AIR TRANSPORTATION AND SOCIOECONOMIC CONNECTIVITY IN THE UNITED STATES SINCE DEREGULATION

Ryan Tam and R. John Hansman

International Center for Air Transportation
Department of Aeronautics and Astronautics
Massachusetts Institute of Technology
Cambridge, Massachusetts, USA

Professor R. John Hansman
Department of Aeronautics & Astronautics
77 Massachusetts Ave #33-303
Cambridge, MA 02139
Phone: (617) 253-2271
E-mail: rjhans@mit.edu

Ryan Tam, Graduate Student
Department of Urban Studies and Planning
77 Massachusetts Ave #35-220
Cambridge, MA 02139
Phone: (617) 869-6254
E-mail: rtam@mit.edu

Abstract

In light of ongoing threats to the viability of traditional airline business models and the provision of air service in the United States, this paper studies the fundamental interdependence of the national economy and the air transportation system. A conceptual framework has been developed to identify the mechanisms that enable air transportation to shape regional economic productivity and social connectivity. Regional economic census data is combined with airline traffic and financial data to illustrate the changes in supply and demand for air travel after the deregulation of the airline industry in 1978. The paper focuses on how the utilization of air transportation system supports economic and social activities across greater distances than would otherwise be possible—changing the economic geography of market access. An analysis of industry restructuring after the economic bubble and the attacks of September 11, 2001 are also used to look at the potential impacts on economic activity at the regional and national levels.

1. Introduction

The attacks of September 11, 2001 and the current financial crisis within the airline industry have highlighted the critical instabilities in the structure of the US air transportation system. This paper focuses on analyzing the dynamics of supply and demand within the air transportation system since deregulation as they pertain to socioeconomic connectivity in the US. Industry trends such as the development of hub-and-spoke systems or the use of revenue management systems have shaped the demand for regional air travel and helped to facilitate national social and economic integration. The economy and changes to air travel patterns are having an effect on the airline industry, and current efforts to restructure airline businesses could have an impact on connectivity and mobility. This paper will begin to discuss the interrelated evolution of the airline industry and socio-economic travel patterns before looking at the current industry restructuring and the implications for connectivity.

To better understand the relationships of supply and demand relationships within the air transportation system, a conceptual model was developed. This is shown in Figure 1. The model sets up the external relationship between the economy (shown in the upper left corner) and the air transportation system (shaded in gray on the lower right). The internal relationship between the air travel supply-demand equilibrium and the airline companies is shown within the gray box. The economy generates a **Travel Need** that translates into a **Demand** for air transportation services. The **Supply** of air transportation services, in turn, provides an **Economic Enabling Effect** that creates access to people, markets, ideas and capital and thus enables the economy to function at a regional or national level. These relationships between **Supply**,

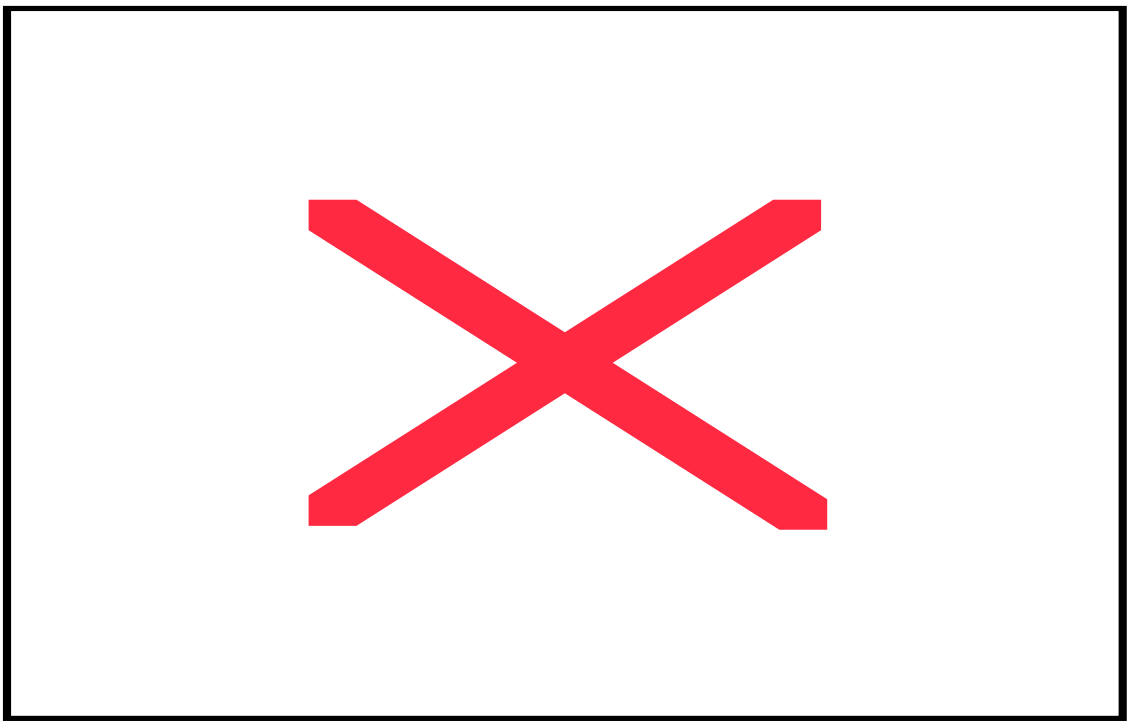


Figure 1: Relationship between the economy, air travel demand, and airline supply.

Demand, and the **Economy** illustrate the basic macro functionality of the air transportation system.

