Airline Microeconomics

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By

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This book is dedicated to the amazing care that has been provided to me by my wife.
She rescued me from a knock-out punch, and I will always be indebted to her.

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FOREWORD

I was intrigued when Tony told me of his plans to write this book on air transport economics, as I've long admired his analytical approach to the industry's key economic issues. During my 17 years as Chief Economist at the International Air Transport Association I have come across few industry insiders that have applied to air transport the analytical tools of economics with such enthusiasm, vigour, and insight. I first met Tony when he was heading up the economics team at Qantas. When he returned to academia and consulting, we were quick to use his modelling talents to tackle some of the issues we were grappling with at the time.

This is a key moment for air transport, both for its users and providers. The COVID pandemic virtually stopped the air transport of passengers (but not cargo) and, at the time of writing, shows little sign of allowing a return to the pre-virus normal. Preferences for air travel, particularly for business, may change following the forced use of video conferencing as a substitute. A second challenge to air transport's future is climate change, or rather the response to it. The industry is a small cause of rising temperatures today, but business-as-usual expansion over coming decades would use up much of the atmospheric carbon budget that climate models estimate is left, if we are to keep global temperature rise to 1.5 degrees. Air transport may get more expensive as a result – though to fully understand what may happen you need the tools contained in this book.

This book will show you, in depth and with many useful examples drawn from Tony's experience, how the analytical tools of economics can be applied to the myriad of issues around airline revenue, cost, competition and profitability, as well as topics like the carbon taxes or cap-and-trade schemes facing the industry because of climate change. The first part is structured around the airline profit and loss account, with a deep dive into the detail and modelling of unit revenues, costs, and key concepts such as breakeven load factors. For any analyst wanting to better understand or predict the profitability of firms in the airline sector this is required reading. There is a comprehensive assessment of demand, the markets of various kinds for air transport service, services to transport goods as well as people. The section on elasticities – how travellers and shippers respond to changes in prices and incomes at various market levels is particularly useful. Of course, what matters to firms is revenue not just the number of customers, and there is a comprehensive tour through the intricacies of modelling these to help decision-making over different time horizons. How this translates to the financial success or otherwise of the air transport firm depends critically on the economics of the production process, how costs are affected by economies of scale and scope, about how this interacts with competition to drive route profitability. Much detail is provided here about how to apply analytical tools to model these key determinants of profitability. The book continues using the same analytical approach to tackle issues like competition, fuel surcharges and oil markets.

This book contains a first-class toolkit for anyone seeking to apply the analytical tools of economics to model many of the key issues in air transport, written with an insiders' experience and replete with useful illustrations.

Brian Pearce

12 December 2021

PREFACE

When I first started at Qantas, I felt like I didn't fit in. I was the new kid on the block with a mountain of microeconomic and statistical modelling expertise under my belt but very little aviation expertise. The Qantas people who had worked at Qantas for ten, twenty, thirty and in some cases forty years, who had been completely immersed in the complex world of aviation since they were just out of high school, didn't understand my language and I didn't understand theirs; at least not at the start. I realised quickly that I was never going to hold my own against these experienced aviation warriors on practical aviation knowledge, so I needed to win them over in another way. I needed to win them over based on my strengths not their strengths.

This certainly wasn't easy because my strengths can often confound people, largely because my strengths are bound-up in the analytics of aviation economics and finance. Most people, including the good people working at Qantas, are very binary – they either enjoy an analytical approach to solving complex problems, or they see this type of approach and dissolve like an aspirin in water. The majority of the very experienced aviation people at Qantas were the latter, and so when they saw my analytical approach to tackling complex problems, rather than try and understand it they often would completely write it off. "It doesn't work"; "This is silly"; "The world doesn't work like that"; "You can't model this complexity using analytical approaches"; "The elasticity doesn't exist", were just some of the responses I would get. To try and break down these walls and views I needed to get some early wins with my modelling, and that I did.

Probably the first win was in relation to something that is called fuel hedge effectiveness testing. This is a test that airline accountants must conduct to determine whether the airline's fuel hedging has been good or bad. When I first started at Qantas, probably within a week or two, I was thrown straight into this complex problem of coming up with a new test because the test that Qantas was using at the time simply wasn't working. As it turns out, this was probably the best thing that could have happened to me. It meant that, not only was I forced into learning probably the most important and complicated financial aspects of an airline's business, that being fuel hedging, but I also had a complex mathematical problem to solve which is my strength. I ended up building a test that worked called the WHET, or the Webber Hedge Effectiveness Test, which Qantas continued to use even after I left the organisation. From that point on I gained some respect from the Treasury Risk Management team at Qantas and that respect seemed to spread across several departments, albeit after a period of time.

Another big win came when I correctly forecast that Qantas' revenue would continue to fall for another year half-way through the impact of the Global Financial Crisis. This was met by enormous scepticism by some very senior people at Qantas, as my views were presented to both the Qantas Board and the senior executive committee of the airline. But it turned out to be a reasonably accurate position. This position came after I spotted a strong correlation between Qantas' revenue and the Australian stock market. Using the strength of this correlation and knowing that the Australian equities market was continuing to head downward, I knew that Qantas was likely to be headed for a second year of revenue weakness and this turned out to be accurate. I named the two years of revenue weakness as wealth and income effects, with the wealth effect in the first year and the income effect in the second year. It was a reference that the current CEO of the Qantas Group, Allan Joyce, started using in presentations and speeches and so my analysis had rubbed-off on the right people.

