

Transportation by air: job growth moderates from stellar rates

Aviation employment and business activities increased massively for decades, but growth slowed in the '90s

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Commercial air transportation has grown rapidly in the United States since 1938 or earlier.¹ The most significant reason for such growth is probably that air travel has become almost continuously more affordable. Ticket prices adjusted for inflation have been falling consistently since 1950 or earlier.²

Airfares have decreased over the years not because of any one consistent reason, but because of two distinct sets of circumstances: regulation and deregulation. From 1938 to 1978, Federal control of fares, routes, and even the existence of each airline prevailed. After the lifting of economic regulation, price competition was a major force. Before 1978, development of the commercial airplane itself contributed heavily to decreases in the costs of operations and consequently to lower fares (after adjustment for inflation). After 1978, when changes in routes and fares and the formation of new airlines became unrestricted, price competition and a variety of management responses to competition have reduced operators' costs. The resulting lower fares have multiplied demand and jobs in the industry.

According to estimates from the Bureau of Labor Statistics,³ employment in commercial aviation increased by about 700,000 jobs, or more than 400 percent, from 1958 to 1996 as output, consisting mainly of passenger-miles and cargo ton-miles, increased by more than 1,800 percent.⁴ Although the main purpose of this article is to explain the trend in numbers of jobs in the industry, the movement of aviation output is cited often. Some industries have been known to lack a close connection be-

tween production and employment; thoroughly automated processes in certain industries may explain the possibility of little connection between volume of production and number of employees. The aviation industry, despite its great technological advances, remains a service industry, and is labor-intensive. According to the Air Transport Association, ". . . there is no changing the fact that they [airlines] are in a service business where customers require, and often demand, a lot of personal attention. More than one-third of the revenue generated each day by the airlines goes to pay its workforce."⁵ This article shows the extent to which employment and production are linked in the aviation industry.

Despite the massive cumulative increases of output and employment, the growth of both decelerated; recent increases have been at reduced rates. This article explains some of the many technological, legislative, and business changes that have caused the growth and the deceleration of the industry.

Economic performance

The amount of growth that has occurred in the industry's jobs and business, both in isolation and in relation to other transportation industries, the general economy, and U.S. international trade, is extraordinary. To give one of many possible perspectives, from 1971 to 1997, the proportion of U.S. adults who had ever traveled by an airliner increased from less than half (49 percent) to 81 percent. According to surveys from the Air Transport Association of America, the proportion of adults who

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Trends in the former and current estimates of air transportation employment, 1988–96

Within the transportation division, establishments are assigned to a specific industry based on the main economic activity of the entire company. In 1996, a considerable number of establishments engaged in express delivery of letters and packages were re-evaluated regarding the industry in which they properly belonged. Most of the establishments in question had been considered members of the trucking industry; a smaller number had been assigned to the transportation services industry. In 1997, these establishments were reassigned to the air transportation industry. Estimates of employment in trucking were reduced, and estimates of employment in transportation by air were increased. Each of the two changes was on the order of 250,000 jobs. Because of the significant break in the aviation employment data, the old series, which is analyzed in this article, was terminated in 1997. On the basis of the changes in industry classification, new estimates of employment in trucking and in transportation by air were calculated from microdata back to the year 1988.

The revision in the estimated number of employees in transportation by air is large enough so that estimates for years prior to 1988, available only in the old series, are not compatible with estimates from the new series for purposes of analyzing the trends of the industry. To analyze the

growth of employment in airlines over several decades, starting in 1958, analysis of employment in this article is generally confined to the use of the old series of estimates.

Despite the difference in magnitude between the old series and the new one, the 8-year trend of the old series in terms of percent employment growth agrees with the new series' trend during the period of overlap, from 1988 to 1996. Although the two time-series show differing percent changes in various individual years, the two estimated aggregate percent changes from 1988 to 1996 are within 1 percentage point of each other. (As shown below, the aggregate growth in employment is estimated at 31.1 percent in the discontinued series and 30.2 percent in the new series.) Average annual percent growth during the 8-year period is 3.4 percent in each of the two series.

An indication of growth in jobs in years after 1996 is provided only by the new series. From 1996 to 1999, growth accelerated somewhat to 3.8 percent per year from 3.4 percent in the preceding 8-year period.

The recent growth, however, is clearly slower than that of still earlier years as estimated by the old series. In the 31-year period through 1989, employment grew by an average of 4.7 percent per year, sharply differing from the more recent 3.8 percent rate.

Comparison of two sets of estimates of employment in transportation by air, 1988–99

<i>Year</i>	<i>Old series</i>		<i>New series</i>	
	<i>Thousands</i>	<i>Percent change</i>	<i>Thousands</i>	<i>Percent change</i>
Total 1988–96 .....	...	31.1	...	30.2
1988	646	...	850	...
1989	683	5.7	897	5.5
1990	745	9.1	968	7.9
1991	733	-1.6	962	-0.6
1992	730	-0.4	964	0.2
1993	740	1.4	988	2.5
1994	753	1.8	1,023	3.5
1995	788	4.6	1,068	4.4
1996	847	7.5	1,107	3.7
1997 .....	...	...	1,134	2.4
1998 .....	...	...	1,183	4.3
1999 .....	...	...	1,237	4.6

had traveled on an airliner in the latest 12 months increased from 21 percent to 39 percent during the period.⁶

Between 1960 and 1996, the output of the air transport industry increased sixteen-fold. By comparison, the output of the entire business sector only increased by a factor of 3.6. Total passenger-miles of all major forms of transportation tripled, and domestic ton-miles of all major modes of freight transportation increased 1-1/2 times. (See chart 1.)⁷

Substitution? Most modes of transportation have grown during the last 40 years. But to a considerable extent, aviation has taken over the roles of other forms of travel in the typical American life; flight is now a more frequent experience, and most other major modes of passenger transportation have not kept up with the growth of the general economy. The only large category of U.S. transportation to show an actual reduction of business in recent decades is rail passenger transport, which lost 12 billion annual passenger miles from 1960 to 1996. Even if all those who previously traveled by train now travel by air, the loss in rail passenger transport would explain only 3 percent of the increase in domestic air passenger business. In 1960, air transport was 2 percent of all U.S. domestic passenger-miles (including the use of private automotive vehicles); air transport rose to 10 percent of the total by 1996. The following tabulation compares changes in the volumes of the major passenger modes from 1960 to 1996. (Over the same period, by comparison, gross domestic product in chained 1996 dollars increased by 231 percent.)⁸

Mode	Change in passenger-miles	
	In billions	In percent
Total, all modes	2,939	200
Air	395	1,293
Highway, except bus	2,400	170
Intercity bus (1960-95)	9.7	50
Rail	-12	-70

In contrast to air *passenger* service, air *cargo* has not taken the role of any other mode of freight transportation to any large extent. All three domestic surface modes of freight transportation (truck, rail, and water) operate on a much greater scale than air transportation of freight and have shown much more massive growth. The increase in domestic air freight ton-miles since 1960, though large as a percentage of its 1960 level, is about 12 billion ton-miles, while intercity trucking, domestic water, and rail freight have *each* increased by between 350 billion and 785 billion ton-miles. Similarly, the scale of international air cargo has been insufficient to affect the growth of the much vaster operations of international water cargo by much. Aviation has not seriously reduced the growth of any

major mode of freight transportation.