The model further illustrates how the internal structure of the Air Transportation System (gray box) is based on the profitability of the airline industry. This internal feedback loop connects the demand for air travel to airline revenues and the supply of air transportation. **Airlines** control the **Supply** of air transportation by modifying **Prices, Networks, and Schedules**, which in turn have a major impact on the **Demand** for air transportation services. Finally, the model also shows the traditional financial relationships between the economy and the airline industry (shown in dashed lines). The **Economy** influences the ability of the **Airlines** to secure capital Equity and finance debt. Employment and spending by the airlines, in turn, have **Direct, Indirect, and Induced impacts** on the economy. A recent study for the Federal Aviation

Administration, for example, estimated that US commercial aviation was responsible for over $800 billion dollars in direct, indirect, and induced employment in 2000—about 8 percent of the US economy.[1]

2. Air Travel Supply and Demand after Deregulation

Prior to 1978, the Civil Aeronautics Board (CAB) regulated entry, routes, and fares[2] in order to promote stability in the air transportation system. Amidst a wave of political support and a growing body of academic research that disputed long-held concerns about economies of scales, monopolies, and degraded service, the Airline Deregulation Act of 1978 eliminated CAB authority over routes and domestic fares.[3] This triggered a set of dynamics that would reshape the air transportation system and would set the stage for dramatic growth in the supply and demand of domestic air travel.

The rapid growth of air transportation after deregulation can be seen through increases in capacity as measured in terms of Available Seat Miles (ASMs), and traffic—measured through Revenue

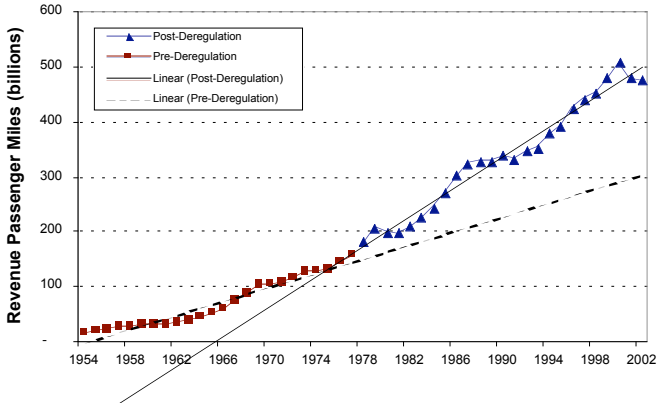


Figure 2: RPMs before and after deregulation.
Source: US DOT and ATA data.

[1] Air Transport Association, "Airlines in Crisis" (Washington: 2003), p. 25.
[2] National Research Council, Winds of Change: Domestic Air Transport Since Deregulation, Special Report 230 (Washington DC: Transportation Research Board, 1991), p. 26
[3] National Research Council, p. 28.

Passenger Miles (RPMs). Figure 2 shows that scheduled RPMs grew considerably faster after deregulation than in the period between 1954 and 1978. Between 1954 and 1978, RPMs grew at an average annual rate of 5.8 million RPMs per year, but this more than doubled during the period between 1978 and 2002 to an average rate over 11.7 million RPMs per year. Airline capacity grew accordingly with this increased demand. Figure 3 shows the growth of scheduled ASMs together with the growth in RPMs. Scheduled annual ASMs increased from 300 billion in 1978 to over 700 billion by 2000.

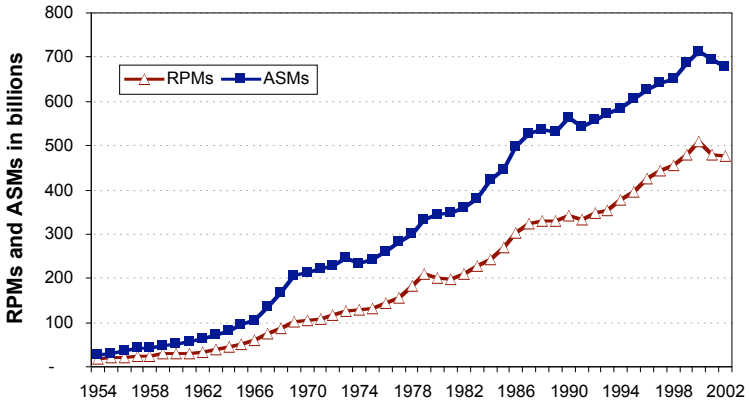


Figure 3: RPM and ASM growth, 1954-2002. Source: US DOT and ATA data.

More recently, the close relationship between economic growth and the demand for air travel also translated into record traffic loads and profits for the airline industry during the economic growth cycle of the late 1990's. Fueled by the development of the internet and the investment boom in startup dot-com companies, this bubble economy was responsible for increasing the real US gross domestic product by $2.3 trillion in 1996 dollars between 1992 and 2000.[4] This affected the dynamics of supply and demand as airlines adjusted their operating strategies and passengers modified their travel behavior. Between 1990 and 2000, the domestic revenue passenger miles at the major US carriers[5] increased by 40 percent from 338 to 474 billion RPMs. Total capacity increased by

[4] US Bureau of Economic Analysis, "Current-Dollar and Real Gross Domestic Product." http://www.bea.gov/bea/dn/gdplev.xls

[5] Data includes traffic for Air Transport Association member carriers, including: Alaska, Aloha, America West, American, Continental, Delta, Hawaiian, JetBlue, Midwest, Northwest, Southwest, United, and US Airways. ATA

only 23 percent, however, and thus load factors climbed to record levels. The average load factor in 1990 was 60.5 percent, but that had increased to 71.7 percent by 2000.