Both the fuel hedge effectiveness testing and revenue forecasting wins set off a chain rection of wins which allowed me to garner much more respect within the airline than when I started, even amongst quite senior aviation people who had been a part of the Qantas furniture for decades. These wins occurred across a range of departments, including Treasury, Finance, Strategy, Yield Management, Government Relations, Marketing, Communications and Revenue Forecasting to name but a few. I mention this in this preface because the analysis and the modelling that was an integral part of the worked performed for these departments are a key part of the contents of this book. All the major wins that I had at Qantas use techniques that are documented in this book. And I want to share this with you the reader.

PART A:

INTRODUCTION AND AVIATION LANGUAGE

CHAPTER 1

THE DIFFICULTIES OF CONSISTENTLY MAKING MONEY IN AVIATION

1.1 Richard Branson and Warren Buffett

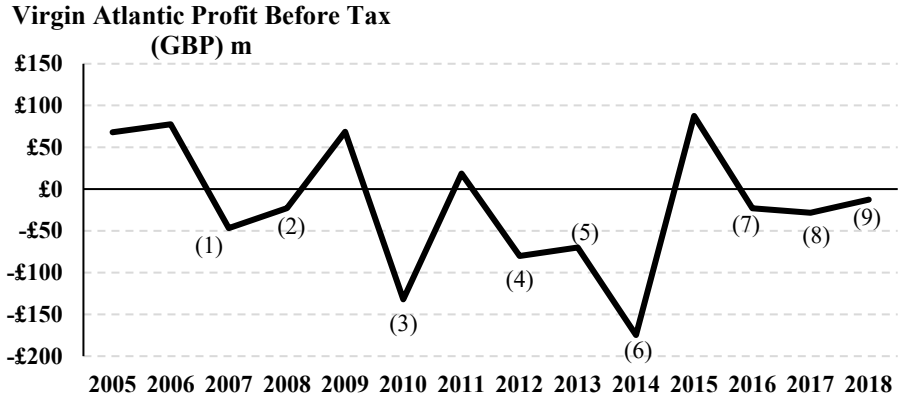
Richard Branson, founder of airline businesses such as Virgin Atlantic, Virgin Express (now Brussels Airlines), Virgin Australia, Virgin Nigeria (now Air Nigeria) and Virgin America (now part of Alaska Airlines), once famously said about investing in airlines:

> "If you want to be a Millionaire, start with a billion dollars and launch a new airline" (Metcalf, Pendleton, and Mak 2020)

Meaning that if you invested a billion dollars in an airline then you will eventually wind up with something materially less than 1 billion dollars because of the losses the airline is expected to make. One of the world's most successful share market investors in history, Warren Buffet, was also just as scathing about airline investments:

> "Investors would have saved millions of dollars if someone had shot down the Wright Brother's plane" (Levine-Weinberg 2021)

Why would two of the most astute and successful investors and entrepreneurs in modern history recommend, in the strongest possible way, to invest in anything else but airlines? In the case of Buffett, it is quite understandable. He lost a considerable amount of money back in the late 1980s investing in an airline called U.S. Air, which was a major airline operating in the U.S. international and domestic markets until it merged with American Airlines in 2013. According to an article published in the New York Times on October 3, 1995, Mr Buffett's company, Berkshire Hathaway, bought preferred shares in the airline for US$358m in 1989. By March 1995, however, the value of those shares fell to just US$89.5m, resulting in Mr Buffet bearing a considerable capital loss on his U.S. Air investment (Feder 1995). This was to be Mr Buffet's last foray into airline investments for decades.



Source: Airline Intelligence and Research Database 2021

Fig. 1-1: Virgin Atlantic Profit Before Tax 2005 to 2018

Mr Branson's view, on the other hand, was shaped by his role as a founder and owner of airlines, the biggest of which, and his first airline, being Virgin Atlantic. As can be seen in Figure 1-1 above, the earnings of Virgin Atlantic between 2005 and 2018 were miserable.

Figure 1-1 shows that the airline lost money in 9 years out of 14, with the numbers in parentheses in the figure indicating those annual periods in which the airline made a loss. On aggregate between 2005 and 2019, the airline had lost £271m, which means that the airline's good years have not been enough to compensate for the bad years. When looking at these numbers, it is not at all surprising that Mr Branson has arrived at his dismal view of airline investments. Despite the underwhelming performance of his airline ventures, Mr Branson has maintained much of his investment and interest in airlines, in addition to flying into space, because of his clear passion for the sector.

1.2 Aircraft are an Expensive Investment

The easiest way to understand why Warren Buffett was wrong with his airline investments, and Richard Branson was unable to consistently make any money from airline operations, is to understand the wide variety of factors that determine the return on an investment in aircraft by airlines. The topic of this book, airline microeconomics, helps us to identify these factors, and understand how unpredictable they can be, how they impact airline earnings, and how airlines should respond to them in a way that maximises profit.

The first and most important factor that determines an airline's return on investment in an aircraft is the cost of that investment as represented by the price of aircraft. As Buffett has pointed out, one of the reasons why it is difficult to make money in airlines is that it is capital intensive, and the capital that is bought by airlines is expensive (Zhang 2017a). To buy an aircraft the cost to airlines is in the hundreds of millions of dollars. Table 1-1 below provides the 2018 list price of a range of popular Boeing and Airbus aircraft. The prices of these popular aircraft range from just over US$100m for the Boeing 737-800 to almost US$450m for the Airbus A380.