It is true, however, that the percent increases in international air cargo and domestic air cargo are not nearly approached by the other modes. The following tabulation shows rates of growth in the major forms of freight transportation.⁹

Mode	Increase in ton-miles	
	In billions	In percent
1960-96:		
Domestic air cargo	12	2,226
Intercity trucking	701	146
Rail	784	37
Domestic water	351	85
1970-94:		
International air cargo	7	502
International water tonnage (ton-miles not available)	455 million tons	78

Deceleration. The growth of output in air transport, however, has decelerated over the decades. The output of the industry increased by 648 percent, or 10.6 percent per year, from 1958 to 1978. A closer look shows that growth was concentrated in the earlier part of the period and slowed to a 6.0-percent rate in the 10 years ending in 1978. From 1978 to 1996, output increased by 5.5 percent per year. From 1986 to 1996, output gained a further decelerated 5.0 percent per year.¹⁰ Some, but not all, of the deceleration is attributable to reduced growth in the business sector as a whole. The following tabulation shows the relationship between growth of output in air transport and increases in output in the entire business sector.

	Percent change per year in output		
	Air transport (a)	Business sector (b)	Ratio of (a) to (b)
1960-70	14.3	4.3	3.3
1970-80	6.0	3.5	1.7
1980-90	6.1	3.4	1.8
1990-96	4.4	3.0	1.5

Further explanations for the deceleration in air transport business, and in turn for the deceleration of employment in aviation, have to do with the history of aviation technology, regulation by the Federal Government, and the airlines' operational methods. Other explanations relate to general economic deceleration. The technology, regulation, and business strategies of the industry have changed greatly; major changes will be explained in later sections of this article.

Growth of subdivisions of air transport. The various categories of air transport (freight, passenger, domestic, and in-

Chart 1. Aviation output and business-sector output, 1959 to 1996

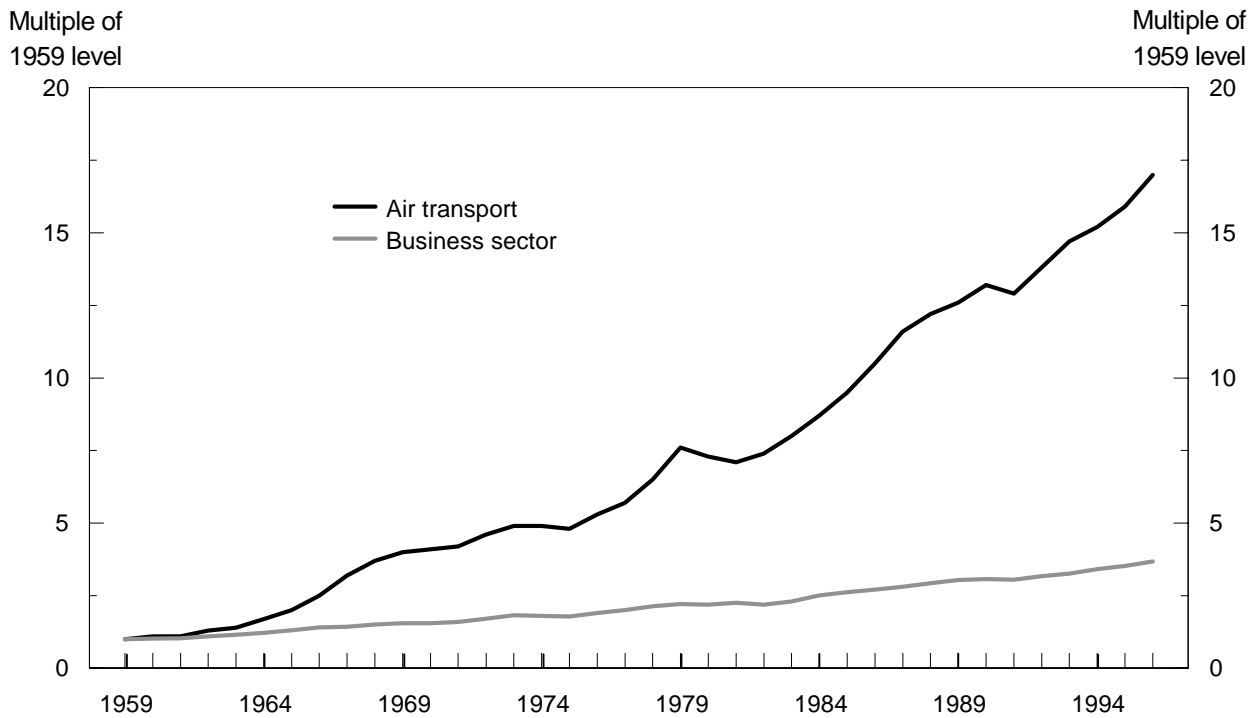
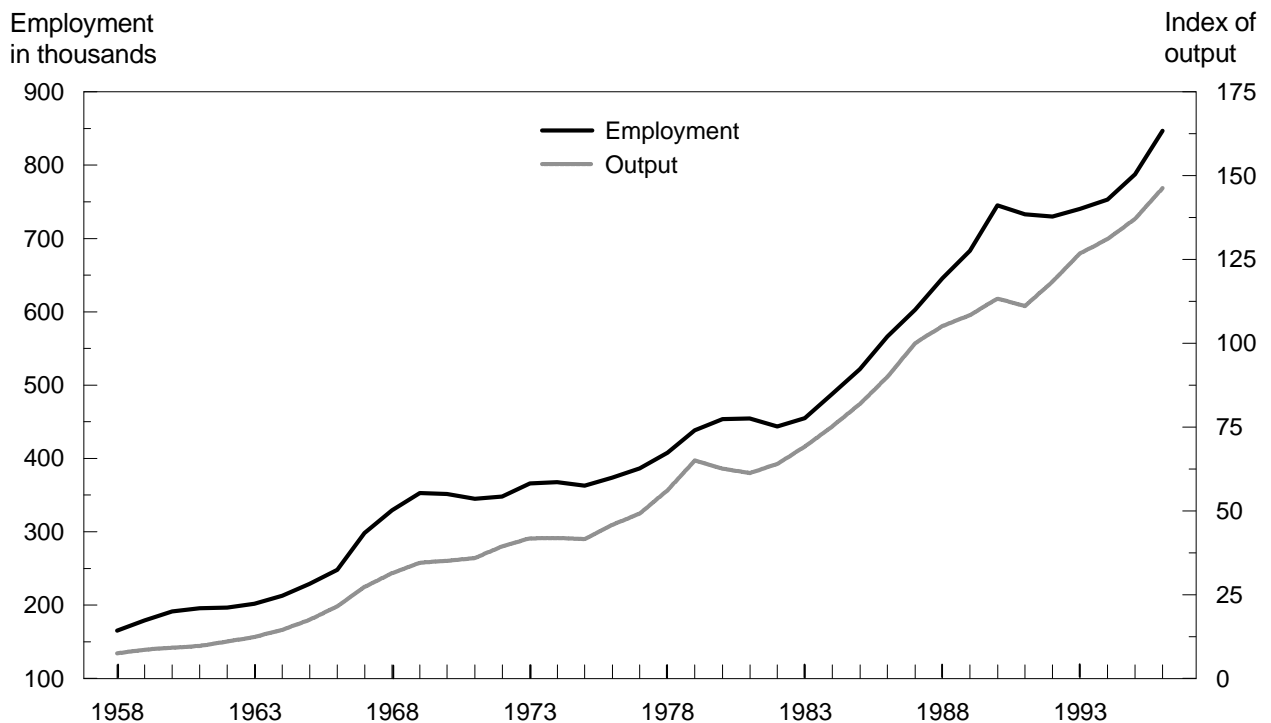


Chart 2. Output and employment in transportation by air, 1958 to 1996



ternational) have grown at far different rates. Air cargo has increased much more rapidly, in percent terms, than passenger flight. From 1970 to 1996, while passenger-miles almost quadrupled, air cargo ton-miles increased to about six times their 1970 level. One explanation for the rapid growth of air cargo may be the growth of catalog and mail-order retailers, who often offer express delivery by air. From 1982 to 1995, the output of such catalog and mail-order retailing increased by 222 percent, while the output of the entire business sector increased by 61 percent.¹¹ In the domestic market for freight transportation, relative costs are a factor; from 1960 to 1996, the cost of domestic airfreight adjusted for inflation declined, while the cost of class 1 intercity trucking increased.¹² Greater international trade is another explanation for the growth of air cargo, as discussed later in this article.