2.1 Industry Evolution

After deregulation, the airline networks evolved to provide greatly enhanced connectivity while yield management brought down prices. Horizontal consolidation occurred through mergers and acquisitions—creating instant nationwide or regional airline networks. Vertical integration occurred as airlines developed regional feeder services and acquired international route authorities. Airlines moved to develop hub-and-spoke networks which captured as much connecting traffic as possible. By funneling passenger connections from multiple cities through a central hub, the consolidation of demand offered fundamental economies of scale—enabling more frequent service to smaller cities or other weak markets that wouldn't otherwise be covered in a point-to-point network.

Advances in seat inventory control and automated pricing systems in the years after deregulation also enabled the major carriers to effectively compete with low-fare airlines without diluting their entire inventory and revenues. By offering different prices for virtual groupings of seats, yield management systems enabled airlines to offer a range of low fares to stimulate demand and sell-off excess seat inventory while preserving the revenue from passengers willing to pay higher fares. Evidence of how yield management has affected the industry can be seen through data on airline revenue and traffic. Airline yields (the average price paid per passenger-mile) were

---

Monthly Passenger Traffic Report: Scheduled Mainline Service -- ATA U.S. Member Airlines. http://www.airlines.org/public/industry/bin/traffic.xls

examined using constant 1978 dollars in order to account for inflation. Figure 4 shows that the average yield has been continually declining since the 1960s, although this decline slowed in the 1990s. At the same time, Figure 5 shows that the average industry domestic load factors increased from about 60 percent in 1978 up to 72 percent in 2000. This indicates that even though prices on average were going down, airplanes had more seats filled and were thus generating more revenue per flight.

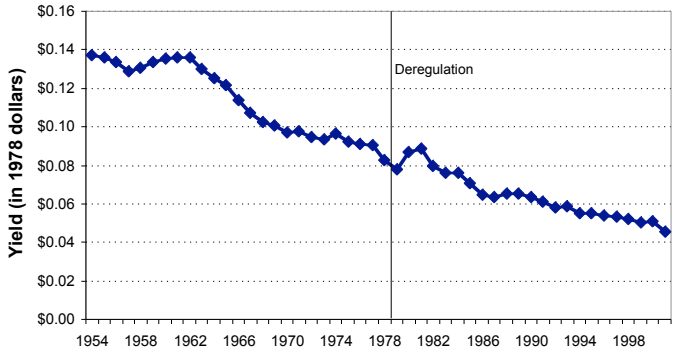


Figure 4: Declining Real yields after deregulation (in 1978 dollars). Source: ATA data.

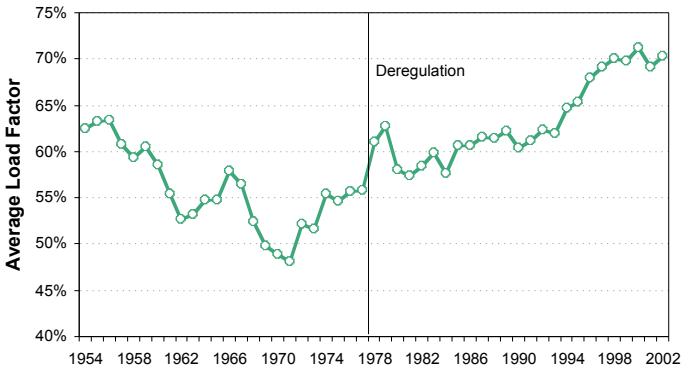
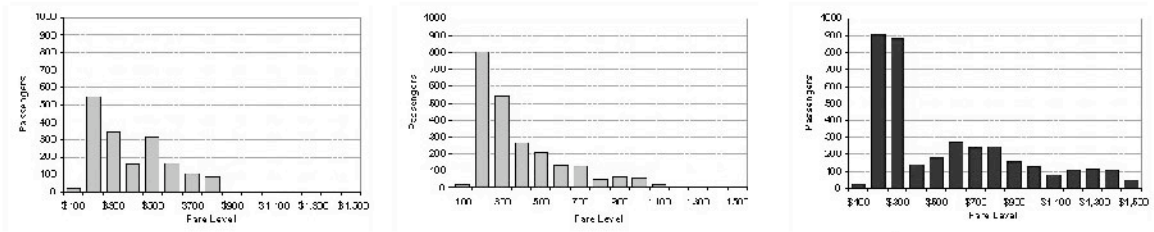


Figure 5: Average industrywide domestic load factors, 1954-2002. Source: US DOT Form 41 data and ATA.

To illustrate the changes in network pricing strategies, the evolution of fares in one specific city-pair market at one major airline was analyzed using the US DOT DB-1A ten-percent sample of all domestic tickets. Figure 6 shows the distribution of the fares purchased between New York-Kennedy and Los Angeles using a histogram set at $100 dollar intervals.[6] The data shows several key changes. The average current-dollar fare actually dropped between 1985 and 1990,

[6] Although this example does not necessarily account for the effects of competition, aircraft size, and other factors, it nevertheless provides some insight into the pricing actions within the industry. It should be noted the typical network carrier offers a myriad of fares in thousands of origin-demand markets. The market between New York-Kennedy and Los Angeles was selected because it is a highly competitive market linking the two largest cities in the United States with basically no alternate mode of transportation. Only the middle 90 percent is plotted in order to reduced the effect of frequent flyer award tickets, non-revenue travel, and other data anomalies.

but had increased significantly by 1998. This is important because at the same time, there was a distinct increase in the gap between the highest and lowest fares. The ratio between the highest and lowest fares increased from 10.3 in 1985 up to 16.3 in 1998. In addition, the number of passengers in the lowest fare segments had increased dramatically by 1998, creating a much more skewed distribution of passengers at the lower end.



