Impacts of Productivity Changes in Air Transportation on Profits, Prices, and Labor Compensation: 1990–2001

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ABSTRACT

The objective of the paper is to assess the impacts of productivity changes in air transportation since 1990 in three basic economic areas: 1) industry profits, 2) consumers/users of air transportation services, and 3) industry employees. In this regard, an analysis is initially carried out between productivity measures and industry profits. Comparisons are also made between the general price level of the economy and several price indexes of the air transportation subsector. Also, an evaluation is conducted of labor compensation in air transportation, the U.S. economy, and other transportation industries. The analysis results in several findings. First, there is a marked association between productivity changes in air transportation and industry profits. Second, the benefit of productivity increases in air transportation does not seem to have transferred to consumers of air passenger services in the form of lower prices. On the other hand, users of scheduled cargo services did seem to benefit from lower prices. Finally, a portion of the benefit of productivity increases went to industry labor in the form of relatively high levels of labor compensation.

KEYWORDS: Air transportation, productivity, profits, prices, labor compensation.

INTRODUCTION

The objective of this paper is to measure productivity and assess the impact of productivity increases in air transportation in three economic areas: 1) industry profits, 2) consumers, and 3) airline employees.

According to economic theory, changes in productivity in an industry (firm) can affect profits, prices, and labor compensation. Increases in productivity are expected to result in higher profits for the industry. Subsequently, there can be positive impacts on consumers and on the employees of the industry.

In elaborating on the above theoretical framework, the basic benefit of increased productivity is that more output can be produced with the same quantity of inputs (some inputs can be of improved quality). Alternatively, the same output can be produced with fewer resources. Other things being equal, this results in a bigger difference between total revenues and total costs, and thus higher profits for the industry. The existence of higher profits can subsequently be followed by three effects:

1. the firms in the industry can keep a portion of the increased profits for internal use;
2. the firms can decrease prices for their service to the consumers, or—perhaps more likely—they may increase prices less than they would in the absence of productivity increases; and
3. the firms can provide higher compensation to their employees (in the form of higher wages and/or fringe benefits).

The assessment of this paper applies this theoretical framework to the air transportation subsector. Greater profits benefit the air carriers directly. With regard to users, a decrease in prices for passengers increases their real incomes. For shippers of air freight, a decrease in prices reduces their (distribution) costs. In addition, higher profits resulting in increased labor compensation for airline employees raises real incomes. Such increases in real incomes, to consumers and labor, are the important contributions of greater productivity. Increases in real incomes lead to more consumption, which contributes to the economy's growth.

High increases of productivity imply a higher likelihood that the above effects would occur. A decline in productivity could reverse the positive effects of a productivity increase, resulting in declines in labor wages and, in extreme cases, bankruptcies of companies, accompanied by job losses.

Data and Period of Analysis

The paper uses a consistent set of the most recent data available—for the 1990 to 2001 period. These data refer to the main variables needed for the industry analysis: productivity (labor and multifactor), profits, prices (various types), and labor compensation. Additional data used relate to the U.S. business sectors and the U.S. economy.

Industry data used in this paper are classified under the North America Industry Classification System (NAICS). Labor productivity is examined for three transportation industries/subsectors: air transportation data refer to NAICS industry number 481, line-haul railroads refer to NAICS 48211, and general freight trucking long-distance refer to NAICS 48412. Comparisons are also made with the U.S. business sector. The words "industry" and "subsector" are used interchangeably in the paper.

LABOR AND MULTIFACTOR PRODUCTIVITY

This section examines changes in labor and multifactor productivity in the U.S. air transportation subsector during the 1990 to 2001 period. It also examines data on productivity of the U.S. economy and the two other transportation subsectors—railroads and trucking.

Labor productivity is defined as output per unit of labor and is calculated by dividing output by a measure of labor input used in the production of the output. For air transportation, output is measured in terms of passenger-miles and ton-miles; and for rail and trucking, output is measured in terms of ton-miles. Labor productivity can be affected by factors that include improved labor skills and training as well as by physical capital per worker.

Multifactor productivity relates to the productivity of all the inputs used in the production process. These include labor, capital (with land), and intermediate inputs. Multifactor productivity is a more comprehensive measure of productivity than labor productivity. It indicates the overall production efficiency of an industry as it relates to increases in

industry output that are not accounted for by increases in the factor inputs. The analysis of the specific impacts, or potential benefits, of productivity increases in an industry is the basic objective of this study.

To evaluate labor productivity in air transportation, data on levels of labor productivity in that industry, over time, are plotted in figure 1. These data indicate that labor productivity increased from 1990 until 1997, when it reached its peak. In 1998, labor productivity declined and stayed at this lower level until 2000. In 2001, it declined again, quite significantly. This was affected by the drop in output/demand as a result of the catastrophic events of September 11, 2001 (9/11), and by a recession in that year.

To compare labor productivity in air transportation with the other two transportation industries and the U.S. business sector, relevant data are plotted in figure 2. There, one can observe that between 1990 and 2000 (and with the exception of 1991 to 1993), labor productivity in air transportation increased faster than in long-distance trucking and the U.S. business sector. In 2001, however, labor productivity in air transportation declined while that of the U.S. business sector increased.

Rail transportation was the one subsector in which labor productivity increased faster than labor productivity in air transportation. Rail transportation had continual increases in labor productivity over time. In fact, labor productivity in this subsector continued to increase in 2001 even as it declined in air transportation and trucking.

