EVOLUTION OF US AIR CARGO PRODUCTIVITY

David J. Donatelli. Advised by Dr. Peter Belobaba
EXECUTIVE SUMMARY

This report examines the US air cargo industry since airline deregulation in 1978, beginning with a brief overview of recent trends in the global air cargo industry. A deeper analysis of the US air cargo industry follows, emphasizing the growth of all-cargo carrier traffic in the past 30 years while noting the decline of combination carrier traffic within the past decade. The productivity of US air cargo carriers is explored from 1990 to 2010 through two types of metrics, single-factor productivity (SFP) and multi-factor productivity (MFP).

Integrated cargo carriers FedEx and UPS showed the most consistent trends during the past 30 years. For these two carriers, traffic and capacity grew about 10% per year through the 1990s but capacity outgrew traffic in the mid-2000s. Unit costs, operating expense per available ton mile (ATM), have remained relatively constant, near 60 cents per ATM.

The other all-cargo carriers experienced the largest growth since deregulation, with major increases occurring during the early 1990s and the early 2000s. While the unit costs of FedEx and UPS remained relatively steady, the other all-cargo carriers achieved great reductions in unit costs. Since 1990, their unit costs have nearly halved, decreasing from around 50 cents per ATM to nearly 25 cents per ATM.

Combination carrier cargo traffic increased through the 1990s, with cargo ATMs growing over 7 percent per year and RTMs around five percent per year. This resulted in load factor steadily declining from around 38% in the early 1980s to 30% in 2000. More stringent security measures imposed following the 2001 terrorist attacks in 2001, led combination carriers to reduce both cargo RTMs and ATMs.

Single-factor productivity results show that the US air cargo industry has made significant improvements in labor productivity and capital productivity, with minor improvements in fuel productivity. FedEx and UPS achieved the smallest overall improvements in productivity over the past 20 years, while other all-cargo carriers and combination carriers realized substantial gains.

Multi-factor productivity results are similar to the SFP results. Positive MFP growth occurred during periods of traffic growth in the early 1990s and early 2000s. However, negative growth occurred in the late 1990s, when labor productivity decreased, and in the
mid-2000s when fuel prices rose dramatically. Over the past 20 years, FedEx and UPS improved MFP 18%, while combination carriers became approximately twice as productive.
The Air Cargo Industry

Two distinct categories of airlines operate in the air cargo industry, combination carriers and all-cargo carriers. For this report, the definition of a combination carrier includes any airline that carries cargo and passengers, in any configuration. Some combination carriers also have freight-only aircraft in their fleets. The classification of all-cargo carriers includes dedicated freight carriers – airlines that operate only freight aircraft with no scheduled passenger service – and integrated freight carriers. An integrated freight company, or integrator, combines all operations of freight shipping into one business, including road carriage, freight forwarding and air transport. Two major US integrated freight companies, FedEx and UPS, dominate the US all-cargo industry, and are examined separately in the productivity comparisons.

Recent Global Air Cargo Trends

Recent trends in global air cargo are explored in this section by analyzing revenue ton-kilometers (RTKs), available ton-kilometers (ATKs), and average load factor (LF). Load factor is the proportion of available payload (weight) carried, calculated by dividing RTKs by ATKs. Figure 1 shows the trends in global air cargo during the past decade, including RTKs carried and LF. RTKs increased by over 40% from 2001 to 2007, and the more rapid growth of RTKs relative to capacity led to increasing load factors. The financial crisis and economic recession of 2008-09 had a short-term negative impact on both cargo carried and load factors.
The top 20 world air cargo carriers ranked by RTKs in 2010, shown in Figure 2, appear to be divided into three tiers. The top tier contains the largest integrated freight companies, FedEx and UPS. The second tier consists of established carriers, with representation from large combination carriers, such as Cathay Pacific, Lufthansa, Air France-KLM, and Emirates. The third tier of carriers represents a mix of growing air cargo carriers and combination carriers whose cargo operations may be waning.