1985 Q3
Sample size: 1738 (1937 total)
Highest: $741 Lowest: $72
Mean: $340
Multiplier: 10.3

1990 Q3
Sample size: 2293 (2252 total)
Highest: $1016 Lowest: $89
Mean: $335
Multiplier: 11.42

1998 Q3
Sample size: 3633 (4042 total)
Highest: $1468 Lowest: $90
Mean: $494
Multiplier: 16.3

Figure 6: Histograms showing distribution of one-way airfares purchased between New York-JFK and Los Angeles for selected years on American Airlines. Middle 90 percent of fares shown in current-year dollars. Source: Author's calculations from US DOT DB1A.

2.2 Change in Passenger Dynamics

Changes in travel patterns and consumer behavior in recent years have also affected the dynamics of supply and demand in the air transportation system. Increased network connectivity and the availability of low fares have shaped the way air travel was integrated into social and economic activity patterns. To examine how air transportation may have affected regional population and economic growth, an analysis of regional economic and air traffic data was conducted. Economic census data on population growth and Per Capita Personal Income (PCPI)

at the state level was combined with the Department of Transportation 10% air traveler coupon database. The number of airline trips per capita was also used to normalize the data for the size of each state. Figure 7 illustrates the percentage change in air traffic over the percentage change in population between 1980 and 2000 (normalized to 1980 levels). Figure 8 shows a comparison of the change in per capita personal income over air traffic. Nationally, there was a 24 percent growth in population and a 190 percent growth in PCPI between 1980 and 2000. In comparison, air travel grew by 136 percent on average.

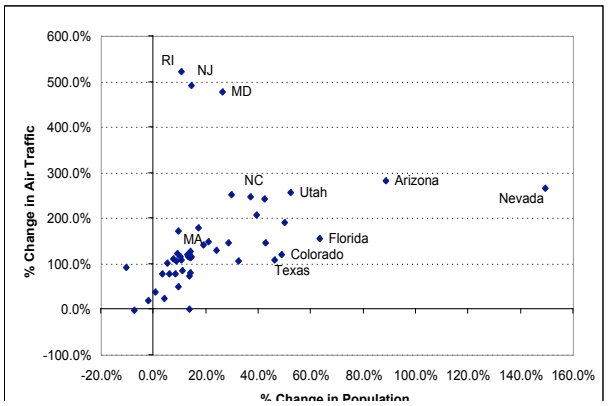


Figure 7: Change in state population vs. air traffic, 1980-2000. Source: US BEA REIS and DOT

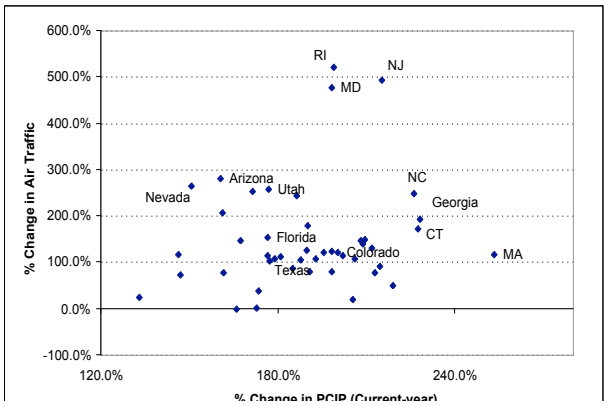


Figure 8: Change in per capita personal income vs. air traffic. Source: US BEA REIS and DOT

In general, some of the faster-growing locations—by population and PCPI—in the West and Southeast were also associated with higher utilization of air travel. Although Nevada and Arizona had very high rates of population growth and air travel, they had some of the lowest increases in PCIP versus air travel. This is thought to be due to the rapid growth of the tourism industry and retirement relocations that were facilitated by air travel and created new demand but which generated relatively low-paying service jobs.

This analysis also illustrated how the limits of the aviation infrastructure affected travel patterns across state borders. Massachusetts had the highest increase in PCIP between 1980 and 2000, but its air traffic only doubled over the same period. This is because as Boston Logan International Airport (BOS) reached saturation, traffic increased at regional airports in Manchester, New Hampshire (MHT) and Providence, Rode Island (PVD)—airports with unusually high traffic increases with respect to their population or income growth.[7] These regional effects can also explain other areas with anomalously high air traffic growth including Baltimore, Maryland (BWI) supporting the Washington DC-Northern Virginia region and Newark, New Jersey (EWR) supporting the New York city market.

Increased Social Travel. The growth of the airline industry after deregulation and the overall decrease in prices has also led to a change in air travel patterns. To more closely examine the changes in the use of air transportation, survey data on long-distance travel was examined. The data was collected from a periodic personal travel survey conducted by the US Department of Transportation.[8] Figure 9 shows the rapid rise in the reported number of long distance (greater than 100 miles) trips by air. While overall long-distance air travel has gone up, the ratio of work to non-work trips has also changed. In 1972, less than 40 percent of trips were taken for non work-related purposes, but this had

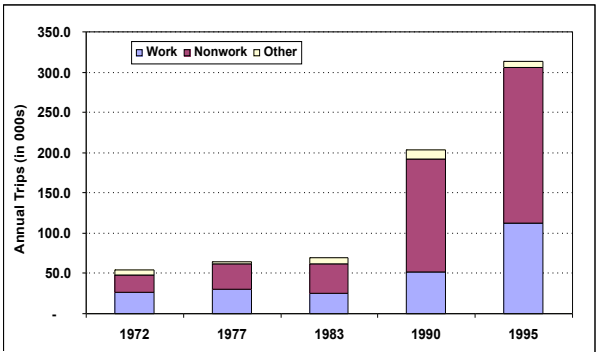


Figure 9: Growth in long-distance trips by airplane, 1972-1995. Source: US DOT NPTS.

[7] When these states were grouped together to account for the regional effects, the utilization of air travel fell in line with the national average.