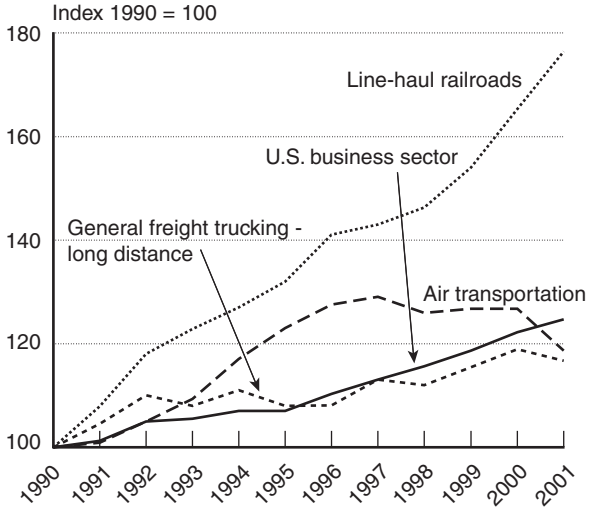
In order to make comparisons from another perspective, growth rates of labor productivity are presented in table 1. These growth rates show that, over the 1990 to 2000 period, labor productivity in air transportation grew at a higher annual rate (2.4%) than it did in the U.S. business sector (2.0%) and in trucking (1.7%).

Between 1990 and 2001, however, the growth rate for air transportation was lower (1.6%) than that of the U.S. business sector (2%) and just above trucking (1.4%). These data also indicate a significant drop in the annual growth rate of labor productivity in air transportation between 1990 and 2000 (2.4%) and 1990 and 2001 (1.6%). This sudden drop when 2001 data are included reflects the significant impact of 9/11 on this subsector. After that date, output of air transportation dropped immediately and significantly while the labor force in air transportation also declined, but with a time lag. In both time periods, rail transportation experienced the highest growth rate of labor productivity. Air transportation productivity, in 2001, was affected more adversely than productivity in the U.S. economy and in the trucking industry, and significantly more adversely than in the railroad indus-

FIGURE 1 Labor Productivity in Air Transportation

Source: The data on which this chart is based were obtained from Bureau of Labor Statistics internet site, section on Productivity, subsection on Productivity and Costs.

FIGURE 2 Labor Productivity in Transportation and the U.S. Business Sector



Source: The data on which this chart is based were obtained from Bureau of Labor Statistics internet site, section on Productivity, subsection on Productivity and Costs.

TABLE 1 Growth Rates of Labor Productivity in Transportation
(Growth rates—average annual percentage rate)

	1990–2000	1990–2001	1990–1995	1995–2000	1995–2001
Air transportation	2.4	1.6	4.2	0.6	–0.6
Line-haul railroads	5.2	5.3	5.7	4.6	5.0
General freight trucking—long distance	1.7	1.4	1.5	2.0	1.3
U.S. business sector	2.0	2.0	1.4	2.6	2.5

Source: The data on which these growth rates are based were obtained from the Bureau of Labor Statistics Internet site, section on Productivity, subsection on Productivity and Costs

try. There was a recession in 2001 that affected the economy and output of industries; air transportation would seem to have been particularly affected by the events of 9/11. Nevertheless, labor productivity in air transportation increased significantly over the analysis period.

Multifactor Productivity

With regard to multifactor productivity (MFP), the plots presented in figure 3 show that MFP in air transportation was at higher levels than that of the U.S. business sector over the period of analysis, indicating higher growth rates. Over 1990 to 2000, multifactor productivity in air transportation grew at an annual rate of 1.9% while in the U.S. private business sector it grew at an annual rate of 0.9% (appendix table 1).

These data indicate that, over 1990 to 2000, both labor and multifactor productivity in air transportation generally increased. The same observation applies to the 1990 to 2001 period, with the qualifications noted. The paper proceeds to assess the impacts of this productivity increase in the three areas mentioned previously— profits of air carriers, prices paid by users, and labor compensation of airline employees.

PRODUCTIVITY AND PROFITABILITY

The basic equation illustrating the calculation of profit of an enterprise is:

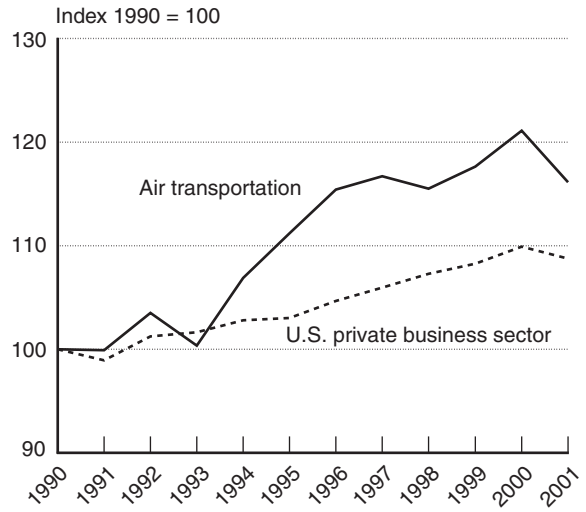
Profit = total revenues – total costs.

Total revenues consist of the quantity of items sold multiplied by the price per item. In air transportation, the items would relate to tickets for passengers or tons-miles of freight. Total costs are composed of fixed and variable costs. For air carriers, fixed costs would include the periodic payments made for the purchase of an airplane, while variable costs would include fuel and labor costs.

The basic source for data on profits in air transportation (net income after taxes) is the Bureau of Transportation Statistics (BTS), Office of Airline Information (OAI). These data can be obtained from TranStats, a database on the BTS Internet site that provides data on net income for various sizes of airlines (Majors, National, Regionals, and Small). Also, the *Airline Quarterly Financial Review*, by the Office of the Secretary of Transportation, presents profit data for Major air carriers.

Table 2 presents annual data on productivity and profits in air transportation for the analysis period. These data indicate that, particularly since 1995, operations in the air transportation industry resulted in profits that were maintained over time, up to year

FIGURE 3 Multifactor Productivity in Air Transportation and U.S. Business Sector



Source: Data on which this chart is based were obtained from Bureau of Labor Statistics Internet site, section on Productivity, subsection on Multifactor Productivity.

