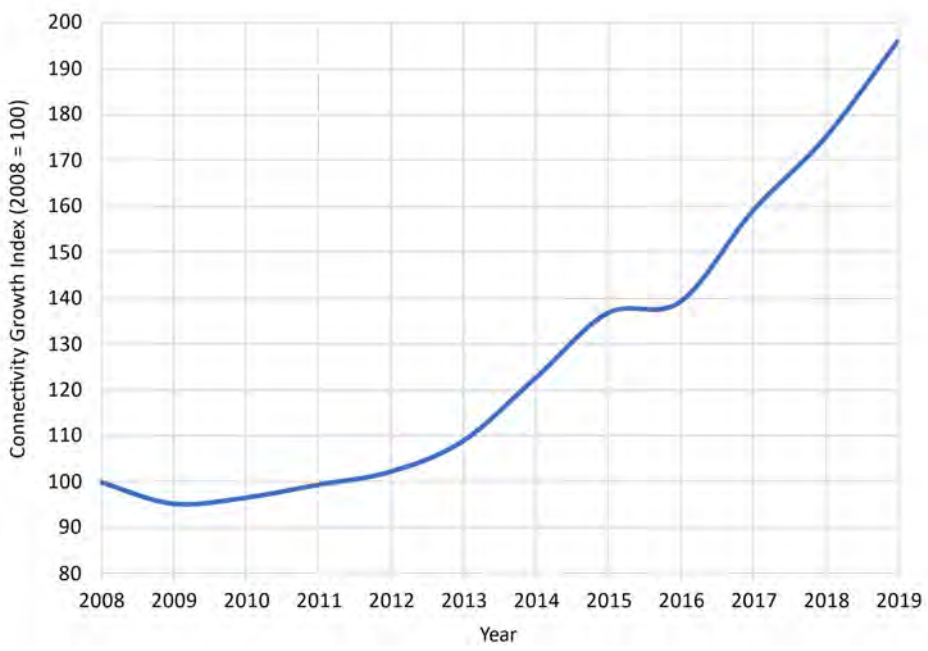
Figure AUS-7 summarizes the formula for the IATA connectivity index. Using airline schedule data for passenger service, the index measures the number of frequencies and available seats to a particular destination. It then weights the number of available seats by the size of the destination airport (in terms of total capacity handled each year). This weighting reflects both the size and economic importance of the destination and the potential for convenient onward connections.

Figure AUS-7: IATA Connectivity Index Formula

$$\frac{\text{[Number of destinations x Weekly Frequency x Seats per flight]}\ \textit{Weighted by the Size of the Destination Airport}}{\text{Scalar factor of 1000}}$$

Figure AUS-8 below summarizes how connectivity at AUS has nearly doubled between 2008 and 2019. The impact of the Great Recession – which saw industry-wide consolidation of air service and mass reductions in air connectivity – was particularly short-lived at AUS, as it returned to its 2008 level of connectivity within just a few years. The growth in connectivity at AUS totaled 37% 2008-2015, and 43% 2015-2019. Overall, connectivity growth averaged 6.3% per annum between 2008-19, facilitated by both new and growing service to major markets in the U.S. as well as to major international hubs in Europe (London and Frankfurt). The consistent improvement in connectivity at AUS reflects not simply the pure growth in seat capacity and aircraft operations over time but more importantly the development of the airport as an increasingly effective means to reach key markets globally.

Figure AUS-8: AUS Connectivity Growth Index (2008=100)



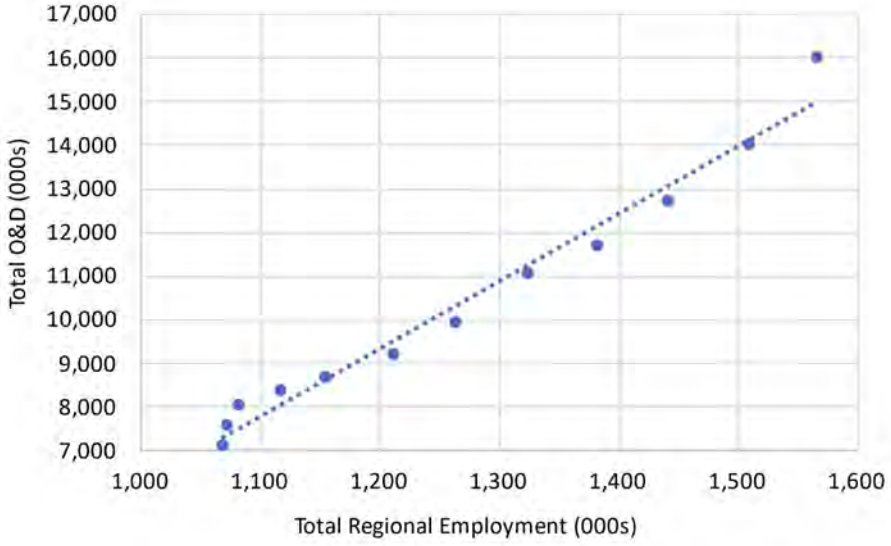
Note: Chart shows the IATA Connectivity Index for AUS, indexed against 2008 (2008 = 100).
Source: Inter*VISTAS* analysis of Innovata schedule data from Diio Mi.

Change in Air Service and Economic Activity

The total amount of O&D traffic at AUS is highly correlated with total local employment. Figure AUS-9 summarizes how changes in total O&D traffic have aligned with changes in regional employment. The line summarizes a strong positive relationship between the two. As total employment increases, total O&D increases. The correlation coefficient between the two is a near-perfect .987. Yet correlation alone does not demonstrate causation; that is, correlation analysis alone is not evidence that rising total employment levels leads to more air traffic, or whether more air traffic leads to more total employment.

However, readers should recall that much recent academic research shows that improvements in air service and connectivity in fact do lead to increases in employment and economic activity, especially in several industry sectors that are reliant upon air transportation such as Business Services (e.g., corporate headquarters, computer services, consulting, and engineering), PST, and Management of companies and enterprises. The link between international service and foreign direct investment (and related employment) is strong evidence. The issue is discussed in greater depth in the Guidebook.

Figure AUS-9: Relationship between Total Regional Employment and Total O&D Traffic



Stakeholders Perspectives on Contributions of Air Service to Economic Development

The Greater Austin Chamber of Commerce (Chamber) works with businesses looking to create or expand their presence in the Austin region and help them create more jobs. The Chamber represents businesses in the five-county region anchored by Austin. The Chamber invests in a broad range of programs that build, support, and diversify the Austin region's economy. Its vision is for Austin to have the country's most prosperous business community.

Improved air service is a critical element of the Chamber's efforts to enhance regional economic development. That broader economic development effort ("Opportunity Austin") is a five-year regional economic development initiative aimed at fostering job-creating investment across the Austin region. Nearly 400 corporate and community partners participate and invest in Opportunity Austin. Its top priorities include boosting economic diversification to proactively strengthen the economy, deepening the talent pool through development and attraction, and keeping the Greater Austin region attractive to entrepreneurs,

business leaders and site selectors through advocacy on issues such as a comprehensive regional transportation system and regional collaboration.

Opportunity Austin targets key industries for future economic development, including advanced manufacturing, creative and digital media technology, clean energy and power technology, life sciences, data management, space technology, and corporate headquarters and regional offices. These industries have notable reliance on air service.

Opportunity Austin is noteworthy for purposes of this project in part because of the integration of economic development, air service, and other considerations of sustainable and livable communities. The initiative has three broad themes:

- Economy (separate teams focus on business expansions, relocations, Global Technology & Innovation);

- Education and Talent (working with the school districts to implement new college and career readiness and placement initiatives to expand college and career preparation options for Central Texas students); and

- Place (which includes elements of livability, mobility, and infrastructure).

ABIA coordinates with the Chamber through its Air Service Committee (AS Committee). The AS Committee was created within the Chamber in 2010 after business leaders decided to invest in the community. It includes representatives from many major employers in the region (e.g., Dell). The AS Committee works to improve the service, frequency, and competitive prices for nonstop service. It directly helped to bring transatlantic service to the region, succeeding in 2014 luring British Airways service to London and later in 2019 bringing Lufthansa's flight to Frankfurt.

The AS Committee meets on a bimonthly basis with the airport. These meetings give employers an opportunity to inform the airport staff of current and planned business changes (e.g., new manufacturing plants) that may affect travel needs (e.g., needs for new nonstops). The Committee also develops an annual workplan that sets goals or objectives for air service. A target for additional European nonstop service is Amsterdam.

Austin Global Gateway (AGG) is another important Chamber program. Through AGG, the Chamber intends to bolster the region's reputation among foreign business leaders. Austin's global reputation has risen alongside events such as SXSW and the Formula 1 automotive race. The AGG executive committee hopes to further the region's international reputation by leveraging its member relationships to demonstrate Austin's comparative advantage to discriminating investors, creative entrepreneurs, and dynamic corporations worldwide.

The Chamber also recognizes the challenge of measuring and reporting the effects of its economic development efforts for different audiences. For internal purposes, because the Board comprises senior business executives, they are familiar with various metrics of economic activity, including technical measures. For public reports, the Chamber posts basic measures on its website:[16]

- Job growth (e.g., "423,600 jobs since 2004")

- Rising wages ("We have helped the median household income increase from $47,182 in 2004 to $73,800 in 2017.")

- Economic diversity ("We strengthen our economy by recruiting businesses across a diverse set of industries.")

- Workforce ("We help train talent to grow our already highly capable and motivated talent pool.")

The Chamber cites specific examples of successful efforts through press releases. For example, in April 2019, it announced that European internet access and networking provider Brodynt opened its US headquarters in Austin.

"In choosing Austin, Brodynt reinforces our region's standing as an international destination for innovative companies," said Opportunity Austin Senior Vice President of Economic Development Charisse Bodisch. "These additional jobs will give Austinites more opportunities to find work and provide for themselves and their families. This is another win for Opportunity Austin, our region, and our community."

The Chamber also includes information on its website about the airport in its "Greater Austin Profile" that covers key topics of interest to businesses about the region, such as population, employment, workforce, major employers, telecommunications and utilities, climate, cost of living, and quality of life.

In addition to the Chamber, in October 2020 the Austin City Council created the Austin Economic Development Corporation (AEDC) to help local government meet various challenges—from affordability, homelessness, and equity, to sustaining and growing the small businesses, arts and culture. The aim is serve as the City of Austin's economic development agent without duplicating the work of the existing Chamber of Commerce/Opportunity Austin and City of Austin Economic Development Department.

The City of Austin's Economic Development Department supports and recruits business to Austin through. Its mission is to promote a competitive, sustainable and equitable economy. Among other tasks, it works to facilitate international expansion and manage City-issued incentives.

Communicating the Airport's Economic Impact

The latest economic impact assessment for the airport covered airport operations for 2017. As reported on the airport's website,[17] the analysis found that ABIA:

- generated $7.6 billion in total economic impact and
- supported 74,000 jobs in the region.

The report noted the significant growth in passenger traffic since 2010 and the resulting 212% increase in total economic output. The website also noted that "[t]he tastes of Central Texas are growing at Austin-Bergstrom as well. In 2017, passengers enjoyed:

- 61.5 tons of brisket (up 13% from 54.5 tons in first year recorded 2012)
- 684,199 breakfast tacos (up 37% from 498,141 in first year recorded 2012)
- 1,500 live music performances (up 86% from 805 in first year recorded 2012)"

It also noted that the airport is not dependent on support from state or local taxes. "Austin-Bergstrom is entirely self-sustaining, generating revenue to cover airport operating costs and future improvements."

Columbia, Missouri: A Small Shadow Airport with Increasing Passenger Traffic

The Columbia Regional Airport (COU) is located in central Missouri, roughly halfway between the larger St. Louis and Kansas City metropolitan areas. The region's economy is anchored by a major university and research system, which has in turn supported a young, growing workforce for private industry sectors including finance, insurance, and management. The airport also serves the Missouri state capital in Jefferson City. Commercial passenger traffic at COU has increased more than tenfold from nearly 22,200 in 2008 to over 256,000 in 2019, as the airport began pursuing nonstop commercial service to more destinations and key routings with daily frequencies.[18]

COU is incorporated under the leadership of the municipal economic development department and, as such, is actively engaged with stakeholders throughout the community.

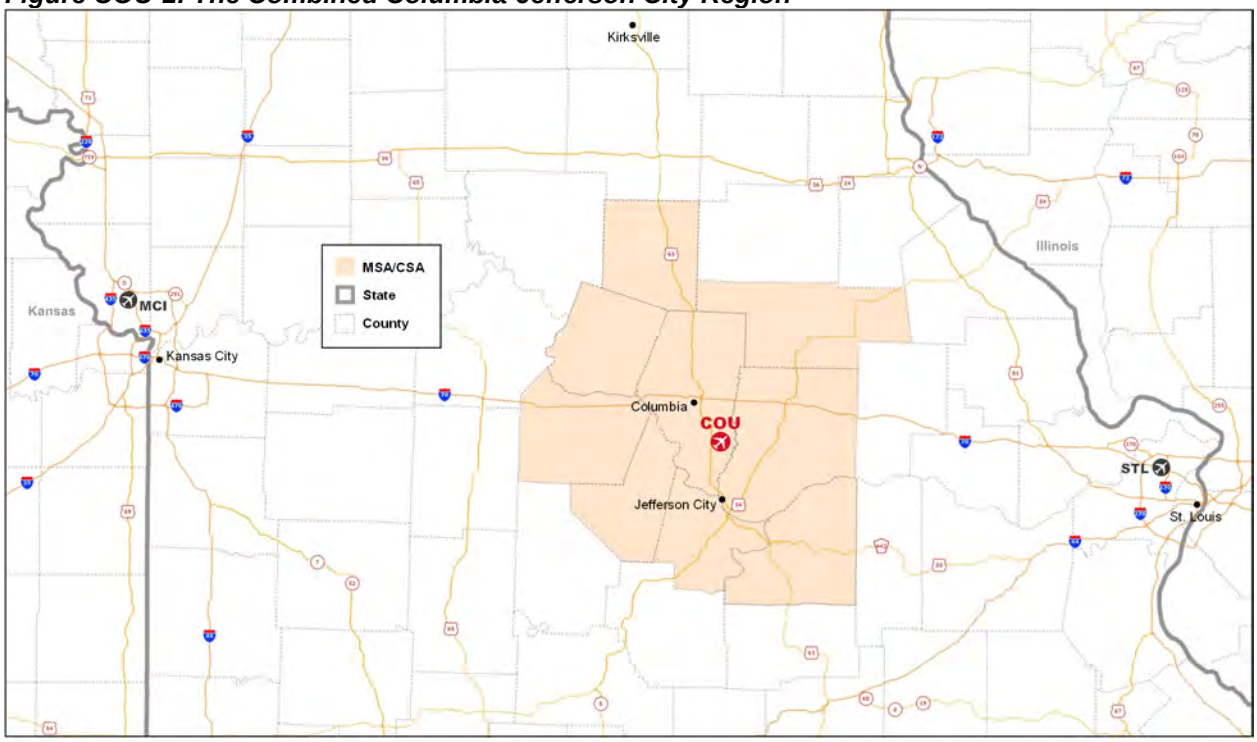
The airport is an example of one that has succeeded in increasing its capacity and traffic to better serve the regional economy despite operating in the shadow of larger facilities outside of the region.

Introduction to the Columbia-Jefferson City Region

The combined Columbia-Jefferson City region is home to the major urban areas of central Missouri, encompassing a total population of nearly 410,000 in 2019.[19] Within the region, the City of Columbia accounts for the largest population (also the fourth largest city in the state) followed by the state capital of Jefferson City, see Figure COU-1. The region overall has maintained steady incremental population growth over the past decade, increasing a total of 6.4 percent over the 11-year period from 2008 through 2019 – well above the statewide average over the same period (3.7 percent) but below the national average (8.0 percent).[20]

According to the U.S. Bureau of Economic Analysis (BEA), in 2019, the Columbia MSA had a 2019 population of slightly over 200,000 making it the 216th largest MSA in the country (out of 384 total). It produced $10.6 billion in current-dollar Gross Domestic Product (GDP), ranked 223rd among MSAs. The Jefferson City MSA had a 2019 population of slightly over 150,000, making it the 278th largest MSA. It produced $8.1 billion in current-dollar GDP.[21]

Figure COU-1: The Combined Columbia-Jefferson City Region



The region's population and employment have grown moderately since 2008. Table COU-1 summarizes the changes in key socio-economic characteristics for the period. As shown, from 2008 through 2019:

- Total population rose by nearly 25,000 (6 percent). As a point of comparison, population for the entire state of Missouri increased by 4 percent over the same period.

- Total employment increased by almost 18,000 (7 percent). Statewide total employment increased by 5 percent.

- Average per capita income (nominal dollars) rose from $34,800 to $45,300 (30 percent).[22] While this falls below the state and national averages ($48,600 and $56,500, respectively), the mid-Missouri region also offers a lower cost of living in many respects when compared to other urban areas nationwide.[23]

- The number of establishments operating in the region rose slightly from 2015 to 2019. (Data were unavailable for 2008.) (The BEA uses data from the U.S. Census Bureau, which defines an establishment as "a single physical location at which business is conducted or services or industrial operations are performed. It is not necessarily identical with a company or enterprise, which may consist of one or more establishments. … Establishment counts represent the number of locations with paid employees any time during the year." The count excludes government establishments except for certain situations, such as state-operated retail liquor stores, local government-owned/operated hospitals, and federally chartered credit unions.)

Table COU-1: Socio-economic Summary of the Combined Columbia-Jefferson City Region

				Change 2008-15		Change 2015-19		Change 2008-19	
	2008	2015	2019	#	%	#	%	#	%
Population	384,892	404,071	409,544	19,179	5.0%	5,473	1.4%	24,652	6.4%
Total employment	256,154	263,626	274,131	7,472	2.9%	10,505	4.0%	17,977	7.0%
Non-farm Private Employment	178,955	190,103	199,302	11,148	6.2%	9,199	4.8%	20,347	11.4%
Gov't Employment	67,591	64,432	65,935	-3,159	-4.7%	1,503	2.3%	-1,656	-2.5%
Income per capita (dollars)	$34,776	$40,947	$45,329	6,170	17.7%	4,382	10.7%	10,553	30.3%
Number of Establishments	-	9,717	9,799	-	-	82	0.8%	-	-

Source: BEA; U.S. Census Bureau QuickFacts, 2019; BLS.
Note: data includes combined figures for the Columbia-Moberly-Mexico Combined Statistical Area and the Jefferson City Metropolitan Statistical Area. Dollar ($) figures are expressed in nominal terms. Data were unavailable for certain years.

Regional Economic Strengths

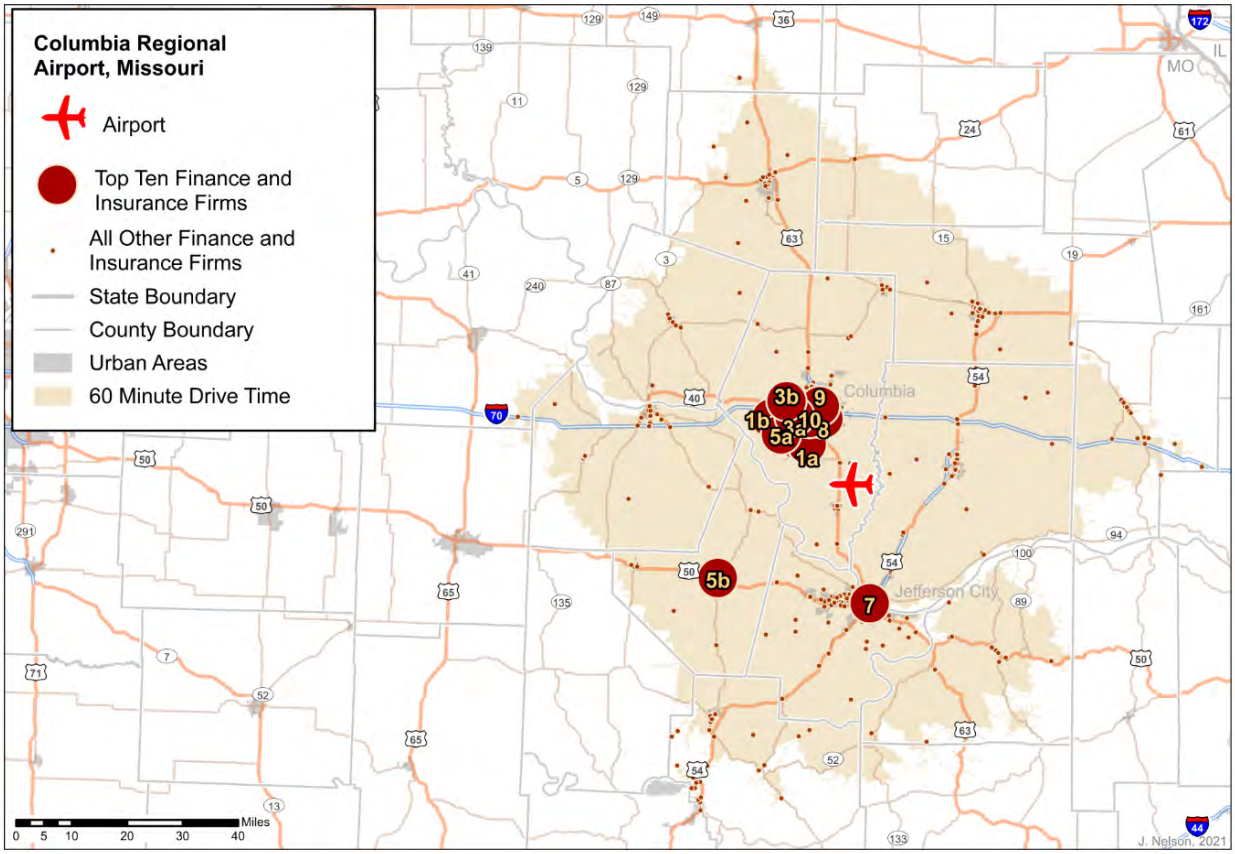
The bulk of economic activity in the region, centered around Columbia and Boone County, is driven by a major post-secondary education system as well as private businesses in a variety of sectors, from professional services to manufacturing. The region hosts more than a dozen colleges and universities supporting a collective annual enrollment exceeding 66,000 students, with the largest institution being the main campus of the University of Missouri ("Mizzou").[24] Mizzou is a $2.2 billion enterprise known for its Division I NCAA athletics program and expertise in medical and life sciences research, the latter of which has in turn fostered a local ecosystem of technical and Research & Development activity like the Life Science Business Incubator at Monsanto Place and the Discovery Ridge Research Park. The influence of the higher education system on the community is further reflected in the well-educated population; Columbia in particular has a notable share of residents with college degrees or higher: over 52 percent of adults hold bachelor's degrees, compared to the statewide and national averages, both of which are around 30 percent.[25] It has also fostered a relatively younger resident population from students who often remain in the region after graduation (or eventually return) and supply a workforce for educated, mid-level positions across various businesses.

Beyond the university system, major employers in the region include headquarters or corporate locations for multiple national finance/insurance firms, local centers for technology and professional services, and major manufacturing and processing facilities in food and beverage as well as consumer goods.[26] In addition, both Columbia and Jefferson City host a substantial government workforce, mostly related to state and local agencies. Since 2008, government-sector employment increased by 5.8 percent. More the 30,000 jobs in the region are related to government activity, including more than 18,000 employees of the state government.

Beyond Mizzou (which is a major generator of air travel demand through its student body, faculty, and research institutions), private interests in air service development span a variety of sectors that generate further demand for business travel from Columbia. These include large local employers in finance/insurance and information, as well as corporate personnel involved with local manufacturing or processing operations for food/beverage and consumer goods. While air cargo is not currently served out of COU, some local stakeholders may also have potential air-eligible shipping needs, particularly specialized radiopharmaceutical production out of Mizzou.

Figure COU-2 illustrates the economic activity within a one-hour drive from the airport. The location of businesses in the Finance and Insurance are indicated.

Figure COU-2: Key Business Locations near COU



Source: ESRI Business Analyst

Key highlights of socio-economic activity *within the 60-minute drive of the airport*:

- The total estimated 2019 population was 425,520. Of that, about 273,000 (64 percent) were considered "working age" (between the ages of 18 and 64).

- The region supported nearly 15,600 businesses employing nearly 235,000. In terms of major industry sectors (defined by NAICS codes), the largest based on total employment was Finance, Insurance, and Real Estate ("FIRE") with nearly 17,000 employees, followed by Professional, Scientific, and Technical Services (PST), with over 13,500, and Manufacturing (about 12,000). The Information sector included about 340 businesses that employed 7,000.

The drive-time analysis and business mapping highlights the predominance of private business in corporate management as well as finance and insurance in Boone County.

Table COU-2 summarizes the economic strength of the region by focusing on employment in the two counties home to most of the population and jobs. It reveals some notable economic restructuring that has occurred since 2008, with a shift in employment toward professional services.

- Total nonfarm private employment increased by nearly 20,000 from 2008 to 2019, rising at a compound annual growth rate (CAGR) of 1.4 percent. Between 2015 and 2019, the increase was about 7,200 jobs (1.3 percent CAGR).

- The sectors with the largest number of employees were Retail Trade, Health care and social assistance, and Accommodation and food services.

- The greatest rate of growth for the 2008-2019 period was in Finance and insurance; Real estate; and Arts, entertainment, and recreation. Employment in those sectors grew more than twice as fast as employment in the region.

- For the more recent period 2015-2019, the sectors with the greatest growth were Transportation and warehousing (9.4 percent CAGR), Finance and insurance (5.7 percent CAGR), and Arts, entertainment, and recreation (4.1 percent CAGR). In addition, employment in the Manufacturing sector rebounded somewhat during the period, rising by 3.7 percent CAGR.

Table COU-2: Employment by Industry Sector in Boone and Cole Counties, Missouri (sorted by employment in 2019)

				Change 2008-19		Change 2015-19	
Sector	2008	2015	2019	Number	CAGR	Number	CAGR
Retail trade	19,615	21,008	19,893	278	0.1%	(1,115)	-1.4%
Health care and social assistance	16,457	18,785	19,245	2,788	1.4%	460	0.6%
Accommodation and food services	12,031	13,913	15,227	3,196	2.2%	1,314	2.3%
Finance and insurance	7,932	8,812	10,996	3,064	**3.0%**	2,184	**5.7%**
Professional, scientific, and technical services	8,035	10,137	10,191	2,156	2.2%	54	0.1%
Real estate and rental and leasing	6,761	8,605	9,386	2,625	**3.0%**	781	2.2%
Other services (except gov't and gov't enterprises)	8,592	8,761	9,334	742	0.8%	573	1.6%
Administrative / support and waste mgmt / remediation services	7,657	8,646	9,172	1,515	1.7%	526	1.5%
Construction	9,786	8,191	8,431	(1,355)	-1.3%	240	0.7%
Manufacturing	6,513	6,521	7,549	1,036	1.4%	1,028	**3.7%**
Wholesale trade	4,614	5,147	4,744	130	0.3%	(403)	-2.0%
Transportation and warehousing	N/A	2,933	4,208	N/A	N/A	1,275	**9.4%**
Management of companies and enterprises	3,568	4,051	3,954	386	0.9%	(97)	-0.6%
Educational services	3,074	3,974	3,836	762	2.0%	(138)	-0.9%
Arts, entertainment, and recreation	2,379	2,835	3,328	949	**3.1%**	493	**4.1%**
Information	2,951	2,930	2,934	(17)	-0.1%	4	0.0%
Utilities	N/A	385	395	N/A	N/A	10	0.6%
Total Private Nonfarm Employment	**123,600**	**136,224**	**143,401**	**19,801**	**1.4%**	**7,177**	**1.3%**

Source: BEA

Economic Clusters

The U.S. Cluster Mapping Project's analysis of the Columbia region also highlights its broad economic strength. The area's economy features four tradeable clusters in which the region has strength. These are Insurance, Financial Services, Education, and Marketing.

- The Insurance cluster includes insurance companies and related services. Specific industries include life, health, property and casualty insurance. The region's LQ for this sector was 4.98.

- The Financial services cluster includes securities brokers, dealers, and exchanges; credit intermediation; and financial investment activities. The region ranks 33rd nationally in securities brokers, dealers, and exchanges. The region's LQ for this sector was 3.64.

- The Education cluster includes colleges, universities, professional schools, research organizations (e.g., biotechnology; physical, engineering, and life sciences), and professional organizations. The region's LQ for this sector was 1.74.

- The Marketing cluster includes publishing (e.g., internet publication and broadcasting, periodical publishers), advertising related services, and interior and graphic design services. The region's LQ for this sector was 1.27.

Table COU-3 summarizes the changes in the largest tradeable sectors by total employment in 2018 along with employment in each in 2008. It indicates the changes in employment among these sectors. Not all experienced growth commensurate with the change in population or overall employment for the 2008-2019 period (+ 6 percent and 7 percent, respectively). Both Business Services (+1,550, or 54 percent) and Financial Services (+2,100 or 417 percent) grew exceptionally fast. Two of the area's major employment sectors – Insurance and Education – saw decreases in employment. And total employment dropped from 2008 to 2018 in Distribution and Electronic Commerce (-800 or 30 percent).

Table COU-3: Changes in Employment in Major Traded Clusters (Sorted by 2018 Employment)

Cluster Name	2008	2018	Change	Percent
Business Services	2,881	4,433	1,552	54%
Insurance Services	3,713	2,842	(871)	-23%
Financial Services	499	2,580	2,081	417%
Education and Knowledge Creation	2,426	1,960	(466)	-19%
Distribution and Electronic Commerce	2,701	1,885	(816)	-30%
Hospitality and Tourism	1,100	1,597	497	45%
Marketing, Design, and Publishing	599	642	43	7%

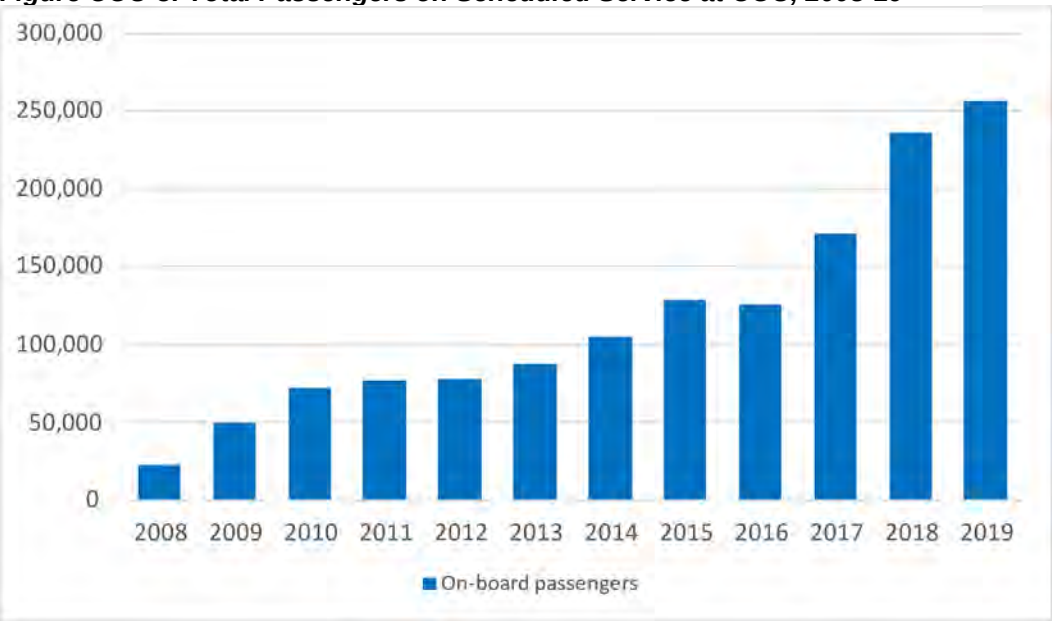
Source: Data from U.S. Cluster Mapping Project

Overview of the Airport and its Air Service

The Columbia Regional Airport (COU) is located midway between the two major population centers of Columbia and Jefferson City. The airport is owned and operated by the City of Columbia, with a reporting structure that directly links the airport to the municipal economic development team. The Airport Manager, who oversees day-to-day operations at COU, reports directly to the Director of the Department of Economic Development.

COU is the 4th busiest commercial service airport in Missouri, with passenger enplanements on scheduled service totaling over 256,000 in 2019.[27] Passenger enplanements experienced more than a ten-fold increase between 2008 and 2019, as commercial scheduled service shifted toward larger hubs that substantially improved direct connectivity out of COU, which predominantly serves origin-destination (O&D) traffic to/from the local region, see Figure COU-3. Scheduled capacity at COU rose from roughly 1,000 total scheduled flights serving two regional destinations (Kansas City and Memphis) in 2008, to nearly 3,300 non-stop flights to three major hubs (Chicago O'Hare, Dallas/Ft. Worth, and Denver) in 2019. Over the same timeframe, average seat capacity per flight grew from 25 in 2008 to 59 in 2019, driven by a broader industry trend of up-gauging regional air service from turboprops to larger regional jets.

Figure COU-3: Total Passengers on Scheduled Service at COU, 2008-19



Source: U.S. DOT T-100 data for scheduled passenger service.

Estimates developed by the City of Columbia and its air service consultant indicate that the air service catchment area in the combined Columbia-Jefferson City region included approximately 730,000 O&D passengers. Even with improved connectivity from COU, the air travel demand generated in this region still utilizes other airports for air service – most notably St. Louis International (STL) and Kansas City International (MCI). Each of those airports is roughly 2 hours' drive from Columbia but provide a wider range of nonstop destinations. Table COU-4 summarizes the percentage of that estimated market captured by the area's airports.

Table COU-4: Percent of Estimated Regional Passenger Traffic Captured by COU and Other Airports

Airport	Share of Estimated Regional Traffic Captured
STL	47%
MCI	28%
COU	**23%**
Other	2%

Source: COU Passenger Demand Analysis

The growth in air service at COU has involved new non-stop flight destinations as well as growing capacity on existing services. Historically, non-stop service at COU was limited to small aircraft services to St. Louis (STL) and Kansas City (MCI). After its merger with Northwest Airlines, Delta Air Lines operated service to Memphis (MEM), but that service was replaced in 2012 for a short time by service to Atlanta (ATL) before being abandoned in 2013. COU service to Dallas/Ft. Worth (DFW) and Chicago O'Hare (ORD) was introduced by American Airlines in 2013, and more recently to Denver (DEN) and ORD in 2017 by United Airlines. Between 2008 and 2019, total available seat capacity at COU increased nearly eight-fold after the entry by American and United.

As of June 2019, total direct non-stop scheduled services from COU included 1,100 weekly seats to three hubs. Air service fluctuates seasonally at COU, though seasonal trends have changed over time. In 2019, peak months occurred in the summer to accommodate leisure demand, whereas 2008 saw peak capacity throughout the fall and winter months when Northwest operated its Memphis service. (For the other months in 2008, scheduled service was limited to US Airways' operations to MCI.) Table COU-5 shows the change in available non-stop seat capacity at COU by comparing weekly seats from June 2008 to June 2019. In 2019, American offered 66 percent of the average weekly capacity, against United's 34 percent.

Table COU-5: COU Outbound Seat Capacity, June 2008 vs. June 2019

Destination Airport	Airline	Weekly Seat Capacity	
		2008	2019
DEN	United	-	350
DFW	American	-	1,210
MCI	US Airways	456	-
ORD	United	-	1,050
	American	-	1,820
Total		**456**	**4,430**

Source: U.S. DOT T-100 data on scheduled service for the weeks of June 8-14, 2008 and June 9-15, 2019.

As a result of the expansion of air service and traffic levels at COU, the City is undertaking the development of a new passenger terminal. By replacing the existing terminal, a higher quality of space and services will be made available to the traveling public.

Connectivity

With the addition of service to American's and United's major hubs in Chicago, Dallas, and Denver, the ability of local passengers to reach large numbers of domestic and international destinations via one-stop flights has expanded significantly. As a result, this improvement in air connectivity facilitates sustained economic growth and increases the appeal and competitiveness of a regional economy. Connectivity (or the ability to reach a wide range of places in a short amount of time) is not simply a matter of the number of routes or number of frequencies operated. Connectivity is fundamentally about access to markets and regions. Connectivity creates efficiencies that make firms more productive, which in turn attracts more high-flying businesses that have their choice of locations and starts a virtuous cycle of economic growth. Even just the time-savings enjoyed by travelers, who are now able to fly in/out of COU and access the region directly instead of driving two hours to MCI or STL, creates substantial efficiencies that enhances the appeal of the region.

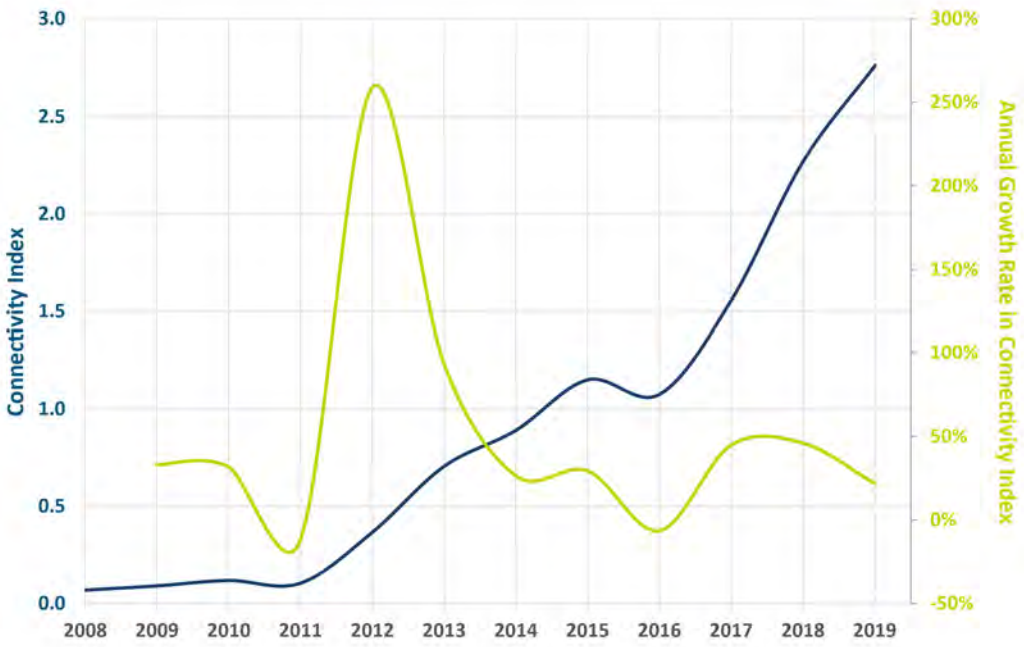
The growth in connectivity can be measured in a variety of ways. One is a method developed by the International Air Transport Association (IATA). The IATA connectivity index estimates the quality of air service at an airport based on the degree of service to other airports with the largest and most diverse route networks, as a proxy for how accessible the local economy is to the rest of the world. Figure COU-4 summarizes the formula for the IATA connectivity index. Using airline schedule data for passenger service, the index measures the number of frequencies and available seats to a particular destination. It then weights the number of available seats by the size of the destination airport (in terms of total capacity handled each year). This weighting reflects both the size and economic importance of the destination and the potential for convenient onward connections.

Figure COU-4: IATA Connectivity Index Formula

$$\frac{\text{[Number of destinations x Weekly Frequency x Seats per flight]}\ \textit{Weighted by the Size of the Destination Airport}}{\text{Scalar factor of 1000}}$$

Figure COU-5 summarizes changes in the connectivity index for COU. Connectivity growth at COU between 2008 and 2019 has been near-exponential due largely to the fact that commercial capacity in 2008 was so limited. COU's air service development over the past decade exemplifies how a regional airport's initial entry into major hub networks can invigorate accessibility to the local region.

Figure COU-5: COU Connectivity Index, 2008-19



Source: Inter*VISTAS* analysis using the IATA method.
Note: The spike in connectivity growth between 2011 and 2012 is reflective of service to ATL in 2012. ATL is the world's largest airport in terms of seat capacity, so new service to ATL will retrieve a higher connectivity score relative to other airports (all else being equal). From 2013 onward, COU continued its capacity growth with entry by American, which drove COU's continued improvement in connectivity even after Delta, removed the ATL service. United added service to Denver and Chicago in 2017

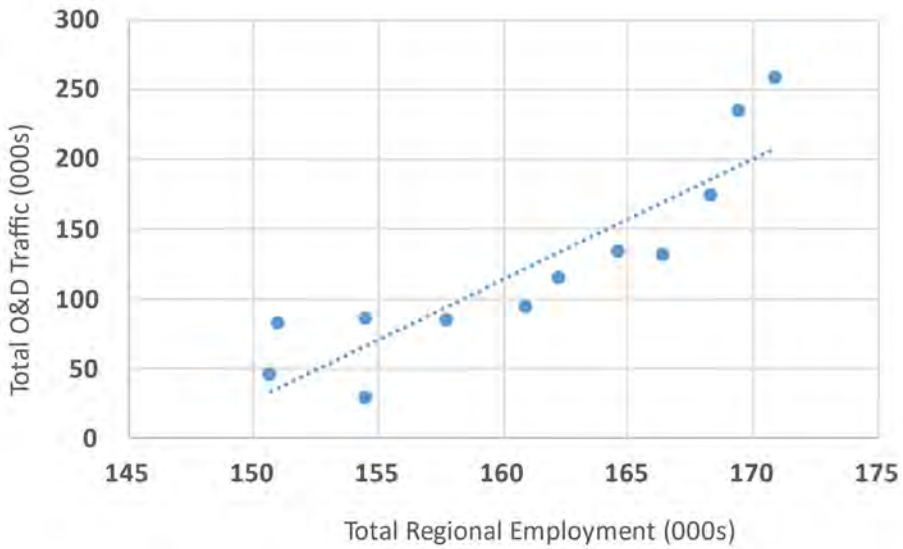
Air service development plans for COU continue to focus on improved nonstop domestic connectivity. In 2019, the COU airport administration placed a high priority on air service to Charlotte Douglas International Airport (CLT), a hub for American. This objective was prioritized by the affiliation of the University of Missouri with the Southeastern Conference (SEC college athletic conference), and the need for better connectivity to the southeastern region of the U.S. more broadly. The U.S. Department of Transportation's "Small Community Air Service Development Program" awarded an $800,000 grant in 2019 to support COU-CLT service by American. This DOT grant was combined with additional support from the business/economic development and university, totaling over $1.1 million. The start of service, however, was delayed due to the impacts of the COVID-19 pandemic.

Additional service is a priority for the airport. This includes both service to other destinations especially on the west coast and in the northeast, as well as increased frequencies to existing gateways like DEN. The airport would also like to attract service from an ultra-low-cost airline to leisure destinations.

Analysis of Changes in Air Services and Employment

COU's O&D traffic is highly correlated with total local employment. Figure COU-6 summarizes how changes in total O&D traffic have aligned with changes in regional employment. The line indicates a basic positive relationship between the two. As total employment increases, total O&D increases. The correlation coefficient between the two is 0.89. However, correlation alone does not demonstrate causation; that is, it is not evident whether rising total employment levels leads to more air traffic, or whether more air traffic leads to more total employment. At the same time, it is important to recall that much recent academic research shows that improvements in air service and connectivity in fact do lead to increases in employment and economic activity, especially in industry sectors that are reliant upon air transportation. This is discussed in greater detail in *ACRP Web-Only Document 53*.

Figure COU-6: Relationship Between Air Traffic and Employment (in thousands)



Regional Economic Stakeholders

Without dedicated air service development staff, the acquisition of commercial air service at COU has been a community-driven effort supported by various stakeholder groups who understand the impact that local air service can have on economic growth and the welfare of the region at large. Airport staff, public officials, and local businesses identified that the region's growth as well as its higher education and business operations could not be adequately supported by minimal commercial air service out of COU and more substantial air service located two hours away. Efforts to bring American and United into COU over the past decade involved a coordinated strategy by private and public entities who were proactive about approaching these carriers. This involved raising funds from local businesses toward airline revenue guarantees as well as identifying key destinations (e.g. DFW, DEN) that had significant O&D traffic by local businesses but were also major gateways capable of serving all local demand from the region.

The nexus between air service development and economic development is apparent in both the formal organization and COU's continued strategic efforts. Within the City of Columbia, the COU airport administration reports to the Economic Development Department. This municipal Economic Development Department is comprised of staff who work under a non-profit, public-private partnership called Regional Economic Development Inc. (REDI). Founded in 1988, REDI is funded by the City of Columbia, Boone County, the University of Missouri and local private businesses. REDI is responsible for managing Boone County's economic development activities under the strategic priorities "Attract, Expand, Grow"; that is, the pursuit of creating quality jobs in the community by attracting new business, supporting the expansion of existing local business, and helping entrepreneurs grow startups, see Figure COU-7. REDI is the main vehicle through which planning, funding, and engagement between private and public sectors in the community are coordinated. The airport, as an economic driver in its own right, is actively incorporated into the economic development strategy of the city and the associated activities of REDI.

Figure COU-7: REDI's Goals

Source: REDI Overview, 2019.

The integration between the airport and REDI occurs via a process in which the airport and the business community collaborate on expanding air service at COU. REDI staff are involved with air service development and airport initiatives, including coordinating stakeholder support and financing. REDI works with community interests represented by municipal bodies, the University of Missouri, the Columbia Chamber of Commerce, and individual businesses (often major local employers) with particular interests in air service development. Each of these stakeholder groups supports air service development efforts by providing:

- input on identifying new non-stop services that would support the community's travel needs,
- research and marketing support, and
- financial backing (e.g., community-raised funds toward airline revenue guarantees) to successfully obtain these services.

Community interests are also represented in the COU Airport Advisory Board (operating in a strictly advisory role to Columbia City Council), which has in recent years expanded to include individual seats for the higher education system, the insurance sector, healthcare, and the broader business community (via a representative from the Chamber of Commerce), among others.

In turn, air service development initiatives at COU – which have focused so prominently on improved connectivity to destinations that are both key national hubs and have direct links to Columbia businesses – help support the "Attract, Grow, Expand" priorities of the community's economic development strategy.

For instance, improved accessibility to Columbia has a "magnetic" effect that can help attract new residents. Local stakeholders note that direct air service and the airport itself play a critical role in supporting the image of Columbia as a robust university/research hub with a vibrant community that appeals to incomers who can supply a capable workforce and investment to the region. This image requires coordination with an airport that should make incomers feel like they are entering that kind of space, which is why direct air service is crucial; otherwise it is difficult to break preconceived notions of the region as a remote, sleepy Midwest enclave. Additionally, airport facilities should be outfitted in a way that sets the tone for the city, as few public infrastructures have the same kind of impact on a region's "feel" and "first impression" than the local airport.

Accessibility also attracts new and more diverse business into the region – particularly from industry sectors that are more reliant on air service and, at the same time, generally bring higher paying job opportunities. REDI's mandate focuses not only on job creation but also quality; any incentives offered to new businesses looking to locate in the community must offer local jobs that are at or above the county average wage. As a result, REDI seeks out new opportunities in sectors like life sciences, advanced manufacturing, and information – industries that can have higher demand for air service and can be supported by a coordinated air service development strategy out of COU. In this manner, air service facilitates not only economic growth but a high quality of growth that supports a higher standard of living and a more resilient economy.

Communicating the Airport's Economic Impact

Airport operations form a substantial part of Missouri's transport system and deliver a wide range of benefits to the community. The economic impact of the statewide aviation system, including COU, was most recently evaluated in 2012.[28] COU's economic impacts (including direct, indirect, and induced impacts) amounted to a total of 745 jobs earning $26.9 million in wages, while generating a total of $87.2 million in output for the state economy. However, operations at COU have changed significantly since 2012 (passenger traffic in 2012 only amounted to 30 percent of traffic in 2019, as it preceded the entry by American and United); the growth in service and improvements in nonstop connectivity, as previously noted, have likely changed (and presumably increased) the airport's economic footprint.

For airports similar to COU, economic impact studies can provide useful insight but may not capture the full scale of the airport's contribution to the regional economy. In cases where an airport's role cannot be easily quantified, or where the airport is not among the largest direct employers of a community, the numbers from an economic impact study can be difficult to put in context or may simply "miss the boat" on communicating the wider economic benefits of having local commercial air service available to residents and businesses. For airports where air service has changed substantially over a relatively short period time, the results from an economic impact study for a given snapshot in time could become outdated.

Instead, as the leadership at REDI explains, the proper narrative is critical in conveying the importance and role of air service to a community. Concise graphics and other visual representations can help stakeholders grasp the concept of their airport as an economic driver that facilitates not only the movement of people and goods but also the development of a robust, resilient economy. For instance, local stakeholders in the Columbia-Jefferson region point out that direct air service out of COU should be understood as more than a mode of transportation; it is also a means to put the local community on display and attract newcomers to experience it as a desirable place to work and live.

Additionally, individual stakeholders like local businesses may be more apt to understand how a specific initiative will affect them directly; for instance, the introduction of a new direct service at COU could lower the cost of doing business by saving affected business travelers from a two-hour commute to/from STL or

MCI. Stakeholder outreach initiatives may also benefit from identifying one or two high-profile leaders in the community who can champion the effort and encourage others to get involved.

Des Moines, Iowa: A Region with Significant Economic Activity Related to Finance and Insurance

Des Moines, Iowa is the capital of Iowa. The Des Moines-Ames-West Des Moines, IA Combined Statistical Area (CSA) consists of the Des Moines-West Des Moines Metropolitan Statistical Area (MSA), the Ames MSA, and two contiguous micropolitan statistical areas -- Oskaloosa and Pella. These multiple geographies (Greater Des Moines) are considered as a whole because they are most likely within the catchment area of the main commercial airport in the area, Des Moines International Airport (DSM). (See Figure DSM-1.)

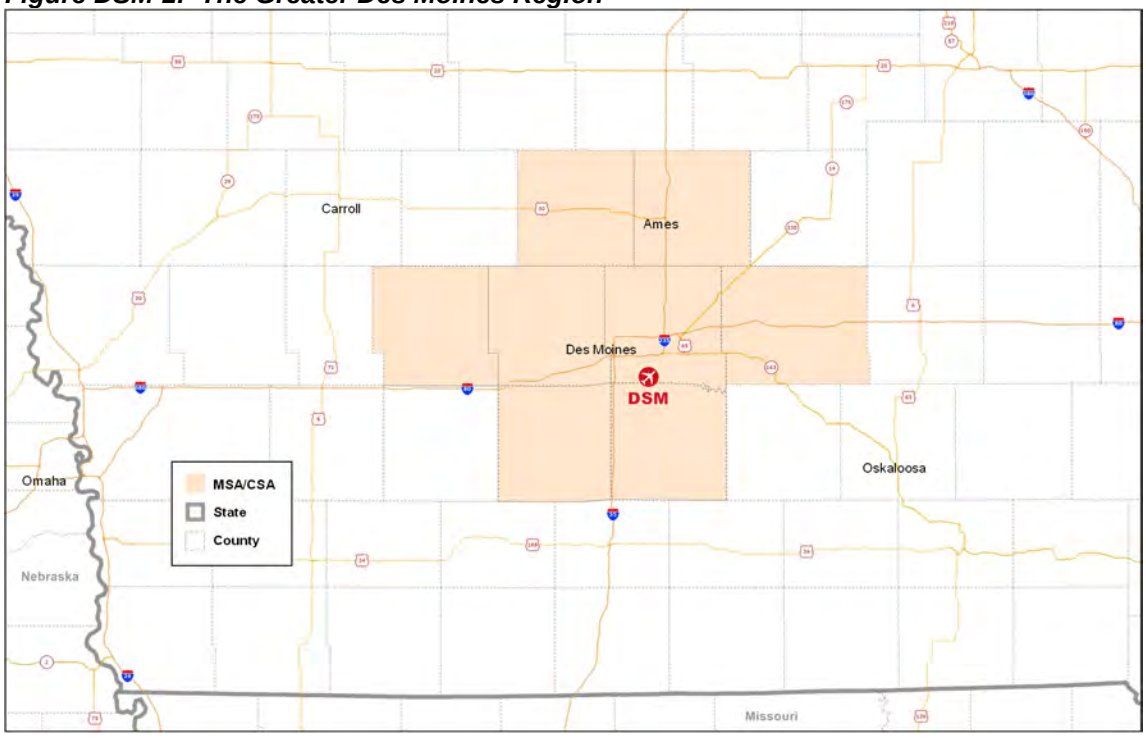
Des Moines is a major center of the US insurance industry and has a sizable global financial services and publishing business base. It is included as a case study because of that consideration.

Introduction to the Region and its Economy

Des Moines is a major center of the U.S. insurance industry, with the highest concentration of insurance employment among metros in the U.S. The region is also known for its global financial services and publishing business base.

The Greater Des Moines region has a strong, diversified economy. Some of Des Moines key industries include advanced manufacturing, ag-bioscience, data centers, insurance and financial services, logistics and technology. The region's finance and insurance sector supports a $4.8 billion annual payroll and contributed $17 billion to the GDP in 2019.[29]

Figure DSM-1: The Greater Des Moines Region



According to the U.S. Bureau of Economic Analysis (BEA), in 2019, the Des Moines-West Des Moines MSA had a 2019 population of 699,200, making it the 83rd largest in the U.S. (out of 384 total MSAs). It produced $52 billion in current-dollar total GDP, ranked 62nd among MSAs. It represents an increase in the region's national ranking from 2009, when it ranked 70th among MSAs.[30] The Ames MSA 2019 population was just under 125,000 (323rd largest). It produced nearly $7 billion in current-dollar total GDP, ranked 291st among MSAs.

The region's population and employment have grown moderately since 2008. Table DSM-1 summarizes the changes in key socio-economic characteristics for the period. As shown, from 2008 through 2019:

- Total population rose by 117,000 (15 percent). Statewide, Iowa's population grew by 5 percent.

- Total employment increased by over 70,000 (13 percent). This growth rate is over twice that for Iowa, which rose by 5 percent.

- Average per capita income (nominal dollars) rose from about $41,000 to $53,200 (30 percent). Expressed in constant 2019 dollars, the increase was 6 percent. The region's per capita income was roughly 3 percent higher than the Iowa average ($51,791).

- The number of establishments operating in the region also increased, rising by more than 7,000 (36 percent). (The BEA uses data from the U.S. Census Bureau, which defines an establishment as "a single physical location at which business is conducted or services or industrial operations are performed. It is not necessarily identical with a company or enterprise, which may consist of one or more establishments. … Establishment counts represent the number of locations with paid employees any time during the year." The count excludes government establishments except for certain situations, such as state-operated retail liquor stores, local government-owned/operated hospitals, and federally chartered credit unions.)

Table DSM-1: Summary of Changes in Major Socio-Economic Variables, Greater Des Moines, 2008-2019

	2008	2015	2019	2008-15		2015-19		2008-19	
				Chg	%	Chg	%	Chg	%
Population	761	838	878	77	10%	40	5%	117	15%
Total Employment	533	570	604	38	7%	34	6%	71	13%
Private Non-farm Employment	449	486	518	36	8%	33	7%	69	15%
Public Sector Employment	74	75	76	1	1%	1	2%	2	3%
Income per Capita ($)	$40,919	$47,903	$53,249	$6,984	17%	$5,346	11%	$12,330	30%
Number of Establishments	20	25	27	5	24%	2	10%	7.3	36%

Source: BEA

Note: All data in 1,000s except per capita income, which is shown in nominal dollars.

The region is a center for higher education. In Des Moines, there are six colleges and universities, including Drake University (2019 enrollment around 5,000). Ames is home to Iowa State University, the largest in Iowa, with an enrollment of nearly 32,000. The CSA's population is well-educated, with 38 percent of adults holding bachelor's degree or higher.

Regional Economic Strengths

The region's economy is anchored by several large employment sectors. As the capital of Iowa, the region has a significant public sector presence, including local, state, and federal employees. This also takes into account the large number of staff associated with education, especially because of the presence of Iowa State University in Ames. The other major sectors and changes in employment are illustrated in Table DSM-2. The table shows only changes from 2015 to 2019 because employment subtotals for too many sectors for 2008 were suppressed to protect confidentiality.

Outside of accommodations, food service, and retail, the other large sectors (based on total employment in 2019) were finance and insurance; health care; manufacturing; construction; and professional, scientific, and technological (PST). Each of those comprised 5 percent or more of regional employment.

Table DSM-2: Changes in Employment by Major Sector 2008-2019

Employment sector	2015	2019	Change	
			Chg	%
Government and government enterprises	74,960	76,151	1,191	2%
Finance and insurance	63,123	67,484	4,361	7%
Health care and social assistance	58,141	61,734	3,593	6%
Retail trade	60,404	60,546	142	0%
Accommodation and food services	36,960	40,202	3,242	9%
Manufacturing	36,429	40,166	3,737	10%
Construction	32,200	35,721	3,521	11%
Professional, scientific, and technical services	30,793	35,055	4,262	14%
Other services (except government and gov't enterprises)	29,996	30,556	560	2%
Administrative services	28,002	28,432	430	2%
Real estate and rental and leasing	21,178	25,317	4,139	20%
Wholesale trade	22,167	21,663	(504)	-2%
Arts, entertainment, and recreation	11,287	14,416	3,129	28%
Educational services	13,817	12,360	(1,457)	-11%
Management of companies and enterprises	9,304	9,936	632	7%
Information	9,081	9,709	628	7%
Farm employment	9,845	9,626	(219)	-2%
Total Employment	**570,390**	**604,201**	**33,811**	**6%**

Source: BEA
Note: Figures will not sum to total because sectors with small amounts of employment are excluded.

Economic Clusters

The U.S. Cluster Mapping Project's analysis of the Des Moines region also highlights its broad economic strength. A cluster is a concentration of related industries in a particular region. Clusters consist of companies, suppliers, and service providers, as well as government agencies and other institutions that provide specialized training and education, information, research, and technical support. *Traded clusters* are groups of related industries that serve markets beyond the region in which they are located and therefore require some form of transport connectivity. Examples include financial service or information technology. By contrast, *local clusters* consist of industries that serve the local market. Examples include local grocery stores or restaurants.[31]

The Cluster Mapping Project's analysis is based on MSAs or broad geographic "economic areas," with the economic strengths identified separately for each MSA.

The Des Moines MSA's economy features multiple tradeable clusters that are among the top performers in the country, and several are of notable strength. Those include Insurance, Financial Services, and Marketing.

- The Insurance Services sector includes insurance for life, health and medical, property and casualty, title, and other. The region is ranked 14th nationally (out of 917) in its economic strength in insurance services. The region's LQ for this sector was 5.64.

- The Financial Services sector includes businesses in credit intermediation (e.g., Consumer lending; Financial Transactions Processing, Reserve, and Clearinghouse Activities; Sales financing); financial investment activities; and securities brokers, dealers, and exchanges. The region is ranked in the top 50 nationally in its economic strength in credit intermediation. The region's LQ for this sector was 1.89.

- The Marketing, Design, and Publishing includes internet publishing and broadcasting; web search portals; information services; marketing consulting services; advertising; and industrial, graphic, interior, and other specialty design services. The region is ranked in the top 50 nationally based on its strength in this sector. Its LQ for this sector was 1.11.

The analysis of the Ames MSA revealed economic strength in three other traded clusters:

- Information Technology and analytical instruments, with an emphasis on software publishing. The MSA's LQ for this is 6.09.

