

# THE GLOBAL AIRLINE INDUSTRY

**Second Edition**

Edited by

**Peter Belobaba**

*Department of Aeronautics & Astronautics, MIT, USA*

**Amedeo Odoni**

*Departments of Aeronautics & Astronautics and Civil & Environmental Engineering,  
MIT, USA*

**Cynthia Barnhart**

*Department of Civil & Environmental Engineering, MIT, USA*

**WILEY**

# Contents

Notes on Contributors	xiii
List of Contributors	xix
Series Preface	xxi
Acknowledgments	xxiii
<b>1 Introduction and Overview</b>	<b>1</b>
<i>Peter P. Belobaba</i>	
1.1 Introduction: The Global Airline Industry	1
1.1.1 <i>Deregulation and Liberalization Worldwide</i>	4
1.1.2 <i>Industry Evolution Since 2000</i>	6
1.2 Overview of Chapters	13
References	17
<b>2 The International Institutional and Regulatory Environment</b>	<b>19</b>
<i>Amedeo R. Odoni</i>	
2.1 Introduction	19
2.2 Background on the International Regulatory Environment	20
2.2.1 <i>The Chicago Convention</i>	20
2.2.2 <i>Freedoms of the Air</i>	21
2.3 Airline Privatization and International Economic Regulation	24
2.3.1 <i>Airline Privatization</i>	24
2.3.2 <i>Types and Critical Aspects of Air Service Agreements</i>	25
2.3.3 <i>Typical Content of Bilateral and Multilateral ASAs</i>	26
2.3.4 <i>The Unified EU Market and Other Major Developments</i>	29
2.3.5 <i>The Role of Airline Alliances</i>	32
2.4 Airports	33
2.4.1 <i>Restrictions on Airport Access</i>	33
2.4.2 <i>Airport Ownership and Management</i>	36
2.5 Air Traffic Management	39
2.6 Key Organizations and Their Roles	41
2.6.1 <i>International Organizations</i>	41
2.6.2 <i>Organizations in the United States</i>	43

2.7	Summary and Conclusions	45
	References	46
<b>3</b>	<b>Overview of Airline Economics, Markets and Demand</b>	<b>47</b>
	<i>Peter P. Belobaba</i>	
3.1	Airline Terminology and Definitions	47
3.1.1	<i>Basic Airline Profit Equation</i>	49
3.2	Air Transportation Markets	51
3.2.1	<i>Typical Air Passenger Trip</i>	51
3.2.2	<i>Spatial Definitions of Airline Markets</i>	52
3.3	Origin–Destination Market Demand	55
3.3.1	<i>Dichotomy of Airline Demand and Supply</i>	55
3.3.2	<i>Factors Affecting Volume of O–D Demand</i>	57
3.3.3	<i>Quality of Service Factors</i>	57
3.3.4	<i>Total Trip Time and Frequency</i>	58
3.4	Air Travel Demand Models	60
3.4.1	<i>Elasticity of Air Travel Demand</i>	60
3.4.2	<i>Air Travel Demand Segments</i>	62
3.4.3	<i>O–D Market Demand Functions</i>	64
3.5	Airline Competition and Market Share	67
3.5.1	<i>Market Share/Frequency Share Model</i>	67
3.5.2	<i>“S-Curve” Model Formulation</i>	69
3.5.3	<i>Quality of Service Index (QSI) Models</i>	70
3.6	Summary	71
	References	72
<b>4</b>	<b>Airline Pricing Theory and Practice</b>	<b>75</b>
	<i>Peter P. Belobaba</i>	
4.1	Airline Prices and O-D Markets	75
4.1.1	<i>Regulated versus Liberalized Pricing</i>	76
4.1.2	<i>Theoretical Pricing Strategies</i>	77
4.1.3	<i>Price Discrimination versus Product Differentiation</i>	79
4.2	Differential Pricing	79
4.2.1	<i>Market Segmentation</i>	81
4.2.2	<i>Fare Product Restrictions</i>	82
4.2.3	<i>Airline Fare Structures</i>	83
4.3	Recent Trends in Airline Pricing	89
4.3.1	<i>Branded Fare Families</i>	90
4.3.2	<i>Unbundling and Ancillary Revenues</i>	91
4.4	Airline Pricing Strategies	93
4.4.1	<i>Factors Affecting Fare Structure in an O-D Market</i>	93
4.4.2	<i>Competitive Fare Matching</i>	96
	References	98