The transportation of passengers may be divided between business travel and personal travel. Both business trips and personal trips have increased substantially, but the growth of personal travel has been greater. From 1977 to 1997, business trips increased by 125 percent, but personal trips increased by 175 percent. As personal travel is more sensitive to fares, the long-term decline in fares is a more important factor in personal flights than in business trips.

Within the broad category of reasons for personal travel, the specific reason that showed the most dramatic gain was sightseeing and resort use. Travel to resorts and the sights motivated trips for 20 percent of air travelers in 1977 and 31 percent in 1997. Flying to visit friends or relatives also increased as a proportion of air travelers' purposes. In 1977, 53 percent of air travelers flew to visit people; in 1997, 71 percent did. (Some individuals took more than one trip for more than one personal reason.)¹³

Growth: domestic versus international. Within the category of passenger transport, domestic flight contributed most of the increase in business because domestic operations constitute the bulk of the passenger business. But international business grew proportionately more. From 1960 to 1996, domestic passenger miles increased by 1,293 percent (395 billion passenger miles), and international passenger-miles increased by 1,741 percent (145 billion passenger-miles).¹⁴

From 1983 to 1996, the number of overseas visitors to the United States nearly tripled (a 189-percent increase), reaching a level of 22.7 million arrivals in 1996. Trips to the United States by overseas residents grew to outnumber overseas trips from the United States by U.S. residents, during the period. While a single trip can have more than one purpose, a nearly constant percentage of visitors from overseas (32 percent in 1983 and 31 percent in 1996) performed business or professional activities in the United States. The proportion that visited friends or relatives in the United States also was stable at 30 percent to 31 percent. The percentage indulging

in leisure activities during at least part of their stay increased substantially, from 47 percent in 1983 to 63 percent in 1996. Growth in visits to the United States appears to be concentrated among those motivated by leisure and recreational activities.¹⁵

Among U.S. residents flying overseas, growth in trips has the opposite concentration in motive. All major categories of activity contributed to an overall 103-percent increase in overseas flights by U.S. residents, but the proportionately greatest increase was in work and work-related activities. Those performing business or professional activities overseas increased from 27 percent of the total in 1983 to 36 percent in 1996.¹⁶

In freight transport as well, domestic service is greater in scale than international service and contributed a larger increase in ton-miles. From 1970 to 1996, domestic air cargo increased by 10.7 billion ton-miles, and international ton-miles increased by 7.4 billion. But, as in passenger service, international freight increased at a greater percentage rate (567 percent) than domestic freight (488 percent).

The enormously increased share of international, as opposed to domestic, business in general requires more air travel, including both cargo transport and passenger flight for business purposes. International cargo traffic is also boosted by manufacturers' "just-in-time" approach to inventory, which became widespread in the 1980s and 1990s, and by recent consumer demand for fresh foods of all kinds regardless of the season.¹⁷ The following tabulation shows the increasing proportions of international business as a part of the U.S. economy.¹⁸

	<i>U.S imports as a percentage of gross domestic product</i>	<i>U.S exports as a percentage of gross domestic product</i>
1960	4.6	3.7
1970	6.3	4.5
1980	6.7	6.8
1990	9.5	8.6
1996	12.3	11.2

Jobs. Employment of airline personnel is linked tightly to air transport output. Ninety-nine percent of the variation in numbers of employees from 1958 to 1996 can be predicted on the basis of industry output, according to a regression calculation. Chart 2 shows that the curves representing output and employment over time have similar shapes.

The number of jobs added and the amount of output added each year, however, have not been in a constant proportion to each other. Over time, fewer employees are hired for a given amount of additional business because technological and operational progress allows for the more efficient use of both old and new employees.

Like output, employment in the industry has grown almost every year since 1958. From 1958 to 1996, despite various mass layoffs, mergers, and failures, employment in the air transportation industry as a whole increased from 165,000 to 847,000, a 413-percent increase, or an average of 4.4 percent per year. (See table 1.)

Not surprisingly, employment in air transportation has expanded at a far greater rate than employment in other modes of travel. Aside from the much greater percent increases of business in air transportation, another major factor contributes to the differences in hiring: employment in rail and water transportation declined even as ton-miles increased. Percent increases or decreases in jobs by mode are shown in the following tabulation:

Mode	Year	Employment change in percent
Rail	1958-96	-76
Water	1964-96	-24
Air	1958-96	413
Trucking and warehousing	1988-96	21
Air	1988-96	31

A deceleration is evident in aviation employment. While jobs increased by 4.6 percent per year from 1958 to 1978, from 1978 to 1996 they increased by 4.1 percent per year. From 1990 to 1996, the rate of increase slowed to 2.2 percent. The following tabulation shows the relationship between growth in aviation-industry jobs and all nonfarm payroll jobs:

	Annual percent change in jobs		Ratio of percent growth in air transportation to percent growth in total nonagricultural industry
	Air transport	Total nonfarm	
1958-78	4.6	2.7	1.7
1978-96	4.1	1.8	2.3
1980-90	5.1	1.9	2.7
1990-96	2.2	1.5	1.5

In proportion to the general economy, then, jobs in transportation by air have not increased as strongly in the 1990s as they had in earlier decades.

Estimates from the Bureau of Labor Statistics permit the comparison of rates of job growth in the following subdivisions of the aviation industry since 1988: scheduled passenger service, air courier service (the carrying of letters and small parcels), nonscheduled air transportation, and support services, including the operation of airports and the servicing of aircraft. The following tabulation shows rates of growth in employment by industry from 1988 to 1998.¹⁹

SIC	Industry	Percent increase in employment	Increase as a percentage of entire increase in jobs in transportation by air
45	Transportation by air ..	39	100
4512	Scheduled air transportation (passenger and cargo, over regular routes on regular schedules)	15	20
4513	Air couriers (letters, parcels, and generally smaller packages)	70	59
452	Nonscheduled transport (nonscheduled cargo, charter, and others)	137	8
458	Support services (airports, flying fields, services)	48	13

The faster recent growth of cargo transportation, as opposed to passenger traffic, is reflected in the more rapid growth of air couriers (who carry only letters, parcels, and packages) and nonscheduled transport (which is dominated by cargo). Scheduled air transportation, on the other hand, is dominated by the more slowly growing passenger traffic. The rapid growth of support services such as airport operations is explained in part by the building up of airport facilities to handle greater cargo traffic.²⁰

Layoffs in recessions. During and soon after the last three recessions (over the years 1980 to 1991), layoffs in the industry have been proportionately much more severe than those of the entire nonfarm sector. (See table 2.) Because personal air travel is generally not a necessity, individuals may be more likely to sacrifice it as opposed to other goods or services. The consistently thin financing of the airlines also makes layoffs and company failures more difficult to avoid.²¹

After the recession of 1969 to 1970 (and to a lesser extent, after the recession of the mid-1970s), air transport employment continued to fall well after the official end of the recession and the upturn of total employment. In the case of the 1969 to 1970 period, the decline in airline employment also started before the recession. In both periods, the declines were not strictly recessionary, as various special problems then affected the industry. (See the section on deregulation later in this article.)