Source: *Airline Business*
Table 1 details the five fastest growing and five slowest growing carriers among the top 20, in terms of RTK growth since 2002. Qatar Airways led all carriers, growing 1564% since 2002, although from a very low base of RTKs in 2002. In absolute terms, Qatar Airways rose from the 69th largest cargo carrying airline in 2002 to 17th largest in 2010. The fastest growing cargo carriers are all from either the Middle East (Qatar Airways, and Emirates) or East Asia (China Eastern Airlines, China Southern Airlines, and Air China).

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<th>Rank</th>
<th>Carrier</th>
<th>% Growth since 2002</th>
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<tr>
<td>1</td>
<td>Qatar Airways</td>
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<tr>
<td>2</td>
<td>China Eastern Airlines</td>
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<td>3</td>
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US All-Cargo Carrier Trends

Due to data irregularities for the period immediately following deregulation of the airline industry in 1978, we analyzed US air cargo traffic figures for the period from 1983-2010. Detailed financial data were not available until 1990, therefore, financial analyses in this report are limited to the period from 1990-2010. Data were collected for the top 11 US all-cargo carriers and the top seven US combination carriers, accounting for approximately 90% of the reported US air cargo traffic.

In the mid-1980s, combination carriers carried a greater percentage of cargo RTMs than the all-cargo carriers, approximately a 60%-40% split. Since then, the percentage of RTMs carried by all-cargo carriers has grown consistently, with all-cargo carriers handling nearly 80% of RTMs by 2010. This shift can in large part be explained by the emergence of dominant integrated freight companies, such as FedEx and UPS.

The 11 selected US all-cargo carriers account for nearly 92% of the cargo traffic carried by US all-cargo carriers from 1983 to 2010. Figure 3 summarizes the evolution of carriers since 1983. The entrances and exits of some carriers contributed to unusual spikes in the data, and so throughout the rest of this report, gray boxes on graphs indicate questionable results.

The analysis summarized in this report separated FedEx and UPS from the other nine all-cargo carriers because of distinct differences in operations. FedEx and UPS operate vertically integrated business models that require strict service schedules and consolidated cargo services, whereas the other all-cargo carriers tend to operate based on flexible chartered services. These two carriers combined for between 60%-91% of the total US all-cargo RTMs between 1983 and 2010. Figure 4 shows the trend in RTMs and ATMs for FedEx and UPS. Strong traffic growth during the 1980s slowed in the early 1990s because of the oil price shock and subsequent mini-recession. Load factor dropped to 56% before almost a decade of substantial growth.

This growth started slowing in 1998, when ATMs grew only 6.8% from 1998 to 2000. RTMs, however, grew more than 14% during this period, causing a 4 percent increase in load factor. In 2001, RTMs dropped in response to the declining economy of the US and to the terror attacks of September 11. RTMs recovered strongly, exceeding pre-2001 levels the very next year, growing 28% over the next five years. ATM growth slowed in the early 2000s, and, subsequently, load factor rebounded, peaking at 64% in 2004.
During the next four years, 2004–2008, load factor declined as ATMs grew faster than RTMs. When the economic recession occurred in the US in 2008-2009, ATMs decreased 7.5% and RTMs decreased 8 percent. However, traffic and load factors rebounded in 2010, with ATMs reaching pre-2008 levels and RTMs reaching all-time highs.

Traffic figures for the other nine all-cargo carriers are provided in Figure 5. Both ATMs and RTMs increased more than 300% from 1983 to 1989 for the other all-cargo carriers. When the mini-recession occurred in 1990, ATMs decreased faster than RTMs, which caused load factor to increase 2% that year. This increase in load factor marked the beginning of a prosperous period of traffic growth from 1990 to 1997. In the late 1990s, growth stalled, and ATMs steadied near 6 billion ton-miles and RTMs leveled off near 4 billion ton-miles.
The stalled traffic growth persisted through 2001 but growth picked up in 2002, and traffic more than doubled over the next four years. Load factor dropped 5 percent during this same time period, however, because capacity grew faster than traffic. The gray box in Figure 5 indicates the specific data range that is questionable due to entry and exit of major industry players.