TABLE 2 Productivity and Profits in Air Transportation

Year	Labor productivity	Multifactor productivity	Net income ($millions, all carriers)	Net income ($millions, Majors)
1992	105.0			
1993	109.3	100.4	$272	
1994	117.2	106.9	($344)	($578)
1995	123.0	111.2	$2,340	$2,235
1996	127.5	115.4	$2,804	$2,779
1997	129.0	116.7	$5,168	$5,488
1998	125.9	115.5	$4,531	$4,577
1999	126.7	117.6	$5,357	$5,075
2000	126.7	121.1	$2,533	$2,599
2001	118.6	116.1	($8,171)	($7,139)

Note: Numbers in parentheses (in columns 3 and 4) indicate losses.

Sources: For data in columns 1 and 2, same as chart 1 and 2. For data in column 3, from BTS, TranStats (on the Internet); data refer to all air carriers. For data in column 4, from DOT, Airline Quarterly Financial Review; data refer to Majors.

2000. In 2000, industry profits declined although they were still positive. In 2001, industry profits became negative; they were affected significantly by the events of 9/11, which suddenly reduced demand for air travel, and the industry was not able to reduce costs proportionately.

The data in this table indicate that there is an association between increases in the productivity measures and profits of the air transportation subsector. From 1995 to 1997, industry productivity (labor and MFP) increased, and industry profits increased. One also notes that 1997 was the year in which air transportation earned the highest amount of profits, and in that year the industry experienced the highest level of labor productivity. During 1998, productivity (labor and MFP) decreased and profits decreased; and during 1999, productivity increased and profits increased. Finally, during 2001, productivity decreased and profits decreased, affected by the events of 9/11. On the other hand, MFP increased in 1994 and 2000, but industry profit declined during these years. Overall, these data are consistent with economic theory predicting a relationship between productivity and profits.

In order to quantify the association between profits and productivity, Spearman rank correlation coefficients were calculated, and they are presented in appendix table 2. An asterisk next to the coefficient indicates significance at the 95% level, given the number of observations (Kvanli 1988, chapter 4). All four coefficients relating to labor productivity and profits indicate a positive and significant association between the two variables at the 95% level. These coefficients range from 0.77 to 0.83, which shows a substantial association between the two variables.

The rank correlation coefficient is lower between multifactor productivity and profits. One of the four coefficients calculated between these variables is significant at the 95% level (0.74). The calculation of this coefficient does not include data for 2001. The rank correlation between MFP and profits of Majors (OST data) for 1994 to 2001 is 0.45; when data for 2001 are dropped, the coefficient increases to 0.61.

Therefore, visual observation and correlation coefficients indicate a rather marked association between productivity and profits in air transportation.[1] This substantiates and is consistent with economic theory, which predicts the basic benefit of

[1] In addition, regression analysis was used to estimate the relationship between profits (dependent variable) and productivity (independent variable). Better results were obtained when data for year 2001 were dropped. The estimated equation using profits from TranStats and labor productivity is:

Profits (OAI) = f (Labor Productivity) $n = 8$

Profits =	–28,845.11 + 257.20 *Labor Productivity*	
	(9,425.23)	(76.43)
t-statistic	–3.06	3.37

Adjusted R-squared = 0.60

Durbin-Watson= 1.93

productivity increases (in an industry) is a rise in profits.

PRODUCTIVITY AND PRICES

Rising profits of an industry can impact industry prices. If the price of air transportation were to decrease, or increase by slower rates, as a result of greater productivity, then the users of air transportation services would benefit. Lower prices for consumers/passengers increase the purchasing power of consumers' incomes, that is, increase their real income and thus their standard of living. Lower prices for producers of goods that use air transportation services for freight shipments would contribute to lower costs for these producers, and thus higher profits. The occurrence and extent of lower prices—or slower growth of prices—as a result of productivity increases are more likely in industries characterized by a relatively high degree of competition.

In order to evaluate the relationship between productivity and prices in air transportation, an initial comparison is made of price changes in that industry, over time, with price changes in the general economy. The objective is to assess whether greater productivity in air transportation was accompanied by relatively small price increases, or price declines, compared with prices in the general economy. If that occurred, there would be indications that a portion of the benefit from productivity increases (higher profits) went to consumers/users of air transportation services.

Table 3 presents relevant price data for the economy and air transportation. Prices in the general economy are measured by the Consumer Price Index (CPI), while the prices of air transportation services are measured by several price indexes to cover the various segments of the industry. These segments are consumers/passengers and entities using air cargo services. One price index is the CPI for air transportation (CPI-AT), which measures the prices that consumers pay for air transportation services (column 5). This index includes domestic and international air travel. Data are also presented for three other price indexes: the Producer Price Index (PPI) for scheduled passenger service—domestic and international (in column 7 of the table); the PPI for scheduled passenger service—domestic (column 9); and the PPI for scheduled air cargo (column 11). Growth rates of prices are computed in the columns next to the indexes.

The Bureau of Labor Statistics (BLS) publishes the CPI for the economy and both a CPI and a PPI for airfares. The CPI for commercial air travel is based on prices listed by the airlines in the SABRE system, a reservation system used by many travel agencies. This index measures changes in the prices paid by consumers for airline trips, including taxes and any distribution costs not received by the air carriers, such as travel agents' fees. The PPI-Air Travel measures changes in revenues received by producers of airline trips.

The CPI-Air Travel includes trips purchased from foreign carriers while the PPI-Air Travel excludes these. Monthly prices for the two programs are gathered from different data sources: CPI prices come from the SABRE system, while PPI prices are gathered directly from airline pricing departments.