<b>5</b>	<b>Airline Revenue Management</b>	<b>99</b>
	<i>Peter P. Belobaba</i>	
5.1	Computerized Revenue Management Systems	101
5.2	Flight Overbooking	103
5.3	EMSR Model for Flight Leg Revenue Optimization	108
5.4	Network Revenue Management	112
	5.4.1 <i>O-D Control Mechanisms</i>	113
	5.4.2 <i>Network RM Optimization Models</i>	118
	5.4.3 <i>Revenue Benefits of O-D Control</i>	120
5.5	Revenue Management for Less Restricted Fare Structures	121
	5.5.1 <i>Demand Forecasting by Willingness to Pay</i>	122
	5.5.2 <i>Marginal Revenue Optimization: Fare Adjustment Theory</i>	123
	References	125
<b>6</b>	<b>Airline Operating Costs and Measures of Productivity</b>	<b>127</b>
	<i>Peter P. Belobaba</i>	
6.1	Airline Cost Categorization	127
	6.1.1 <i>Administrative versus Functional Cost Categories</i>	128
	6.1.2 <i>Cost Drivers by Functional Category</i>	132
6.2	Operating Expense Comparisons	133
	6.2.1 <i>Percentage Breakdown of Operating Expenses</i>	133
	6.2.2 <i>Aircraft Operating Cost Comparisons</i>	134
	6.2.3 <i>Low-Cost Carriers</i>	140
6.3	Comparisons of Airline Unit Costs	145
	6.3.1 <i>Total Operating Costs versus Unit Costs</i>	145
	6.3.2 <i>Legacy versus Low-Cost Carrier Unit Costs</i>	148
6.4	Measures of Airline Productivity	153
	6.4.1 <i>Aircraft Productivity</i>	153
	6.4.2 <i>Labor Productivity</i>	156
	References	158
<b>7</b>	<b>The Airline Planning Process</b>	<b>159</b>
	<i>Peter P. Belobaba</i>	
7.1	Fleet Planning	160
	7.1.1 <i>Airline Fleet Decisions</i>	161
	7.1.2 <i>Fleet Planning Methods</i>	166
7.2	Route Planning	170
	7.2.1 <i>Hub Economics and Network Structure</i>	170
	7.2.2 <i>Route Planning and Evaluation</i>	175
7.3	Airline Schedule Development	180
	7.3.1 <i>Frequency Planning</i>	181
	7.3.2 <i>Timetable Development</i>	182
	7.3.3 <i>Fleet Assignment and Aircraft Rotations</i>	185
7.4	The Future: Integrated Airline Planning	186
	References	187

<b>8</b>	<b>Airline Schedule Optimization</b>	<b>189</b>
	<i>Cynthia Barnhart and Vikrant Vaze</i>	
8.1	Schedule Optimization Problems	190
8.2	Fleet Assignment	191
	8.2.1 <i>The Fleet Assignment Model</i>	195
	8.2.2 <i>Fleet Assignment Solutions/Impacts</i>	198
	8.2.3 <i>Extending Basic Fleet Assignment Models</i>	198
8.3	Schedule Design Optimization	203
	8.3.1 <i>Modeling the Optimization of Flight Retiming and Fleet Assignment Problems</i>	206
	8.3.2 <i>Importance of Modeling Competition in Schedule Design</i>	207
8.4	Crew Scheduling	209
	8.4.1 <i>The Crew Pairing Problem</i>	210
	8.4.2 <i>Crew Scheduling Problem Solutions and Impacts</i>	215
8.5	Aircraft Maintenance Routing and Crew Pairing Optimization	215
	8.5.1 <i>Modeling and Solving the Extended Crew Pairing Problem</i>	217
	8.5.2 <i>Modeling and Solving the Restricted Aircraft Maintenance Routing Problem Based on the Solution to the Extended Crew Pairing Problem</i>	218
8.6	Future Directions for Schedule Optimization	219
	References	221
<b>9</b>	<b>Airline Flight Operations</b>	<b>223</b>
	<i>Alan H. Midkiff, R. John Hansman, Jr., and Tom G. Reynolds</i>	
9.1	Introduction	223
9.2	Regulation and Scheduling	224
	9.2.1 <i>General Regulatory Requirements</i>	224
	9.2.2 <i>Flight Crew Regulation and Training</i>	224
	9.2.3 <i>Flight Crew Scheduling</i>	226
9.3	Flight Crew Activities during a Typical Flight	227
	9.3.1 <i>Flight Crew Sign-In</i>	228
	9.3.2 <i>Operations/Planning</i>	228
	9.3.3 <i>Preflight</i>	233
	9.3.4 <i>Predeparture</i>	240
	9.3.5 <i>Gate Departure</i>	242
	9.3.6 <i>Taxi-Out</i>	243
	9.3.7 <i>Takeoff</i>	244
	9.3.8 <i>Terminal Area Departure</i>	245
	9.3.9 <i>Climb</i>	246
	9.3.10 <i>Cruise</i>	247
	9.3.11 <i>Descent</i>	250
	9.3.12 <i>Terminal Area Arrival</i>	253
	9.3.13 <i>Final Approach</i>	254
	9.3.14 <i>Landing and Rollout</i>	256
	9.3.15 <i>Taxi-In</i>	257