Capacity remained around 15 billion ton-miles from 2006 to 2008, but traffic began decreasing, which resulted in a declining load factor leading into the 2008-2009 economic recession. In 2009, RTMs bottomed out at 6.9 billion ton-miles, 33% below the peak RTMs in 2005. Removing some excess capacity from the system slowed the decline in load factor, which bottomed out just below 58% in 2009. More recently, RTMs have grown and surpassed 2008 levels, while ATMs have not grown quite as fast, resulting in load factor increases.

**US Combination Carrier Traffic Trends**

Data were gathered for seven US network legacy carriers (NLCs) to represent the US combination carrier cargo industry: American, Alaska, Continental, Delta, Hawaiian, Northwest, and United. Pan American World Airways data are included until 1991, when the airline declared bankruptcy and was acquired by Delta. These carriers were selected based on two criteria: cargo revenues exceeded two percent of total operating revenues, and cargo RTMs constituted over 10% of total RTMs (cargo plus passenger). They account for approximately
90% of the total cargo traffic carried by US combination carriers from 1983-2010.

Cargo traffic figures for US combination carriers since 1983 are displayed in Figure 6. The RTM and ATM data presented have been adjusted to remove a standardized weight per passenger that airlines include in data reported to the US Bureau of Transportation Statistics (BTS) (approximately 0.1 tons/passenger)\(^1\). Cargo traffic carried by combination carriers experienced significant growth from 1983 to 1990, with ATMs doubling and RTMs growing approximately 70% during that time span. As a result of ATMs growing faster than RTMs, load factor decreased from about 39% to 32%. ATM growth continued to grow faster than 7 percent through the 1990s, while RTM growth slowed to just greater than 5 percent per year, causing load factor to decrease further.

The economic recession following the September 11 terror attacks caused a decline in RTM and ATM, and subsequently a sharp drop in load factor. Increased security measures contributed to a major decrease in RTMs and load factor during the 2000s, as most US combination carriers began reducing their cargo operations due to the increased security costs.

![Figure 6. US Combination Carrier Cargo Traffic and Capacity](image)

### 2 Operating Cost Trends

Data used in this study were gathered from the BTS. The traffic data consists of available-ton-miles (ATMs), revenue-ton-miles (RTMs), block hours, and aircraft-days. Freight and mail RTMs represent the cargo RTMs transported by airlines. Reported ATMs

\(^1\) A method is explained in Section 2 for calculating cargo-only statistics for combination carriers
include passenger weight for combination carriers, which must be removed so that only cargo capacity is analyzed. When airlines report ATM data to the BTS, they account for passengers and baggage using a representative weight, typically 180-200 pounds per passenger, for available seats. For this study, the upper range value, 200 pounds per passenger, was used to approximate cargo ATMs from the reported ATMs.

The BTS financial data include total operating expenses, depreciation costs, amortization costs, and aircraft rental costs for US air carriers. All costs were adjusted to 2010 dollars using the US Consumer Price Index. Furthermore, the operating expenses reported for combination carriers were adjusted to account for only the expenses related to cargo operations. We employed the proportional profit-cost allocation method (Morrell, 232), in which the percentage of total operating expenses allocated to cargo operations is assumed to be equal to the percentage of total revenue that cargo operations produce. This modification is based on cargo revenues relative to total revenues, meaning that the size of an airline’s cargo business directly affects the operating expenses used in this analysis. In other words, decreasing costs may result from a decreasing cargo business for combination carriers, rather than improved cost efficiencies.

Similarly, the fuel data reported for combination carriers include fuel consumed to transport both passengers and cargo. Therefore, fuel consumption and fuel cost data for combination carriers were weighted by the proportion of cargo carried by each combination carrier to estimate the fuel consumption and fuel cost attributable to cargo operations.

Finally, labor statistics are reported in BTS Form 41 according to specific categories, such as general managers, pilots, passenger handling, cargo handling, administrative, etc. The BTS database also contains an aggregate full-time employee equivalent (FTE) statistic reported by each airline. The FTE statistic is used for all-cargo carriers because every employee contributes in some way to producing cargo-related outputs. However, this study includes only the cargo-handling employees for the analysis of combination carriers because it is unclear how all other employees contribute to the cargo operations. It is understood that labor productivity will appear extraordinarily high for combination carriers because the labor force used for the analysis, cargo-handling employees, excludes many employees who contribute and produce cargo output.

