If we priced tickets fairly, we'd be out of business.

Peter A. Forsyth*

February 6, 2019

It is getting to be that time of year when many of us are booking flights for vacations. Let me relate to you what I learned about *"full service"* airlines.

About 10 years ago, I attended a conference in Germany, which was a combination of two topics: quantitative analysis of futures and options for commodities and revenue management.

The quantitative analysis part was familiar to me. This was all about hedging contracts involving natural gas, oil, electricity, etc. This is all very challenging, due to the possibility of sudden jumps in the prices of the underlying commodities[1]. So I knew what was going on here.

What is revenue management? This is all about the quantitative methods used to capture extra revenue from consumers. A classic example is the on-line purchase of hotel rooms. You might notice that when you are looking around to book a room, the prices seem to change every few minutes. Sometimes when you go back to a site, you find that the room you wanted is *no longer available*, and that the remaining rooms have increased in price. Basically, this is an example of revenue management. In other words, the objective is to maximize the amount you end up paying for your room. As you can imagine, this is an area which uses lots of interesting methods in statistics and machine learning.

Getting back to the German conference: I think the organizer thought it was a brilliant idea to bring together these two different communities: quantitative finance and revenue management, since many of the same basic techniques are used by both.

I remember distinctly the first day of the conference, which was in the middle of summer. It was extremely hot, and the presentation rooms (on a German university campus) were not air conditioned. At the lunch break, most of us went back to our hotels and changed into shorts and T-shirts. However, there were several presenters from German corporations. They continued to wear black suits, white shirts and ties. They did a lot of sweating. I asked one of the besuited presenters after his talk why he was wearing formal attire under such circumstances. Apparently, it was a corporate rule: if you were making a presentation at a conference, you had to wear a dark suit and tie.

Anyway, there was a particularly interesting talk from a revenue management guy from a major European airline. He basically described the revenue management division of the airline (over 100 employees as I recall). He proceeded to describe some of the algorithms used to ensure that the airline would squeeze the maximum amount from anyone booking an on-line ticket. The prices would change in seconds, and depended on the time, location, and their guess on how much you really wanted to fly on that day. This confirms all your worst fears about how these tickets are priced.

From a quantitative finance perspective, this is all a bit strange. Quantitative analysts (quants) view prices as determined by the market, based on unobservable supply and demand forces. This

*David R. Cheriton School of Computer Science, University of Waterloo, Waterloo ON, Canada N2L 3G1, paforsyt@uwaterloo.ca, +1 519 888 4567 ext. 34415.

[1] I talked about this in an earlier blog https://www.pwlcapital.com/making-bets-with-other-peoples-money/

results in prices being essentially some type of random process, that we can only observe but not predict. But the revenue management people were essentially creating prices.

During the question period after the airline talk, one of the quant guys asked

> *"I don't understand why you put so much effort into setting the prices for these tickets. Shouldn't the market decide the price based on supply and demand? For example, you could just use some sort of on-line auction process to sell the tickets. Then, efficient market forces would set the clearing prices for the tickets."*

The revenue management presenter looked at the quant as if he was insane. He replied

> *"We are a full service airline[2]. If we charged the fair price for these tickets, we'd go bankrupt."*

I think about this every time I fly a full service airline.

[2] As opposed to a discount carrier