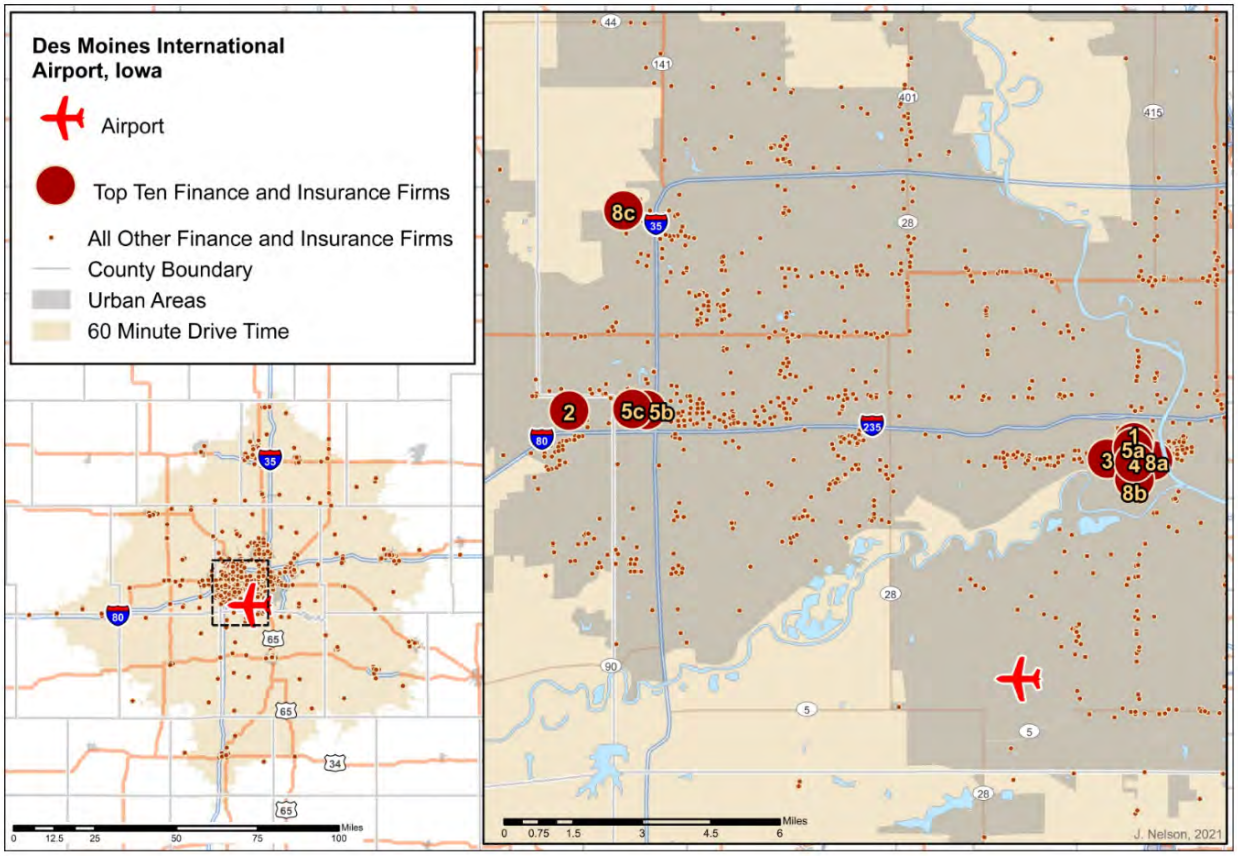
- Printing services. The region's LQ for this is 13.86.

- Agricultural services. Businesses in this cluster included postharvest crop activities, support activities for animal production, and farm management services. The region's LQ for this is 17.51.

Drive Time Analysis

Another alternative for examining the region's economic base is to visualize business activity within a certain driving distance from the airport. Figure DSM-2 illustrates a 60-minute drive time around DSM and the location of Finance and Insurance businesses within that area. The largest are all within the urban area.

Figure DSM-2: Spatial Distribution of Finance and Insurance Firms (NAICS 52) in the DSM Airport One-Hour Drive Time Trade Area



Key highlights of socio-economic activity *within the 60-minute drive of the airport*:

- The total estimated 2019 population was 850,000. Of that, about 530,000 (62 percent) were considered "working age" (between the ages of 18 and 64).

- The region supported over 28,000 businesses employing nearly 460,000. In terms of major industry sectors (defined by NAICS codes), the largest based on total employment was Finance, Insurance, and Real Estate ("FIRE") with nearly 56,000, followed by Manufacturing (over 26,000 employees) and Professional, Scientific, and Technical Services (PST), with nearly 26,000.

- A large percentage of the total population is relatively highly educated. Of the total, 25.7 percent held a Bachelor's degree and another 12.5 percent held a Graduate or Professional degree.

Overview of the Airport and its Air Service

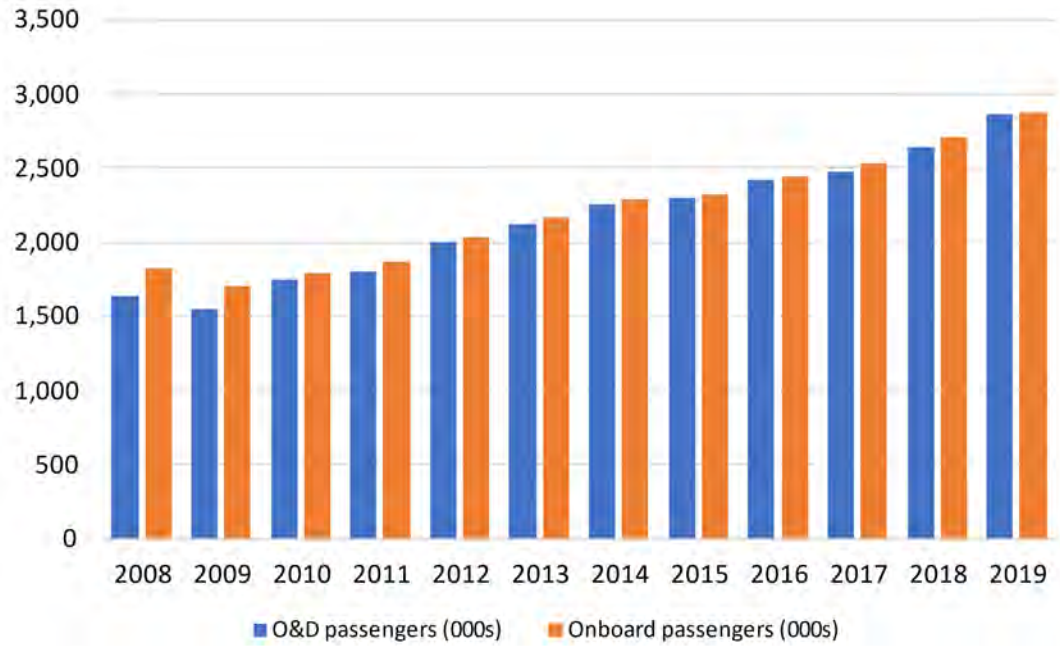
The Des Moines International Airport (DSM) is the largest airport in Iowa and located in the capital city. The Des Moines Airport Authority is a public authority independent entity that oversees the operations and maintenance of DSM and works to improve the quality of air service while making air travel to and from Des Moines more convenient and pleasurable. Since opening in 1933, the DSM campus footprint has expanded from 160-acres to 2,600 acres. In 2019, the airport set a new annual passenger record: 2.9 million people traveled through the airport.[32]

DSM's air service goals focus on underserved markets. While the strategy varies by carrier, the focus for larger carriers is up-gauging and increasing frequencies on existing routes. The business and leisure traveler mix is split at 50 percent each. With a number of international companies' sales teams traveling to and from the area, an airport official indicated that the community needs service to San Francisco and New York. (Delta Air Lines served DSM-LaGuardia Airport until the second quarter of 2020 and ceased operations due to the pandemic.)

In 2018, DSM conducted a leakage study focused on a catchment area with a 90-mile radius that estimated a population base of 3.4 million annual passengers. DSM loses traffic to Minneapolis-St. Paul International Airport (MSP) directly north 3 hours, Kansas City International Airport (MCI) directly south 3 hours, and Omaha Eppley Airfield (OMA) 2 hours away. If a passenger is flying internationally, they will typically drive the 3 hours. DSM believes its international capture rate is strong when they have nonstop service. Conversely, DSM may "win" passengers from other regional airports, especially Eastern Iowa Airport in Cedar Rapids (120 miles east) and Sioux City (Sioux Gateway Airport), about 200 miles to the northwest.

Figure DSM-3 shows the change in total passenger and Origin & Destination (O&D) passenger activity. The O&D traffic represents the majority of total traffic, given the airport is primarily a facility that serves local traffic.

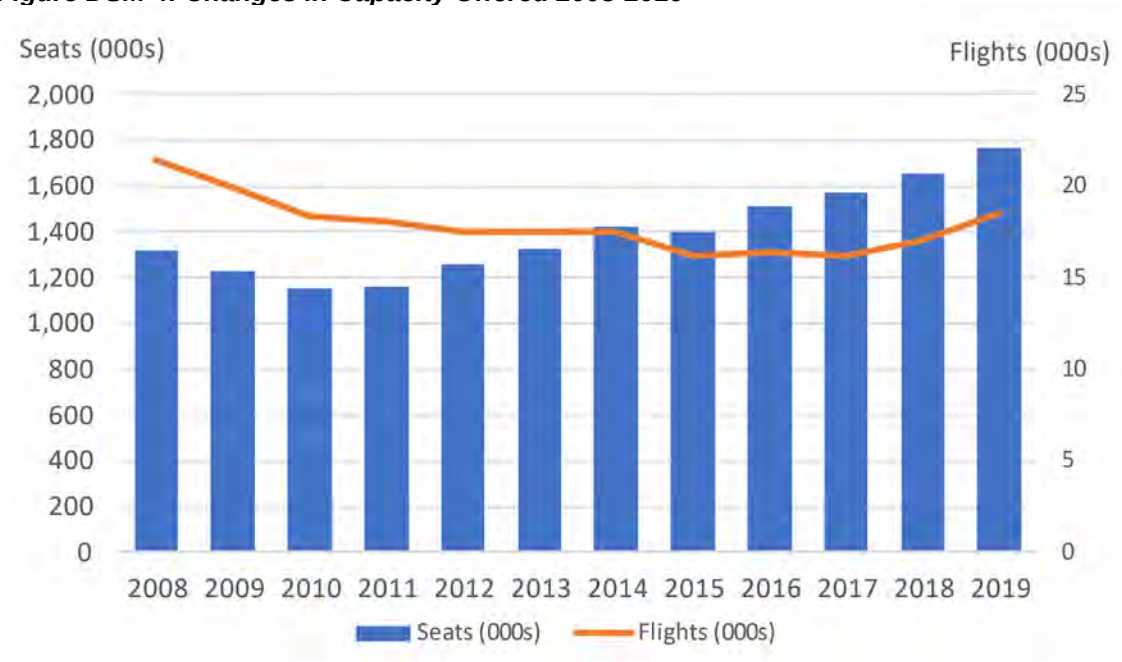
Figure DSM-3: Growth in Total and O&D Passenger Activity 2008-2019



Source: Schedule data from Diio Mi from Cirium.

Figure DSM-4 shows the growth in the amount of capacity offered at DSM, in terms of both total flights and seats available for sale. From 2008 to 2019, the number of available seats rose by 452,862 (34 percent), equivalent to an extra 1,200 seats per day. The number of flights declined by 2,857 (13 percent), or a loss of nearly 8 flights per day. Average aircraft size (seats per departure) rose from 61 to 95.

Figure DSM-4: Changes in Capacity Offered 2008-2019



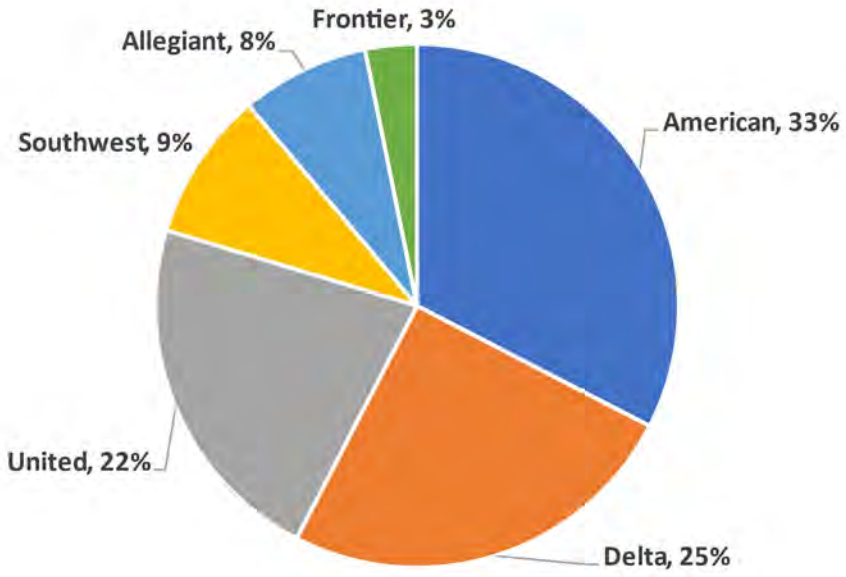
Source: Schedule data from Diio Mi from Cirium.

The number of nonstop markets served declined from 2008 to 2019 as did the number of flights to major markets. In 2009, DSM had service (defined as 50 flights in a year or more) to 33 destinations. In 2019, it had service to 23. It gained service to Charlotte (over 1,000 flights) and service Philadelphia International Airport (PHL). The airport does not currently have international service. Numbers of flights to major markets are mixed, with some declining and some increasing between 2008 and 2019:

- Atlanta: (54)
- Charlotte: +1,054
- Chicago O'Hare: (530)
- Dallas/Fort Worth: (838)
- Denver: +166
- Detroit: (143)
- Houston Intercontinental: +238
- Las Vegas: +315
- Minneapolis-St. Paul: (709)
- New York La Guardia: (135)
- Philadelphia: +595
- Phoenix: +170
- Salt Lake City: +344
- St. Louis: (589)
- Washington National: +224

Figure DSM-5 highlights the relative balance of the passenger market share among carriers based on 2019 passenger traffic. American was the largest carrier with one-third of the total. Delta held 25 percent of the total, followed by United at 21 percent and Southwest at 9 percent. Allegiant and Frontier make up the remaining 11 percent.

Figure DSM-5: Passenger Market Share 2019



Source: US DOT O&D Summary Report

DSM accounts for 50 percent of the state air cargo, carrying 74 million pounds in 2019.

Connectivity

High quality transportation – of all modes – is a prerequisite for sustained economic growth and competitiveness for a region. Specifically, these factors of economic development are driven by productivity growth, which is underpinned by trade, foreign investment, and innovative activity – all of which are facilitated by connectivity. "Connectivity" generally means the ability to reach a wide range of places in a short amount of time. Connectivity is not simply a matter of the number of routes or number of frequencies operated. Connectivity is fundamentally about access to markets and regions.

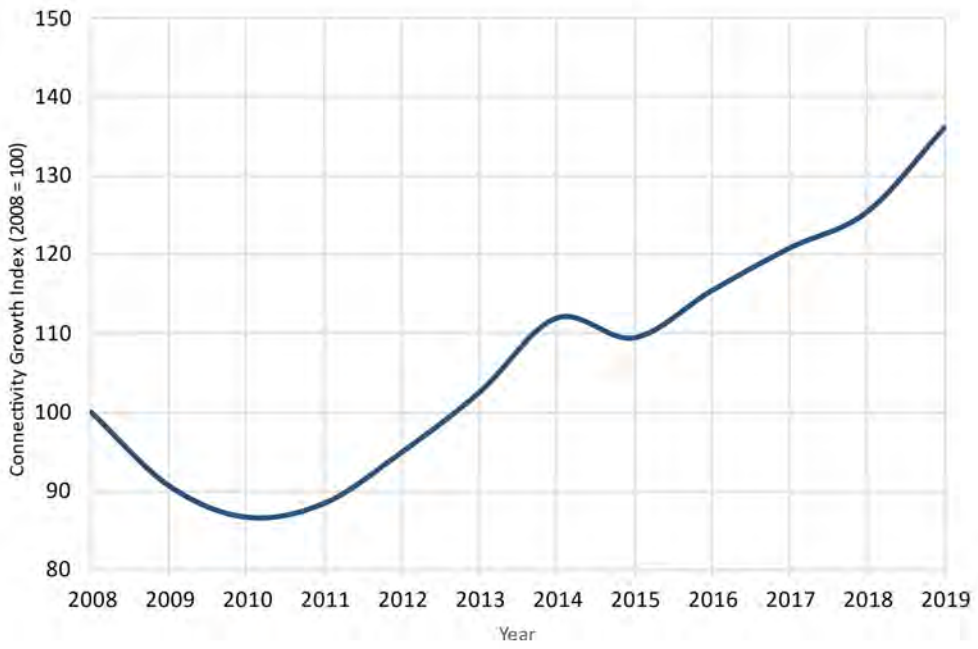
The change in connectivity can be measured in a variety of ways. One is a method developed by the International Air Transport Association (IATA). The IATA connectivity index estimates the quality of air service at an airport based on the degree of service to other airports with the largest and most diverse route networks, as a proxy for how accessible the local economy is to the rest of the world. Figure DSM-6 summarizes the formula for the IATA connectivity index. Using airline schedule data for passenger service, the index measures the number of frequencies and available seats to a particular destination. It then weights the number of available seats by the size of the destination airport (in terms of total capacity handled each year). This weighting reflects both the size and economic importance of the destination and the potential for convenient onward connections.

Figure DSM-6: IATA Connectivity Index Formula

$$\frac{[\text{ Number of destinations x Weekly Frequency x Seats per flight }]\ \textit{Weighted by the Size of the Destination Airport}}{\text{Scalar factor of 1000}}$$

Using the IATA index with 2008 as a baseline, Figure DSM-7 summarizes the changes in connectivity at DMS. Although the count of nonstop markets from DSM declined between 2008 and 2019, the continued growth in capacity – specifically to major national hubs – enabled continued improvement in air connectivity over the same timeframe. Between 2008 and 2019, connectivity grew 36% (or an annual average rate of 2.8%) at the airport. DSM was not immune to the impacts of the Great Recession but it returned to pre-recession levels of connectivity by 2013, then sustained continued growth in most years through 2019. The trend in connectivity at DSM is highly correlated with overall growth in total seat capacity, but beyond that is the fact that DSM has grown its air service (or replaced lost service) to large national hubs like Charlotte and Philadelphia which in turn facilitated onward connections to a larger number of markets and regions.

Figure DSM-7: DSM Connectivity Growth Index (2008=100)



Note: Chart shows the IATA Connectivity Index for DSM, indexed against 2008 (2008 = 100).
Source: Inter*VISTAS* analysis of Innovata schedule data from Diio Mi.

Analysis of Changes in Employment and Air Service

DSM's O&D traffic is highly correlated with total local employment. Figure DSM-8 summarizes how changes in total O&D traffic correspond with changes in regional employment. The line summarizes the strong positive relationship between the two. As total employment increases, total O&D increases. The correlation coefficient between the two is 0.945. But correlation alone does not demonstrate causation; that is, it is not evident whether rising total employment levels leads to more air traffic, or whether more air traffic leads to more total employment.

At the same time, it is important to recall that much recent academic research shows that improvements in air service and connectivity in fact do lead to increases in employment and economic activity, especially in industry sectors that are reliant upon air transportation such as Finance, Insurance, and Real Estate (FIRE) and PST. This is discussed in greater detail in *ACRP Web-Only Document 53.*

Figure DSM-8: Relationship between Regional Employment and Total O&D Traffic

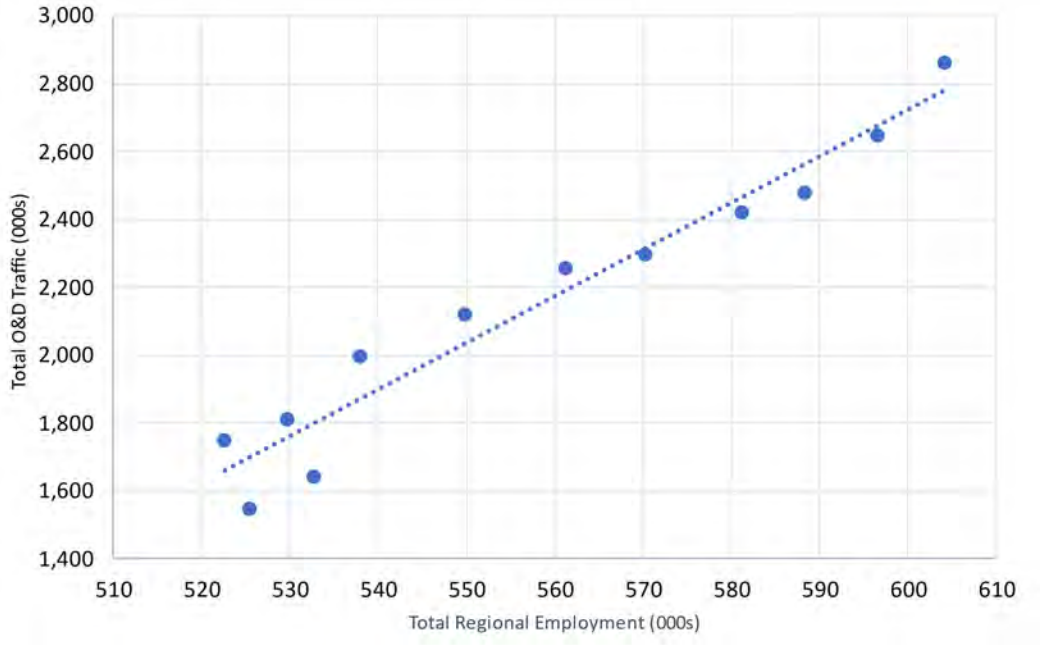
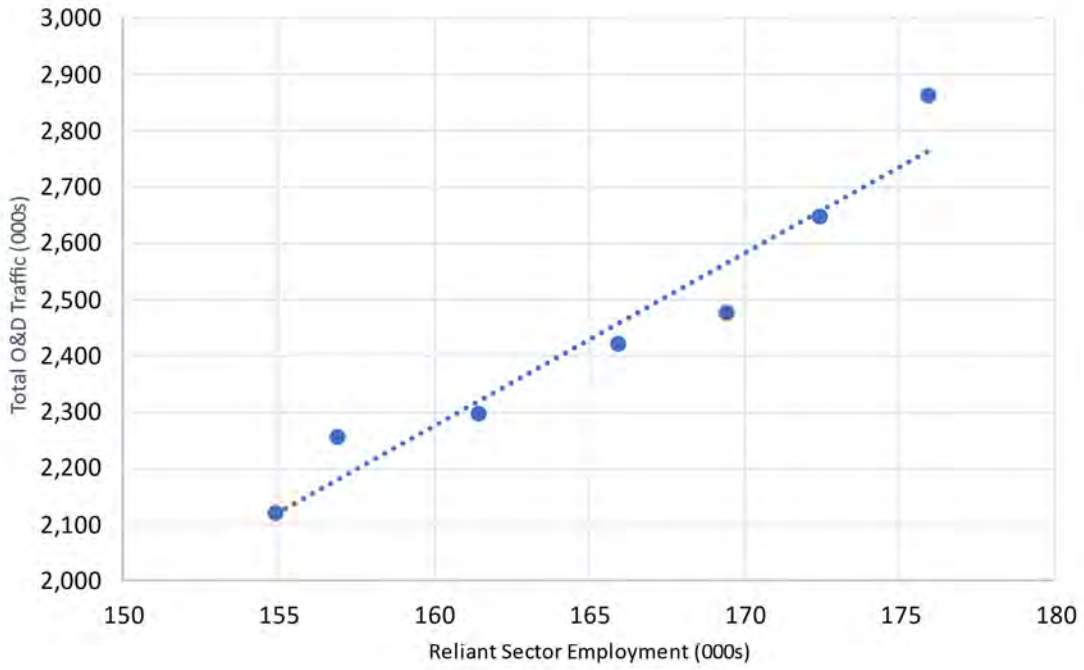


Figure DSM-9 isolates changes in O&D traffic against changes in employment in industry sectors that have a relatively higher propensity to fly than others. Those sectors include information technology; FIRE; PST; management of companies, and administrative services. As with the analysis of air traffic and total employment, the correlation of changes in air service and these "aviation-reliant" industries is also very high: 0.93. Data are available only for the years 2013-2019 because those for prior years were suppressed to protect confidentiality. Again, the two variables move together: Increases in one correspond with increases in the other.

Figure DSM-9: Relationship Between Air Traffic and Employment in Aviation-Reliant Sectors



Communicating the Airport's Economic Impact

DSM conducted an economic impact in 2013/2014 and there is a new state study in progress. The 2014 economic impact study concluded that DSM contributed significantly to the state's economy, supporting 7,156 jobs, $271 million in annual payroll, and $644 million in annual economic output. These impacts did not include the additional economic benefits associated with the increased productivity realized by non-aviation businesses and government entities in the Des Moines region that rely on the Des Moines International Airport to improve their efficiency. DSM is considering conducting one in the near future, however, has been hesitant to move forward given the large monetary investment. They do like the idea of a tool that is created to help airports boil down to their own airport. Airlines also have access to enplanement data but want to also see if an economy is flourishing and economic impact studies can indicate that. In the past DSM has used economic impact studies to build support for the airport itself. It allows them to share infrastructure projects and shares the value and impact an airport brings. DSM works with stakeholders to help build their story and leverage relationships to broaden their ASD case. The information in an economic impact analysis is reliable, but not always understandable. The investment must be made in the study to ensure it is understandable and communicated in a meaningful way to the community and to airlines.

The airport and regional stakeholders raised some questions and concerns when talking about how to persuade stakeholders about the airports value to the regional economy. The first was the amount of time an economic impact study takes, and whether there might be a more efficient way to capture information and better understand it. Another concern involved the potential impact associated with a new route (e.g., service to a new hub). The airport believes that type of information and insight could be useful.

The more people that travel the more routes can be pitched. As more destinations are served, more competition across carriers and airfare affordability. First, data is reviewed, and they look at whether a market is underserved or unserved. Then, they look at anecdotal insights from the business industry where certain routes can be prioritized over others. While San Francisco (SFO) is a target market, it may not be

the first you ask for due to the airport's slot restrictions. As the region becomes more tech-focused, there are opportunities for investors and other companies relocating. A stronger story can be told when linkages and insights from business community are uncovered.

Stakeholders Perspectives on Contributions of Air Service

One key stakeholder that represents the interests of the business community and economic development in the region is the Greater Des Moines Partnership (the Partnership). This organization works to grow the region's economic and community development through collaborative partnerships, while working to recruit and assist new and expanding businesses and cultivate a talented and educated workforce. The Partnership covers business and economic activities in a 10-county region, with the City of Des Moines roughly in the center, in Polk County.

As a mid-size community in a mid-size region, the Partnership believes that good air service is crucial for business. Its effort to recruit companies and people to work and live in Des Moines relies in part on the range of nonstop flights available at DSM. There is substantial business travel within the finance and technology sector, and accessibility is of the utmost importance. A few of the top industry sectors in the region include insurance, finance, manufacturing, and agriculture. The Iowa economy produces products and goods that serve the globe. Most of the international activity is freight-related or private, but both bioscience and agricultural sectors have international markets. With over 80 entities alone in the insurance field, connectivity is very important for business operations.

While DSM does not now offer nonstop international service, it has connectivity options through major hubs such as Chicago (ORD), Atlanta (ATL), Dallas (DFW), Denver (DEN), and Philadelphia (PHL). The Partnership recognizes that growth in air service metrics (passengers, nonstop flights) gives them strong talking points on regional growth and personal travel. The Partnership would like to see further additions to the number of markets served. It believes that the region needs nonstop service to San Francisco or Los Angeles. The Partnership works closely with DSM airport in supporting their air service development efforts.

Regional economic goals are developed and by engaging frequently with industry partners and other stakeholders. They work with chambers of commerce, counties, and cities in addition to public sector and private sector influencers to advance initiatives and develop goals that serve the community. In terms of the region's economic structure, health and vitality, goals are measured by capital investment, job creation, and new business growth.

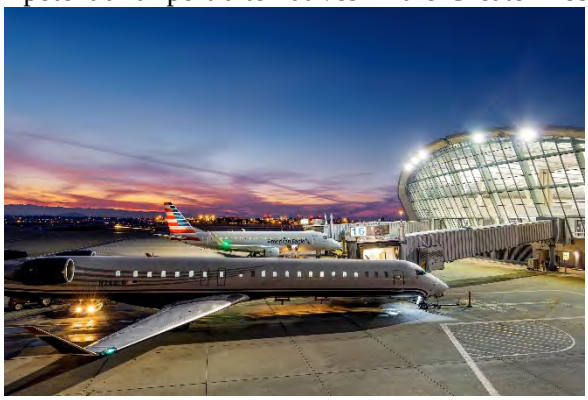
The regional economic development goals are not necessarily tied in any manner to aviation and transportation, though some strategy has focused on targeting companies specifically where there is direct airport connectivity. Their ability to have meaningful conversations is directly enhanced by having a nonstop flight. It is critical to have sufficient connectivity for companies to be able to get to markets to meet with decision makers. Showcasing DSM's connectivity is a useful marketing tool to entice companies to locate in the region. Other considerations for marketing the destination include the cost-of-living and how the school systems contribute to the quality of life. Improving area amenities, placemaking and downtown revitalization efforts are also important for attracting companies and talent.

Fresno, California: A Small Hub with Growing Air Service and Economic Activity

Fresno is in the Central Valley of California, one of the world's most important and productive agricultural areas. It is the closest city to the major national parks: Yosemite, Sequoia, and Kings Canyon. The metropolitan area anchored by Fresno is the third largest in northern California, after the San Francisco Bay area and the Greater Sacramento region.

Fresno is the largest city within several adjoining Metropolitan Statistical Areas (MSA): The Fresno, Madera, and Hanford-Corcoran. Together, they constitute the larger Fresno-Madera-Hanford Combined Statistical Area (CSA or Greater Fresno). That CSA is the 45th largest in the U.S. in population, just behind the Birmingham (AL) area and ahead of Harrisburg (PA).

Fresno Yosemite International Airport (FAT) is the only commercial service airport in the region. There are few other options for travelers in the immediate area: Sacramento International (SMF) is about 190 miles to the northwest, San Jose International (SJC) is 160 miles to the west. Oakland International Airport is 175 miles away. San Francisco International Airport is 190 miles. Traffic congestion especially around the Bay Area adds to travel time and uncertainty. Other potential airport alternatives in the Greater Los Angeles area are further away; Los Angeles International is roughly 225 miles to the south (3.5 hours driving) and suffers from similar uncertain travel times due to highway congestion.



The region is included as a case study because is an FAA-defined small hub and it has shown overall growth in air traffic activity over the period 2008-2019.

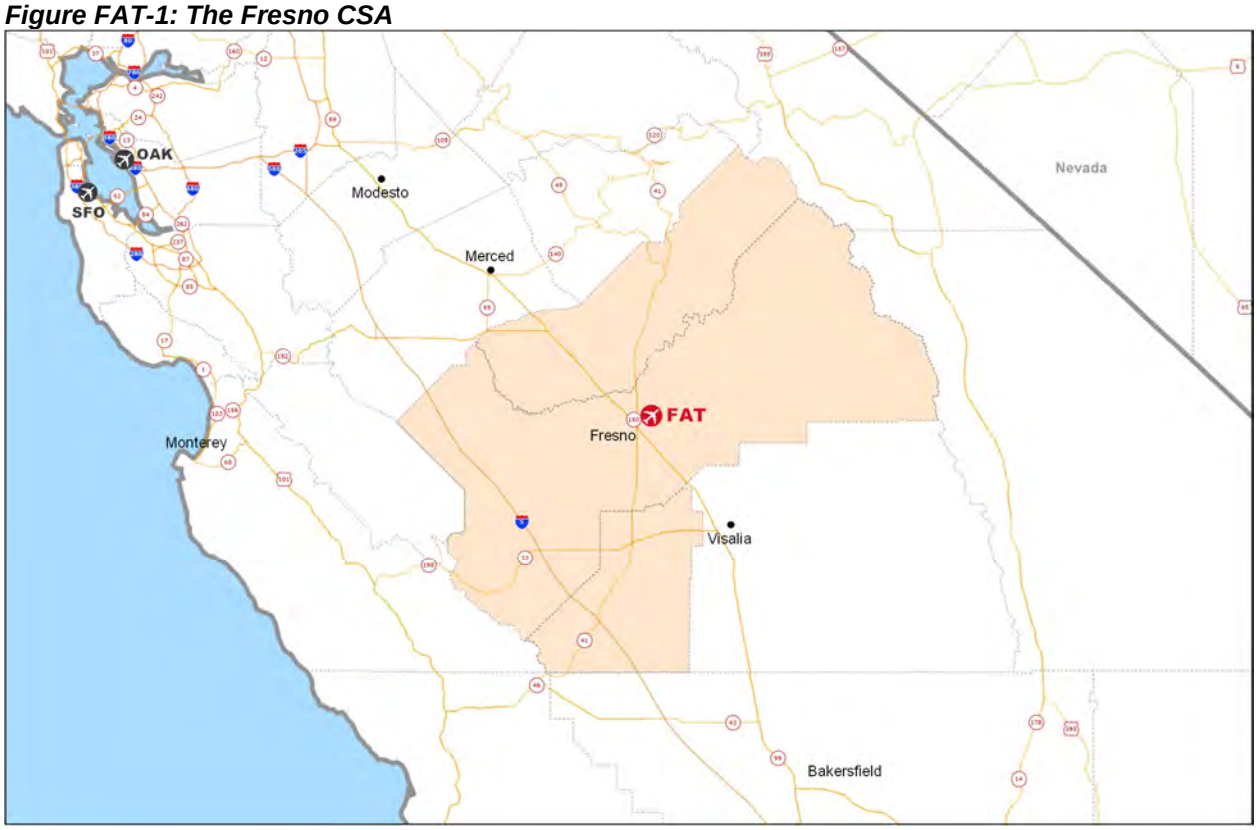
Introduction to the Region and its Economy

The Fresno-Madera-Hanford Combined Statistical Area (CSA) is home to a mix of urban environments, centered on its largest urban center Fresno, and significant agricultural production. Located within the heart of San Joaquin Valley in California's Central Valley, see Figure FAT-1, the Fresno-Madera-Hanford CSA is part of one of the United States most productive agricultural regions for fruits, nuts, and vegetables in particular. As of 2019, the CSA had an estimated population of 1,309,368 persons, growing at a compound rate of 0.7 percent per annum since 2008. The CSA has a population which is somewhat less educated than California's state average, with only 21 percent of the CSA's population holding a bachelor's degree or higher and only 76 percent of the populating having a high school degree or higher (vs 89 percent nationally). In 2019, the median household income in the CSA totaled $58,788 while per capita income was $24,912. Household and per capita incomes are lower in the CSA than both the state and national averages. Nearly 20 percent of the CSA's population is classified as below the poverty line, approximately 1.6 times higher than the state and national average.

The Fresno area includes a mix of urban environments and intensive agriculture and rural environments. While the largest employment categories in the CSA are related to government, healthcare, and services

industries, between 4-5 percent of employment in the CSA is farm employment over the past 14 years. This farm employment rate is much higher than the national average of 1.3 percent in 2019 reflecting the high concentration of agricultural employment in the region.[33] Government employment in the region includes local, county, and state governments, the 144th Fighter Wing of the California Air National Guard based at FAT, and the CSA's largest education employer California State University, Fresno. The CSA is also well situated along major transportation corridors including Interstate 5, State Route 99, and two Class I railways providing critical surface access for individuals and industry in and out of the region. Fresno is the CSA's largest population center, with the city accounting for approximately 40 percent of the CSA's population and more than three-quarters of the CSA's population located within Fresno County.

Figure FAT-1: The Fresno CSA



According to the U.S. Bureau of Economic Analysis (BEA), in 2019:

- the Fresno MSA had a 2019 population of just under 1 million, making it the 54th largest in the nation (out of 384 total MSAs). Fresno produced $50.7 billion in current-dollar total GDP, ranked 65th among MSAs, representing a slight increase in ranking from 2009. In 2019, Fresno had a per capita personal income (PCPI) of $45,487. This PCPI ranked 234th in the United States and was 81 percent of the national average, $56,490.

- The Hanford-Corcoran MSA had a 2019 population of 152,940, ranked 272nd in the nation. The MSA produced $7.2 billion in current-dollar total GDP, ranked 277th among MSAs. Per capita personal income (PCPI) in the MSA was $39,433. This ranked 352nd in the United States and was 70 percent of the national average.

- The Madera MSAs had a 2019 population of 157,327, which ranked 267th in the nation. It produced $7.1 billion in current-dollar total GDP, 281st among MSAs, up from 333rd in 2009. Per

capita personal income in 2019 was $41,267, which ranked 320th in the country, 73 percent of the national average, $56,490.

The region's population and employment have grown moderately since 2008. Table FAT-1 summarizes the changes in key socio-economic characteristics for the period. As shown, from 2008 through 2019:

- Total population rose by about 100,000 (8 percent). As a point of comparison, the population for the state of California also increased by 8 percent over the period.

- Total employment increased by 96,000 (17 percent). Total statewide employment for California increased by 17 percent over the period.

- Average per capita income (nominal dollars) rose from under $30,000 to $44,300 (49 percent), the same percentage increase as experienced for California. Expressed in constant 2019 dollars, the increase was 22 percent.

- The number of establishments operating in the region also increased, rising by more than 8,000 (24 percent). (The BEA uses data from the U.S. Census Bureau, which defines an establishment as "a single physical location at which business is conducted or services or industrial operations are performed. It is not necessarily identical with a company or enterprise, which may consist of one or more establishments. … Establishment counts represent the number of locations with paid employees any time during the year." The count excludes government establishments except for certain situations, such as state-operated retail liquor stores, local government-owned/operated hospitals, and federally chartered credit unions.)

Table FAT-1: Summary of Changes in Major Socio-Economic Variables, Greater Fresno, 2008-2019

	2008	2015	2019	Change 2008-15		Change 2015-19		Change 2008-19	
				#	%	#	%	#	%
Population	1,210	1,273	1,309	63	5%	36	3%	99	8%
Total Employment	560	598	656	38	7%	58	10%	96	17%
Private Non-farm Employment	427	470	520	43	10%	50	11%	93	22%
Government Employment	104	99	109	(5)	-5%	10	10%	5	5%
Income per Capita ($)	29,784	38,927	44,273	$9,143	31%	$5,346	14%	$14,489	49%
Number of Establishments	34	36	42	2	7%	6	17%	8	24%

Source: BEA

Note: All figures shown in 1000s except income per capita, which is shown in nominal dollars.

Regional Economic Strengths

The Fresno CSA is home to an economy of contrasts. While government and services industries make up the largest share of employment in the region, the CSA features approximately three times the national average of farm employees as a percentage of total CSA employment. Still, total farm employment in the region declined during the 2008-2019 period. (See Table FAT-2.) Conversely, the area has seen a strong growth in health care employment over the past decade, as well as growth in hospitality-related employment and administrative and support services. Transportation and warehousing industries have seen their employment nearly double between 2008 and 2019 as the region has positioned itself as a growing logistics and manufacturing center given its surface transportation links and air cargo services at FAT.

Table FAT-2: NAICS Employment in the Fresno-Madera-Hanford CSA (sorted by employment in nonfarm private sectors in 2019)

Industry Sector	2008	2015	2019	Change 2008-19	
				#	%
Farm Employment	29,018	28,777	26,809	(2,209)	-8%
Private Nonfarm Employment	426,833	469,891	519,923	93,090	22%
Health care and social assistance	56,244	79,654	92,882	36,638	65%
Retail trade	54,482	56,656	57,772	3,290	6%
Forestry, fishing, and related activities	(D)	(D)	44,962	--	--
Accommodation and food services	32,627	36,811	42,108	9,481	29%
Manufacturing	36,970	36,188	36,702	(268)	-1%
Administrative and support services	26,925	32,448	32,850	5,925	22%
Transportation and warehousing	16,741	20,057	32,123	15,382	92%
Construction	28,340	24,154	29,088	748	3%
Finance and insurance	20,952	20,269	23,985	3,033	14%
Professional, scientific, and technical services	(D)	21,917	23,725	--	--
Real estate and rental and leasing	18,526	19,847	21,807	3,281	18%
Wholesale trade	16,685	19,246	19,173	2,488	15%
Arts, entertainment, and recreation	6,780	7,233	8,382	1,602	24%
Educational services	6,161	6,392	6,660	499	8%
Management of companies and enterprises	(D)	2,833	3,349	--	--
Utilities	2,274	2,637	2,671	397	17%
Mining, quarrying, and oil and gas extraction	(D)	(D)	650	--	--
All other private sector	118,341	102,644	62,746	(55,595)	-47%
Government and government enterprises	104,266	99,264	109,197	4,931	5%
Total employment	**560,117**	**597,932**	**655,929**	**95,812**	**17%**

Source: BEA

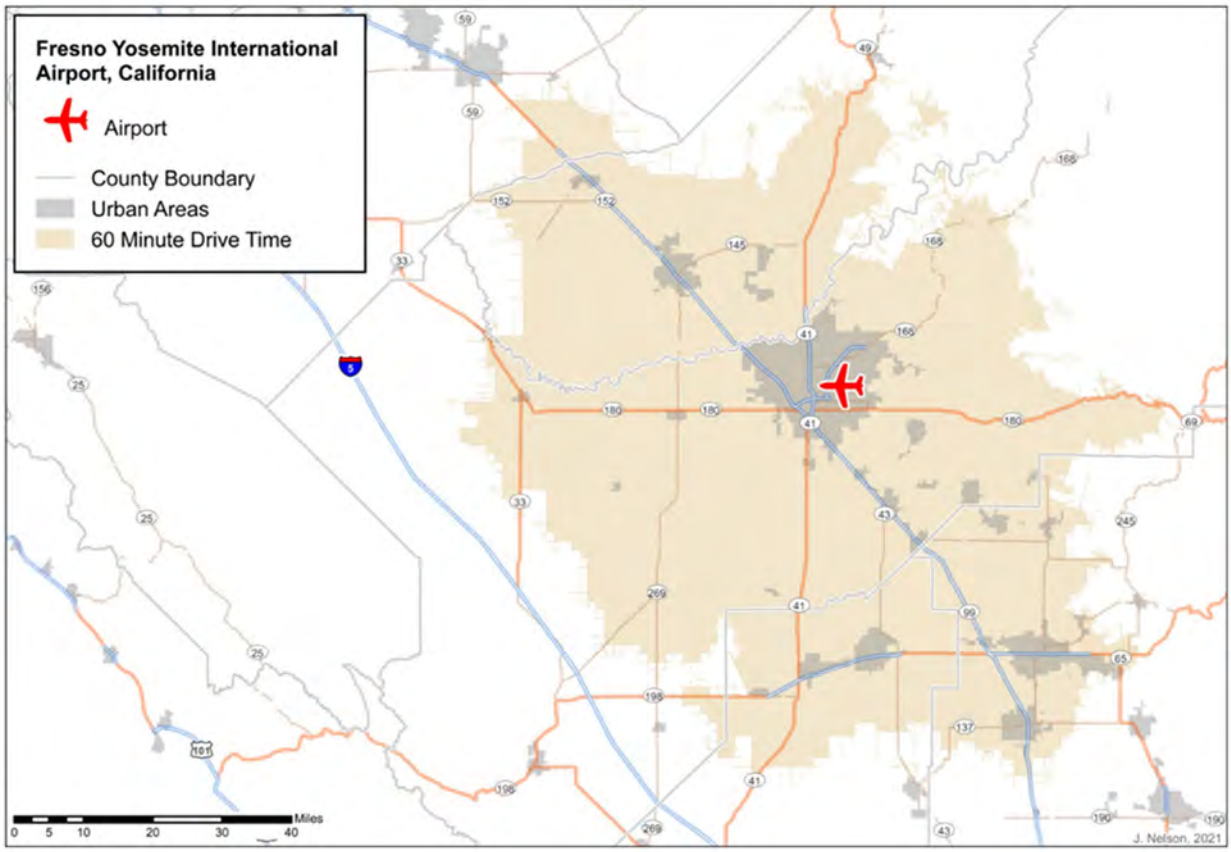
Notes: (D) = data suppressed to protect confidentiality. As a result, " – " indicates that changes cannot be calculated. "All other private sector" summarizes employment in sectors with fewer than 10,000 employees. It also includes employment in sectors where data were suppressed.

Furthermore, recent expansion of food processing, packaging, wholesaling, and agri-food manufacturing businesses in the region are building upon the core agricultural base of the region with higher value-added processes, bringing higher compensated employment to the region. Since 2008, the number of establishments[34] in the CMA grew from just fewer than 33,800 in 2008 to more than 42,000 in 2019 – a growth of 8,200 establishments or a 24 percent growth in just 11 years. This demonstrates the region's recovery from the impacts of the Great Recession in 2008/09 and, coupled with the growth in non-agriculture and service sector jobs, the diversification of the economy in the CMA.

Drive Time Analysis

Another alternative for examining the region's economic base is to visualize business activity within a certain driving distance from the airport. Figure FAT-2 illustrates a 60-minute drive time around FAT.

Figure FAT-2: FAT and the Geographic Region Within a 60-Minute Drive



Key highlights of socio-economic activity *within the 60-minute drive of the airport*:

- The total estimated 2019 population was 1.53 million. Of that, about 920,000 (60 percent) were considered "working age" (between the ages of 18 and 64).

- The region supported nearly 47,000 businesses employing nearly 524,000. In terms of major industry sectors (defined by NAICS codes), the largest based on total employment was Manufacturing (over 38,000 employees), Finance, Insurance, and Real Estate ("FIRE") with nearly 30,000, followed by and Professional, Scientific, and Technical Services (PST), with over 22,000.

- About 20 percent of the total population over the age of 25 held college degrees. This includes 13.3 percent with a Bachelor's degree and another 6.6 percent with a Graduate or Professional degree.

Economic Clusters

The U.S. Cluster Mapping Project's analysis of the Fresno region also highlights its broad economic strength. A cluster is a concentration of related industries in a particular region. Clusters consist of companies, suppliers, and service providers, as well as government agencies and other institutions that provide specialized training and education, information, research, and technical support. *Traded clusters* are groups of related industries that serve markets beyond the region in which they are located and therefore require some form of transport connectivity. Examples include financial service or information

technology. By contrast, *local clusters* consist of industries that serve the local market. Examples include local grocery stores or restaurants.[10]

The Cluster Mapping Project's analysis is based on MSAs or broad geographic "economic areas." The Fresno economic region has strong economic clusters in eight areas: Three are closely affiliated with the region's agricultural base: Agricultural Inputs and Services, Food Processing, and Livestock. In addition, the region has strength in Distribution and eCommerce, Paper and Packaging, Performing Arts, Communications, and Environmental Services.

- Agricultural Inputs and Services. The region is ranked 3rd nationally in this cluster (out of 179 total economic areas). Subsectors include agricultural services (ranked 3rd in U.S. out of 179 economic areas) and farm management and labor services (ranked 2nd in the U.S.) The region is also ranked in the top 50 for Fertilizer subsector. The region's specialization (Location Quotient) is 22.29.

- Food processing and manufacturing. The Fresno economic area is ranked 14th in the U.S. and has an LQ of 6.82. The Fresno region ranks in the top 10 nationally in several subsectors, including packaged fruit and vegetables, dairy products, and wineries. It is in the top 50 nationally in specialty food and ingredients, baked goods, animal foods, and soft drinks and ice.

- Livestock processing. The region is ranked 26th in the U.S. and has an LQ of 5.28.

The only other cluster with significant levels of employment is Distribution and eCommerce, with over 21,000 employed.[35] The region is ranked 40th in the U.S. and has an LQ of 1.37. Subsectors include wholesale of food products (ranked 21st), wholesale of farm products and supplies (22nd), sale of farm and garden machinery (15th), and warehousing and storage (58th).

A 2018 study of the impact of the airport on the local economy highlighted the transition of the regional economy from a primarily agricultural based economy in the 1990s to a specialized "agricultural manufacturing cluster" as a sign of the region's economic growth and diversification.[36] While the region has a high proportion of farm workers and farm employment, compared to state and national averages, farm employment has seen declines over the 2008 to 2019 period while manufacturing and service-sector employment is on the rise. Even though farm employment is on a declining trend, average wages in the agricultural sector have seen a significant rise since the Great Recession. Both trends are reflective of increasing automation in the agricultural sector, which has carry-over impacts in supporting services supporting the agriculture industry in the region.

Overview of the Airport and its Air Service

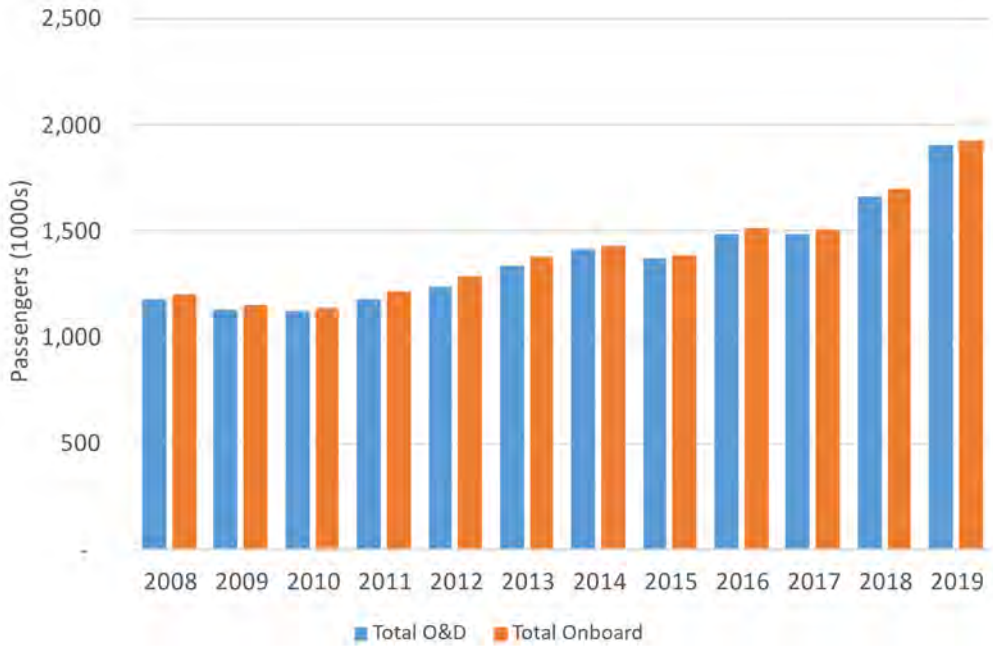
Fresno Yosemite International Airport (FAT) is the primary passenger and commercial service for California's central San Joaquin Valley. It is California's 12th largest airport, serving just fewer than 1.9 million passengers in 2019. The Airport is also the closest commercial service airport Yosemite, Sequoia, and Kings Canyon national parks, giving FAT a unique gateway role to a national parks-based tourism in California. The airport is owned and operated by the City of Fresno under the Airports Department within the city government. The City of Fresno also owns and operates Fresno Chandler Executive Airport (FCH), which is a primarily General Aviation airport.

The airport's catchment area includes the Fresno-Madera-Hanford CSA as well as neighboring Tulare, Merced, and Mariposa counties.[37] Due to its relatively geographically isolated nature in California's Central Valley, FAT does not have any competing commercial service airports within its primary catchment area. The nearest major hub airports are San Francisco (SFO) and Los Angeles (LAX), a minimum three and

four-hour drive time, respectively, though both cities feature significant road congestion that may lead to longer driving times. Other medium hub airports such as Sacramento (SMF), Oakland (OAK), and San Jose (SJC) provide limited competition as the primary competition away from FAT is for international services at LAX and SFO.

Although connecting itineraries are possible, the airport primarily serves a market that originates its travel there or is destined for the airport. Consequently, a high percentage of passenger traffic is "origin and destination" traffic. Figure FAT-3 shows the changes in total onboard (enplaned and deplaned) passengers and total O&D passengers at Fresno from 2008-2019. By 2019, total O&D traffic at the airport had grown to more than 1.9 million passengers, growing at a compound annual rate of 4.4 percent per annum.

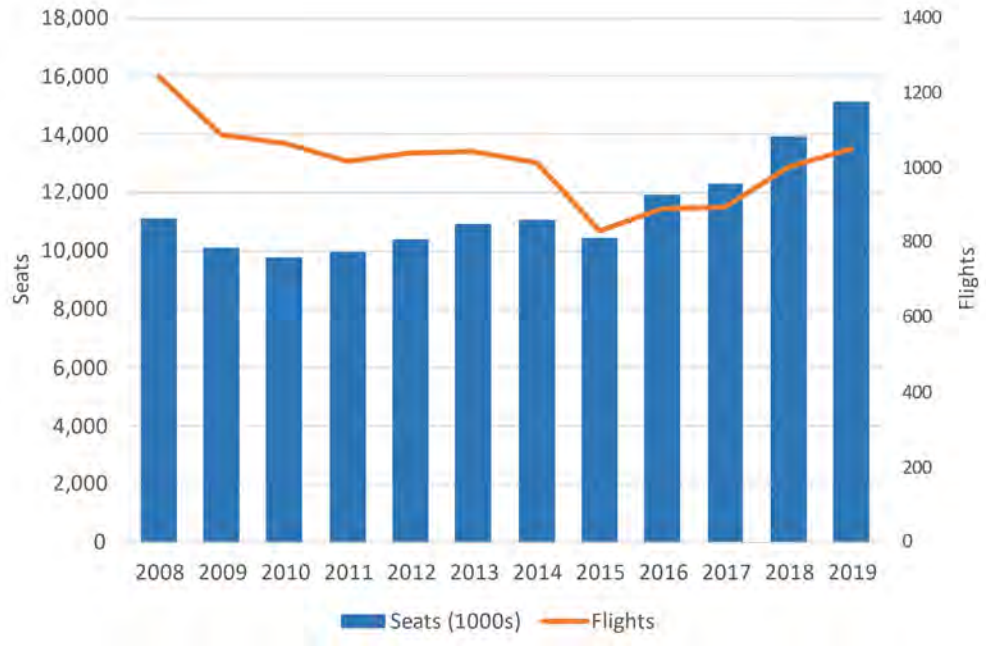
Figure FAT-3: Changes in Total and O&D Passenger Activity 2008-2019 (1000s)



Source: Sabre (O&D estimates) and T-100 data via Cirium – Diio.

Total capacity at FAT has recovered notably since 2015. Following the Great Recession, airlines dropped a significant number of flights and available seats at the airport. From 2008 through 2011, carriers dropped almost 20 percent of flights but 10 percent of seat capacity. Carriers dropped capacity again from 2014 to 2015, when airlines again removed 18 percent of flight operations but only 6 percent of seat capacity. From 2008 through 2015, average aircraft size (available seat capacity) at FAT rose from 54 to 76. Since then, however, airlines have returned flight activity nearly back to 2010 levels and offered a record number of available seats. Figure FAT-4 summarizes the changes in flights and seats.

Figure FAT- 4: Changes in Capacity Offered 2008-2019

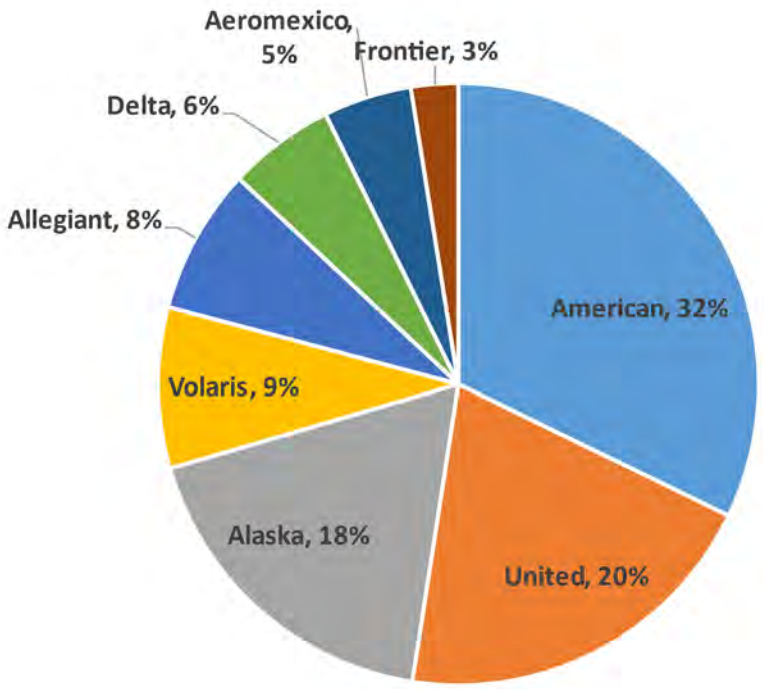


Source: T-100 data from Diio – Cirium

Classified by the FAA as a small hub primary commercial service airport, in 2019, FAT was served by a diverse set of scheduled carriers operating at the airport including network carriers (American, United, Alaska, and Delta), foreign carriers (Volaris, Aeromexico), and ultra low-cost carriers (Allegiant, Frontier). Network carriers carry over 75 percent of the total traffic, as shown in Figure FAT-5. (Southwest entered the Fresno market in 2021.)

Seven of the top ten non-stop destinations served at FAT in 2019 by seat capacity were large hub airports (e.g., LAX, SFO, DFW), which provided one-stop connectivity to/from Fresno and Central California to a multitude of destinations in the U.S. and around the world. In addition to connectivity to airports in the U.S., FAT had non-stop service to two destinations in Mexico. Non-stop service by two Mexican carriers highlights the important economic and cultural ties between the region and Mexico.

Figure FAT-5: FAT Seat Capacity Share by Airline, 2019



Since 2015, FAT experienced significant increases in service to major hubs. Compared to 2015, the number of annual (2019) flights increased by

- Over 180 to Denver
- Over 200 to Dallas-Ft. Worth International
- 363 to Guadalajara (on AeroMexico)
- 234 to Las Vegas
- Almost 600 to Los Angeles International
- 135 to Morelia International Airport (on Volaris)
- 260 to Chicago O'Hare
- 350 to Phoenix Sky Harbor International
- 335 to San Diego
- 94 to Seattle
- 147 to San Francisco
- Almost 100 to Salt Lake City

Connectivity

High quality transportation – of all modes – is a prerequisite for sustained economic growth and competitiveness for a region. Specifically, these factors of economic development are driven by productivity growth, which is underpinned by trade, foreign investment, and innovative activity – all of which are facilitated by connectivity. "Connectivity" generally means the ability to reach a wide range of places in a short amount of time. Connectivity is not simply a matter of the number of routes or number of frequencies operated. Connectivity is fundamentally about access to markets and regions. As FAT is the

primary commercial service airport within the CSA then changes in connectivity out of the Airport can have notable impacts on how quickly and conveniently Fresno and the Central Valley area can be reached, or how local residents can access outbound markets.

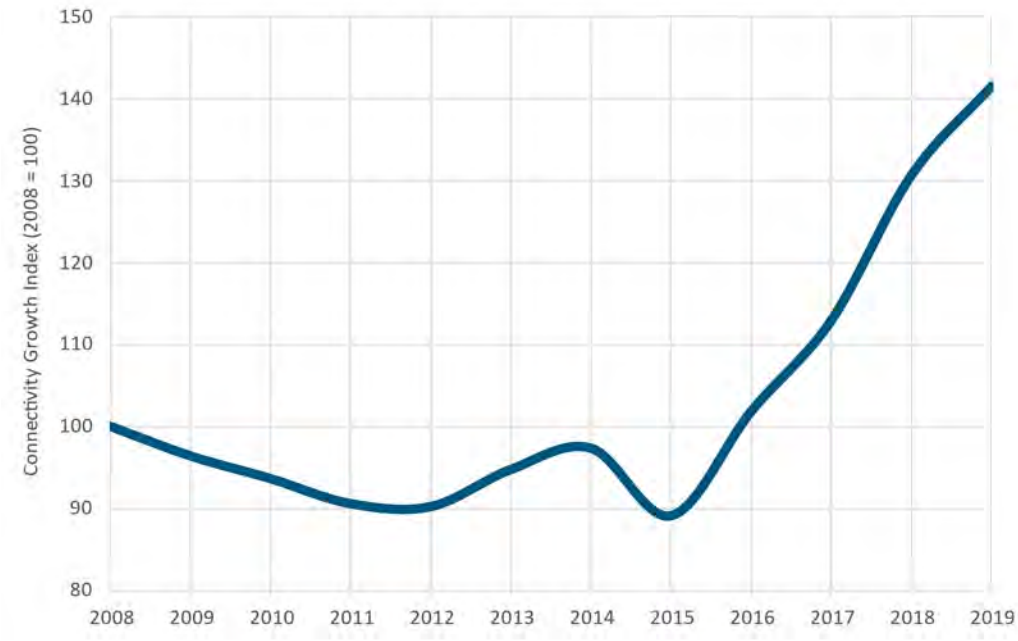
The change in connectivity can be measured in a variety of ways. One is a method developed by the International Air Transport Association (IATA). The IATA connectivity index estimates the quality of air service at an airport based on the degree of service to other airports with the largest and most diverse route networks, as a proxy for how accessible the local economy is to the rest of the world. Service to airports with the highest total seat capacity (e.g. ATL) receives the highest weighting. Figure FAT-7 summarizes the formula for the IATA connectivity index. Using airline schedule data for passenger service, the index measures the number of frequencies and available seats to a particular destination. It then weights the number of available seats by the size of the destination airport (in terms of total capacity handled each year). This weighting reflects both the size and economic importance of the destination and the potential for convenient onward connections.

Figure FAT-7: IATA Connectivity Index Formula

$$\frac{\text{[Number of destinations x Weekly Frequency x Seats per flight]}\ \textit{Weighted by the Size of the Destination Airport}}{\text{Scalar factor of 1000}}$$

The change in FAT's connectivity index or score is charted in Figure FAT-8, by indexing the score against 2008 levels for comparison. Connectivity at FAT in 2019 was 42 percent higher than in 2008. While the airport did experience a dip in connectivity between 2008 and 2015, largely due to the declines in seat capacity seen over that period, since 2015 the airport has seen a strong growth in connectivity. In particular, the connectivity growth has exceeded seat capacity growth as the bulk of capacity added at the airport since 2015 has been to major national hubs such as LAX, DFW, SFO, DEN and the addition of ORD. All else being equal, each additional seat serving routes to major hubs will yield a higher level of connectivity than capacity growth at smaller airports with fewer, if any, onward connecting opportunities and services. This is why connectivity at FAT grew by 60 percent between 2015 and 2019 while seat capacity grew by 45 percent over the same period. Growth in capacity to Guadalajara (GLD) also provides an important boost to FAT's connectivity score, both as an international destination with key economic and socio-cultural links to the Fresno region, but as a hub and focus city for Volaris and Aeromexico, respectively, providing one-stop access to many destinations in Mexico.