Airbus		Boeing	
Aircraft	**2018 List Price (US$m)**	**Aircraft**	**2018 List Price (US$m)**
A320neo	US$110.6	B737-800	US$102.2
A321neo	US$129.5	B737 Max 9	US$124.1
A330-200	US$238.5	B787-800	US$239m
A350-900	US$317.4	B787-900	US$281.6
A380	US$445.6	B747-800	US$402.9

Source: McNutt 2018

Table 1-1: List Prices for Boeing and Airbus Aircraft in 2018

When airlines decide to invest in a new aircraft, it is a small fortune that they must pay. In addition to the cost of the aircraft they must also pay for the funds that must be raised to pay for the aircraft. Airlines will raise funds to make this purchase by borrowing money from financial institutions, or sometimes a group of institutions, ask airline owners for more funding, or use funds that the airline has accumulated from its operations. These sources of capital come at a cost, such as an interest rate that is paid to a financial institution or a dividend paid to owners of share capital. The cost of capital that airlines pay is relatively high because it depends on the riskiness of aircraft investments, which is considered high.

1.3 Uncontrollable Macroeconomic Forces Affect Revenue Forecasts

Aircraft have an average life of around 20 years. This means that when an airline buys a plane it is a long-term investment. The business case that the airline must build to justify making such a long-term investment involves determining the revenue and costs from operating the aircraft over a 20-year, forward looking horizon. Forecasting the revenue and the costs associated with operating an aircraft is difficult one day, one week and one month into the future, let alone 20 years into the future. In fact, it would be fair to say that airlines almost always get these forecasts wrong not because they are terrible forecasters but because it is simply too difficult to forecast revenue and costs 20 years into the future.

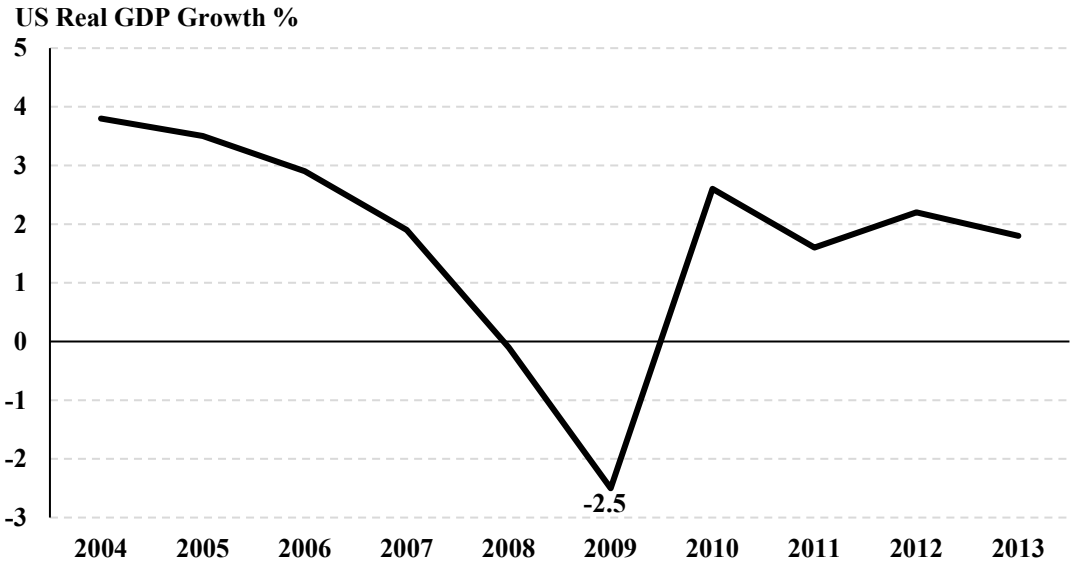
The reason it is so difficult to forecast the revenue that is generated by selling seats to passengers and space to freight, is that it is affected by so many different variables. This includes macroeconomic and microeconomic variables that the airline cannot control, and microeconomic variables that the airline can control but whose effect on revenue is difficult to quantify. Let us spend a few moments discussing some of these variables.

Probably the most influential variable that uncontrollably affects the revenue generated from airline investments is economic growth. Economic growth is a measure of the extent to which the income and the production of an economy grows over time. Economic growth can be measured for a country, a state within a country or a major city within a country. It can also be measured for a group of countries that share a similar geographical location, such as the countries of Asia and Europe. Economic growth affects an airline's passenger and freight revenue because it influences the ability of a passenger to pay for a seat on a plane, and it influences the amount of goods that are produced in the economy, which in turn affects the demand for space on aircraft to carry freight.

Airlines cannot control economic growth and economic growth is unpredictable. We typically expect at least one and sometimes two severe economic downturns every ten years. Each time there is a severe economic downturn this results in depressed airline yields, weak passenger and freight loads, and airline revenue that is in the doldrums. This means that over the life of an aircraft we would expect up to four years of weak economic growth, which feeds into subdued airline revenue. Knowing this, how does the airline factor this into the revenue it expects to earn from operating an aircraft? How many periods of economic weakness does it assume? When are these periods of weakness assumed to occur? How long after the economic weakness is airline revenue impacted? How deep will be the impact of economic

weakness on the aircraft's revenue? These are extremely difficult questions to answer, but they are questions to which the airline must provide answers if it is to quantify the revenue it is expected to obtain from an aircraft investment. Unfortunately, these questions are so difficult to answer that airlines rarely get them right, and understandably so.

Weak economic growth can have a devastating impact on airline revenue. To see this, let us examine the impact that the Global Financial Crisis had on airlines in the U.S. in 2009. Figure 1-2 presents the movement over time in the economic growth of the U.S. economy.