**All-Cargo Carrier Operating Cost Trends**
Since 1990, competition has driven down unit operating expenses per ATM, even while fuel prices have reached all-time highs. Operating expense (OPEX) is divided into four common categories for US airlines in this report – fuel, labor, ownership, and intermediate. Fuel expenses are straightforward and include the total cost of fuel required to operate an airline’s fleet. Labor costs include total salaries, benefits, and other costs paid by airlines to employees. Ownership costs consist of depreciation and amortization costs associated with aircraft ownership, and aircraft rental costs. The intermediate expense category represents all other costs incurred by the airline, such as maintenance, advertising, insurance, airport fees, etc.

Figure 7 displays the evolution of unit costs, OPEX per ATM, for FedEx and UPS from 1990 to 2010, adjusted to 2010 dollars. As shown, unit costs for these integrated cargo carriers have remained near 60 cents per ATM for the past 20 years, decreasing only four cents per ATM, from 62 to 58 cents per ATM.

Although total unit costs did not change much for FedEx and UPS over the past 20 years, there were significant changes in the relative shares of unit costs. Fuel expense as a percentage of total OPEX increased from 17% in 1990 to 23% of total OPEX in 2010; most of this increase occurred in the mid-2000s as the price of fuel reached all-time highs. During the same time span, intermediate expenses grew 4 percent, while labor expenses and ownership costs have decreased 3 percent and 7 percent, respectively.

The other all-cargo carriers experienced different unit cost trends than FedEx and UPS.
Figure 8 shows that unit costs for the other all-cargo carriers neared 50 cents per ATM in the early 1990s, but decreased almost 40% to 32 cents per ATM by 2000. This reduction in unit costs was caused primarily by introducing new capacity; larger planes with larger cargo holds and longer flights (stage lengths) spread fixed costs over increased capacity and decreased unit costs. Unit costs reached a low of 18 cents per ATM in 2004, before rising fuel prices and capacity cuts increased unit costs to 33 cents per ATM in 2008. In 1990, fuel expense represented approximately 14% of total OPEX, whereas fuel expense constituted 36% of total OPEX in 2010.

**Figure 8. Other All-Cargo Carrier Unit Costs**

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**Combination Carrier Cargo Operating Cost Trends**

Total operating expenses reported in this section for combination carriers represent only the cargo-related expenses for each category. Figure 9 shows the trend of US combination carriers’ cargo-related unit costs from 1990 to 2010 separated into the four OPEX categories. Unit costs have decreased 60% in the past 20 years from 14 cents per cargo ATM in 1990 to 5.6 cents per cargo ATM in 2010. Labor expense cuts and decreasing intermediate costs were the drivers of this unit cost reduction. Fuel unit costs decreased until the mid-2000s when fuel expenses soared. In 2008, fuel unit costs peaked at 3.4 cents per cargo ATM, but dropped to 1.8 cents per cargo ATM in 2010.

In 2010, fuel expense as a percentage of total OPEX represented 33% of total OPEX, whereas fuel expense was 20% of total OPEX in 1990. On the other hand, labor expenses
decreased from 37% to 34%, intermediate expenses decreased from 35% to 27%, and ownership expenses decreased from 8 percent to 6 percent.

It is worth noting that some of the decrease in unit costs resulted from combination carriers reducing their cargo operations. Ultimately, while combination carriers have improved cost efficiencies, especially through renegotiating labor contracts and reducing intermediate and ownership costs, part of the apparent cargo OPEX cost reduction over the past 20 years results from an overall decrease in cargo operations by these combination carriers.

![Figure 9. Combination Carrier Cargo-Related Unit Costs](image)

3 **US Air Cargo Carrier Productivity**

This report explored two types of productivity metrics, single-factor and multi-factor. The single-factor productivity metrics compare the output of the US air cargo industry, RTMs or ATMs, with a single input measure such as the amount of fuel consumed, or the size of the workforce.