Figure FAT-8: FAT Connectivity Growth Index (2008=100)



Note: Chart shows the IATA Connectivity Index for FAT, indexed against 2008 (2008 = 100).
Source: Inter*VISTAS* analysis of Innovata schedule data from Diio Mi.

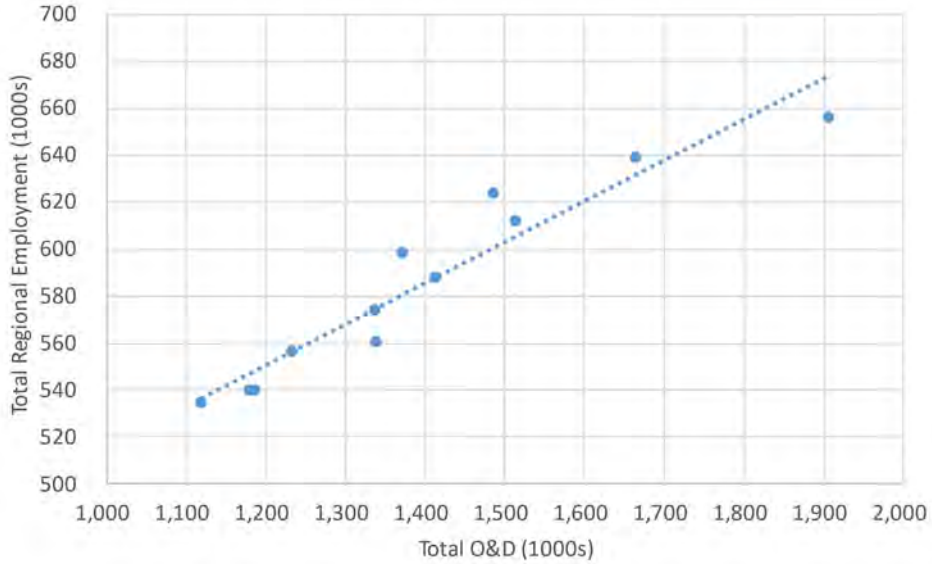
In 2021, Southwest Airlines added scheduled service from FAT to Las Vegas and Denver, and Volaris added service to Mexico City and Leon/Guanajuato. Both of those changes would further improve connectivity.

Analysis of Changes in Employment and Air Service

FAT's O&D traffic is highly correlated with total regional employment. Figure FAT-6 summarizes how changes in total O&D traffic have aligned with changes in regional employment. The line indicates a positive relationship between the two. As total employment increases, total O&D increases. The correlation coefficient between the two is 0.915. However, correlation does not demonstrate causation. That is, correlation analysis does not provide evidence whether rising total employment levels leads to more air traffic, or whether more air traffic leads to more total employment.

\At the same time, it is important to recall that much recent academic research shows that improvements in air service and connectivity in fact do lead to increases in employment and economic activity, especially in industry sectors that are reliant on air transportation. This is discussed in greater detail in *ACRP Web-Only Document 53*.

Figure FAT-6: Relationship between Regional Employment and O&D Traffic, 2008-2019



Communicating the Airport's Economic Impact

California's aviation industry provides a major source of economic activity throughout the state. The aviation sector provides direct and indirect economic benefit with activity closely associated with aviation activity, including commercial passenger service, air cargo, general aviation, government and military activities. Importantly, the aviation industry and aviation activity provide connectivity and access for people and goods that propel economic resilience and vibrance.

The recent *California Aviation System Plan* (CASP) draft report in 2020 noted that the aviation industry contributed an estimated $33 billion dollars in economic activity and more than 148,000 jobs to the State's economy.[38] Commercial aviation activity in the state was estimated to be responsible for $177 billion in economic output and responsible for 1.5 million jobs in the state resulting from commercial activity at California's primary service commercial airports.[39]

In a 2018 economic impact study, FAT was estimated to have generated an overall economic output of more than $426 million from the airport alone.[40] Combined with the city-run Chandler Executive Airport and airport-associated visitor and real estate activities, the city's aviation activity was estimated at more than $788 million in overall economic contribution. Economic impacts in the region were highly driven by the commercial and air cargo activity taking place at FAT.

The growing urbanization and focus on government, services, and professional employment in the CSA highlights the importance of air passenger and air cargo links at FAT. Air connectivity at FAT is also important in supporting the region's agriculture sector by providing non-stop air links to key source locations for temporary agricultural workers from Mexico.

The airport uses its economic impact study in its marketing material, messaging to stakeholders, elected officials at all levels (Federal, State, County and Local), and in discussions our federal partners such as TSA, Customs and Border Protection, FAA and the Department of Defense. The airport manager also noted that it helps the airport staff better understand the economic impact of each enplaning passenger and flight in the market area.

Stakeholders Perspectives on Contributions of Air Service

The interests of the business community and economic development authority in the region are represented by the Fresno County Economic Development Corporation (EDC) and the Fresno Chamber of Commerce. Commercial air service is extremely important to both. The Fresno EDC is an organization responsible for bringing in new business to the county. The Fresno Chamber works to promote and support the success of the regional business community through effective advocacy, education and relationship building. The airport also works closely with the Visalia Chamber of Commerce, which is supportive of its air service development initiatives.

These organizations note how the Greater Fresno area's economy is diversifying and changing. The metro region is growing measurably in the logistics and technology field. Some of the key industries in the Fresno area are manufacturing, healthcare, and agriculture. There is a strong international traveler base in the agricultural industry, with frequent China, Japan, Germany, and Spain as it relates to what is being manufactured in the region.

The Fresno EDC President & CEO travels extensively. Access to Chicago, Atlanta, New York, and Washington is critically important. International business is also extremely important for trade and efforts to attract international businesses to relocate to the region. In April 2021, the community succeeded in convincing Southwest to enter the market, an effort that took 10-15 years. The EDC believes that the new service will not only help domestic connectivity but be beneficial in discussions with business site selectors about the region's accessibility. The EDC would also like a nonstop flight from FAT to the east coast to improve connectivity.

Community stakeholders have embraced regional economic development in California's Central Valley. Historically, communities there have not had a collective voice as strong as areas in northern and southern California. Now, however, with close to 5 million people in the Central Valley and with Fresno being the 5th largest city in the state, the region is working together to express their needs, especially on transportation matters.

The Fresno EDC has had a close working relationship with FAT for many years. The airport staff will reach out to the EDC to discuss goals (e.g., potential target destinations for new nonstop flights) and what information are they hearing from clients.

When reviewing economic impact as it relates to FAT, economic impact studies of Fresno and Madeira counties were performed. The Fresno EDC looks at population growth, industry growth and the economy of the region. Air quality is also a big concern. International trade has moved up the list. In partnership with the Department of Social Services, the EDC works directly with businesses to create and provide customized training programs and cost saving incentives to local businesses to help meet their hiring needs.

The regional economic goals are tied to transportation and aviation. Roads, rail, and air are the three main things the region must address together to improve Greater Fresno.

Green Bay: Competing Against Other Nearby Airports

Green Bay Austin Straubel International Airport (GRB) serves northeastern Wisconsin. The City of Green Bay, on the western side of Lake Michigan, is the population and employment center of the metropolitan region, known for being home to its famous National Football League team and historic manufacturing base.

The region is an example of one within a fragmented market where the population and total regional employment has remained relatively stable over time. GRB is about 30 miles away from Appleton International Airport (ATW) in Appleton, Wisconsin; and 130 miles to Milwaukee Mitchell International Airport (MKE), see Figure GRB-1. Other airport options for travelers are Chicago O'Hare International Airport (ORD), roughly 200 miles to the south, and Minneapolis-St. Paul International Airport (MSP), 275 miles to the west.

Introduction to Metropolitan Region and its Economy

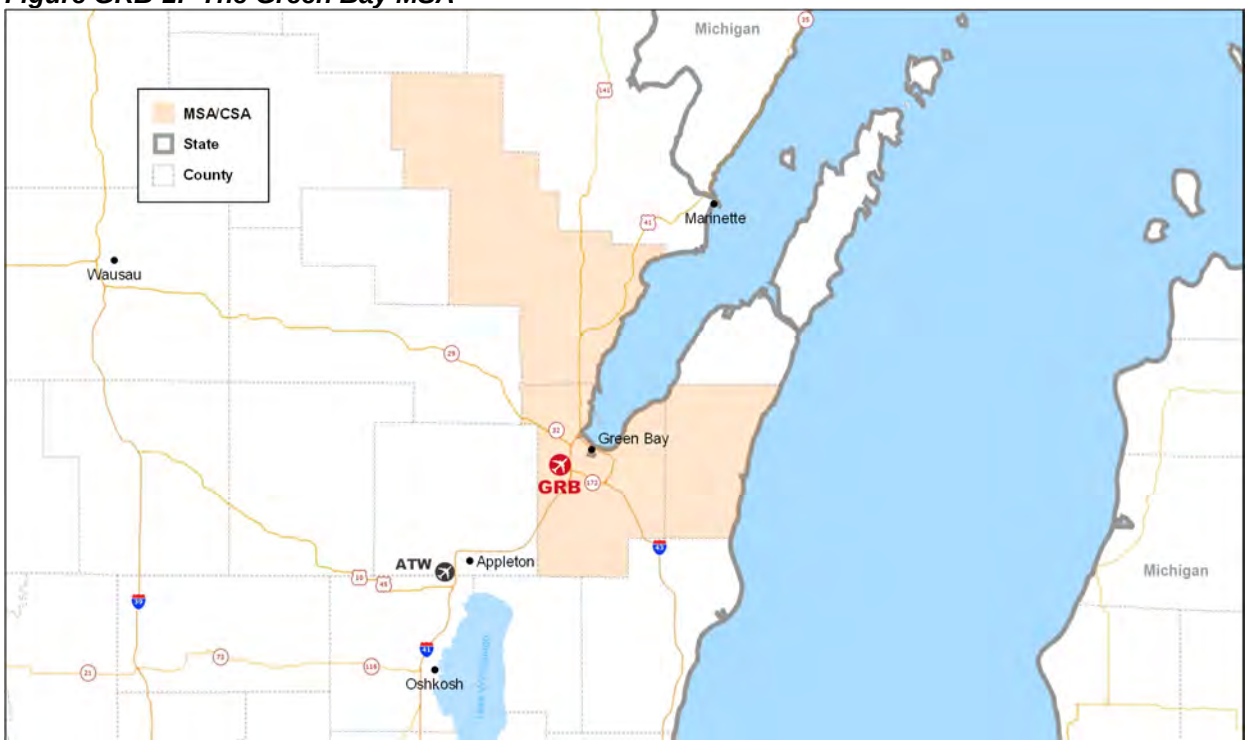
The Green Bay-Shawano Combined Statistical Area ("CSA") is located in the eastern part of the State of Wisconsin, approximately 130 miles north of Milwaukee. The CSA includes three counties and both the Green Bay Metropolitan Statistical Area (MSA) and Shawano Microstatistical Area. With a population of 104,777 in 2019, the City of Green Bay is the largest of several cities within the region.

The CSA has experienced a 5.7 percent increase in population (from 348,576 to 368,361) over the period 2008-2019. That represents faster growth compared to the Wisconsin statewide average (3.3 percent) but slower growth than the national average (8 percent). The region's economy is balanced, having demonstrated resistance to severe changes in economic output that typically occur during economic recessions. The leading economic sectors in the region are agriculture, food processing, paper, advanced manufacturing, and transportation/logistics.

The Green Bay Packers of the National Football League is a major generator of economic activity in the region. The combination of home games, training, administration and merchandising, combined with local hospitality industry activity related to the team and the games, are a major generator of jobs in the region.

Northeastern Wisconsin is the home of the Oneida Nation. The tribe's reservation encompasses western parts of the CSA. The recently established Casino in Green Bay generates substantial revenues largely dedicated for economic development of the reservation.

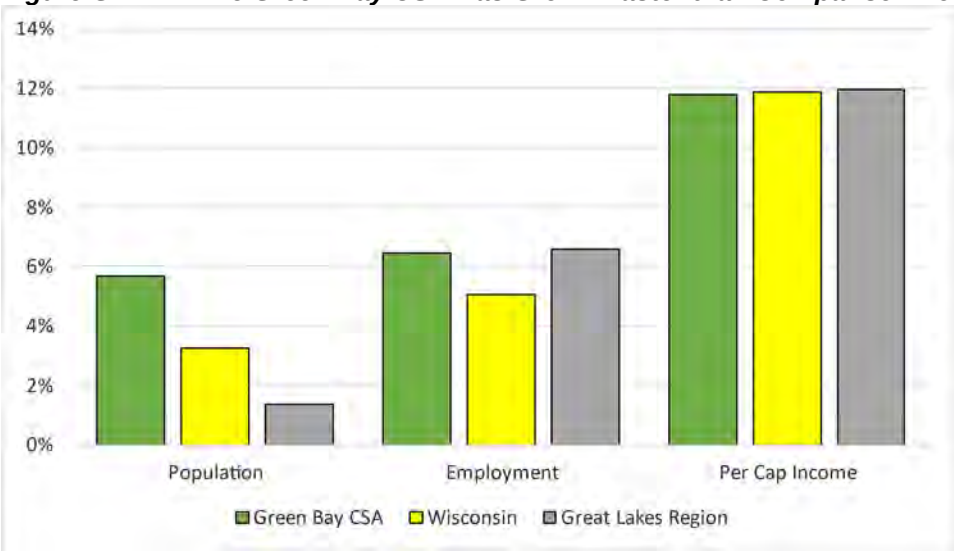
Figure GRB-1: The Green Bay MSA



According to the U.S. Bureau of Economic Analysis (BEA), in 2019, the Green Bay MSA had a population of over 320,000, ranked 158th in the nation (out of 384 total). It produced $21.5 billion in current-dollar total GDP. This ranked 136th among MSAs. It represents a decline in the region's national ranking from 2009, when it ranked 65th among MSAs.[41]

The Green Bay CSA has grown since 2008, and generally grown more than either Wisconsin as a whole and the 5-state Great Lakes region (Illinois, Indiana, Michigan, Ohio, and Wisconsin). (See Figure GRB-2.)

Figure GRB-2: The Green Bay CSA Has Grown Faster than Comparison Points



Source: BEA. Changes in per capita personal income expressed in constant 2019 dollars.

As shown in Table GRB-1, from 2008 to 2019:

- Total population in the MSA increased from about 350,000 to nearly 370,000 (5.7 percent). That is a higher rate of growth than that experienced by either the State of Wisconsin (3.3 percent) or the Great Lakes states (1.4 percent).

- Similarly, employment growth in the region exceeded that of the State and matched that for the Great Lakes states. Total employment in the CSA increased by 6.4 percent, compared to 5.1 percent in Wisconsin and 6.6 percent in the Great Lakes states.

- Changes in per capita personal income were essentially the same. Per capita personal income (expressed in constant dollars) grew by 11.8 percent in the CSA vs. 11.9 percent in Wisconsin and 12.0 percent in the Great Lakes.

- However, for 2019, per capita personal income in the CSA ($51,733) remains lower than the statewide average ($53,207) and that of the Great Lakes region ($52,462).

Table GRB-1: Changes in Key Socio-economic Metrics. 2008-2019

	2008	2015	2019	Change 2008-15		Change 2015-19		Change 2008-19	
				#	%	#	%	#	%
Population (000s)	349	361	368	13	4%	7	2%	20	6%
Total Employment (000s)	230	236	245	6	3%	9	4%	15	6%
Private Non-farm Employment (000s)	196	202	211	6	3%	9	4%	15	7%
Gov't Employment (000s)	27	28	28	1	3%	(0)	-1%	1	2%
Income per Capita ($)	$37,849	$45,889	$51,733	$8,040	21%	$5,844	13%	$13,884	37%
Number of Establishments (000s)	N/A	9	10	N/A	N/A	1	0	N/A	N/A

Source: BEA

Notes: All data in 1,000s except income per capita, which is shown in nominal dollars. N/A = not available

The region is home to several quality higher education institutions—the University of Wisconsin-Green Bay (UWGB), Northeast Wisconsin Technical College (NWTC), St. Norbert College, Medical College of Wisconsin, and Bellin College. According to Census estimates, approximately 28 percent of the CSA's population over the age of 25 held college degrees (undergraduate or above), slightly below the U.S. average of 32 percent.

Regional Economic Strengths

The region's economy is anchored by its manufacturing sector, which employed over 30,000 in 2019 (almost 15 percent of total nonfarm employment), see Table GRB-2. Manufacturing is an essential part of the region's economy and accounts for 12 of the region's 30 largest employers. Historically, the region demonstrated great economic strength in its paper and packaging sector. Other sectors with substantial employment included health care, finance and insurance, construction, and transportation.

Table GRB-2: Employment by Major Industry Sectors, 2019

Sector	2015	2019	Change 2015-19	
			Number	Percent
Farm employment	5,763	6,060	297	5%
Nonfarm private sector				
Manufacturing	32,472	34,555	2,083	6%
Health care and social assistance	25,422	28,743	3321	13%
Retail trade	22,985	23,105	120	1%
Finance and insurance	15,355	15,683	328	2%
Accommodation and food services	15,605	15,488	(117)	-1%
Construction	11,395	11,973	578	5%
Other services (except government and gov't enterprises)	11,355	11,746	391	3%
Transportation and warehousing	9,376	10,579	1203	13%
Professional, scientific, and technical services	9,890	10,422	532	5%
Administrative and support services	10,172	10,006	-166	-2%
Wholesale trade	9,909	9,857	(52)	-1%
Real estate and rental and leasing	7,320	8,044	724	10%
Management of companies and enterprises	5,950	5,592	(358)	-6%
Arts, entertainment, and recreation	4,882	5,213	331	7%
Educational services	3,255	3,385	130	4%
Information	2,465	1,997	-468	-19%
Forestry, fishing, and related activities	N/A	1,441	N/A	N/A
Utilities	788	710	-78	-10%
Mining, quarrying, and oil and gas extraction	334	218	(116)	-35%
Government and government enterprises	*27,911*	*27,643*	*-268*	*-1%*
Grand Total	**283,917**	**293,147**	**9,230**	**3%**

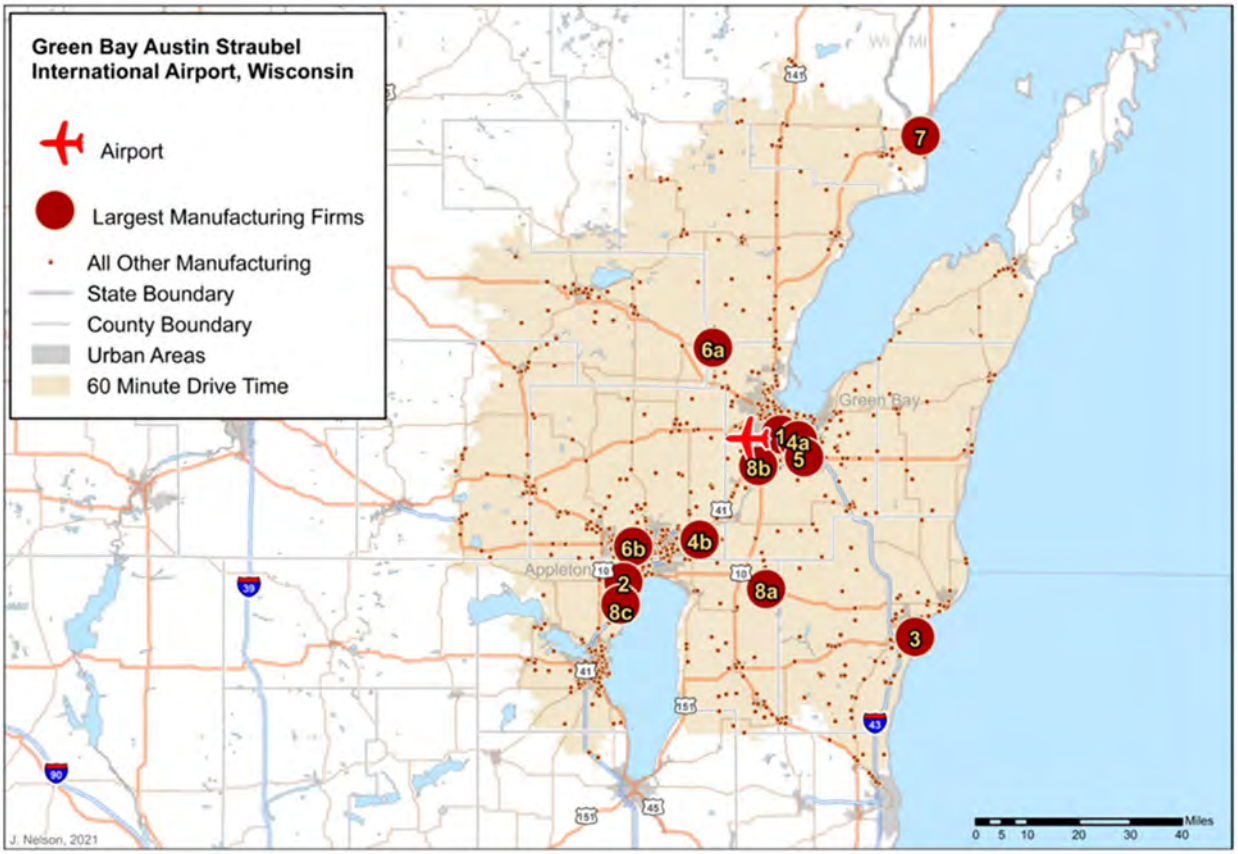
Source: BEA

Note: N/A = Data were suppressed to protect confidentiality.

The number of establishments[42] in the Green Bay metropolitan area has expanded. In 2008, the region supported 7,322 establishments that employed almost 153,000. In 2019, there were 7,867 establishments that employed 159,000. This represents an increase of 545 establishment (7 percent) and 6,000 jobs (4 percent).

Figure GRB-3 shows the location of the airport in the region. It highlights the geographic area within a one-hour drive of the airport. It also shows the locations of manufacturing businesses within that drive time.

Figure GRB-3: GRB and Selected Manufacturing Businesses in the Region



Source: ESRI Business Analyst

Key highlights of socio-economic activity <u>*within the 60-minute drive of the airport*</u>:

- The total estimated 2019 population was over 900,000. Of that, about 557,000 (62 percent) were considered "working age" (between the ages of 18 and 64).

- The economy supported nearly 33,000 businesses employing over 500,000. In terms of major industry sectors (defined by NAICS codes), the largest based on total employment was Manufacturing (82,000 employees) followed by Professional, Scientific, and Technical Services (PST) with about 35,000 and Finance, Insurance, and Real Estate (FIRE) with about 28,000.

- Of the total population, 19.6 percent held a Bachelor's degree and another 8.4 percent held a Graduate or Professional degree.

Economic Clusters

The Green Bay region includes seven "traded clusters." A cluster is a concentration of related industries in a particular region. Clusters consist of companies, suppliers, and service providers, as well as government agencies and other institutions that provide specialized training and education, information, research, and technical support. *Traded clusters* are groups of related industries that serve markets beyond the region in which they are located and therefore require some form of transport connectivity. Examples include

financial service or information technology. By contrast, *local clusters* consist of industries that serve the local market. Examples include local grocery stores or restaurants.[43]

The Green Bay region maintained economic strength in several traded clusters during 2018 (the most recent year for which the Cluster Mapping project had data). In particular, those clusters ranked in the top 50 nationally included:

- Transportation and Logistics, which includes ground transportation, especially long-distance trucking, and support industries. The region is ranked 15th nationally in trucking specifically and 46th nationally in transportation and logistics more broadly.
- Paper and packaging, which includes paper mills, paper products, and packaging.
- Livestock processing (e.g., meat processing), ranked 18th nationally.
- Printing services, ranked 32nd nationally.
- Furniture, ranked 42nd nationally.

Table GRB-3 summarizes the amount of employment in these sectors in 2018 and the Location Quotient (LQ) for each. LQs compare the concentration of an industry within a specific area to the concentration of that industry nationwide. An LQ value equal to 1.0 indicates that the percentage of employment for that industry in the region is the same as that for the nation. A LQ greater than 1.0 indicate an unusually high proportion of employment in the local economy while a location quotient less than 1.0 would suggest a disproportionately low share of employment, relative to the national norm or share. As shown below, the Green Bay region's employment base has relative strength in several industry sectors.

Table GRB-3: Major Traded Clusters in the Green Bay Area 2018

Cluster (2018)	Jobs	LQ
Transportation	7,499	3.46
Insurance	5,207	2.71
Paper and packaging	5,050	12.32
Livestock processing	3,911	6.17
Printing services	2,871	5.22
Performing Arts	938	2.01
Furniture	859	2.14

Source: U.S. Cluster Mapping Project https://www.clustermapping.us/
Note: LQ - Location Quotient

Overview of the Airport and Its Air Service

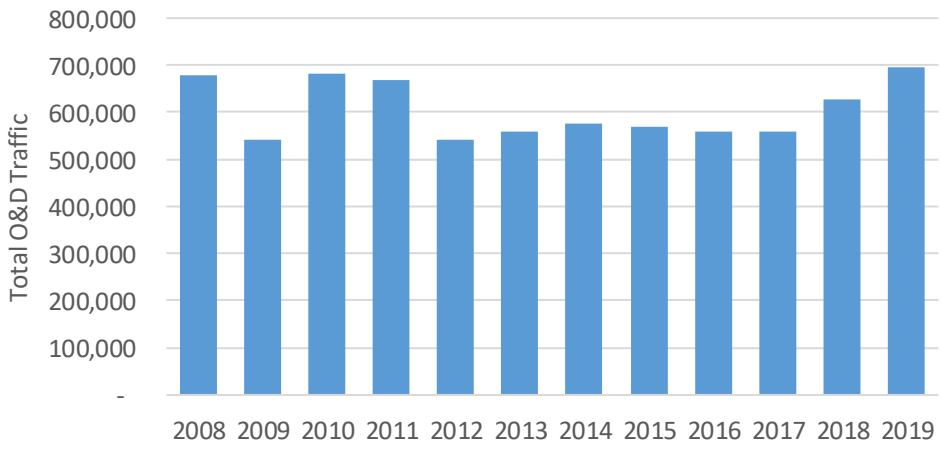
GRB is located 8 miles west of the City of Green Bay. The airport is owned and operated by Brown County, of which Green Bay is the county seat. GRB has two runways, with a primary runway of 8,700 feet in length and a secondary runway of 7,700 feet in length.

GRB shares the Northeast Wisconsin air travel market with several other airports. A study done for the airport in 2019 estimated that the air service catchment area generated 1.2 million Origin and Destination (O&D) passengers. GRB captured 16 percent of that traffic. Located 33 miles southwest of GRB, Appleton

International Airport (ATW), captured 12 percent of the market. Milwaukee Mitchell International Airport (MKE), 127 miles away, captured over 23 percent. Chicago's O'Hare International Airport (ORD), 194 miles away, captured almost 40 percent of the traffic. Other airports in Wisconsin, Illinois and Minnesota get the remainder.

GRB was the 4th busiest commercial service airport in Wisconsin in 2019, with a passenger enplanement level of nearly 350,000. Air passenger traffic at GRB has been steady over the past 20 years, ranging just above or just below 600,000 origin and destination ("O&D") passengers, see Figure GRB-4. In 2019, GRB recorded a total of just under 700,000 total O&D passengers, an increase of nearly 25 percent over 2017.

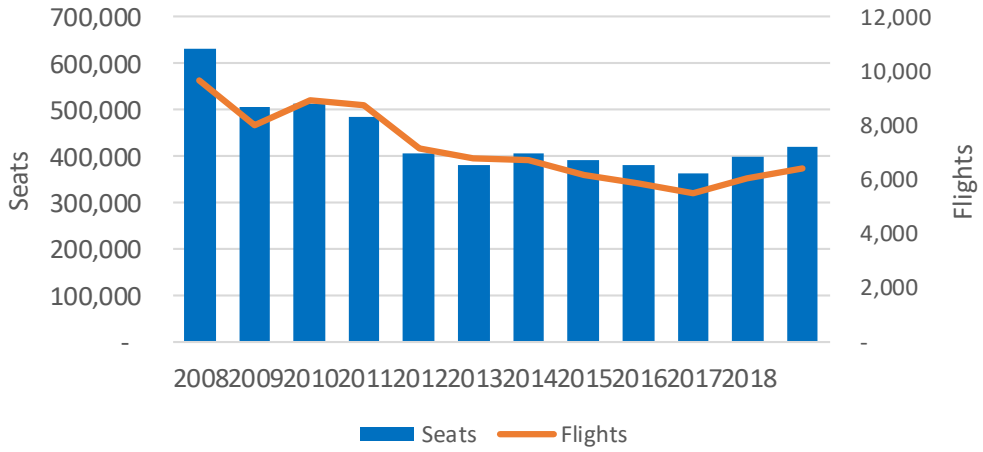
Figure GRB-4: Changes in GRB O&D Traffic 2008-2019



Source: Diio by Cirium

The combination of relatively modest market size growth, airline industry, and the proximity of alternative airports has resulted in an overall decline in capacity offered at GRB, but with a modest amount of growth in airline seat capacity in the past few years. Figure GRB-5 indicates the service levels provided by air carriers at GRB from 2008 to 2019.

Figure GRB-5: Changes in Flights and Available Seat Capacity



In 2019, total departure capacity at GRB was 33 percent lower than in 2008. The primary cause of this decline was the consolidation of the airline industry and the resulting service reductions, especially to the network carriers' connecting hub airports. For example, the merger of Northwest Airlines and Delta Air Lines (Delta) in 2008 resulted in the significant downsizing of the Delta hub at Cincinnati (CVG). In 2019, Delta offered 220,000 outbound seats available for sale, a reduction of 34 percent from the seats that Delta and Northwest provided in 2008. Likewise, the merger of Continental Airlines and United Airlines (United) in 2012 resulted in the abandonment of United's hub at Cleveland (CLE) and the restructuring of its service patterns at United's global hub at Chicago O'Hare International Airport (ORD). In addition, the demise of Midwest Airlines in 2011 resulted in the loss of service (and about 40,000 annual seats) between GRB and its hub at Milwaukee (MKE). GRB lost all its nonstop flights to Cincinnati, Cleveland, and Milwaukee (over 1,900 flights total in 2008). Delta reduced flight operations to Detroit and Minneapolis/St. Paul, but eventually added service to Atlanta.

Since those mergers and consolidations, GRB's overall air service levels have been generally stable, with flights to multiple hubs by several of the major network carriers. In addition, Frontier initiated service at GRB in 2019, providing ultra-low-cost carrier service to Denver and Orlando. Table GRB-4 summarizes GRB's 2019 nonstop route offerings. Delta offered the majority of available outbound capacity in 2019. Delta served Atlanta, Detroit, and Minneapolis. American Airlines and United operated from GRB to Chicago O'Hare. Frontier operated to Denver and Orlando.

Table GRB-4: Share of Seat Capacity Offered 2019 (inbound + outbound)

Carrier	Seats	Share	Markets
American	172,976	22%	1
Delta	440,790	55%	3
United	152,851	19%	1
Frontier	33,016	4%	2
Total	**799,633**	**100%**	**6**

Source: T-100 data, Diio
Note: Total markets reflect unique airports. Both American and United operate from GRB to Chicago O'Hare International Airport.

By contrast, total available capacity grew at nearby Appleton Airport, increasing between 2008 and 2019 by 18 percent. As at GRB, ATW lost service to Cincinnati and Milwaukee due to industry consolidation. It gained service to Denver on United. American entered the market with competing service to ORD, and Allegiant offered services in 2019 to five leisure destinations. Allegiant had operated from GRB to two of those destinations in 2008 but moved the flights to ATW. In total, carriers offered slightly over 100,000 more available seats from ATW in 2019 than from GRB, almost all of which is accounted for by ATW's Allegiant services. The availability of capacity to major network hubs is comparable.

Connectivity

High quality transportation – of all modes – is a prerequisite for sustained economic growth and competitiveness for a region. Specifically, these factors of economic development are driven by productivity growth, which is underpinned by trade, foreign investment, and innovative activity – all of which are facilitated by connectivity. "Connectivity" generally means the ability to reach a wide range of places in a short amount of time. Connectivity is not simply a matter of the number of routes or number of frequencies operated. Connectivity is fundamentally about access to markets and regions.

GRB is not the only commercial airport serving the region, as noted, and therefore is not the only source of air connectivity; however, changes in connectivity out of GRB can have notable impacts on how quickly and conveniently the immediate area, particularly the City of Green Bay, can be accessed.

Connectivity can be quantitatively measured in a variety of ways; the figure below summarizes the growth in connectivity at GRB between 2008 and 2019 using a method developed by the International Air Transport Association (IATA). The IATA connectivity index estimates the quality of air service at an airport based on the degree of service to other airports with the largest and most diverse route networks, as a proxy for how accessible the local economy is to the rest of the world.[44]

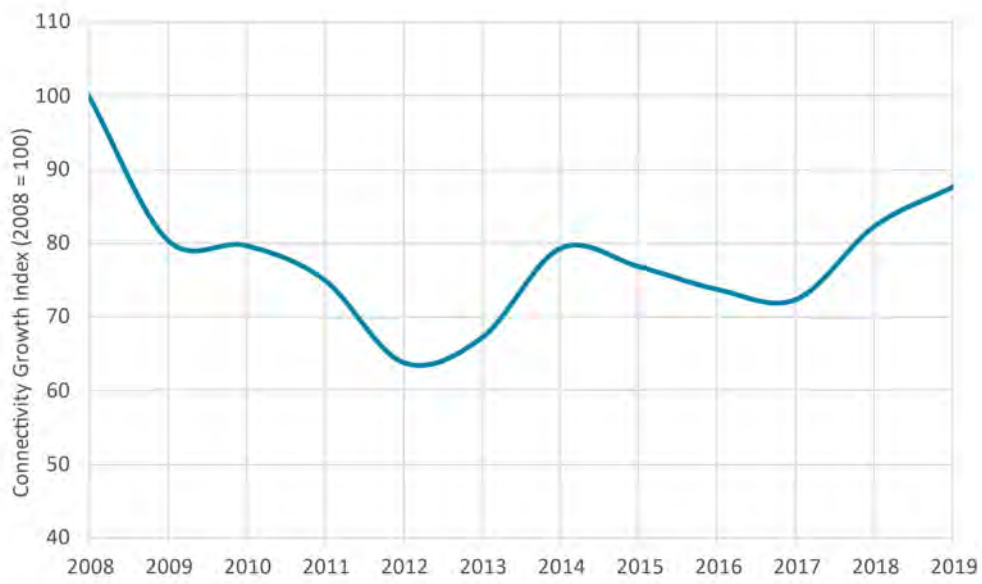
Changes in connectivity can be measured in a variety of ways. One is a method developed by the International Air Transport Association (IATA). The IATA connectivity index estimates the quality of air service at an airport based on the degree of service to other airports with the largest and most diverse route networks, as a proxy for how accessible the local economy is to the rest of the world. Service to airports with the highest total seat capacity (e.g. ATL) receive the highest weighting. Figure GRB-6 summarizes the formula for the IATA connectivity index. Using airline schedule data for passenger service, the index measures the number of frequencies and available seats to a particular destination. It then weights the number of available seats by the size of the destination airport (in terms of total capacity handled each year). This weighting reflects both the size and economic importance of the destination and the potential for convenient onward connections.

Figure GRB-6: IATA Connectivity Index Formula

$$\frac{\text{[Number of destinations x Weekly Frequency x Seats per flight]}\ \textit{Weighted by the Size of the Destination Airport}}{\text{Scalar factor of 1000}}$$

Figure GRB-7 summarizes the change in GRB's connectivity index or score against a baseline of 2008. It shows that connectivity at GRB was 12 percent lower in 2019 than 2008 levels. This is not as low as the decline in seat capacity (-33 percent), because GRB retained service to several key national hubs including ATL, ORD, MSP, and DTW. All else being equal, each additional seat to those airports will yield a higher level of connectivity than seats to smaller airports with fewer onward destinations and service. This is why, for instance, connectivity grew at its fastest rate 2012 and 2014 (+24 percent) even though total seat capacity remained relatively the same.[45] Between 2012 and 2014, GRB lost service to CLE and had reduced capacity to MSP and DTW, but gained service to ATL, thereby boosting connectivity out of GRB. In more recent years, expanded capacity to ORD as well as the reintroduction of service to DEN have improved GRB's connectivity. Overall, from the worst of the post-Great Recession downturn in 2012, GRB's connectivity rebounded 22 points.

Figure GRB-7: GRB Connectivity Growth Index (2008=100)

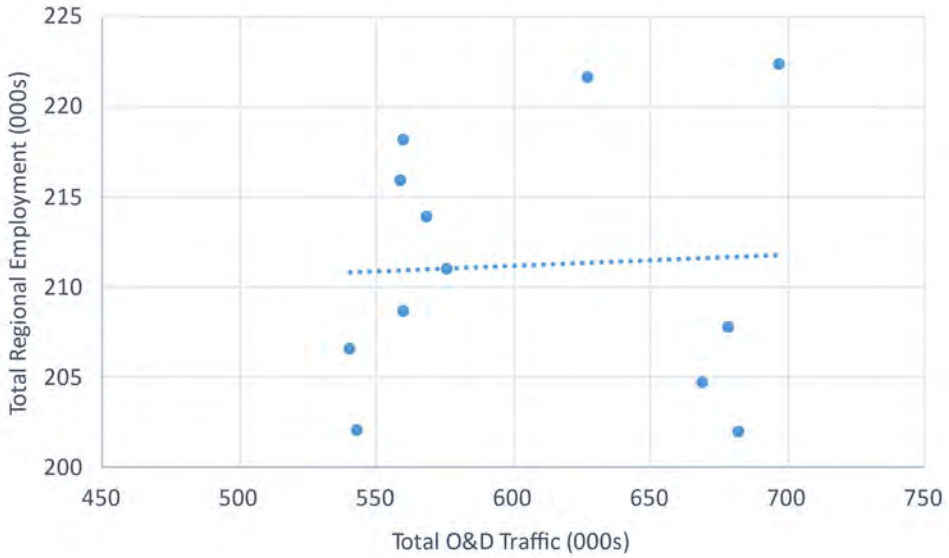


Note: Chart shows the IATA Connectivity Index for GRB, indexed against 2008 (2008 = 100).
Source: Inter*VISTAS* analysis of Innovata schedule data from Diio Mi.

Analysis: Changes in Air Service and Economic Activity

GRB's O&D traffic is not correlated with total local employment. Figure GRB-8 summarizes the relationship between total O&D traffic and regional employment. The correlation coefficient is 0.05, effectively indicating no relationship between the two. Changes in one variable do not appear to be associated with changes in the other. That is, the total amount of O&D traffic at the airport does not appear to be related to total regional employment.

Figure GRB-8: Relationship between O&D Traffic and Regional Employment



A similar absence of relationship exists between total O&D traffic at GRB and the region's overall population levels. Changes in the population base have not apparently translated into changes in traffic at the airport.

Air Service Goals Tied to Business Activity

While recognizing the importance of the access to connecting hubs currently provided by the incumbent carriers, GRB's air service development program is seeking additional hub services and point-to-point leisure services via a grant from the U.S. Department of Transportation's Small Community Air Service Development Program (SCASDP). The grant would be used to support service to Dallas on either American or Southwest. These efforts are being undertaken in cooperation with the regional Chambers of Commerce and other economic development organizations. Letters of support attached to the application cite the importance of business connections to the Dallas region and improved connectivity on both airlines' networks, including access to Latin America.

A major stakeholder in the community is the Greater Green Bay Chamber of Commerce, has an arm devoted to economic development. The Chamber's strategic plan has 11 initiatives that are geared towards supporting economic development for the Greater Green Bay area, with one focused on enhancing transportation access and connectivity. The Chamber discussed the importance of transportation access and connectivity, given that the region is very adept at manufacturing products, thus the need to have strong transportation linkages to move product to market.

From the perspective of foreign direct investment, Canada and Italy are the top two countries with investment in the Greater Green Bay area. The firms that have located to the area cut across several different industries, including manufacturing, paper products, food processing, and ship building. These companies view the area as a prime location in which to build supply chain redundancy for their operations. Italy is a country of focus for the Chamber in which to further attract businesses to the Green Bay area, given that there is already a base of companies upon which to continue to build connectivity.

Communicating the Airport's Economic Impact

The Wisconsin Department of Transportation ("WDOT") performed an economic impact study of the commercial service airports in the State in 2017. GRB was estimated to generate $242.9 million in economic output in Brown County. The study estimated that the airport generated 1,633 jobs, with $68.8 million in labor income in Brown County. However, the true economic impact of commercial aviation extends beyond the airport boundaries, as aviation is a critical element of the economic activity of multiple industry sectors.

The Chamber of Commerce's Strategic Plan includes similar metrics to track the effectiveness of the plan's implementation, as seen in Table GRB-5.[46]

Table GRB-5: Greater Green Bay Chamber, Economic Development Strategic Plan Metrics

Metric	Explanation
Employment growth	Increase the number of jobs from existing and new employers
High-wage employment growth	Increase the number of jobs that pay above area median and/or above the median wage within the industry
Capital investment	Attract a higher level of new investment from new and existing companies, real estate developers, and other investors
Business startups	Increase the number of new businesses created locally and startups attracted from outside of the region
Business recruitment	Attract business expansion and/or relocation projects from outside of the community
Educational attainment	Increase the share of adult population with bachelor's degrees
Tax base growth	Expand the local property tax and sales base for Brown County and for local municipalities

Piedmont Triad International Airport: Expanding Traffic in the Shadow of Larger Regions

The Piedmont Triad Region (the Region or the Triad) in north central North Carolina encompasses twelve counties and is anchored by three cities: Greensboro, Winston-Salem, and High Point. That area's Combined Statistical Area (CSA) is the 33rd largest in the country. Greensboro, with a 2019 estimated population of nearly 300,000, is the largest of the three cities. The region's economy has long been oriented around transportation, as railroads developed in the area before the Civil War to link central North Carolina to points west and south. It is also a region with a concentration of manufacturing.

Home to approximately 1.7 million, the Region is served by Piedmont Triad International Airport (GSO or the airport). To the south is the larger Greater Charlotte area, home of nearly 2.8 million and the location of one of American Airlines' hubs at Charlotte Douglas International Airport (CLT). To the east is the Raleigh-Durham area with a population of about 2.1 million and home of the state's capital and the Research Triangle Park, served by Raleigh-Durham International Airport (RDU). GSO is the third largest airport in North Carolina after CLT and RDU in terms of passenger traffic, shown in Figure GSO-1.

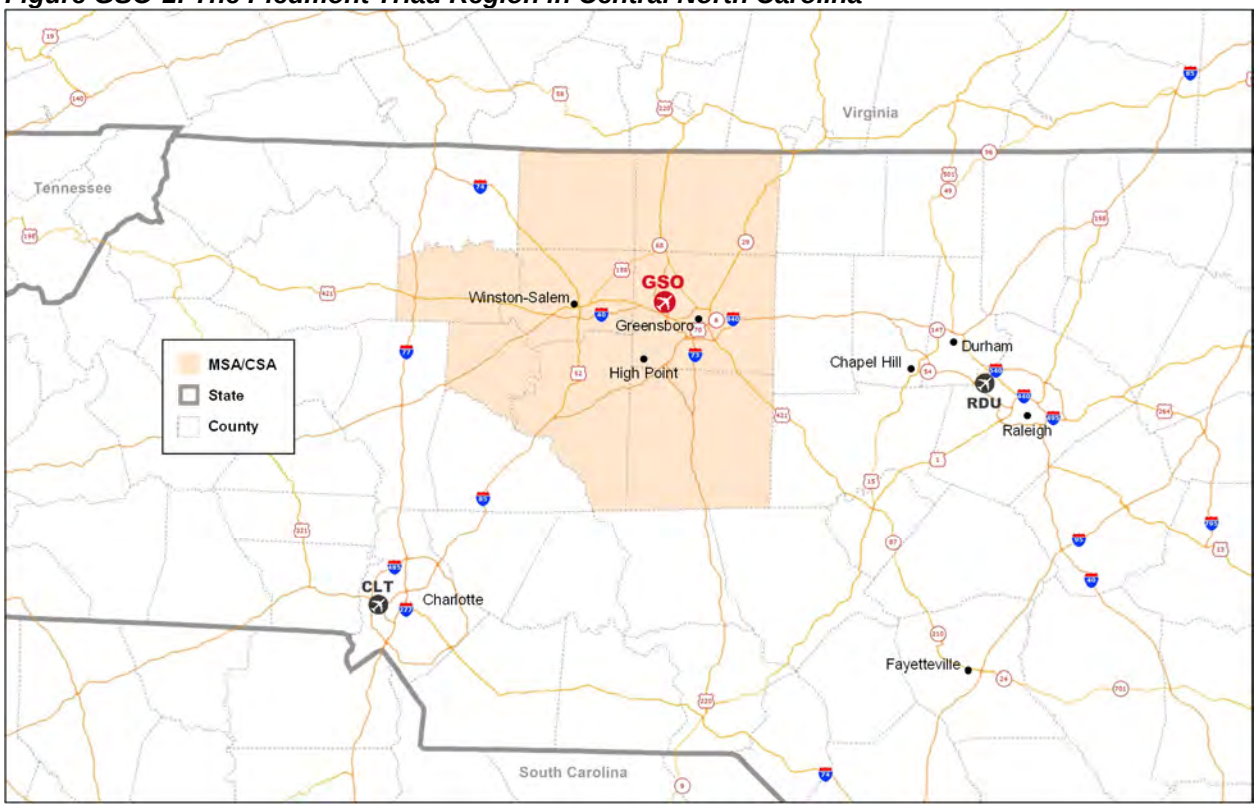
The region is included as a case study to demonstrate how shadow airports competing for market share of passenger traffic can still achieve economic growth and contribute to regional economic objectives such as growing and developing the workforce.

Introduction to the Region and Its Economy

The Region's economy has changed significantly over time. As recently as the middle of the 1900s, the region's economy was centered largely on tobacco, textiles, and furniture. Since then, it has evolved to a blend of trade, manufacturing and service businesses as well as its universities and colleges. Local industry is characterized by the production of a wide range of products, including aircraft, machinery, electronics equipment, textiles, apparel and tobacco, and expansion in the aircraft maintenance, transportation and financial services industries.

The continued evolution of the region's economy is marked by the presence of a wide variety of specialized business sectors including aerospace and aviation, automotive and heavy truck manufacturing, biomedical and life sciences, tech and entrepreneurship, and logistics. Between 2014 and 2019, employment in the aerospace sector grew by 40%, while the automotive industry workforce increased by 30%. The region is positioning itself to test and service the next generation of technology in transportation, including electric unmanned aircraft, self-driving cars, electric freight trucks and hybrid-electric vertical takeoff and landing (eVTOL) aircraft.

Figure GSO-1: The Piedmont Triad Region in Central North Carolina



According to the U.S. Bureau of Economic Analysis (BEA), in 2019, the Greensboro-High Point MSA produced $44.5 billion in current-dollar total GDP. This ranked 74th among MSAs (out of 384 total). It represents a decline in the region's national ranking from 2009, when it ranked 65th among MSAs.[47] The Winston-Salem MSA is slightly smaller (2019 population 676,008, ranked 87th) and produced $36.2 billion in GDP in 2019.

The region's population and employment have grown moderately since 2008. Table GSO-1 summarizes the changes in key socio-economic characteristics for the period. As shown, from 2008 through 2019:

- Total population rose by nearly 125,000 (8 percent). By contrast, population for the state of North Carolina rose by 13 percent.

- Total employment increased by almost 60,000 (6 percent). For the state as a whole, total employment rose by 14 percent.

- Average per capita income (nominal dollars) rose from $35,300 to $44,700 (27 percent). Expressed in constant 2019 dollars, the increase was 4 percent. Per capita incomes for the state of North Carolina also rose by 27 percent in nominal dollars.

- The number of establishments operating in the region declined slightly. (The BEA uses data from the U.S. Census Bureau, which defines an establishment as "a single physical location at which business is conducted or services or industrial operations are performed. It is not necessarily identical with a company or enterprise, which may consist of one or more establishments. … Establishment counts represent the number of locations with paid employees any time during the year." The count excludes government establishments except for certain situations, such as state-

operated retail liquor stores, local government-owned/operated hospitals, and federally chartered credit unions.)

Table GSO-1: Change in Major Socio-Economic Variables, Triad Region 2008-2019

	2008	2015	2019	Change 2008-15		Change 2015-19		Change 2008-19	
				#	%	#	%	#	%
Population	1,565	1,637	1,689	72	5%	53	3%	124	8%
Total Employment	923	931	982	9	1%	50	5%	59	6%
Private Non-farm Employment	819	830	882	11	1%	52	6%	63	8%
Government Employment	94	91	90	(2)	-3%	(1)	-1%	(4)	-4%
Income per Capita ($)	$35,308	$40,186	$44,683	$4,878	14%	$4,497	11%	$9,375	27%
Number of Establishments	39	38	39	(2)	-4%	1	2%	(1)	-2%

Source: BEA, U.S. Census Bureau
Note: All figures in 1000s except for income per capita, which is shown in nominal dollars.

Regional Economic Strengths

The region has significant strength in economic activity relating to transportation. The Piedmont Triad is home to nearly 200 aerospace companies including Honda Aircraft, HAECO Americas, Cessna, North State Aviation, B/E Aerospace, Honda Aero and Federal Express.[48] Five of the top 60 companies on the Fortune 500 list have operations in the Greensboro area, including Proctor & Gamble, UPS, Federal Express, AT&T and UnitedHealth Group.

In addition to the aerospace and aviation-related industries, several major logistics operations are located in the Region. These include EPS Trucking, Old Dominion Freight, drayage companies, an Inland Port, Norfolk Southern Railroad and the Amazon Fulfillment Center in Kernersville, NC and three Amazon last-mile distribution facilities. In addition, Federal Express and UPS both have extensive operations in the area. FedEx operates its Mid-Atlantic hub at GSO and established a Ground "super hub" sorting and distribution center in nearby Kernersville. UPS's facilities employ over 2,000 people in the area.[49]

Changes in employment for all major NAICS sectors are summarized in Table GSO-2. The largest sectors by employment in 2019 were health care and manufacturing. Between 2008 and 2019, the sectors with the greatest growth were Transportation and Warehousing (25 percent) and Real Estate (23 percent). The Arts, Entertainment, and Recreation sector also grew by over 25 percent. Conversely, employment in Manufacturing and Construction fell. Employment figures in certain key sectors like Information, PST, and Management of Companies for 2008 were suppressed to protect confidentiality. However, employment estimates were available for 2015. Employment PST and Management of Companies increased, as did employment in the Health Care Sector.

Table GSO-2: Changes in Employment by Major Sector 2008-2019

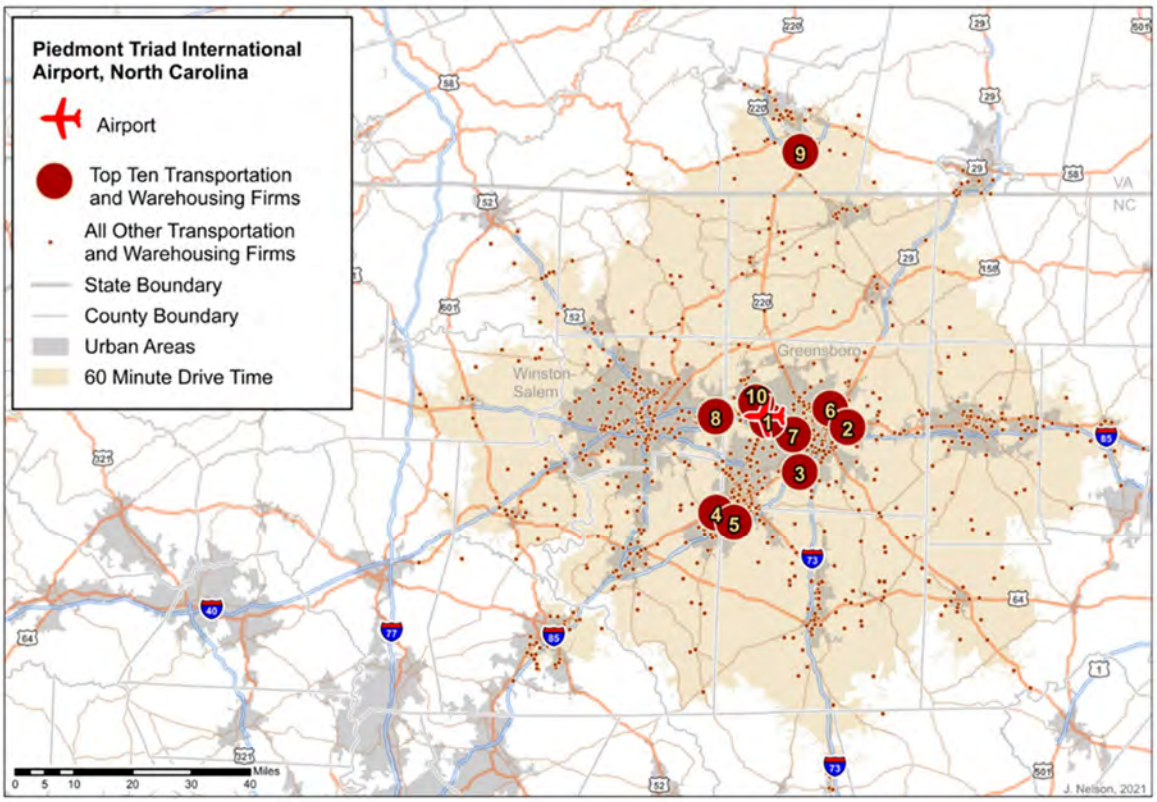
Industry Sector	2008	2015	2019	Change 2008-19	
				Number	Percent
Construction	59,336	47,709	56,842	(2,494)	-4%
Manufacturing	118,783	104,064	104,802	(13,981)	-12%
Wholesale trade	N/A	N/A	38,241	N/A	N/A
Retail trade	95,420	96,490	99,592	4,172	4%
Transportation and warehousing	34,417	N/A	43,076	8,659	25%
Information	N/A	10,055	9,996	N/A	N/A
Finance and insurance	44,487	42,914	48,419	3,932	9%
Real estate and rental and leasing	33,124	35,932	40,683	7,559	23%
Professional, scientific, and technical services	N/A	42,702	46,342	N/A	N/A
Management of companies and enterprises	N/A	16,543	17,077	N/A	N/A
Administrative services	67,652	78,416	78,023	10,371	15%
Educational services	N/A	26,854	24,172	N/A	N/A
Health care and social assistance	N/A	109,424	118,221	N/A	N/A
Arts, entertainment, and recreation	15,373	16,387	19,400	4,027	26%
Accommodation and food services	61,400	65,544	74,213	12,813	21%
Other services (except gov't and gov't enterprises)	51,044	56,463	56,978	5,934	12%
Total private nonfarm employment	818,717	829,688	882,105	63,388	8%
Government and government enterprises	93,852	91,439	90,160	(3,692)	-4%
Total employment	**922,589**	**931,428**	**981,923**	**59,334**	**6%**

Source: BEA

Note: N/A = Data suppressed to void disclosure of confidential information; estimates are included in higher-level totals. Farm employment not shown but included Total.

Figure GSO-2 illustrates a 60-minute drive time around GSO and the location of Transportation and Warehousing (T&W) businesses within that area. The largest are all within the urban area.

Figure GSO-2: Spatial Distribution of Transportation and Warehousing Firms (NAICS 48-49) in the GSO Airport One-Hour Drive Time Trade Area



Source: ESRI Business Analyst

Key highlights of socio-economic activity *within the 60-minute drive of the airport*:

- The total estimated 2019 population was 1.72 million. Of that, 1.06 million (61 percent) were considered "working age" (between the ages of 18 and 64).

- The economy supported over 59,000 businesses employing nearly 800,000. In terms of major industry sectors (defined by NAICS codes), the largest based on total employment was Manufacturing (110,000 employees) followed by Finance, Insurance, and Real Estate with over 42,000. The Transportation and Warehousing sector included over 1,100 businesses that employed nearly 19,000.

- Of the total population, 18.9 percent held a Bachelor's degree and another 10.2 percent held a Graduate or Professional degree.

Economic Clusters

The U.S. Cluster Mapping Project's analysis of the region also highlights its broad economic strength. The area's economy features multiple tradeable clusters that are among the top performers in the country, and several are of notable strength. Those include the traditional furniture and textile industry clusters as well as downstream chemical products and T&W.

- The Furniture Cluster includes subclusters of manufacturing of household and office furniture along with wood cabinets and woodworking. This includes metal, wood, upholstered and non-upholstered furniture. The region is ranked in the top ten nationally in this cluster. Its 2018 LQ was 5.83.

- The Textile Cluster includes subclusters of mills for knitting, fabric, yarn and thread as well as textile and fabric finishing, and household textile products. The region is ranked in the top ten nationally in this cluster. Its 2018 LQ was 12.25. A related cluster is Apparel. The region's 2018 LQ was 2.63.

- The Downstream Chemical Products cluster includes subclusters for personal care and cleaning products; dye, pigments, and coatings; and processed chemical products. The region is ranked in the top fifteen nationally. Its 2018 LQ was 3.42.

- Transportation and Warehousing includes the subclusters of trucking, ground transportation support activities, air transportation, and specialty air transportation (e.g., nonscheduled charter air transportation). The region is ranked in the top 50 nationally. Its 2018 LQ was 1.34.

Other traded clusters that the U.S. Cluster Mapping Project identifies as particularly strong for the region were Insurance Services and Printing Services.

Table GSO-3 shows the strongest traded sectors by total employment in 2018 along with employment in each in 2008. It indicates the changes in employment among these sectors. It reveals the continued decline in the traditional furniture and textile clusters with increasing activity in Business Services and Education.

Table GSO-3: Changes in Employment in Major Industry Clusters 2008-2018

Cluster Name	2008	2018	Change	
			Number	%
Business Services	18,918	22,371	3,453	18%
Distribution and Electronic Commerce	21,081	19,091	(1,990)	-9%
Furniture	11,579	7,412	(4,167)	-36%
Transportation and Logistics	6,276	6,671	395	6%
Textile Manufacturing	9,986	5,674	(4,312)	-43%
Insurance Services	4,947	5,058	111	2%
Plastics	5,099	4,672	(427)	-8%
Hospitality and Tourism	6,354	4,630	(1,724)	-27%
Education and Knowledge Creation	3,897	4,361	464	12%
Downstream Chemical Products	3,253	3,585	332	10%
Information Technology and Analytical Instruments	3,954	3,082	(872)	-22%
Automotive	2,864	2,915	51	2%
Printing Services	3,191	2,490	(701)	-22%
Marketing, Design, and Publishing	3,386	2,290	(1,096)	-32%
Financial Services	4,747	2,175	(2,572)	-54%

Source: U.S. Cluster Mapping Project data for the Greensboro-High Point Metropolitan Area.

Overview of the Airport and its Air Service

GSO is located in Guilford County, west of Greensboro. The Airport is owned and operated by the Piedmont Triad Airport Authority ("Authority"), established by the North Carolina legislature in 1942. Members of the Authority's Board of Directors are appointed by the governing bodies of the counties of

Guilford and Forsyth and the cities of Greensboro, High Point and Winston-Salem. Management of the Airport is the responsibility of the Executive Director.

The FAA classifies GSO as a small hub airport. In 2019, GSO was the 96th busiest airport in the country based on enplaned passengers.

The Catchment Area and the Shadow Cast by CLT and RDU

GSO generally defines its catchment area to include the 12 counties in north central North Carolina. However, it faces significant challenges in attracting and retaining passengers due to the region's proximity to other major airports nearby. The major drivers of consumers' air service decisions are price and service levels (e.g., flight frequency or timing, aircraft size, airline of preference, etc.) Consumers in the Triad thus can take advantage of flight opportunities not only at GSO but at the other two major competing airports.

As a result, GSO leaks traffic to RDU and CLT, for multiple reasons.

- Both RDU and CLT offer a larger number of destinations that can be served on a nonstop basis. Because CLT is a major hub for American, those destinations also include international points. In June 2019, CLT offered scheduled services to 42 international destinations. RDU also had flights to six international destinations.

- Both RDU and CLT have more offerings from low cost carriers, most notably Southwest and JetBlue, neither of which operate at GSO. In June 2019, Southwest scheduled daily flights from RDU to 15 destinations from RDU. JetBlue also operated daily flights to three locations. At CLT, Southwest made daily flights to five locations and JetBlue to two.