	9.3.16 <i>Parking</i>	258
	9.3.17 <i>Postflight</i>	259
9.4	<b>Summary</b>	259
	<b>List of Abbreviations</b>	260
	<b>References</b>	262
<b>10</b>	<b>Irregular Operations: Schedule Recovery and Robustness</b>	<b>263</b>
	<i>Cynthia Barnhart and Vikrant Vaze</i>	
10.1	Introduction	263
10.2	Irregular Operations	264
	10.2.1 <i>Managing Irregular Operations: Airline Operations Control Centers</i>	266
	10.2.2 <i>Options for Schedule Recovery from Irregular Operations</i>	267
	10.2.3 <i>Schedule Recovery from Irregular Operations: Objectives and Process</i>	269
	10.2.4 <i>Evaluating the Costs of Recovery Options: The Challenges Imparted by Uncertainty and Downstream Effects</i>	278
10.3	Robust Airline Scheduling	279
	10.3.1 <i>Robust Schedule Design</i>	280
	10.3.2 <i>Robust Fleet Assignment</i>	281
	10.3.3 <i>Robust Aircraft Routing</i>	281
	10.3.4 <i>Robust Crew Scheduling</i>	283
10.4	Directions for Ongoing and Future Work on Schedule Recovery from Irregular Operations	284
	References	285
<b>11</b>	<b>Labor Relations and Human Resource Management in the Airline Industry</b>	<b>287</b>
	<i>Jody Hoffer Gittell, Andrew von Nordenflycht, Thomas A. Kochan, Greg J. Bamber, and Robert B. McKersie</i>	
11.1	Alternative Strategies for the Employment Relationship	288
11.2	Labor Relations in the US Airline Industry	289
	11.2.1 <i>Regulatory Framework for US Labor Relations</i>	291
	11.2.2 <i>US Airline Responses to Cost Pressures Postderegulation</i>	293
	11.2.3 <i>US Labor Relations Post-September 11, 2001</i>	299
11.3	Labor Relations in the Airline Industry in Other Countries	302
	11.3.1 <i>The International Regulatory Framework for Labor Relations</i>	302
	11.3.2 <i>Summary of Airline Labor Relations Strategies: What Works?</i>	310
11.4	Human Resource Management at Airlines	312
	11.4.1 <i>Hiring and Training for Relational Competence</i>	316
	11.4.2 <i>Flexible Boundaries between Jobs</i>	316
	11.4.3 <i>Supervisory Coaching and Feedback</i>	317
	11.4.4 <i>Performance Measurement at the Process Level</i>	318
	11.4.5 <i>Conflict Resolution</i>	318
	11.4.6 <i>Boundary Spanning Roles</i>	319

