The Sports Product Market - Part 2

ECONOMICS OF SPORTS (ECON 325)

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Are sports broadcasts excludable?

- Assume for a moment they are: how should viewership be priced vis-à-vis game tickets?
  - Depends if the two are substitutes or complements.
- The purchaser of broadcast rights is a monopolist.
  - Though theoretically he should bid away all profit to the upstream monopolist (league) if rights are sold collectively.
- How does the monopoly broadcaster maximize profit?

Monopoly profit, revisited

- Assume the airing of broadcasts has zero marginal cost.
  - It is equally costly to broadcast to 100 or 100,000 households.
  - Even in addition to the rights, probably high fixed costs.
- Broadcaster can charge a combination of:
  - price (*p*) for viewership, with downward sloping (inverse) demand, $p = a - bq$ and
  - λ per viewer to advertisers.
- Profit is:

$$\pi = q(a - bq) + \lambda q - c_o$$

- Since MC=0, maximizing revenue will maximize profit.

Broadcaster's optimal pricing

- The profit-maximizing price solves:

$$\max_q \pi = q(a - bq) + \lambda q - c_o$$

$$\frac{d\pi}{dq} = a - 2bq + \lambda = 0; p^* = \frac{a - \lambda}{2}$$

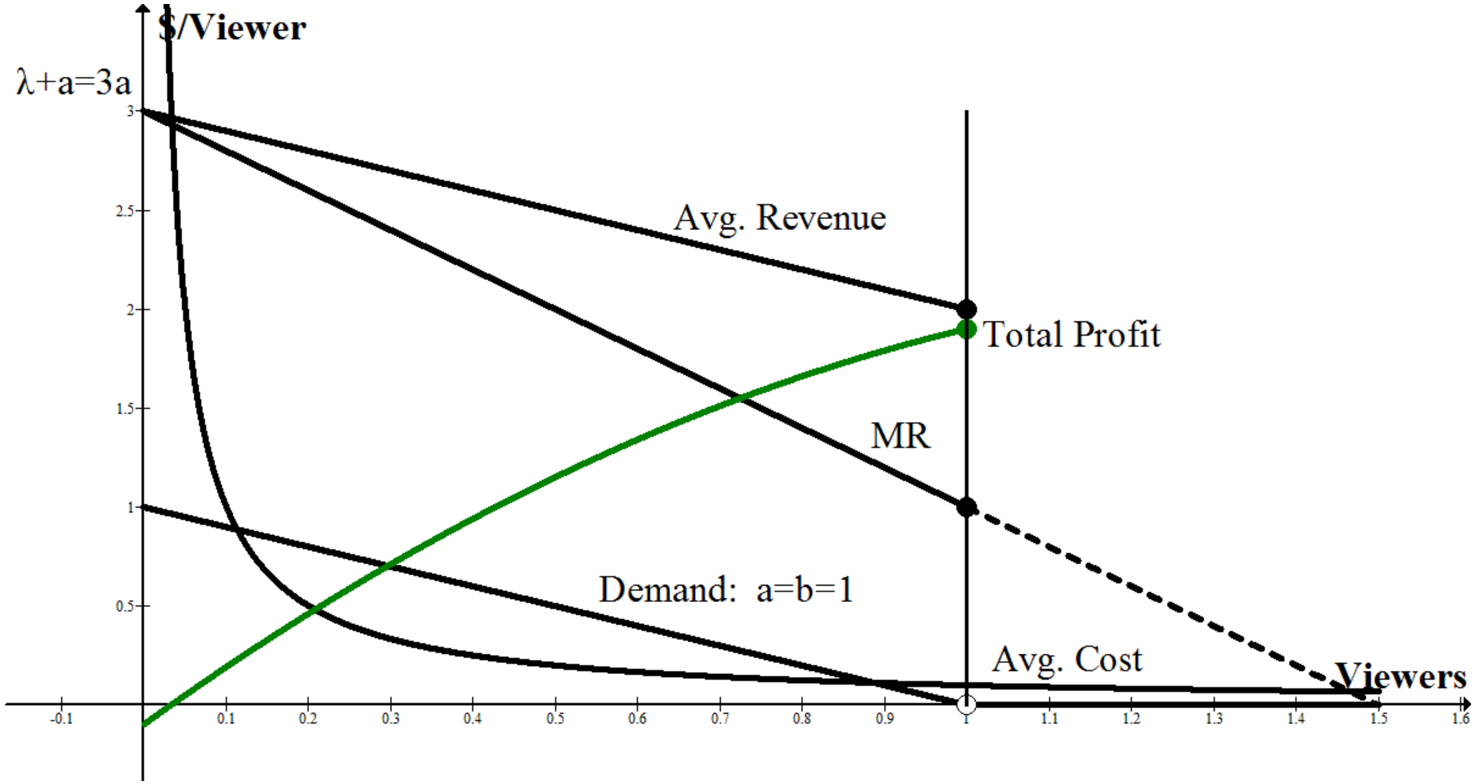
- It could be $p^* > 0$. Or it could be $p^* = 0$ if the ad rate is sufficiently large, relative to the demand from viewers: $\lambda > a$.
  - Free-to-view TV broadcasts are a possible solution (next slide).