- Access to both airports is relatively fast and easy via interstate highways. Depending on a customer's location in the region, drive times can range from 1.5 hours to 2 hours or less to RDU or CLT.

To a less extent, Concord-Padgett Regional Airport north of Charlotte also draws passenger traffic from the area, because Allegiant Airlines operates from there to leisure destinations that it does not serve from GSO.

The airport recognizes that the level of service and presence of an airline at one, two or all three of the airports affects the scope of its catchment area. When GSO offers a unique service among the competing airports, the reach of the catchment area expands.

- If an airline offers service to a destination and operates at all three airports, then GSO's catchment area is only about 35 miles. This sweeps in the areas of Greensboro, High Point and Winston-Salem and their suburbs.

- If an airline operates a unique service at GSO (e.g., flights to a particular market), then the catchment area may be as wide as 60-75 miles. It includes small markets in southern Virginia.

Table GSO-4 summarizes the estimated percentage of passengers that the airport captures, among those who live within 35 miles of the airport (encompassing the three large cities in the region).

Table GSO-4: Percent of Triad Region Travelers Captured by Airport

Airport	Passengers	Share
GSO	371,448	37%
RDU	354,010	35%
CLT	257,865	26%
Other	20,117	2%
Total	**1,003,440**	**100%**

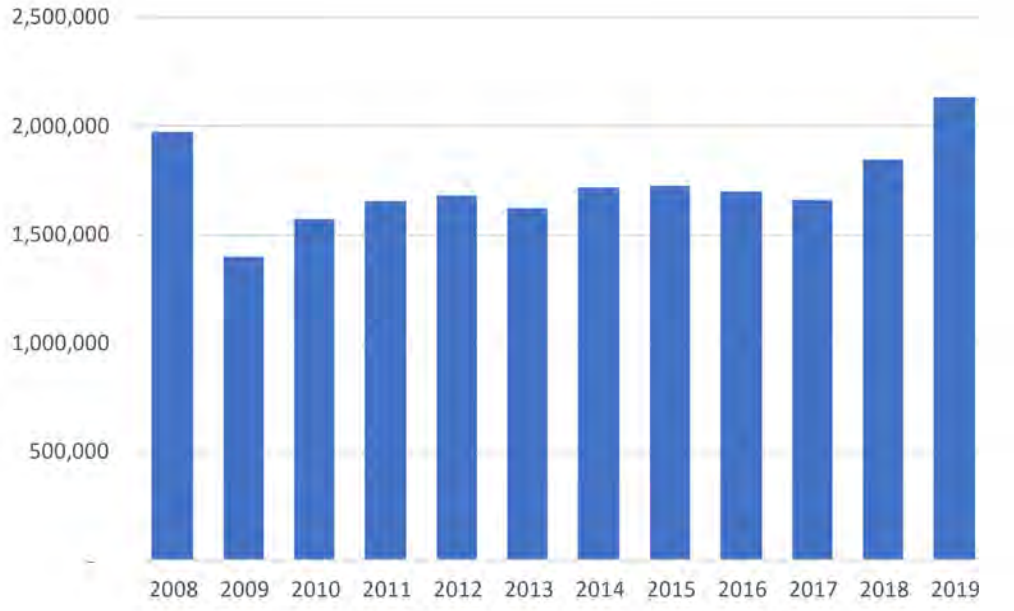
Source: GSO
Note: Only travelers within 35 miles of airport considered.

As a result, GSO leaks roughly two-thirds of its traffic to other airports. Slightly more of that leakage is lost to RDU.

Air Service Activity at GSO

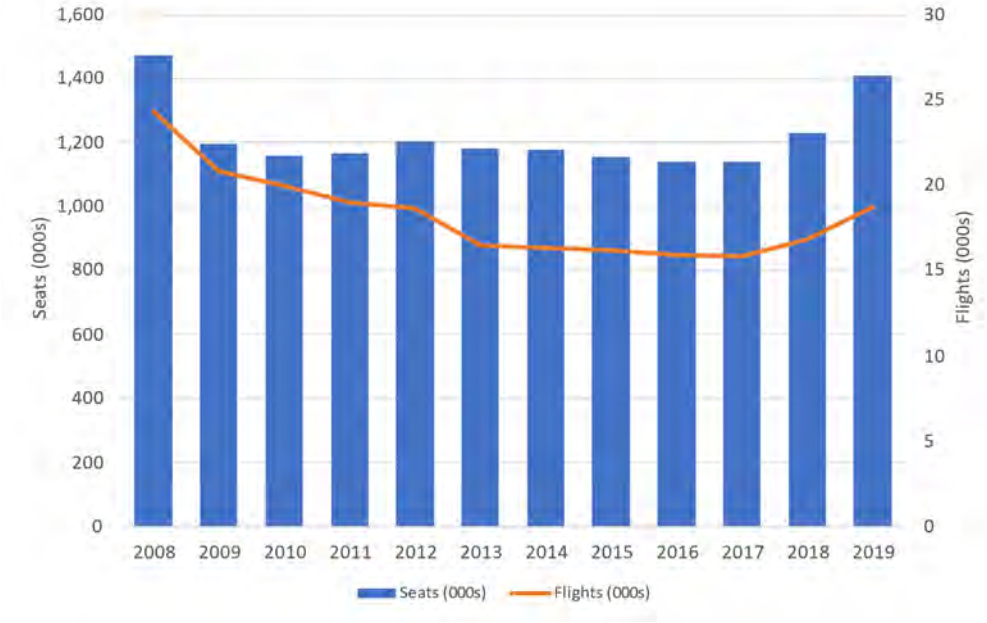
Passenger traffic at GSO is primarily customers originating at or destined for the region – Origin and Destination (O&D) traffic. At times in the airport's history, it has served as a "mini-hub" for different airlines. In the mid-1990s, GSO was a hub for Continental Lite, a subsidiary of Continental Airlines. That effort ceased operations in 1995. More recently, short-lived Skybus Airlines used GSO as a hub in 2007-2008, but the airline ceased operations in 2008. Consequently, virtually all of the airport's passenger activity is local rather than connecting. Figure GSO-3 shows the change in total O&D passenger traffic from 2008 to 2019. Since the drop in 2009, O&D traffic has generally recovered, rising from 1.4 million to 2.1 million (an increase of 52 percent).

Figure GSO-3: Change in O&D Passengers at GSO



The Airport has experienced a slow return of airline capacity to 2008 levels in the last 11 years. In 2019, the Airport nearly regained all the capacity that it had provided in 2008. Available capacity changed little between 2010 and 2017. Since then, capacity increased 24 percent, see Figure GSO-4.

Figure GSO-4: Changes in Available Seat Capacity and Flights 2008-2019



Source: T-100 data from Diio Mi by Cirium

Over the period, in response to significant financial losses tied to the Great Recession, U.S. airlines made changes to their fleets and network operations. This included changes in service to different hubs and a broad "up-gauge" of aircraft, especially serving smaller airports. At GSO, the airport lost service to what had been legacy network airline hubs at Cleveland, Memphis, and Minneapolis-St. Paul. In addition, average aircraft size rose 57 seats per departure in 2009 to 75 in 2019.

In 2019, Delta and American basically divided the GSO market, as can be seen in Table GSO-5. Delta was slightly larger based on seat departures, with 40 percent, but American carried 39 percent of the traffic and served seven destinations vs. three for Delta. United, Allegiant, and Spirit also operate at the airport, with United operating to its major hubs in Chicago, New York Newark, and Washington Dulles, while the two ULCCs serve leisure destinations in Florida.

Table GSO-5: Summary of Service Offerings at GSO 2019

Airline	Flights	Seats	% of Total	Markets *
Delta	5,190	543,808	40%	3
American	8,701	539,290	39%	7
United	3,548	180,500	13%	3
Spirit	437	68,841	5%	3
Allegiant	223	37,689	3%	2
Total	**18,098**	**1,370,128**	**100%**	**16**

Source: T-100 market data from Diio Mi by Cirium.
Note: * Total markets shown are unique airport destinations. Two carriers both serve LGA and ORD.

Cargo and Freight Activity at GSO

GSO is the largest cargo airport in North Carolina and the 35th largest cargo airport in the United States based on landed weight. In 2019, total landed cargo and freight weight at GSO exceeded that at CLT by almost 20 percent and at RDU by nearly 70 percent. Figure GSO-5 shows the change in total landed weights at the three major airports in North Carolina, comparing data for 2008 and 2019.

Figure GSO-5: Change in Total Landed Weight at North Carolina's Major Airports, 2008 v. 2019

Source: FAA

FedEx opened its mid-Atlantic hub at GSO in 2010 and fully stood up the operation in 2018. Today, FedEx occupies a one million square foot facility on the Airport. FedEx is a major regional employer with its operations at GSO and its ground facility in nearby Kernville, NC.

Air Service Development

The airport's air service development efforts resulted in returning capacity and passenger traffic to 2008 levels. Between 2008 and 2019, the Airport attracted but then lost a variety of air services. In many of these instances the loss of service was not necessarily due to a lack of regional market demand, but instead to broader economic or industry conditions, such as airline mergers and general consolidation.

Between 2008 and 2019 the Airport succeeded in expanding consumer choice by:

- Retaining and expanding the service from Allegiant,
- Attracting Spirit Airlines to the market in 2018,
- Retaining non-stop competition in the New York LaGuardia (LGA) market by convincing American to continue service to New York LaGuardia after its slot divestiture there. Delta also operates to LGA. United also serves the New York market from GSO by flying to New York Newark Liberty International Airport.
- Working with American to expand the number of nonstop destinations served from six to seven. American and US Airways had both served GSO in 2008.

The Airport's pre-pandemic goals for its passenger air service development program included adding new destinations and growing existing services. GSO's goals include:

- New non-stop markets where demand and leakage retention/recapture justifies the business case for service either to a new hub or another major market
- Attracting additional ULCC or LCC air carriers to expand consumer choice
- Focusing on reducing leakage and improving passenger retention

Connectivity

High quality transportation – of all modes – is a prerequisite for sustained economic growth and competitiveness for a region. Specifically, these factors of economic development are driven by productivity growth, which is underpinned by trade, foreign investment, and innovative activity – all of which are facilitated by connectivity. "Connectivity" generally means the ability to reach a wide range of places in a short amount of time. Connectivity is not simply a matter of the number of routes or number of frequencies operated. Connectivity is fundamentally about access to markets and regions.

GSO is not the only commercial airport serving the region, as noted, and therefore is not the only source of air connectivity; however, changes in connectivity at GSO affect how quickly and conveniently the immediate area can be accessed.

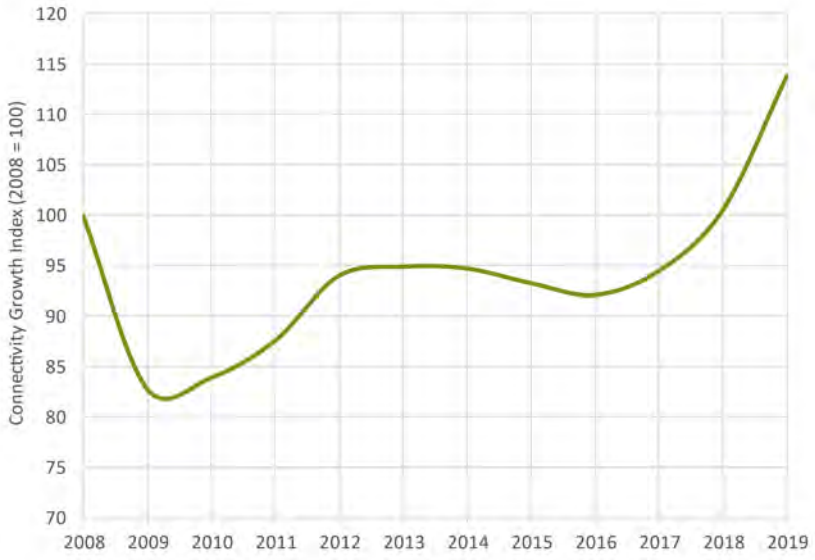
Changes in connectivity can be measured in a variety of ways. One is a method developed by the International Air Transport Association (IATA). The IATA connectivity index estimates the quality of air service at an airport based on the degree of service to other airports with the largest and most diverse route networks, as a proxy for how accessible the local economy is to the rest of the world. Service to airports with the highest total seat capacity (e.g., ATL) receives the highest weighting. Figure GSO-6 summarizes the formula for the IATA connectivity index. Using airline schedule data for passenger service, the index measures the number of frequencies and available seats to a particular destination. It then weights the number of available seats by the size of the destination airport (in terms of total capacity handled each year). This weighting reflects both the size and economic importance of the destination and the potential for convenient onward connections.

Figure GSO-6: IATA Connectivity Index Formula

$$\frac{[\text{ Number of destinations x Weekly Frequency x Seats per flight }]\ \textit{Weighted by the Size of the Destination Airport}}{\text{Scalar factor of 1000}}$$

Figure GSO-7 summarizes the change in connectivity at GSO against 2008 levels for comparison. Changing economic conditions along with airline mergers (DL/NW, UA/CO and AA/US) had a profound impact on consumer choice and connectivity at GSO, with reduced service suppressing connectivity below pre-Recession levels. However, connectivity at GSO has recovered slightly faster than overall seat capacity and passenger traffic. Connectivity returned to 2008 levels by 2018 and continued to grow, driven by expanded capacity to major national hubs like Atlanta (ATL), Chicago O'Hare (ORD), and Dallas/Ft. Worth (DFW). All else being equal, each additional seat serving these airports yields a higher level of connectivity than seats going to smaller airports with fewer onward destinations. By maintaining a diversity of service into several hubs and gradually rebuilding capacity, GSO has been able to recover its connectivity. As of 2019, GSO's connectivity was 14 percent higher than 2008 levels.

Figure GSO-7: GSO Connectivity Growth Index (2008=100)



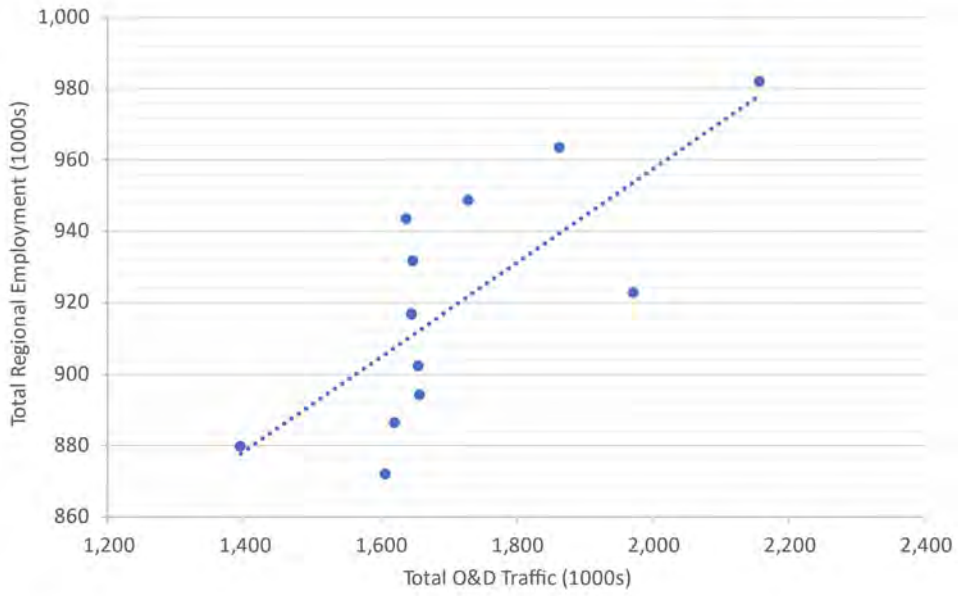
Note: Chart shows the IATA Connectivity Index for GSO, indexed against 2008 (2008 = 100).
Source: Inter*VISTAS* analysis of Innovata schedule data from Diio Mi by Cirium.

Analysis of Air Service and Economic Variables

In the Triad, passenger traffic is relatively highly correlated with total regional employment. This means that as one variable rises, so does the other. As total regional employment increases, total O&D traffic at GSO also increases. However, correlation does not demonstrate causation. It is not unambiguous that changes in employment necessarily lead to changes in O&D activity. The opposite could equally be true: changes in O&D traffic led to changes in regional employment. As shown in Figure GSO-8 below, the relationship between the two concepts is positive, and the strength of the statistical correlation ($R^2 = 0.747$) is relatively strong.[50]

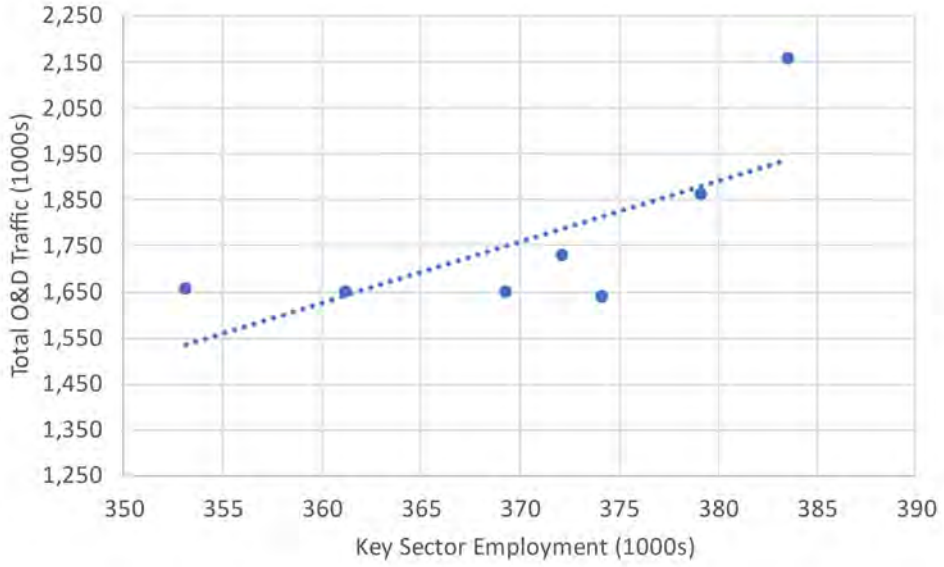
At the same time, readers should recall that much recent academic research shows that improvements in air service and connectivity in fact do lead to increases in employment and economic activity, especially in industry sectors that are reliant upon air transportation. This is discussed in greater length in the Guidebook.

Figure GSO-8: Relationship between Total Regional Employment and Total O&D Passenger Traffic



If the analysis is limited to employment in sectors that are more reliant upon air service, the strength of the correlation remains roughly the same. Figure GSO-9 illustrates the relationship between total O&D traffic and employment in the "aviation-reliant" sectors: Manufacturing; wholesaling; information technology; finance and insurance; real estate; professional, scientific, and technical services; administrative and support services; and management of companies. The correlation coefficient for the two variables here is 0.717.[51] As before, the correlation does not establish causation. Correlation does not mean that changes in employment necessarily lead to changes in O&D activity. The opposite could equally be true: changes in O&D traffic led to changes in aviation-reliant employment.

Figure GSO-9: Relationship between Total O&D Traffic and Aviation-Reliant Employment



Air Service Development and Regional Stakeholders

A former executive director at GSO believes that "…the airport is a reflection of the community."[52] With economic performance (e.g., jobs, job growth and economic output) as the primary consideration, air service patterns serve as a lagging indicator of economic growth.

Growing the pipeline of business on and adjacent to the airport is a goal of the airport in cooperation with its regional partners. Extensive interactions with its partners are a key to the airport's economic development initiatives. As a result, the airport's links to the community tie primarily to employment at and around the airport and the role the airport plays in economic development. The airport's value to the regional economy is measured first by regional employment levels and secondarily by the air service offered at GSO. In terms of air service, firms in the region with international parent companies will use CLT for quick access to international destinations. Yet many employees of businesses in the area choose to fly out of GSO due to its connectivity, convenience, and location.

One key regional stakeholder is the Piedmont Triad Partnership (PTP), whose primary objective is to promote prosperity, growth, and economic development in the region. In August 2018, the PTP launched a strategy named the "Carolina Core" -- a 120+ mile stretch of central North Carolina from west of Winston-Salem to Fayetteville encompassing Greensboro and High Point and in close proximity to Charlotte and the Research Triangle.[53] The region's assets include approximately 2 million people, over 30 post-secondary education institutions, as well as four "mega sites" (approximately 7,200 acres), industrial sites, research parks, and mixed-use developments. An objective of the Carolina Core initiative is to attract 50,000 new jobs to the region by 2038.

The PTP partners with the airport to support regional economic development initiatives. The PTP's sectors of interest include biomedical and life sciences, technology, transportation and logistics, and automotive manufacturers, all of which rely on air service offerings in the region for their travel needs. However, a major focus in the region is aviation and aerospace. As evidence of the commitment to growing the aerospace sector, PTP and other regional stakeholders funded a dedicated sales position to market the region to the aerospace industry. The regional partnership's efforts to support and expand high value sectors of the economy will drive greater demand for both passenger and cargo air services.

An aerospace-centered airport economic development strategy is built on the theme of "The Center of North Carolina Aerospace." In partnership with the Carolina Core initiative, GSO has positioned the airport as at the center of the North Carolina aerospace sector based on its success in attracting aerospace business to the airport, the presence of nearly 200 aerospace companies in the region, and GSO's vision for its 4,000-acre campus. Among the on-airport partners of the airport is the T.H. Davis Aviation Center of the Guilford Technical Community College, which has 600 students in technical fields that support the aerospace sector.[54] Aerospace workforce training programs at GSO directly benefit airport businesses.

GSO invested in the future of the regional economy with the GSO Aerospace "Mega site." Also known as the PTI Aerospace Center, the site has 1,000 acres of land ready for development, direct ground access to the interstate highway system, and a taxiway bridge offering access to the GSO airfield.[55] The investment in the site is a recognition of the value that the Airport contributes to facilitating economic development.

Communicating the Airport's Economic Impact

The State of North Carolina Department of Transportation, Division of Aviation contracted with North Carolina State University, Institute for Transportation Research and Education to conduct a state-wide study of economic contribution of North Carolina airports. The most recent report covered airport operations for 2019.[56] This study highlighted the following for GSO:

- 30,015 jobs
- $1,630,780,000 in Personal income
- $204,727,000 in State and local taxes
- $8,641,160,000 in Economic output

These figures represent the impacts of on-airport contributions (jobs, income and spending by tenants such as airlines, rental car companies and airport security), airport capital projects and operations (construction, facility maintenance and operational services), and visitor spending.

The airport uses the information from these economic impact studies in its communications with regional stakeholders, local, state and federal government officials, and with businesses it seeks to attract.

GSO and other airports used the information from the reports to persuade the State of North Carolina to revise the formula its uses to distribute aviation grants. The airports argued that the economic impact-based formula better represents the total economic value of the airport to the State of North Carolina.

Greater Miami: Growth in International Air Service and Related Economic Activity

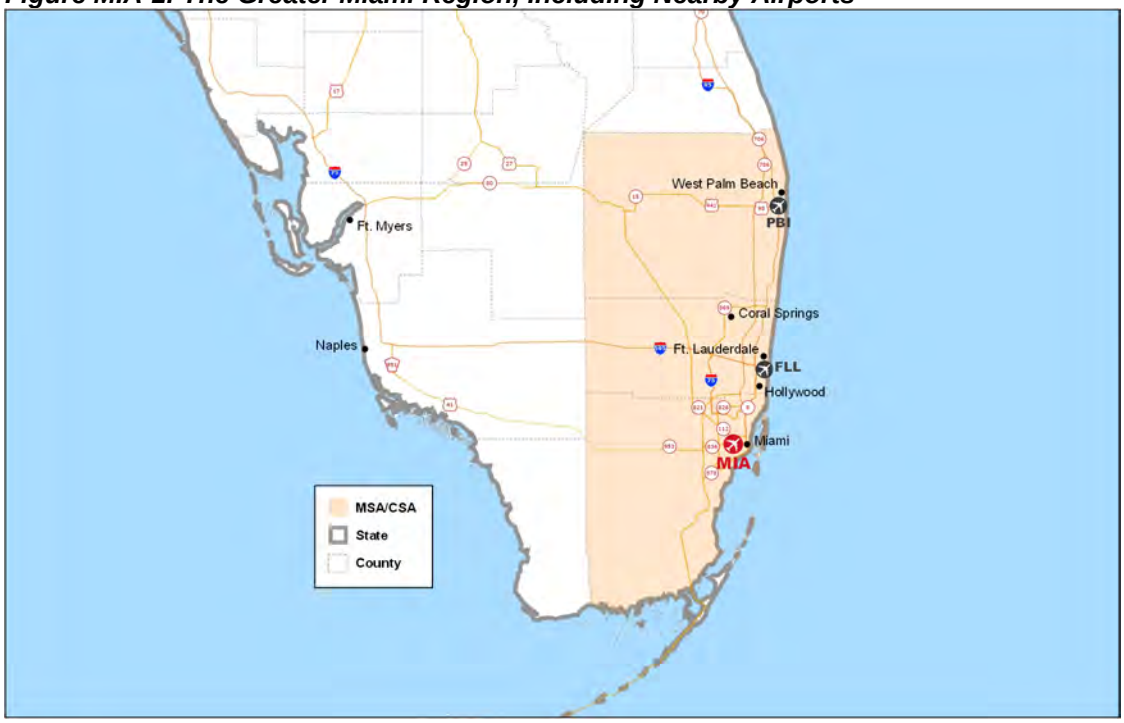
Like other large population centers in the U.S., the South Florida region around Miami is served by multiple general aviation airports and more than one commercial airport. The largest commercial facility is Miami International Airport (MIA or the Airport), a hub for American Airlines. Owned by the Miami-Dade County government and operated by the Miami-Dade Aviation Department, MIA offers more flights to Latin America and the Caribbean than any other U.S. airport. It is the country's third-busiest airport for international passengers and is the top U.S. airport for international freight.[57]

The Miami region, depicted in Figure MIA-1, is included as a case study because of its international operations and the related regional economic activity.

Introduction to the Region and its Economy

The Miami-Port St. Lucie-Fort Lauderdale Combined Statistical Area ("Greater Miami," "Metro Miami," the region or CSA) is the seventh-largest metropolitan area in the United States. The area includes Miami-Dade, Broward, and Palm Beach counties, which are the three most populous counties in Florida. Anchored by the City of Miami, other major cities in the area include Fort Lauderdale, West Palm Beach, and Boca Raton. Bounded on the west by the Everglades, the east by the Atlantic Ocean, and the south by the Florida Keys, the area is known collectively as the "Gold Coast."

Figure MIA-1: The Greater Miami Region, Including Nearby Airports



The region has undergone significant growth in population and employment since 2008. Table MIA-1 summarizes the changes in key socio-economic characteristics for the period. As shown, from 2008 through 2019:

- Total population rose by over 800,000 (13 percent). The population of the entire state of Florida rose slightly more, 16 percent.

- Total employment increased by more than 1 million (29 percent). By contrast, total Florida employment rose by 25 percent.

- Average per capita income (nominal dollars) rose from $44,700 to $61,500 (38 percent). This PCPI ranked 39th in the United States and was 109 percent of the national average, $56,490. The Miami area's per capita income also rose by more than the average for the state of Florida, which increased by 33 percent over the same time period.

- The number of establishments operating in the region grew. Between 2015 and 2019 alone, the establishment count increased by over 20,000 (9 percent). Data for 2008 were unavailable. (The BEA uses data from the U.S. Census Bureau, which defines an establishment as "a single physical location at which business is conducted or services or industrial operations are performed. It is not necessarily identical with a company or enterprise, which may consist of one or more establishments. … Establishment counts represent the number of locations with paid employees any time during the year." The count excludes government establishments except for certain situations, such as state-operated retail liquor stores, local government-owned/operated hospitals, and federally chartered credit unions.)

Table MIA-1: Change in Major Socio-Economic Variables, Greater Miami 2008-2019

	2008	2015	2019	2008-15		2015-19		2008-19	
				Chg	%	Chg	%	Chg	%
Population	6,081	6,646	6,890	565	9%	244	4%	809	13%
Total Employment	3,549	4,093	4,585	545	15%	492	12%	1,037	29%
Private Non-farm Employment	3,156	3,729	4,205	573	18%	476	13%	1,049	33%
Gov't Employment	377	350	365	(28)	-7%	15	4%	(12)	-3%
Income per Capita ($)	44,715	51,725	61,486	7,010	16%	9,761	19%	16,771	38%
Number of Establishments	#N/A	231	252	#N/A	#N/A	21	9%	#N/A	#N/A

Source: U.S. Bureau of Economic Analysis; U.S. Bureau of Labor Statistics.
Notes: All figures in '000s except for income per capita, which is shown in nominal dollars. Government employment includes military and civilian. Data may be unavailable for certain years.

From 1998 through 2019, the region's population grew faster than the U.S. average, increasing by 1.16 percent annually compared to 0.83 percent. According to the U.S. Bureau of Economic Analysis (BEA), in 2019, Greater Miami had the 7th largest population in the country. In 2019, Miami-Fort Lauderdale-Pompano Beach produced $377.5 billion in current-dollar total GDP. This GDP ranked 12th among the 384 total MSAs.

Employment growth in the region is especially noteworthy. According to data from the U.S. Cluster Mapping project, for the period 1998 – 2018, private non-agricultural employment growth in the region averaged 4.14 percent annually – the fastest growth in the country. The U.S. national average was 0.96 percent.[58]

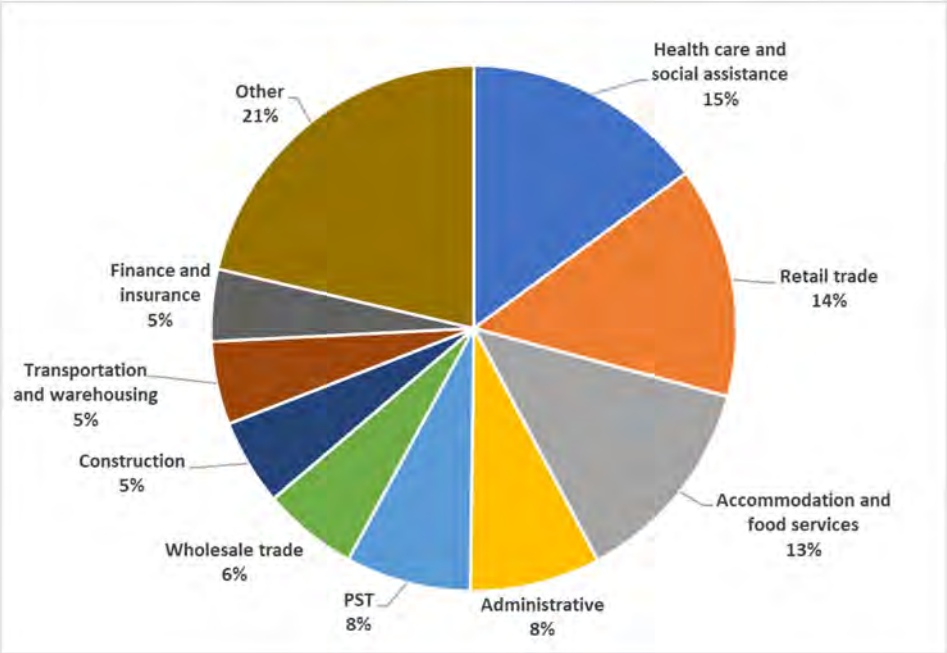
The region is a major center of higher education. Greater Miami is the home of the University of Miami, which had a total enrollment of nearly 18,000 in 2019-20. Other large colleges and universities in the area include Florida Atlantic University in Boca Raton (total enrollment of 37,000) and Florida International University (with an enrollment of around 50,000). Several other colleges and universities are located in the area.

A part percentage of the region's population is foreign-born. In Miami-Dade County, over half of the population is foreign born. For the three-county area, over 40 percent of the total population is foreign born.[59]

Regional Economic Strengths

Like many large urban areas, the region's economy is diversified. No single sector had more than 15 percent of the region's total employment. In 2019, the largest employment sectors were health care, retail, accommodations and food services, and administrative, as shown in Figure MIA-2.

Figure MIA-2: Distribution of MIA Employment by Industry Sector 2019



Source: BEA.
Note: The "Other" category covers 10 industrial sectors. "Administrative" includes comprises establishments performing routine support activities for the day-to-day operations of other organizations. The functions include office administration, hiring and placing of personnel, collection, security services, cleaning, and waste disposal services.

However, during the 2008-2019 period, there have been significant changes within the regional economy, seen in Table MIA-2, with several sectors showing growth at a pace much faster than the regional average. In particular:

- Management of companies rose by 25,000 jobs (80 percent)
- Employment in real estate-related industries rose by almost 150,000 jobs (68 percent)
- Finance and insurance increased by nearly 90,000 jobs (42 percent)
- Hospitality-related employment in accommodations and food service increased by 100,000 (39 percent)
- Professional, scientific, and technical services employment rose by nearly 100,000 (38 percent)

Table MIA-2: Change in Employment in Major Industrial Sectors 2008 to 2019

Sector	2008	2019	Change	Percent
Health care and social assistance	368,799	481,381	112,582	31%
Retail trade	383,999	440,571	56,572	15%
Administrative and support services	281,670	374,045	92,375	33%
Real estate and rental and leasing	216,212	363,507	147,295	68%
Accommodation and food services	259,493	359,697	100,204	39%
Other services (except gov't and gov't enterprises)	272,402	359,225	86,823	32%
Professional, scientific, and technical services	254,381	351,803	97,422	38%
Finance and insurance	208,501	295,157	86,656	42%
Transportation and warehousing	N/A	259,278	N/A	N/A
Construction	215,855	251,911	36,056	17%
Wholesale trade	N/A	181,427	N/A	N/A
Manufacturing	110,193	120,532	10,339	9%
Arts, entertainment, and recreation	81,634	105,252	23,618	29%
Educational services	76,954	99,691	22,737	30%
Information	65,337	70,552	5,215	8%
Management of companies and enterprises	31,903	57,315	25,412	80%
Subtotal Private Nonfarm Employment	3,155,831	4,204,757	1,048,926	33%
Public Sector Employment	377,483	364,986	(12,497)	-3%
Total Employment	**3,548,653**	**4,585,266**	**1,036,613**	**29%**

The strength of the regional economy is also reflected in large increases in the number of business establishments. For the Miami-Ft. Lauderdale-West Palm MSA, the total number of establishments increased by over 25,000 (14 percent). (Data were not available for the entire CSA.) Table MIA-3 summarizes the changes in the number of establishments between 2008 and 2019, sorted based on the sectors with the largest absolute amount of growth. Notably, businesses in the sectors with relatively high propensities to depend on commercial aviation – Professional, Scientific, and Technical Services along with Real Estate – had the largest growth.

Table MIA-3: Change in Establishments 2008-2019

Sector	2008-2019	%
Professional, scientific, and technical services	6,679	24%
Real estate and rental and leasing	3,618	36%
Health care and social assistance	3,120	16%
Accommodation and food services	2,591	24%
Construction	2,183	16%
Other services (except public administration)	1,811	13%
Transportation and warehousing	1,562	31%
Administrative	1,417	13%
Arts, entertainment, and recreation	776	30%
Educational services	742	38%
Retail trade	537	2%
Information	396	13%
Management of companies and enterprises	119	14%
Agriculture, forestry, fishing and hunting	91	53%
Industries not classified	85	45%
Finance and insurance	68	1%
Mining, quarrying, and oil and gas extraction	(16)	-30%
Wholesale trade	(357)	-2%
Manufacturing	(422)	-9%
Total	**25,114**	**14%**

Source: BEA
Note: Data for Miami-Fort Lauderdale-West Palm Beach, FL Metro Area only.

Economic Clusters

The U.S. Cluster Mapping Project's analysis of the Greater Miami region highlights its broad economic strength. A "cluster" is a concentration of related industries in a particular region. Clusters consist of companies, suppliers, and service providers, as well as government agencies and other institutions that provide specialized training and education, information, research, and technical support. *Traded clusters* are groups of related industries that serve markets beyond the region in which they are located and therefore require some form of transport connectivity. Examples include financial service or information technology. By contrast, *local clusters* consist of industries that serve the local market. Examples include local grocery stores or restaurants.[60]

The area's economy features multiple traded clusters that are among the top performers in the country. Those include Marketing, Apparel, and Performing Arts.

- The Marketing, Design, and Publishing Cluster includes advertising, design services, and other marketing services (e.g., media buying services, market research and polling, public relations) all of which are among the top ranked in the country. The sector had nearly 28,000 employed in 2018.

- Information Technology and Analytical Instruments includes software publishing, semiconductor manufacturing and machinery, and computer and peripherals manufacturing. The region's LQ for this sector was 3.52.

Table MIA-4 shows the strongest traded clusters by total employment in 2018 along with changes in employment in each since 2008. The largest growth occurred in the Business Services cluster, which increased by over 25,000 jobs (18 percent). The Transportation and Logistics cluster grew by the greatest

percentage (+16,000 jobs, or 43 percent). Others with notable increases were Information Technology (+2,900 or 32 percent), and Marketing, Design, and Publishing (+3,600 or 15 percent). Conversely, total employment dropped from 2008 to 2018 in Financial Services (-10,000 or 24 percent).

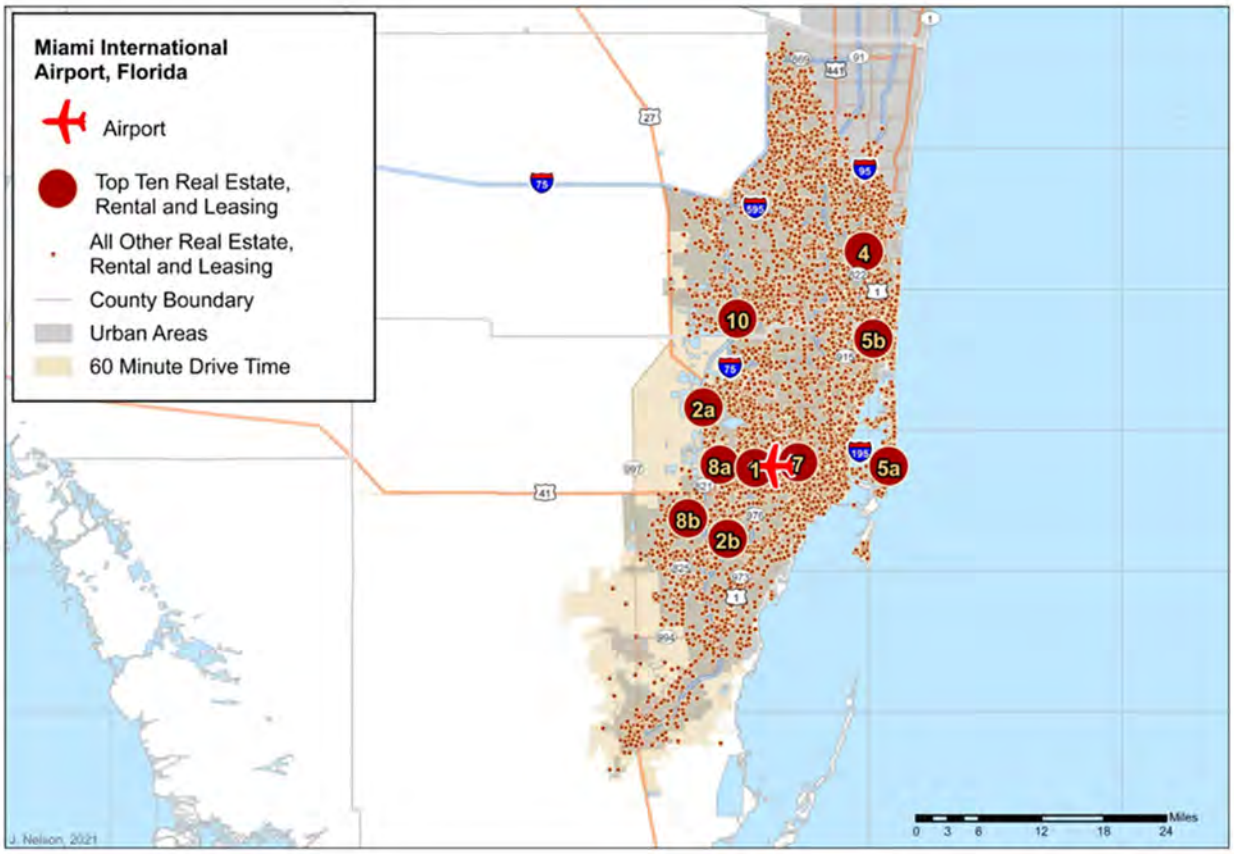
Table MIA-4: Changes in Employment in Major Industry Sectors 2008-2018

Cluster Name	2008	2018	Change	
			Number	Percent
Business Services	142,754	168,235	25,481	18%
Distribution and Electronic Commerce	117,746	123,462	5,716	5%
Hospitality and Tourism	85,591	89,111	3,520	4%
Transportation and Logistics	38,384	54,782	16,398	43%
Education and Knowledge Creation	39,482	48,077	8,595	22%
Financial Services	44,081	33,687	(10,394)	-24%
Marketing, Design, and Publishing	24,244	27,856	3,612	15%
Insurance Services	18,917	21,911	2,994	16%
Water Transportation	17,851	18,102	251	1%
Information Technology and Analytical Instruments	9,128	12,068	2,940	32%
Communications Equipment and Services	7,883	9,743	1,860	24%
Performing Arts	7,005	8,854	1,849	26%
Food Processing and Manufacturing	6,037	6,524	487	8%
Construction Products and Services	6,436	6,236	(200)	-3%
Printing Services	7,392	5,537	(1,855)	-25%

Source: U.S. Cluster Mapping Project (http://clustermapping.us/), Institute for Strategy and Competitiveness, Harvard Business School. Data Sources (http://clustermapping.us/content/data-sources-and-limitations)

Another insight into regional employment is available by examining changes in population and economic activity within a given drive time from the airport. Figure MIA-3 illustrates a 60-minute drive time around AUS and the location of T&W businesses within that area. The largest are all within the urban area.

Figure MIA-3: Spatial Distribution of Real Estate, Rental and Leasing Firms (NAICS 53) in the MIA Airport One-Hour Drive Time Trade Area



Key highlights of socio-economic activity *within the 60-minute drive of the airport*:

- The total estimated 2019 population was 4.16 million. Of that, 2.61 million (63 percent) were considered "working age" (between the ages of 18 and 64).

- The economy supported over 234,000 businesses employing over 1,800,000. In terms of major industry sectors (defined by NAICS codes), the largest based on total employment was Finance, Insurance and Real Estate (FIRE) (184,000 employees) followed by Professional, Scientific & Technical Services (PST) with over 168,000. Another 77,000 employees worked in the Manufacturing Sector, and 55,000 in Transportation and Warehousing.

- Of the total population, 19.7 percent held a Bachelor's degree and another 11.2 percent held a Graduate or Professional degree.

Foreign Direct Investment

The Miami-Dade area is home to approximately 1,300 multinational companies, of which over 500 firms are headquartered outside of the U.S. These companies cover over 50 nations in North America, South America, Caribbean, Asia, Europe and the Middle East. The top 10 countries cover over 70 percent of firms that are headquartered outside of the U.S., as follows in Table MIA-5. Data from BEA show that, for Florida as a whole, employment in multinational enterprises rose 40 percent from 2008 through 2018 (the latest available data), with the fastest growth in the PST and real estate sectors.

Table MIA-5: Number of Multinationals with HQ Outside of the U.S.

Rank	World Region	Country	# of firms	% Share
1	Europe	Spain	74	14%
2	Europe	United Kingdom	57	11%
3	Europe	France	42	8%
4	North America	Canada	35	7%
5	Europe	Netherlands	34	7%
6	Europe	Germany	33	6%
7	Europe	Switzerland	32	6%
8	Asia	Japan	26	5%
9	Europe	Italy	22	4%
10	South America	Brazil	19	4%
41 Other Countries			146	28%
Total			**520**	**100%**

Source: The Beacon Council.

Overview of the Airport and its Air Service

Owned by the Miami-Dade County government and operated by the Miami-Dade Aviation Department, MIA offers more flights to Latin America and the Caribbean than any other U.S. airport. Among U.S. airports for 2019, it is a "top ten" airport based on multiple metrics:

- 1st International Freight
- 3rd International Passengers (behind New York JFK and Los Angeles International)
- 3rd Total Cargo (Freight + Mail)
- 3rd Total Freight[61]

According to MIA's Comprehensive Annual Financial Report for 2019, MIA offered an extensive air service network, enhanced by multiple daily scheduled and non-scheduled flights covering over 160 cities on five continents. MIA's stronghold market, the Latin America / Caribbean region, was served by more passenger flights from the airport than from any other U.S. airport. MIA was Florida's busiest airport, and the premier international gateway to Florida, having handled nearly 60 percent of Florida's total international passenger traffic.[62]

MIA is a major transshipment point by air for the Americas. During calendar year 2018, the most recent year for which such information is available, the Airport handled 79 percent of all air imports and 77 percent of all air exports between the U.S. and the Latin American/Caribbean region. In 2015, IATA designated MIA as the first pharmaceuticals (pharma) freight hub in the U.S. and only the second in the world at that time. This certification brands the airport to pharmaceutical manufacturers as a trusted industry leader that transports their products in accordance with global best practices.

In 2018, MDAD gained final approval from the U.S. Department of Commerce to designate MIA as a Foreign Trade Zone (FTZ) magnet site. This will assist MIA to attract new types of business, increase trade, enhance air service development, and diversify the airport's revenue stream.

MIA is American Airline's (American) largest international hub operation, both for international passengers and international cargo. American accounted for approximately 60 percent of the enplaned passengers at the Airport during fiscal year 2019, and together with its affiliate, Envoy (previously known as American Eagle), approximately 67 percent of all enplaned passengers during such period. Table MIA-6 summarizes the share of MIA's enplaned passenger market for the major airlines in 2019.

Table MIA-6: Passenger Market Share by Carrier 2019

Marketing Airline	Total passenger enplanements (1,000s)	Percent
American Airlines	15,176	67%
Delta Air Lines	1,348	6%
United Airlines	632	3%
Swift Air	418	2%
Avianca Airlines	404	2%
TAM Linhas Aereas	354	2%
British Airways	335	1%
COPA Airlines	300	1%
Air Canada	199	1%
All others	3,520	16%
Total	**22,685**	**100%**

Source: MIA CAFR 2019 for fiscal year ending Sept. 30, 2019.

For the period 2008-2019, there are three major trends that have been occurring with MIA's passenger traffic.

- First, total passenger volumes have been increasing steadily over time. From 2008 through 2019, total passenger traffic increased by over 10 million (31 percent), rising from 32.5 million to 42.7 million.

- Second, much of that increase can be attributed to local rather than connecting traffic. Origin and destination (O&D) traffic increased by over 9 million for the period (48 percent). Of MIA's total traffic, the percentage represented by O&D traffic rose from 59 percent to 67 percent. This would seem to reflect changes in American's hub operations along with the growing strength of the local economy. Figure MIA-4 summarizes the changes in total and O&D traffic over the period.

- Third, the balance of MIA's passenger traffic has been shifting to become increasingly international over time, as shown in Figure MAI-5. In 2010, the ratio of MIA's domestic to international enplanements was 53:47. By 2019, it had become 51:49.

Figure MIA-4: Total Passenger Onboards and O&D Traffic at MIA, 2008-2019

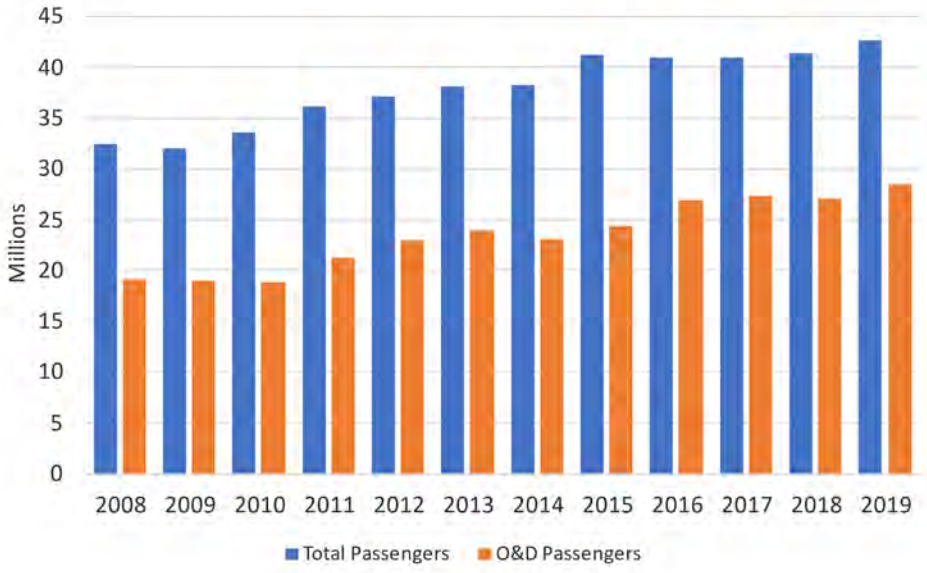
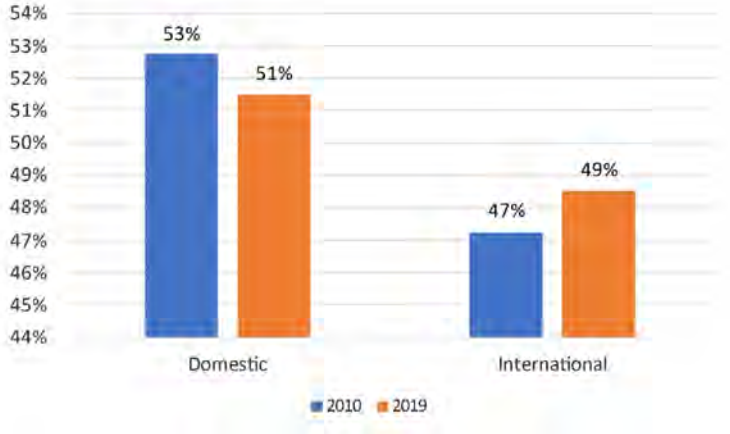


Figure MIA-5: Change in the Balance of MIA's Passenger Traffic Markets



Cargo Activities

MIA remains the number one airport in the U.S. for international freight. From 2010 through 2019, total cargo (mail and freight) tonnage rose 18 percent, from 2.0 million tons to 2.3 million tons.

In 2019, MIA was the 4th largest airport in the country in terms of total (domestic and international) cargo and freight landed weight, trailing only Memphis, Louisville, and Anchorage. In 2019, MIA accounted for 9.2 million lbs. of cargo and freight, an increase of 2.2 million lbs. (32 percent) over the 7.0 million lbs. handled in 2008.

Connectivity

"Connectivity" generally means the ability to reach a wide range of places in a short amount of time. Although connectivity is influenced by the magnitude of service, it is not only a matter of the number of routes or number of frequencies operated. Connectivity is fundamentally about access to markets and

regions. In this way, connectivity and the transportation infrastructure of a community are vital for its economic development because they enable productivity growth, particularly by facilitating improvements in trade, foreign investment, and innovative activity. For instance, a country or region that has continental and intercontinental linkages only to a limited number of destinations will be a costlier (and less desirable) place to do business, whereas a community with direct access to a broad range of markets – especially the fastest growing markets – will have a lower cost of doing business.

Changes in connectivity can be measured in a variety of ways. One is a method developed by the International Air Transport Association (IATA). The IATA connectivity index estimates the quality of air service at an airport based on the degree of service to other airports with the largest and most diverse route networks, as a proxy for how accessible the local economy is to the rest of the world. Service to airports with the highest total seat capacity (e.g., ATL) receives the highest weighting. Figure MIA-6 summarizes the formula for the IATA connectivity index. Using airline schedule data for passenger service, the index measures the number of frequencies and available seats to a particular destination. It then weights the number of available seats by the size of the destination airport (in terms of total capacity handled each year). This weighting reflects both the size and economic importance of the destination and the potential for convenient onward connections.

Figure MIA-6: IATA Connectivity Index Formula

$$\frac{[\text{ Number of destinations x Weekly Frequency x Seats per flight }]\ \textit{Weighted by the Size of the Destination Airport}}{\text{Scalar factor of 1000}}$$

MIA offers a particularly unique form of connectivity because it is the nation's international gateway to the Southern Hemisphere; MIA offers more flights to Latin America and the Caribbean than anywhere else in the U.S. Based on a method developed by the International Air Transport Association (IATA) for quantifying connectivity, MIA offers among the highest levels of international air connectivity in the world. Table MIA-7 shows that on the basis international service only (i.e., excluding domestic capacity), MIA ranked sixth in the U.S. (70th in the world) for international connectivity in 2019, behind only major airline hubs situated in the nation's largest population centers in New York (JFK, EWR), Los Angeles (LAX), Chicago (ORD), and San Francisco (SFO).

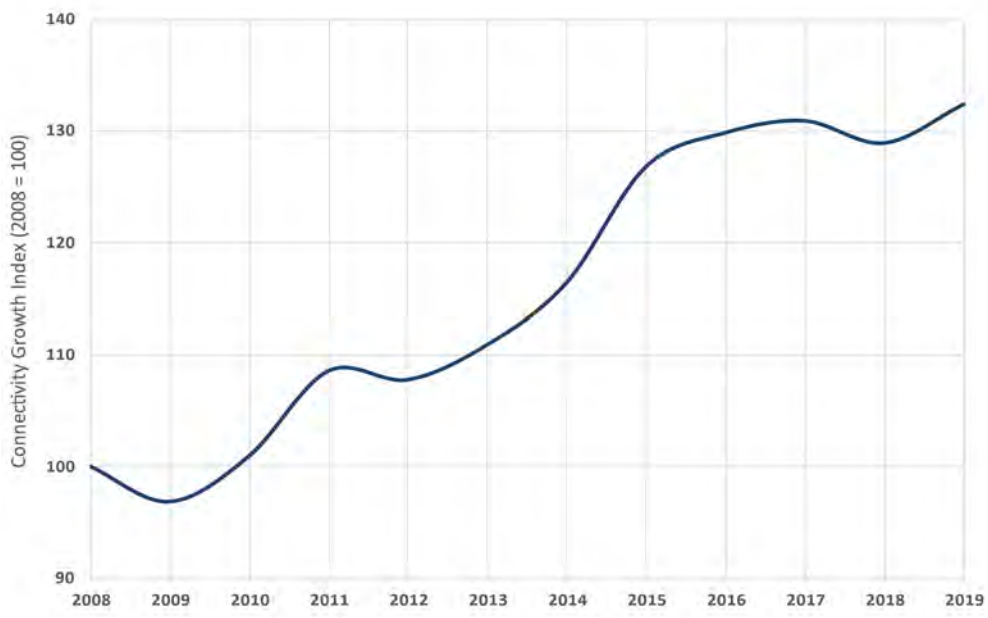
Table MIA-7: Top 10 U.S. Airports based on the IATA Connectivity Index, 2019 *International Service Only*

U.S. Airport Code	Airport Name	No. of Intl Destinations	Total Intl Seats (Millions)	Intl Connectivity Index	Intl Connectivity Global Rank
JFK	New York John F Kennedy Intl	131	21	139	14
LAX	Los Angeles Intl	91	15	100	29
SFO	San Francisco Intl	53	9	78	40
ORD	Chicago O'Hare Intl	76	8	62	57
EWR	Newark Liberty Intl	91	9	50	65
MIA	Miami Intl	115	13	46	70
IAD	Dulles Intl	60	5	43	80
ATL	Atlanta Hartsfield Jackson Intl	76	7	43	81
BOS	Boston Logan Intl	59	5	40	85
DFW	Dallas/Fort Worth Intl	66	6	35	97

Source: Inter*VISTAS* analysis of Innovata schedule data from Diio Mii.

Continued growth and improvement in connectivity can also facilitate sustained economic growth. As shown in Figure MIA-7 below, air service development at MIA has produced steady incremental growth in air connectivity in most years over the past decade. Between 2008 and 2019, connectivity at MIA (domestic and international) grew at an average rate of 2.6 percent per annum. The largest single-year gains in connectivity occurred in 2011 and 2015; in 2011, a significant number of new flights were added to several major hubs including New York John F. Kennedy International Airport and London Heathrow Airport, while 2015 saw the largest single-year increase in the number of destinations.

Figure MIA-7: MIA Connectivity Growth Index (2008=100)

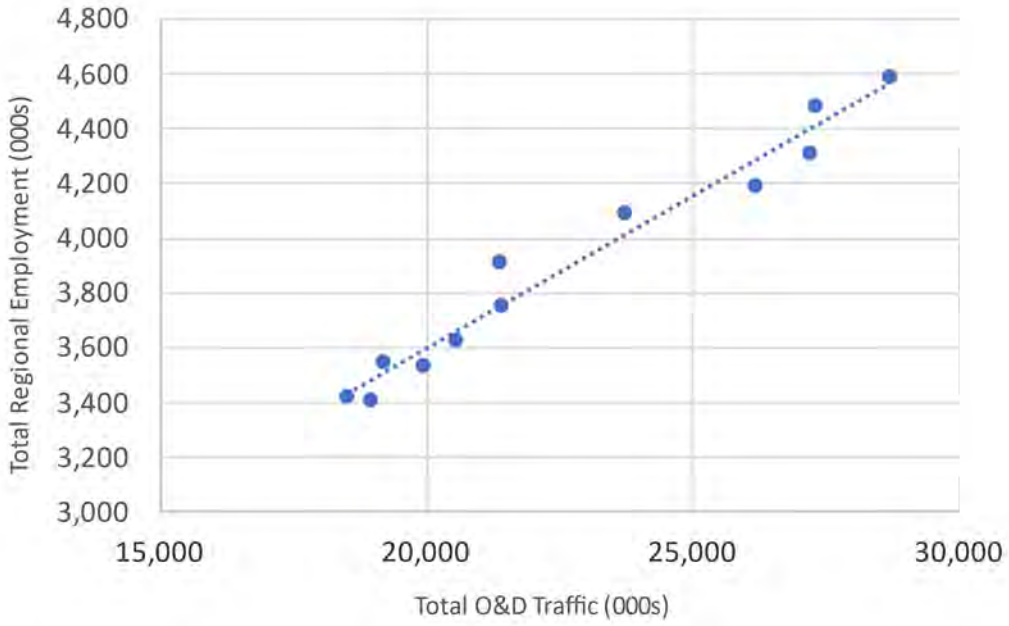


Source: Inter*VISTAS* analysis of Innovata schedule data from Diio Mii.
Note: Chart shows the IATA Connectivity Index for MIA, indexed against 2008 (2008 = 100).

Change in Air Service and Economic Activity

MIA's O&D traffic is highly correlated with total local employment. Figure MIA-8 summarizes how changes in total O&D traffic have aligned with changes in regional employment. The line indicates a strong positive relationship between the two. As total employment increases, total O&D increases. The correlation coefficient between the two is 0.98. However, correlation does not establish causation. That is, it is not evident whether rising total employment levels lead to more air traffic, or whether more air traffic leads to more total employment.

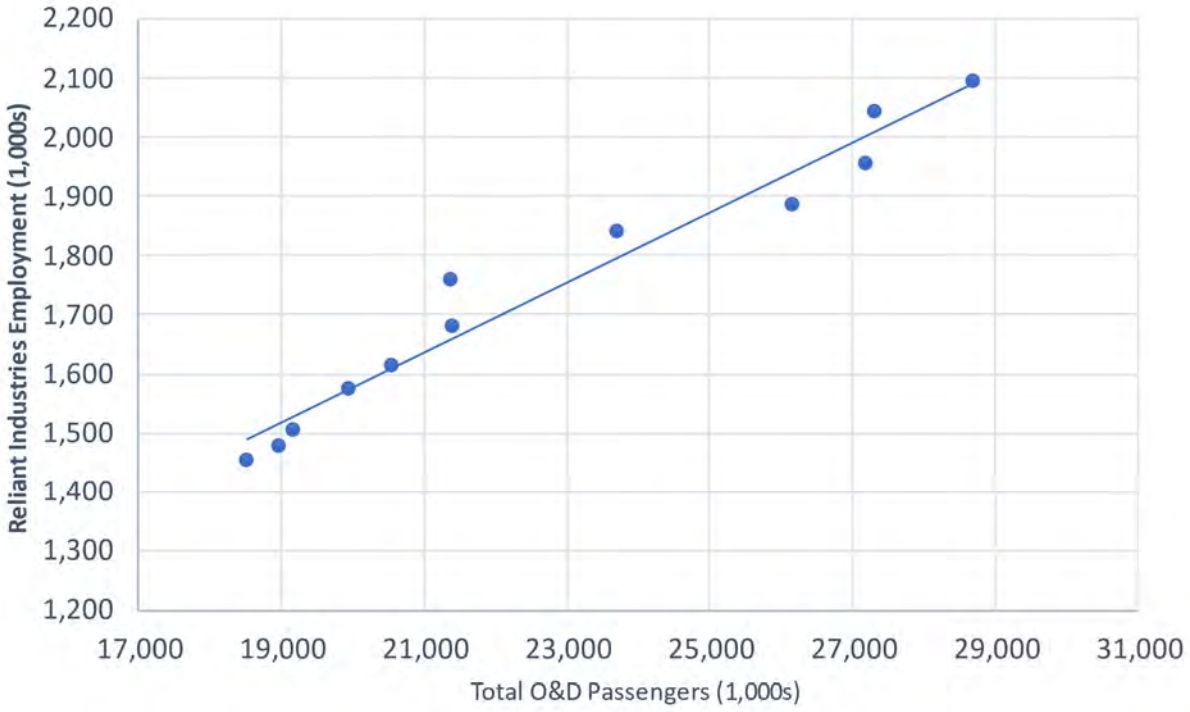
Figure MIA-8: Relationship between Total Regional Employment and Total O&D Traffic



If the analysis is limited to changes in total O&D passengers and employment in sectors that tend to be somewhat more "aviation-reliant," the correlation remains 0.98. Figure MIA-9 summarizes the relationship between O&D passenger traffic and employment in multiple sectors: Information Technology; FIRE; PST; Management of Companies; Administrative and support services; Educational services; and health care.