The data in table 3 show that, since 1990, prices of air transportation for scheduled passenger service increased significantly faster than the CPI of the economy. Moreover, prices of domestic passenger service increased substantially faster than prices of domestic and international services, combined. The data indicate that while the CPI rose by 36% over the 1990 to 2001 period, prices of passenger service increased by 61% based on the CPI-airline fare, which includes domestic and international air travel; by 81% for PPI-domestic and international; and by 101% for PPI-domestic service.

On the other hand, prices of scheduled air cargo increased by a substantially lower percentage than the general price level. These prices rose by less than 10% over the period of analysis, compared with CPI growth of 36%. Consequently, prices of air cargo also increased by a significantly lower percentage than prices in the passenger segment of the air transportation industry.

These data indicate that although productivity and profits went up in air transportation, prices for passenger service also tended to increase at relatively high rates. In this segment of the industry, the providers of transportation services appear to have kept that part of the benefit of productivity increases.

TABLE 3 Productivity and Prices in Air Transportation

Year	Labor productivity	Multifactor productivity	Consumer Price Index—U.S. (1982-84=100)	Growth rate—CPI	Consumer Price Index—airline fare (1982-84=100)	Growth rate—CPI, airline fare	PPI-air transportation, scheduled passenger-domestic, international (Dec.1989=100)	Growth rate—PPI, scheduled passenger-domestic, international	PPI-air transportation, scheduled passenger-domestic (Dec.1989=100)	Growth rate—PPI, scheduled passenger-domestic	Scheduled air cargo (Dec.1987=100)	Growth rate—PPI, scheduled air cargo
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1990	100.0	100.0	130.7		148.4		110.6		111.3		102.0	
1991	100.9	99.9	136.2	**4.2**	155.2	**4.6**	122.4	**10.7**	125.1	**12.4**	105.2	**3.1**
1992	105.0	103.5	140.3	**3.0**	155.2	**0.0**	114.8	**–6.2**	115.4	**–7.8**	107.0	**1.7**
1993	109.3	100.4	144.5	**3.0**	178.7	**15.1**	126.8	**10.5**	131.2	**13.7**	112.1	**4.8**
1994	117.2	106.9	148.2	**2.6**	185.5	**3.8**	130.6	**3.0**	136.4	**4.0**	109.5	**–2.3**
1995	123.0	111.2	152.4	**2.8**	189.7	**2.3**	137.8	**5.5**	144.8	**6.2**	111.2	**1.6**
1996	127.5	115.4	156.9	**3.0**	192.5	**1.5**	148.1	**7.5**	160.1	**10.6**	108.7	**–2.2**
1997	129.0	116.7	160.5	**2.3**	199.2	**3.5**	153.9	**3.9**	167.9	**4.9**	107.3	**–1.3**
1998	125.9	115.5	163.0	**1.6**	205.3	**3.1**	152.6	**-0.8**	165.2	**–1.6**	104.8	**–2.3**
1999	126.7	117.6	166.6	**2.2**	218.8	**6.6**	161.2	**5.6**	174.2	**5.4**	106.9	**2.0**
2000	126.7	121.1	172.2	**3.4**	239.4	**9.4**	186.5	**15.7**	208.1	**19.5**	110.4	**3.3**
2001	118.6	116.1	177.1	**2.8**	239.4	**0.0**	200.6	**7.6**	223.8	**7.5**	112.0	**1.5**
Percent increase 1990-2001	18.6	16.1	35.5		61.3		81.4		101.1		9.8	

Key: CPI = Consumer Price Index, PPI = Producer Price Index.

Sources: Data for columns 1 and 2, same as Figures 1 and 2. Data for columns 3 and 5, from BLS website, Consumer Price Index. Data for columns 7, 9, and 11, from BLS website, Producer Price Indexes. Column 5 includes domestic and international travel.

Note: Data for CPI refer to “All Urban Consumers”. Data in column 11 are based on Standard Industrial Classification.

On the other hand, it appears that the providers of scheduled air cargo services returned a portion of the benefit of rising productivity to users of these services in the form of relatively lower price hikes. Prices in this segment of the airline industry increased significantly less than the CPI of the economy or the industry passenger segment. In fact, several times during the period of analysis, there occurred price decreases in scheduled air cargo services.

In explaining price changes in the passenger and cargo segments of the air transportation subsector over time, one notes that in the case of passenger service it is the consumers/passengers (typically individually) who are dealing with the providers of air services (air carriers). The individual consumers do not possess much market power with which to negotiate prices for the services they buy—although in recent periods, the Internet has provided more information on ticket prices.

The air transportation industry would be characterized as an oligopoly in the national market or regional markets. Also, a number of mergers and acquisitions in the industry in the 1980s and 1990s resulted in a substantially smaller number of domestic air carriers. According to economic theory, the fewer the number of sellers in an industry, the lower the degree of competition to affect restraints in price increases. This seems to apply to the passenger segment of air transportation.

On the other hand, the purchasers of scheduled air cargo services tend to be business enterprises, often of substantial size, that typically have good information on the available prices for these services. They also tend to provide substantial and repeat business to the providers of air cargo services. Therefore, these enterprises can have substantial market power to use in obtaining advantageous prices for freight transportation services.

Recently, BTS began calculating its own Air Travel Price Index (ATPI).[2] This index measures prices actually paid by passengers rather than prices published in airline price schedules. Data are presented in appendix table 3 to enable comparisons between the ATPI and other price indexes from BLS for 1995 to 2001. These calculations show two results:

1. The ATPI increased significantly less than the CPI, the CPI-airfare, or the PPI-Air Transportation. A recent article that compared the U.S.-Origin ATPI with the BLS Air Travel Index found a significant difference between their increases. The authors stated that this was probably due mainly to: 1) the different methodologies/formulas used in the creation of the indexes, and 2) the ATPI's inclusion of special discount fares (Lent and Dorfman 2005).

