Problem Set 2 Solution

Jugal Marfatia

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Total possible points = 10.

(8 points if you attempt all questions and 2 points for answers being correct).

Due date: Friday Jan 25^{th} beginning of class.

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1. Franchise Value

Suppose that Mark Cuban wants to purchase the Mavericks in 2000 (call this year 0), and he expects to receive $400,000 in profits in years 1, 2, and 3 (each year). Now suppose that value of the Mavericks in year 3 is $500 million and that the interest rate is 4%.

1. What is the expected benefit from owning this team for 3 year. (Find E[B] using the formula and example from chapter 2 notes).

$$
\begin{aligned}
E[B] =& \frac{FV}{(1+i)^t} + \sum_{t=1}^{T} \frac{E[\pi_t]}{(1+i)^t} \\
=& \frac{500,000,000}{(1+0.04)^3} + \frac{400,000}{(1+0.04)} + \frac{400,000}{(1+0.04)^2} + \frac{400,000}{(1+0.04)^3} \\
=& \$444,499,289,372
\end{aligned}
$$

2. Given the expected benefit what is maximum price that Mark Cuban would pay to buy the Mavericks.

   The maximum price Mark Cuban will pay to buy the mavericks is equal to $E[B]$ $=$ $ 444,499,289,372

3. Briefly explain the logic behind the maximum price you found in part 2.

   The E[B] is the present value of future value plus future profit adjusted for interest rates, therefore if Mark Cuban pays anything less than E[B] it will result in economic profit.

2. Revenue sharing

Suppose the Pullman Bison (home team) play the Moscow Tigers (away team) and the demand for home tickets is given by the following function:

$$P_H = 140 - 3H$$

where H is the home attendance in thousands.

The demand for away tickets is given by the following function:

$$P_A = 60 - 4A$$

where A is the away attendance in thousands.

Lastly, the marginal cost for both teams is $20 and total cost is 20H for the home team, and 20A for the away team.

1. What is the profit maximizing price and attendances level (i.e. H^* and A^*) for each team without revenue sharing? What are the corresponding profit levels for each team?

   The profit for home and away teams are:

   $$\pi_{Home} = (140 - 3H)H - 20H$$
   $$\pi_{Away} = (60 - 4A)A - 20A$$

   Next, solving the maximization problem by take the first order derivative and setting it equal to 0 we get:

   $$\frac{d\pi_{Home}}{dH} = \frac{d}{dH}\Bigg((140 - 3H)H - 20H\Bigg) = (140 - 6H) - 20 = 0$$
   $$\frac{d\pi_{Away}}{dA} = \frac{d}{dA}\Bigg((60 - 4A)A - 20A\Bigg) = (60 - 8A) - 20 = 0$$

   And the associated price, quantity and profits are:

   $$H^* = 20, \quad P_H^* = 80, \quad \pi_{Home} = \$1,200$$
   $$A^* = 5, \quad P_A^* = 40, \quad \pi_{Away} = \$100$$

2. Now suppose that the league employs revenue sharing of 60-40 for home and away games respectively. Find the profit maximizing price and attendances level (i.e. H^* and A^*) for each team with revenue sharing? What are the corresponding profit levels for each team?

Now if the teams employ revenue sharing of 80-20, what will be each teams revenue be?

The new profit for home and away teams are:

$$\pi_{Home} = 0.6 * \Big((140 - 3H)H\Big) + 0.4 * \Big((60 - 4A)A\Big) - 20H$$

$$\pi_{Away} = 0.6 * \Big((60 - 4A)A\Big) + 0.4 * \Big((140 - 3H)H\Big) - 20A$$

Taking the partial derivative for home team with respect to H, gives us:

$$\frac{d\pi_{Home}}{dH} = \frac{d}{dH}\Bigg(0.6*\Big((140-3H)H\Big)+0.4*\Big((60-4A)A\Big)-20H\Bigg) = 0.6(140-6H)-20$$

Next, setting it equal to 0 gives us.

$$0.8(140 - 6H) - 20 = 0 \iff 3.6H = 64$$

And solving for H gives us the optimal level of H i.e.

$$H^* = 17.7$$

Similarly, taking the partial derivative for away team with respect to A, gives us:

$$\frac{d\pi_{Away}}{dA} = \frac{d}{dA}\Bigg(0.6*\Big((60-4A)A\Big)+0.4*\Big((140-3H)H\Big)-20A\Bigg) = 0.6(90-8A)-20$$

Next, setting it equal to 0 gives us.

$$0.6(80 - 8A) - 20 = 0$$

And solving for A gives us the optimal level of A i.e.

$$A^* = 3.33$$

Therefore the associated profits are:

$$\pi_{Home} = .6 * (140 - 3(17.7)) * 17.7 + .4 * (60 - 4(3.33)) * 3.33 - 20 * 17.7 = \$631$$

$$\pi_{Away} = .4 * (140 - 3(17.7)) * 17.7 + .6 * (60 - 4(3.33)) * 3.33 - 20 * 3.33 = \$641$$