However, as discussed in greater detail in *ACRP Web-Only Document 53*, much recent academic research finds that increased air service does create new economic activity, and that connectivity is particularly critical to certain industry sectors with a greater reliance on air transportation, such as FIRE, PST, and Management of Companies. The growth of economic activity tied to foreign investment that followed increasing international air service also provides strong evidence of that linkage.

Figure MIA-9: Relationship between Total O&D Traffic and Regional Employment in Aviation-Reliant Sectors



Stakeholders Perspectives on Contributions of Air Service to Economic Development

The Greater Miami Chamber of Commerce mission is "To grow, improve and protect the Greater Miami Business Community by advocating, educating and convening." The Chamber's vision is "To be the champion for the Greater Miami Business Community in times of prosperity and hardship." The organization's membership represents businesses that employ more than 400,000 employees in the Miami-Dade County area.

The Chamber has had a close ongoing working relationship with the airport, working collaboratively and supporting each other to ensure the mutual benefit of air connectivity for the area's business community. The Chamber has a seat on all of the MIA's working committees to ensure that the voice of the business community is heard and present. The airport also continues to support the Chamber by actively participating in meetings, conferences, and webinars to actively convey a consistent message to the Chamber's membership. The Chamber further supports the area's business development through Foreign Trade Zone #32.

The Beacon Council is a public-private partnership that is the official economic development organization for Miami-Dade County. Their mission is to increase jobs and investment in Miami-Dade. The Beacon Council works in concert with the initiatives of the Greater Miami Chamber of Commerce to bring the area's economic development activities to fruition. The work of the Beacon Council focuses on seven target industries that have been identified as "high wage" and "high growth" industries for the area, as follows:

1. Aviation – the strength of the aviation industry is directly tied to the passenger and air cargo performance of MIA. MIA is one of the world's busiest passenger and air cargo hubs in the

U.S. for both domestic and international traffic. MIA is the busiest U.S. airport handling international freight.

2. Banking & Finance – Miami is known as the financial capital of Latin America. The community's strong ties to other geographies strengthen the bond.

3. Creative Design – home to a diverse creative community, the talent pool connects with customers in various languages (Spanish, Portuguese, French, Italian and other languages), air connectivity helps to maintain these important client relationships,

4. Hospitality & Tourism – known widely as a tourism destination for land, sea and air visitors.

5. Technology – the tech sector is thriving in the area, home to many entrepreneurial start-ups that cut across several different industry sectors. Professionals in the industry frequent the growing number of industry conferences and networking events that bring people together from around the world.

6. Life Sciences & Healthcare – global leaders in the biomedical, medical device and pharmaceutical sciences operate in Miami-Dade and with strategic connection to the University of Miami's Life Science Park.

7. Trade & Logistics – attracting global supply chain companies to take advantage of Miami's strategic location as a gateway to Latin America, which is supported by strong connections via air and sea.

Communicating the Airport's Economic Impact

The State of Florida's Department of Transportation issued an economic impact study covering the state's public airports in March 2019. That report relied upon a prior study of the economic impact of MIA based on airport operations for 2016. There has been no update published since then. The March 2019 report included only high-level summary metrics for MIA:

- $17.3 billion in on-airport impacts
- $13.0 billion in related visitor spending
- $2.9 billion in multiplier impacts
- $33.2 billion in total output
- 264,000 jobs
- $11.4 billion in total payroll.

The airport's website summarizes these figures, noting that MIA is the leading economic engine for Miami-Dade County and the state of Florida, generating business revenue of $31.9 billion annually and approximately 60 percent of all international visitors to Florida.[63]

Raleigh-Durham: Building on the Region's Strength in PST Industries

The Raleigh-Durham region in North Carolina is associated with the Research Triangle and a concentration of employment in science and technology. The area is bounded by the three tier-one research universities that are within 25 miles of each other. Because of those schools' presence, education, innovation, and a culture of collaboration are key drivers of the area's development. The primary "Triangle region" consists of Durham, Orange and Wake counties. The wider Research Triangle region encompasses a 13-county area.

Raleigh-Durham International Airport (RDU) is roughly midway between the two cities, straddling Durham and Wake counties. The second largest airport in terms of passenger traffic in North Carolina (behind Charlotte Douglas International Airport), it was the 37th busiest in 2019 based on enplaned passengers, with nearly 7 million.

The Research Triangle Park (RTP) is the largest research park in North America and remains one of the most successful science parks across the globe. Stretching 7,000 acres across Durham and Wake counties, the park is home to over 250 businesses, ranging from Fortune 100 multinational Research & Development (R&D) operations to entrepreneurial-driven start-ups.

With the RTP, state capital, and major universities anchoring the area, the region features exceptional economic activities in the Professional, Scientific and Technical Services (PST) sector. Industries in the PST sector are defined based on the particular expertise and training of the services provider and include services as legal, accounting, architectural, engineering, and scientific research.

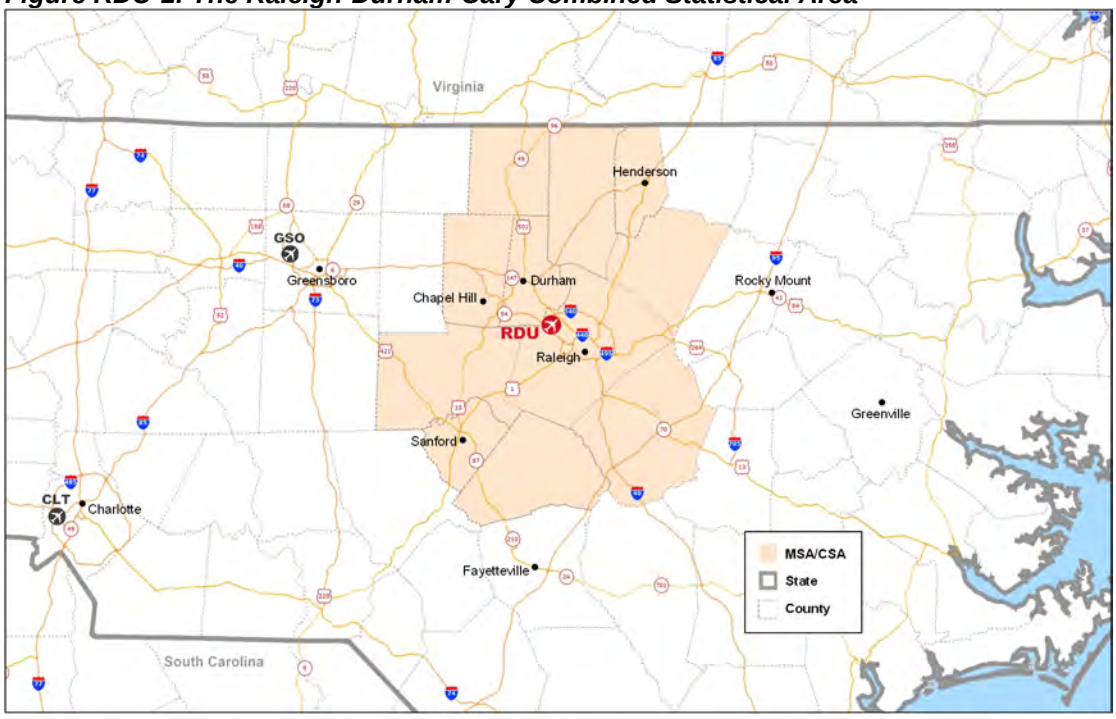
This region is included as a case study to illustrate the relation between growth in air service and increases in PST-related economic activity.

Introduction to Metropolitan Region and its Economy

The Raleigh-Durham-Cary Combined Statistical Area ("Raleigh-Durham" or the CSA) is the home to distinct urban clusters. Raleigh is the largest of the three areas and is the state capital of North Carolina. With a 2019 population of 2.1 million, the Raleigh-Durham region is well-educated, with 46.9 percent of adults holding bachelor's degree or higher. The median household income was $73,654, and the per capita income was $38,760. Both measures are about 10 percent.[64]

The Raleigh-Durham area is rich in educational opportunities being home to several traditional universities, colleges, and for-profit institutions of higher education. Among the traditional colleges are North Carolina State University, North Carolina's largest university. The region's academic research network is enhanced by the presence of the University of North Carolina at Chapel Hill and by Duke University and North Carolina Central University in Durham. Other notable educational institutions include Shaw University, Campbell Law School, and William Peace University.[65] Figure RDU-1 below shows a map of the Raleigh-Durham-Cary CSA Area.

Figure RDU-1: The Raleigh-Durham-Cary Combined Statistical Area



According to the U.S. Bureau of Economic Analysis (BEA), in 2019, the Raleigh-Cary MSA had a population of 1,390,785 and ranked 42nd in the nation (out of 384 total). The region produced $94.8 billion in current-dollar total GDP, making it the 41st ranked, up from 51st in 2009.[66] BEA reported that the Durham-Chapel Hill MSA had a 2019 population of 644,367, ranked 92nd in the nation. The region produced $53.7 billion in current-dollar total GDP, making it the 61st ranked, up slightly from 2009.[67]

The region has undergone significant growth in population and employment since 2008. Table RDU-1 summarizes the changes in key socio-economic characteristics for the period. As shown, from 2008 through 2019:

- Total population rose by over 400,000 (25 percent). By contrast, population for the state of North Carolina rose by 13 percent.

- Total employment increased by almost 300,000 (27 percent). Employment for the entire state of North Carolina grew by 14 percent.

- Average per capita income (nominal dollars) rose from $43,070 to $56,300 (31 percent). (In constant 2019 dollars, the increase was 7 percent.) Average per capita personal income (in nominal dollars) for the State of North Carolina rose less quickly, by 27 percent.

- The number of businesses operating in the region increased by 13,000 (28 percent).[68]

Table RDU-1: Change in Major Socio-Economic Variables, Raleigh-Durham 2008-2019 (data in 1,000s)

Raleigh-Durham-Cary, NC CSA	2008	2015	2019	2008-15		2015-19		2008-19	
				Chg	%	Chg	%	Chg	%
Population	1,670	1,923	2,080	253	15%	156	8%	409	25%
Total Employment	1,083	1,220	1,380	138	13%	160	13%	297	27%
Non-farm Employment	1,076	1,213	1,373	137	13%	160	13%	297	28%
Private Non-farm Employment	908	1,036	1,189	128	14%	153	15%	281	31%
Gov't Employment	168	177	184	9	6%	7	4%	17	10%
Income per Capita ($)	$43,068	$48,935	$56,306	$5,867	14%	$7,371	15%	$13,238	31%
Number of Establishments	48	55	61	7	15%	6	11%	13	28%

Source: U.S. Bureau of Economic Analysis (BEA)
Note: All data are in 1,000s except for per capita income.

From 2008 to 2019, the population grew at an annual rate of 2.0 percent per year, reaching 2,079,687 in 2019. (By comparison, the U.S. population as a whole grew by 0.96 percent over the same period.) When compared to other metro areas, Raleigh-Durham was the 2nd fastest growing large metro region after Austin, TX. From 2010 through 2019, Austin grew by 29.8 percent, while Raleigh grew by 23 percent.

The region is relatively highly educated. Among the population aged 25 and over, 27.4 percent held Bachelor's degrees and another 19.5 percent held graduate or professional degrees. By comparison, among the entire state's population aged 25 and over, 20.5 percent held Bachelor's degrees and another 11.8 percent held graduate or professional degrees.

Regional Economic Strengths

The region's economy is anchored by several large employment sectors. As the capital of North Carolina, the region has a significant public sector presence, including local, state, and federal employees. This also takes into account the large number of staff associated with education, especially because with the large public universities in the region.

In the private sector, the large sectors (based on total employment in 2019) are professional, scientific, and technological (PST); health care; administrative and support services; and information technology. The Table RDU-2 also highlights the extraordinary growth in employment in PST; finance and insurance; real estate; and arts, entertainment, and recreation. Employment in each of those sectors grew by 40 percent or more from 2008.

Table RDU-2: Changes in Employment by NAICS Sector, Raleigh-Durham, 2008-2019

NAICS Sector	2008	2019	Change #	Change %
Private Sector Employment				
Professional, scientific, and technical services	97,163	151,084	53,921	55%
Health care and social assistance	N/A	134,097	N/A	N/A
Retail trade	103,241	121,158	17,917	17%
Accommodation and food services	68,566	94,472	25,906	38%
Administrative services	70,222	91,080	20,858	30%
Construction	70,448	79,856	9,408	13%
Manufacturing	83,986	75,198	(8,788)	-10%
Other services (except government and gov't enterprises)	57,228	74,413	17,185	30%
Real estate and rental and leasing	47,517	66,372	18,855	40%
Finance and insurance	43,961	65,032	21,071	48%
Educational services	N/A	55,780	N/A	N/A
Wholesale trade	37,885	44,460	6,575	17%
Transportation and warehousing	N/A	39,266	N/A	N/A
Information	25,351	34,660	9,309	37%
Arts, entertainment, and recreation	20,715	34,401	13,686	66%
Management of companies and enterprises	13,374	15,147	1,773	13%
Public Sector Employment (Fed, State, Local, Military)	172,845	189,724	16,879	10%
Total Employment	1,082,819	1,380,126	297,307	27%

Source: BEA.
Note: Figures will not sum to total because employment in smallest sectors and those where data were suppressed are not shown.

Focus on Changing Economic Activity in Professional, Scientific and Technical Services (PST)

The Raleigh Durham area is home to a diverse economy, with significant concentrations in a few key industries. Primary drivers of these industries stem from an impressive supply of well-educated and innovative talent and a strong collaborative environment between academia, government, and industry. Some of the main industries include Life Sciences, Advanced Manufacturing, IT & Technology, and Clean Tech/Smart Grid, which provide a strong network of economic development linkages across each industry.[69]

The Professional, Scientific and Technical services (PST) drive a substantial amount of air traffic. Major PST subsectors include but are not limited to:

- Legal services
- Accounting, Tax Preparation, Bookkeeping, and Payroll Services
- Architectural, Engineering, and Related Services
- Management, Scientific, and Technical Consulting Services
- Scientific Research and Development Services (e.g., Physical, Engineering, and Life Sciences, nanotechnology, Biotechnology, Research and Development in the Social Sciences and Humanities)

Based on NAICS employment in Table RDU-2, the PST sector has had the most robust job growth from 2008-2019 compared to other sectors, growing at an annual rate of 4.1 percent.[70]

Economic Clusters

The U.S. Cluster mapping project provides additional insight into the region's economic strength. The region featured 11 traded clusters in 2016 (the latest available data), with the largest by employment being distribution and e-commerce, education, livestock, information technology (IT), and biopharma.[71]

- In the Biopharma cluster, over 14,700 individuals were employed in 2016, and the region had a location quotient of 6.19. The cluster includes biopharmaceutical products, biological products, and diagnostic substances. The CSA ranks in the top 10 nationally in each of those areas. The Economic Development Partnership of North Carolina (EDPNC) notes that the state's biotechnology industry includes 730+ companies and over 66,000 employees. It claims that in terms of total employment, the state is first in the U.S. in bio manufacturing and pharma manufacturing, and that the biotech cluster has grown 25 percent since 2010.[72]

- The IT Cluster includes software publishing and semiconductors, process and laboratory instruments, electronic components, and computers and peripherals. EDPNC states that North Carolina's technology industry grew at twice the rate of the national average between 2013 and 2017, that the Raleigh-Durham area was ranked 10th nationally among top tech markets, and that Forbes magazine ranked Raleigh the #2 tech hub in the country.[73]

- The Education and Knowledge Creation Cluster covers employment at the colleges and universities, research organizations, and training programs. This includes R&D in biotechnology; the physical, engineering, and life sciences; and social science and humanities. The CSA has high employment specialization in these matters, with research organizations ranked in the nation's top 10.

Overview of the Airport and Its Air Service

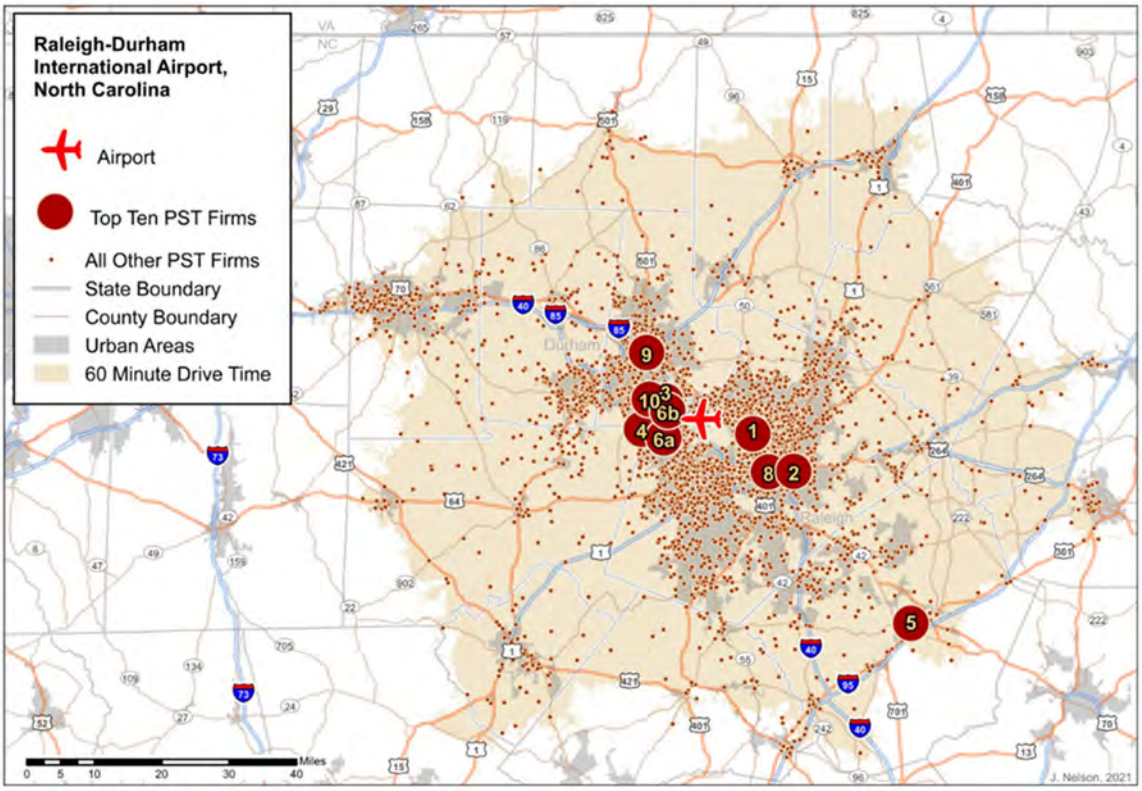
Raleigh Durham International Airport (RDU) is North Carolina's second largest commercial airport based on passengers, serving over 14 million passengers in 2019. Classified by the Federal Aviation Administration (FAA) as a medium hub, RDU is the primary international hub for nearly half the State of North Carolina and serves as one of this region's most influential economic engines.

The airport is governed by the Raleigh-Durham Airport Authority, established by the North Carolina General Assembly in 1939. The Airport Authority is a local government responsible for the development, operation, and maintenance of RDU and has played a central role in the growth of the Research Triangle Region.[74]

The RDU catchment area reaches roughly 4 million people. Beyond the immediate CSA, RDU serves as the main airport for residents in the eastern half of North Carolina and from southern Virginia southward to the South Carolina border.[75] Smaller airports such as Roanoke (ROA) and Greensboro (GSO) leak traffic to RDU. Charlotte Douglas International Airport (CLT), a major hub for American Airlines, is the main airport RDU loses traffic to due to its strong international connectivity.

Another way to consider the economic activity within the catchment area is to examine business activity within a given drive time from the airport. The figure RDU-2 below illustrates the area within a 60-minute drive from RDU and highlights the PST-related activities within that radius.

Figure RDU-2: Spatial Distribution of Professional, Scientific, and Technical Service Firms (NAICS 54) in the RDU Airport One-Hour Drive Time Trade Area



Source: ESRI Business Analyst

Key highlights of socio-economic activity <u>*within the 60-minute drive of the airport:*</u>

- The total estimated 2019 population was 2.3 million. Of that, about 1.5 million (63 percent) were considered "working age" (between the ages of 18 and 64).

- The region supported over 82,000 businesses employing over 1 million. In terms of major industry sectors (defined by NAICS codes), the largest based on total employment was PST with nearly 86,000, followed by Manufacturing (over 71,000 employees) and Finance, Insurance, and Real Estate ("FIRE") with nearly 60,000.

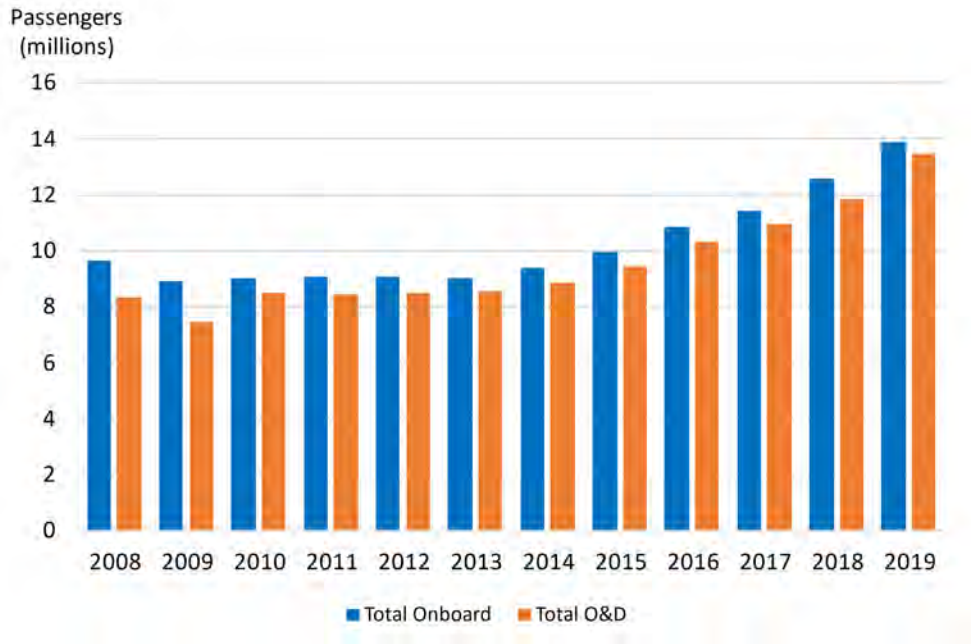
- A large percentage of the total population is relatively highly educated. Of the total, 26.9 percent held a Bachelor's degree and another 17.7 percent held a Graduate or Professional degree.

Changes in Air Service

Passenger activity at RDU has grown significantly since 2008, as can be seen in Figure RDU-3. After declining slightly following the Great Recession through 2013, the airport reported steady increases in both total passengers and local (origin and destination, O&D) activity. While connecting itineraries are possible

given the overall volume of aircraft operations, the airport is principally a facility that serves local traffic, so O&D traffic represents the majority of total traffic. Passenger traffic reached an all-time high in 2019.

Figure RDU-3: Growth in Total and O&D Passenger Activity 2008-2019 (millions of passengers)



Source: US DOT O&D Summary Report.

The number of nonstop markets served grew, as did the number of flights to major markets. In 2008, RDU had service (defined as 50 flights in a year or more) to 45 destinations. In 2019, it had service to 57. RDU's 2019 international service included two European destinations -- London Heathrow Airport (LHR), and Paris Charles De Gaulle Airport (CDG) -- along with Cancun (CUN) Mexico and multiple Caribbean locations: San Jose (SJU), Montego Bay (MBJ), Punta Cana (PUJ), Nassau (NAS), and Freeport (FPO). Transborder service to Canada included Toronto Pearson (YYZ) and Montreal Trudeau (YUL).

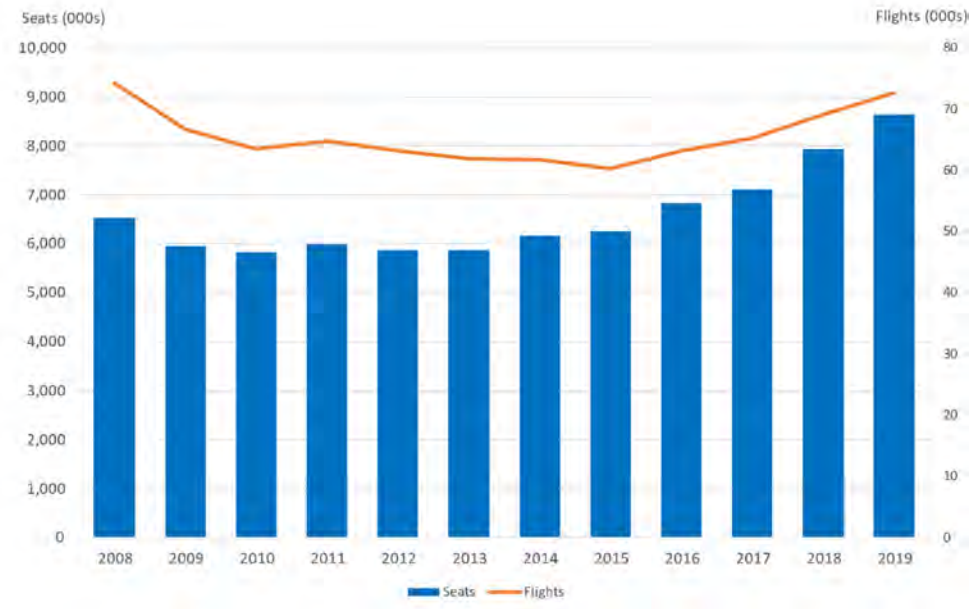
In addition, the number of flights to major markets rose significantly, notably expanding connectivity to western markets such as Denver, Los Angeles, San Francisco, and Seattle from 2009 to 2019:

- Austin: +114
- Baltimore: +937
- Boston: +309
- Chicago O'Hare: +915
- Dallas Love Field: +432
- Denver: +1,277
- Detroit: +329
- Fort Lauderdale: +711
- Houston Hobby: +410
- Los Angeles: +840
- Miami: +165
- Minneapolis: +560
- Montreal Dorval: +210
- New York Newark: +756
- Orlando: +503

- Paris De Gaulle: +317
- San Francisco: +939
- San Juan: +158
- Seattle/Tacoma: +713
- Tampa: +787
- Trenton: +172
- West Palm Beach: +118

Figure RDU-4 shows the growth in the amount of capacity offered at RDU, in terms of both total flights and seats available for sale. From 2008 to 2019, the number of available seats rose by 2.1 million (32 percent), equivalent to an extra 5,800 seats per day. The number of flights declined by just over 1,600 (2 percent), or 5 less flights per day. Average aircraft size (seats per departure) rose from 88 to 119.[76]

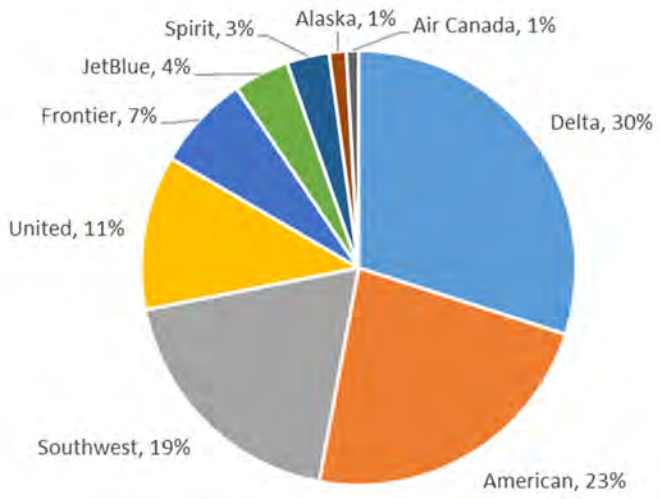
Figure RDU-4: Changes in Capacity Offered 2008-2019



Source: Diio Schedules

Since Delta classified RDU as a "focus city," the airport has become one of the carrier's largest non-hub centers of operations. Delta leads all airlines in passenger market share at 30 percent. American captures 23 percent of the market, and Southwest and United comprise 19 percent and 11 percent, respectively, as can be seen in Figure RDU-5.

Figure RDU-5: Passenger Market Share 2019



Source: US DOT O&D Summary Report

North Carolina ranked 16th among states in total tons of air freight cargo moved in 2019, carrying over 1.1 million tons totaling over $23 billion in value. RDU ranked 3rd in the state behind moving 251,300 tons, which accounted for 23 percent of the state's total cargo, behind Piedmont Triad International Airport (GSO) and Charlotte Douglas International Airport (CLT).[77]

Analysis of Changes in Air Service and Economic Activity

RDU's O&D traffic is highly correlated with total local employment. Figure RDU-6 summarizes how changes in total O&D traffic have aligned with changes in regional employment. The line indicates a simplified linear relationship between the two. As total regional employment increases, total O&D increases. The correlation coefficient between the two is 0.907. However, correlation alone does not demonstrate causation. That is, correlation is not evidence whether rising total employment levels leads to more air traffic, or whether more air traffic leads to more total employment.

At the same time, it is important to recall that much recent academic research shows that improvements in air service and connectivity in fact do lead to increases in employment and economic activity, especially in industry sectors that are reliant upon air transportation such as PST. The topic is discussed in greater detail in *ACRP Web-Only Document 53*.

Figure RDU-6: Relationship between Regional Employment and Total O&D Passenger Traffic

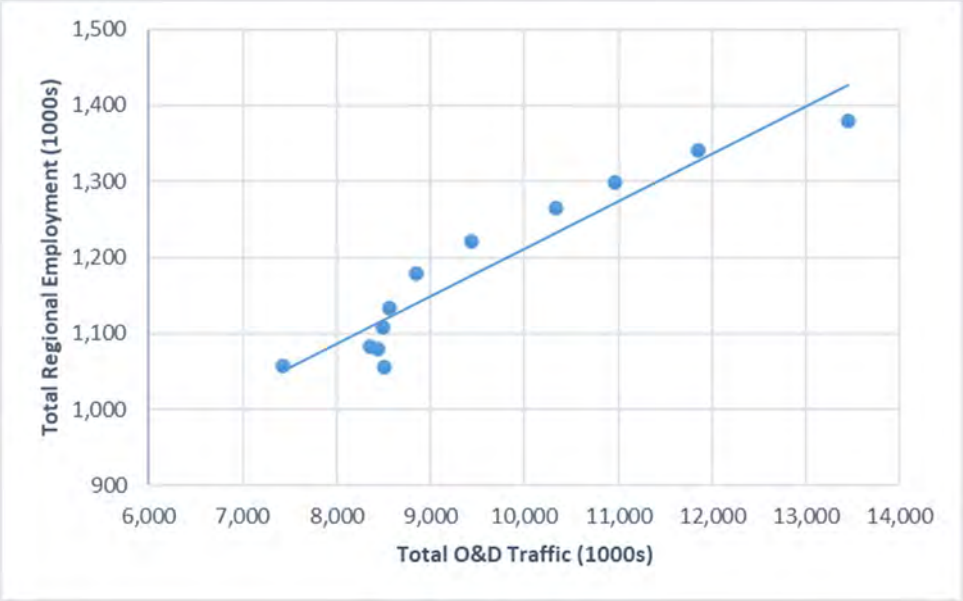
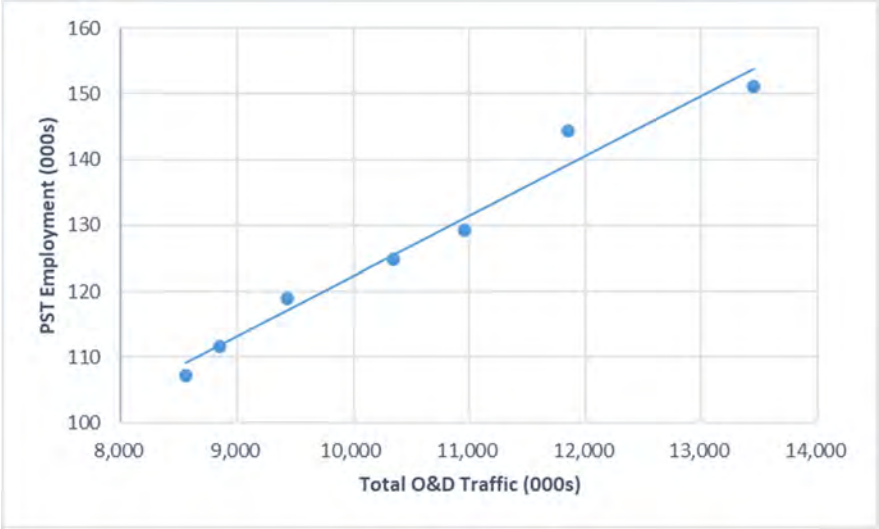


Figure RDU-7 isolates changes in O&D traffic against changes in employment in industry sectors that have a relatively higher propensity to fly than others. Those sectors include PST, information technology; FIRE; PST; management of companies, administrative and support services, educational services, and health care. As with the analysis of air traffic and total employment, the correlation of changes in air service and these "aviation-reliant" industries is also very high: 0.96. Data are available only for the years 2013-2019 because those for prior years were suppressed to protect confidentiality.

Figure RDU-7: Relationship between Total O&D Passenger Traffic and Employment in Aviation-Reliant Industries

Figure RDU-8 isolates changes in O&D traffic against employment in PST only. As above, the correlation of changes in air service and PST employment is also very high: 0.97. Data are available only for the years 2013-2019 because those for prior years were suppressed to protect confidentiality. Again, the two variables move together: Increases in one correspond with increases in the other.

Figure RDU-8: Relationship between Total O&D Passenger Traffic and Employment in PST



Connectivity

High quality transportation – of all modes -- is a prerequisite for sustained economic growth and for maintaining economic competitiveness. *International* competitiveness is driven by productivity growth, which is underpinned by trade, foreign investment and innovative activity, all of which are facilitated by connectivity via commercial aviation.

"Connectivity" generally means the ability to reach a wide range of places in a short amount of time. Connectivity creates efficiencies that make firms more productive, which in turn attracts more high-flying businesses that have their choice of locations and starts a virtuous cycle of economic growth.

Changes in connectivity can be measured in a variety of ways. One is a method developed by the International Air Transport Association (IATA). The IATA connectivity index estimates the quality of air service at an airport based on the degree of service to other airports with the largest and most diverse route networks, as a proxy for how accessible the local economy is to the rest of the world. Service to airports with the highest total seat capacity (e.g. ATL) receives the highest weighting. Figure RDU-9 summarizes the formula for the IATA connectivity index. Using airline schedule data for passenger service, the index measures the number of frequencies and available seats to a particular destination. It then weights the number of available seats by the size of the destination airport (in terms of total capacity handled each year). This weighting reflects both the size and economic importance of the destination and the potential for convenient onward connections.

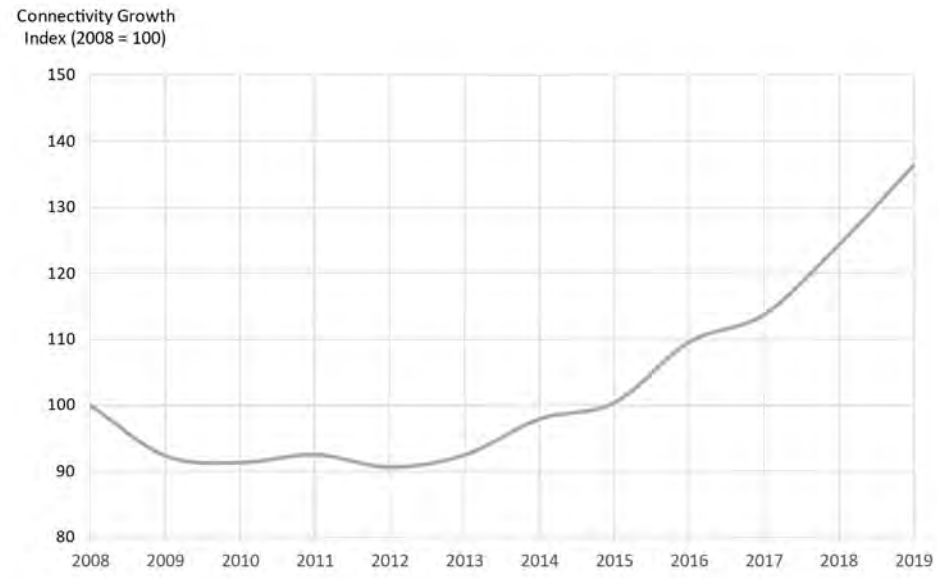
Figure RDU-9: IATA Connectivity Index Formula

$$\frac{\text{[Number of destinations x Weekly Frequency x Seats per flight]}\ \textit{Weighted by the Size of the Destination Airport}}{\text{Scalar factor of 1000}}$$

Figure RDU-10 summarizes the change in connectivity at RDU against 2008 levels for comparison. The growth in new destinations as well as increased capacity to major markets have manifested into a robust, continuous improvement in air connectivity provided by RDU to the regional economy over the past several years. While RDU was not immune to the impact of the Great Recession – connectivity dropped below

2008 levels for several years with the loss of nonstop service to several destinations and an overall reduction in capacity to most major hubs – the airport's connectivity has since recovered and grown. Connectivity fully recovered to 2008 levels by 2015, then proceeded to grow by a total of +36 percent (or an average rate of +8 percent per annum) between 2015 and 2019. This growth was driven in large part by expanded connectivity to western hubs like Denver, Los Angeles, San Francisco, and Seattle, as well as the introduction of service to Paris (CDG) in 2016. Expanded service to these destinations have a particularly profound impact on improved connectivity given the scope and degree of onward service that they offer; every additional seat to these leading hubs will improve connectivity for RDU by a higher margin, relative to added capacity to smaller or less connected airports.

Figure RDU-10: RDU Connectivity Growth Index (2008=100)



Source: Inter*VISTAS* analysis of Innovata schedule data from Diio Mi.
Note: Chart shows the IATA Connectivity Index for RDU, indexed against 2008 (2008 = 100).

Connecting Air Service and Changing Regional Economic Activity

RDU has not typically involved the community in its air service development goal creation. They choose instead to inform the community of its goals based on the strategy it develops internally and with consultants. This is a process that is ever-changing, and RDU is striving to create a model in which they identify the needs of the community prior to developing our air service development strategy.

RDU's Director of Air Service Development relies heavily on data analysis to drive the identification and prioritization of air service development goals for the coming 5-10 period. When pitching to airlines about markets, in addition to a strong traffic base, RDU aims to look deeper into the industries connecting markets and turn to the community to understand what is driving business and business travel.

The regional economy and business base are closely interrelated with RDU's air service development goals. The booming technology business community is bringing people to live and work in the area in addition to creating a leisure/VFR connectivity component. Business travel is comprised of roughly 20 percent at RDU, and companies are continuing to invest and expand in the Raleigh-Durham area and generating travel.

Regional Stakeholders and Air Service Interests

RDU's communications team and CEO coordinate all external outreach to community stakeholders. They believe in forging relationships with local partners and aim to capture the community sentiment in terms of air service needs.

Two of the key regional stakeholder organizations are the Research Triangle Regional Partnership (RTRP) and the Economic Development Partnership of North Carolina (EDPNC).

- The Research Triangle Regional Partnership (RTRP) is an economic development organization committed to the 12 core counties located in Central North Carolina surrounding the Raleigh-Durham area. The RPRP's efforts focus on five target industries:

    - Advanced manufacturing (e.g., medical devices, automotive and aerospace components, military or agricultural equipment, and advanced materials.)

    - Agriculture technology

    - CleanTech (e.g., smart grid technologies, smart metering and expanding renewable energy technologies)

    - Life Sciences. More than 500 companies employing 24,000 workers with an average salary of over $140,000 are in the region.

    - Technology. This includes software developers, hardware manufacturers, and telecommunication companies. Some of the fastest growing segments in the Triangle are in fields such analytics, nanotechnology, Internet of Things, photonics, and wearables.

- The EDCNP is a nonprofit public-private partnership that works with the North Carolina Department of Commerce on economic development and tourism. With a board composed of business leaders, it focuses on recruiting new businesses to the state, supporting the needs of existing businesses, connecting exporters to global customers, helping small business, and attracting tourists and visitors.

  The EDPNC promotes activity in 14 industry groups. Noting that the state was once known mostly for tobacco and textiles, the state has evolved to become a major location for knowledge-based industries. Included among those are biotechnology and information technology.

  The EDPNC also touts five major attributes for attracting and retaining business: Workforce and education (e.g., colleges and universities, large numbers of military personnel based in the state who leave the service with specialized skills), business climate (e.g., legal and regulatory environment), incentives (e.g., grants and tax incentives), quality of life (cost of living, health care, climate, outdoor recreation, etc.), and infrastructure. The infrastructure component features the state's airports and the domestic and international connectivity provided. Air service positively contributes to the regional quality of life. The vibrant regional economy and robust air service offering helps retain local talent and attract and retain investment in the region.

RDU works with local organizations such as the chamber of commerce, the local convention and visitor bureaus (Visit Raleigh, Discover Durham, the Economic Development Partnership of NC, and Raleigh Economic Development & Innovation to connect with corporate organizations. RDU also goes directly to companies and reaches out to their leadership teams. When there is an obvious need for air service,

companies will contact the Chamber and ask how to get service to a particular market. When airlines realized that RDU was one of the fastest growing markets with a higher-than-average mean income and an abundance of unserved markets, they initiated routes from RDU without much prodding from the airport itself. Delta's decision to name RDU a focus city did not come as a result of RDU's marketing, but rather the airline seeing the strategic opportunity in the data and launching a number of point-to-point (non-hub) markets. Many market pushes have come from the community in the past, where the community communicates that business ties exist and there is a want or need for the service. One example is RDU's efforts to target non-stop service to China (prior to the pandemic), with many economic development organizations leading that push.

Communicating the Airport's Economic Impact

The State of North Carolina published an economic impact assessment of its network of 72 publicly owned airports in January 2021 covering operations for the calendar year 2019.[78] The report summarizes the economic impacts generated by the state's public airports and the many assets that support the aviation and aerospace sector.

The report found that RDU accounted $15.15 billion in total economic output in RDU, $518.3M of state and local taxes, $3.5B in personal income, and 99,335 jobs. The analysis included the impacts of on-airport contributions (jobs, income, and spending by tenants such as airlines, rental car companies and airport security), airport capital projects and operations (construction, facility maintenance and operational services), and the impact of visitors.[79]

The airport suggests that analyses on the possible economic impact that new air service (e.g., the economic impact of a new nonstop international flight, including the generation of tax revenues to local and state governments) may have more credibility, and be more influential, if completed or sponsored by organizations separate from the airport. Analyses like those could be useful to help convince businesses and other organizations to invest in efforts to attract new air service.

The airport uses economic impact for different audiences in a variety of ways. Convention & Visitors Bureaus (CVBs) are generally interested in economic impact data specific to visitors – i.e., visiting passenger numbers, estimated spend, etc. Other economic development organizations might be interested in the overall economic impact of the airport in terms of the capital it produces directly or indirectly. Alternatively, political stakeholders are principally interested in tax revenues and jobs.

Reno-Tahoe: A Region That Rebounded

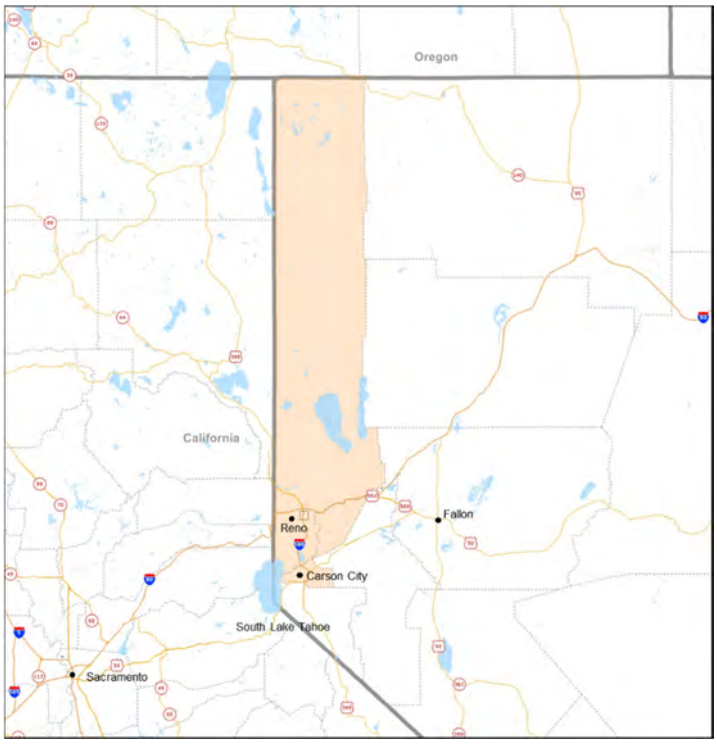
The Reno-Tahoe area in northwestern Nevada has long been associated with outdoor recreation and casinos. On the eastern side of the Sierra Nevada mountain range and 20 miles from Lake Tahoe, Reno is known as "The Biggest Little City in the World." Reno is the largest city in the region (and second largest in Nevada after Las Vegas), with a 2019 estimated population of slightly over 250,000.

Reno-Tahoe International Airport (RNO or the Airport) is the principal commercial airport in the region. The primary catchment area of RNO, which includes areas surrounding Reno, Sparks, Carson City and Lake Tahoe, has a population of 825,000. Including the secondary catchment area, the population size is 1.5 million. From 2008 through 2014, total passenger traffic at the Airport dropped by 1.2 million (25.5 percent). From then through 2019, however, traffic has nearly completely recovered, rising by 1.1 million. The Airport's 2019 traffic (4.45 million) was less than 16,000 (0.4 percent) short of its 2008 levels.

The Reno-Tahoe region is included as a case study based on the recovery of its economy and air services following the Great Recession.[80]

Introduction to the Region and its Economy

The Reno–Tahoe–Fernley Combined Statistical Area ("Reno-Tahoe region" or the CSA) encompasses the northwestern corner of the state of Nevada. It includes four counties and the independent city of Carson City, Nevada's state capital. The CSA combines two Metropolitan Statistical Areas (MSAs): The Reno MSA with a 2019 population of 475,642 (ranked 115th in the nation out of 384) and the Carson City MSA, with a population of 55,916 (the smallest MSA in the nation). In addition, the CSA includes three other "micropolitan" areas.



In 2019, Reno produced $30.4 billion current-dollar total GDP. This GDP ranked 100th among MSAs, up from its 2009 ranking of 110th. Carson City produced $3.9 billion current-dollar total GDP, ranked 371st.

The CSA has a relatively more highly educated population than the State of Nevada on average. Of residents aged 25 and over in the CSA, 28 percent held a Bachelor's degree or higher, versus 26 percent statewide. Reno is home to the University of Nevada, with a 2019 enrollment of more than 21,000 students, and both Reno and Carson

City feature business and government activity attracting employees with post-secondary educations.

The region experienced a significant loss of employment associated with the Great Recession of 2007-2009. From 2008 through 2015, total employment in the area dropped by 6,700 jobs even though population in the CSA grew by approximately 27,000 persons.

Table RNO-1 summarizes the changes in the CSA's major socio-economic characteristics, which has undergone significant changes in population and employment since 2008.

- Combined, the CSA had an estimated 2019 population of 638,000, having grown from 574,000 persons in 2008 at a compound rate of 1.0 percent per annum. (The Airport notes that the population of the primary catchment area rose from 782,000 in 2014 to 825,000 in 2020, an increase of 5.5 percent.)

- Total employment dropped from 2008 through 2015. Since then, as the national economy and regional economies recovered from the Great Recession, the CSA added more than 50,000 new jobs between 2015 and 2019, growing to well above pre-recession levels.

- Per capita and household incomes in the CSA have seen a rise over the past 13 years. As of 2019, the region's average per capita income exceeded both state and national averages. Per capita incomes were 10 percent higher than state average and slightly higher than the national average. The Economic Development Authority of Western Nevada reported that the median household income in Washoe County rose from about $49,000 in 2012 to nearly $72,000 in 2019, rising an average of 5.8 percent per year.

- Between 2015 and 2019, the number of establishments (i.e., workplaces) in the CSA grew only modestly, from 19,500 in 2015 to 20,400 in 2019.[81] While the number of establishments only grew by 4 percent over this five year period, total employment grew by 14 percent suggesting that employment growth has been predominantly concentrated in large establishments with many employees. This trend is exemplified by the growth of manufacturing, transportation, and warehousing employment in the region.

Table RNO-1: Socio-economic Summary of the Reno-Tahoe-Fernley CSA (Figures in '000s unless otherwise noted)

	2008	2015	2019	Change 2008-15		Change 2015-19		Change 2008-19	
				#	%	#	%	#	%
Population	574	600	638	26	5%	38	6%	64	11%
Total Employment	369	362	414	(7)	-2%	52	14%	45	12%
Private Non-farm Employment	323	318	368	(5)	-2%	50	16%	45	14%
Gov't Employment	45	43	44	(2)	-4%	1	3%	(1)	-1%
Income per Capita ($)	$41,498	$50,043	$61,185	$8,545	21%	$11,142	22%	$19,687	47%
Number of Establishments	N/A	20	20	N/A	N/A	1	4%	N/A	N/A

Source: BEA; U.S. Census Bureau QuickFacts, 2019; BLS.

Note: Dollar ($) figures are expressed in nominal terms. Data may be unavailable for certain years. Establishments refer to individual physical locations where business is done and with paid employees (rather than a company, for instance, which can have more than one location, or self-employed operations).

Regional Economic Strengths

Traditionally, the Reno-Tahoe area's employment base reflected its status as the state's capital and its history with gaming. Government and government enterprises, including Nevada State University, Reno, is the largest employment category in the region. The area's gaming industry and its proximity to Lake Tahoe and resorts in the Sierra Nevada range have long made it a major tourism destination.

Since the Great Recession, which negatively affected the tourism and services sectors, the region has seen a major recovery in economic activity and a great diversification. A key theme in this recovery has been the growth and expansion of new industries to the region, with a focus on advanced manufacturing, high-tech and bio-tech, transportation, warehousing, and construction driving growth. The creation of the Tahoe-Reno Industrial Center has provided a significant land base for the development of many of these new industries to the region, including distribution and warehousing centers, data centers, and Tesla's Gigafactory 1. These three industries accounted for more than half of the 48,000 net new jobs grown in the region between 2015 and 2019, as can be seen in Table RNO-2. Each of these three industry sectors have grown by more than 33 percent over the past five years, with manufacturing employment growing by 62 percent and adding more than 13,000 jobs alone to the region.

Table RNO-2: NAICS Employment in the Reno-Tahoe-Fernley CSA

Industry Sector	2008	2015	2019	Change 2015-19	
				number	%
Farm Employment	1,502	1,691	1,582	(109)	-6%
Private Nonfarm Employment	322,840	317,791	368,154	50,363	16%
Accommodation and food services	44,209	41,659	43,850	2,191	5%
Retail trade	(D)	35,794	38,221	2,427	7%
Health care and social assistance	(D)	32,075	36,878	4,803	15%
Manufacturing	22,825	21,076	34,156	13,080	62%
Real estate and rental and leasing	(D)	24,908	27,640	2,732	11%
Construction	(D)	20,229	27,264	7,035	35%
Administrative and business support services	20,529	22,747	25,158	2,411	11%
Management of companies and enterprises	(D)	4,461	5,147	686	15%
Transportation and warehousing	(D)	18,797	25,003	6,206	33%
Finance and insurance	(D)	18,796	19,599	803	4%
Other services (except government)	16,466	17,661	19,403	1,742	10%
Arts, entertainment, and recreation	12,945	11,759	13,934	2,175	18%
Arts, entertainment, and recreation	(D)	4,139	4,284	145	4%
Educational services	(D)	4,461	5,147	686	15%
Management of companies and enterprises	(D)	807	860	53	7%
Utilities	(D)	3,056	1,994	(1,062)	-35%
Mining, quarrying, and oil and gas extraction	(D)	12,173	12,600	427	4%
Wholesale trade	205,866	47,829	51,901	4,072	9%
All other private sector *	44,784	42,994	44,283	1,289	3%
Government and government enterprises	44,784	42,994	44,283	1,289	3%
Total employment (number of jobs)	**369,126**	**362,476**	**414,019**	**51,543**	**14%**

Source: BEA

Notes: (D) = data suppressed to protect confidentiality. * Employment in sectors with less than 10,000 employees summed into "All other private sector," which also includes employment in sectors where data were suppressed.

These key areas of job growth are driving higher incomes for new workers, with the average salary of newly added jobs to the region increasing from just under $40,000 in 2012 to nearly $73,000 in 2019, an 82 percent increase over a seven year period.[82] The growth of higher-income jobs to the region will likely have a positive impact on aviation activity at RNO, as higher income households tend to have a higher propensity to fly both for leisure and as a function of business activity.

The growth and diversification in industry is generally expected to foster a more resilient economy and enable continued growth in the region overall. For instance, one pre-COVID (January 2019) forecast developed by community stakeholders anticipates continued growth in the region through 2023, with population and employment growing by 1.7 percent and 2.4 percent per annum, respectively.[83]

This growing diversification of the regional economy helped Reno to be named #1 of the nation by multiple sources, including Forbes.[84] Resonance Consulting highlighted the growth of the city beyond its tourism and outdoor leisure role to one attracting new residents who are better educated than before.[85] Drawn in by the new range of technology, manufacturing, and professional services business growth in the region, the lower cost of living (relative to costal tech hubs in California or Washington State) is also bringing in new workers to stay in the region.

Economic Clusters

The U.S. Cluster Mapping Project's analysis of the Reno-Tahoe region also highlights its broad economic strength. A cluster is a concentration of related industries in a particular region. Clusters consist of companies, suppliers, and service providers, as well as government agencies and other institutions that provide specialized training and education, information, research, and technical support. Traded clusters are groups of related industries that serve markets beyond the region in which they are located and therefore require some form of transport connectivity. Examples include financial service or information technology. By contrast, local clusters consist of industries that serve the local market. Examples include local grocery stores or restaurants.

The area's economy features multiple tradeable clusters that are among the top performers in the country, and several are of notable strength. Those include Hospitality and Tourism, Distribution and e-Commerce, Aerospace and Defense, and Recreational Goods.

- The region's Hospitality and Tourism cluster is ranked 36th out of 917 nationally. Employing nearly 18,000 in 2018 (the latest available data), the cluster includes accommodations and related services as well as gambling which are the employment basis of the Reno-Tahoe region's tourism and leisure industries.

- Over 16,000 are employed in the Distribution and e-Commerce cluster, ranked 65th in the country. This includes warehousing and storage, electronic and catalog shopping, wholesale of electronical and electronic goods, among others.

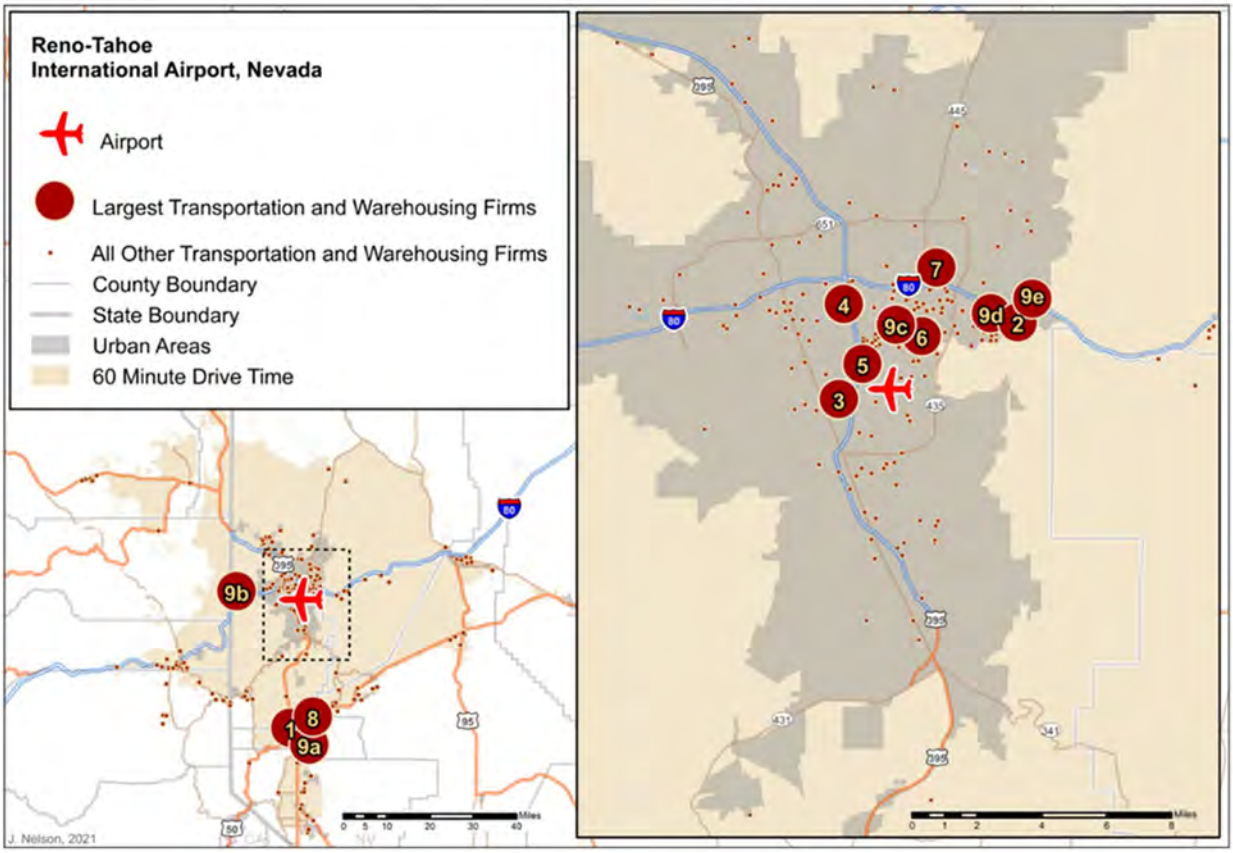
- The region ranks 21st nationally in aerospace vehicles and defense. Subclusters include both aircraft and search and navigational equipment.

- The Recreational Goods cluster employed nearly 2,000. The region ranked 4th nationally in this sector.

Economic Activity near the Airport

Figure RNO-1 illustrates a 60-minute drive time around RNO and the location of Transportation and Warehousing businesses within that area. The largest are all within the urban area.

Figure RNO-1: Spatial Distribution of Transportation and Warehousing Firms (NAICS 48-49) in the RNO Airport One-Hour Drive Time Trade Area



Key highlights of socio-economic activity <u>*within the 60-minute drive of the airport*</u>:

- The total estimated 2019 population was 643,000. Of that, about 395,000 (61 percent) were considered "working age" (between the ages of 18 and 64).

- The region supported nearly 25,000 businesses employing nearly 320,000. In terms of major industry sectors (defined by NAICS codes), the largest based on total employment was Finance, Insurance, and Real Estate ("FIRE") with over 20,000, followed by Professional, Scientific, and Technical Services (PST), with over 19,000, and Manufacturing (about 15,000 employees). The transportation and warehousing sector included about 400 businesses that employed 6,500.

Overview of the Airport and Its Services

Reno-Tahoe International Airport (RNO) is Nevada's second largest commercial airport by passenger traffic, having served more than 4.3 million passengers in 2019. The Airport is located in Washoe County, Nevada just three miles southeast of Reno's downtown center. The airport is owned and operated by the Reno-Tahoe Airport Authority (RTAA) and governed by a Board of Trustees. The RTAA operates Reno-

Tahoe International and Reno-Stead airports as a self-sufficient business funded by user fees and airport operations. The RTAA does not fund the airports from local taxes.