Source: Federal Reserve Bank of St Louis 2019

Fig. 1-2: Economic Growth in the USA During the Global Financial Crisis

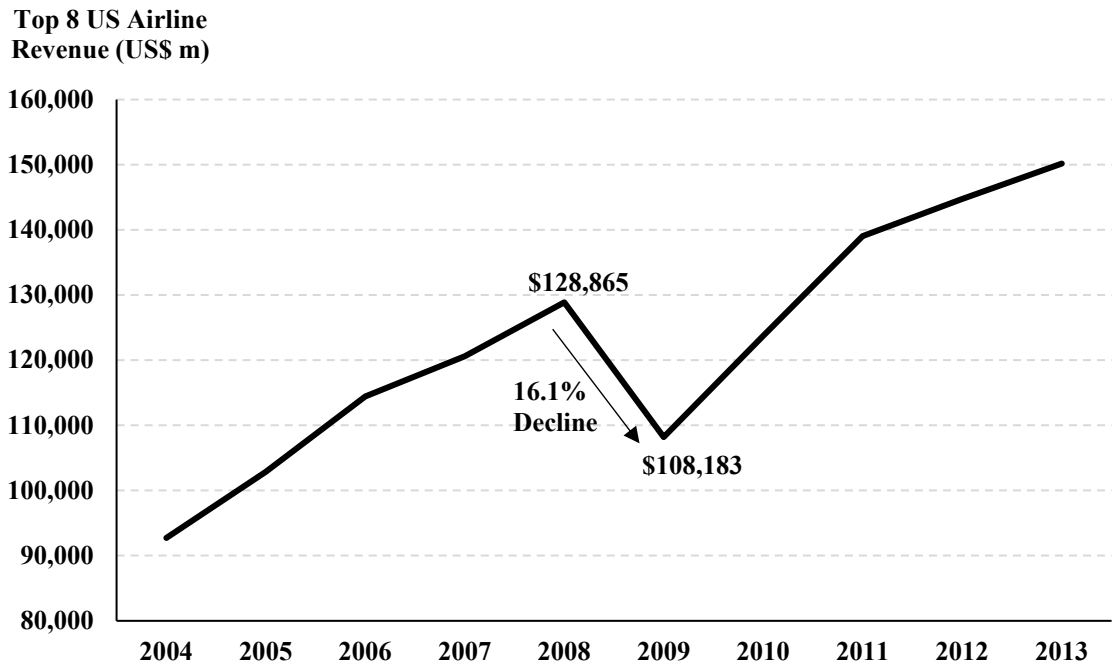
We can see that during the 2009 Global Financial Crisis the U.S. economy went backwards by 2.5%, when it usually grows by between 2% and 3% per annum. This effectively means that the income for the U.S. economy fell in 2009. When an economy's income falls, the households and businesses in that economy spend less on goods and services, and they especially spend less on discretionary items such as air travel and a holiday.

Less spending on air travel is precisely what happened during the Global Financial Crisis. As can be seen in Figure 1-3, the money that passengers and freight distributors spent on air travel with the top 8 airlines in the U.S. fell by 16.1% in 2009, which represents around US$21b. To put this drop in revenue into perspective, a decline in revenue of 1% to 2% is usually considered significant and unusual for an airline. This was, however, one of the most significant economic downturns since the great depression in both the U.S. and for the global economy, and unusually weak revenue was to be expected. It presents a clear example of the extent to which an unpredictable, adverse economic event can have an impact on the fortunes of the airline business, and deeply affect the business case for investing in aircraft. For airlines that invested heavily in aircraft assets, and received delivery of aircraft assets, in and around the time of the Global Financial Crisis, this would not have augured well for the aircraft meeting the desired or budgeted return on the airline's aircraft investment.

Gross Domestic Product does not capture the entire impact of economic activity on the decisions made by passengers to travel or not, and the revenue streams of airlines. This is because it does not capture the capacity and willingness to pay for air travel of a large segment of passengers that are likely to pay for their travel from their savings, and the returns to those savings. These retired passengers will pay for their grey nomad journeys through the cash they have in the bank, the investments they have made in property and the share market, and the money they have tucked away in superannuation and pension funds. The variable that often captures these types of effects, which I call wealth effects, is the movement in the stock market.