Graph of broadcaster's profit

- To check that, if $\lambda > a$, the broadcaster gets less profit by charging a small $\varepsilon > 0$ compared to $p = 0$:

$$(\varepsilon + \lambda)\left(\frac{a}{b} - \frac{\varepsilon}{b}\right) < \frac{\lambda a}{b}$$
$$\Leftrightarrow (a - \lambda) < \varepsilon,$$

Which holds because epsilon is positive and $(a - \lambda)$ is negative.



Broadcasting, extensions

- Cheaper viewer fees enable the club/league to pass on some of the revenue earned from on-field advertisements (visible on TV).
  - Billboards, backstops, the players' clothing.
  - In the form of cheaper broadcast rights: $\downarrow C$.
  - For simplicity: $C = c_0 - \theta\left(\frac{a+\lambda}{2b}\right)$, where the second term is the discount given (θ) on the TV contract per viewer.
- Blackouts: "not good" Putsis & Sen (2000)
- Formal model analyzing broadcasters and league jointly: Dietl & Hasan (2007).
- Differences between the U.S. and Europe: Hoehn & Lancefield (2003).

Attending and watching are subs, right?

- Why else would the clubs/leagues want to black out games?
- Why have they always worried about this?
  - "Mr. Radio is going to butt into the business of telling the world all about the ball game without the world having to come to the ballpark to find out." – *The Sporting News* (1922), quoted in Jules Tygiel, Past Time, p. 72.
- Maybe only the away team fans watch the broadcasts, though.
  - Or only home fans that live so far away that going to the game is a very poor substitute.
- If they're complements, maybe leagues should be doing more to lower the price to viewers.
  - Simmons (2006 in Handbook on the Economics of Sport, Edward Elgar Publishing)
  - Kaempfer & Pacey (1986) speculate that broadcasts are like advertising, increase demand for *future* tickets.
- Does fantasy sports work the same way? Nesbit & King (2010a, 2010b), Karg & McDonald (2011)

Cross price elasticity!

- The revenue maximizing price for tickets depends on substitutability/complementarity of TV (and vice versa).
- Demand for Attendance at a game between home team "i" and visiting team "j" is:

$$A_{ij} = f\left(p_{tix}, p_{tv}, m_i, m_j, distance_{ij}, w_i, w_j\right), \text{where}$$

"m" is the size of the team's fan base (including their incomes), "w" is the strength of the team, and "distance" is how far the visiting fans would have to travel to attend a road game.

- Again revenue* is maximized when:

$$\frac{\partial R_i}{\partial p_{tix}} = A_{ij} + p_{tix}\frac{\partial A_{ij}}{\partial p_{tix}} + \frac{\partial B_i}{\partial q_{tv}}\frac{\partial q_{tv}}{\partial p_{tix}} = 0.$$

* Revenue includes the ticket sales, plus the earnings from selling the broadcast (B_i) rights.