   These price changes shown by the ATPI indicate that the benefits of productivity increases also accrued to the consumers of air transportation. This is different than the results based on BLS price indexes. This may be a topic for future research.
2. Within the ATPI, the ATPI U.S.-Origin increased substantially more than the ATPI-Foreign, which actually declined. Both sets of price indexes—the CPI-Air and PPIs from BLS, and the ATPI—indicate that prices of domestic air transportation increased faster than prices of international air travel. In attempting to explain such differences, one notes that typically increasing prices would be affected by increasing production costs or by the degree of competition in the industry. The production costs of domestic and international travel would not be expected to diverge significantly over time. The other factor is the degree of competition. Available information indicates that the degree of competition in domestic air transportation has decreased in the domestic market over the period of analysis.

In this regard, a study by U.S. Department of Transportation (DOT 1999), which covered 1992 to 1997, stated a number of findings indicating such a situation. These findings include:

[2] There are three primary ATPI series. The U.S. Origin ATPI measures changes in the cost of itineraries originating in the United States, whether the destinations are domestic or international. The Foreign-Origin ATPI measures changes in the cost of itineraries within a foreign origin and a U.S. destination. The Full-Scope ATPI combines the domestic and foreign-origin itineraries. The CPI-Air Fare and ATPI both cover domestic and international travel. However, the CPI is U.S.-Origin only; thus, it is more limited in scope than the Full-Scope ATPI.

1. In short-distance markets without low-fare competition, inflation adjusted fares are substantially higher (26%), not lower, than pre-deregulation fares. These markets account for about one-fourth of total domestic passengers.
2. There was a reversal of growth in low-fare competition in the last year of the period—1997. Markets with low-fare competition have significantly lower fares on average—often less than one-half—than similar markets without such competition.
3. One observes high fares in short distance markets at hub airports where one major network airline has a dominant market share. Average fares at some of these airports can be 50% to 60% higher when compared with more competitive markets.
4. New entrants in the airline industry experienced difficulties that can contribute to a decrease in low-fare competition. A number of factors make it difficult for new airlines to enter a hub market. These factors include: higher frequency service made available by hub-and-spoke systems; frequent flyer programs; travel agent commissions bonuses (overrides); and lack of gates and ticket counter or takeoff and landing slots for new competitors at certain airports.

The DOT study "concluded that unfair exclusionary practices have been a key reason that competition from new low-fare carriers has not been able to penetrate concentrated hubs..." (USDOT 1999, p.8). In addition, another study assessed predatory pricing in air transportation (Oster and Strong 2001). This study found that the early years of airline deregulation were characterized by periods of significant competition among the major established airlines as well as by competition from new-entrant carriers and from carriers formerly confined to intrastate markets. However, in the mid- to late-1980s, considerable industry consolidation occurred as a result of a wave of mergers. A number of these mergers involved the acquisition of larger carriers such as Frontier, Republic, Eastern, Ozark, Western, and Piedmont.

Following these mergers, the source of deregulation's benefits began to change. The benefits gradually became more attributable to the actions of a small number of low-fare carriers rather than to the actions of major network airlines. By the late 1990s, the domestic route networks of major airlines had become fairly stable and were built around hub airports, typically dominated by a single carrier. These hub-based networks established geographic areas in which each major network airline has substantial presence and market power, especially in short-haul smaller markets.

Some of the responses of the incumbent network carriers to entry by low-fare carriers resulted in concerns, by government and others, about the use of predatory pricing or unfair methods of competition. In one example (described in more detail in appendix 4), after a new, low-fare airline entered a particular market, the major network carrier responded by adding more flights on the entrant's network, by offering bonus miles, by offering special agent commission overrides,[3] and by matching the fares of the entrant in that particular market. As a result, within one month after the entrant began service, losses forced it to reduce its service to one flight a day, and soon thereafter, it exited the market altogether.

The study also examined 12 cases during the 1994 to 1997 period that involved short- to medium-haul flights and entailed a major network carrier hub, at one or both ends, and a new entrant (Oster and Strong 2001, p.10). The main features of the cases are described in appendix 5. The results include the lowering of average fares by the major carriers after the new entry, the exiting of the entrants, and the subsequent increase in fares by the major carriers. The authors of the study point out that predatory practices may be a rational strategy in the airline industry because short-run revenue losses may be recouped in the longer term. Such aggressive responses by major network incumbents to new entry can drive entrants from specific routes. Moreover, they provide a signal to other prospective

[3] Travel Agent Commission Overrides (TACOS) are special bonus commissions paid by an airline to travel agents as a reward for booking a targeted proportion or number of passengers on that airline. Such overrides, of which travelers are typically not aware, provide incentives to travel agents to steer some travelers from one airline to another. These overrides can also serve as a barrier to entry.

entrants that despite high fares being charged in a number of markets, any new entry will be met with a response that renders unprofitable the entrant's operation. This results in barriers to entry that can contribute to higher prices.

From the perspective of the consumers, there have been complaints by the Consumer Federation of America (CFA) with regard to competition and prices in air transportation. In testimony to Congress, Mark N. Cooper, the Director of Research of CFA, pointed out that 25 states filed comments in support of the DOT's antipredation rule that identified 15 airports at which the dominant firm had a market share in excess of 70%. Another half dozen airports had a dominant carrier, with 50% to 70% market share (Cooper 2001).

Mr. Cooper noted that airline markets are generally highly concentrated, and most routes have fewer than four carriers. He pointed to one study which found that, measured at the airports, the Hirschman-Herfindahl Index (HHI) was just under 3,300; this is equivalent to three airlines per airport. However, when measured by city pairs, the HHI was over 5,000—the equivalent of 2 airlines per route.[4] He noted that because there is a high level of concentration, one should not be surprised to find that anticompetitive behavior and changes in market structure have a significant impact on fares. Exercising market power is easy in such highly concentrated markets.