11.4.7	<i>Partnering with Other Key Players</i>	320
11.4.8	<i>Leadership</i>	321
11.5	Conclusions	322
	References	323
<b>12</b>	<b>Aviation Safety and Security</b>	<b>327</b>
	<i>Arnold I. Barnett</i>	
12.1	Safety	328
12.1.1	<i>Safety Is No Accident</i>	328
12.1.2	<i>Measuring Air Safety: Some Hazards</i>	329
12.1.3	<i>The Q-Statistic</i>	331
12.1.4	<i>Some Calculated Q-Values</i>	332
12.1.5	<i>Other Approaches to Safety Measurement</i>	333
12.1.6	<i>Are Some Airlines Safer Than Others?</i>	334
12.1.7	<i>The Last Century</i>	335
12.1.8	<i>A Collision Risk Assessment</i>	337
12.1.9	<i>Midair Collision Risk</i>	340
12.2	Security	341
12.2.1	<i>September 11 in Context</i>	341
12.2.2	<i>Some Costs of Aviation Security</i>	342
12.2.3	<i>Some Security Procedures</i>	343
12.2.4	<i>Is It Worth It?</i>	349
12.2.5	<i>Two Economic Paradigms</i>	349
12.2.6	<i>A European Dilemma</i>	351
12.2.7	<i>More Security Dilemmas</i>	353
12.2.8	<i>Final Remarks</i>	358
	References	359
<b>13</b>	<b>Airports</b>	<b>361</b>
	<i>Amedeo R. Odoni</i>	
13.1	Introduction	361
13.2	General Background	363
13.3	Physical Characteristics	366
13.3.1	<i>Airside Design Standards</i>	366
13.3.2	<i>Geometric Configuration on Airside</i>	369
13.3.3	<i>Typology of Passenger Buildings</i>	372
13.3.4	<i>Assessing Passenger Building Concepts</i>	374
13.3.5	<i>Ground Access</i>	376
13.4	Capacity, Delays, and Demand Management	377
13.4.1	<i>Airside Capacity</i>	377
13.4.2	<i>Airside Delays and Their Mitigation</i>	379
13.4.3	<i>Landside Capacity and Level of Service</i>	381
13.5	Institutional, Organizational, and Economic Characteristics	384
13.5.1	<i>Airport Ownership and Management</i>	384
13.5.2	<i>Airport User Charges</i>	385

13.5.3	<i>Economic Regulation</i>	389
13.5.4	<i>Financing Capital Projects</i>	391
	References	392
<b>14</b>	<b>Air Traffic Control</b>	<b>395</b>
	<i>R. John Hansman, Jr. and Amedeo Odoni</i>	
14.1	Introduction	395
14.2	The Generic Elements of an ATC System	396
	14.2.1 <i>Communications Systems</i>	397
	14.2.2 <i>Navigation Systems</i>	397
	14.2.3 <i>Surveillance Systems</i>	402
	14.2.4 <i>Flight and Weather Information Systems</i>	404
14.3	Airspace and ATC Structure	405
14.4	ATC Operations	408
14.5	Standard Operating Procedures	410
14.6	Capacity Constraints	411
14.7	Congestion and Air Traffic Flow Management	417
14.8	Future ATC Systems	420
	References	420
<b>15</b>	<b>Air Transport and the Environment</b>	<b>423</b>
	<i>Karen Marais, Philip J. Wolfe, and Ian A. Waitz</i>	
15.1	Introduction	423
15.2	Limiting Aviation's Environmental Impact: The Role of Regulatory Bodies	425
15.3	Airport Water Quality Control	426
	15.3.1 <i>Effects of Deicing Fluids</i>	428
	15.3.2 <i>Managing Airport Water Quality</i>	429
15.4	Noise	430
	15.4.1 <i>Effects</i>	432
	15.4.2 <i>Noise Measurement</i>	433
	15.4.3 <i>Noise Trends</i>	435
	15.4.4 <i>Noise Controls</i>	436
	15.4.5 <i>Emerging Issues</i>	438
15.5	Air Quality	439
	15.5.1 <i>Effects</i>	442
	15.5.2 <i>Emissions Measurement</i>	443
	15.5.3 <i>Emissions Trends</i>	443
	15.5.4 <i>Emissions Control</i>	447
	15.5.5 <i>Emerging Issues</i>	448
15.6	Impact of Aviation on Climate	449
	15.6.1 <i>Effects</i>	449
	15.6.2 <i>Measurement</i>	451
	15.6.3 <i>Greenhouse Emissions Control</i>	452
15.7	Alternative Fuels	453