In the latest recession, the loss of jobs in air transportation was almost entirely in scheduled air transportation (SIC 4512, losing 24,000 jobs). Air couriers (SIC 4513) expanded in employment at a reduced rate during the recession; they gained 19,000 jobs in the 12 months just before the recession and

Table 1. Comparison of employment in air transportation and in all nonagricultural industry, 1958–96

Year	Air transportation employment		Total nonagricultural employment		Ratio of percent growth in air transport employment to percent growth in total nonfarm employment
	Number (in thousands)	Percent change	Number (in thousands)	Percent change	
1958	165	...	51,322	...	...
1959	179	8.5	53,270	3.8	2.2
1960	191	6.7	54,189	1.7	3.9
1961	196	2.6	53,999	-4	-7.5
1962	197	.5	55,549	2.9	.2
1963	202	2.5	56,653	2.0	1.3
1964	213	5.4	58,283	2.9	1.9
1965	229	7.5	60,763	4.3	1.8
1966	248	8.3	63,901	5.2	1.6
1967	298	20.2	65,803	3.0	6.8
1968	329	10.4	67,897	3.2	3.3
1969	353	7.3	70,384	3.7	2.0
1970	352	-3	70,880	.7	-4
1971	345	-2.0	71,211	.5	-4.3
1972	348	.9	73,675	3.5	.3
1973	366	5.2	76,790	4.2	1.2
1974	368	.5	78,265	1.9	.3
1975	363	-1.4	76,945	-1.7	.8
1976	374	3.0	79,382	3.2	1.0
1977	386	3.2	82,471	3.9	.8
1978	408	5.7	86,697	5.1	1.1
1979	438	7.4	89,823	3.6	2.0
1980	453	3.4	90,406	.6	5.3
1981	455	.4	91,152	.8	.5
1982	444	-2.4	89,544	-1.8	1.4
1983	455	2.5	90,152	.7	3.6
1984	488	7.3	94,408	4.7	1.5
1985	522	7.0	97,387	3.2	2.2
1986	566	8.4	99,344	2.0	4.2
1987	603	6.5	101,958	2.6	2.5
1988	646	7.1	105,209	3.2	2.2
1989	683	5.7	107,884	2.5	2.3
1990	745	9.1	109,403	1.4	6.4
1991	733	-1.6	108,249	-1.1	1.5
1992	730	-4	108,601	.3	-1.3
1993	740	1.4	110,713	1.9	.7
1994	753	1.8	114,163	3.1	.6
1995	788	4.6	117,191	2.7	1.8
1996	847	7.5	119,608	2.1	3.6

gained 5,000 during the recession. Airports, flying fields, and services (sic 458), previously gaining about 7,000 jobs per year, stopped growing, but lost only 1,400 jobs during the recession. It appears that scheduled passenger service is the component most vulnerable to economic layoffs.

Quality. An increasing volume of complaints in recent years indicates that the flight experience is more often unpleasant. Complaints have been about less spacious configurations, “. . . unexplained delays, baggage hassles and crowded cabins.”²² Unlike other aspects of the industry, the quality of the flight experience is difficult or impossible to quantify.²³ Exactly how to weight less comfortable flights against seriously lower prices is unclear.

Technological progress

By 1958, economic regulation of the industry was well established and effectively prevented price competition. Airlines therefore had incentive to compete and advance in aspects other than fares. Between 1958 and 1978 (as well as earlier), the large civil aircraft typically in use changed greatly. Its improvements both appealed to the general public in and of themselves and lowered operational costs. Although prices did not vary between airlines at a given point in time, cost savings achieved through more advanced aircraft were passed on to passengers in the form of substantially declining ticket prices after adjustment for inflation. Two changes to the aircraft were of particular economic importance. First,

aircraft consistently became larger, so that more travelers could share the cost of a particular flight. From 1960 to 1978, the average number of passenger seats per plane increased from 66 to 146.²⁴

Secondly, aircraft became faster because of the gradual transition from propeller-generated thrust to jet power, starting in the late 1950s.²⁵ A much faster craft could make more runs in a given amount of time, so that the crew and the plane became more productive; consequently, the average cost of a flight declined. Furthermore, at the time, jet fuel cost about half as much as the gasoline used in piston aircraft engines. Faster travel also was more attractive to passengers, and demand increased because of quicker trips and because of lower prices.

Perhaps surprisingly, wide-bodied aircraft, introduced in 1969,²⁶ represented the last major technological change in the craft to have major economic consequences. After the late 1970s, technological advances in civil air transport have continued, especially in the areas of fuel efficiency and noise reduction,²⁷ but have been less economically important than earlier developments. By the late 1970s, the transition to jet power among the major airlines was already accomplished. The size of the average airliner in passenger service (in terms of the number of seats) peaked in 1983, when the average craft had 165 passenger seats. The average number of seats then declined to 152 in 1996.²⁸

An initiative to build a domestic supersonic jet for passenger service ended in 1971 because of the issue of sonic booms traveling over populated areas. No U.S. airline has ever operated a supersonic craft.²⁹ Airlines have continued to improve in fuel efficiency, emissions control, and noise abatement.³⁰

If the further development of civil aircraft had less economic importance after 1978, a certain earthbound type of technological system did have considerable economic impact. Computer-based reservations systems made reservations bookkeeping more efficient. Certain major airlines shared systems, generating still greater efficiency. Travel agents' electronic access to the airlines' reservations systems further facilitated the sales process. Most recently, customers can check

fares and make reservations via the Internet.

More importantly, computers are well suited to a much more sophisticated use. Although ticket pricing had been simple before the late 1970s (typically divided into only two classes: first and coach), modern computer reservations systems enable airlines to provide a complicated and rapidly changing set of prices for better economic advantage.

Computerized reservations systems facilitate benefiting from the differing natures of two types of demand: business travel and personal travel. Generally, the executive on a business trip has an inflexible schedule and relative indifference to ticket prices. The pleasure traveler has more time to spend on layover, more ability to adapt to unpreferred times and dates of travel, and more sensitivity to prices. With computer reservations systems, the airlines can rapidly formulate and implement lower fares with certain restrictions in scheduling, typically required stayovers, to attract more pleasure travelers. The computer systems also quickly calculate higher fares with freer scheduling to attract executives on business.

In addition, tickets tend to become more valuable as the flight becomes more filled and as the date of travel approaches. Computer reservations systems enable the airlines to recalculate fares rapidly in accordance with the changing supply and demand for seats on a particular flight.³¹ The industry has succeeded in filling more seats by means of varying fares; therefore more passengers share the cost of a flight, bringing down average fares and consequently aiding growth as average ticket prices fall.

Deregulation: new ways of competing

After the 1970s, fares continued to fall, even though *technological* changes had much less economic impact. The reasons for the continued reductions of fares are mainly related to the end of most of the Federal Government's economic control of air transport.

Federal control of fares and allocation of routes can be traced back to 1938, when Congress created the Civil Aeronautics Authority to foster satisfactory air service. The theory

Table 2. Cyclical behavior of aviation employment, 1960–91

Official dates of recession	Total nonagricultural industry			Transportation by air		
	Dates of decline in employment	Duration of decline (in months)	Percent decline in employment	Dates of decline in employment	Duration of decline (in months)	Percent decline in employment
Apr. 1960—Feb. 1961	Apr. 1960—Feb. 1961	10	2.3	Aug. 1960—Jan. 1961	5	2.1
Dec. 1969—Nov. 1970	Mar. 1970—Nov. 1970	8	1.5	Sept. 1969—Jan. 1972	28	6.6
Nov. 1973—Mar. 1975	Oct. 1974—Apr. 1975	6	2.9	Dec. 1974—Oct. 1975	10	6.0
Jan. 1980—Jul. 1980	Mar. 1980—Jul. 1980	4	1.4	Jan. 1980—Nov. 1980	10	2.8
Jul. 1981—Nov. 1982	Jul. 1981—Nov. 1982	16	3.0	Aug. 1981—Aug. 1982	12	4.2
Jul. 1990—Mar. 1991	Jun. 1990—Feb. 1992	20	1.6	Dec. 1990—Dec. 1991	12	5.1

NOTE: Recessions are designated by the National Bureau of Economic Research.

that excess, disorderly competition would be bad for the industry exerted a crucial influence on Congress. Unregulated start-ups of an unlimited number of operators theoretically would have resulted in so much competition that any particular airline would be unable to attract the capital required to offer good, sustainable service. A certain degree of concentration of capital was believed to be necessary for the development of adequate airlines. “Chaotic competition” had been a great problem in the 1920s in various industries. The Civil Aeronautics Act of 1938 and the Federal Aviation Act of 1958 provided government control of fares, of the creation of any new interstate airlines, and of allocation of routes among airlines.³² The airlines were to be protected from too many competitors and destructive price slashing.