We examined four measures of single-factor productivity (SFP): aggregate, labor, fuel, and aircraft (capital). Note that all values used for combination carriers include only the cargo-related values. Aggregate productivity provides an overall sense of the airlines’ ability to transform operating expenses into outputs. Labor productivity measures how effective a carrier is at producing outputs from the labor inputs. The fuel productivity metrics assess carriers’ efficient use of fuel resources, and the aircraft productivity metric measures how efficiently a
carrier utilizes its capital assets (aircraft).

This study also employed the basic growth-accounting method to examine multi-factor productivity (MFP) in the US air cargo industry, which compares the combination of several inputs to the change in a single output. Two approaches were used to calculate the growth of MFP, year-on-year and cumulative since 1991.

**Single-Factor Productivity Metrics**

Figures 10 and 11 show the trends of aggregate productivity for FedEx/UPS and the other all-cargo carriers, respectively, over the past two decades for two output values, RTMs and ATMs. The input quantity, total operating expense (OPEX) excluding transport related expense, is shown in 2010 dollars.

Aggregate productivity for FedEx and UPS has remained relatively constant since 1990, with a minor decrease occurring during the mid-2000s as fuel costs and total OPEX increased. ATM aggregate productivity for FedEx and UPS has remained around 1.7 ton-miles per dollar of OPEX, achieving only a 6% growth during the past 20 years. Similarly, RTM aggregate productivity has hovered around 1.0 ton-mile per dollar, with an 11% growth over the past 20 years. This relatively small increase in aggregate productivity for FedEx and UPS results from operating expenses increasing proportionally to increases in traffic, ATMs and RTMs, over the past 20 years.
In contrast, the other all-cargo carriers have experienced a different aggregate productivity trend, as shown in Figure 11. Aggregate productivity for the other all-cargo carriers saw rapid growth through the first half of the 1990s before steadying in the late 1990s with ATM productivity near 3.5 ton-miles per OPEX and RTM productivity near 2.25 ton-miles per dollar of OPEX. With the rise in fuel prices after 2005 and the economic downturn in 2008, aggregate productivity declined back to levels near the start of the 2000s. Questionable data were reported in the early and mid-2000s during the entry and exit of several carriers; a gray box in Figure 11 identifies these unusual results.

The typical measure of aircraft productivity used in the airline industry is aircraft utilization, defined in terms of block hours per day. Aircraft utilization for FedEx and UPS has remained relatively constant for the past 20 years, hovering between 3 and 3.5 hours per day per aircraft. The other all-cargo carriers have seen a more cyclical trend in aircraft utilization from 1991 to 2010. One peak occurred in the early 1990s as a result of booming cargo traffic following the mini-recession in 1990. The second peak occurred in 2002, but questionable data reporting by all-cargo carriers raises uncertainty about the validity of this spike in aircraft utilization. Since 2005, the other all-cargo carriers’ aircraft utilization has hovered just below 6 hours per day, 2.5 hours per day more than FedEx and UPS.

This disparity in aircraft utilization results from operational differences. FedEx and UPS operate many short-haul flights to and from their hubs to sort and consolidate cargo, which results in fewer flights per day and low fleet-average utilization. On the other hand, the other carriers tend to operate more long-haul flights with less consolidated cargo, which increases flight stage length and improves aircraft utilization.
The metric used for the fuel productivity analysis compares either ATM or RTM, with the amount of fuel consumed by the aircraft used to generate the output. Figure 12 shows the trends of the fuel consumption productivity metric for FedEx and UPS, along with the amount of fuel consumed during each year. Fuel consumption for FedEx/UPS more than doubled over the past two decades. However, even with significant growth in total fuel consumption, fuel consumption productivity grew during the past 19 years because traffic figures, ATMs and RTMs, grew faster than fuel consumption. ATM fuel consumption productivity grew 25% from 1991 to 2010, while RTM fuel consumption productivity increased 35% during the same time period.