[8] It should be noted that in 1983, the sample size of the survey was drastically reduced and may have affected the results for that year.

increased to 70 percent by 1990. The increase in the number of non-work related trips indicates that the role of the air transportation system has changed since deregulation. The enhanced connectivity and accessibility of the air transportation system appears to have enabled air transportation to be more fully integrated into the social fabric of the nation. The availability of low airfares and frequent service made it easier for people to relocate for economic or other opportunities while still maintaining close relationships with family and friends.

Low-Fare Travel. One of the crucial dynamics that began during the late 1990's was a change in the demand for air travel as both business and leisure travelers became more sensitive to price. During the economic growth bubble of the late 1990's, yield management techniques enabled airlines to successfully extract more revenue from passengers who needed to travel while also stimulating demand for discretionary travel. Yet the combination of increased volume of lower-fare nonwork travel, the growing spread between highest and lowest fares, and more acceptable low-fare travel alternatives, led to increased acceptance of low-cost carriers such as AirTran or JetBlue in recent years. The physical scope and size of these networks originally limit their transportation utility of low-fare carriers, but other qualitative issues such as safety and service reliability also presented barriers to market penetration. Safety, for example, was often cited as a major concern with travelers flying on low-cost carriers, and the Valujet crash in the Florida Everglades in 1996 fueled these doubts.[9] As the low-fare segment of the airline industry recreated itself in the late 1990's with new airplanes and innovative business models to

[9] Like other low-cost startup airlines in the early 1990's such as Kiwi and Frontier, the business model at Valujet was to use old aircraft and reinforce its visible appearance of a low-cost operation. This model backfired after the 1996 crash, however, as it was perceived that inexperienced, low-paid personnel and outsourced maintenance providers contributed to the crash.

overcome issues of safety and image, they began to present a real and credible threat to the traditional major network carriers throughout the country and even in specific home markets.

The relative change in RPM market share between the US majors and other carriers from 1991 to 2001 is shown in Figure 10. While the legacy network carriers—including American, Continental, Delta, Eastern, Northwest, TWA, United, and USAir—accounted for 88.4 percent of the total market share of revenue passenger miles in 1991. By 2001, this had dropped to 73.1 percent. In contrast, Southwest increased its market share from 3.0 percent in 1991 to over 9.2 percent in 2001, while the combined total of the other smaller carriers had a similar increase. An analysis of itinerary-level data from the DOT ten-percent ticket sample shows that AirTran has been able to penetrate Delta's fortress hub at Atlanta, and has increased its share of the local origin-demand market from 9.9 percent in 1998 to 14.0 percent in 2001. JetBlue has been able to capture 28.6 percent of the local market at New York-JFK within two years of its startup in 2000.[10]

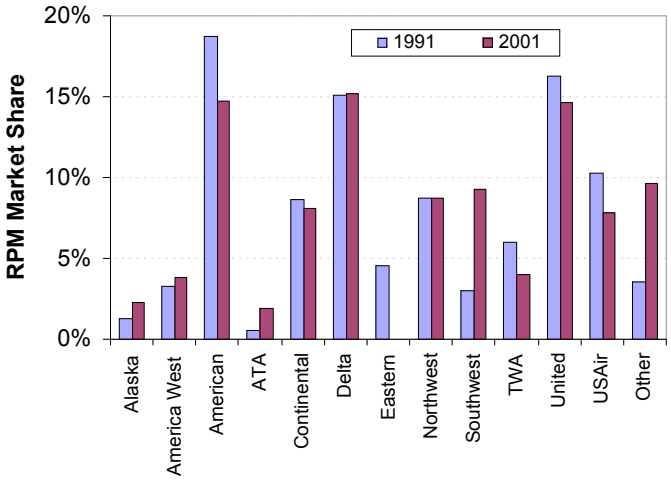


Figure 10: Domestic market share of US majors and other carriers, 1991 and 2001. Source: US DOT Form 41 data,

Customer Behavior. One of the other factors that contributed to the growth of low-fare airlines has to do with changes in the way passengers perceive the value of air travel. The advent of the

[10] Author's calculations using ODPLUS software (Database Products, Inc) to access the DOT DB1A ten-percent database of ticket coupons.

internet and web-based ticketing has enabled passengers to emphasize ticket price rather than travel time or other service characteristics. To help attract customers to their websites, airlines marketed the price-saving benefits of online ticketing, while other third-party websites such as Travelocity or Orbitz also focused on comparing prices instead of travel time. When customers were given the ability to book flights themselves, they became more willing and able to take the time to find the lowest fares and rearrange their activity schedules in order to save money. By contrast, traditional distribution methods involving travel agents and airline reservation systems provided little incentive and made it often difficult for customers to find the lowest airfares. Web-based booking engines also gave customers more access and exposure to the schedules and fares of lesser-known, low-cost airlines such as Southwest or JetBlue. This would increase their visibility and market competitiveness with the network carriers.

3. Industry Restructuring

Given the evolution of airline business strategies and passenger travel patterns, the air transportation system has transformed in recent years into a two-tiered system which provides high levels of network connectivity at the high end and low-cost, economical travel at the low end. The current restructuring of the airline industry has placed these two segments in competition with each other. The potential changes in capacity, price, and service quality could have an impact on connectivity and mobility in the US. This section will discuss the current financial threats to the airline industry.

During the first two decades of deregulation, sustained traffic growth and gains from yield management had somewhat insulated the two segments of the industry from each other. Yet the end of the internet bubble in the late 1990's, however, put the majors found themselves in competition with the low-cost carriers for passengers who were no longer willing to pay premium fares. As the revenue bases at the US major airlines eroded in 2001, the competition with low-cost carriers rose to the forefront of restructuring issues facing the US majors. The relatively low cost structures and stronger operating financial position of low-fare carriers such as Southwest, AirTran, or JetBlue made them less vulnerable to the downturn in traffic and revenues after 9/11. Low-cost carriers continued to expand their networks with new transcontinental flights and more cities, while network carriers matched these moves and strengthened their hub operations. Figure 11 shows the continued expansion of available seat miles at JetBlue and AirTran in the quarters before and after 9/11.