With regard to competition in the international market, a DOT study found that as transatlantic deregulation unfolds, competition intensifies and provides price benefits to consumers. This was apparently affected by open skies bilateral agreements that have provided carriers the operating flexibility necessary to improve and expand services. This new flexibility for carriers to respond to marketplace demands has led to downward pressure on prices, due both to increased supply and increased competition (USDOT OST 2000, p.2).

Data for 1996 to 1999 show decreases in price fares in international air travel. During this time period, average fares (not adjusted for inflation) to open-sky countries declined by 20% (compared with 1996). Moreover, they decreased by various percentages that approached 15% in connecting markets beyond European gateways (USDOT OST 2000, p.3).

In summary, we can see that in using BLS price data, prices of passenger service rose higher than the CPI. Thus, it would appear that the air carriers kept that part of the benefit of the productivity increase. On the other hand, prices of air cargo services increased relatively slowly. Thus, the users of these services were able to benefit from greater productivity in the industry.

Within the passenger segment of the air transportation industry, price data indicate that prices for domestic air transportation services rose faster than for international air transportation. This seems to be consistent with studies that indicated a trend toward decreased competition in the domestic market segment, resulting from increased concentration in the industry and predatory pricing behavior of network carriers toward low-cost entrants. In the international segment, a government study showed prices to have declined during several years in the decade of the 1990s.

PRODUCTIVITY AND LABOR COMPENSATION

The other potential effect of increasing productivity in an industry (or firm) is for a portion of the benefit to go to the employees in the form of higher labor compensation (wages and fringe benefits). In order to evaluate this possibility for air transportation, data are presented in table 4 on compensation per worker for that industry and for the U.S. economy (average labor compensation for all civilian workers), as well as for line-haul railroads and general freight trucking. These data are in current and constant dollars. In current dollars, they indicate that labor compensation in air transportation grew relatively faster, over time, than in the overall economy and in the two other transportation industries.

[4] Ibid. Cooper 2001. The HHI is calculated by expressing the market share of each firm in the industry as a percentage, squaring these figures, and adding them. For example, if in an industry, two firms control 50% of the market each, the index would be 50 squared + 50 squared = 2500 + 2500 = 5000. For an industry in which each of four firms controls 25% percent of the market, the HHI would be: 25 squared + 25 squared + 25 squared + 25 squared = 625 + 625 + 625 + 625 = 2500.
Source: Case and Fair, 1994, pp. 378.

TABLE 4 Labor Compensation per Employee
(In current and constant dollars)

	In current dollars					In constant dollars			
Year	Air transportation	Line-haul railroads	General freight trucking, long distance	U.S. economy	CPI (1982–84=100)	Air transportation	Line-haul railroads	General freight trucking, long distance	U.S. economy
1990	$47,815	$50,236	$30,092		130.7	$36,584	$38,436	$23,024	
1991	$49,799	$51,947	$30,605	$34,216	136.2	$36,564	$38,140	$22,471	$25,122
1992	$52,084	$52,461	$32,482	$35,922	140.3	$37,123	$37,392	$23,151	$25,603
1993	$53,844	$54,322	$31,746	$37,190	144.5	$37,263	$37,593	$21,970	$25,737
1994	$56,286	$56,256	$32,738	$38,064	148.2	$37,980	$37,959	$22,090	$25,684
1995	$58,485	$58,439	$32,961	$37,877	152.4	$38,376	$38,346	$21,628	$24,854
1996	$59,419	$60,701	$32,358	$38,854	156.9	$37,871	$38,688	$20,623	$24,764
1997	$60,742	$62,259	$34,882	$39,978	160.5	$37,846	$38,791	$21,733	$24,908
1998	$61,350	$64,328	$35,842	$41,101	163.0	$37,638	$39,465	$21,989	$25,215
1999	$62,771	$64,700	$37,196	$42,203	166.6	$37,678	$38,835	$22,326	$25,332
2000	$64,736	$66,782	$38,746	$44,013	172.2	$37,593	$38,782	$22,501	$25,559
2001	$68,350	$69,351	$39,147	$46,072	177.1	$38,594	$39,159	$22,105	$26,015
Percentage change over time									
1990–2001	42.9	38.1	30.1		35.5	5.5	1.9	–4.0	
1991–2001	37.3	33.5	27.9	34.7	30.0	5.6	2.7	–1.6	3.6
1992–2001	31.2	32.2	20.5	28.3	26.2	4.0	4.7	–4.5	1.6
1990–2000	35.4	32.9	28.8		31.8	2.8	0.9	–2.3	
1990–1999	31.3	28.8	23.6		27.5	3.0	1.0	–3.0	
1990–1998	28.3	28.1	19.1		24.7	2.9	2.7	–4.5	

Key: CPI = Consumer Price Index.

Sources: Industry data were obtained from BLS staff (personal communication).

Note: Data for the U.S. economy (all civilian workers) were computed as follows: compensation per hour (BLS website) x 2,080 (hours per year).

Labor compensation in air transportation was significantly higher than the U.S. average over the period of analysis. Over 1991 to 2001, labor compensation in air transportation increased by 37%, while for the U.S. economy, it increased by 35%. Moreover, during 1990 to 2001, labor compensation in air transportation increased by 43% in nominal dollars, while compensation in rail increased by 38%, and in trucking it increased by 30%.

In real terms, one observes a similar phenomenon. Real labor compensation in air transportation outpaced inflation, and it increased faster than the mean compensation for the economy, and in the two other transportation industries.