Fuel consumption productivity for the other all-cargo carriers experienced mostly growth during the past 19 years. ATM fuel consumption productivity grew from 9.6 ton-miles per gallon in 1991 to 16.6 ton-miles per gallon in 2010, a 73% growth over 19 years. RTM fuel consumption productivity grew from 5.5 ton-miles per gallon in 1991 to 10.5 ton-miles per gallon in 2010, a 90% growth over 19 years.
Labor productivity was explored using a metric that compares the output, ATM or RTM, to the total full-time equivalent employees (FTEs). Figure 13 shows the labor productivity trends and the trends of FTE employees from 1990 to 2010 for FedEx/UPS. For FedEx/UPS, labor productivity growth was slow during the 1990s, but accelerated in the 2000s with greater use of automated systems for cargo processing, which reduced total FTEs and security clearance delay times. Since 1990, FedEx/UPS experienced growth of 80% in ATM labor productivity and 88% in RTM labor productivity, a majority of which has occurred in the past decade.

The other all-cargo carriers have experienced cyclical labor productivity growth. Over the past 20 years, the other all-cargo carriers experienced an apparent 316% growth in ATM labor productivity and a 358% growth in RTM labor productivity, although the data are questionable for the reasons noted earlier. It is also worth noting that the other all-cargo carriers appear approximately 10 times more productive than FedEx/UPS. One reason for this discrepancy is that the labor statistics provided in BTS Form 41 include all of the ground-handling employees for FedEx/UPS, which would significantly increase the total FTEs and reduce this labor productivity metric.
Focusing on combination carriers’ cargo productivity, Figure 14 shows the trends of aggregate productivity and estimated cargo OPEX from 1990 to 2010. Over this time period, ATM aggregate productivity increased 153%, with a small drop caused by extremely high fuel prices and the 2008 US economic recession. On the other hand, RTM aggregate productivity increased during the 1990s, but decreased slightly throughout the 2000s, growing only 88% over the past 20 years. The decrease in RTM aggregate productivity over the past 10 years is attributed to new security regulations after the September 11th terrorist attacks that require intensive cargo screening on passenger flights. Many combination carriers decided that this extra effort did not justify maintaining full cargo operations, and, as a result, RTM aggregate productivity declined.
Figure 15 shows the evolution of combination carrier aircraft productivity and the trend of aircraft-days from 1990 to 2010. The aircraft productivity trends closely follow the aggregate productivity trends described above. Cargo ATM aircraft productivity rose 60% over the past 20 years, but the economic recession and high fuel prices during the mid-2000s caused a reduction in cargo traffic and stalled aircraft productivity growth. RTM aircraft productivity increased during the 1990s but leveled off during the 2000s; a net 20% growth was realized over the past 20 years. As discussed above, the decline in RTM productivity (relative to ATM productivity) during the 2000s represents the industry shift to limit cargo operations by combination carriers.
Figure 15. Combination Carrier Aircraft Productivity

![Graph showing Combination Carrier Aircraft Productivity](image)

Figure 16 shows the trends of the fuel consumption productivity metric, as well as the evolution of total gallons of fuel consumed per year. The combination of decreased capacity as airlines shifted away from cargo operations and improved engine technology, coupled with improvements in capacity management, fleet scheduling and planning, resulted in an overall decrease of consumed fuel over the past 20 years. As a result, ATM fuel consumption productivity has increased 108%, and RTM fuel consumption productivity experienced a 59% increase.

Figure 16. Combination Carrier Fuel Consumption Productivity

![Graph showing Combination Carrier Fuel Consumption Productivity](image)
Figure 17 displays the trends of combination carrier labor productivity and the number of cargo-related FTEs from 1990 to 2010. Over the past 20 years, cargo-related FTEs decreased approximately 61%. As a result, ATM and RTM productivity increased 316% and 208%, respectively, over the past 20 years. The lagging growth of RTM productivity is once again explained by combination carriers’ reduction of cargo traffic in the 2000s.