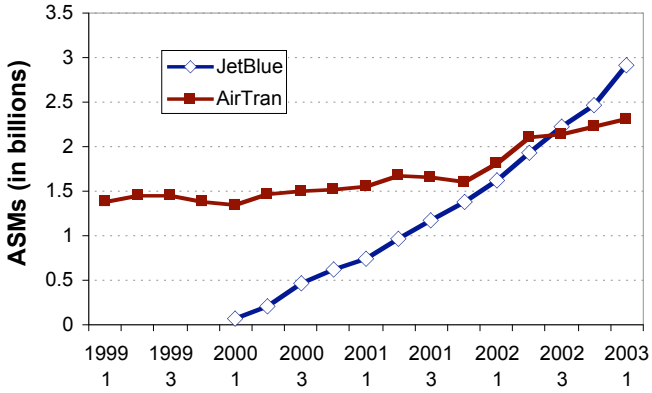


Figure 11: Expansion of scheduled ASMs, JetBlue and AirTran from 1999-2003. Source: US DOT Form 41,

3.1 Revenue Threats

The price and revenue equilibrium has shifted considerably in recent years. In 2001 and 2002, the industry lost $18 billion dollars, and current projections are losses of $8 billion dollars for 2003. US carriers have historically experienced losses during recession periods, but the

magnitude of the current losses for the major carriers (excluding Southwest) is clearly unprecedented. Coupled with the impacts of 9/11, the enormity of these losses has transformed the financial environment of the airline industry and threatens the long-term sustainability of the traditional large US network carriers.

Revenues. The softening economy and increased competition began to drive passengers from higher fare, premium-class tickets to lower fares by the first half of 2001. Figure 12 shows the quarterly year-over-year change in passenger traffic by fare category.[11] First class traffic during the first half of 2001 dropped by 15 to 20 percent over 2000 levels, while business class traffic dropped by about 10 percent. Coach traffic continued to grow by about 5 to 7 percent, however, and it appears that passengers were indeed shifting to cheaper tickets. Industry data for a typical 1,000-mile domestic trip was also used to analyze the trend in airfares.[12] Airfares had grown in 1995 and 1996, but stayed relatively flat during 1997, 1998 and 1999 before increasing about 3 to 5 percent during 2000. Starting in February 2001, however, the average airfares actually began to decrease significantly below the prior-year levels and by August had already dropped 12 percent less than the year before.

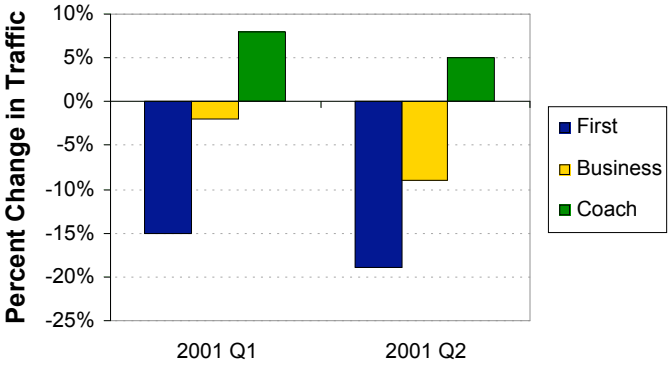


Figure 12: Downshift in fare types. Source: IATA data.

[11] Source: IATA data.
[12] Participating carriers include Alaska, American, America West, Continental (incl. Micronesia), Delta, Northwest, United, and US Airways. "ATA Monthly Airfare Report: Scheduled Mainline Services, Participating Carriers." http://www.airlines.org/public/industry/bin/press.pdf.

The shift to low-fare tickets and the decline in airfares have had a major impact on the financial performance of the airline industry, especially since the airlines had traditionally relied on a small number of premium-fare passengers for a disproportionately high percentage of the revenue.[13] Losses at the US majors began to show in the fourth quarter of 2000, and they increased significantly even after the attacks of 9/11 and billions of dollars in government aid. In the six quarters following the 9/11, the three largest US carriers collectively lost over $10.3 billion dollars. Figure 13 shows the recent quarterly earnings for American, Delta, United, and Southwest Airlines. Of these four airlines, Southwest Airlines was the only one to remain profitable, although its profits have eroded considerably. Net profits at Southwest in the first quarter of 2003 amounted to only $24 million dollars, compared to $191 million in the second quarter of 2002. The net profit per available seat-mile unit for five of the major carriers was analyzed in Figure 14. It shows that the profits began to drop below costs in the second half of 2000. United and USAirways had major spikes in the third and fourth quarters

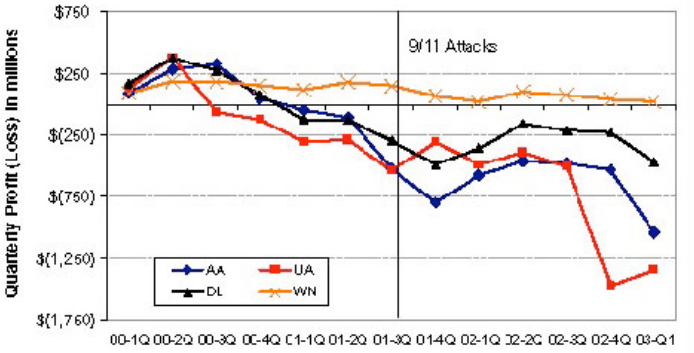


Figure 13: Quarterly profits of selected US major carriers. Source: Airline press releases.