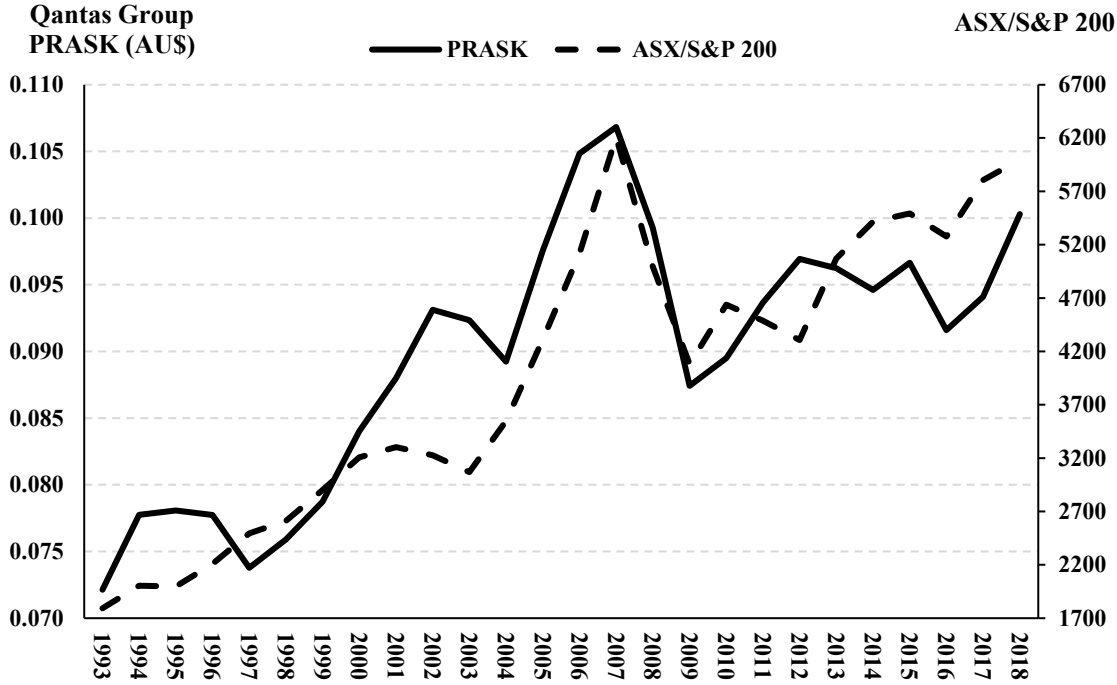
As the movement in the stock market captures the wealth and confidence of around one third of the population that is retired, particularly in developed countries, we find that it is an important driver of the underlying demand for air travel and therefore the revenue that airlines earn from aircraft investments. This is reflected in the observation that airline yields, which we will talk in more detail about in chapter 2, are often highly correlated with movements in the stock market, or as investors like to call them, equity indices. For example, in Figure 1-4 below, we present the movement through time in Qantas Group passenger revenue per ASK (PRASK) versus the aggregate equity index for the Australian economy, which is the ASX/S&P 200.[1]

[1] As we will see in chapter 2, PRASK is a particular measure of airline yield that is determined by dividing passenger revenue by a measure of airline seat capacity called available seat kilometres. In jurisdictions that use miles it is referred to as PRASM, or passenger revenue per available seat mile.



Source: Airline Intelligence and Research Database 2021

Fig. 1-3: Total Revenue of the Top 8 Airlines in the USA



Source*:* Airline Intelligence and Research Database 2021, Yahoo Finance ASX/S&P 200 2019

Fig. 1-4: Qantas Passenger Revenue per ASK Versus the ASX/S&P 200 Stock Market Index

The Qantas Group is the biggest airline Group in Oceania and indeed one of the biggest airline Groups in the world. It has its main headquarters in Mascot, Sydney as well as a smaller head office in Melbourne, Australia. The airline Group operates two flying brands – Qantas Mainline, which is a full-service airline, and the Jetstar Group, which is a low-cost carrier, both operating extensively in domestic Australian and international aviation markets. Between 1993 and 2018 there was a +88% correlation between Qantas Group passenger revenue per available seat kilometre and the ASX/S&P 200. This means that a stronger stock market in Australia, which led to greater consumer and business wealth and confidence, coincided with higher Qantas Group yields and revenue.

The fact that there is a strong positive correlation between stock market indexes and airline yields, and stock market indices are highly volatile, highlights how difficult it is to attempt to forecast the 20-year forward revenue stream of an aircraft investment. To do so with any accuracy would require the airline to guess what is likely to happen to the share market for each year, 20 years into the future. If the airline was able to do this with any accuracy, then it would give up the airline business and open-up a remarkably successful stock broking firm or investment bank.

The exchange rate is another, important variable that an airline must forecast to predict the revenue that an aircraft is likely to generate over its life, particularly if that aircraft is used for international services carrying passengers from different currency zones. Aircraft used on international routes are likely to generate revenue for the airline in a variety of currencies, such as the US dollar, the Euro, the Japanese Yen, the Chinese Yuan, the Great British Pound, the Canadian dollar, the Swiss Franc, and the Australian dollar. For example, in the case of the British low-cost carrier easyJet, which flies services throughout the United Kingdom and Europe, the airline generated 42% of its revenue in Pound Sterling, 47% in Euro, 1% in US dollars, and 10% in mostly Swiss Franc over the 12 months to 30 September 2020 (easyJet Annual Report 2020, 58). When these currencies change against the local currency of the airline (the Great British Pound in the case of easyJet), so does the revenue that is earned by the aircraft investment. For the airline to accurately predict the 20-year revenue stream of its aircraft investment, it will need to accurately predict the movement in a range of currencies.

Most very experienced exchange rate analysts and economists find it exceptionally difficult to predict what is likely to happen to currencies a month or a quarter ahead let alone each year for 20 years ahead. In fact, the exchange rate is usually so difficult to predict that one of the best models of the exchange rate says that the forecast of the exchange rate tomorrow is the exchange rate today (Meese and Rogoff 1983, 3). This is a model of the exchange rate called the random walk (Hamilton, 1994, 436).

The revenue generated by aircraft is also affected by completely random, usually adverse events. These events include the outbreak of deadly viruses such as the Coronavirus and SARS. It also includes the disruption to flying due to ash that is present in the sky at flying altitude that is the result of volcanic eruptions, such as the Eyjafallajökul eruption in April 2010 which heavily impacted air travel in Europe for several days. Adverse shocks to air travel also come about because of the impact of earthquakes in tourism areas, and the subsequent flooding generated by tsunamis such as the Indian Ocean earthquake and tsunami in 2004. They also include events of terror, such as the events of 9-11 in September 2001 and the Bali bombings in 2002 and 2005. Events such as these most certainly cannot be predicted by airlines in determining the revenue that aircraft investments are likely to generate over their lifetime. This is despite history telling us that over the life of an aircraft asset it may be affected by such events two to three times.