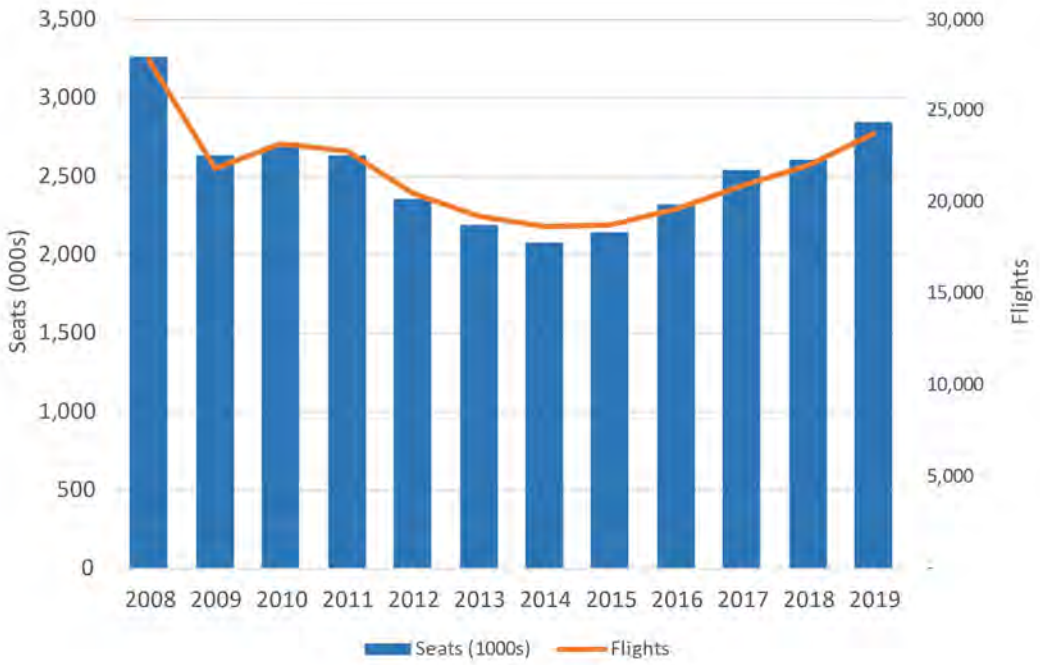
The RTAA has pursued a strategy of developing RNO as a "low-cost airport" to airlines by pursuing a relatively low cost per enplaned passenger compared to nearby airports in the West and across the nation.[86] The Airport serves a primary catchment area of the Reno/Sparks MSA, Lake Tahoe, and Carson City that encompasses the primary destination draws of the leisure and entertainment draws of urban Reno and the outdoor recreation opportunities in the Lake Tahoe region.

Between 2008 and 2019, the Airport has experienced periods of both declining passenger volumes and strong growth in traffic, as shown in Figure RNO-2. By 2008, RNO has experienced a ten-year trend of declining traffic volumes. The Airport reached its historical peak activity in 1997 at more than 7.2 million passengers as local carrier Reno Air built a hub at RNO and low-cost carrier Southwest built significant traffic into the region. However, by 1999 Reno Air ceased operations (after being acquired by American Airlines), leading to a downturn in traffic at the airport as the local hub carrier dissolved. The 2001 terrorism attack and economic downturn led to further declines in traffic at the Airport as air travel demand declined. While RNO did experience a period of traffic recovery between 2003 and 2005, the sharp rise in fuel prices beginning in 2006 and the onset of the Great Financial Crisis and recession in late 2008 led to further declines in traffic at the Airport as travel demand withered and airlines consolidated their networks. Between 2009 and 2014, a sluggish economic recovery and period of airline capacity rationalization, mergers, and consolidation led to a subsequent period of decline in RNO's traffic, declining to just over 3.2 million passengers in 2014.

Over the past five year (2015-2019), RNO has experienced a period of strong growth, rising from 3.2 million passengers to more than 4.3 million passengers at a compound rate of 6.0 percent per annum. This rebound in traffic has come about as the Reno-Tahoe region experienced a resurgence in economic activity, as well as a major re-introduction of seat capacity by multiple airlines and the addition of new destinations to RNO's air service network.

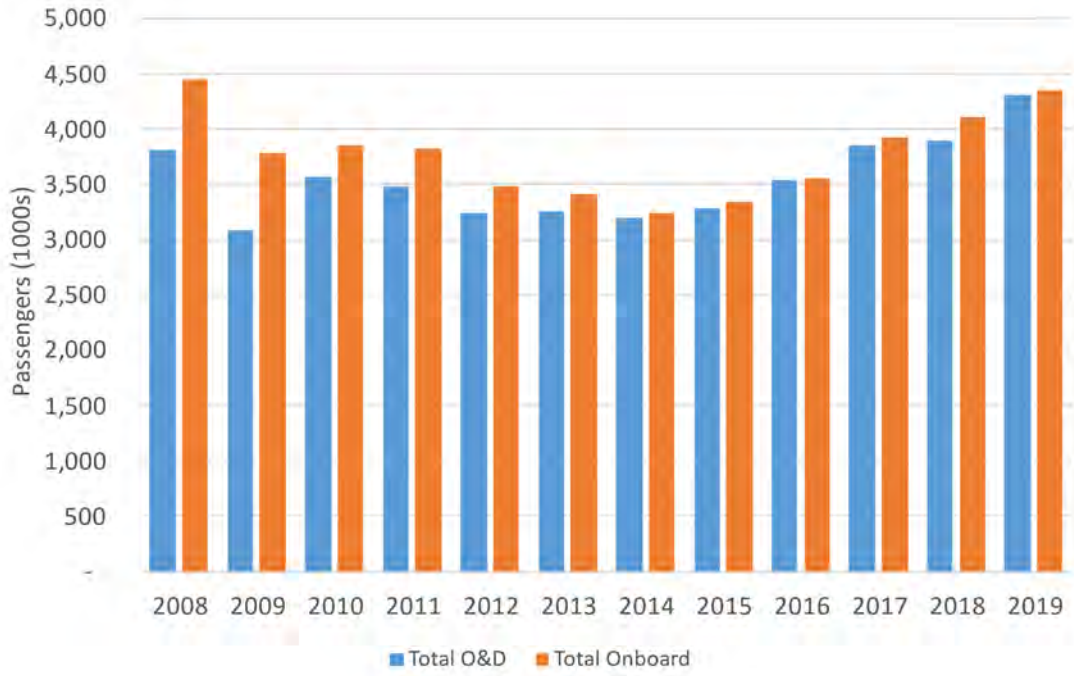
Over the past ten years, RNO has transitioned into a primarily origin-destination (O/D) airport, with only relatively small numbers of connecting (e.g., transit and transfer) passengers. This means that nearly all passengers travelling at RNO are either originating from the local catchment area or are inbound visitors travelling to the Reno-Tahoe area or Northern Nevada. As shown in Figure RNO-3 below, while before 2013 RNO had some level of connecting activity,[87] this has largely disappeared as airlines currently serving the airport do not use RNO as a connecting hub for their networks.

Figure RNO-2: RNO Commercial Flights and Seat Capacity, 2008-19



Source: T-100 data from Diio - Cirium

Figure RNO-3: O&D and Onboard Passenger Activity at RNO, 2008-2019 (1000s)

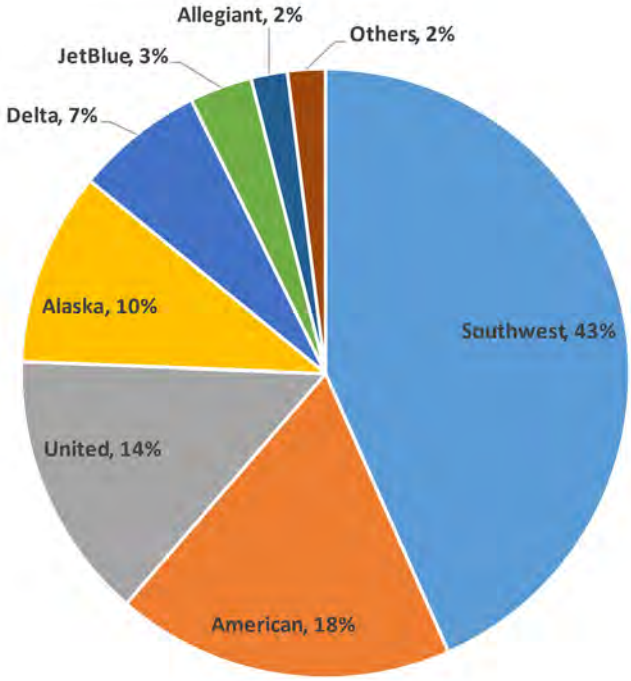


Source: Sabre (O&D estimates) and T-100 data via Cirium – Diio.

Passenger traffic by airline at RNO is dominated by its primary carrier Southwest which, in 2019, carried 44 percent of all passengers at the airport. While RNO is served by other low-cost (JetBlue) and ultra-low-

cost carriers (Allegiant and Frontier), these airlines make up less than 6 percent of total traffic combined, shown in Figure RNO-4. The airport is served by the major network carriers (American, United, Alaska, and Delta) that connect RNO to other key hub airports and cities across the U.S. Mexican carrier Volaris has also provided non-stop international service to Guadalajara beginning in December 2014. Over the past 20 years, Southwest has remained the dominant carrier at the airport to provide low-cost service to support the local leisure and tourism industries as well as local outbound travel demand. The RTAA's strategy of creating a low-cost operating environment for airlines at RNO has likely been an important strategic choice to retain and encourage low-cost and ultra-low-cost carriers to serve RNO.

Figure RNO-4: Seat Capacity by Airline



Source: O&D Report from Diio by Cirium

The Airport reports that it leaks relatively few passengers to other airports. Of those who live within 50 miles of RNO flying outbound, the airport captures 81 percent of all travelers. Sacramento International Airport (SMF) captures 10 percent and San Francisco International Airport (SFO) captures 6 percent. The remainder use airports in Oakland and San Jose. For inbound travelers visiting the Reno-Tahoe area, RNO captures 74 percent, SMF captures 13 percent, and SFO gets 10 percent, with Oakland and San Jose picking up the remainder.

Connectivity

High quality transportation – of all modes – is a prerequisite for sustained economic growth and competitiveness for a region. Specifically, these factors of economic development are driven by productivity growth, which is underpinned by trade, foreign investment, and innovative activity – all of which are facilitated by connectivity. "Connectivity" generally means the ability to reach a wide range of places in a short amount of time. Connectivity is not simply a matter of the number of routes or number of frequencies operated. Connectivity is fundamentally about access to markets and regions. As RNO is the

primary commercial service airport within the CSA, changes in connectivity out of the Airport can have notable impacts on how quickly and conveniently Reno and its catchment area can be reached, or how local residents can access outbound markets.

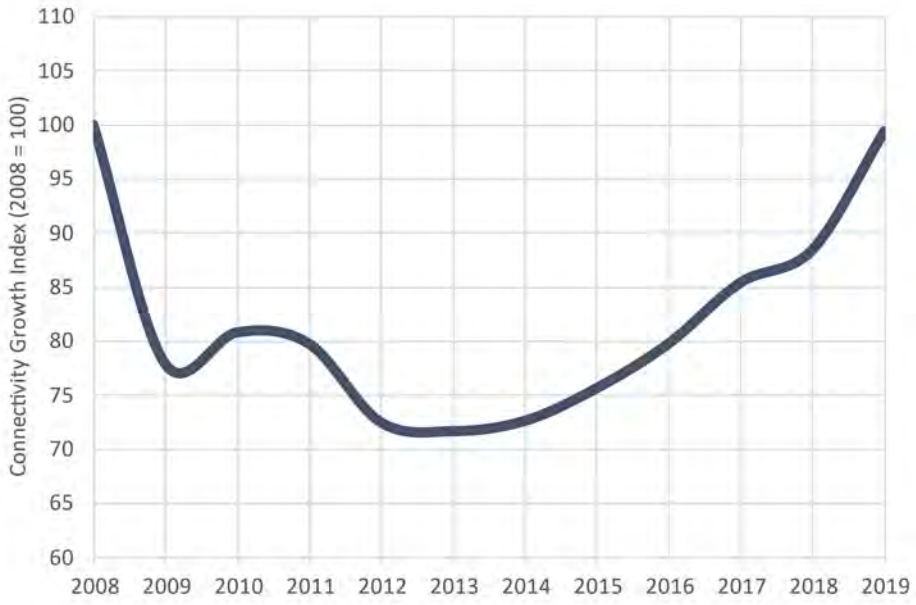
Changes in connectivity can be measured in a variety of ways. One is a method developed by the International Air Transport Association (IATA). The IATA connectivity index estimates the quality of air service at an airport based on the degree of service to other airports with the largest and most diverse route networks, as a proxy for how accessible the local economy is to the rest of the world. Service to airports with the highest total seat capacity (e.g. ATL) receives the highest weighting. Figure RNO-5 summarizes the formula for the IATA connectivity index. Using airline schedule data for passenger service, the index measures the number of frequencies and available seats to a particular destination. It then weights the number of available seats by the size of the destination airport (in terms of total capacity handled each year). This weighting reflects both the size and economic importance of the destination and the potential for convenient onward connections.

Figure RNO-5: IATA Connectivity Index Formula

$$\frac{\text{[Number of destinations x Weekly Frequency x Seats per flight]}\ \textit{Weighted by the Size of the Destination Airport}}{\text{Scalar factor of 1000}}$$

As shown in Figure RNO-6, connectivity at RNO in 2019 was less than one percent lower than 2008 levels. By comparison, seat capacity at the airport in 2019 was 13 percent lower than it was in 2008 indicating that RNO has retained and in some cases grown seat capacity to key national hubs such as LAX, DEN, SFO, SEA, LAS, PHX, and DFW. All else being equal, each additional seat serving routes to major hubs will yield a higher level of connectivity than smaller airports with fewer onward destinations and services. This is why, for instance, connectivity grew at its fastest rate (12 percent year-over-year) between 2018 and 2019 as capacity was added at major hubs like DFW, DEN, ORD, and SEA. In that same year, overall capacity at the airport grew by 9 percent, which underscores the importance of connectivity to large airports and hubs in improving the connectivity index at an airport. While RNO may not have as many destinations in its air service network in 2019 as in 2008, the airport is relatively better connected (as measured by aggregate seat capacity by destination) to major hub airports in the U.S. which has allowed the airport to have a very similar connectivity index value in 2019 to its pre-Great Recession level.

Figure RNO-6: RNO Connectivity Growth Index (2008=100)



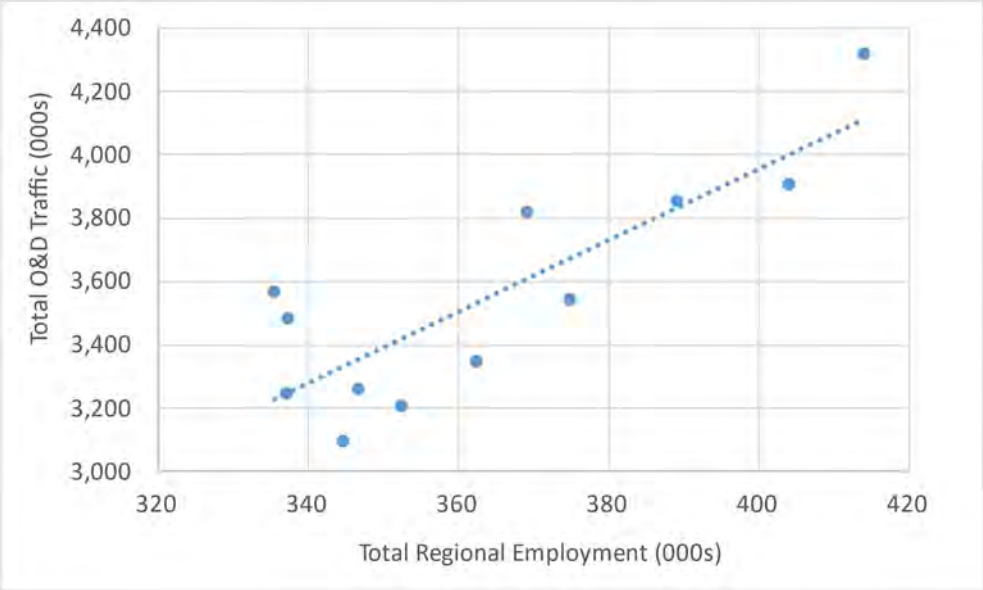
Source: Inter*VISTAS* analysis of Innovata schedule data from Diio Mi.
Note: Chart shows the IATA Connectivity Index for RNO, indexed against 2008 (2008 = 100).

Analysis of Changes in Employment and Air Service

RNO's O&D traffic is correlated with total regional employment. Figure RNO-7 summarizes how changes in total O&D traffic have been related to changes in regional employment between 2008 and 2019. The line indicates a basic relationship between the two. As total regional employment increases generally so too does O&D traffic at the airport, demonstrating a positive relationship between the measures of employment and aviation activity. However, correlation does not establish causation. That is, using correlation alone, it is not evident whether rising total employment levels *leads to or causes* more air traffic, or whether more air traffic *leads to or brings about* more total employment. However, O&D traffic growth at RNO is more highly correlated to regional employment than its regional population, suggesting that employment (and by extension economic activity) is more closely related to aviation traffic growth than population growth alone.

At the same time, it is important to recall that much recent academic research shows that improvements in air service and connectivity in fact do lead to increases in employment and economic activity, especially in industry sectors that are reliant upon air transportation. This is discussed in greater detail in *ACRP Web-Only Document 53*.

Figure RNO-7: Relationship between Regional Employment and O&D Traffic, 2008-2019



Regional Stakeholder Input

The airport authority's planning strategy includes incorporating regional economic development goals and mindfully developing the airport in ways that support its role as an economic driver for the region. RTAA's strategic plan is guided by a long-term vision to operate its airports as a "source of community pride" and guide their development as "a significant contributor to the region's economic health."[88] The authority's strategic priorities for air service and cargo development involve a commitment to working with regional stakeholders, including partnering with local sources to identify and monitor leisure and business market demand, as well as strengthening community awareness and support for air service developments and opportunities. Additionally, RNO's latest master plan was developed with economic development goals and RTAA's same strategic priorities in mind; the project introduced new technical capabilities for incorporating public comments into the planning process, along with consistent and streamlined means of delivering materials and updates to all stakeholders throughout the project.[89]

The authority draws upon several channels for collecting input from the community on planning and air service initiatives. Stakeholders in the regional economy are represented by a large ecosystem of economic development groups, chambers of commerce, destination marketing organizations, the Nevada Commission on Tourism, and multiple convention and visitor bureaus. Two prominent institutions with substantial representation as well as linkages to RNO include the Economic Development Authority of Western Nevada (EDAWN) and the Reno-Sparks Chamber of Commerce.

- The Reno-Sparks Chamber of Commerce is the largest business membership in Northern Nevada, with 2,300 members employing more than 150,000 residents throughout the region. EDAWN is a non-profit, public-private partnership and one of the region's largest and truly "community-neutral" economic development agencies, comprised of a board of trustees that comprehensively represent all stakeholder interests in local government, education, and business, along with several "key partners" that include the airport.

- EDAWN's work includes traditional economic development planning for the community as well as action-oriented responsibilities. For instance, EDAWN undergoes extensive community

outreach including rotating monthly visits to 600 businesses identified as primary employers in the region. The goal of these regular visits is to understand local business conditions, emerging trends and needs, and opportunities for business growth in the region. They are also an important means by which EDAWN collects feedback on RNO's air service including identifying deficiencies, requests for new routes, etc., which are then conveyed back to RTAA staff.

Air service development (ASD) at RNO is also supported through the Regional Air Service Corporation (RASC), a consortium made up of public and private entities that collects community input on ASD initiatives, including much of the private financing for ASD marketing and risk-mitigation (e.g., airline revenue guarantees for new routes). RASC provides funding for ASD work through its membership fees and donations.[90] Although RASC's representation and ASD strategy traditionally focused on the needs of the gaming and entertainment sector, the organization's focus has diversified over time in lockstep with the evolution of the broader regional economy. Current membership is comprised of over two dozen local partners representing a wide range of industry and community interests; this includes seats for EDAWN and Reno-Sparks Chamber of Commerce, both of which have encouraged local businesses across a variety of sectors to get involved as well.

Collective and comprehensive community involvement has helped establish commercial air service at RNO that can properly support the progress of the regional economy at large. The region's economic development goals are outlined in EDAWN's 5-year strategic plan and summarized in Table RNO-3, below.

Table RNO-3: EDAWN Economic Development Objectives for the Greater Reno-Sparks Region

Economic Development Objective	Sample of Strategic Priorities
Attract new companies paying salaries above current average	• Target companies in certain industries such as high-tech, advanced manufacturing, and logistics • Branding Reno as an attractive place to run a business • Schedule in-bound visits with companies
Retain & Expand existing businesses	• Continue interactions and strengthen EDAWN relationship with key local companies • Advocate for primary companies in policy-making
Entrepreneurial Growth that creates new companies and jobs	• Promotion and awareness of regional quality of life to entrepreneurs and start-ups • Facilitate connections between entrepreneurs and sources of capital • Resource and educational support services
Workforce development to meet the needs of current and future employers	• Research impending workforce needs • Coordination with workforce training providers and educational institutions
Community enhancement and improvements that continue to make the region an attractive place to work and live	• Planning for economic growth and land-use needs • Revitalization of downtown core; infrastructure improvements • ***Continue to work with partners to improve air service***

Source: EDAWN, "Continuing Economic Vitality in the Region: 3-Year Strategic Plan" (July 2019).

Community stakeholders note that growth and improvements in air service support all these development goals in direct and indirect ways. For instance, improved air connectivity between RNO and key corporate locations, like California, supports efforts to attract conventions and other events to Reno and appeal to

some of the largest businesses in emerging sectors to the region, while growth in air cargo service has supported the region's logistics hub development. Similarly, the collaborative efforts of RASC across a range of business sectors showcase Reno-Tahoe as a "business-friendly" community.

However, what is most notable is that air service improvement is specifically listed as a key strategy for community development.[91] Beyond "big business" development, the airport's priorities around balanced air service options (from ultra-low-cost carriers to legacy network carriers) and comprehensive connectivity to nearly anywhere within the U.S. in 1-stop or less are designed to support and attract small businesses and to serve the community at large.[92] The region has roughly 20,000 business establishments, and most of these are the small businesses that define the character and appeal of the community – they are the community's own residents who are invested in developing a robust local economy and fostering a nice place to live. They generate demand for air travel – both business-related and personal – and the network of air services offered out of RNO plays a key role in attracting people who want to live here and run their business out of this community, in turn shaping the identity and vitality of the region.

In this manner, the value of air service is not simply about making it easier for corporate executives to visit the region but also contributing toward a standard of living that will attract the businesses and residents who want to see the community thrive. RNO offers a unique experience that aligns with the broader appeal of Reno as a "The Biggest Little City in the World" – that is, an airport offering a similar expanse of airlines, routes and connectivity that can be had at airports in the largest metropolitan areas but with the kind of ease, convenience, and pleasant experience that comes with a community-minded operation. Residents can take a 5-minute drive from downtown to RNO, enjoy easy parking and little congestion in the terminal, and then fly to their destination quickly and easily. Air travel can be an essential part of life for many in a community (whether they are frequent fliers or not), and air service that enables convenient and affordable travel contributes accordingly to a higher standard of living for the connected region.

Communicating the Airport and its Economic Impact

RTAA has periodically engaged the University of Nevada and supporting consultants to conduct fiscal and economic impact analysis of the two airports it operates, RNO and Reno-Stead (RTS). The most recent economic impact study was completed in 2018, specifically for 2017 operations at the airports. The study estimated the following economic impacts related to RNO:[93]

- Nearly 3,300 jobs directly employed at the airport and airport-related industries in the county, and a total of 7,600 jobs supported throughout Northern Nevada by airport operations and airport-related industries (including direct, indirect, and induced impacts).

- Nearly $1.2 billion in total economic output generated by airport operations and airport-related industries (including direct, indirect, and induced impacts).

- Additional economic impacts through capital expenditures at the airport, as well as visitor spending by non-locals who fly into the region via RNO.

The report also includes a fiscal impact analysis, which provides a more detailed look into the impacts associated specifically with the generation of tax revenues by airport operations, air service, and tourism. Airport authority staff note that the fiscal impacts are particularly important in expressing the role of the airport to the local community because RNO is operated as a business and does not receive any funding from state or local taxes. As such, airport operations only contribute positively to local government finances including, for instance, $11 million per year to the local school district. Total annual public sector revenue

related to RNO amounted to more than $51 million in 2017. These fiscal impacts exemplify how the benefits of aviation and air service can be reinvested into the regional community.

While economic impact studies may be well understood and used by industry analysts to gather key insights, EDAWN staff note additional considerations that can be important for communicating an airport's role in regional economic development. Concise messaging and context play a role in delivering research findings to key stakeholders, including local elected officials and the general public. Large impact numbers cannot necessarily convey a message on their own and should be accompanied with benchmarks, comparisons, graphics, or any sort of context that helps an audience quickly interpret the main findings. Additionally, standard marketing strategies within the regional community can have a role in generating awareness for the airport as a driver of economic growth. Local advertisements that showcase key successes in ASD or at the airport can help generate support from the community for future initiatives.

San Diego: More Than a Major Tourist Destination

Located along the coast of Southern California, San Diego is renowned as a major tourist destination for its mild climate, expansive beaches, and must-see attractions, such as the San Diego Zoo, LEGOLAND, and SeaWorld. Close to 35.2 million tourists visit San Diego annually, spending approximately $11.6 billion in the region.[94] San Diego County, shown in Figure SAN-1 is comprised of 18 cities. It is the southwestern most county of the U.S. and is adjacent to the Mexican border. With a population of over 3.3 million, it is the second largest county in California and the fifth largest county in the U.S.

San Diego County also has the largest military concentration in the world, as the headquarters of 16 stations of the U.S Navy, U.S. Marine Corps and U.S. Coast Guard. Recently, San Diego has become known as a healthcare, mobile telecommunications, and biotechnology development center, leading the way with technology-driven health innovation such as wireless health. Numerous research institutions are also based in San Diego, making it one of the research and development capitals in the U.S. With 98 percent of firms in the region being small businesses, 68 percent of San Diego's economy is comprised of local businesses.[95]

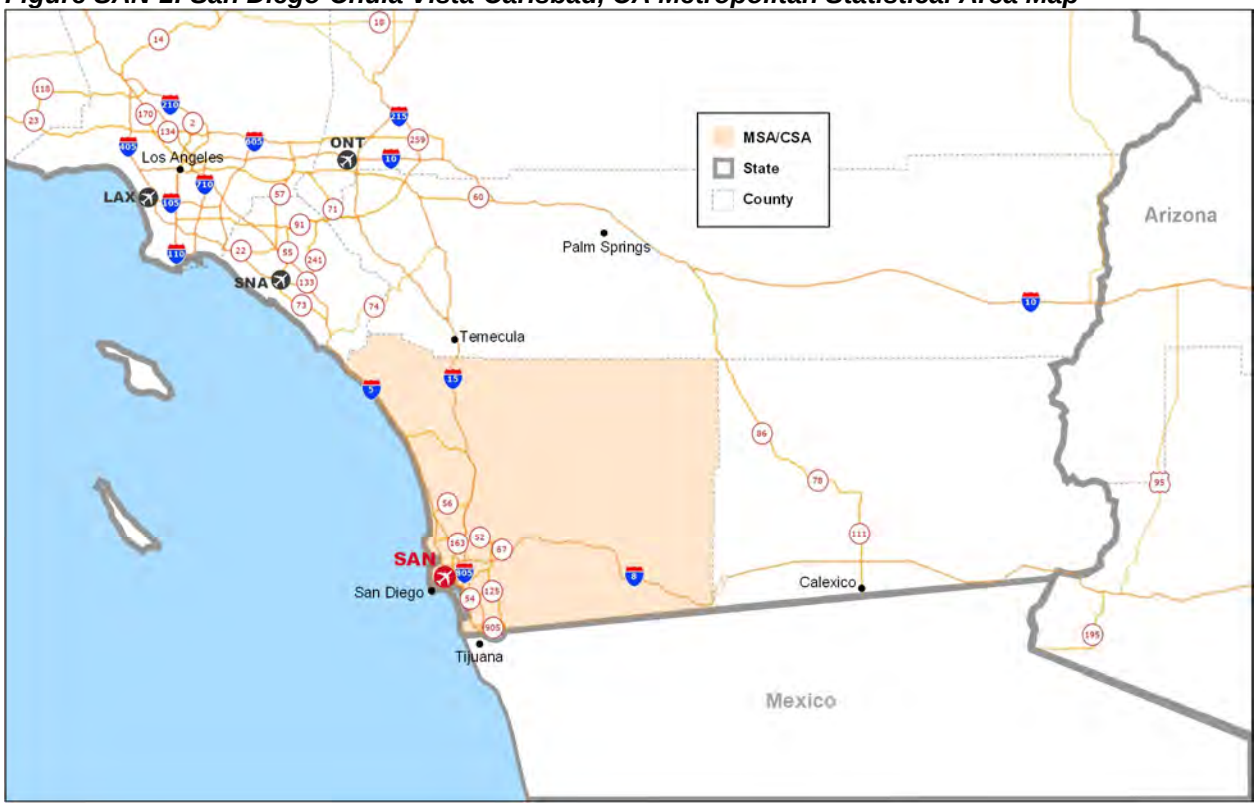
San Diego International Airport (SAN) offers close to 500 flights daily, with over 60 nonstop destinations across the U.S. and in Asia, Europe, Mexico, and Canada.[96] Prior to the pandemic, the airport handled a record of over 25 million passengers in 2019.[97] Majority of passengers (over 24 million) were domestic travelers, with the largest seat capacity growth accounted for by west coast markets.

The region is included as a case study because it is an FAA-defined large hub competing in an area with multiple airports. These are Los Angeles International Airport (LAX), which served more than 88 million passengers in 2019; John Wayne Airport (SNA) in Orange County, CA that handled nearly 11 million passengers in 2019; and Ontario International Airport (ONT) in San Bernardino County with over 5.5 million passengers in 2019.

Introduction to the Region and its Economy

San Diego County consists of the San Diego-Chula Vista-Carlsbad, CA Metropolitan Statistical Area. The region supports 1.39 million jobs and contributes over $250 billion in GDP.[98] Within the local economy, the largest industries are finance; real estate; insurance; professional, scientific, and technical services; and information. Comprising 13 percent of San Diego's economy, tourism in the region directly and indirectly supported 199,800 employees and generated almost $850 million in state and local transient occupancy, sales, and property taxes in 2019.[99] Recognized as a leading high-tech hub in the U.S., the region's innovation cluster, which includes technologies in information and communications, aerospace and navigation, as well as biotechnology and pharmaceuticals, accounts for 9.7 percent of the regional economy. Defense makes up 9.1 percent of the regional economy, with over 60 percent of vessels of the U.S. Pacific Fleet stationed in San Diego. Between 2014 and 2018, approximately $15.6 billion in foreign direct investment was invested into the region, 70 percent of which was in the life sciences sector. Total exports from San Diego amounted to $20.2 billion in 2018.[100]

Figure SAN-1: San Diego-Chula Vista-Carlsbad, CA Metropolitan Statistical Area Map



The region's population and employment have grown moderately since 2008. Table SAN-1 summarizes the changes in key socio-economic characteristics for the period. As shown, from 2008 through 2019:

- Total population rose by 316,000 (10 percent). This is slightly faster than the growth for California as a whole, which increased by 8 percent.

- Total employment increased by over 320,000 (17 percent). This rate is slightly below the rate for California, which rose by 19 percent.

- Average per capita income (nominal dollars) rose from about $45,100 to $63,700 (41 percent). The region's 2019 per capita income was 4.5 percent less than the California average ($51,791).

- The number of establishments operating in the region also increased, rising by about 17,000 (17 percent).[101]

Table SAN-1: Change in Major Socio-Economic Factors: San Diego

	2008	2015	2019	Change 2008-15		Change 2015-19		Change 2008-19	
				#	%	#	%	#	%
Population	3,022	3,281	3,338	259	9%	57	2%	316	10%
Total Employment	1,883	2,030	2,204	147	8%	174	9%	322	17%
Private Non-farm Employment	1,526	1,684	1,839	157	10%	155	9%	313	20%
Gov't Employment	344	335	354	(9)	-3%	19	6%	10	3%
Income per Capita ($)	$45,131	$54,822	$63,729	$9,691	21%	$8,907	16%	$18,598	41%
Number of Establishments	96	101	113	5	5%	12	12%	17	17%

Source: BEA

Note: Data are for the San Diego-Chula Vista-Carlsbad, CA Metropolitan Statistical Area. Government employment includes both military and civilian. All data are in 1,000s except for per capita income.

Regional Economic Strengths

Among the largest industry sectors (those with at least 100,000 employees in 2019), data from the BEA shows that employment in government and government enterprises was the highest with approximately 353,500 employees. This was 3 percent more than employment in 2008. This is partly a reflection of the significant military presence in the area.

For private nonfarm industry sectors, the largest in terms of employment was professional, scientific and technical services (PST) with 233,000 employees, an increase of 21 percent over the 11 years. With a 52 percent change from 2008 to 2019, health care and social assistance is the third largest industry sector in terms of employment, with 214,900 employees in 2019. Transportation and warehousing experienced the highest growth of employment, with more than double the number of employees in 2019 (77,600 employees) than in 2008 (31,600 employees). Table SAN-2 shows changes in employment for the largest industry sectors from 2008 to 2019.

Table SAN-2: Changes in Employment 2008-2019 for Largest Industry Sectors (ranked by number of private nonfarm sector employees in 2019)

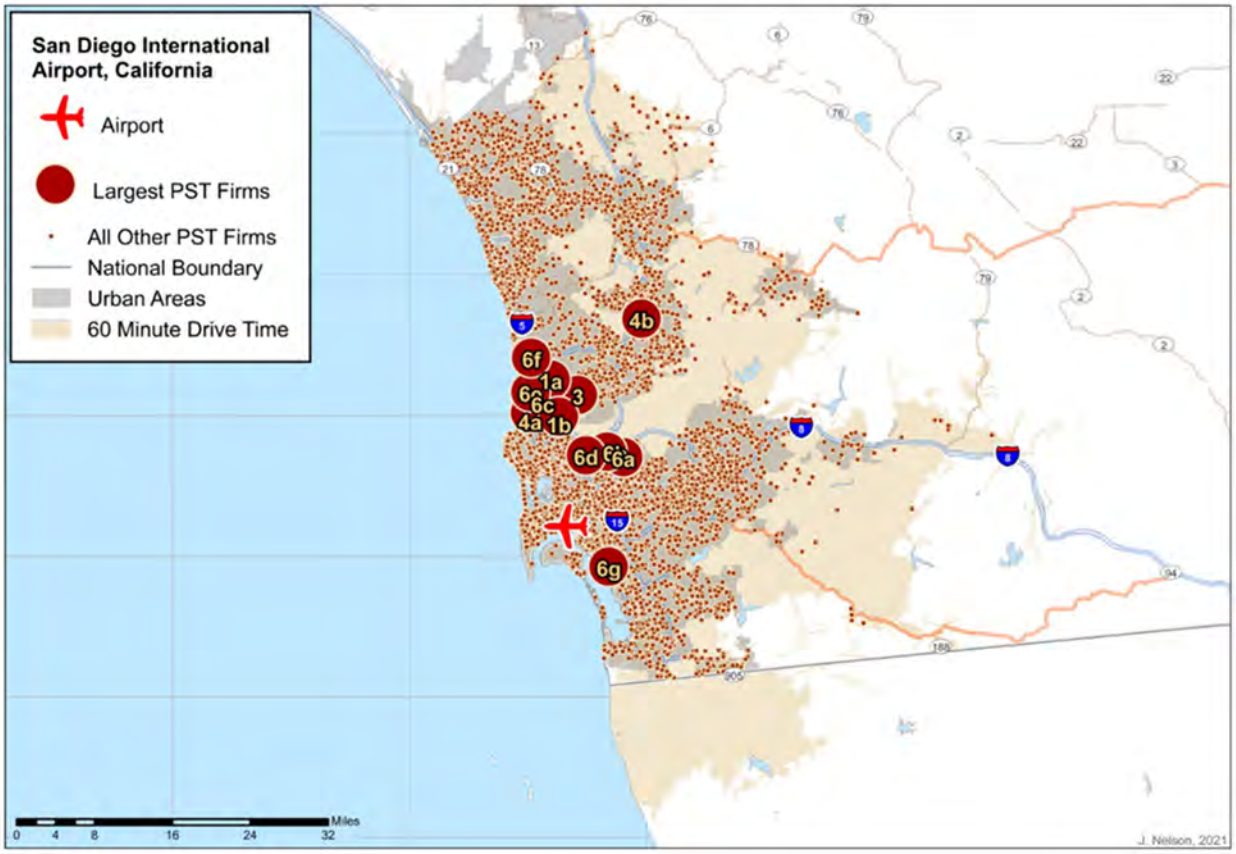
Industry Sector	2008	2015	2019	Change 2008 - 2019	
				Number	Percent
Private nonfarm employment					
Professional, scientific, and technical services	192,306	206,969	232,964	40,658	21%
Health care and social assistance	141,693	191,500	214,893	73,200	52%
Accommodation and food services	147,467	167,865	184,964	37,497	25%
Retail trade	178,039	183,272	182,524	4,485	3%
Other services (except gov't and gov't enterprises)	108,100	124,851	133,028	24,928	23%
Administrative and support and waste management and remediation services	121,067	125,910	130,570	9,503	8%
Manufacturing	110,329	114,463	124,439	14,110	13%
Real estate and rental and leasing	101,180	106,613	115,815	14,635	14%
Construction	104,089	97,239	112,793	8,704	8%
Finance and insurance	83,279	88,630	99,565	16,286	20%
Transportation and warehousing	31,608	47,068	77,608	46,000	146%
Arts, entertainment, and recreation	46,807	51,875	58,964	12,157	26%
Wholesale trade	55,967	61,050	54,620	(1,347)	-2%
Educational services	35,409	49,150	49,056	13,647	39%
Information	38,358	30,494	29,926	(8,432)	-22%
Management of companies and enterprises	17,144	24,203	27,144	10,000	58%
Government and government enterprises	343,937	334,997	353,501	9,564	3%
Grand Total (includes farm-related)	**1,882,625**	**2,029,956**	**2,204,327**	**321,702**	**17%**

Source: BEA data, San Diego-Chula Vista-Carlsbad, CA Metropolitan Statistical Area.

Drive Time Analysis

An alternative way to examine the region's economic base is to visualize business activity within a certain driving distance from the airport. Figure SAN-2 illustrates a 60-minute drive time around SAN and the location of PST businesses within that area.

Figure SAN-2: Spatial Distribution of Professional, Scientific, and Technical Service Firms (NAICS 54) in the SAN Airport One-Hour Drive Time Trade Area



Source: ESRI Business Analyst

Key highlights of socio-economic activity *within the 60-minute drive of the airport*:

- The total estimated 2019 population was 3.2 million. Of that, about 2 million (64 percent) were considered "working age" (between the ages of 18 and 64).

- The region supported over 135,000 businesses employing nearly 1.5 million. In terms of major industry sectors (defined by NAICS codes), the largest based on total employment was Professional, Scientific, and Technical Services (PST, with over 126,000 employees) followed by Manufacturing (almost 109,000 employees), and then Finance, Insurance, and Real Estate ("FIRE") with nearly 105,000.

- A large percentage of the total population is highly educated. Of the total population within the drive time, 24.3 percent held a Bachelor's degree and another 15.4 percent held a Graduate or Professional degree.

Traded Economic Clusters

The U.S. Cluster Mapping Project also highlights the region's economic advantages, noting particular strengths in aerospace and defense, biopharmaceuticals, Information technology and analytical instruments, marketing, and education. *Traded clusters*, which are groups of related industries that serve markets beyond the region in which they are located and therefore require some form of transport connectivity, make up 36

percent of San Diego's economy. The Cluster Mapping project noted great strength in five traded clusters in 2018, the latest data available:

- **Aerospace Vehicles and Defense:** This sector includes aircraft, missiles, and space vehicles, as well as search and navigation equipment. The region is ranked 6th nationally in its economic strength in aerospace and defense.

- **Biopharmaceuticals:** This sector includes biopharmaceutical products, diagnostic substances, and biological products. The region is ranked 7th nationally in its economic strength in biopharmaceuticals.

- **Education and Knowledge Creation:** This sector includes research organizations, colleges, universities and professional schools, training programs, educational support services and professional organizations. The region is ranked 11th nationally in its economic strength in education.

- **IT and Analytical Instruments:** This sector includes software publishers, medical apparatus, and audio and video equipment. The region is ranked 13th nationally in its economic strength in IT.

- **Marketing, Design and Publishing:** This sector includes marketing and advertising related services, as well as design services. The region is ranked 17th nationally in its economic strength in marketing.

The region also is ranked in the top ten nationally in two other traded industry sectors;

- **Hospitality and Tourism,** which includes accommodations, amusement parks, cultural and educational entertainment, spectator sports and other tourism attractions. The region is ranked 8th nationally in its economic strength in hospitality.

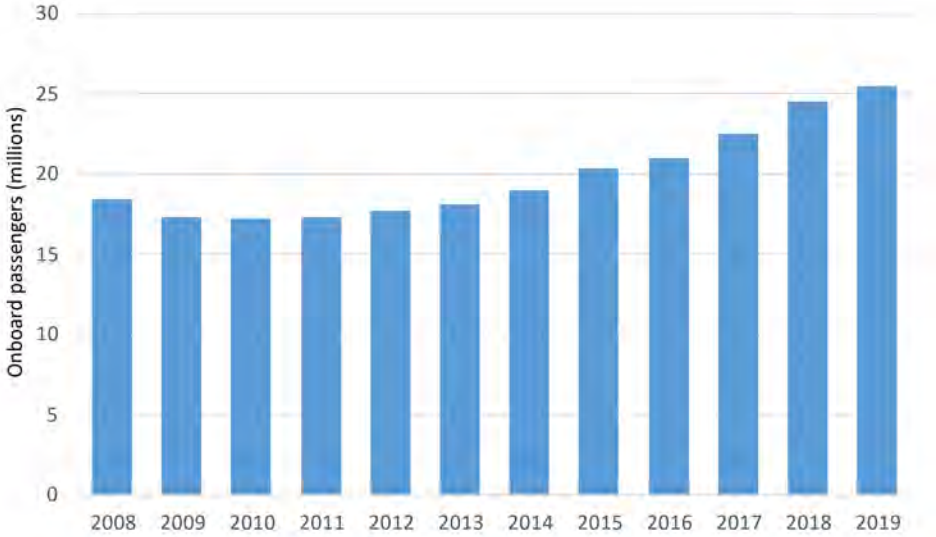
- **Water transportation**, which includes boat building and repair and marine transportation services. The region is ranked 9th nationally in this sector.

Overview of the Airport and Changes in Air Service

San Diego International Airport is managed and operated by the San Diego County Regional Airport Authority (SDCRAA). Established on January 1, 2003, the independent agency is governed by a nine-member Board, with three additional members serving ex officio. In addition to managing day-to-day operations, the airport authority is also responsible for overseeing the long-term air transportation needs of the region.

Passenger traffic at SAN has been increasing steadily since 2010, reaching the highest level of passengers handled at the airport of over 25 million in 2019. Since 2008, passenger traffic at the airport has grown with a compound average growth rate of 3 percent. Following recovery from the global economic downturn in 2008, the growth rate at the airport over the last five years has been 6 percent. Figure SAN-3 shows the development of passenger traffic at SAN from 2008 to 2019.

Figure SAN-3: Onboard Passenger Traffic at SAN, 2008-2019

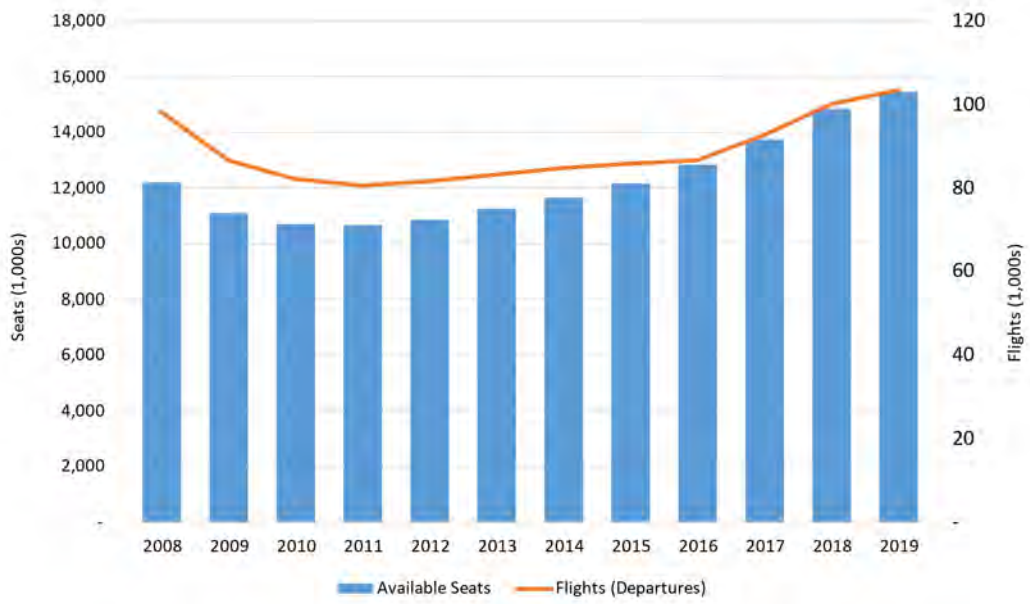


Source: T-100 data for Scheduled Passenger Service via Diio by Cirium

The total number of nonstop markets served by the airport, as well as number of flights to major markets, also grew from 2008 to 2019. In 2008, SAN offered service to 50 destinations.[102] In 2019, the airport had service to 60 destinations, an increase of 20 percent over the 11 years. Domestic markets made up majority of the destinations, but only had a growth of 8 percent from 2008 to 2019. San Francisco (SFO) continued to be the largest destination in terms of flights, followed by San Jose (SJC). International markets accounted for the majority of the growth in services during this time period, increasing from two destinations in 2008 to eight destinations in 2019. As of 2019, SAN offered international services to three Canadian destinations – Vancouver (YVR), Toronto (YYZ), and Calgary (YYC); two Mexican destinations – Los Cabos (SJD), and Puerto Vallarta (PVR); two European destinations – London (LHR), and Frankfurt (FRA); as well as one Asian destination – Tokyo-Narita (NRT).[103]

The growth in the amount of capacity offered at SAN, in terms of both total flights and seats available for sale is shown in Figure SAN-4. The number of available seats rose from over 12 million in 2008 to more than 15 million seats in 2019, an increase of 27 percent. This is equivalent to an additional 8,900 seats per day. Available seat capacity had a compound average growth rate of 2 percent over the 11-year time period. The number of flights at SAN also increased from more than 98,100 departures in 2008 to over 103,400 departures in 2019. The addition of nearly 5,300 flights, or growth of 5 percent, is equivalent to 14 more flights per day. The compound average growth rate of flights at SAN from 2008 to 2019 was 0.5 percent. Average aircraft size (seats per departure) rose from 124 to 149, an increase of 20 percent.[104]

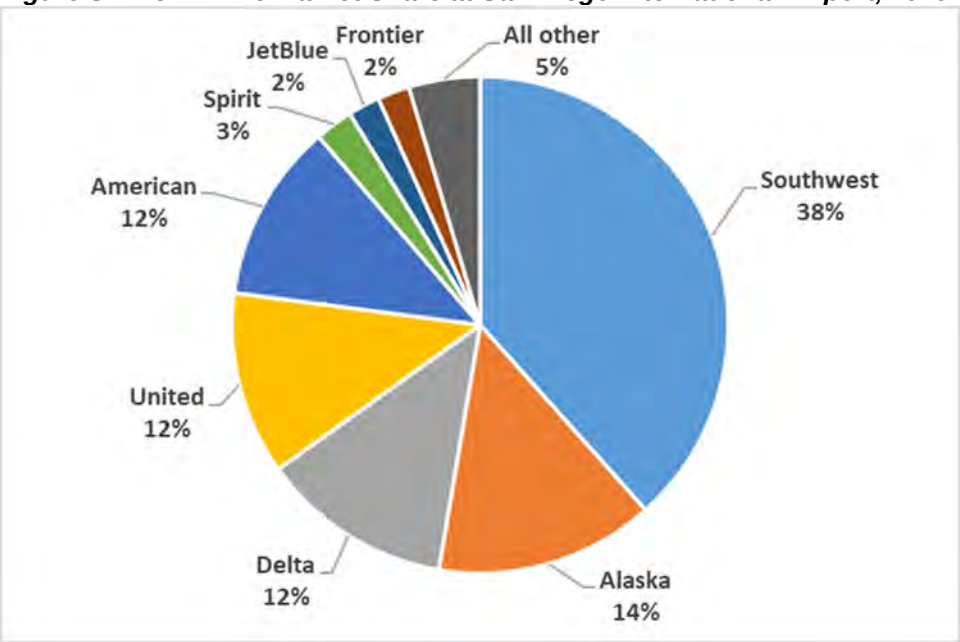
Figure SAN-4: Changes in Capacity Offered 2008-2019



Source: Schedule data from Diio by Cirium

Six domestic carriers operate out of the SAN's Terminal 1, while 11 domestic and foreign carriers operate out of Terminal 2. Southwest Airlines is the largest carrier at SAN based on onboard passengers, accounting for nearly 38 percent in 2019, followed by Alaska Airlines with 14 percent. Delta Air Lines, United Airlines and American Airlines each with 12 percent. In 2019, scheduled seats at the airport reached nearly 31 million, with an estimated 82.8 percent load factor. Figure SAN-5 shows airline market share at the airport in 2019, based on onboard passengers.

Figure SAN-5: Airline Market Share at San Diego International Airport, 2019



Although passenger traffic levels at SAN in 2020 was impacted by the travel restrictions of the COVID-19 pandemic, airlines continued to announce new routes. In 2020, 12 additional routes were launched by Alaska Airlines and Allegiant to five new destinations each, as well as by JetBlue and Southwest to one new destination each. With a growth in seat capacity of 30 percent, Allegiant was the only carrier to experience an increase in 2020 compared to 2019. Despite a decrease in cargo tonnage handled as a result of reduced passenger operations, total cargo operations at SAN increased by 6.2 percent year-over-year with nearly 7,100 cargo operations in 2020.[105]

San Diego County is the primary catchment area of the airport, while nearby Imperial County is a secondary catchment area. The Northern Baja California region is also a secondary catchment area, with Mexican residents using SAN for U.S. domestic flights. With Los Angeles International Airport approximately 127 miles away and a 2.5-hour drive from SAN, there is leakage to the airport with passengers using LAX, in particular for international services, Mexico services to Tijuana, and domestic services where SAN is underserved. Two other airports nearby include John Wayne Airport in Orange County and Ontario International Airport in San Bernardino County, which also offer a range of nonstop domestic and international destinations. However, as mentioned, SAN has been able to capture passengers from Baja California, which was never able to support services to the U.S., as well as some traffic from southern Orange County. (In addition, SAN experiences unusual competition for flights to many locations in Mexico from Tijuana International Airport (TIJ), which has a unique cross-border passenger bridge. Using the "Cross Border Xpress" provides travelers with access to more than 35 destinations including cities such as Mexico City, Guadalajara, Monterrey, Querétaro, Puebla, Zacatecas, Morelia and beach destinations such as La Paz, San José del Cabo, Puerto Vallarta, Cancun, Ixtapa, and Loreto.) Table SAN-3 summarizes the competition from the other nearby U.S. airports.

Table SAN-3: Summary of Airport Proximity and Service

Airport	Distance (miles)	Drive Time (hrs.)	Avg. Daily Flights 2019	Markets Served 2019
San Diego International Airport (SAN)	---	---	283	60
Los Angeles International Airport (LAX)	127	2.5	864	162
John Wayne Airport (SNA)	87	1.5	125	24
Ontario International Airport (ONT)	115	2.5	66	19

Note: Drive times based on Google maps, estimates for mid-morning weekday. "Average daily flights" based on scheduled operations. "Markets served" based on a minimum of 150 annual departures and refer to unique airports. If two or more airlines serve the same destination (e.g., ORD), the "market served" is counted only once.

Changes in Air Service and Economic Activity

There is a high correlation between SAN's origin-destination traffic and total local employment. Figure SAN-8 shows how changes in passenger traffic have aligned with changes in the regional economy, based on employment. The line demonstrates a strong linear relationship between the two. As the regional economy develops through increases in employment, total passenger traffic also increases. The correlation coefficient between the two is close to 1 at 0.97, indicating a significant positive relationship. However, correlation does not demonstrate causation. That is, based on correlation alone, it is not evident whether rising total employment levels lead to more air traffic, or whether more air traffic leads to more total employment.

Further, readers should recall that much recent academic research shows that improvements in air service and connectivity in fact do lead to increases in employment and economic activity, especially in industry sectors that are reliant on air transportation. This is discussed in greater detail in *ACRP Web-Only Document 53.*

Figure SAN-8: Relationship between Regional Employment and Total Origin-Destination Passenger Traffic

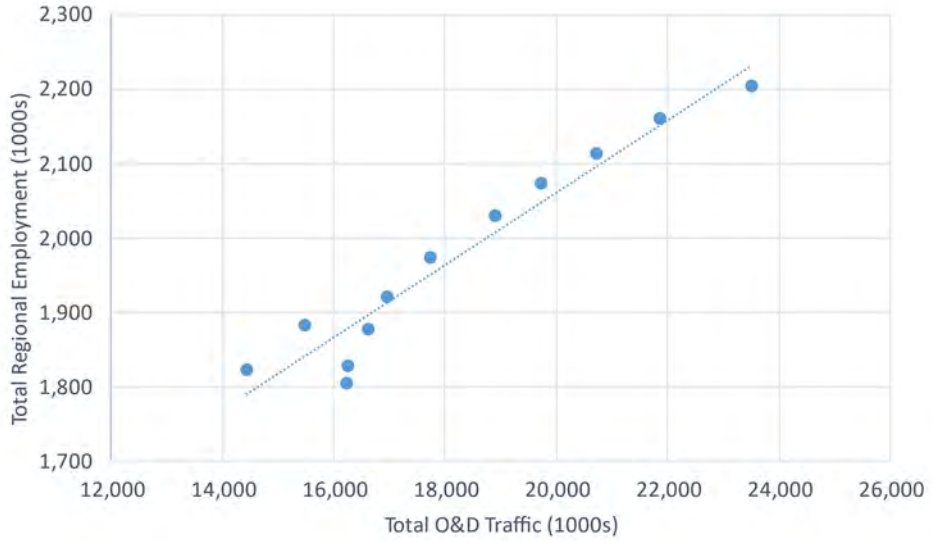
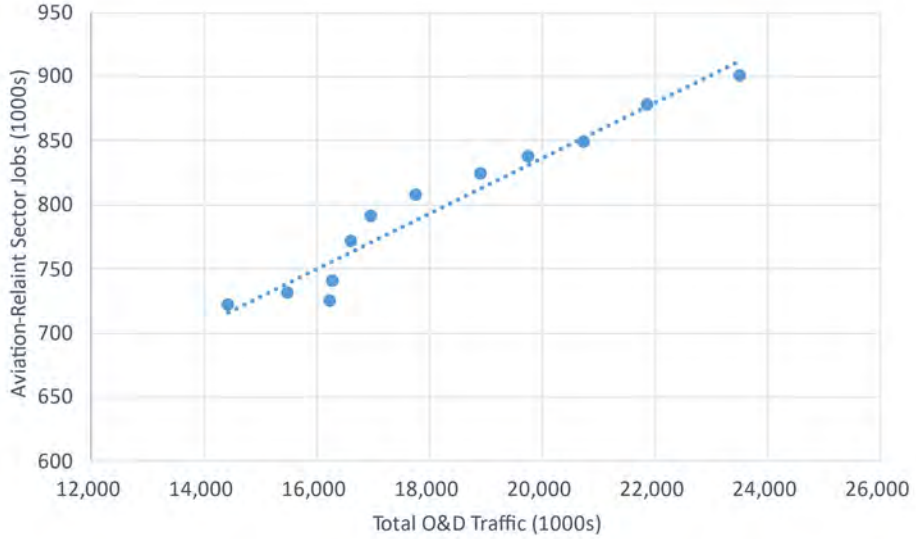


Figure SAN-9 summarizes the correlation between the airport's total O&D traffic and the region's employment in "aviation-reliant" industry sectors. Those include information technology; finance, insurance, and real estate; PST; management of companies, administrative services, educational services, and health care. The correlation remains very high: 0.94. Again, the two variables move together: increases in one correspond with increases in the other.

Figure SAN-9: Relationship between Total Origin-Destination Passenger Traffic and Aviation-Reliant Industry Employment



Airport's Connections with Regional Economic Stakeholders

SDCRAA's Air Service Development (ASD) program is directly related to economic activity in the region. Comprised of two full-time staff members, the ASD team is currently focused on international growth, in particular hub operations to maximize load factors. In the past, SAN was able to introduce services to the U.K. through British Airways, and Asia through Japan Airlines. The next focus for the airport authority was Latin America. Within the U.S., the ASD team focuses on domestic markets with more than 100 passengers daily each way (PDEW). With consolidators trucking mostly to LAX, the airport's ASD program does not have specific air cargo or freight goals.

To obtain these goals, SAN uses passenger traffic trends and statistics to determine the next best option for them, or the next best hub to serve passengers one-stop. The airport looks at the number of passengers flying two-stops, which they would do one-stop for through a new hub. Businesses in the regional economy also influences ASD targets, as SDCRAA regularly reaches out to corporate businesses to see how they are travelling.

Regional stakeholders, including both the government and private sector, are extremely important. They are actively engaged with the airport's ASD team. The U.S Navy, Army and Marines have a natural connection with cities with sizeable bases, and with the large military concentration in San Diego, SAN has a strong relationship with military departments in the region. The airport authority also has frequent conversations with companies, such as ViaSAT – a communications company based in the City of Carlsbad within San Diego County, about the order of magnitude or size of the market. Qualcomm, a multinational corporation based in San Diego that manufactures semiconductors, has also attended meetings with an international carrier.

With the trifecta of the airport, tourism authority and economic council, SAN has been able to successfully attract non-stop services to strategic domestic and international markets. In particular, by working together, the airport has met its goal of obtaining air services to Europe and Asia. Key partners of the SDCRAA include the San Diego Economic Development Council and World Trade Center San Diego, San Diego Tourism Authority, and the Port of San Diego.

The SDCRAA is closely connected with the San Diego Economic Development Council (EDC), a non-profit and independently funded organization with a mission to "maximize the San Diego region's economic prosperity and global competitiveness."[106] The EDC works directly with local businesses and the airport to tie the global story to broader economic sectors developing in the region, providing services to companies that enable them to expand and increase employment in San Diego. The EDC's international affiliate, World Trade Center San Diego (WTCSD), specifically assists local small businesses with growing international exports and attracting foreign direct investment (FDI). By focusing on high growth industries in the region, the World Trade Center connects the region to key global markets.[107] Once or twice a year, the airport authority, EDC and WTCSD have a relationship upkeep meeting to ensure all groups are on the same page.

The WTCSD's flagship program called MetroConnect assists small and medium businesses in exporting and growing internationally by providing them resources needed to participate in the global market. There have been 65 companies that have participated in the MetroConnect program. Since it started, the program has made a significant impact in the regional economy, with an $85 million net increase in exports, 18 new facilities established overseas, and 269 new jobs created in San Diego.[108]

Whenever an airline comes into town, a big marketing push is made by the airport and organizations to bring awareness in the market. Through these activities, and through airport connections, the EDC and WTCSD are introduced to the airline's business development representative. The EDC and WTCSD will

meet with this individual, or team, to pitch to them potential ways to partner with them and grow their presence in San Diego. Some suggestions might include involvement in the MetroConnect program or outbound trade missions with business and elected leaders. The role of the EDC and WTCSD is to steward good relationships with the carrier and serve as the liaison between the carrier and local businesses. To further develop their presence in the region, the carrier may offer different incentives and packages for local businesses, such as flight discounts. The EDC and WTCSD will have a go-to contact for MetroConnect companies that want to make use of those discounted flights.

Communicating the Airport's Economic Impact

In June 2018, the airport authority released an Economic Impact Study of SAN prepared by CDM Smith. The technical report of the study can be found on the airport's website.[109] This latest study is based on airport operations in 2017. The study assessed the economic contribution of the airport, including onsite businesses and government organizations, off-site airport parking, and related air cargo facilities located off-airport. It also included an analysis of visitor spending and on-airport construction impacts.

The direct employment supported by SAN, including airport operations (onsite and offsite), visitor spending and on-airport construction, amounted to more than 67,800 jobs. Including multiplier impacts that are generated throughout the regional economy, total employment supported by the airport in 2017 reached nearly 118,000 jobs. This total employment comprises 5.7 percent of San Diego County's total number of employed persons in 2017, equivalent to 2.1 million employees. These airport activities generated close to $6.1 billion in direct economic output and approximately $11.9 billion in total economic output when multiplier impacts are included.