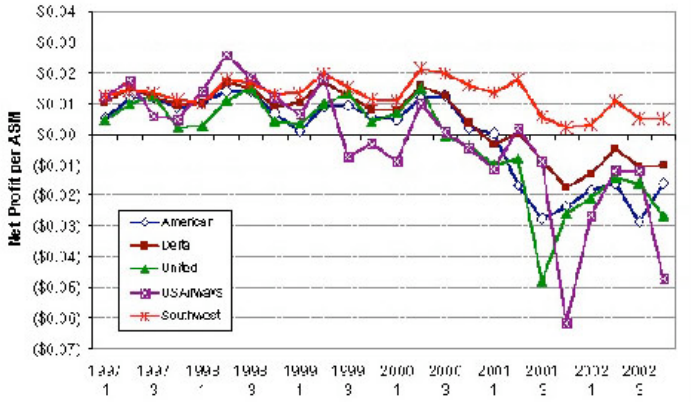


Figure 14: Net Profit per ASM, 1997-2002. Source: Form 41 data and airline financial releases.

[13] A common industry rule-of-thumb was that ten percent of the passengers produced half of the overall revenue. Joan M. Feldman, "Pricing for Profit," Air Transport World, February 2003, p. 51.

of 2001 as they reduced their flight operations (less ASMs) before being able to cut their costs accordingly.

Financial Markets. Investors have recognized that the traditional major US network airlines face considerable challenges in returning to long-term profitability, and have withdrawn market capital or shifted investments to low-fare carriers such as Southwest and JetBlue. Figure 15 shows the changes in the market capitalization[14] of several major carriers between 1995 and 2001. The decline at Delta and American started in mid-1999, but perhaps more notable is the increase in market cap value at Southwest. This showed that investors had a much stronger perception of the long-term market prospects of Southwest and was also indicative of the increased market for low-fare travel. What is also significant is that the markets have withdrawn $14.8 billion dollars in market value from the US majors, JetBlue, and AirTran between August 2001 and December 2002. Between May 2002 and March 2003, over $15.2 billion dollars have been withdrawn from the entire US airline industry—including the national and regional carriers.

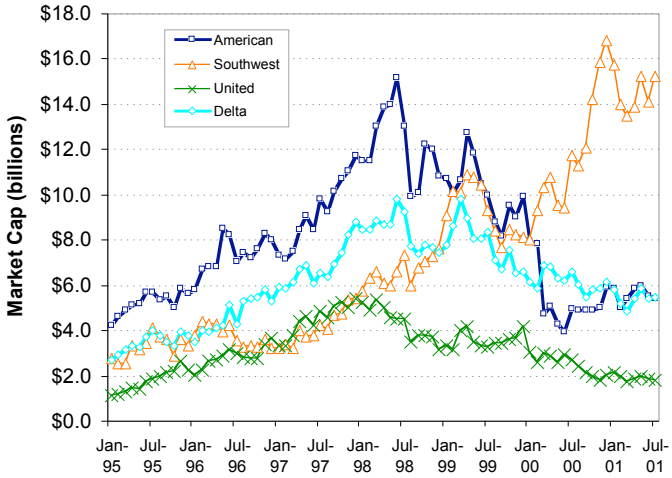


Figure 15: Market capitalization of selected carriers, 1995-2001. Source: Author's calculations from WRDS data.

[14] Market capitalization is the stock price times the number of outstanding shares that are available to trade. This measures the relative attractiveness of airline stocks and their long-term value.

To analyze the changes in airline market capitalization relative to its transportation function, Figure 16 shows the change in Market Cap and RPM share[15] between August 2001 and March 2003. Southwest had a very small increase in market share compared to its large increase in relative market importance. Delta dramatically increased its market share, but lost market value. American, United, US Airways, and Continental both lost market share and market capitalization.

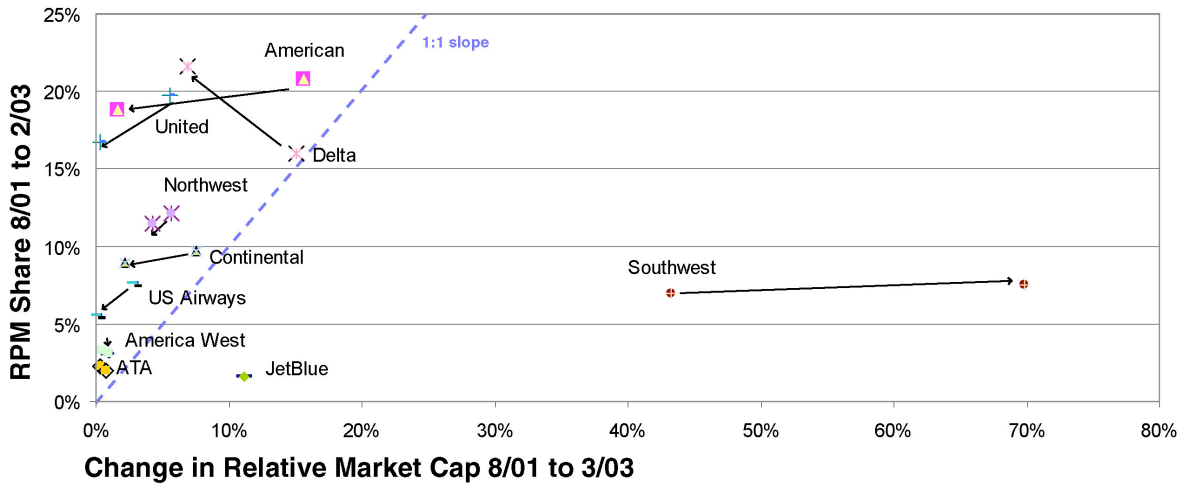


Figure 16: Plot of change in relative market capitalization and RPM share, August 2001 to March 2003. Source: Author's calculations from WRDS data, Yahoo! Finance, and airline new releases.