![Combination Carrier Cargo Employee Productivity](image)

**Figure 67. Combination Carrier Cargo Employee Productivity**

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<th>Year</th>
<th>Cargo FTEs</th>
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<th>RTM</th>
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**Multi-Factor Productivity Metrics**

Figure 18 shows the cumulative MFP results for FedEx/UPS from 1992 to 2010 for ATM and RTM output. MFP productivity has grown 16.5% for RTM output and 14% for ATM output since 1992. MFP growth increased quickly in the early 1990s, but rising labor costs and slowing traffic growth contributed to decreasing cumulative MFP growth during the late 1990s. Strong growth emerged in the early 2000s as capacity and traffic recovered from the economic recession and terror attacks, but MFP growth slowed in the late 2000s during the fuel price hike and the 2008 economic recession.
Annual MFP for the other all-cargo carriers experienced a mixed record of positive and negative MFP growth. However, the results are not included here because of data issues: the entry and exit of several carriers in the early 1990s and the early 2000s caused unreasonable spikes in the data, as mentioned previously.

Finally, Figure 19 shows the cumulative MFP growth for combination carriers. As labor productivity decreased in the late 1990s, cumulative MFP growth stalled, hovering around 30% until the early 2000s. However, as labor productivity increased in the early 2000s, ATM and RTM cumulative MFP increased. Reduced cargo operations and rising fuel costs cause MFP growth to stall from 2004 to 2008. But, labor productivity and RTM increases in 2009 and 2010 contributed to the surge in our calculations of cumulative MFP growth realized during 2009 and 2010 for combination carriers. Since 1992, ATM cumulative MFP increased 108% and RTM cumulative MFP increased 86%.
4 Conclusions

The US air cargo industry has grown significantly in the past 30 years, responding to internal and external changes such as multiple economic recessions, the terrorist attacks of 9/11, and historic increases in fuel prices. This report examined how these events have shaped the US air cargo industry. Furthermore, this report discussed the evolution of productivity metrics for US cargo airlines over the past 20 years.

FedEx and UPS showed the most consistent trends during the past 30 years, in terms of traffic and capacity, and OPEX. For these two carriers, traffic and capacity grew about 10% per year through the 1990s but capacity outgrew traffic in the mid-2000s, resulting in a decreasing load factor leading into the 2008 economic recession. Unit costs, OPEX per ATM, have remained relatively constant, near 60 cents per ATM for the past 20 years. However, as fuel prices increased in the past decade, the fuel proportion of OPEX increased from 17% to 23% while labor and capital proportions decreased 3 percent and 7 percent, respectively.

The other all-cargo carriers experienced the largest growth over the past 30 years, with major increases occurring during the early 1990s and the early 2000s; however the entry and exit of several carriers caused significant shifts in the reported data, distorting the apparent growth trends in the 2000s. While the unit costs of FedEx and UPS remained relatively steady, the other all-cargo carriers achieved great reductions in unit costs during the past 20 years. Since
1990, their unit costs have nearly halved, decreasing from around 50 cents per ATM to nearly 25 cents per ATM, as a result of increasing system-wide capacity with larger planes and longer stage flights to spread out fixed costs.

Combination carrier cargo traffic increased through the 1990s, with cargo ATMs growing over 7 percent per year and RTMs around five percent per year. This resulted in load factor steadily declining from around 38% in the early 1980s to 30% in 2000. Following the terrorist attacks in 2001, both RTMs and ATMs decreased over the rest of the decade.

This report analyzed four different single-factor productivity metrics: aggregate productivity, aircraft productivity, fuel productivity, and labor productivity. Additionally, a multi-factor productivity metric was used to examine the effectiveness of airlines in transforming the combination of inputs (fuel, capital, and labor) into outputs, ATMs and RTMs.

Single-factor productivity results show that the US air cargo industry has made significant improvements in labor productivity and capital productivity, with minor improvements in fuel productivity. FedEx and UPS achieved the smallest overall improvements in productivity over the past 20 years, while other all-cargo carriers and combination carriers realized substantial gains. These improvements were achieved by adopting automated systems for cargo load management and introducing more fuel efficient aircraft.

Multi-factor productivity results are similar to the SFP results. Positive MFP growth occurred during periods of traffic growth in the early 1990s and early 2000s. However, negative growth occurred in the late 1990s, when labor productivity decreased, and in the mid-2000s when fuel prices rose dramatically. Over the past 20 years, FedEx and UPS improved MFP 18%, while combination carriers became approximately twice as productive.
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