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Interpreting economic data - taking off: the development of the air travel industry in the United States

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Interpreting Economic Data

Taking Off - The Development of the Air Travel Industry in the United States

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Introduction

Most products go through a life-cycle with certain common features across a wide range of different industries. In the early stages a new product has relatively few outlets and is often viewed as a luxury item by consumers. Sales are therefore low and prices are high when it first appears on the market. However, as the product becomes established, production methods are standardised, costs and prices fall and it gradually takes on the characteristics of a mass-market good. This leads to a period of rapid growth which levels off as sales reach the potential capacity of the market. At this time the market may stabilise or even go into a period of decline as rival products enter the market or as low cost foreign competition replaces domestic production.

In this article we will discuss the product life-cycle for domestic air travel in the United States. This is an interesting industry because air travel has only existed for about the last eighty years and so we have accurate statistics which allow us to trace out its development from an infant to a mature industry. The plan of the article is as follows. In the next section we seek to identify the key stages of transition for this industry. This is followed by an assessment of the effects of the business cycle on this market in its mature stage of development. Finally, we present some overall conclusions and some questions for further discussion.

The US Airline Industry

It is easy to forget that powered flight of any kind is only just over a century old. Considering that that Wright brothers first flight took place in December 1903, it is remarkable to note that commercial air flights within the US were already taking place by the mid 1920s. The subsequent development of the industry can be seen in Figure 1 which shows *Revenue Passenger Miles* for US domestic flights over the period 1926-2003. Revenue Passenger Miles (RPMs) are a basic measure of the volume of air traffic. They are calculated by taking the number of paying customers on each flight and multiplying by the distance travelled. These data are taken from the website of the *Air Transport Association of America* www.air-transport.org. Note that these data are for domestic flights only and therefore exclude flights to and from foreign destinations.

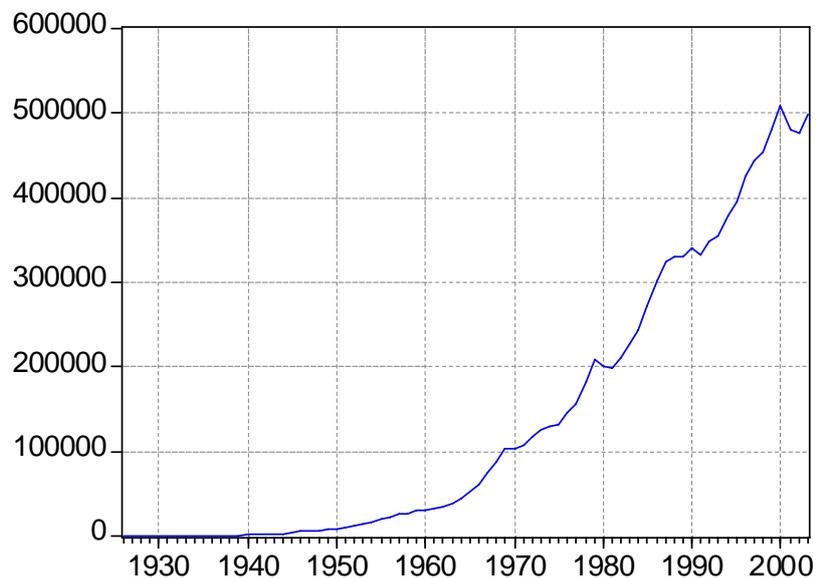


Figure 1: Revenue Passenger Miles for US Domestic Airline Industry (Millions)

Figure 1 illustrates a characteristic development path for a new industry. From a value of virtually zero in 1926, airline traffic increases steadily through time although there are a

number of periods in which this growth is interrupted by the effects of recession. For example, we observe downturns in growth following the cyclical peaks of 1979 and 1990. However, the downturn after the peak of 2000 is more likely to have been caused by the effect on confidence of the September 11th hijackings rather than the state of the economy.

Now simple analysis of raw data can tell us a good deal about the development of the industry but it can also be misleading. For example, despite the fact that the slope of the graph is increasing with time the growth rate is actually decelerating throughout the period. This is because if a series is growing through time then a given percentage increase will result in a larger and larger absolute increase as time progresses. Thus in order to investigate the development of the airline industry more deeply we will have to dig a little further into the data. The first stage is to *smooth* the data so as to reduce the effects of the business cycle in order to concentrate on the trend. We will also express the data in *per-capita terms* so as to allow for the effects of the growth in the potential market over the period.