The airport economic impact study has been used by the SDCRAA in their ASD initiatives, in particular when procuring international air services. It was also used by the airport authority when commencing new capital infrastructure projects, such as the construction of Terminal 1 and new Federal Inspection Station (FIS). Although the economic impact study was not necessary to justify these new services or projects, it quantified the value of SAN in economic terms. The study has been well received by stakeholders, with many organizations citing the study and results in their own newsletters.

Connectivity

High quality transportation – of all modes – is a prerequisite for sustained economic growth and competitiveness for a region. Specifically, these factors of economic development are driven by productivity growth, which is underpinned by trade, foreign investment, and innovative activity – all of which are facilitated by connectivity. "Connectivity" generally means the ability to reach a wide range of places in a short amount of time. Connectivity is not simply a matter of the number of routes or number of frequencies operated. Connectivity is fundamentally about access to markets and regions.

Changes in connectivity can be measured in a variety of ways. One is a method developed by the International Air Transport Association (IATA). The IATA connectivity index estimates the quality of air service at an airport based on the degree of service to other airports with the largest and most diverse route networks, as a proxy for how accessible the local economy is to the rest of the world. Service to airports with the highest total seat capacity (e.g. ATL) receives the highest weighting. Figure SAN-6 summarizes the formula for the IATA connectivity index. Using airline schedule data for passenger service, the index measures the number of frequencies and available seats to a particular destination. It then weights the number of available seats by the size of the destination airport (in terms of total capacity handled each year).

This weighting reflects both the size and economic importance of the destination and the potential for convenient onward connections.

Figure SAN-6: IATA Connectivity Index Formula

$$\frac{\text{[Number of destinations x Weekly Frequency x Seats per flight]}\ \textit{Weighted by the Size of the Destination Airport}}{\text{Scalar factor of 1000}}$$

Figure SAN-7 summarizes the change in connectivity at SAN against 2008 levels for comparison. Connectivity at SAN in 2019 was 25 percent higher than 2008 levels, with continued growth in nonstop passenger services to key destinations over the years. All else being equal, each additional seat serving these routes will yield a higher level of connectivity than smaller airports with fewer onward destinations and service. Between 2008 and 2019, connectivity at the airport had a compound annual growth rate of 2.9 percent. As mentioned, passenger traffic at SAN was impacted by the Great Recession, which impacted the airport's connectivity level. However, it returned to pre-recession levels of connectivity by 2015, and then sustained continued growth in most years through 2019.

Figure SAN-7: SAN Connectivity Growth Index (2008=100)

Source: Inter*VISTAS* analysis of Innovata schedule data from Diio Mi.
Note: Chart shows the IATA Connectivity Index for SAN, indexed against 2008 (2008 = 100).

Charles M. Schulz Sonoma County Airport: Expanding Services in Shadow of Major Hubs

The Charles M. Schulz Sonoma County Airport (STS or "airport") is located near the City of Santa Rosa, the largest city in Sonoma County. It serves the Santa Rosa – Petaluma Metropolitan Statistical Area (MSA) and the broader North Bay Region ("region"), which comprises the counties of Sonoma, Lake, Napa, Marin, Mendocino and Humboldt north of San Francisco along the Pacific Ocean. The MSA is part of the larger San Jose-San Francisco-Oakland Combined Statistical Area. It is the northernmost county in the nine-county San Francisco Bay Area region. The Region's economy revolves around high technology industries and agriculture, particularly the world-famous wine industry and tourism.

STS is a non-hub airport operating in the shadow of several larger international facilities. These are San Francisco International Airport (SFO), Oakland International Airport (OAK), San Jose International Airport (SJC), and Sacramento International Airport (SMF).

STS is included as a case study as an example of a smaller airport that has expanded its services since 2008, despite being within a relatively short distance from larger airports with significantly more air service options.

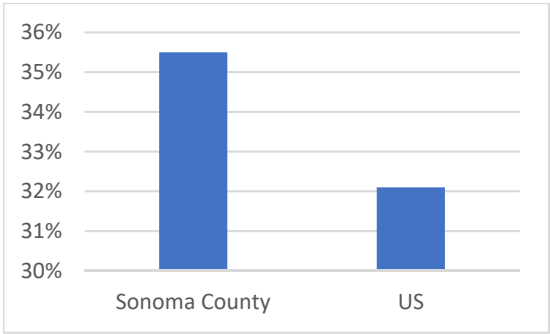
Introduction to the Sonoma County Region and its Economy

Along with the neighboring Napa, Mendocino, Solano, and Lake counties, Sonoma County is in the heart of California's world-renowned Wine Country. The region is famous for its wineries, cuisine, resorts, and culture. Santa Rosa is the largest city in the county, with a population of about 180,000. Figure STS-1 shows the location of the area on the California coast north of San Francisco.

Figure STS-1: The Sonoma County MSA

According to the U.S. Bureau of Economic Analysis (BEA), in 2019, the Santa Rosa-Petaluma MSA had a population of 494,336, ranked 112th in the nation (out of 384 total). The MSA produced $33.3 billion in current-dollar total GDP. This ranked 90th among MSAs, an increase in the region's national ranking from 2009, when it ranked 97th among MSAs.[110]

The region is relatively highly educated. Almost 40 percent of the adult population aged 25 or older holds a Bachelor's degree or graduate or professional degree. This is slightly above that for California as a whole, where 35 percent hold a Bachelor's degree or graduate or professional degree.



Compared to the U.S. average, more Sonoma County residents over age 25 have a Bachelor's degree or higher.

The region's population and employment have grown moderately since 2008. Table STS-1 summarizes the changes in key socio-economic characteristics for the period. As shown, from 2008 through 2019:

- Total population rose by over 21,000 (4 percent). By contrast, population for the state of California rose by 8 percent. The population peaked at 503,000 in 2016 before declining. Some of that decrease may be associated with the significant wildfire activity that swept through the area in three consecutive years, beginning in 2017.

- Total employment increased by almost 60,000 (6 percent). For the state as a whole, total employment rose by 19 percent.

- Average per capita income (nominal dollars) rose from $43,600 to $66,700 (54 percent), roughly equal to the average per capita income for all in California. Expressed in constant 2019 dollars, the increase was 25 percent. Per capita incomes for the state of California rose by 52 percent in nominal dollars. The MSA's per capita income is roughly $10,000 above the 2019 average U.S. per capita income, $56,467.

- The number of establishments operating in the region declined slightly.[111]

Table STS-1: Change in Major Socio-Economic Variables, Sonoma County Region 2008-2019

	2008	2015	2019	2008-15		2015-19		2008-19	
				Change	Percent	Change	Percent	Change	Percent
Population	473,091	500,863	494,336	27,772	6%	(6,527)	-1%	21,245	4%
Total Employment	276,221	296,758	313,181	20,537	7%	16,423	6%	36,960	13%
Private Non-farm Employment	240,249	260,449	277,362	20,200	8%	16,913	6%	37,113	15%
Government Employment	29,800	30,185	29,532	385	1%	(653)	-2%	(268)	-1%
Income per Capita ($)	$43,658	$55,437	$66,700	$11,779	27%	$11,263	20%	$23,042	53%
Number of Establishments	13,957	27,492	28,560	13,535	97%	1,068	4%	14,603	105%

Source: BEA

Regional Economic Strengths

Several sectors experienced employment growth of 20 percent or more. These included health care and social services (12,000 jobs, an increase of 44 percent); accommodations and food service (nearly 4,500 jobs, or 22 percent); administrative and support services (over 4,500 jobs, or 31 percent); arts, entertainment, and recreation (nearly 2,200 jobs, or 28 percent); transportation and warehousing (nearly 2,400 jobs, or 48 percent); forestry, fishing, and related services (almost 1,500 jobs or 66 percent); and management of companies (over 400 jobs or 20 percent). Table STS-2 summarizes the change in employment by major industry sectors from 2008 to 2019, ranked by the largest number of employees in the MSA in 2019.

Table STS-2: Summary of Employment by Sector and Changes Since 2008

Industry Sector	2008	2015	2019	Change 2008-2019	
				Number	Percent
Health care and social assistance	27,300	36,661	39,329	12,029	44%
Retail trade	29,480	31,111	30,043	563	2%
Manufacturing	24,392	24,950	26,258	1,866	8%
Accommodation and food services	20,350	23,585	24,832	4,482	22%
Professional, scientific, and technical services	25,785	23,393	24,209	(1,576)	-6%
Construction	20,438	18,929	23,796	3,358	16%
Other services (except government and gov't enterprises)	16,370	19,003	19,183	2,813	17%
Administrative and support services & waste remediation	14,488	16,509	19,010	4,522	31%
Real estate and rental and leasing	13,744	14,430	16,016	2,272	17%
Finance and insurance	11,039	10,495	11,388	349	3%
Arts, entertainment, and recreation	7,880	9,212	10,068	2,188	28%
Wholesale trade	9,672	10,329	9,552	(120)	-1%
Transportation and warehousing	4,992	5,945	7,371	2,379	48%
Educational services	4,373	5,146	5,213	840	19%
Information	4,119	3,990	3,737	(382)	-9%
Forestry, fishing, and related activities	2,226	2,860	3,697	1,471	66%
Management of companies and enterprises	2,030	2,321	2,446	416	20%
Utilities	861	743	754	(107)	-12%
Mining, quarrying, and oil and gas extraction	710	837	460	(250)	-35%
Subtotal private nonfarm employment	240,249	260,449	277,362	37,113	15%
Government and government enterprises	29,800	30,185	29,532	(268)	-1%
Total employment	**276,221**	**296,758**	**313,181**	**36,960**	**13%**

Source: BEA

Economic Clusters

The U.S. Cluster Mapping Project's analysis of the region also highlights its broad economic strength. The area's economy features multiple tradeable clusters that are among the top performers in the country, and several are of notable strength. They include those associated with the region's agricultural and wine industry (food processing), along with agriculture, medical devices, and financial services, among others.

- The Food Processing cluster includes subclusters for wine, malt beverages, and distilleries. The region is ranked 2nd nationally in the wineries subcluster, 28th in breweries, and 37th in distilleries. The region's location quotient for the cluster is 9.30.

- Within the Agricultural Inputs and Services Cluster, the region is ranked 8th in the nation for industries related to farm management and labor services. The LQ for this cluster is 6.54.

- The region is also ranked in the top 50 nationally for employment in the Medical Device cluster. Subclusters include optical instruments and ophthalmic goods and surgical and dental instruments and supplies. Its LQ is 5.14.

- The region also has economic strength (high employment specialization) in the Financial Services cluster. Over 1,000 are employed in the credit intermediation subclusters, with another 500 in financial investment activities. The region's LQ for financial services is 1.32.

Drive Time Analysis

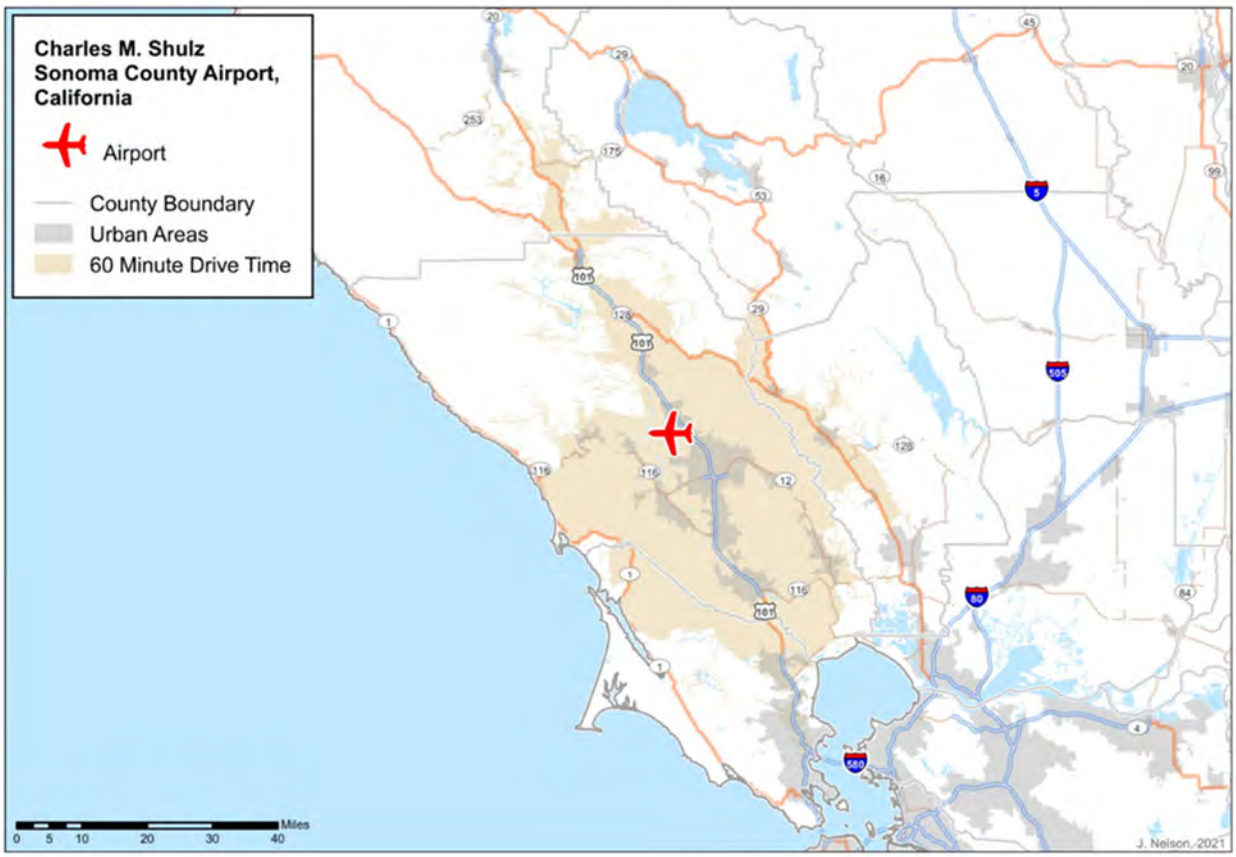
Figure STS-2 illustrates a 60-minute drive time around STS. Key highlights of socio-economic activity *within the 60-minute drive of the airport:*

- The total estimated 2019 population was 632,000. Of that, 384,000 (61 percent) were considered "working age" (between the ages of 18 and 64).

- The economy supported over 35,000 businesses employing nearly 300,000. In terms of major industry sectors (defined by NAICS codes), the largest based on total employment was Manufacturing (31,000 employees) followed by Professional, Scientific, and Technical Services (PST), with over 20,000 and Finance, Insurance, and Real Estate with nearly 20,000.

- Of the population within the drive area, 24 percent held a Bachelor's degree and another 14.0 percent held a Graduate or Professional degree.

Figure STS-2: Spatial Distribution of the STS Airport One-Hour Drive Time Trade Area



Overview of the Airport and its Commercial Service

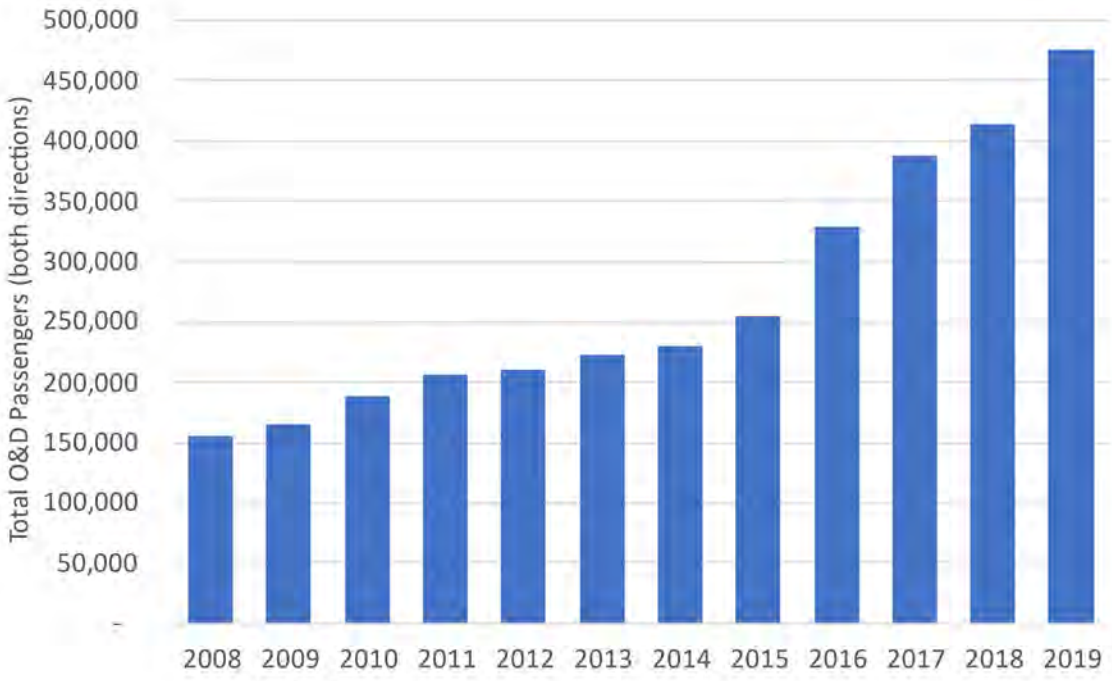
STS is the only airport that offers scheduled commercial air service into the North Bay region. The Airport is a division of the Sonoma County Department of Transportation and Public Works. Operation of the Airport is the responsibility of the Airport Manager, with support from the Aviation Advisory Commission appointed by the County Board of Supervisors.

The Airport is classified as a non-hub airport by the Federal Aviation Administration in 2019. Based on enplaned passengers, STS was the 182nd busiest airport in the country in 2019 and the 15th busiest in California.

The Airport defines its catchment area to be broader than the MSA, encompassing the "North Bay region," which includes Sonoma, Lake, Napa, Marin, Mendocino and Humboldt counties.[112] The catchment area had an estimated population of 1,195,163 in 2018. This represented 14 percent of the total San Francisco Bay Area population of 8.3 million.

STS primarily serves customers originating at or destined for the Airport. According to available data, in 2019, over 99 percent of the total passenger traffic used the airport as its point of origin or destination (O&D). The airport has succeeded in tripling total O&D traffic since 2008, with the number of passengers rising from just over 150,000 to 475,000 as shown in Figure STS-3. With clear passenger demand, airlines were increasingly willing to add capacity at the airport.

Figure STS-3: Change in Total O&D Passengers at STS



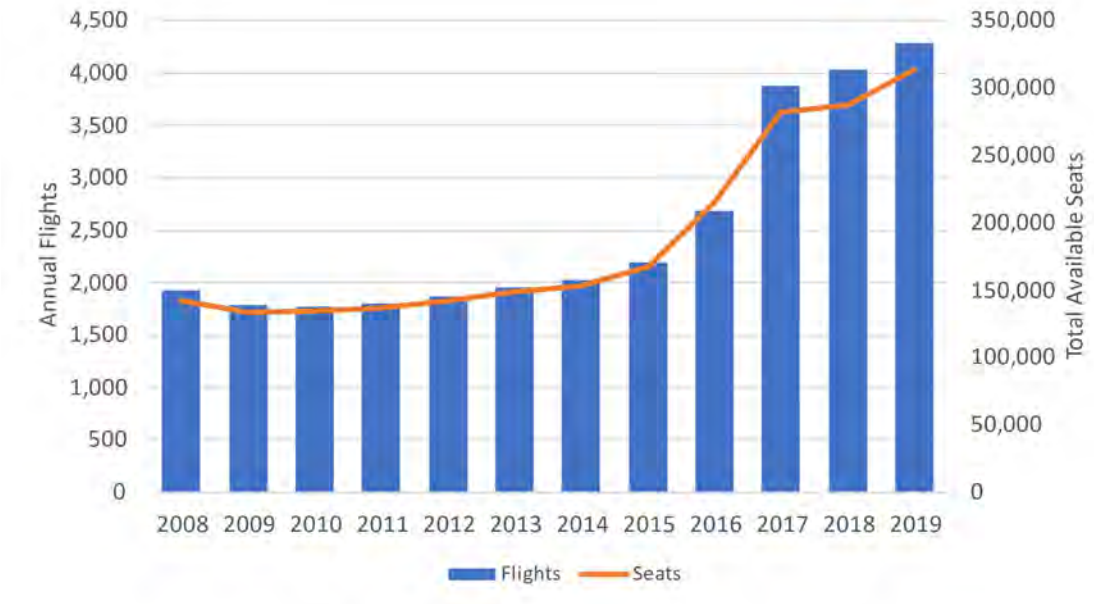
Somewhat uniquely at STS, capacity was constrained by the length of its main runway. When Alaska Airlines (Alaska) initiated service at STS in 2007, it was able to do so because the airport's main runway – at 5,121' – could accommodate aircraft no larger and no more powerful than the airline's 76-seat Q400s. Alaska started service with flights to Los Angeles International (LAX) and Seattle Tacoma International (SEA). It soon expanded to Portland (PDX) and Las Vegas.

In 2014, the airport was able to extend its main runway to 6,000.' The extension was necessary to bring the airport into compliance with FAA standards. The additional length also allowed airlines to use turbofan aircraft at the airport.

Total capacity offered at the airport rose significantly (see Figure STS-4), especially beginning in 2016 when Alaska added daily flights to Orange County John Wayne Airport (SNA). Allegiant also launched service to Phoenix-Mesa Gateway Airport (AZA) and Las Vegas International Airport (LAS), but

discontinued those flights the next year. In 2017, American Airlines (American) added flights to Phoenix Sky Harbor International Airport (PHX) and United Airlines (United) entered service at STS with operations to San Francisco International (SFO). In 2019, American added flights to Los Angeles International (LAX) and to Dallas/Ft. Worth International (DFW), and United added service to Denver International (DEN). Throughout the period, the average size of aircraft using the airport was largely unchanged, at between 70 and 75 seats per departure.

Figure STS-4: Change in Flights and Available Seats at STS, 2008-2019



In July 2019, a peak domestic travel timeframe in the U.S., airlines serving STS offered non-stop schedule service to 10 destinations. These services were clustered in the western region of the U.S. with one service each to the Rocky Mountain and Southwest Regions. Table STS-3 summarizes STS's July 2019 services. Alaska remains the airport's market leader holding 63 percent of the available capacity.

Table STS-3: Summary of Scheduled Service Offerings at STS, July 2019

Airline	Destination	Flights	Seats	Share of seats
American	DFW	31	2,356	23%
	LAX	31	2,356	
	PHX	31	2,356	
Alaska	LAX	83	6,308	63%
	PDX	62	4,712	
	SAN	31	2,356	
	SEA	48	3,648	
	SNA	31	2,356	
Sun Country	MSP	9	1,191	4%
United	DEN	31	1,550	10%
	SFO	31	1,550	
Total		**419**	**30,739**	**100%**

Source: Schedule data from Diio by Cirium

Connectivity

High quality transportation – of all modes – is a prerequisite for sustained economic growth and competitiveness for a region. Specifically, these factors of economic development are driven by productivity growth, which is underpinned by trade, foreign investment, and innovative activity – all of which are facilitated by connectivity. "Connectivity" generally means the ability to reach a wide range of places in a short amount of time. Connectivity is not simply a matter of the number of routes or number of frequencies operated. Connectivity is fundamentally about access to markets and regions.

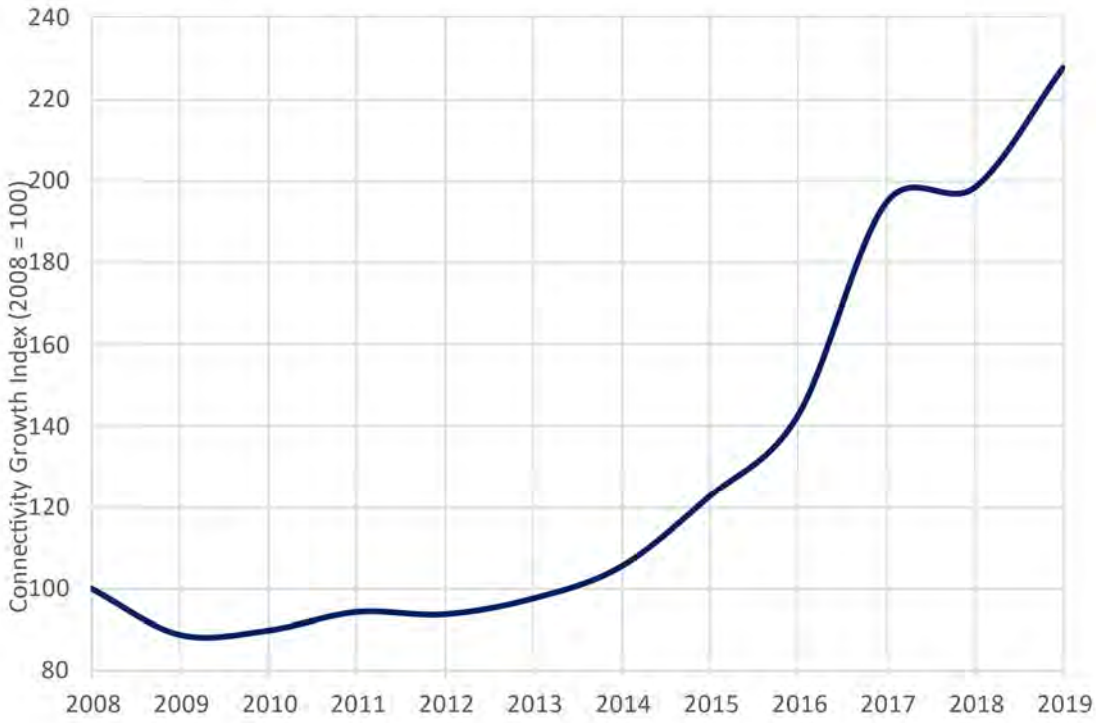
Changes in connectivity can be measured in a variety of ways. One is a method developed by the International Air Transport Association (IATA). The IATA connectivity index estimates the quality of air service at an airport based on the degree of service to other airports with the largest and most diverse route networks, as a proxy for how accessible the local economy is to the rest of the world. Service to airports with the highest total seat capacity (e.g. ATL) receives the highest weighting. Figure STS-5 summarizes the formula for the IATA connectivity index. Using airline schedule data for passenger service, the index measures the number of frequencies and available seats to a particular destination. It then weights the number of available seats by the size of the destination airport (in terms of total capacity handled each year). This weighting reflects both the size and economic importance of the destination and the potential for convenient onward connections.

Figure STS-5: IATA Connectivity Index Formula

$$\frac{\text{[Number of destinations x Weekly Frequency x Seats per flight]}\ \textit{Weighted by the Size of the Destination Airport}}{\text{Scalar factor of 1000}}$$

Figure STS-6 summarizes the change in connectivity at GSO against 2008 levels for comparison. Connectivity at STS increased substantially from 2014 onwards, due not only to the growth in overall capacity enabled by the runway extension but more particularly with the introduction or expansion of nonstop service to well-connected hubs like Los Angeles (LAX), San Francisco (SFO), Phoenix (PHX), Denver (DEN), and Dallas (DFW). Service to these hubs facilitated onward connections to a larger number of domestic and international markets, thereby helping to more than double the air connectivity between 2014 and 2019. The single largest year of growth in connectivity at STS occurred in 2017, when connectivity jumped by 37 percent due largely to the introduction of daily service to SFO and PHX.

Figure STS-6: STS Connectivity Growth Index (2008=100)



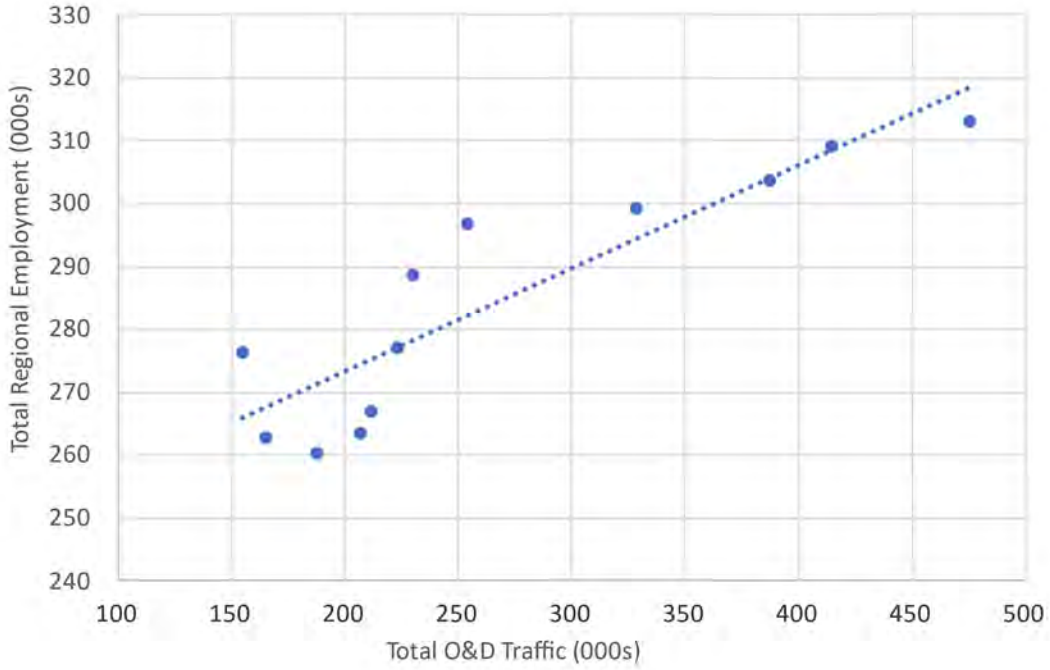
Source: Inter*VISTAS* analysis of Innovata schedule data from Diio Mi.
Note: Chart shows the IATA Connectivity Index for STS, indexed against 2008 (2008 = 100).

Analysis of Air Service and Economic Variables

In this part of California, passenger traffic is relatively highly correlated with total regional employment. This means that as one variable rises, so does the other. As total regional employment increases, total O&D traffic at STS also increases. However, correlation analysis does not establish causation. It is not unambiguous that changes in employment necessarily lead to changes in O&D activity. The opposite could equally be true: That changes in O&D traffic lead to changes in regional employment. As shown in Figure STS-7 below, the relationship between the two concepts – shown with the data points and line – is positive, and the strength of the statistical correlation is relatively high (0.895).

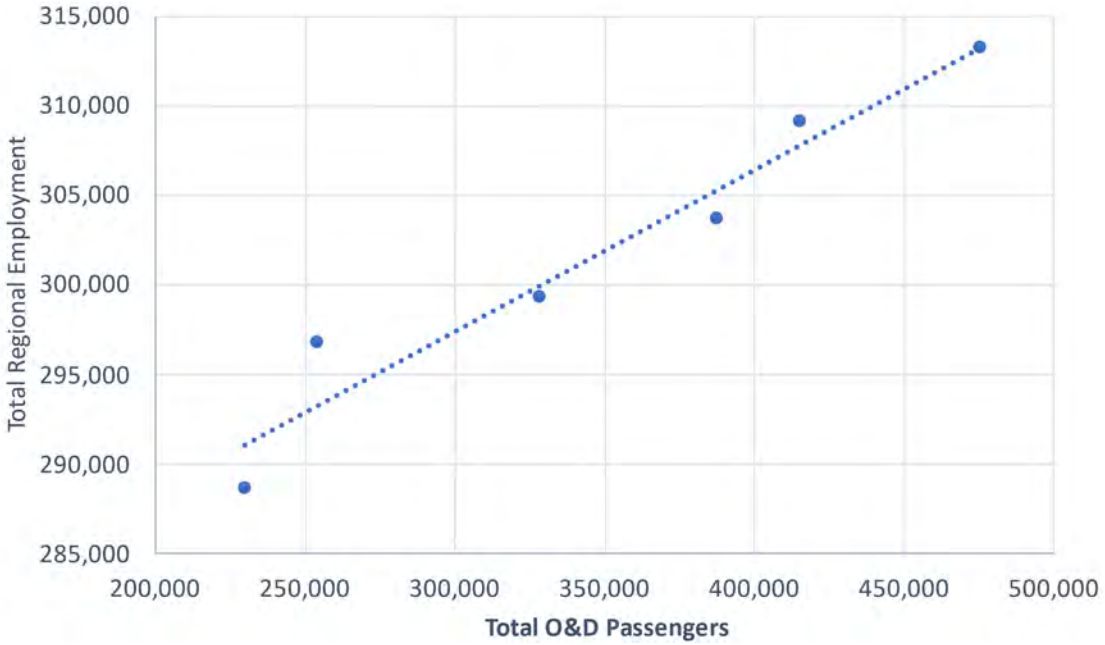
At the same time, it is important to recall that much recent academic research shows that improvements in air service and connectivity in fact do lead to increases in employment and economic activity, especially in industry sectors that are reliant on air transportation.

Figure STS-7: Relationship between Total Regional Employment and Total O&D Passenger Traffic (2008-2019)



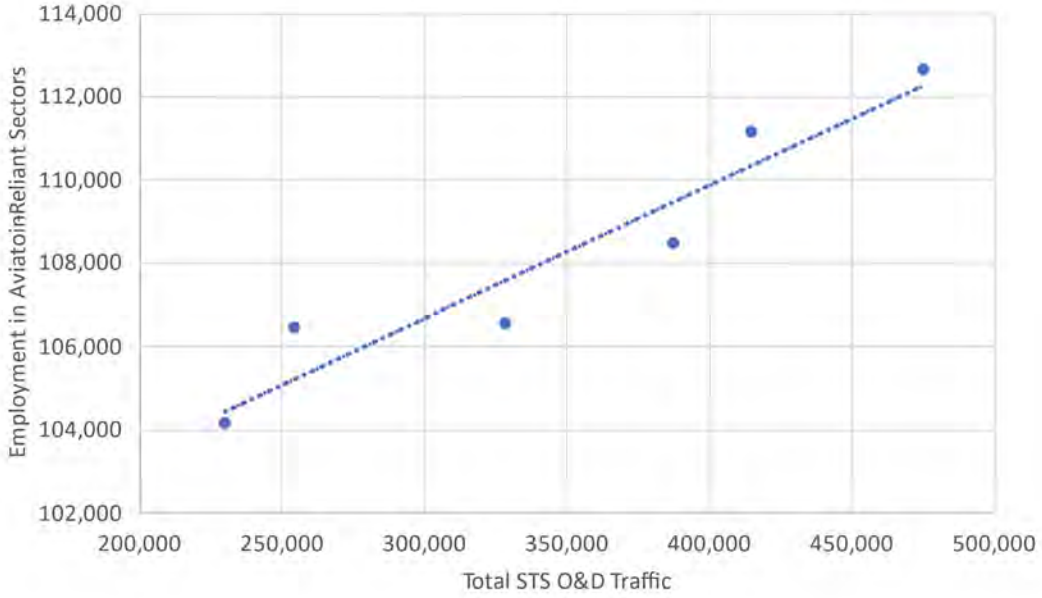
If the analysis is confined to the period from 2014 through 2019 (thus eliminating the period immediately following the Great Recession and when the airport's main runway length precluded jet operations), the strength of the correlation rises to 0.970. See Figure STS-8.

Figure STS-8: Relationship between Total Regional Employment and Total O&D Passenger Traffic (2014-2019)



If the analysis is further restricted to employment in sectors that tend to be more reliant or dependent on commercial aviation (i.e., manufacturing; wholesaling; PST; management of companies; information; financial and insurance service; real estate; and administrative, support, and waste management and remediation service), then the correlation remains essentially unchanged, at 0.956. See Figure STS-9.

Figure STS-9: Relationship between Total O&D Passenger Traffic and Employment in Aviation-Reliant Sectors (2014-2019)



STS's Competitive Challenge

The analysis above suggests that the region's population and employment base are increasingly willing to use their local airport, especially as service offerings expand. Nevertheless, STS faces significant challenges for airline service and passenger traffic because of its proximity to four other large airports in Northern California. All offer a wider range of nonstop domestic and international destinations, with highly competitive air fare pricing. The combination of service and pricing options, as is the case with all non-hub and small hub airports within driving distance of one or more large hub airports, results in travelers gravitating to these. Table STS-4 summarizes the competition from the other nearby airports.

Table STS-4: Summary of Airport Proximity and Service

Airport	Distance (miles)	Drive time (hrs.)	Avg. daily flights 2019	Markets served 2019
Sonoma County (STS)	--	--	12	9
Oakland International Airport (OAK)	74	1.25	148	42
San Francisco International Airport (SFO)	74	1.5	520	101
Sacramento International Airport (SMF)	105	2	158	35
San Jose International (SJC)	119	2	195	41

Note: Drive times based on Google maps, estimates for mid-morning weekday. "Average daily flights" based on scheduled operations. "Markets served" based on a minimum of 150 annual departures and refer to unique airports. If two or more airlines serve the same destination (e.g., ORD), the "market served" is counted only once.

Ground access and traffic congestion have significant influences on travelers' choices when determining which airport they are most likely to use. STS is located 57 miles north of the Golden Gate Bridge on California Route 101, the main north-south non-interstate artery in California. As such, it is heavily congested, so travel times, particularly during peak periods, from the North Bay Area to OAK and SFO can be excessive.

According to airport estimates for 2018, STS retained five percent of the passenger bookings from the catchment area. The rates vary significantly by county. SFO captures over 80 percent of the bookings from the catchment area.[113]

% of Passenger Bookings Captured by STS	
County of residence	%
Sonoma	12.2
Mendocino	7.0
Humboldt	5.9
Lake	4.1
Napa	2.7
Marin	1.4

Air Service Development

As is the case in most U.S. markets, airport management initiates contacts with the airlines to discuss potential air service development opportunities. The business community may partner with the Airport and engage with air carriers after the airlines have expressed interest in discussing the potential of air service. The engagement by the business community can take multiple forms, from direct participation in meetings to contacts between local companies and airline sales teams to persuade the airline to add and/or up-gauge services.

In 2008, the Airport was served only by Alaska, via its Horizon regional affiliate. At that time, the Airport's air service development goals included expanding the number of flights and air carriers to key West Coast markets and adding service to a hub airport toward the east. Over the last 12 years, those goals have been largely accomplished with the introduction of non-stop services to most major hubs in the western U.S. Non-stop services to Denver (DEN) and Dallas Fort Worth (DFW) in 2019 are the latest hub markets to be added. In the summer of 2021, the Airport will be served by four air carriers providing non-stop

service to ten markets.[114] The newest air carrier at STS, Avelo, launched service to Hollywood Burbank Airport (BUR) on April 28, 2021.

The Airport now seeks to attract new non-stop service to an additional hub in the Mountain region and add service to a Midwest hub and markets on the East Coast. The pandemic has not materially impacted the Airport's air service development goals.

Air Service Development and Community Stakeholders

In 2002, the County Board of Supervisors formed the Air Service Retention Committee comprised of members of the public and private sector stakeholders interested in air service. As a result of these efforts, scheduled commercial air service was reinstated at STS by Horizon (the regional subsidiary of Alaska) in March 2007.

The Airport continues to enjoy a positive working relationship with the local business community. This is evident from the successes the Airport and its partners have enjoyed in U.S. Department of Transportation Small Community Air Service Development Grant Program. Together, the airport, local business community, and federal grant secured community and federal funding for new service at STS:

- Alaska (operated by Horizon) to LAX in 2007
- American to PHX in 2017

STS provides the region with a "quality of life asset" for all air travelers seeking to avoid commutes and the crowds at other Bay Area airports. There is a clear recognition in the business community of the benefit of retaining and expanding air service at STS. Business leaders value the time saved and the reduction in travel risk for the company when employees can forgo the two-hour plus drive to other airports in the region.

The Airport Airline Advisory Committee meets two or three times a year to review the air service development program and other airline related initiatives. The committee includes representatives from area chambers of commerce, the Sonoma County Economic Development Board, the City of Santa Rosa, and Sonoma County.

The Marketing Roundtable meets bi-monthly to keep members informed of each organization's current marketing programs and to look for joint marketing opportunities. A subcommittee assists STS on its marketing programs on an "as needed" basis.

Airport management works closely with all its partners including the local Chambers of Commerce, Sonoma County Tourism and Visit Santa Rosa. These partners have provided financial, marketing and data support for the Airport's air service development initiatives.

Businesses participate directly in STS's air service development initiatives. In the past, the Airport has partnered with Medtronic in the pursuit non-stop service to Minneapolis, the corporate headquarters. Medtronic is a medical technology and services company, with an operation about one mile from STS.

Recently, the Airport and Keysight Technologies, an electronic design, test and automation company, worked together to assure the return of service by United Airlines In addition, Keysight and other partners supported the effort to secure non-stop service to Denver in 2019.

The wine industry of the North Bay region, centered in Sonoma and Napa counties, engages with the Airport to encourage expanded air services at STS. The focus of the Wine Industry is to expand connectivity at STS to more efficiently connect its employees, vendors and wine buyers to domestic and international

markets. Engagement takes the form of support for STS's hosting of airline decision makers at various wineries in the Region.

Communicating the Airport's Economic Impact

In 2013, the Airport initiated an airfield improvement project that included extending the main runway at STS to 6,000' to comply with FAA standards and accommodate operations by regional jet aircraft. Before the project won approval from various government agencies, STS funded an economic impact analysis to highlight the value of this project to regional stakeholders. This analysis concluded new daily non-stop regional jet service to major markets in the western U.S. would produce an estimated $9.5 million in annual revenue per each new non-stop market. Convincing regional stakeholders was a key factor in building the support needed to launch this project.

The Airport's last economic impact study was completed in 2008. Consequently, it was based on operations at the airport restricted to turboprop aircraft.

It is the view of the Airport that for most stakeholders, a high-level economic impact works best. The airport recognizes that some stakeholders may understand the "finer points of the results of an economic impact study," but most stakeholders would be more receptive to a simplified summary of the results. A "lite" version of an economic impact study would be beneficial.

STS management's air service development efforts are primarily geared toward expanding connectivity for its customer base. As a non-hub airport in a region with multiple large hub airports, new air service (e.g., additional capacity on existing routes or service to a new market) requires STS to convince an airline that both local and connecting traffic demand would be adequate to support such as service.

Naturally, all air travelers want to fly non-stop to their destinations. In seeking support from the community for service to major hubs, it is a challenge to "sell" the value of connectivity to local stakeholders, including the business community. Economic analysis that provides Airport management with a more robust and easily communicated story line on the value of connectivity to all stakeholders would be useful. This type of analysis and output should be incorporated into all future economic impact studies. It would allow the airport to show how new connecting service via a hub airport would benefit the community economically and environmentally.

SECTION II:

Case Studies of Air Cargo and Air Freight Airports

Allentown-Lehigh Valley Airport's Cargo Operations and Contributions to Regional Economic Development

The Allentown-Bethlehem-Easton Metropolitan Statistical Area (MSA) is in Eastern Pennsylvania approximately 60 miles north of Philadelphia and 100 miles west of New York City. This area is also known as the Lehigh Valley. Allentown is located close to the junction of I-78, which runs from New York City, and I-476, which runs from Philadelphia to Northern Pennsylvania. The MSA is the third largest metro area in Pennsylvania with a population of nearly 850,000 in 2019, trailing only the Philadelphia and Pittsburgh regions.

The Lehigh Valley International Airport (ABE or the Airport) is 3 miles northeast of Allentown and 2 miles northwest of Bethlehem. It is the fourth busiest airport in the Commonwealth of Pennsylvania after Pittsburgh International (PIT), Philadelphia International (PHL), and Harrisburg International (MDT).

In part because of its location close to major population centers on the east coast, ABE has become a major airport for handling air cargo. In 2015, Amazon selected ABE as one of the few airports to be served by the company's new air freight division, Amazon Air.

The region was selected as a case study because of its air cargo and freight operations.

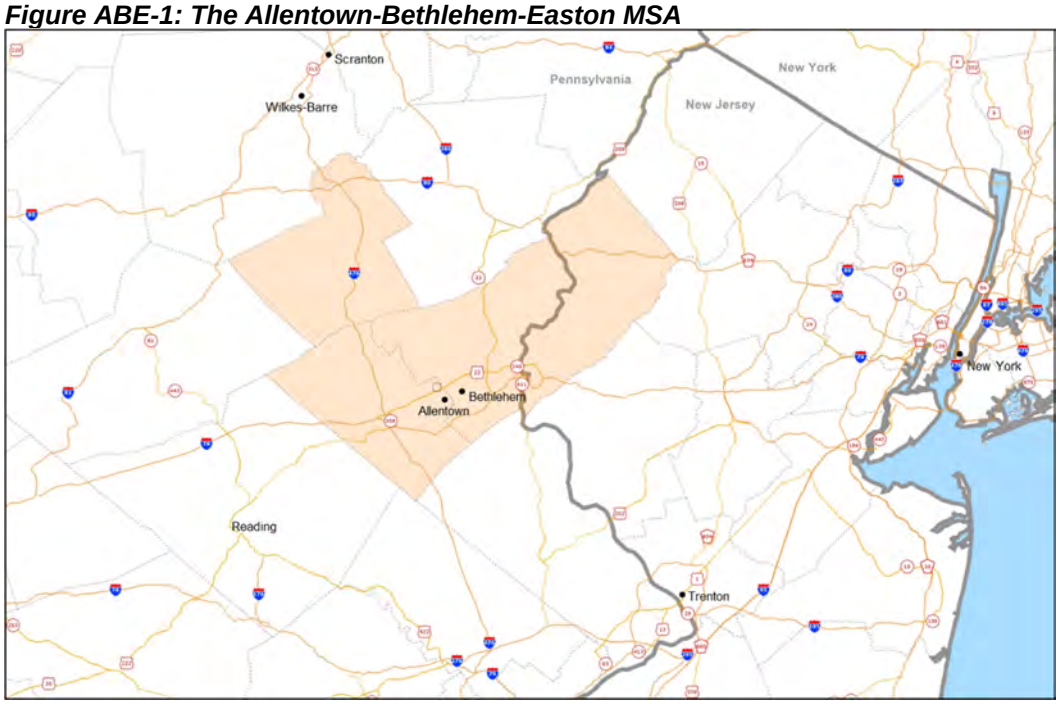
Introduction to the Region and its Economy

According to the U.S. Bureau of Economic Analysis (BEA), in 2019, the MSA had a population of 844,052 and ranked 70th in the nation (out of 384 total). The MSA produced $47.2 billion in current-dollar total GDP. This ranked 69th among MSAs, a slight drop from 2009, when the region was ranked 66th nationally.[115]

Located as it is in a relatively populated part of the east coast and shown in Figure ABE-1, this MSA is bordered by other large metropolitan regions, including the largest in the U.S. To the southeast is the Reading, PA MSA (population 420,000). To the northwest is the Scranton--Wilkes-Barre MSA (population 554,000). To the immediate north is the East Stroudsburg MSA (population 170,000). To the southeast is the greater Philadelphia-Camden-Wilmington region, with 6.1 million, and to the east is the greater New York-Newark-Jersey City area, with a population of 19.2 million.

The region is home to two community colleges and nine four-year colleges and universities, including Lafayette College and Lehigh University. Almost 30 percent of the adult population aged 25 or older holds a Bachelor's degree or graduate or professional degree. Nationally, just over 32 percent of the population has a Bachelor's degree or more.[116]

Figure ABE-1: The Allentown-Bethlehem-Easton MSA



The region has undergone significant changes in population and employment since 2008. Table ABE-1 summarizes the changes in key socio-economic characteristics for the period. As shown, from 2008 through 2019:

- Total population rose by 30,000 (4 percent). That was a faster increase than realized for the entire Commonwealth of Pennsylvania, which rose by only 1 percent.

- Total employment increased by almost 55,000 (13 percent). By contrast, employment for the Commonwealth rose by 8 percent.

- Average per capita income (nominal dollars) rose from $42,300 to $55,700 (32 percent). In constant 2019 dollars, the increase for the Allentown-Bethlehem area was 8 percent. In 2019, the per capita income for the region was 4 percent less than the average for all of Pennsylvania, $58,046.

- The number of business establishments operating in the region was largely unchanged.[117]

Table ABE-1: Change in Major Socio-Economic Variables, Allentown-Bethlehem Region 2008-2019

	2008	2015	2019	Change 2008-15		Change 2015-19		Change 2008-19	
				#	%	#	%	#	%
Population	814	830	844	16	2%	14	2%	30	4%
Total Employment	435	459	490	24	5%	31	7%	55	13%
Private Non-farm Employment	388	415	445	27	7%	30	7%	57	15%
Gov't Employment	45	42	43	(3)	-7%	1	2%	(2)	-6%
Income per Capita ($)	$42,338	$48,632	$55,675	$6,294	15%	$7,043	14%	$13,337	32%
Number of Establishments	19	18	19	(1)	-3%	1	3%	(0)	0%

Regional Economic Strengths

The region's economy is anchored by several large employment sectors. Table ABE-2 summarizes employment by industry sectors for the MSA. The largest sector (based on total employment in 2019) was health care and social assistance. Employment in that sector increased by over 13,000 (22 percent) between 2008 and 2019. The other largest sectors based on 2019 employment were Retail trade, Manufacturing, Accommodations and Food Service, and Administrative and support and waste management and remediation services ("administrative and support services"). However, the sectors where employment changed most significantly were Transportation and Warehousing (in which employment more than doubled); real estate and rental and leasing services (increased 32 percent); and arts, entertainment, and recreation (30 percent).

Table ABE-2: Changes in Employment by Major Sector 2008-2019

Description	2008	2019	Change	
			Number	Percent
Private nonfarm sectors				
Manufacturing	40,789	41,442	653	2%
Retail trade	50,775	49,179	(1,596)	-3%
Transportation and warehousing	16,866	(D)	18,992	113%
Finance and insurance	19,954	20,238	284	1%
Real estate and rental and leasing	15,461	20,342	4,881	32%
Professional, scientific, and technical services	(D)	25,169	3,427	16%
Administrative and support services	25,640	31,968	6,328	25%
Educational services	12,714	15,729	3,015	24%
Health care and social assistance	59,302	72,452	13,150	22%
Arts, entertainment, and recreation	9,921	12,908	2,987	30%
Accommodation and food services	27,230	33,185	5,955	22%
Other services (except gov't and gov't enterprises)	24,630	25,939	1,309	5%
All other (includes suppressed categories)	84,463	96,191	11,728	14%
Subtotal - Private nonfarm employment	**387,745**	**444,742**	**56,997**	**15%**
Government and government enterprises	**45,116**	**42,629**	**(2,487)**	**-6%**
Total employment	**435,265**	**489,934**	**54,669**	**13%**

Source: BEA table CAEMP25N

Note: (D) = BEA suppressed the employment figures for Transportation and Warehousing sector in 2019 and for PST in 2008 to avoid disclosing confidential information. Changes for Transportation and Warehousing calculated using 2018 data (35,858). Changes for PST sector based on 2009-2019. (2009 PST employment was 21,742.)

The Lehigh Valley Economic Development Corporation (LVEDC) reports that the area is within a day's drive of one-third of the U.S. population. The area has developed into a logistics hub, with 35,000 jobs and year-over-year growth of 9.4 percent for the past five years. Major logistics employers in the Lehigh Valley include

- Amazon
- FedEx Ground
- NFI
- Walmart

- McKessson
- Zulily
- Americold
- US Cold Storage

Economic Clusters

The U.S. Cluster Mapping Project's analysis of the region also highlights its broad economic strength. A cluster is a concentration of related industries in a particular region. Clusters consist of companies, suppliers, and service providers, as well as government agencies and other institutions that provide specialized training and education, information, research, and technical support. *Traded clusters* are groups of related industries that serve markets beyond the region in which they are located and therefore require some form of transport connectivity. Examples include financial service or information technology. By contrast, *local clusters* consist of industries that serve the local market. Examples include local grocery stores or restaurants.[118]

The area's economy features multiple tradeable clusters that are among the top performers in the country, and several are of notable strength. They include Distribution and eCommerce, Education, and Medical Devices, among others.

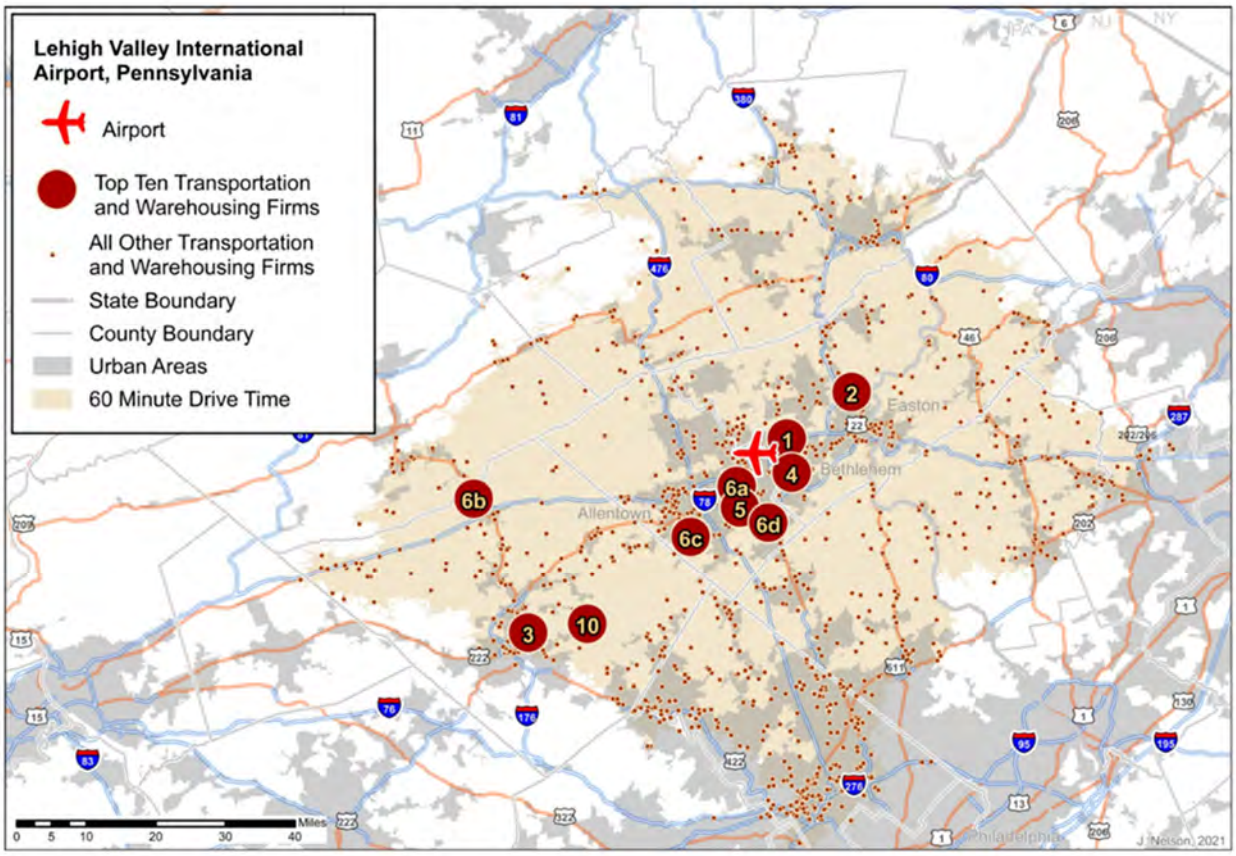
- The region is ranked 44th nationally (out of 917) in Distribution and Electronic Commerce. Estimated regional employment in this sector in 2018 was over 26,000. The region has economic strengths in multiple related subclusters, including Warehousing and Storage, Electronic and Catalog Shopping, Professional and Commercial Equipment and Supplies, Wholesale of Electrical and Electronic Goods, Wholesale of Drugs and Druggists' Sundries, and Wholesale of Chemical and Allied Products. In each of those subclusters, the region is ranked among the top 50 in the U.S.

- The region was ranked 59th nationally for Education and Knowledge Creation. With estimated 2018 employment of nearly 11,000, the region's strength is a reflection of the large number of colleges and universities in the area.

- Medical devices is also a regional economic strength, with employment specialization in Surgical and Dental Instruments and Supplies. The region is ranked 33rd nationally. Over 1,700 worked in this subcluster in 2018.

Another way to analyze the economics of the area is to more closely examine business and socio-economic data within a given radius around the airport. Figure ABE-2 illustrates the area within a 60-minute drive of ABE and identifies those establishments in the Transportation and Warehousing sector located there.

Figure ABE-2: Spatial Distribution of Transportation and Warehousing Firms (NAICS 48-49) in the ABE Airport One-Hour Drive Time Trade Area



Key highlights of socio-economic activity *within the 60-minute drive of the airport*:

- The total estimated 2019 population was 2.1 million. Of that, 1.3 million (61 percent) were considered "working age" (between the ages of 18 and 64).

- The economy supported over 80,000 businesses employing nearly 1.1 million. In terms of major industry sectors (defined by NAICS codes), the largest based on total employment was Manufacturing (102,000 employees) followed by Professional, Scientific, and Technical Services (PST), with over 94,000 and Finance, Insurance, and Real Estate with nearly 68,000. The Transportation and Warehousing sector included over 1,400 establishments that employed over 20,000.

Overview of the Airport and its Air Service

The Lehigh Valley International Airport (ABE or the Airport) has two runways, one 7,600 feet and one 5,800 feet. The Airport has a passenger terminal complex consisting of one landside and one satellite terminal, connected by an underground tunnel. There are 9 gates in the passenger terminal. On airport property, there are rental car facilities, general aviation facilities with a fixed base operator and a dedicated air cargo ramp with nearby cargo warehouses.

ABE is owned and operated by the Lehigh-Northampton Airport Authority (LNAA). LNAA is overseen by a 15-member Board of Governors appointed by both Lehigh and Northampton Counties.

ABE is a small hub airport and in 2019 handled 912,000 passengers in 2019. At that time, ABE's total passenger level ranked 142nd amongst U.S. airports.[119] In 2019, the Airport was served by 4 commercial passenger airlines to 11 nonstop domestic U.S. markets, with an average of about 18 daily departures, shown in Table ABE-3.[120] Regional jets are the most common passenger aircraft at ABE, accounting for nearly 80 percent of departures.

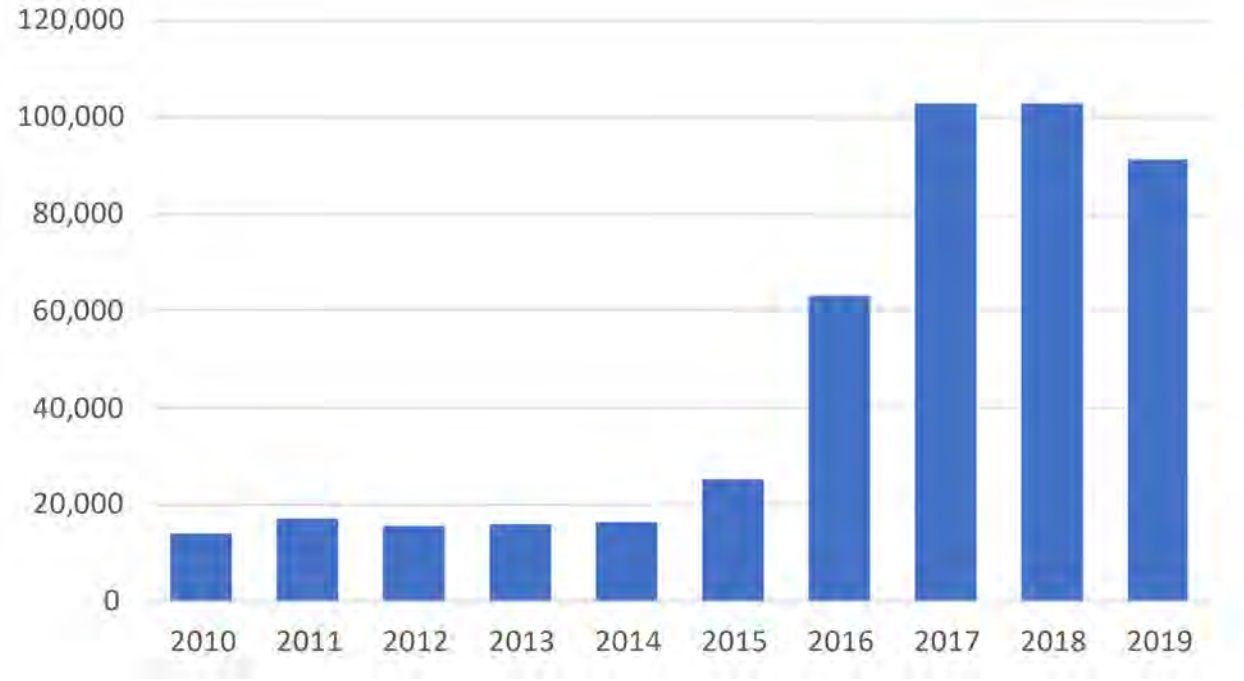
Table ABE-3: Summary of Passenger Market 2019

Carrier	Seats	Share	Markets
American	151,480	29%	3
Delta	132,937	25%	2
Allegiant	195,842	37%	7
United	42,341	8%	1
Total	522,600	100%	12

Source: T-100 data from Diio / Cirium
Note: "Markets" based on a minimum of 50 annual departures. Allegiant served four markets with basically weekly service. Only its flights to Orlando Sanford Airport were scheduled on the equivalent of a daily basis. Total markets reflect that both American and United serve Chicago O'Hare.