The Civil Aeronautics Board, the agency created by Congress to regulate the airlines economically, prevented cuts in fares in several ways. First, considerable advance notice of a change in fare had to be given to the board, alerting competitors and thereby reducing the financial incentive to cut fares. The board also disallowed the formation of new airlines; from 1950 to 1974, 79 companies submitted applications to start airline service, but none of the applications were approved. Furthermore, starting in the late 1960s, the Board’s rules effectively required an airline to change fares, if it did so, on all of its routes rather than selected ones. The result was that fare cuts seldom occurred after 1968.³³ The government not only set rates, but also held down the number of carriers servicing most routes to three or fewer, greatly reducing the potential competition. (Despite these problems, airfares *adjusted for inflation* did decline substantially and almost continuously during the period of regulation, but perhaps not as much as they could have.)

With no competition on price, airlines competed on amenities and on convenience, meaning frequency of scheduled flights. Routine flights, including coast-to-coast ones, by about half-empty planes became a recognized example of vast waste. At least theoretically, such wasteful practices at the expense of travelers would be seriously reduced by unrestricted market entry and price competition.

Why Congress deregulated airlines. Various economic papers from as early as the late 1950s suggested that price competition in air transport would seriously lower fares.³⁴ Deregulation did not occur, however, until the combination of three economic events contributed to widespread public dissatisfaction with air travel and passage of the Airline Deregulation Act of 1978. First, the Arab oil embargo of 1973 was followed by huge increases in fuel costs. The price of jet fuel climbed greatly through 1981. Secondly, the recession of the mid-1970s reduced growth in airline business and contributed to a downturn in airline volume in 1975. And third, the carriers’ financial vulnerability was worsened because carriers had recently in-

curred the expense of newly developed wide-bodied aircraft and were unable to fill them. To protect the airlines, the Civil Aeronautics Board allowed considerable increases in fares (the price of a passenger-mile, not adjusted for inflation, rose by a third from 1973 to 1978³⁵) and allowed carriers to reduce service. The public response to higher prices and scarcer seats was unfavorable. Prominent Senate subcommittee hearings spread the idea that ticket prices would be reduced significantly under free competition. Fares, including the cost of moving freight as well as people, availability of seats, and the financial soundness of the carriers, then, were the key issues in a historic reversal of government policy.³⁶

Starting in late 1977, *cargo* carriers were allowed to set their own prices and fly any domestic route. The Airline Deregulation Act passed in October 1978, and by late 1979, “carriers were able to launch just about any domestic service they wanted” and decide on their own ticket prices.³⁷ New providers of domestic airline service also were permitted to start operations; the number of carriers using craft with over 60 passenger seats more than tripled from 1978 to 1984.³⁸ International air service, however, was not deregulated, as the various governments did not agree to do so.

In retrospect, two of the developments that caused deregulation were of relatively short duration or were misperceived. The large increases in ticket prices were perhaps the most important immediate motivation, yet they were arguably illusory. The nominal price increases near the end of regulation, from 1973 to 1978, were indeed large, but adjustment of the fares for general inflation (using the Consumer Price Index or CPI) shows that real prices of airline tickets continued to fall even in that time, despite the Arab oil embargo. Adjusted for inflation, airfares fell by 2.3 percent per year from 1973 to 1978. The downward trend in real prices in the 5-year period, then, was at about the same rate as in the preceding years.³⁹

The mid-1970s recession, which in reducing airline business led to fears about the airlines’ financial survival, ended in 1975. Even during the recession, airline business (as measured by output) declined in only one year, 1975, the final year of the recession. In 1976, still under regulation even if regulation was eased in policy, airline-industry output (consisting primarily of passenger-miles and cargo ton-miles) rose by 10 percent and reached an all-time high, as it had in every year since 1948 except for 1975. Two of the immediate motivations for deregulation (rising fares and declining business), then, were arguably illusory reasons for a permanent change in policy.

Changes in economic trends of the industry clearly occurred soon after deregulation. Greater competition, generating lower prices and consequently greater demand, was a major development. The number of carriers was obviously affected. Soon after passage of the Airline Deregulation Act, entrepreneurs did indeed respond to the sudden possibility of flying routes at will. The number of major, national, and regional airlines had

decreased from 52 in 1971 to 43 in 1978; but in 1979, 60 such carriers (40 percent more) operated. Still more airlines opened for business, until the number peaked at 87 in 1984.⁴⁰

The established major airlines successfully regained market share by means of the following changes:

- Flying more routes
- Making cooperative arrangements with commuter airlines to offer more continuous routes under the same brand name so as to offer greater convenience and more visibility
- Using computer reservation systems tied in with travel agencies and offering a range of prices for the same trip
- Conducting frequent-flyer programs
- Increasing production quotas of personnel

The number of carriers decreased to 60 in 1989 as mainly the newer ones failed. The number of carriers then climbed to 96 by 1996⁴¹ as demand for travel continued to increase and the successful strategies of the majors had already had their most crucial effects.⁴²

Yet the level of competition has been greater ever since deregulation because, since 1978, the major carriers have competed much more with each other on particular routes.⁴³ Surprisingly enough, the number of carriers nationwide shows little relationship to overall prices, the volume of business, or employment. (See chart 3.) But the number of carriers *servicing a particular route* is highly relevant to ticket prices on that route. Naturally, routes served by a larger number of competitors have lower prices per mile.⁴⁴

During regulation, from 1969 to 1978, average per-mile ticket costs, adjusted for inflation using the CPI, fell 2.2 percent per year. After deregulation, real prices fell at only a slightly faster rate, 2.3 percent. (See chart 4.) While the airliner was no longer changing so substantially to produce more economical operations, price competition was occurring. According to one respected source, deregulation was responsible for 58 percent of the price cuts from 1978 to 1993 and made fares 22 percent lower than they would have been without deregulation.⁴⁵ As stated earlier, lower prices raise demand and contribute to growth and, in turn, employment.

In recent years, however, ticket prices have fallen at a reduced rate. From 1986 to 1998, they declined by 1.8 percent per year.

Changed rules and productivity

Labor productivity, highly relevant to the rate of growth in jobs, had already been increasing impressively before deregulation; larger and faster craft made greater productivity on the part of flight crews possible. After 1978, the causes of increasing productivity changed, as management developed responses to the newly competitive environment. In earlier years, the increasing capacity of the average airliner allowed more

passengers to be transported by a flight crew, aided by a dispatcher and other ground personnel whose efforts also became more efficient as the airliner grew. But in the new competitive market, the average capacity of a passenger aircraft (in seats) about leveled off, then dropped by 14 percent from 1986 to 1996. When a price war strained airline budgets soon after deregulation, massive layoffs by certain major airlines, reduced pay, and renegotiated work rules were used to cut costs.⁴⁶ Reservations systems were computerized and shared among airlines, reducing the manual workload entailed in reservations.