The air transportation subsector is characterized by volatility, with booms and busts, and labor compensation to some extent can be affected by those cyclical movements. In order to check the robustness of the results, percentage rates of change were calculated with different starting and ending years. The results are shown in the bottom part of table 4. It can be observed in the table that in every case, except one (for the 1992 to 2001 period compared to railroads), labor compensation in air transportation has the highest percentage increase compared to the economy as well as rail and trucking.

Thus, productivity increases in air transportation were accompanied by relatively rapid rises in labor compensation compared with the U.S. economy and the two transportation industries. Labor compensation increases in air transportation would have been affected by a more productive industry. Labor compensation could also have been affected by the existence of labor unions that would attempt to maximize income of their members. This factor is examined below.

The air transportation labor force is characterized by well-entrenched unions in various segments of the industry. All the major airlines have union representation in at least part of their labor force (USGAO 2003). The various labor groups that unions typically represent include pilots, flight

attendants, mechanics, and dispatchers. Sometimes unions represent customer-service agents and clerical workers, aircraft and baggage handling personnel, and flight instructors. Different unions may represent a given employee craft or class at different airlines. The existence of strong labor unions has been described in a recent study related to bankruptcy proceedings of a major airline (United Airlines 2002).

A study by the General Accounting Office points out that although the Railway Labor Act is designed to bring about settlement without unions resorting to strikes, negotiations between the airlines and their unions have sometimes been contentious, and strikes have occurred. Since 1990, negotiations have been marked by nonstrike work actions on the part of unions, such as sickouts and work slowdowns. These actions are designed to place economic pressure on airlines (USGAO 2003, p.1).

In the years since deregulation, the frequency of strikes has declined, but the number of nonstrike work actions has increased. Seventy-five percent of *strikes* occurred prior to 1990. By comparison, all identified *nonstrike work actions*—such as sickouts or refusals to work overtime—and all (six) *presidential interventions* occurred after 1990 (USGAO 2003, p.9). Moreover, the length of time to negotiate airline contracts has increased since deregulation, and particularly since 1990. From 1978 to 1989, the median contract negotiation was 9 months while the median negotiation length from 1990 to 2002 increased to 15 months (USGAO 2003, p.10). Consequently, the activities of strong labor unions in air transportation would have exerted a significant influence in the relatively rapid growth of labor compensation in that industry.

CONCLUSIONS

The paper assesses the benefits of productivity increases in air transportation during the period 1990 to 2001. The choice of this time period is based on the availability of productivity data that are central to the analysis. The benefits of productivity are shown through subsequent impacts on profits, prices, and labor compensation. The evaluation of these three impacts is dependent on productivity data; therefore, the data for assessing those impacts are for the same time period.

The results show that labor and multifactor productivity in the air transportation subsector generally increased since 1990 and up to 2000. Productivity increases are expected to result in higher industry profits. Subsequently, a portion of this benefit may be passed on to consumers/users of the industry's services, in the form of lower prices, and/or to industry employees, in the form of higher labor compensation.

There is an association between productivity and profits in the industry. This applies particularly with regard to labor productivity. The increases in labor and multifactor productivity over the period of analysis tended to be accompanied by increased industry profits, which can subsequently impact prices and labor compensation.

With respect to productivity and prices, it appears that consumers of scheduled passenger services did not obtain that part of the benefit of productivity increases. Prices for consumers/passengers continued to increase (rather than decrease) relatively rapidly over time—while noting the different conclusion provided by ATPI data. On the other hand, commercial users of scheduled air cargo services obtained a portion of the benefit from productivity increases as prices for those services increased relatively slowly or declined.

In explaining why consumers of scheduled passenger services did not benefit from productivity increases while commercial users of freight services did, one may note that in the case of passenger services, it is the consumers (individually) who are dealing with the providers of the service. Prices are affected by the relative bargaining power of the buyer and seller and the degree of competition in the industry. The industry is an oligopoly, which implies a relatively low level of competition. Moreover, mergers/acquisitions and bankruptcies reduced the number of air carriers over time, further lessening the degree of industry competition. On the other hand, businesses that purchase scheduled air cargo services tend to have substantial bargaining power (including repeat business) and a good knowledge of prices. These factors can be used to obtain advantageous prices for freight transportation.

Another finding with respect to price is that prices for domestic air travel are shown to have increased considerably faster, over the period of analysis, than prices of international air travel. The analysis indicates that this was affected by a trend toward decreased competition in the domestic market, a result of mergers and thus fewer larger firms who, according to various studies, put up aggressive responses to the entry of low-cost air carriers. With this situation in the domestic market, and with other things constant in the international market, one could explain the evolution of domestic and international prices. In addition, in open-sky countries, prices for international air travel declined over a period of years during the 1990s.

With regard to productivity and compensation, the analysis indicates that a part of the benefit of the productivity increase in air transportation went to the employees of air carriers, in the form of higher labor compensation. This can be observed in terms of levels and changes over time in compensation. In terms of levels, labor compensation in air transportation was significantly higher than the average for the U.S. economy. In addition, labor compensation—in nominal and real terms—in air transportation increased at relatively high rates during the period of analysis. It increased faster than the U.S. average and in the other transportation subsectors—railroads and trucking. One also notes that the relatively strong degree of unionization in air transportation would have been instrumental in labor obtaining a substantial portion of the benefit of increased productivity.

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APPENDIX TABLE 1 Growth of Multifactor Productivity in Air Transportation
(Annual percentage rates)

	1990–2000	1990–2001	1990–1995	1995–2000	1995–2001
Air transportation	1.9	1.4	2.1	1.7	0.7
U.S. private business sector	1.0	0.8	0.6	1.3	0.9

Source: The data on which these growth rates are based were obtained from the Bureau of Labor Statistics Internet site, section on Productivity, subsection on Multifactor Productivity.