It is clear that financial markets are withdrawing money from the airline industry, and a significant share of the national air transportation lift capacity is at risk of insolvency. The disconnection between transportation productivity and financial sustainability poses some significant challenges for the airline industry and government.

[15] Market share is calculated as the percentage of the total RPMs for the US majors and JetBlue. Traffic data on regional feeders such as American Eagle or Continental Express are not included where they are run by separate operating companies.

4. Air Transportation, the Economy, and Mobility

Despite ongoing restructuring efforts at several of the major carriers, the US airline industry continues to lose vast amounts of money—projected to be almost $10 billion dollars in 2003. The more recent and ongoing impacts of the Iraq war and the outbreak of Severe Acute Respiratory Syndrome are having serious impacts on international traffic and airlines in Europe and Asia. With profitability not expected to recover until 2005, many of the traditional major network carriers are restructuring to minimize losses and cope with the changes in industry dynamics. Labor negotiations and attempts to reduce operating costs also achieved a new sense of urgency during 2002 and 2003 as major carriers such as United, US Airways, and American dipped into or loomed under the threat of bankruptcy.

In a worst-case scenario, the failure of restructuring efforts coupled with an economic crisis could result in several large airlines liquidating within the span of several weeks. It can be reasonably assumed, however, that other airlines would step in to fill the market opportunities using the pool of pilots, airplanes, routes, and other assets. So, it is not necessarily likely that such a scenario would result the in the loss of service to any cities—or that it would even be bad for the industry. But the question remains: what is the impact of air transportation on the larger economy and mobility?

The framework presented at the beginning of this paper outlined the closely coupled relationship between the supply and demand of air travel and the economy. It has been shown that economic growth in the 1990's paralleled an increase demand for air travel and enabled the airlines to

adjust their business strategies accordingly. Yet with the low-cost carriers challenging the established network carriers, one of the critical questions is how the surviving business model will affect overall mobility—including the community access to air service, travel time, and cost. The fundamental demand for air travel should not abate, however, since there is no effective alternative to the speed and efficiency of jet airplanes.

In theory, the economics of scale and scope will continue to favor hub-and-spoke networks, and these efficiencies will make it possible to preserve service to smaller communities. Indeed, while some communities lost service after 9/11, many others received new regional jet connections to major hubs and other cities. The range and speed of regional jets will enable smaller locales to be efficiently served through more distant hubs—increasing stage lengths and enable smaller regional hubs to be consolidated with larger ones. This should also increase the efficiency of airline networks. Runway and airspace capacity at the surviving hubs will remain a limiting factor, although rolling bank schemes may alleviate this pressure.

Overall travel times could be increased as airlines optimize their operations to increase aircraft utilization and minimize costs. Passenger wait times could also increase as customer convenience becomes less important to airline scheduling and rolling hubs replace tightly banked systems. Transfers could also take longer if independent regional low-cost carriers replace the seamless networks of the major airlines. Hub consolidation may also limit service in regional commuter markets, and slower modes of travel could have to replace shorter trips (under 300 miles, for example) between smaller cities and towns. Flight delays were a critical issue prior to

9/11, and could return as a serious issue when the demand warrants that latent capacity is restored to the system.

Industry consolidation could also have an impact on mobility. On the one hand, reduced competition could lead to fare increases, and could reduce availability and access to air travel services for the general public. Competition with low-cost carriers and increased demand for low-fare products will maintain pressure within the industry to keep airfares down, even if one or more carriers are forced into liquidation. Smaller, low-growth, low-demand markets could also be threatened if airlines forgo market share in place of profits—thus threatening connectivity.

Equitable and stable access to air service infrastructure are among the necessary conditions to enable economic growth. The larger economic and social impacts of air travel need to be fully considered when evaluating the design, structure, and performance of the air transportation system. High costs, long travel times, and other barriers to travel could suppress economic growth and quality of life in the United States. There is a role for government in stabilizing the dynamics of the air transportation system and ensuring public safety. However, care must be taken to avoid artificially supporting untenable business models and suppressing innovation in the air transportation system.

Bibliography

Air Transport Association. Annual Passenger Prices (Yield), US Scheduled Airlines. Washington: ATA, September 4, 2002. Available on-line from: http://www.airlines.org/

Air Transport Association. Annual Traffic and Capacity: US Scheduled Airlines. Washington: ATA, 2003.

Air Transport Association. Monthly Passenger Traffic Report – Scheduled Service Only. Washington: ATA, 2003.

National Research Council, Transportation Research Board. Winds of Change: Domestic Air Transport Since Deregulation. Special Report 230. Washington DC: Transportation Research Board, 1991.

Official Airline Guides. Secaucus, NJ: Reed Travel Group, 1965-2002.

Tam, Ryan and John Hansman. 2002. "Impact of Air Transportation on Regional Economic and Social Connectivity in the United States." Paper presented at the Aircraft Technology, Integration, and Operations Forum in Los Angeles, CA, October 1-3, 2002. American Institute of Aeronautics and Astronautics, 2002.

US Department of Transportation Bureau of Transportation Statistics, Historical Air Traffic Statistics, Annual 1954-2001. Washington: BTS, 2002. Database on-line. Available from: http://www.bts.gov/oai/indicators/top.html

US Department of Transportation Bureau of Transportation Statistics. National Transportation Statistics 2001. Washington: US GPO, July 2002. Database on-line. Available from: http://www.bts.gov/publications/nts/index.html