The macroeconomic variables discussed above which affect aircraft revenue streams, are beyond the control of the airline. The airline has no control over the extent to which economies grow, the movement in the stock market, the value of different currencies, and extreme events of nature. These forces are not only uncontrollable, but they are also highly volatile or unpredictable, some more than others. Economic growth, share markets and exchange rates are exceptionally difficult to predict, especially over a 20-year horizon.

1.4 Microeconomic Variables Affecting Revenue Forecasts

The lifetime revenue stream of an aircraft investment will also depend on variables that are within the control of the airline. The airline will determine the number of seats on the aircraft, and the mix of first, business, premium economy, and economy class seats. It will control the prices that it offers passengers and freight forwarders and the number of seats that it makes available for sale at different prices. It determines the number of seats on the plane that are occupied by passengers, also called the passenger seat factor. It will determine the frequency of services of the aircraft, the timing of services and where the aircraft will be flown.

The airline will also determine how much it will spend on marketing and the channels it uses for marketing, such as TV, radio, social media, magazines, billboards, newspapers, and emails. It determines the extent to which it trains cabin crew, which in turn affects the customer experience. It determines the training that flight crew and engineers receive, which in turn influences the ability of the aircraft to arrive safely. The airline also determines the points that frequent flyer members need to book a seat on a plane, or upgrade to a better seat, and it determines the points that frequent flyer members earn when they fly with the airline or spend money on a credit card.

While the airline has control over these variables, and they affect the revenue stream of an aircraft over its lifetime of operation, this does not mean that the airline knows exactly how these variables will affect said revenue. This too adds to the difficulty in predicting a new aircraft's revenue stream. For example, if an airline decides to sell more seats at cheap fares, it does not know exactly the extent to which this will encourage passengers to fly on the airline, which will have a significant impact on the revenue that the airline earns. When an airline decides to advertise its lower fares on Facebook, it does not know how this will influence the demand for seats and thus revenue. When an airline decides to form a relationship with another airline on a route, such as a codeshare or interline arrangement which we will discuss in more detail in chapter 10, it does not know how this will impact its revenue and earnings.

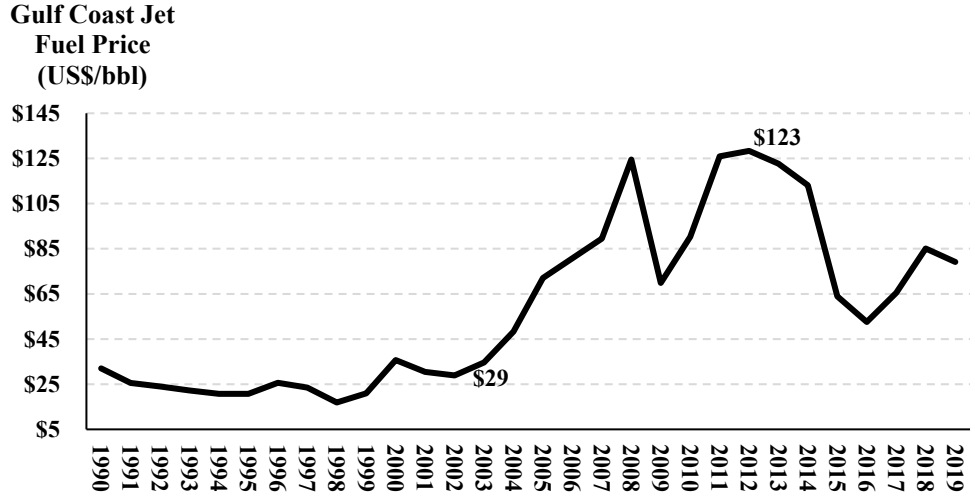
There are also variables that are industry in nature, or microeconomic, which affect an airline's revenue that are outside of the control of the airline. The first and probably most significant is competition from, and decisions made by, other airlines. Airlines may battle against aggressive competitors with materially lower costs and better products, in many of its markets or routes. It can come up against carriers that are owned by Governments, with aggressive growth underwritten by their owners. Or it can come up against new types of carriers, such as low-cost carriers and ultra-low-

cost carriers. Over a 20-year period, the number of competitors, the types of competitors and the quality of competitors can change markedly. All are difficult to predict and have a deep impact on the yields, demand, and revenue of an aircraft investment.

Other microeconomic variables that can have a significant impact on the revenue stream of aircraft assets are taxes, many of which we will discuss in chapter 11. Income, departure, carbon, payroll and goods and service taxes can all affect the potential revenue stream generated by aircraft assets. It is often the case that governments make changes to taxes that are both unpredictable and have a material impact on the revenue that can be earned by an aircraft investment.

1.5 Forecasting Cost for the Life of Aircraft Investments

Not only is the revenue stream of a new aircraft asset difficult to predict over the life of the asset, but so too is the cost stream. The most difficult component of an airline's cost to predict is its fuel cost, and the most unpredictable component of an airline's fuel cost is the fuel price. The fuel price that is relevant to aircraft costs is the jet fuel price. As indicated in Figure 1-5 below, since the early 2000 period the jet fuel price has trended rapidly upward and moved in a volatile manner around that upward trend.