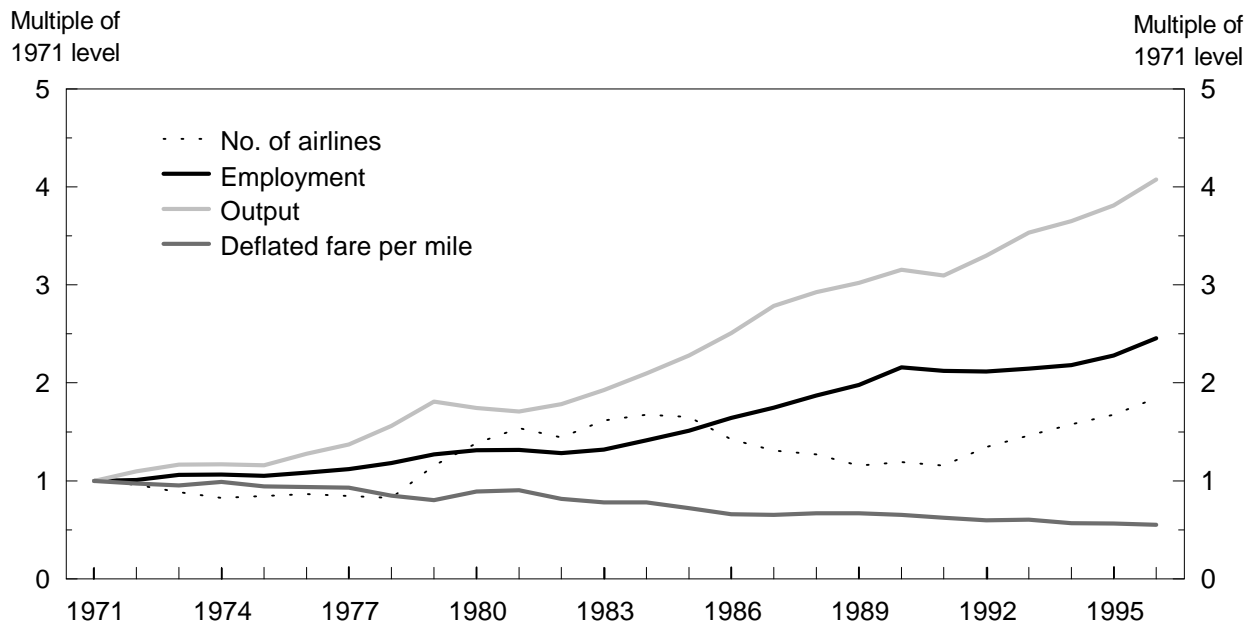
The development of the hub-and-spoke system of routes in the early 1980s was especially advantageous.⁴⁷ Instead of the simpler, more traditional arrangement of routes between paired cities, passengers from various points of origin were flown to a “hub” and then grouped together to fill a large craft more fully during a common leg of their journeys. The hub-and-spoke system was successful in increasing the number of seats filled. “Load factor,” the percentage of passenger seats filled, had increased by 0.2 percent per year from 1958 to 1978, but increased more than three times as fast, by 0.7 percent per year, from 1978 to 1996. The hub-and-spoke system, however, was only one factor responsible for the gains; the deliberate use of smaller aircraft on routes with less demand has been another important cause of increasing load factors.⁴⁸ Despite more frequent use of smaller craft, the average number of *passengers carried* per aircraft mile increased from 90 in 1978 to 103 in 1996, making craft and crew more productive.⁴⁹

Productivity on a per-employee basis⁵⁰ has shown improvement almost continuously since 1947, increasing every year except 1980, 1981, and 1988 to 1991 (mostly years of recession, when reduced business activity in general worked against load factors). Despite all the benefits of competition, output per employee advanced much more slowly after 1978, when ongoing changes to the aircraft were not so economically meaningful. Gains of 6.4 percent per year from 1958 to 1978 slowed to 2.6 percent per year during the 18-year period ending in 1996. Once the hub-and-spoke system and computer reservations systems had already been implemented, the rate of increase in productivity slowed to 1.7 percent per year from 1986 to 1996. The following tabulation summarizes the percent change per year in output per person in air transport.

	Annual rate of change
1958–78	6.4
1968–78	4.8
1978–96	2.6
1978–86	3.8
1986–96	1.7

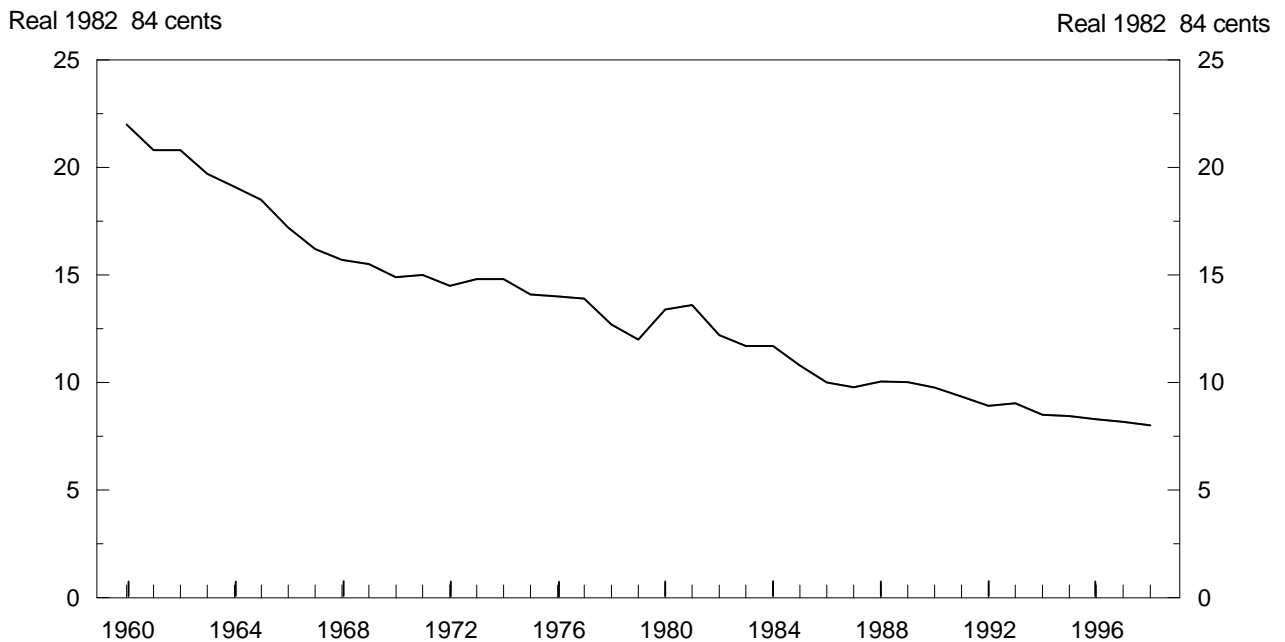
Because productivity has been rising more slowly in recent years, requirements for labor have been greater recently than

Chart 3. Number of carriers, fares, and industry output, 1971–96



SOURCES: Bureau of Transportation Statistics, U.S. Department of Transportation (number of carriers); Office of Productivity and Technology, BLS (output); Air Transport Association (real fares).

Chart 4. Fare per mile of U.S. scheduled airlines, adjusted for inflation, 1960–98



NOTE: The Consumer Price Index for all Urban Consumers (CPI-U) is used to adjust raw fare per mile.
SOURCE: Unadjusted fares are from the Air Transport Association.

they would have been if productivity had continued to rise at the faster rates of the past.