	Revenue Passenger Miles (RPM)	Population	RPM (centred average)	Population (centred average)
1977	156609	219.8		
1978	182669	222.1		
1979	208891	224.6	189542.6	224.5
1980	200829	226.5		
1981	198715	229.5		

Table 1: Revenue Passenger Miles for US Domestic Flights (Millions) and US Population (Millions)

In Table 1 we illustrate a method for smoothing the data by taking a centred average for each year. For example, we know that there was a peak in airline traffic in 1979 which

coincided with a peak in the US business cycle around the same date. To smooth out the effects of the business cycle we take an average of the demand figures for the two previous years, the current year and the following two years. The smoothed value is therefore an average of five years data centred on 1979. In this case this gives a figure of about 190 billion RPMs as the trend value of demand in 1979 relative to an actual level of demand of about 209 billion. The effects of the business cycle can therefore be estimated as the percentage difference between the actual and the trend value for this year as shown in the calculation below. Our estimates therefore indicate that demand for airline travel was about 10% higher than its underlying trend value due to the effects of the 1979 boom.

$$\text{Effect of business cycle} = 100 \times \left(\frac{209 - 190}{190} \right) = 10\%$$

Another way to make it easier to interpret the data is to scale it for the effects of population growth. For comparability we smooth the data for total US population in the same way as we did for air travel. We then calculate the ratio of revenue passenger miles to the overall size of the US population from 1930 to the present day as shown in column three of Table 2. Scaling demand by the level of population enables us to assess the extent to which air travel had become a mass-market industry at specific dates during the past eighty years. From Table 2, we see that in 1930 air travel was still very much a luxury item. The average number of miles travelled by air per member of the US population in 1930 was only 0.6. However, this ratio grows significantly in subsequent decades. By 1960 the average distance travelled by air was 167 miles and by 2000 it was ten times this figure at 1,176 miles. During this period therefore the airline industry made the transition from a small industry producing a luxury product for a small number of individuals to a mass-market industry used intensively by a significant fraction of the population.

In discussing revenue passenger miles per capita, we do need to be a little cautious of talking loosely about an ‘average’ figure. The idea that the air travel was spread evenly across the population so that each individual travelled less than a mile by aeroplane in 1930 is of course ridiculous. What happened was that a small minority travelled reasonably long distances while the vast majority did not travel by air at all. At the end of the period it is more reasonable to think in terms of an average figure spread across the population since by then air travel was more evenly spread. However, it is still probably the case that the distribution of miles travelled by air is not symmetric and the median traveller is likely to be quite different from the fictitious average traveller calculations presented here. There is an exercise in the questions at the end of this article which illustrates this point.

	Revenue Passenger Miles (millions)	Population (millions)	RPM÷ Population	Annual Growth Rate of RPMs %	Annual Growth Rate of Population %
1930	73.0	123.4	0.6		
1940	1003.6	131.9	7.6	30.0	0.7
1950	8788.6	151.4	58.0	24.2	1.4
1960	29985.0	180.0	166.6	13.1	1.7
1970	103789.6	204.0	508.8	13.2	1.3
1980	200250.6	226.9	882.6	6.8	1.1
1990	336002.4	249.6	1346.2	5.3	1.0
2000	479863.8	279.6	1716.3	3.6	1.1

Table 2: Revenue Passenger Miles per Capita and Growth Rates

Another way to assess the transition of air travel from luxury product to a mass-market industry is by calculation of the compound annual growth rates for this product between decades. These calculations are shown in the fourth column of Table 2. For example, the annual growth rate between 1930 and 1940 can be calculated as the number g which satisfies the equation $73 \times \left(1 + \frac{g}{100}\right)^{10} = 1003.6$. This gives a value $g = 30\%$ per annum.

Although this formula looks forbidding, it is relatively easy to calculate using a spreadsheet or even a pocket calculator. Our calculations indicate that the growth rate of this industry was very rapid in the 1930s and 1940s but has tended to slow down over time. During the early part of our period growth in air travel has the characteristics of an infant industry in that the growth rate is much greater than that of the potential market as reflected in the growth rate of population. However, by 2000, the air travel industry had taken on the characteristics of a mature industry. This can be seen by the fact that, while its growth between 1990 and 2000 was still faster than that of population, the difference was only 2.5% as opposed to 29.3% between 1930 and 1940.