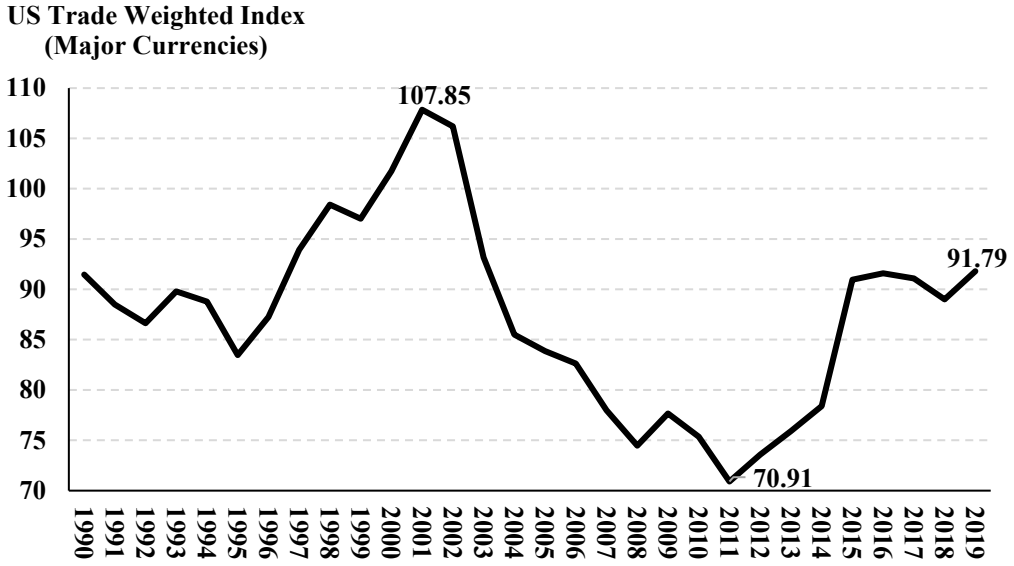
Source: Energy Information Administration Spot Prices 2021

Fig. 1.5: Gulf Coast Jet Fuel Price 1990 to 2019

When airlines purchased aircraft for hundreds of millions of dollars back in 2003 their expectation was that the jet fuel price would cycle up and down around US$29 per barrel for the next 20 years, as it had done prior to 2003. Instead of this occurring the jet fuel price decided to surge upward to around the US$100 per barrel mark. It would be hard to imagine that any of the business cases built in 2003 for aircraft purchases would have conceivably anticipated the jet fuel price increasing to over $100.

To examine the impact that a higher jet fuel price would have had back in 2003, consider an Emirates Boeing 777 aircraft that consumes around 300,000 barrels of jet fuel per year. At a jet fuel price of US$30 per barrel, consuming 300,000 barrels of jet fuel per year amounts to an annual fuel cost of US$9m. At an average jet fuel price of US$85 per barrel, which is the average between 2003 and 2019, the fuel cost for the aircraft for a year of jet fuel consumption becomes US$25.5m – more than double the average fuel cost prior to 2003.

The exchange rate not only makes it difficult to predict the revenue stream of an aircraft investment but also the cost stream. In fact, it usually has a deeper impact on cost than revenue because of the concentration of costs denominated in US dollars, most notably fuel and aircraft capital costs (depreciation and operating lease costs). As indicated in Figure 1-6 below, the US dollar fell by 33% between 2003 and 2011 but then appreciated by 18% thereafter. Such exchange rate volatility would have resulted in materially lower fuel and aircraft capital costs between 2003 and 2011 but higher costs thereafter. This type of unpredictability and volatility makes it extremely difficult to accurately put together business cases for aircraft investments.



Source: Federal Reserve Bank of St Louis 2019

Fig. 1-6: US Trade Weighted Index (Major Currencies) 1990 to 2019

1.6 Aims of this Book and the Remaining Chapters

The airline microeconomics topics that we present in this textbook aim to draw attention to the abovementioned factors and variables that make it difficult to consistently make money in aviation, and difficult to predict the return that an airline is expected to make on an investment in an expensive aircraft. It will present topics that help us understand how these variables and factors influence demand, revenue, costs and therefore airline profitability. It will also analyse how airlines should adjust the variables that they can control, such as capacity and prices, in response to changes in these variables and factors to maximise the profit that they earn.

The first step in meeting these aims is to understand the acronyms and language that aviation people use – this is the focal point of chapter 2. Without this understanding graduates starting out in aviation will be left behind in conversations, meetings, discussions, presentations, media releases, external media pieces on aviation, and internal communications. Communication is an important part of aviation strategy, which is why airlines and airports often have many people working within the Corporation Communications Department and the Head of Corporate Communications is often a member of the executive committee of the airline. Without understanding the language and acronyms of the aviation industry this will delay the development process of young people who enter the industry.

The passenger demand side of the airline business is then examined in chapter 3. To understand the complexity of the airline business it is necessary to understand the forces that drive the demand for passenger travel by air. This will include market drivers such as macroeconomic variables as well as airline specific drivers such as the quality of the airline product and the fares that airlines charge. Probably the most important parameter in aviation is the way that the average airfare impacts airline demand, which is often referred to by economists as the airfare elasticity of air travel demand. This parameter will form a key part of the analysis of chapter 3, as well as other chapters in this book.

The passenger demand for air travel combined with the impact of airfare movements on demand enable us to model the revenue earned by airlines, which is the topic of chapters 4 and 5. The way that revenue is modelled is different in the short and medium runs for airlines. The short run focuses on the relationship between the seat factor, the average airfare and revenue for a fixed level of airline capacity. The medium run analyses the relationship between airline capacity, yields and revenue for a given number of fleet units. In both cases there are ‘bends’, or non-linearity to be technical, in the relationship between revenue and these variables that is due to increases in airline supply causing a decline in price.