Air cargo has been a particular point of emphasis at ABE since September 2015 when Amazon began charter freighter operations at the airport. The operation is now known as Amazon Air and ABE was one of the first three airports in the developing network. Prior to that, FedEx carried almost 100 percent of the cargo at the airport. By 2016 and the first full calendar year of operations, ABE air cargo reached 63,000 metric tons – more than triple the tonnage handled in the years just prior to Amazon Air's entry. By the end of 2017, ABE air cargo exceeded 100,000 metric tons – more than five times the pre-Amazon Air levels. Between 2018 and 2020, ABE's cargo tonnage stabilized between 90,000 and 100,000 metric tons. See Figure ABE-3.

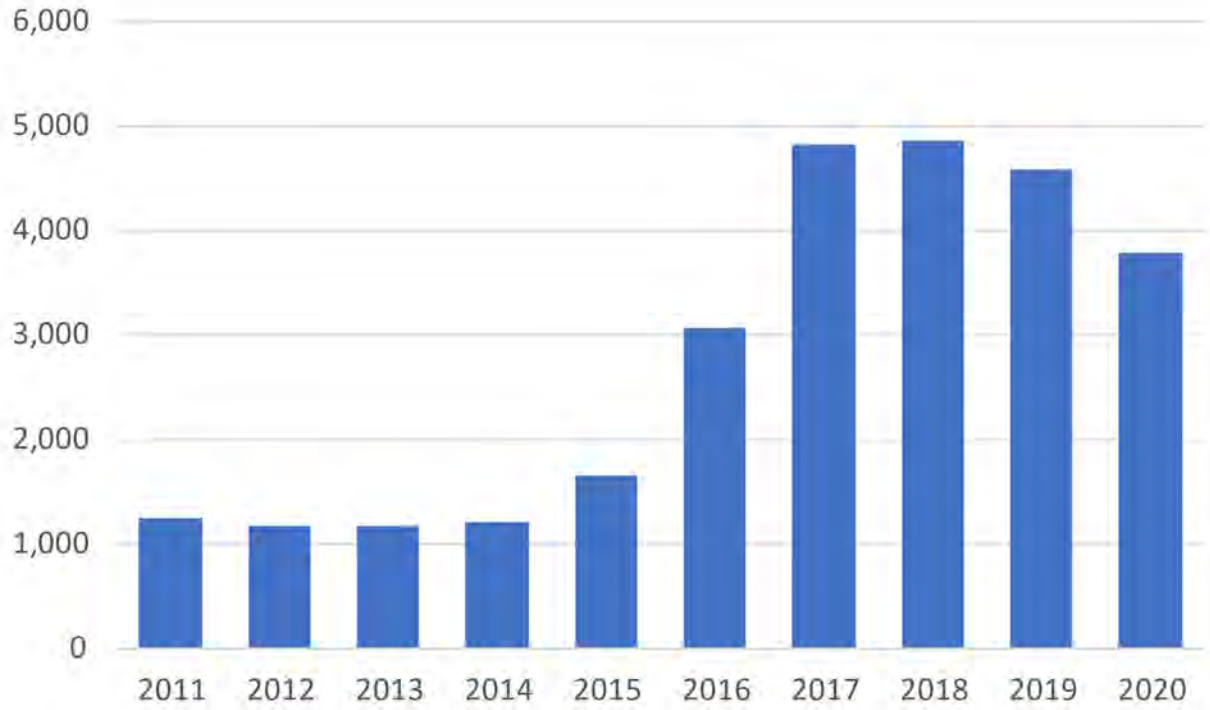
Figure ABE-3: Air Cargo Tonnage at ABE



Source: U.S. DOT, T-100 Carrier Reports

Figure ABE-4 below shows ABE's freighter aircraft operations over the ten-year period 2011-2020. While freighter operations decreased from 2019 to 2020, air cargo tonnage increased in that same timeframe as shown in Figure ABE-3 above. Clearly, the e-commerce boom that occurred during the pandemic led to higher consumer demand and, therefore, increased tonnage levels would be expected in 2020. It also suggests that Amazon Air was allocating more of each aircraft operation to ABE versus other cities on its typical multi-stop itineraries. It may also suggest Amazon Air was loading and unloading heavier goods at ABE in 2020. Whatever the specific reasons, on average, Amazon carried more tonnage per flight at ABE in 2020 than in prior years.

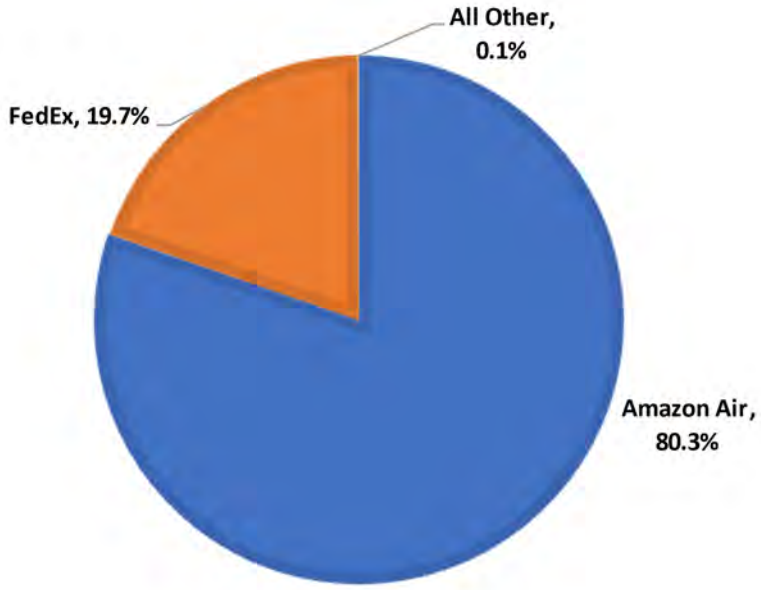
Figure ABE-4: ABE Freighter Aircraft Operations



Source: U.S. DOT, T-100 Carrier Reports and Hubpoint Strategic Advisors analysis.

Amazon Air dominates air cargo volumes at ABE, see Figure ABE-5. For the aggregate three-year period (2018-2020), Amazon Air accounted for 80 percent of the air cargo tonnage carried while FedEx carried almost 20 percent. Passenger airlines and other charter air cargo operators handle a minor amount of the airport's cargo.

Figure ABE-5: Airline Market Shares of ABE Air Cargo Tonnage, 2018-2020



Source: U.S. DOT, T-100 Carrier Reports and Hubpoint Strategic Advisors analysis.

Since Amazon Air's entry at ABE in 2015, the company has added more than 37 other airport stations to its U.S. network. As the air network has grown, the points served at ABE have also diversified. As shown in Figure ABE-6, eleven different markets were served outbound from ABE in 2020 – led by airports at Rockford, IL (RFD), Fort Worth, TX (AFW) and Sacramento (SMF). In 2020, ABE recorded flight arrivals from eight Amazon Air cities – led by AFW, Phoenix, AZ (PHX) and Ontario, CA (ONT). In Fall 2021, Amazon Air is scheduled to open its new primary hub at Cincinnati/Northern Kentucky International Airport (CVG). At that time, it is expected that more of ABE's flights will transit CVG than in prior years.

Figure ABE-6: Amazon Air's Service Points at ABE, 2020

Amazon Air OUTBOUND Markets from ABE

Destination		ABE Flight
Airport Code	City	Departures
RFD	Rockford, IL	357
AFW	Ft. Worth, TX	355
SMF	Sacramento, CA	287
SEA	Seattle, WA	145
CVG	Cincinnati, OH	69
PHX	Phoenix, AZ	69
TPA	Tampa, FL	69
LAL	Lakeland, FL	45
BDL	Hartford, CT	1
IAH	Houston, TX	1
ONT	Ontario, CA	1
Grand Total		**1,399**

Amazon Air INBOUND Markets to ABE

Origin		ABE Flight
Airport Code	City	Arrivals
AFW	Ft. Worth, TX	422
PHX	Phoenix, AZ	356
ONT	Ontario, CA	354
CVG	Cincinnati, OH	145
TPA	Tampa, FL	72
SMF	Sacramento, CA	45
BWI	Baltimore, MD	5
ILN	Wilmington, OH	1
Grand Total		**1,400**

Source: U.S. DOT, T-100 Carrier Reports and Hubpoint Strategic Advisors analysis.

Additional Background on Amazon Air and FedEx at ABE

On an average day, ABE handles five Amazon Air flights operated by its partner airlines including Atlas Air, Air Transport International, and ABX Air, which all utilize Boeing 767 freighters. In 2020, Amazon Air contracted with Sun Country Airlines to fly its smaller Boeing 737 freighters, but those aircraft have not yet operated at ABE. Despite the additions of many more U.S. airports to its network, Amazon Air maintains a robust level of service at ABE.

ABE's strategic location and convenient access to the New York metro area were critical to its early addition to the Amazon Air network. Because Amazon Air exists to serve Amazon customers, the nearby presence of Amazon distribution and fulfillment centers is a prerequisite for an airport to be added to the network. By 2011, two Amazon fulfillment centers were operating 15 miles from ABE and, in 2016, a third facility opened nearby.

Meanwhile, in 2018, FedEx Ground opened an 850,000 square-foot distribution hub in the Lehigh Valley just 2 miles from ABE. The 253-acre site for the facility was owned by ABE and sold to a developer, which leased it to FedEx in 2016. Given the nature of FedEx Ground's use of surface transportation, there is no direct interaction between the facility and ABE currently. However, FedEx has signaled a higher degree of integration between its ground and air operations, so the potential exists for a linkage to connect to ABE's FedEx air cargo services.

Air Cargo Linkages to Regional Economic Development

Clearly, the operations of Amazon Air at ABE have been transformative to the airport and the region. The three Amazon fulfillment centers totaling over 2 million square feet and the Amazon Air operation support employment of approximately 3,000 Amazon employees in the Lehigh Valley.[121] With e-commerce

continuing to experience sustained growth, especially during the pandemic, there is high potential for further economic development related to ABE's air cargo services.

As the initial Amazon Air flights began in 2015, Don Cunningham, president and CEO of the Lehigh Valley Economic Development Corporation said, "The Lehigh Valley has become a key battleground in the e-commerce wars. When you consider that we're within [truck] delivery reach of 100 million consumers, I'm not at all surprised that LVIA is part of this pilot. That airport [ABE] has become an important asset in these wars."[122]

Further, the Airport's 2018 Master Plan Update stated, "The Airport is already mentioned and acknowledged as a key component in attracting business to the area. The region continues to strengthen its role and function as a logistics hub serving the Northeast. As a logistics hub, it will become more attractive to manufacturers, wholesalers, warehousing, and other freight related functions that will benefit from having direct and immediate access to multiple modes of movement. This will lead to increasing demand for truck, rail, and ancillary airfreight services. Increased truck traffic will lead to increasing highway congestion and significantly increase the need for alternative modes to provide access, including enhanced rail service, and ancillary airfreight service."[123]

Interviews with ABE management revealed that the Airport works closely with the Lehigh Valley Economic Development Corporation (LVEDC) and that the Airport's Board Chairman previously worked with LVEDC. Although the LVEDC is more involved in passenger air service development pursuits, there is recognition of the economic development potential related to air cargo services.

For instance, ABE is now considering relocating air cargo to the north side of the airport. This would necessarily require significant assets and resources to be deployed on behalf of cargo, not just by the Airport, but by the community as well. The airport's strategic plan has some focus on cargo and the synergies air cargo has with the region's warehouse and distribution sector. Further, a recent agreement between ABE and Airport Facilities Company (AFCO) is intended to assist with further on-airport cargo development and the recruitment of companies and tenants to utilize those cargo capabilities.

Regional Stakeholders Perspectives on the Airport's Contributions to Economic Development

The Lehigh Valley Economic Development Corporation (LVEDC) is one of the principal regional organizations concerned with driving economic growth and activity for people of all skills and education. Its priorities are to market the economic assets of the Lehigh Valley, recruit companies to targeted sectors, support the growth and retention of new employers, promote and develop the workforce, and expand investment and partnerships for economic growth. It has four targeted sectors: high performance manufacturing, professional business services, life sciences research and manufacturing, and food and beverage processing.

The LVEDC recognizes that the airport plays a pivotal role and impact on regional economic development, and transportation resources are an important resource for site selectors and businesses considering where to locate a building or expand an existing one. LVEDC notes that airports like ABE are important for foreign direct investment, because international companies looking for places to invest in the U.S. need quick access to their facilities via airports.

"LVIA plays a pivotal role and impact on regional economic development in Lehigh Valley, and transportation resources are an important resource for site selectors and businesses considering where to locate a building or expand an existing one, according to LVEDC's President & CEO.

To help support the airport, LVEDC and other regional businesses and organizations have signed a "Fly Local" pledge with the airport. The pledge asks participants to use ABE when a flight is available within four hours of travel time each way from flights at competing airports, and when the cost of the flight from ABE is within $200 of the lowest priced tickets at competing airports.

The Greater Lehigh Valley Chamber of Commerce represents over 30 affiliated local chambers of commerce in the area, with over 5,000 members that employ more than 200,000. Its mission is to improve the economy and quality of life in the metropolitan region. It too recognizes the contribution that the airport makes to the region and supports its development as part of a larger effort to improve the transportation infrastructure necessary for continued economic success. "Inadequate and failing infrastructure systems constrain business." Transportation resources are also important for site selectors and businesses.

The Chamber cites a 2016 survey from *Area Development* that reported accessibility to a major airport is considered important or very important to more than 44 percent of responding site selectors -- more important than corporate tax rates, union presence, and energy availability and costs. The economic impact of airports can be strengthened through improved marketing, investing in infrastructure improvements, and providing incentives such as air subsidies."[124]

Communicating the Airport's Contributions to Regional Economic Impact

The airport has not had an economic impact study completed since the Commonwealth last managed one in 2015. That study reported summary findings:

- Direct Impacts:
    - On-airport output of $155.3 million
    - Visitor output of $137.2 million
- Multiplier (Induced and Indirect) output of $235.8 million
- Total impacts:
    - Total jobs 6,086
    - Total payroll: $190.6 million
    - Total output: $528.3 million

The report also noted that some companies use the airport regularly, and that activities at the airport included recreational flying, air cargo activity, military exercise, and medical flights. Other special events are held at the airport.

Huntsville's Cargo and Freight Operations and Regional Economic Development

The Huntsville metropolitan area is located in North Alabama approximately 200 miles west of Atlanta and 120 miles south of Nashville. The second largest city in Alabama trailing just Birmingham, Huntsville is located close to I-65, which runs from Mobile to Chicago. Like many areas of the Southeastern U.S., Huntsville is growing quickly.

The region is served by Huntsville International Airport (HSV or the airport). HSV is owned and operated by the Huntsville-Madison County Airport Authority (HMCAA), which is often referred to as the Port of Huntsville.[125] In addition to the Huntsville International Airport, the Port also operates the International Intermodal Center (Air Cargo & Rail Cargo), the Jetplex Industrial Park, Signature Flight Support, Foreign-Trade Zone #83, a hotel and a golf course. The Port of Huntsville is led by an Executive Director who reports to a five-member Board of Directors.

This region is included as a case study because of its cargo and freight activities.

Introduction to the Region and its Economy

The Huntsville Metropolitan Statistical Area (MSA) includes Limestone and Madison counties, with Huntsville being the area's principal city, see Figure HSV-1. The Huntsville MSA is adjacent to two other MSAs in northern Alabama: Decatur and Florence-Muscle Shoals. Huntsville's population is greater than the other two MSAs combined.

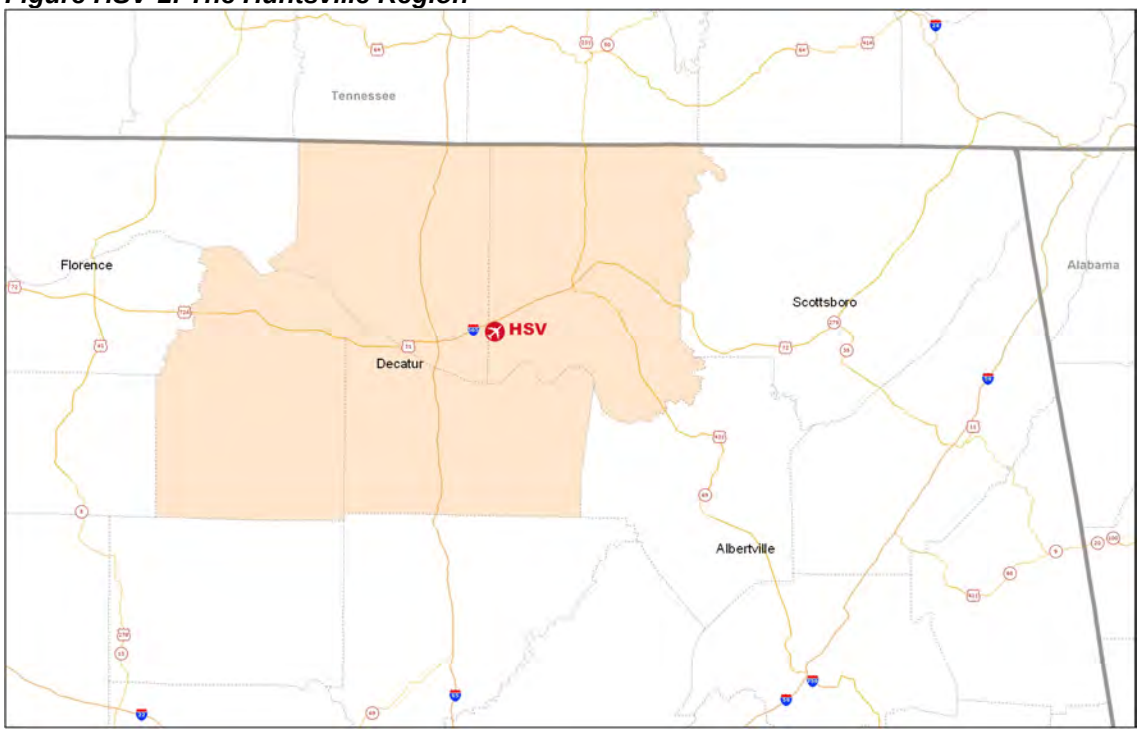
The region is a center of aerospace-related activities. Huntsville is the home of NASA's Marshall Space Flight Center, with a total workforce of nearly 6,000 employees and an annual budget of approximately $2.8 billion. The U.S. Army Aviation and Missile Command is headquartered at Redstone Arsenal, adjacent to Huntsville in Madison County.

According to the U.S. Bureau of Economic Analysis (BEA), for 2019, the Huntsville MSA:

- Had a population of 471,824 and ranked 116th in the nation (out of 384).
- Produced $29.5 billion in current-dollar total GDP. This GDP ranked 106th among MSAs, a slight decline in its ranking from 2009, when it was ranked 102nd among MSAs.

The neighboring Decatur MSA had a 2019 population of 152,603, which ranked 273rd in the nation. It produced $6.7 billion in GDP. The Florence-Muscle Shoals MSA is smaller, with a 2019 population of 147,970 (285th in the nation).[126]

Figure HSV-1: The Huntsville Region



The region has undergone significant growth in population and employment since 2008. Table HSV-1 summarizes the changes in key socio-economic characteristics for the period. As shown, from 2008 through 2019:

- Total population rose by nearly 70,000 (13 percent). As a point of comparison, population for the state of Alabama increased by 4 percent.

- Total employment increased by 45,000 (13 percent). Statewide, employment increased by 6 percent.

- Average per capita income (nominal dollars) rose from $37,200 to $49,200 (32 percent). (In constant 2019 dollars, the increase was 8 percent.) The region's 2019 per capita personal income was 12 percent higher than the statewide average.

- The number of business establishments operating in the region increased by over 3,000 (24 percent).[127]

Table HSV-1: Summary of Socio-economic Metrics for Huntsville Region 2008-2019

	2008	2015	2019	Change 2008-15		Change 2015-19		Change 2008-19	
				#	%	#	%	#	%
Population	554	597	624	43	8%	27	5%	70	13%
Total Employment	344	354	388	10	3%	35	10%	45	13%
Private Non-farm Employment	281	288	320	7	3%	32	11%	39	14%
Gov't Employment	57	60	64	3	5%	3	5%	6	11%
Income per Capita ($)	$37,165	$42,730	$49,223	$5,565	15%	$6,493	15%	$12,058	32%
Number of Establishments	14	16	17	2	15%	1	8%	3	24%

Source: BEA.

Note: All figures in 1,000s except for per capita income, which is shown in nominal dollars. Government employment includes military and civilian.

Regional Economic Strengths

The region's economy is anchored by several large employment sectors. Many large companies, major manufacturers and U.S. government agencies have a significant presence in Huntsville. These include Boeing, Dynetics, Northrup Grumman, the U.S. Army and NASA.

Considering the NASA and military facilities in the region, it is not surprising that the public sector has a large share of total employment. In the private sector, the largest sector was Professional, Scientific, and Technical Services followed by manufacturing. Since 2015, the amount of PST employment grew by almost 8,700 (21 percent). Employment in the manufacturing sector rebounded; after losing jobs between 2008 and 2015, employment there rose almost 4,000 (10 percent) between 2015 and 2019. Table HSV-2 summarizes the changes in employment in the Huntsville region based on major industrial sectors, sorted by the sectors with the greatest number of employees in 2019. The table separately accounts for private and public sector employment. The sectors with the greatest percentage growth since 2008 were educational services, real estate, and health care.

Table HSV-2: Changes in Employment by Major Industrial Sector 2008-2019

Industry Sector	2008	2015	2019	Change 2008-19	
				Number	%
Private Sector					
Professional, scientific, and technical services	--	41,750	50,412	N/A	N/A
Manufacturing	45,208	36,772	40,610	(4,598)	-10%
Retail trade	35,954	37,521	39,082	3,128	9%
Administrative and support services	25,045	28,993	30,077	5,032	20%
Health care and social assistance	21,914	24,328	27,125	5,211	24%
Accommodation and food services	--	23,795	25,599	N/A	N/A
Other services (except gov't and gov't enterprises)	--	18,803	21,048	N/A	N/A
Construction	19,965	17,927	20,890	925	5%
Real estate and rental and leasing	12,028	13,137	15,718	3,690	31%
Finance and insurance	9,095	9,359	10,900	1,805	20%
Wholesale trade	8,499	9,181	9,416	917	11%
Arts, entertainment, and recreation	--	5,073	6,845	N/A	N/A
Educational services	3,952	5,311	5,423	1,471	37%
Farm employment	5,610	5,132	4,814	(796)	-14%
Information	--	3,743	3,841	N/A	N/A
Management of companies and enterprises	--	1,690	1,550	N/A	N/A
Public Sector					
Government (Federal, State, Local, and Military)	57,419	60,463	63,528	6,109	11%
Grand Total	**336,490**	**438,366**	**478,867**	**142,377**	**42%**

Source: BEA

Note: Figures will not sum to totals because industry sectors with smaller amounts of employment are not shown. " – " indicates that the data were suppressed to protect confidentiality. Employment in those sectors is included in the Grand Totals. Employment in the Transportation and Warehousing sector is one where reporting was suppressed.

The region has employment concentrations in PST, Manufacturing, and Administrative and support services, based on their Location Quotients (LQs). LQs quantify the concentration of employment in a region against the nation as a whole. If an LQ is equal to 1, then the industry has the same share of its area employment as it does in the nation. An LQ greater than 1 indicates an industry with a greater share of the local area employment than is the case nationwide. For example, Las Vegas will have an LQ greater than 1 in the Leisure and Hospitality industry because this industry makes up a larger share of the Las Vegas employment total than it does for the nation as a whole. In the Huntsville region, the LQs for the PST, Manufacturing, and Administrative and support services were all above 1.25.

Economic Clusters

The U.S. Cluster Mapping Project's analysis of the Huntsville region also highlights its broad economic strength. A cluster is a concentration of related industries in a particular region. Clusters consist of companies, suppliers, and service providers, as well as government agencies and other institutions that provide specialized training and education, information, research, and technical support. Traded clusters are groups of related industries that serve markets beyond the region in which they are located and therefore require some form of transport connectivity. Examples include financial service or information technology. By contrast, local clusters consist of industries that serve the local market. Examples include local grocery stores or restaurants.[128]

The Cluster Mapping project analyzed the economic strengths of the broader Huntsville economic region. This area includes not only all of the three MSAs but extends to counties in the northeastern corner of the state. The area's economy features multiple tradeable clusters that are among the top performers in the country, and several are of notable strength. Those include Information Technology and Analytical Instruments; Communications Equipment and Services; and Marketing, Design, and Publishing.

- Within the IT sector, the region shows significant economic strength and employment specialization in software reproducing, electronic components, and computers and peripherals. The region was ranked in the top 30 nationally for these subsectors, out of 179 total economic areas.

- Not surprisingly, the region is ranked in the top 10 nationally in the Aerospace Vehicles and Defense Cluster, especially for guided missile and space vehicle manufacturing.

- The region is ranked in the top 10 nationally in the Communications Equipment cluster, with employment specialization in radio and television broadcasting and wireless communications equipment manufacturing.

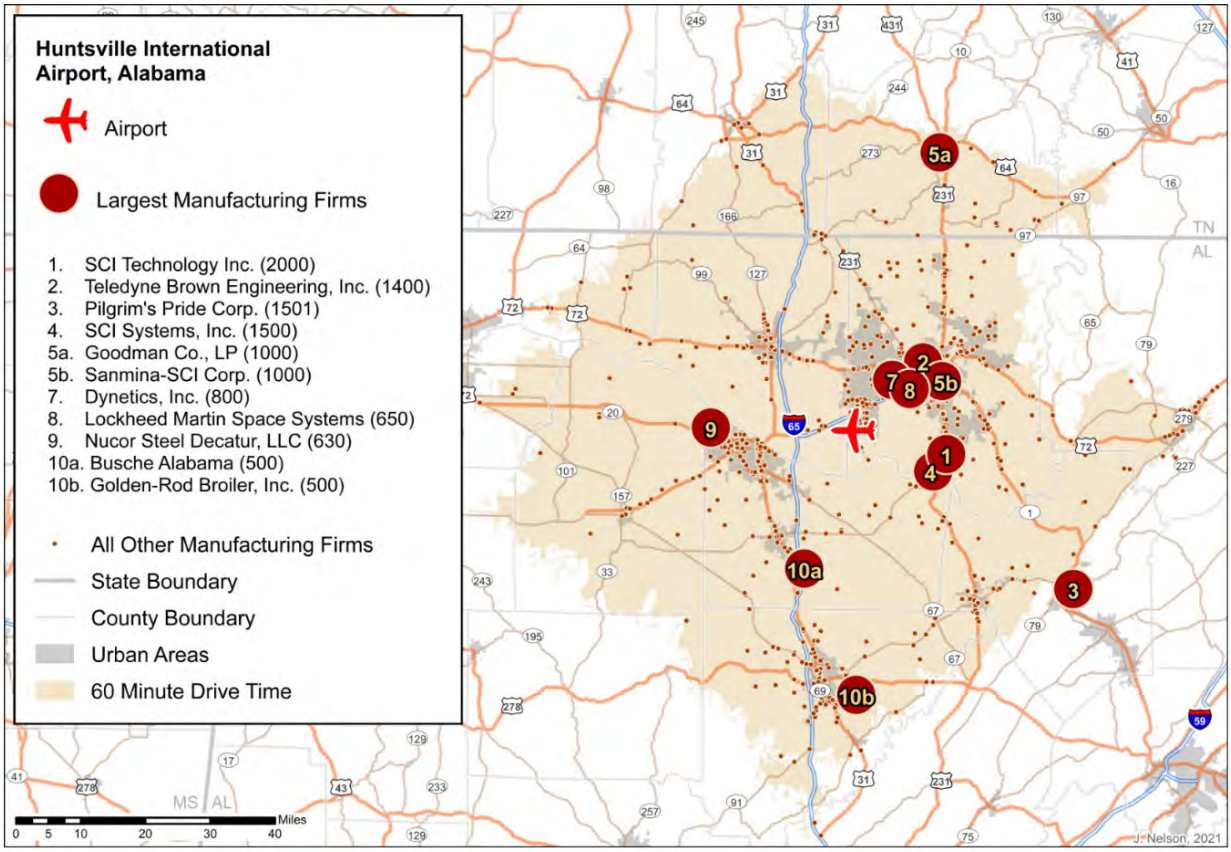
- The region is ranked in the top 20 nationally in the Upstream Metals Processing, with employment specialization in other aluminum rolling, drawing, and extruding.

In addition, the region has significant strength in other traded clusters that are less likely to rely on aviation. For example, the region is ranked 5th nationally in Livestock Processing (e.g., poultry processing), 9th in Textile Manufacturing (e.g., knitting mills, yarn and thread mills, textile and fabric finishing), and 10th in Trailer and Mobile Homes (e.g., truck trailer manufacturing and travel trailer and camper manufacturing).

Economic Activity near the Airport

Figure HSV-2 summarizes economic activity in the region and focuses on businesses within the Manufacturing sector, which is likely to be associated with cargo and freight operations.

Figure HSV-2: Spatial Distribution of Manufacturing Firms (NAICS 31-33) in the HSV Airport One-Hour Drive Time Trade Area



Highlights of the economic activity ***within a 60-minute drive of the airport*** include:

- The estimated 2019 population was just under 810,000, an increase of about 56,000 (7.5 percent) from the 2010 population of just over 750,000. Of the 2019 population, an estimated 498,000 (61.7 percent) were considered "working age" (between 18 and 64).

- Of the 2019 population, an estimated 19.4 percent held a Bachelor's degree and another 11.2 percent held a Graduate or Professional degree.

- The largest industrial sector within the area covered by a 60-minute drive (not in the greater MSA) was Manufacturing, with just under 36,000 employees, followed by Professional, Scientific and Technical Services, with over 27,000.

- The region supported over 26,000 establishments that employed nearly 387,000.

Overview of the Airport and its Services

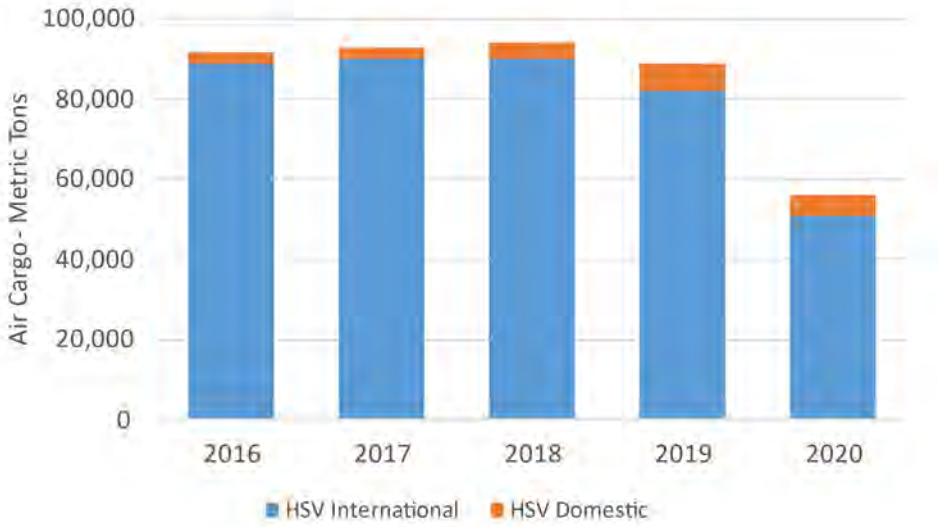
The Airport is located 10 miles southwest of downtown Huntsville near I-565. The Airport has two parallel runways, one 10,000 feet and one 12,600 feet, with a 5,000-foot separation, allowing for simultaneous operations during instrument conditions. HSV is equipped for CAT II operations. The Airport has a 12-gate passenger terminal with an adjacent automobile parking garage, a private aviation terminal,

general aviation hangars, air cargo facilities, a Norfolk Southern intermodal center and other facilities for various aeronautical and non-aeronautical tenants.

[129]HSV is a small hub airport and in 2019 handled a record 725,000 enplaned passengers. For 2019, HSV's total passenger level ranked 123rd amongst North American airports.[130] As of May 2021, the Airport was served by 6 commercial passenger airlines to 10 nonstop domestic U.S. markets totaling 175 weekly departures.[131] For the three-year period 2018-2020, American Airlines and Delta Air Lines accounted for almost 80 percent of passenger enplanements.[132] Regional jets are the most common equipment at HSV, accounting for nearly 80 percent of passenger aircraft departures.

More importantly for this case study, HSV's air cargo tonnage in 2019 totaled 88,769 metric tons which ranks 50th amongst North American airports.[133] Of that tonnage, 81,740 metric tons (92 percent) is carried on international flights and the remainder is on domestic flights, see Figure HSV-3. Preliminary data for 2020 from the Airports Council International – North America indicated a 37 percent drop in HSV's total cargo during the pandemic.

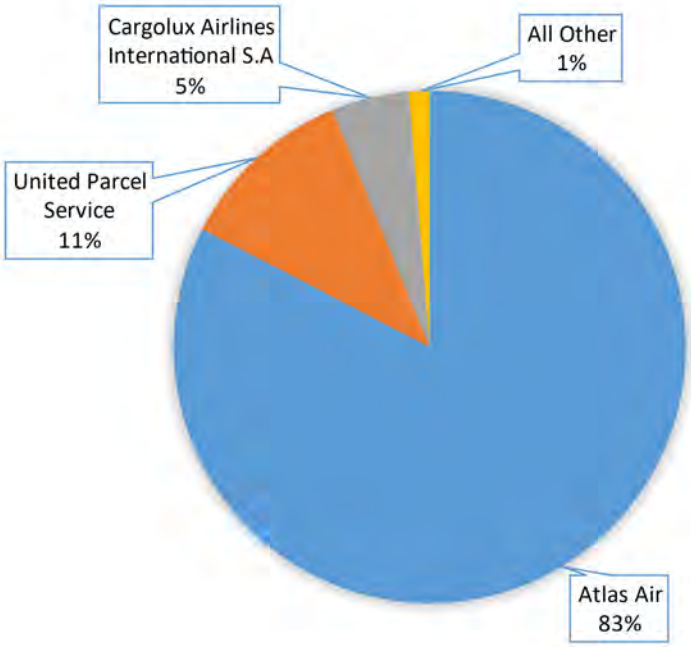
Figure HSV-3: Air Cargo Tonnage at HSV



Source: North American Airport Traffic Report, Airports Council International – North America, 2016-2020

For the aggregate three-year period (2018-2020), Atlas Air accounted for 83 percent of the air cargo tonnage carried at HSV, UPS carried 11 percent and Cargolux carried 5 percent, as shown in Figure HSV-4.

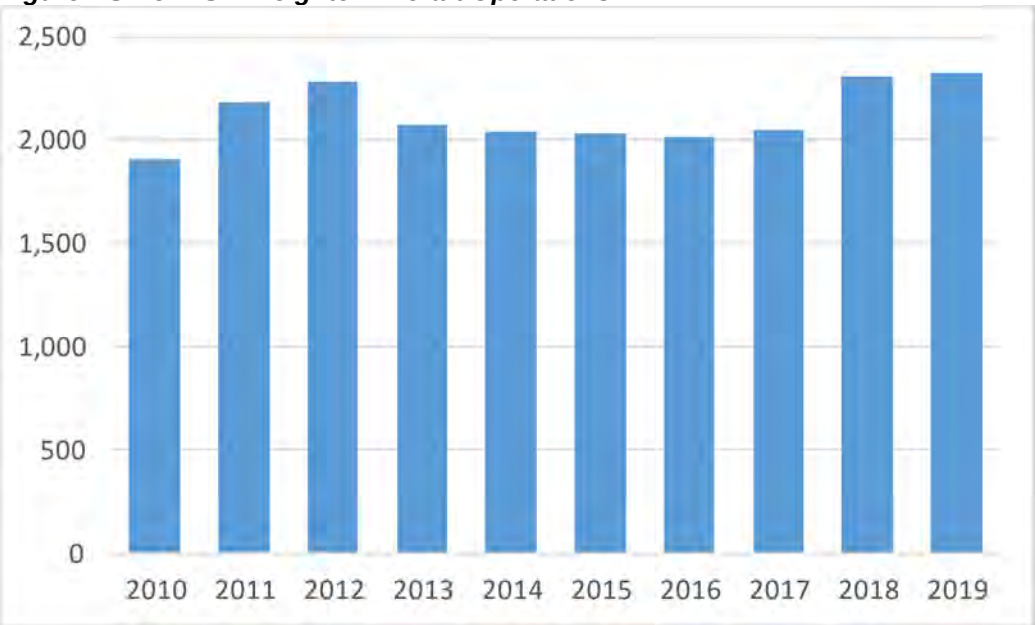
Figure HSV-4: Airline Market Shares of HSV Air Cargo Tonnage, 2018-2020



Source: U.S. DOT, T-100 Carrier Reports.

Due to the nature of publicly available reports of air cargo industry operations, it is difficult to obtain detailed information on the cargo handled at HSV. For instance, the U.S. DOT T-100 carrier reports provide information on the nonstop segments of HSV cargo flights. However, where an international bound flight from HSV stops at another U.S. domestic point first, the onboard cargo is reported at Domestic. Given these reporting challenges, we alternatively report the number of freighter aircraft operations as a proxy for HSV cargo activity levels over time, see Figure HSV-5.

Figure HSV-5: HSV Freighter Aircraft Operations



Source: U.S. DOT, T-100 Carrier Reports.

As shown in Figure HSV-5, the freighter operations at HSV have sustained a high level of activity during the entire period 2010-2019. Particularly notable are the years 2018-2019 where record highs were achieved in consecutive years. In those years, tariffs and international trade wars negatively affected many air cargo markets, but the HSV cargo operators maintained and expanded service levels – perhaps even as regional cargo volumes declined.

HSV's Forwarder-Controlled Freighter Network

HSV enjoys robust international air cargo service thanks to the operations of DSV Panalpina ("DSV"), a Danish transport and logistics company offering transport services globally, which began in 1990. As a leading global freight forwarder, DSV embarked on an innovative plan to better serve its customers. DSV leased freighter aircraft from Cargolux and began operations between HSV and Luxembourg Airport (LUX). HSV provided an attractive location in the Southeast U.S., an uncongested airport, and established industries which drove demand for air cargo, including high-tech, telecommunications, healthcare, oil & gas, fashion, and automotive.

Since then, the DSV forwarder-controlled freighter network at HSV has grown to include Brazil, Hong Kong, and Mexico using leased and chartered freighters. HSV's cargo facilities have grown with the freighter operation – extending runways, expanding taxiways, and building cargo facilities that now total over 300,000 square feet, including multiple temperature-controlled facilities.

By any measure, the forwarder-controlled freighter network is judged as a success. More than 30 years after its inception, it continues to operate high levels of cargo service while carrying a diverse array of commodities and adding new customers. The DSV network at HSV has become a model for other alternative cargo gateway airports to emulate even as it continues to evolve and innovate.

Air Cargo Linkages to Regional Economic Development

Interviews with HSV management revealed strong linkages between the Airport's cargo operations and regional economic development. Existing business retention and new business attraction can be traced back, in some way, to the presence of convenient, reliable air cargo services.

Notably, the Business Development team at HSV has consciously cultivated a cooperative environment within the region where the macro- benefits of economic development outweigh instinctive territorial self-interests, producing results for the greater good. The team of four professionals is dedicated to air cargo development, which then translates to economic development within a stated 600-mile catchment area. Each team member is trained in all facets of the business development process and share equal knowledge of HSV's air cargo business. This translates to a productive, efficient experience for business prospects who are not handed off to individual subject matter experts to meet their needs. It also leads to strong relationships between airport staff and freight forwarders, cargo airlines and others in the logistics eco-system.

The Business Development team is driven by their mission to support DSV's air cargo customers and to serve as a conduit between DSV and its customers. In this manner, the Airport serves as an extension of DSV to assist customers with various issues that may arise. This fosters a sense of partnership between involved parties, which helps to sustain and grow service levels.

The partnerships also extend to elected officials who value the positive downline impacts of the air cargo operations. The active involvement by Alabama's Congressional delegation has enabled HSV to obtain entitlements and Federal grants to improve infrastructure required by air cargo operators. Indeed, the DSV

freighter network at HSV has been leveraged by the State of Alabama to help attract large scale manufacturing facilities in the automotive and aerospace sector.

Examples of the linkages between HSV's air cargo services and regional economic development include:

- The Mercedes auto plant in Vance, Alabama, which opened in the 1990s. This plant is a 2-hour drive south of HSV, but benefits from DSV's frequent air cargo services to Western Europe.

- Similarly, a joint venture between Mazda and Toyota – Mazda Toyota Manufacturing (MTM) – is constructing a massive factory in Huntsville. [134] The $2.3 billion state-of-the-art facility is expected to employee over 4,000 people. The factory's construction is already being supported by HSV air cargo and that will only grow as the plant begins producing automobiles.

The investments made at HSV over time related to air cargo have generated a return on investment and related regional economic development. This has been achieved through regional cooperation, partnerships and collaboration aimed at common goals, which ultimately benefit the citizens and businesses in and around the State of Alabama.[135]

Regional Stakeholders Perceptions of Airport's Contributions to Economic Development

The Huntsville Chamber of Commerce (Chamber) describes itself as "the catalyst for business growth, community engagement, and action to drive economic vitality and advance our position as a global leader in technology and innovation." It is organized around three major departments: Economic Development, Workforce and Education, and Small Business and Events. The Chamber also has departments focusing on communications and government affairs. The Chamber recognizes the value of HSV's non-stop international cargo flights to Luxembourg, Hong Kong, Mexico City, and Sao Palo. Its annual report highlights the number of jobs created and capital investments. The Chamber also reports the number of foreign-based companies with locations in Huntsville/Madison County (see Table HSV-3).

Table HSV-3: Foreign-based Companies in Huntsville/Madison County 2021

Continent	Home Country	Number of Firms
North America	Canada	5
	Mexico	1
Europe	Denmark	1
	France	3
	Germany	7
	Ireland	1
	Italy	2
	Luxembourg	2
	Sweden	2
	Switzerland	3
	United Kingdom	3
Asia	Japan	24
	Korea	1
Australia	Australia	1

Source: https://hsvchamber.org/departments/economic-development/community-data/foreign-based-companies/

The Chamber is also supporting the 'Huntsville Regional Economic Growth Initiative' (HREGI) that aims to establish Huntsville/Madison County as a center of technology in the South and in the nation. HREGI is designed to position the area as one of the leading economic growth centers in the Southeast, comparing with Austin, Raleigh-Durham, Charlotte, and other peer technology-based U.S. cities. Major corporate investors include Toyota, Boeing, Northrop Grumman, Adtran, and Vertiv. Employment in these sectors benefits from connectivity provided by commercial aviation.

The Huntsville Metropolitan Planning Organization (MPO) notes the economic contribution of the airport by referencing the connections with international markets. “The presence of many international companies has been a driving force in continuous economic growth in North Alabama. The Jetplex Industrial Park is home to L.G. Electronics, the first Korean manufacturing operation located in North America. In Madison County alone, there are over 60 foreign-based corporations. These include representation from Canada, France, Denmark, Germany, Ireland, Italy, Japan, Korea, Kuwait, Netherlands, Singapore, South Africa, Sweden, Switzerland, and the UK.”[136]

The Top of Alabama Regional Council of Governments (TARCOG) is the organization in northern Alabama that serves as the economic development organization on behalf of the U.S. Economic Development Administration (EDA). It serves the five-county region that includes the Huntsville, MSA and focuses on addressing common regional issues, opportunities, and challenges. The 2020 update of its Comprehensive Economic Development Strategy (CEDS) notes the region’s history with manufacturing and transition from traditional industries, such as textiles, to advanced manufacturing industries that involve higher technology and robotics. Activities associated with manufacturing, distribution, and logistics share many characteristics, such as locating in close proximity to major transportation facilities.

The CEDS update notes that advanced manufacturing associated with science and technology promises great potential for the area. The region’s intermodal connections of rail and air create outstanding opportunities for effective and efficient transportation, distribution, and logistics. TARCOG supports efforts to facilitate the transportation of goods and services locally, regionally and globally, particularly intermodal transportation networks that support manufacturing and distribution. It also supports workforce

development and education activities that facilitate the retraining of workers displaced by industries that are diminishing in importance, particularly retraining that prepares workers for employment in advanced manufacturing industries.[137]

Communicating the Airport's Economic Impact

HSV's website noted that its overall economic impact was estimated as part of a study of the six airports in the state that had commercial air service.[138] That study concluded that the economic impact of the Port of Huntsville was:

- Economic Impact: $1.8 Billion
- Payroll Impact: $1 billion
- Employment Impact: 28,600 Jobs

A second economic impact study commissioned by the state's Department of Transportation's Aeronautics Bureau was released in December 2020. That study covered all 80 public use airports in the state, including the six commercial service airports, and was based on airport operations for 2019. The report separately estimated the direct, indirect, and induced economic impacts associated with airport operations, capital development, and visitor spending. This study estimated that HSV's operations supported:

- Total employment of 5,108
- Total payroll $170.9 million
- Total economic activity, $483 million.[139]

ENDNOTES

[1] https://www.metroatlantachamber.com/resources/most-popular/fortune-500-fortune-1000-in-metro-atlanta
[2] https://aeroatl.org/economic-development-collective/
[3] https://aeroatl.org/about/
[4] https://www.georgia.org/sites/default/files/2020-02/annual_trade_report.pdf
[5] https://www.clustermapping.us/about/clusters-101
[6] https://www.georgia.org/competitive-advantages/infrastructure#block1
[7] https://www.metroatlantachamber.com/about/metro-atlanta-chamber/about-the-chamber
[8] https://www.metroatlantachamber.com/economic-development/key-industry-segments/supply-chain
[9] https://www.atl.com/about-atl/atl-factsheet/
[10] https://apps.bea.gov/regional/bearfacts/action.cfm
[11] https://www.clustermapping.us/data/report/region/scorecard#/msa/12420/1998/2018/jobs
[12] https://www.utexas.edu/about/facts-and-figures
[13] https://www.census.gov/quickfacts/fact/table/TX,US/PST045219
[14] Need to define and clarify establishments vs. businesses.
[1515] https://www.clustermapping.us/about/clusters-101
[16] https://www.austinchamber.com/what-we-do
[17] http://www.austintexas.gov/news/76-billion-economic-activity-generated-austin-airport
[18] U.S. DOT T-100 data for scheduled passenger service.
[19] The combined Columbia-Jefferson City region refers to the Columbia-Moberly-Mexico Combined Statistical Area (which includes the 5 counties of Boone, Cooper, Howard, Audrain, and Randolph) as well as the Jefferson City Metropolitan Statistical Area (which includes the 4 counties of Cole, Callaway, Moniteau, and Osage). Source: U.S. Bureau of Economic Analysis (BEA).
[20] U.S. Bureau of Economic Analysis (BEA).
[21] https://apps.bea.gov/regional/bearfacts/action.cfm
[22] Expressed in constant 2019 dollars, the increase in per capita income was 7 percent.
[23] Ibid.; C2ER Cost of Living Index 2019 Third Quarter, cited in Regional Economic Development Inc., Facts and Figures – Columbia/Boone County, Missouri.
[24] City of Columbia, MO.
[25] The 52 percent figure refers to the City of Columbia; the average share across the combined Columbia-Jefferson City region, as previously defined, is around 34 percent. U.S. Census Bureau, State & County Quick Facts, 2019.
[26] BEA; Regional Economic Development Inc., Facts and Figures – Columbia/Boone County, Missouri.
[27] U.S. DOT T-100 data for scheduled passenger service.
[28] https://www.modot.org/missouri-statewide-airports-economic-impact-study
[29] Greater Des Moines Partnership
[30] https://apps.bea.gov/regional/bearfacts/action.cfm
[3131] https://www.clustermapping.us/about/clusters-101
[32] www.flydsm.com
[33] USDA ERS, *Ag and Food Sectors in the Economy*, 2020.
[34] Defined as individual physical locations where business is done. An individual company may have multiple locations under a single business, so this metric measures more broadly expansion of business activity within the region.
[35] Total regional employment in the other noted traded clusters were less than 2,500: Performing Arts (2,200), Paper and Packaging (2,100), Communications Equipment and Services (1,600), and Environmental Services (700).
[36] Fresno County Economic Development Corporation, *Descriptive Analysis of The Structure of the Fresno-Madera Economy: How the Regional Economy Impacts Air-Traffic Demand*, March 2018.
[37] Fresno Yosemite International Airport, *Master Plan Update 2018.*
[38] Caltrans, *California Aviation System Plan 2020 Preliminary Draft*.
[39] *Ibid*.
[40] City of Fresno Airports Department, *The Economic Impact of Fresno Yosemite International and Chandler Executive Airport*, 2018.

[41] https://apps.bea.gov/regional/bearfacts/action.cfm
[42] An "establishment" is defined by the Census Bureau as a single physical location at which business is conducted or where services or industrial operations are performed. It is not necessarily identical with a company or enterprise, which may consist of one establishment or more. Generally, counts of establishment represent the number of locations with paid employees any time during the year, excluding government institutions and selected other types of businesses such as wholesale liquor establishments Federally-chartered savings institutions or credit unions and hospitals. Data are from the Census Bureaus' County Business Patterns
[4343] https://www.clustermapping.us/about/clusters-101
[44] The IATA connectivity index measures the number and size of destinations served, as well as the frequency of service to each destination and the number of onward connections available from those destinations. Service to airports with the highest total seat capacity (e.g. ATL) receive the highest weighting. Thus, the index recognises that connections to major global gateways provide greater global connectivity than connections to the same number of spoke ends. The formula for the index is as follows:

$$\frac{[\text{ Number of destinations x Weekly Frequency x Seats per flight }]\ \textit{Weighted by the Size of the Destination Airport}}{\text{Scalar factor of 1000}}$$

[45] Total seat capacity at GRB dipped between 2012-13 then rebounded in 2014 to roughly similar levels as in 2012, while connectivity grew between 2012-13 as well as 2013-14. Source: Innovata schedule data via Diio Mi.
[46] Greater Green Bay Chamber, Economic Development Stratetic Plan, May 2017, p. 23. Available at https://www.greatergbc.org/media/3045/strategic-plan-booklet-web.pdf
[47] https://apps.bea.gov/regional/bearfacts/action.cfm
[48] City of Greensboro, Comprehensive Annual Financial Report, July 2019, p. V.
[49] CAFR p. VII.
[50] The correlation strengthens to 0.808 if the results from 2008 are excluded. Traffic then was affected by the presence of SkyBus, which ceased operations in that year.
[51] For this analysis, fewer years of data are available because employment in many sectors was suppressed to protect confidentiality. Consequently, the analysis covers the period 2013-2019 only.
[52] Ted Johnson, former Executive Director, GSO.
[53] Source: Nccarolinacore.com
[54] https://www.gtcc.edu/about/campuses/aviation.php
[55] Source: Nccarolinacore.com
[56] Source: State of North Carolina, "North Carolina The State of Aviation What Aviation Means to our Economy, January 2021." Economic impact in 2019.
[57] http://www.iflymia.com/about_us.asp
[58] https://www.clustermapping.us/data/report/region/scorecard#/msa/12420/1998/2018/jobs
[59] U.S. Census Bureau Quick Facts based on July 2019 estimates.
[6060] https://www.clustermapping.us/about/clusters-101
[61] http://www.iflymia.com/about_us.asp
[62] Miami-Dade Aviation Department, Comprehensive Annual Financial Report, Fiscal Year ending Sept. 30, 2019, p. ii.
[63] http://www.iflymia.com/about_us.asp
[64] US Census Bureau 2019 1-Year Estimates.
[65] VisitRaleigh.com
[66] https://apps.bea.gov/regional/bearfacts/action.cfm
[67] https://apps.bea.gov/regional/bearfacts/action.cfm
[68] The BEA uses data from the U.S. Census Bureau on "establishments," which it defines as "An establishment is a single physical location at which business is conducted or services or industrial operations are performed. It is not necessarily identical with a company or enterprise, which may consist of one or more establishments. … Establishment counts represent the number of locations with paid employees any time during the year." The count excludes government establishments except for certain situations, such as state-operated retail liquor stores, local

government-owned/operated hospitals, and federally chartered credit unions. https://www.census.gov/programs-surveys/susb/about/glossary.html
[69] Wake County Economic Development
[70] Bureau of Economic Analysis
[71] https://www.clustermapping.us/region/economic/raleigh_durham_cary_nc/cluster-portfolio
[72] https://edpnc.com/industries/biotech-pharmaceuticals/
[73] https://edpnc.com/industries/information-technology/
[74] Raleigh-Durham International Airport
[75] Researchtriangle.org
[76] Diio Schedules
[77] North Carolina Department of Transportation
[78] North Carolina Department of Transportation (NC DOT), North Carolina: The State of Aviation, What Aviation Means to Our Economy, 2021 https://www.ncdot.gov/
[79] Ibid.
[80] The Great Recession began in December 2007 and ended in June 2009, which makes it the longest recession since World War II. Beyond its duration, the Great Recession was notably severe in several respects. Real gross domestic product (GDP) fell 4.3 percent from its peak in 2007Q4 to its trough in 2009Q2, the largest decline in the postwar era (based on data as of October 2013). The unemployment rate, which was 5 percent in December 2007, peaked at 10 percent in October 2009. https://www.federalreservehistory.org/essays/great-recession-of-200709
[81] Data on the number of establishments in the Reno-Tahoe-Fernley CSA for 2008 is not available.
[82] Economic Development Authority of Western Nevada, *Continuing Economic Vitality of the Region: 3-Year Strategic Plan*, July 2019.
[83] Economic Development Authority of Western Nevada, "Northern Nevada Economic Planning Indicators Committee Report 2.0" (January 2019). https://www.edawn.org/epic-report/
[84] *Forbes*, The 'Biggest Little City In The World' Was Just Named The Best Small City In America, June 25, 2020; Milken Institute (Sept 2020), #1 "Best Performing Cities in Job Growth" and #4 in Best Performing; Area Development (Jan. 2020), #1 MSA for Job and 5-Year Growth, #3 for Economic Strength.
[85] Resonance Consulting, "America's Best Small Cities", *America's Best Cities*, 2020.
[86] Reno-Tahoe Airport Authority, *FY 2019-2023 Strategic Plan*, 2018.
[87] Shown as the difference between Onboard passengers and Origin/Destination (O/D) passengers.
[88] RTAA, "FY 2019-23 Strategic Plan"
[89] https://www.esri.com/en-us/landing-page/industry/transportation/2019/reno-tahoe-airport-case-study
[90] RASC, https://renotahoeairservice.com/about-us/
[91] EDAWN, "Continuing Economic Vitality in the Region: 3-Year Strategic Plan" (July 2019).
[92] RTAA, "FY2019-2023 Strategic Plan", 2018.
[93] RTAA, "Fiscal, Economic, and Industry Impacts of the Reno-Tahoe Airport Authority", 2018. Developed in partnership with the University of Nevada, Reno's Center for Regional Studies.
[94] https://www.sandiego.org/about/industry-research.aspx
[95] https://www.sandiegobusiness.org/research/regional-economy/
[96] https://www.san.org/Flights/Nonstop-Destinations
[97] https://www.san.org/Portals/0/Documents/Air%20Traffic%20Reports/2019_Year_in_Review.pdf?ver=2020-02-27-144247-470
[98] https://www.sandiegobusiness.org/research/regional-economy/
[99] https://www.sandiego.org/about/industry-research.aspx
[100] https://www.sandiegobusiness.org/wtcsd/
[101] The BEA uses data from the U.S. Census Bureau on "establishments," which it defines as "An establishment is a single physical location at which business is conducted or services or industrial operations are performed. It is not necessarily identical with a company or enterprise, which may consist of one or more establishments. … Establishment counts represent the number of locations with paid employees any time during the year." The count excludes government establishments except for certain situations, such as state-operated retail liquor stores, local

government-owned/operated hospitals, and federally-chartered credit unions. https://www.census.gov/programs-surveys/susb/about/glossary.html

[102] "Service" is defined by a minimum of 150 departures per year.

[103] Diio Schedules

[104] Diio Schedules

[105] https://www.san.org/Portals/0/Documents/Air%20Traffic%20Reports/2020_Year_in_Review.pdf?ver=2021-01-27-141504-763

[106] https://www.sandiegobusiness.org/about-edc/

[107] https://www.sandiegobusiness.org/wtcsd/

[108] https://www.sandiegobusiness.org/wtcsd/metroconnect/

[109] https://www.san.org/Portals/0/Documents/Finance/Economic%20Impact%20Study/2017-01-06-economic-impact-study.pdf

[110] https://apps.bea.gov/regional/bearfacts/action.cfm

[111] The BEA uses data from the U.S. Census Bureau on "establishments," which it defined as "a single physical location at which business is conducted or services or industrial operations are performed. It is not necessarily identical with a company or enterprise, which may consist of one or more establishments. Establishment counts represent the number of locations with paid employees any time during the year." The count excludes government establishments except for certain situations, such as state-operated retail liquor stores, local government-owned/operated hospitals, and federally-chartered credit unions.
https://www.census.gov/programs-surveys/susb/about/glossary.html

[112] Charles M Schulz Sonoma County Airport Market Assessment Analysis, March 2019.

[113] Percentages may not add to 100 due to rounding.

[114] Airline Schedules as of April 23, 2021. Source: Innovata Schedules via Diio by Cirium.

[115] https://apps.bea.gov/regional/bearfacts/action.cfm

[116] https://www.census.gov/content/dam/Census/library/publications/2021/acs/acsbr-009.pdf

[117] The BEA uses data from the U.S. Census Bureau on "establishments," which it defines as "An establishment is a single physical location at which business is conducted or services or industrial operations are performed. It is not necessarily identical with a company or enterprise, which may consist of one or more establishments. … Establishment counts represent the number of locations with paid employees any time during the year." The count excludes government establishments except for certain situations, such as state-operated retail liquor stores, local government-owned/operated hospitals, and federally chartered credit unions. https://www.census.gov/programs-surveys/susb/about/glossary.html

[118][118] https://www.clustermapping.us/about/clusters-101

[119] FAA Enplanement data, CY 2019

[120] Airline Data Inc., published airline schedules for Week of May 16-22, 2021.

[121] "Amazon's big hiring plans just latest example of competitive market for Lehigh Valley warehouse workers," The Morning Call, May 13, 2021.

[122] "Amazon using Lehigh Valley airport for secret pilot program," The Morning Call, December 27, 2015.

[123] Lehigh Valley International Airport, Master Plan Update, 2018

[124] https://lehighvalley.org/lehigh-valley-international-airports-importance-to-regional-economy-discussed/

[125] Image from https://www.portofhuntsville.com/

[126] https://apps.bea.gov/regional/bearfacts/action.cfm

[127] The BEA uses data from the U.S. Census Bureau on "establishments," which it defines as "An establishment is a single physical location at which business is conducted or services or industrial operations are performed. It is not necessarily identical with a company or enterprise, which may consist of one or more establishments. … Establishment counts represent the number of locations with paid employees any time during the year." The count excludes government establishments except for certain situations, such as state-operated retail liquor stores, local government-owned/operated hospitals, and federally chartered credit unions.
https://www.census.gov/programs-surveys/susb/about/glossary.html

[128] https://www.clustermapping.us/about/clusters-101

[129] Image from https://www.portofhuntsville.com/air-cargo/

[130] North American Airport Traffic Summary, Airports Council International – North America, 2019.
[131] Airline Data Inc., published airline schedules for Week of May 16-22, 2021.
[132] Source: U.S. DOT, T-100 Carrier Reports
[133] North American Airport Traffic Report, Airports Council International – North America, 2019.
[134] Image from https://www.daimler.com/company/locations/tuscaloosa/
[135] Image from https://www.portofhuntsville.com/rail-cargo/
[136] TRIP 2045, City of Huntsville Area Planning Division and the Huntsville Area Metropolitan Planning Organization, May 2020, pp. 96-98.
[137] Top of Alabama Regional Council of Governments, 2020 Annual Update, Comprehensive Economic Development Strategy, pp. 12-13.
[138] The Economic Impact of Alabama's Six Major Commercial Service Airports on the State's Economy, Prepared for: The Aviation Council of Alabama, July 2020. Available at: https://live-flyhsv.pantheonsite.io/wp-content/uploads/2020/09/AL-Airports-Economic-Impact-Study.pdf
[139] Alabama Statewide Economic Impact Study Technical Report, Jviation, p. 70. Available at: http://sites.jviation.com/aldot-airport-study/documents/aldot_economic-impact-study-technical-report.pdf