15.8	Summary and Looking Forward	455
	References	456
16	<b>Information Technology in Airline Operations, Distribution and Passenger Processing</b>	<b>461</b>
	<i>Peter P. Belobaba, Cynthia Barnhart, and William S. Swelbar</i>	
16.1	Information Technology in Airline Planning and Operations	461
16.2	Airline Distribution Systems	464
	16.2.1 <i>Evolution of Computer Reservations Systems</i>	464
	16.2.2 <i>Alternative Airline Distribution Channels</i>	469
16.3	Distribution Costs and e-Commerce Developments	475
	16.3.1 <i>Internet Distribution Channels</i>	477
	16.3.2 <i>Electronic Ticketing</i>	481
	16.3.3 <i>Implications for Airlines and Consumers</i>	481
16.4	Innovations in Passenger Processing	482
	References	485
17	<b>Critical Issues and Prospects for the Global Airline Industry</b>	<b>487</b>
	<i>Peter P. Belobaba, William S. Swelbar, and Amedeo R. Odoni</i>	
17.1	Evolution of US and Global Airline Markets	488
	17.1.1 <i>Evolution of US Airline Markets</i>	488
	17.1.2 <i>Recent Developments in Global Airline Markets</i>	491
17.2	Looking Ahead: Critical Challenges for the Global Airline Industry	494
	17.2.1 <i>Strategies for Sustained Profitability</i>	495
	17.2.2 <i>Infrastructure and the Environment</i>	498
	References	500
	<b>Index</b>	<b>501</b>

## 1

# Introduction and Overview

Peter P. Belobaba

This chapter presents a brief introduction to the global airline industry, its evolution and current status. The major forces shaping the industry are described, including deregulation and liberalization worldwide, along with some important recent industry challenges, such as the severe financial problems and restructuring of some of the industry's largest airlines since 2000. In 2015, the global airline industry is approaching six consecutive years of aggregate profitability for the first time since the late 1990s, although there remain large differences in financial performance among airlines in different regions of the world. The industry still faces major challenges, including historically high and volatile fuel prices, a weak economic recovery from the global financial crisis, and a variety of geopolitical and public health threats that could soon end this streak of moderate profitability. Infrastructure capacity poses a major constraint worldwide and threatens continued evolution and long-term profitability. The final section provides a brief overview of Chapters 2–17.

## 1.1 Introduction: The Global Airline Industry

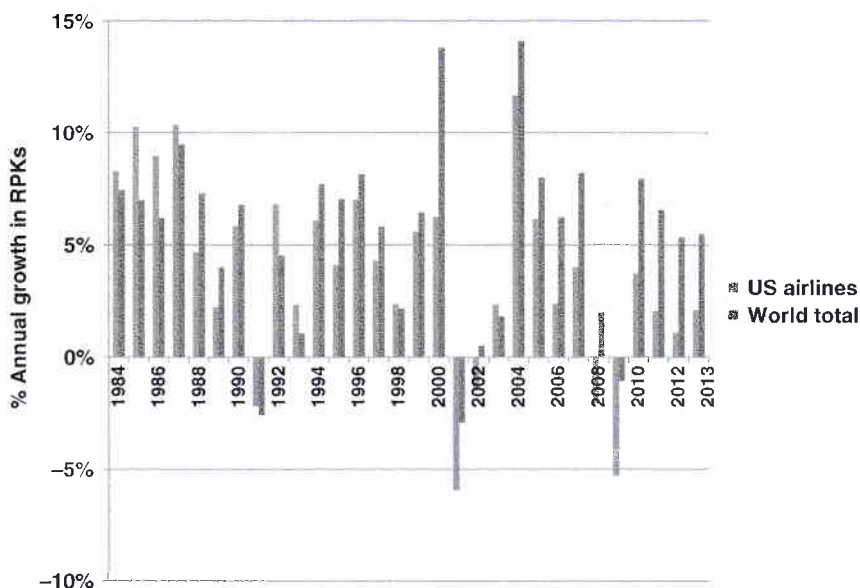
The global airline industry provides service to virtually every country in the world, and has played an integral role in the creation of a global economy. The airline industry itself is a major economic force, in terms of both its own operations and its impacts on related industries such as aircraft manufacturing and tourism, to name but two. Few other industries generate the amount and intensity of attention given to airlines, not only by those directly engaged in its operations but also by government policy makers, the news media, as well as its billions of users, who almost to a person have an anecdote to relate about an unusual, good or bad, air travel experience.