APPENDIX TABLE 2 Spearman Rank Correlation Coefficients

Years	Labor productivity and profits (OAI)	Labor productivity and profits (OST)	Multifactor productivity and profits (OAI)	Multifactor productivity and profits (OST)
1993–2001	0.79 *		0.53	
1994–2001		0.83 *		0.45
1993–2000	0.77 *		0.74 *	
1994–2000		0.78 *		0.61

Key: OAI = Office of Airline Information; OST = Office of the Secretary of Transportation.

Notes: For columns 1 and 3, profit data were obtained from TranStats. For columns 2 and 4, profit data (for Majors) were obtained from *Airline Quarterly Financial Review* (various issues).

* Significant at the 95 percent level. There is a 5% chance of concluding that a positive or negative association exists when in fact it does not.

APPENDIX TABLE 3 Prices In Air Transportation

Year	CPI—U.S. (1982–84=100) (1)	Growth rate—CPI (2)	CPI—airline fare (1982–84=100) (3)	Growth rate—CPI, airline fare (4)	PPI-Air transportation, scheduled passenger—domestic, international (Dec.1989=100) (5)	Growth rate—PPI, scheduled passenger, domestic, international (6)	PPI—Air transportation, scheduled passenger, domestic (Dec.1989=100) (7)	Growth rate—PPI, scheduled passenger, domestic (8)	Scheduled air cargo (Dec.1987=100) (9)	Growth rate—PPI, scheduled air cargo (10)	ATPI, U.S.-origin (11)	ATPI, foreign-origin (12)	ATPI, full scope (13)
1990	130.7		148.4		110.6		111.3		102.0				
1991	136.2	4.2	155.2	4.6	122.4	10.7	125.1	12.4	105.2	3.1			
1992	140.3	3.0	155.2	0.0	114.8	–6.2	115.4	–7.8	107.0	1.7			
1993	144.5	3.0	178.7	15.1	126.8	10.5	131.2	13.7	112.1	4.8			
1994	148.2	2.6	185.5	3.8	130.6	3.0	136.4	4.0	109.5	–2.3			
1995	152.4	2.8	189.7	2.3	137.8	5.5	144.8	6.2	111.2	1.6	100.1	104.5	100.7
1996	156.9	3.0	192.5	1.5	148.1	7.5	160.1	10.6	108.7	–2.2	98.6	98.7	98.4
1997	160.5	2.3	199.2	3.5	153.9	3.9	167.9	4.9	107.3	–1.3	103.9	95.4	102.4
1998	163.0	1.6	205.3	3.1	152.6	–0.8	165.2	–1.6	104.8	–2.3	100.8	84.3	98.1
1999	166.6	2.2	218.8	6.6	161.2	5.6	174.2	5.4	106.9	2.0	101.6	83.5	98.7
2000	172.2	3.4	239.4	9.4	186.5	15.7	208.1	19.5	110.4	3.3	108.7	86.5	105.2
2001	177.1	2.8	239.4	0.0	200.6	7.6	223.8	7.5	112.0	1.5	109.4	84	105.5
Percentage rates of change													
1995-2001	16.2		26.2		45.6		54.6		0.7		9.3	–19.6	4.8

Sources: Data for columns 1 and 2, same as Figures 1 and 2. Data for columns 3 and 5, from BLS website, Consumer Price Index. Data for columns 7, 9, and 11, from BLS website, Producer Price Indexes. Column 5 includes domestic and international travel.

Note: Data for CPI refer to “All Urban Consumers.” Data in column 9 are based on SIC.

Key: CPI = Consumer Price Index, PPI = Producer Price Index.

APPENDIX 4

The example involved the Reno-Minneapolis market. In this case, the major network carrier had previously served that market but had withdrawn from it. However, after a new airline entered the market, the major network carrier responded in several ways. First, it added new service overlaid on the entrant's network. This included three new daily nonstop flights from the same origin (Reno) to three different destinations; these were markets served by the entrant and not previously served by the network carrier. Moreover, the network carrier announced that it would begin a second daily flight from the same origin to one of the three destinations (Seattle). In addition, the network carrier announced that it would offer bonus frequent flier miles for the residents of the city of origin (Reno) on the routes that it offered from that city. It also stated that it would offer special travel agent commission overrides on flights to and from the city of origin.

Two days after the above actions, the network carrier also announced air fares to match the fares of the low-cost entrant on the Reno to Minneapolis route. It had initially announced lower fares than the fares of the entrant. It also announced that its fares for nonstop flights between several cities would be the same as those of the entrant's connecting service via Reno.

The entrant began service from Reno to Minneapolis service on April 1, as originally intended, but by May 20 losses forced it to reduce its service to one flight a day. On June 1, 1993, Reno Air exited the Reno to Minneapolis market. The fares of the network carrier between several cities had dropped sharply in response to the entry of the new small airline into the Reno to Minneapolis market. However, following the exit of the new airline from that market, these fares increased quickly and steadily. In two to three quarters, the fares of the network carrier had increased to a level higher than before the entry of the new entrant. (Source: Oster and Strong, 2001, pp. 9-13)

APPENDIX 5

In 10 of the 12 cases, the new entrant's fare was at least 50 percent lower than the average fare of the incumbent(s) during the quarter preceding entry. In three-fourths of the cases, within two quarters of new entry, the average fare of the incumbent fell by 1/3 or more. The new entrant exited, in half the cases, within eight quarters after entry. In three of the six cases where the entrant exited, average fares then rose to above pre-entry levels; while in the other three markets, average fares increases above the level of the entry period.

With regard to revenue, in five of the six cases in which the new entrant exited from the market, total incumbent revenues were higher eight quarters later, and had increased sufficiently to offset any revenue losses that came from additional low-fare traffic during the period in which the new entrant was in the market. (Source: Cooper, 2001)