The use of smaller planes to reduce costs, while not directly relevant to *labor* productivity, is also an important means of economizing. Smaller aircraft are used more often to cut costs of equipment and fuel, even if labor productivity is reduced somewhat as a result. Smaller craft often are appropriate for more minor spoke routes.⁵¹ Most aircraft also are configured with less room per seat to increase the number of seats and the potential revenues of each flight, reducing comfort but contributing to lower prices.⁵²

The various means of increasing labor productivity and of increasing the productivity of capital contribute to lower costs that enable the airlines to reduce fares. Lower fares attract more passengers and contribute to growth and employment.

Safety

Another important long-term trend in the industry, seldom recognized as a contributor to industry growth in recent decades, is airline safety. The increasingly safe nature of commercial flight may be a factor in the public's increased flying. Rates of accidents and fatalities have declined greatly in the long term.⁵³

As the possibility of deregulation was debated in the 1970s, critics predicted that the loss of regulation would result in a major decline in safety as smaller, less reliable airlines gained larger shares of traffic and as established carriers were pressured to reduce costs, including aircraft maintenance.⁵⁴ (Only *economic* regulation was being debated. Regulation for purposes of safety, including required maintenance of craft, specified training of pilots, and right-of-way rules in the sky, was never ended or even seriously considered for termination by any important party.) Trends in two measures of airline safety have remained favorable, although improvements have decelerated.

Passenger fatalities per million aircraft-miles is one established measure of air safety. Accidents per thousand departures may be a better one, though, for measuring the fitness of pilots, controllers, and equipment, considering that the crash of just one large aircraft can skew the fatality statistic. Departures and arrivals are the most hazardous normal operations because they involve the greatest proximity to the ground as well as the heavier traffic of the airport environment. Furthermore, the fatalities-per-miles measure is subject to distortion when the average length of a flight changes, but the rate of accidents per thousand departures is free of influence by the length of flights.

According to both statistical measures of safety, the air transportation system improved both before and after deregulation. Far greater improvement occurred in times closer to the beginning of substantial commercial aviation, because the relatively young industry had more problems to solve. (See chart 5.)

The following tabulation will give an idea of the progress that has been made since 1958, although the year-to-year variability of figures makes precise analysis of progress in safety difficult.

	<i>Average annual percent change</i>	
	<i>Fatalities per million aircraft miles</i>	<i>Accidents per 1,000 departures</i>
1958-96	-2.1	-3.5
1958-78	-3.7	-6.1
1978-96	-3	-4

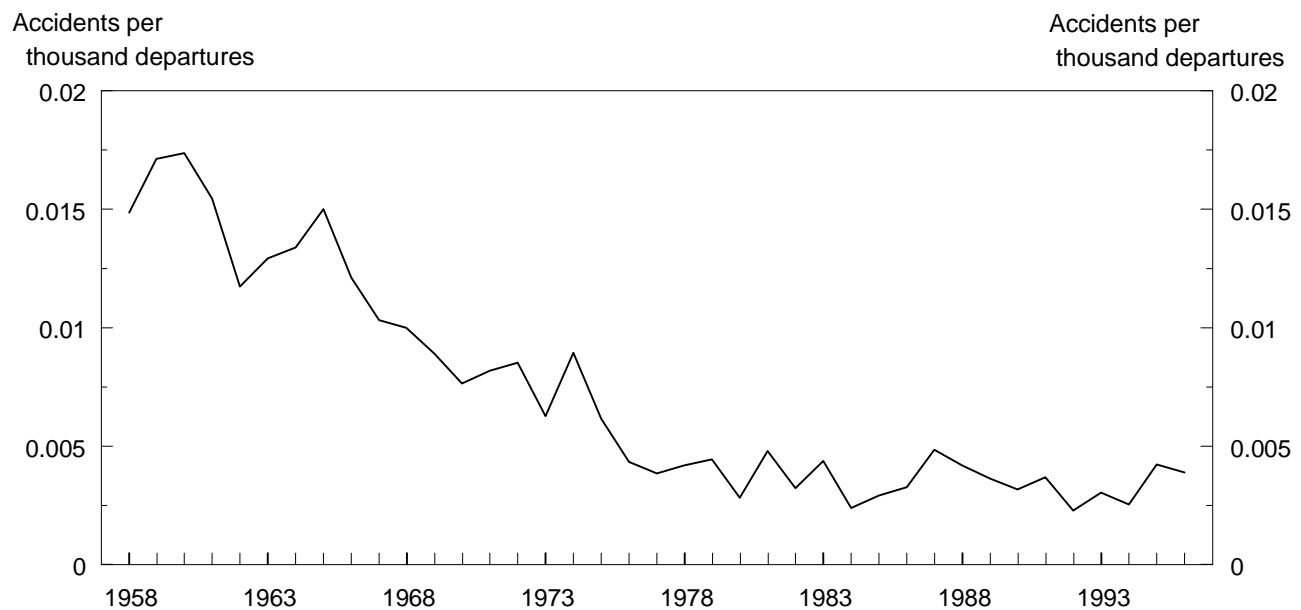
In 1996, 8.2 million scheduled departures entailed 32 accidents, including three fatal ones. The same year, 319 passengers out of 581 million carried were killed, implying a fatality rate of one death for every 1.8 million people boarded.⁵⁵

Because the most dramatic decreases in accidents occurred in the earlier decades of the period under study, it seems likely that most of the increase in the public's confidence in aviation also occurred during the earlier decades. If greater confidence in the safety of aviation contributes to the growth of business, the bulk of such economic effects were probably also in the earlier decades.

Analysis

In the last 40 years, in commercial aviation, fares after adjusting for inflation have declined, labor productivity has increased, and output and employment have increased vastly. Such trends appear to suggest continuous driving forces. Certain factors, such as at least some improvement in safety, general economic growth, and increased international trade have endured from the regulatory period to the free-market period and have continued to contribute to the growth of the industry. But by all accounts, great changes in the economics of aviation occurred. The pre-regulatory, regulatory, and post-regulatory periods each allowed for certain types of progress in the industry. The development of the airplane itself into a safe, fast, and efficient vehicle, primarily during the pre-regulatory and regulatory periods, allowed vast commercial progress. The development of radio navigation systems and air traffic control, also primarily before deregulation, reduced accidents, probably reducing the public's fear of aviation. Navigation systems and air traffic control also made air service more reliable because flight became sensible in a greater range of weather conditions. After deregulation, competition drove airlines to find ways to economize in operations to lower fares. Recent fares, after adjustment for inflation, are cheaper than ever.

General economic deceleration accounts for only part of the deceleration in the growth of air transport. Other explana-

Chart 5. Airline accidents per thousand departures, 1958–96

NOTE: Data are for Part 121 airlines, which are those subject to Part 121 of the Federal Aviation Regulations and include all airlines operating craft with over 30 seats.

SOURCE: Calculated from series from the Air Transport Association.

tions have to do with innovations that contributed to acceleration in growth as they were introduced and as they spread but now have been largely completed. Aircraft ceased to become larger or so radically improved in engine design as when the jet engine first came into commercial use. The time-saving and cost-cutting accomplished by the two major changes to the craft have long ceased to be new advantages over the operations of the recent past. Hub-and-spoke routing and computer reservations systems have become standard in the

industry. They can no longer serve to accelerate growth, as they did when they were introduced and as they spread. The one-time technological and operational innovations of both the regulatory period and the post-regulatory period have been standard for years, and cannot now increase the rate of growth; ticket sales via the Internet are one possible exception. After 1986, increases in productivity, reductions in fares, and the growth of output and employment decelerated. Further innovation may be required if growth is to be as rapid as in the past. □

Notes

¹ Annual numbers of passengers carried starting in 1938 can be found in the "Safety Record of U.S. Airlines," Air Transport Association, on the Internet at <http://www.air-transport.org>.