During much of its development, the growth of the global airline industry was enabled by major technological innovations such as the introduction of jet airplanes for commercial use in the 1950s, followed by the development of wide-body “jumbo jets” in the 1970s. At the same time, airlines were heavily regulated throughout the world, creating an environment in which technological advances and government policy took precedence over profitability and efforts to

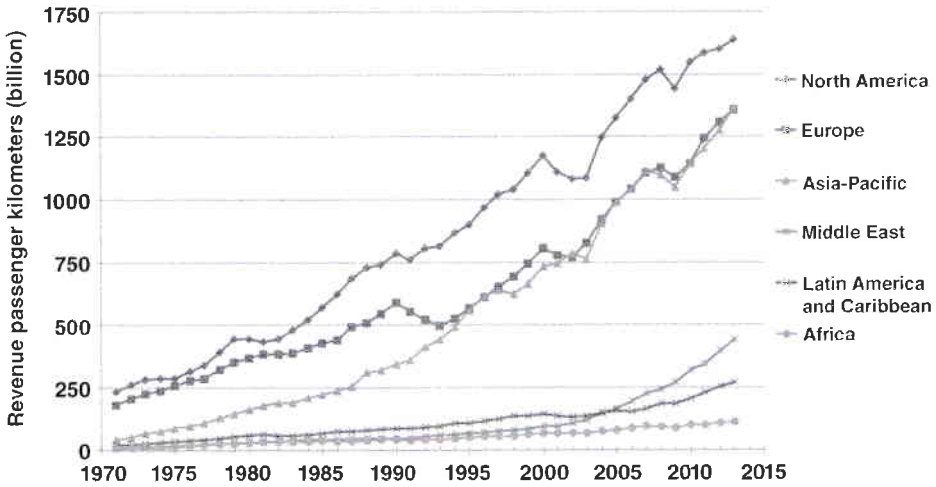
promote competition in the industry. It has only been in the period since the economic deregulation of airlines, beginning with the United States in 1978, that cost efficiency, operating profitability, and competitive behavior have become the dominant issues facing airline management. Airline deregulation or, at least, “liberalization” has now spread far beyond the United States to most of the industrialized world, affecting both domestic air travel within each country and, perhaps more importantly, the continuing evolution of a highly competitive international airline industry.

Today, the global airline industry consists of over 1400 commercial airlines operating more than 25 000 commercial aircraft and providing service to over 3800 airports (ATAG, 2014). In 2013, the world’s airlines flew more than 36 million commercial flights and transported roughly 3.1 billion passengers (IATA, 2014a). The growth of world air travel has averaged approximately 5% per year over the past 30 years, with substantial yearly variations due to both changing economic conditions and differences in economic growth in different regions of the world. Historically, the annual growth in air travel has been about twice the annual growth in gross domestic product (GDP), although this relationship has been weakening in advanced economies in recent years. Even under relatively conservative assumptions concerning economic growth over the next 10–15 years, a continued 4–5% annual growth in global air travel will lead to a doubling of total air travel during this period.

The annual growth rates in passenger air traffic, measured in revenue passenger kilometers (RPKs) (see Chapter 3 for definitions), are shown in greater detail in Figure 1.1, for the period 1984–2013. The principal driver of air travel demand is economic growth: over the period shown in Figure 1.1, the 5–6% average annual growth in air travel has been fed by an average 2–3% annual GDP growth worldwide. However, there has been substantial variability from year to year, as well as differences between US and non-US airlines. World passenger air traffic growth has been positive in all years shown, with only three exceptions. Traffic declined in