Cross price elasticity, unpleasant but useful math

$$\frac{\partial R_{ij}}{\partial p_{tix}} = A_{ij} + p_{tix}\frac{\partial A_{ij}}{\partial p_{tix}} + \frac{\partial B_i}{\partial q_{tv}}\frac{\partial q_{tv}}{\partial p_{tix}} = 0$$

- Solving for the term that is (almost) the elasticity of demand:

$$p_{tix}\frac{\partial A_{ij}}{\partial p_{tix}} = -\left[A_{ij} + \frac{\partial B_i}{\partial q_{tv}}\frac{\partial q_{tv}}{\partial p_{tix}}\right]; |\varepsilon_t| = 1 + \frac{\partial B_i}{\partial q_{tv}}\frac{\partial q_{tv}}{\partial p_{tix}}\frac{1}{A_{ij}}$$

- You can clarify this by multiplying the 2nd term by 1:

$$|\varepsilon_t| = 1 + \frac{\partial B_i}{\partial q_{tv}}\frac{\partial q_{tv}}{\partial p_{tix}}\frac{1}{A_{ij}}\frac{q_{tv}}{q_{tv}}\frac{p_{tix}}{p_{tix}},$$

so these terms can be combined into the cross price elasticity:

$$|\varepsilon_t| = 1 + \frac{\partial B_i}{\partial q_{tv}}\frac{\partial q_{tv}}{\partial p_{tix}}\frac{1}{A_{ij}}\frac{q_{tv}}{q_{tv}}\frac{p_{tix}}{p_{tix}} = 1 + \varepsilon_{t,tv}\frac{\partial B_i}{\partial q_{tv}}\frac{1}{A_{ij}}\frac{q_{tv}}{p_{tix}}.$$

Cross price elasticity, unpleasant but useful math

- The rest of the terms are "the effect on the value of the broadcasting contract of a proportional increase in viewers," which is surely positive. So, using $\beta > 0$ for this,

$$|\varepsilon_t| = 1 + \varepsilon_{t,tv}\beta.$$

- The optimal ticket price could be in the elastic (substitutes, $\varepsilon_{t,tv} > 0$) or inelastic (complements, $\varepsilon_{t,tv} < 0$) range of the demand curve.

Ultimately it's an empirical question

- Overviews of this in the literature: Borland & MacDonald (2003), Buraimo (2006, HES Ch. 10)
- Lots of empirical studies.
  - Not *really* measuring the cross-price elasticity. Hard to measure the price paid for the marginal game viewed on TV: cable bundling, etc.
  - Instead they often measure the effect of the availability or viewership of a sports event on attendance.
- Buraimo (2008) and Forrest, et al. (2004) are typical: analyzes the attendance at individual (tier two and Premier, respectively, English football league) games.

How do you answer empirical questions?

- First phrase them as causal relationships between variables: "does broadcasting a soccer match have a causal effect on stadium attendance of that match?"
  - Broadcasting is a qualitative variable: make it quantitative.

$$SKY = \begin{cases} 1, \text{if broadcast on the BSkyB satellite TV network} \\ 0, \quad \text{if not.} \end{cases}$$

  - Do similarly for other (free over the air "ITV TERRES" or pay digital "ITV DIGITAL") broadcast media.

- "Does change in one (independent) variable have a causal effect on another (dependent) variable?"
  - Does match attendance increase (decrease) when you, e.g., change SKY from 0 to 1?

Think about the counterfactual

- "What would have happened if SKY had *not* changed?"
  - I.e., compared to the observed outcome, what would attendance have been if the match had not been televised?
- This defines the causal effect:

$$Causal\ Effect = (A_o | SKY_o = 1) - (A_c | SKY_c = 0); c \text{ for counterfactual}, o \text{ for observed.}$$

- Problem: without a time machine you can't replay history and observe the 2nd one.
- Imperfect solution: look at other matches that weren't televised as a substitute for the counterfactual.