The Effects of the Business Cycle

So far we have discussed the long-run evolution of the air travel industry in the US but we have neglected an important short-run issue. Like many industries, air travel demand is sensitive to the overall state of the economy in that recessions can lead to a sharp fall in demand while a boom can quickly lead to pressure on capacity. In this section we therefore examine the extent to which deviations of air travel demand from trend depend on the state of the business cycle. Our measure of the business cycle is the deviation of Gross Domestic Product from a five-year centred moving average. This relationship is illustrated in Figure 2.

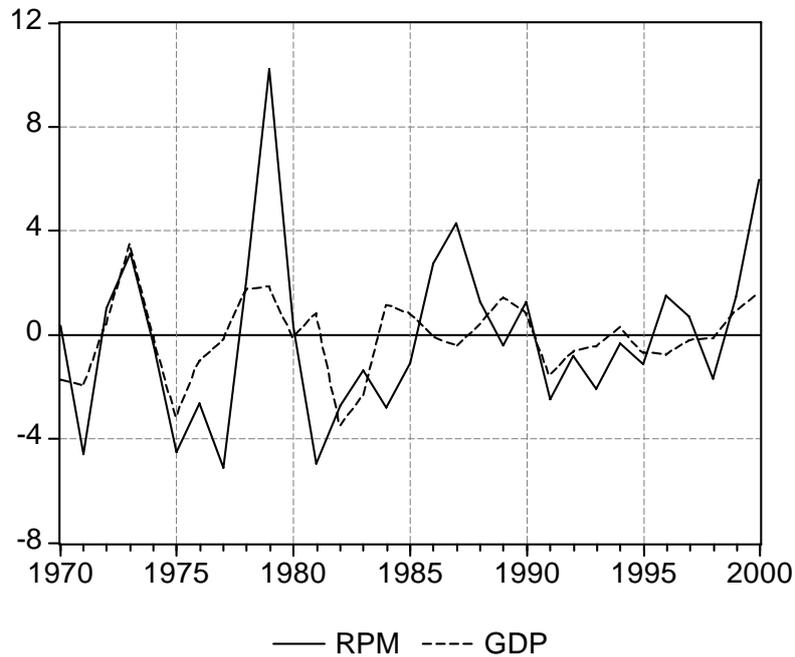


Figure 2: Percentage Deviations from Trend for Revenue Passenger Miles (RPM) and Gross Domestic Product (GDP)

In Figure 2 we have chosen to focus on the last thirty years of data on the basis that during this period the industry had effectively reached a mature stage of development. It is clear that there is a strong positive relationship between deviations in revenue passenger miles from trend and deviations of GDP from trend. There are peaks in demand in 1973 and 1979 which coincide with cyclical peaks in GDP. In later periods the peaks and troughs do not match so closely but a clear positive relationship is still visible. The relationship between demand and the business cycle is important because the airline industry is one in which it is important for suppliers to operate close to capacity. This is because fixed costs are high relative to variable costs and therefore any shortfall in demand means a loss of revenue without any significant fall in costs. As a result company profits are likely to be highly sensitive to the state of demand.

Conclusions

In this article we have used data for domestic air travel in the United States to examine the way in which a new industry develops through time. We have seen that an initial period of rapid growth is followed by a mature stage in which growth slows down to a level which is more consistent with that of the potential market. In this case we see that the very rapid growth in the 1930s and 1940s was followed by a gradual slowdown in the 1950s and 1960s which has continued until the present date. Finally, we have seen that there is a close relationship between deviations from trend in the demand for air travel and those of aggregate output. This is a source of concern for an industry in which there are significant costs of operating below capacity.

Questions and Thought and Further Discussion

1. What features of the airline industry make it particularly susceptible to variations in demand? (Hint: try to illustrate this market by using the diagram for a monopolistic producer faced with constant marginal costs).

2. Suppose we have five individuals whose demand for air travel during a given year is summarised in the following table:

Individual	1	2	3	4	5
Miles Travelled	0	500	0	0	700

Calculate the arithmetic mean number of miles travelled and the median. Comment on which is the more useful measure of average demand for air travel.

In the next year the demand of each individual changes with the results being given in the table below:

Individual	1	2	3	4	5
Miles Travelled	300	0	150	0	200

Again, calculate the arithmetic mean and the median. Comment on how your results have changed and which provides the most useful measure of average demand in this case.

3. Consider the market for personal computers. To what extent can you interpret the development of this market in the way outlined in this article? Has this market reached a mature stage at the present time?