**Figure 1.1** Annual RPK growth rates 1984–2013. (Data sources: Air Transport Association; ICAO)

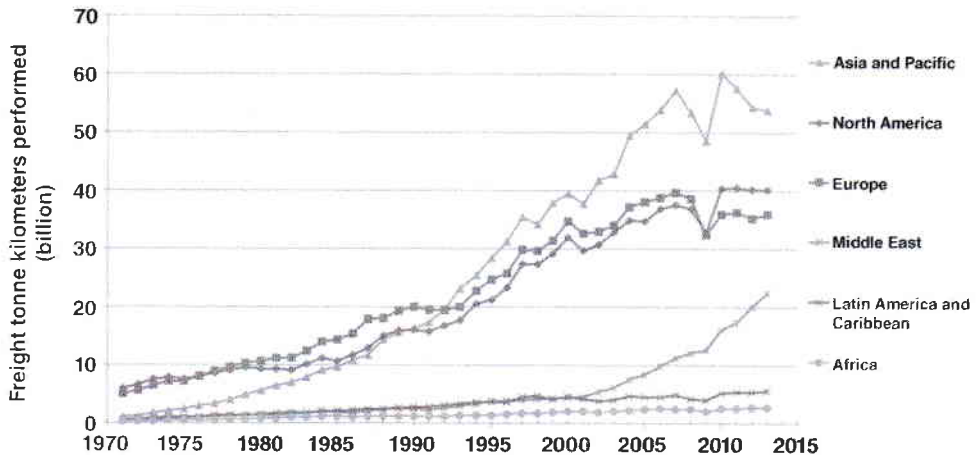


**Figure 1.2** Growth of airline passenger traffic by world region. (Data sources: ICAO, 1971–2005; IATA, 2006–2013)

1991 due to the first Gulf War and the subsequent fuel crisis and economic recession, in 2001 due to the effects of the 9/11 terror attacks in the United States, and then again in 2009 during the global financial crisis. Figure 1.1 also shows that the annual growth rates experienced by non-US airlines have consistently outpaced those of US carriers. As a result, the proportion of world passenger traffic carried by US airlines has declined, from approximately 40% in the mid-1980s to less than 25% in 2013.

The growth of passenger air traffic by region of the world carried by all airlines (irrespective of their nationality) is illustrated in Figure 1.2. North America continues to represent the largest region in terms of air traffic, followed by Europe and Asia-Pacific. North American air travel was clearly the most affected by the terror attacks of 9/11, whereas traffic dropped in all three of the largest regions during the global financial crisis in 2009. Growth rates in the Asia-Pacific region during the 1980s and 1990s were substantially higher than those of North America and Europe, with the result that total passenger air traffic in the Asia-Pacific region has been at about the same level as in Europe for much of the time since 2005. With continued high growth rates expected, the Asia-Pacific region could soon become the second-largest world region for air traffic.

Figure 1.3 provides a similar plot of the growth of air freight by world region since 1971, measured in freight tonne kilometers (FTKs) – defined in Chapter 3. The relative size and growth of air freight in each world region differs from that of passenger air traffic, with Europe generating slightly more air freight than North America in the first part of the period shown in Figure 1.3. However, the growth of air freight in the Asia-Pacific region has surged over the past three decades and the region has led the world in terms of total air freight volume since 1992. The impacts of the global financial crisis on air freight were more dramatic than was the case for passenger traffic. After a partial recovery in 2010, air freight volumes have stagnated in North America and Europe, and have declined in the Asia-Pacific region. In contrast, they have increased consistently in the Middle East region. As shown in Figures 1.2 and 1.3, the Middle East has experienced rapid growth in both categories since 2000.