Substitute for the counterfactual?

- Using other observed matches:

$$Observed\ Difference = (A_o|SKY_o = 1) - (A_o|SKY_o = 0).$$

- Why is this imperfect?
  - Selection bias. Games are not randomly assigned to be televised or non-televised.
  - Televised ones are probably more popular!
  - So,

$$(A_c|SKY_c = 0)\ - (A_o|SKY_o = 0) > 0.$$

- Clever trick: add and subtract the counterfactual to the expression at the top.

$$Observed\ Difference = (A_o|SKY_o = 1) - (A_c|SKY_c = 0) + (A_c|SKY_c = 0) - (A_o|SKY_o = 0).$$

- This equals:

$$Observed\ Difference = Causal\ Effect + Selection\ bias > Causal\ Effect.$$

Better solution: multiple regression

- Non-televised games become better substitutes for the counterfactual, the more of these differences we <u>control</u> for.
  - Statistically you hold these other factors affecting attendance constant.

- This is what Buraimo does in his paper. Models the conditional expectation of attendance in a match between teams (home *i* and visiting *j*) during season *t* as a linear function of the things that determine stadium attendance demand:

$$E(A_{ijt}|\boldsymbol{X}) = \beta_0 + \beta_1 SKY_{ijt} + \sum_{k=2}^{K} \beta_k x_{k,ijt}.$$

- So, when you change SKY from 0 to 1, holding the other *x* variables constant ("ceteris paribus"),

$$\frac{\Delta E(A_{ijt}|\boldsymbol{X})}{\Delta SKY_{ijt}|\{x_2 \ldots x_k\}\text{ constant}} = \beta_1 \approx Causal\ Effect.$$

What do you have to “hold constant?”

- The other things that affect demand for that match’s tickets.
- Buraimo controls for:
  - Each team’s previous season avg. attendance,
  - A binary variable indicating whether the 2 teams are (=1) historical rivals,
  - The distance between the 2 teams’ home cities,
  - Each team’s points per game in the previous matches that season,
  - Each team’s player payroll,
  - The “uncertainty of outcome” to capture how evenly matched the teams are: $|Points_i - Points_j|$,
  - Binary variables for the day-of-the-week and which month of the season when the match is played.
- Part of the reason there is so much literature about this is due to scholars arguing that <u>even more variables</u> belong in the attendance regression.

What did Buraimo find?

- When he estimated the “beta” terms in his regression, the effect of broadcasting a game via the BSkyB network is approximately a <u>4% decrease in stadium attendance</u>.
  - The free over air broadcasts are estimated to decrease attendance by 17%.
  - While it’s not an elasticity, this evidence is suggestive that television is a substitute.
  - He also analyzed the other side of this, finding that bigger stadium audiences feed back in the form of more attendance at later matches.
- Forrest, et al., found comparable results for the Premier league, with the caveat that the larger TV audiences would justify selling the broadcasting rights, on the part of the club/league, to more games.
  - Because the rights would appreciate in value sufficiently to offset the loss of ticket revenue.

Broadcasting, extensions

- The determinants of TV viewership would be of interest to advertisers and the leagues selling the rights.
  - Hausman & Leonard (1997): superstar NBA players really drive TV ratings.
  - Kanazawa & Funk (2001): they might like to watch white players more.
  - Monday Night (NFL) Football get a larger audience when there's a black QB, though: Aldrich, et al. (2005)
  - Also when better teams are playing, the scoring is close and frequent (yup, sounds like the NFL to me): Paule & Weinbach (2007)
  - Same thing in German soccer, plus fast kicking, minus high scoring: Feddersen & Rott (2011)
  - Rodriguez et al. (2016): cycling fans care about competitive balance and the nationality of the race leader.
  - Anecdotally any broadcast featuring Chris Collinsworth has a negative effect on viewership.