² Real fares also are from the Air Transport Association, on the Internet at <http://www.air-transport.org>.

³ Estimates of employment in this article are from the BLS Current Employment Statistics (CES) survey of establishments, unless otherwise noted. The CES program produces estimates of employees on all non-farm payrolls, except in private households, based on a monthly survey of about 390,000 work sites. Data from the survey appear in the Bureau's

monthly periodical, *Employment and Earnings*. See the box on page 3 for the special attributes of the estimates of employment used in this article.

⁴ Output and productivity statistics used in this article are from the Office of Productivity and Technology, Bureau of Labor Statistics.

⁵ Air Transport Association, *The Airline Handbook*, ch. 4, p. 2, on the Internet at www.air-transport.org/handbk/chaptr04.htm.

⁶ Air Transport Association of America, *Air Travel Survey 1998* (Washington, 1998), p. V-1.

⁷ Passenger-mile and ton-mile figures are from *National Transporta-*

tion Statistics 1998 (U.S. Department of Transportation, Bureau of Transportation Statistics, 1998), tables 1–10 and 1–11.

⁸ Passenger-mile and ton-mile figures of the various modes are from *National Transportation Statistics 1998*, tables 1–10, 1–11 and *National Transportation Statistics 1997*, table 1–7, p. 15.

⁹ International water tonnage is from *National Transportation Statistics 1996* (U.S. Department of Transportation, 1997), pp. 49, 50.

¹⁰ Output figures are from the Office of Productivity and Technology, Bureau of Labor Statistics.

¹¹ Traffic figures are from the Air Transport Association, on the Internet at <http://www.air-transport.org>.

¹² *National Transportation Statistics 1998* (U.S. Department of Transportation, Bureau of Transportation Statistics, 1998), table 2–21.

¹³ Figures for reasons for air travel are from the *Air Travel Survey 1998* (Washington, Air Transport Association of America, 1998), p. V-5.

¹⁴ Domestic statistics are from *National Transportation Statistics 1998*, table 1–11. International statistics are for U.S. scheduled airlines and are from the Air Transport Association, on the Internet at <http://www.air-transport.org>.

¹⁵ Figures are from the U.S. Department of Commerce, International Trade Administration, Tourism Industries. Flights between the U.S. and Canada or Mexico are excluded.

¹⁶ International Trade Administration, Tourism Industries. Flights between the U.S. and Canada or Mexico are excluded.

¹⁷ See “TIACA trustee projects industry growth, impact through 2015,” *Presswire* (The International Air Cargo Association, July 7, 1997). Also see Gary Hendricks, “Hartsfield City Limits: Air cargo taking off at airport,” *The Atlanta Journal*, Oct. 20, 1997, p. E5 ff.

¹⁸ Figures are from the Bureau of Economic Analysis, U.S. Department of Commerce, on the Internet at <http://www.stat-usa.gov/online.nsf/NIPAnav?openNavigator>.

¹⁹ SIC is the acronym for Standard Industrial Classification. See *Standard Industrial Classification Manual 1987* (Washington, Office of Management and Budget).

²⁰ Gary Hendricks, “Hartsfield City Limits,” *The Atlanta Journal*.

²¹ See Steven A. Morrison and Clifford Winston, *The Evolution of the Airline Industry* (Washington, The Brookings Institution, 1995), pp. 28–31, on the subject of the relatively low profitability of airlines.

²² Christopher Reynolds, “TRAVEL: Lawmakers and waning profits push airlines into voluntary reforms . . .,” *Los Angeles Times*, June 27, 1999. See also Cynthia Corzo, “Airlines’ Promises to Improve Customer Service Mean Little, Skeptics Say,” *Knight Ridder Tribune Business News*, June 19, 1999.

²³ See Morrison and Winston, pp. 19–20.

²⁴ Calculated from available seat-mile and aircraft-mile statistics provided by the Air Transport Association. Also, the point that seating capacity is an important factor in costs is explained by the Bureau of Transportation Statistics, U.S. Department of Transportation in *Transportation Statistics Annual Report 1995*, p. 122.

²⁵ *Transportation Statistics Annual Report 1996* (U.S. Department of Transportation, Bureau of Transportation Statistics, 1996), p. 234.

²⁶ *The Airline Handbook*, ch. 1, p. 10.

²⁷ *Ibid.*, ch. 4, p. 7.

²⁸ The average seats per craft were calculated by dividing total seat-miles by total aircraft miles. Therefore the average is a weighted average, with the weights being the amount of use (in aircraft miles) of each plane. The raw seat-miles and aircraft miles were obtained from the Air Transport Association.

²⁹ *The Airline Handbook*, ch. 1, p. 10.

³⁰ *Ibid.*, ch. 4, p. 7.

³¹ *Ibid.*, p. 5.

³² Richard H.K. Vietor, “Contrived competition: economic regulation and deregulation, 1920s–1980s,” *Business History*, October 1994, pp. 1 ff.

³³ Stephen Breyer, *Regulation and its Reform* (Harvard University Press, 1982), p. 210.

³⁴ *Transportation Statistics Annual Report 1996*, p. 235.

³⁵ Figures provided by Air Transport Association, on the Internet at <http://www.air-transport.org>.

³⁶ *The Airline Handbook*, ch. 2, pp. 1, 2, and Vietor, “Contrived Competition.”

³⁷ *The Airline Handbook*, p. 2.

³⁸ *Ibid.*, p. 4.

³⁹ Real yield (fare per passenger-mile) is from the Air Transport Association.

⁴⁰ *Transportation Statistics Annual Report 1996*, p. 236.

⁴¹ *National Transportation Statistics 1998* (U.S. Department of Transportation, Bureau of Transportation Statistics, 1999), Appendix A.

⁴² *Winds of Change: Domestic Air Transport Since Deregulation* (Washington, Transportation Research Board, National Research Council, 1991), pp. 103–7.

⁴³ *Winds of Change*, p. 107.

⁴⁴ *Airline Regulation: Changes in Airfares, Service, and Safety at Small, Medium-Sized, and Large Communities*, RCED 96–79 (Washington, General Accounting Office, 1996).

⁴⁵ Morrison and Winston, pp. 12–15.

⁴⁶ Vietor, “Contrived competition.”

⁴⁷ *Transportation Statistics Annual Report 1996*, p. 242.

⁴⁸ Don Phillips, “Climbing out of the Red: Struggling Airlines Are Cramming Passengers into Planes in Bid to Survive,” *The Washington Post*, June 18, 1995, pp. H1 ff.

⁴⁹ Calculated from aircraft-miles and passenger-miles, both from the Air Transport Association.

⁵⁰ The hours spent during layovers and how such hours are counted by employers for purposes of compensation make the hours worked by airline employees difficult to sample and estimate. Therefore labor productivity in air transport is calculated in terms of output per employee, rather than output per hour of work. Considerable changes in the average workweek, if they occur, may cause increases or decreases in output per employee. Such changes may distort the apparent efficiency of personnel. Nevertheless, this section will describe the trends of productivity in terms of the available unit, output per employee.

⁵¹ Phillips, “Climbing out of the Red,” and *The Airline Handbook*, ch. 4, p. 7.

⁵² Phillips, “Climbing out of the Red.”

⁵³ For information on occupational fatalities in aeronautics, see Peggy Suarez, “Flying Too High: Worker Fatalities in the Aeronautics Field,” *Compensation and Working Conditions* (Bureau of Labor Statistics, Spring 2000), pp. 39–42. The article confirms a decreasing trend in fatalities.

⁵⁴ *The Evolution of the Airline Industry*, pp. 31, 32.

⁵⁵ Safety figures are derived from statistics provided by the Air Transport Association, on the Internet at <http://www.air-transport.org>.