The cost side of the airline business is then examined in chapter 6. The dominant costs include fuel, manpower., aircraft capital costs and airport charges. What this tells us is that airlines face significant fixed costs. One of the challenges on the cost side of the airline business is constructing a useful measure of unit cost. While most airlines quite rightly use cost per available seat kilometre to measure unit cost, this is a troublesome measure for airlines that have a significant freight side to their business. There are ways to overcome this problem, but you will have to read chapter 6 for more insights.

To understand how airlines can make better decisions, we make use of some useful tools from microeconomics in chapters 7 and 8. In the short run, airlines wish to choose the seat factor and the average airfare to maximise profit. By understanding how the seat factor influences the average airfare, revenue, and cost, we can determine the optimal level of the seat factor and the average airfare. We will show in this book how this is dependent on the proportion of costs

that vary with the load on the aircraft, the sensitivity of average airfares to the load, and the willingness of consumers to pay for a seat on the plane.

By understanding how airline capacity influences revenue, cost and thus profitability, we can calculate the level of available seat kilometres or capacity that maximises profit. This depends on the proportion of costs that vary with capacity, the elasticity of yield to capacity, and underlying demand. By identifying profit maximising capacity, the airline maximises medium run profit, which places the airline in the best position to overcome the random shocks that affect the business. This is covered in detail in chapter 8.

Chapter 9 investigates how we model competition between airlines. It focusses on two standard models of competition as set out in the economics literature of industrial organisation, specifically monopoly and oligopolistic competition. These two models of competition are the focal points because it is these two models, particularly the latter, that is most likely to accurately explain the reality of airline competition on most routes. The models can then be used to understand why airfares differ across routes and classes of travel. The key findings of the models are that airfares differ across routes and cabins because of unit costs, the number and quality of competitors, and the sensitivity of demand to a change in the average airfare.

One of the ways that airlines can improve their performance is by identifying airlines with which they can build relationships to improve yields, demand, and revenue and to reduce costs. This is the topic of investigation of chapter 10. Airline relationships may take the form of interline and codeshare relationships, joint ventures, revenue sharing, equity investments, mergers, and acquisitions. Airlines will investigate the possibility of making these relationships come to fruition subject to approval from competition authorities.

Governments tax individuals and companies to finance spending on public infrastructure and welfare. Like most other companies, airlines pay their fair share of taxes, including company tax, goods and services tax, departure tax, carbon tax amongst many other taxes. Changes in these taxes can affect the incentives that airlines face to invest in more capacity. This is the topic of discussion of chapter 11.

In chapter 12, we present to you the economics of the oil market. The oil market is pivotal to understanding the financial performance of airlines, given that it is such an important driver of airline costs. In chapter 12 we take you through the demand side of the oil market, including the main consumers of oil globally and the role that world Gross Domestic Product plays in driving changes in the global demand for oil over time. The demand for, and the cost of oil, are important inputs into a model of the global oil market called the dominant-firm/fringe-firm model, which attempts to capture the impact of OPEC (Organisation of Petroleum Exporting Countries) on the oil market. This model will be analysed in detail in chapter 12 and will be used to understand the changes in the price of key oil benchmarks, such as Brent and West Texas Intermediate crude, over time. Crude oil is refined into jet kerosene, which is the product that is consumed by commercial aircraft. Chapter 12 analyses the process of converting crude oil into refined products such as jet kerosene and the forces that determine the margin between the price of oil and the price of jet kerosene.

I hope you enjoy reading this book as much as I have enjoyed writing it. Most importantly I hope you learn something, and that you can use it in your first or next job in aviation.

Quiz 1.1 Why it is Difficult to Consistently Make Money in Aviation?

1. In which of the following airlines did Richard Branson NOT have an equity interest?
(a) Virgin Atlantic.
(b) Virgin Australia.
(c) Virgin Singapore.
(d) Virgin America.

2. Which of the following reasons is behind equity investor guru Warren Buffet's view that investors should steer away from investing in airlines?
(a) He was a CEO of an airline and therefore understands airline industry history of poor returns.
(b) He was a pilot and therefore understands how volatile the passenger and freight loads are likely to be on aircraft.
(c) He invested in the airline U.S. Air and lost money.
(d) Airline share prices are negatively correlated with global economic growth.

3. What has Warren Buffet indicated as one of the potential reasons why it is difficult to make money in airlines?
(a) It is energy intensive, and subject to fluctuations in the price of energy.
(b) Aircraft must be imported and therefore subject to exchange rate fluctuations.
(c) It is labour intensive and expensive to buy labour.
(d) It is capital intensive, and expensive to buy aircraft.

4. Which of the following is NOT a source of capital for funding aircraft investments?
(a) Raising funds from airline owners.
(b) Borrowing money from financial institutions.
(c) Using the proceeds of tax revenue raised by Government.
(d) Using cash reserves that have been built-up because of the airline's operations.

5. What is the approximate average life of an aircraft?
(a) 10 years.
(b) 15 years.
(c) 20 years.
(d) 25 years.

6. What must an airline forecast into the future to construct a business case for an aircraft investment?
(a) Revenue and cost streams generated by the aircraft's operations.
(b) The share price of the airline.
(c) The weather patterns 20 years ahead.
(d) Whether there will be an event such as a Coronavirus over the life of the aircraft.

7. Which of the following is NOT an uncontrollable macroeconomic variable that influences the revenue stream of an aircraft investment?
(a) Economic Growth.
(b) Share market movements.
(c) Exchange rate movements.
(d) Jet fuel price movements.