**Figure 1.3** Growth of air freight volumes by world region. (Data sources: ICAO, 1971–2005; IATA, 2006–2013)

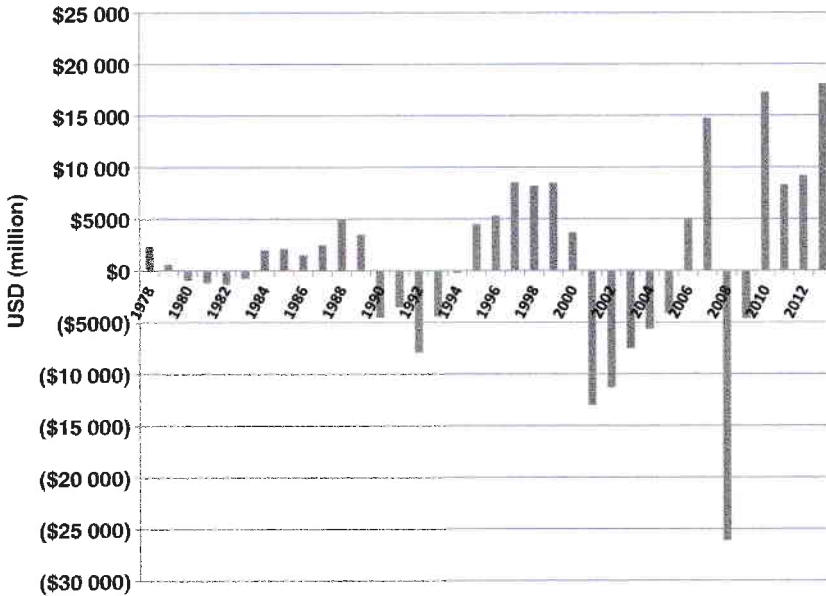
In the US airline industry, approximately 70 certificated passenger airlines operate close to 10 million flight departures per year, and carry approximately one-quarter of the world's total air passengers – US airlines enplaned 743 million passengers in 2013. US airlines (both cargo and passenger) reported \$200 billion in total operating revenues, with approximately 580 000 employees and 6700 aircraft operating over 25 000 flights per day (Airlines for America, 2014a). The economic impacts of the airline industry range from its direct effects on airline employment, company profitability, and net worth to the less direct but very important effects on the aircraft manufacturing industry, airports, and tourism, not to mention the economic impact on virtually every other activity that the ability to travel by air generates.

Commercial aviation contributes 5% of the US GDP, according to recent estimates (Airlines for America, 2014a). Worldwide, the global economic impact of aviation has been estimated to be about 3.4% of world GDP or more than US\$2.4 trillion in 2012 (ATAG, 2014). These estimates include direct, indirect, induced, and catalytic economic impacts, but do not include additional economic benefits such as employment or business activity made possible by air transportation.

The economic importance of the airline industry, and, in turn, its repercussions on so many other major industries, makes the volatility of airline profits and their dependence on good economic conditions a serious national and international concern. As shown in Figure 1.4, the total net profits of world airlines have been cyclical and extremely variable since the start of deregulation in 1978. After the world airline industry posted four consecutive years of losses totaling over \$22 billion from 1990 to 1993, as a result of the Gulf War and subsequent economic recession, it returned to record profitability in the late 1990s. Even more dramatic were the industry's plunges into record losses between 2001 and 2005, and then again in 2008–2009. The string of profitable years since 2010 gives the industry its first period of sustained profitability since the late 1990s.

### 1.1.1 Deregulation and Liberalization Worldwide

Since the deregulation of US airlines in 1978, the pressure on governments to reduce their involvement in the economic regulation of airlines has spread to most of the rest of the world.



**Figure 1.4** World airline net profits 1978–2013. (Data sources: Airlines for America; ICAO)

US airline deregulation is perceived as a success by most other countries, as the overall benefits to the vast majority of air travelers have been clearly demonstrated. While US domestic air travel grew at rates significantly greater than prior to deregulation, average real fares have declined significantly since deregulation and in 2013 were 40% below 1978 levels in constant prices (Airlines for America, 2014b). Successful new entrant and low-fare airlines had a great impact both on airline pricing practices and on the public’s expectations of low-priced air travel. And, despite worries at the time of deregulation that competitive cost pressures might lead to reduced maintenance standards, there has been no statistical evidence that airline safety has deteriorated (Chapter 12).

At the same time, deregulation in the United States has had some negative impacts. The pressure to cut costs, combined with increased profit volatility, mergers, and bankruptcies of several large airlines, led to periodic job losses and reduced wages. Furthermore, the benefits of deregulation have not been enjoyed equally by all travelers. Residents of some small US cities saw changes in the pattern of air service to their communities, as smaller regional airlines replaced previously subsidized jet services. And, despite a substantial decrease in the average real fare paid for air travel in US domestic markets, the disparity between the lowest and highest fares offered by airlines increased, thus forcing business travelers to pay the higher fares. The development of large connecting hubs by virtually all US major airlines also raised concerns about the pricing power of dominant airlines at their hub cities (GAO, 1993).

The management strategies and practices of airlines were also fundamentally changed by increased competition within the industry. Cost management and productivity improvements became central goals of US airlines with the shift to market competition. Non-US airlines have more recently been forced by competitive realities to face this challenge as well. A by-product of the quest for lower costs and increased productivity has been the pursuit of economies of