# The Sports Product Market

ECONOMICS OF SPORTS (ECON 325)

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# What kind of good is sports?

- All goods can be classified according to the combination of 2 properties they have (or don't):
  - Rivalry in consumption and
  - Excludability.
- Sports defined how?
  - Admission as spectator:  excludable and non-rival, until SRO sells out at least.
  - Broadcasts, "accounts and descriptions of this game . . . .":  excludable in principle and non-rival.
    - But difficult to enforce, practically non-excludable.
  - Merchandise:  excludable and rival, a private good.
- Tickets to most games and legal broadcasts of games are "natural monopolies" or "club goods" like toll roads or gated internet content.
- Most other forms are essentially public goods like fireworks displays or national defense.
  - Hard to stop me from playing fantasy baseball using MLB's stats, even if they wanted to.
    - Schwarz, Alan.  2004.  The Numbers Game.  St. Martin's, New York.  173-194.

# Leagues and clubs

- Who is making the choices?
  - Individual clubs.
  - But some coordination with other clubs, restrictions by the league.
- Do the clubs do collectively what a planner in charge of the whole league would do?
  - I.e., price to maximize overall profit, like an economic firm.*
  - Also pay and allocate players to maximize overall profit.
- Do the sports clubs behave like firms, even with respect to maximizing *their own* profits?
  - Even if their collective choices don't maximize overall league profit.

* See Neale, Walter. 1964. "The Peculiar Economics of Professional Sports." *The Quarterly Journal of Economics*: Vol.78, No. 1, 1-14.

# Clubs' objectives

- Profit ("$\pi$"): Ferguson et al. (1991)
- Wins
  - Subject to some kind of break even constraint.
  - Maybe an "acceptable ($) losses" constraint if owners get consumption value from their team's performance: Sloane (1971),
- A combination of profit and wins
- Fans' utility: Madden (2012)
- Zimbalist's (2003) literature review
  - See references for papers that test

# If clubs maximize profits on ticket sales

- They solve:

$$\max\ \pi = pA - C\,,$$

Where $p$ is price, $A$ is attendance, and $C$ is the club's total costs per game.

- As a monopolist facing a downward-sloping demand curve, $A$ is a function of $p$.
- To maximize profit, the club solves the maximization problem with the first order condition:

$$\frac{d\pi}{dp} = p\frac{dA}{dp} + A - \frac{dC}{dA}\frac{dA}{dp} = 0.$$

- And this is even simpler if one assumes that the marginal cost of another fan is zero.

$$\frac{dC}{dA} = 0 \rightarrow p = -A\frac{dp}{dA}.$$

# If clubs maximize profit on ticket sales

- Simplifying this results in a simple pricing rule:

$$\frac{p}{p} = \frac{A}{p}\frac{dp}{dA}; 1 = |\varepsilon|; \varepsilon \equiv demand\ elasticity.$$

  - If the club is an elastic ($|\varepsilon| > 1$) part of the curve, it should cut prices and increase revenue through higher attendance.
  - If it's on an inelastic ($|\varepsilon|<1$) part, it should raise prices and increase revenue; not very many fans will be dissuaded.
  - And stop changing prices when they get to the point where demand is unit elastic.

- Obviously if the capacity of the stadium is less than the optimum implied above, they would only cut price to the point of a sellout.

# Implications

- The club does not price at marginal cost ($0/person).
  - Some fans who are willing to pay more than marginal cost would be denied tickets.
- Fixed costs, like player payroll, do not enter into the optimal ticket price.
- Although it impacts the club's decisions about hiring players, trying to maximize other things, like wins, should not affect the ticket pricing behavior.
  - A better team would shift demand for tickets outward, but taking that new curve as given, the unit elasticity rule still applies.
  - Opponents that attract more fans or games on weekends should have higher prices, if clubs price according to this rule.

# Limitations

- Single price, no price discrimination.
- No differentiation of sections within the stadium (“homogenous” tickets).
- No other sources of revenue accounted for.
  - In a simplistic way, this is easy to relax.

# Broadcasting rights

- Significant revenue comes from excluding all but the buyer of the rights from broadcasting games.
  - Again some teams' games have larger viewing audiences (and ticket-buying audiences).
- Teams could sell individually or the league could sell the rights collectively.
  - The latter saves on transaction costs of repeated negotiation and gives the league more bargaining power, Falconieri, et al. (2004).
  - Revenue sharing across teams is another motivation for, but is not unique to, collective selling.
  - Weaker teams might free-ride because revenue depends only on *league* performance.

# Investing in talent, given optimal pricing

- But where does the broadcast revenue go? Baseline case: clubs get, and try to maximize, their broadcast revenue.
  - But differ in market size.
  - Follow Falconieri, et al., here.

$$R_i = A_i\left(\frac{t_i}{t_i + t_{-i}}\right)(1 + \kappa_i);\, t_i \text{ is team } i's \text{ talent level.}$$

- The big parenthesis is team *i*'s strength and winning probability. Think of this as a shifter of the team's demand curve and the ability to choose a higher $p^*$.
- $\kappa_i$ is the broadcast revenue multiplier, and it's bigger for larger market clubs.
- Talent, of course, is costly, and clubs have to pay to shift their demand curves out.

$$C_i = ct_i + c_i^0.$$

# Investing in talent, continued

- Clubs maximize profit by choosing how much talent to invest in:

$$\pi_i = A_i\left(\frac{t_i}{t_i + t_{-i}}\right)(1+\kappa_i) - ct_i - c_i^0; \frac{d\pi}{dt_i} = A_i(1+\kappa_i)\left[\frac{1}{t_i + t_{-i}} - \frac{t_i}{(t_i + t_{-i})^2}\right] - c = 0.$$

- Equilibrium would mean solving “n” (1 per club) of these conditions simultaneously for the vector, $\boldsymbol{t} = [t_1^* \ldots t_n^*]$ (Falconieri, et al., p. 842).

# Investing in talent, continued

- "Despite all the simplifying assumptions built into the model, in general, we cannot solve this system explicitly" – the authors. So rather than banging your head against a wall, recognize that the square brackets can be expressed in terms of team i's relative strength (win probability):

$$\left[\frac{1}{t_i + t_{-i}} - \frac{t_i}{(t_i + t_{-i})^2}\right] = \frac{t_{-i}}{(t_i + t_{-i})^2} = \frac{1 - w_i}{t_i + t_{-i}}.$$

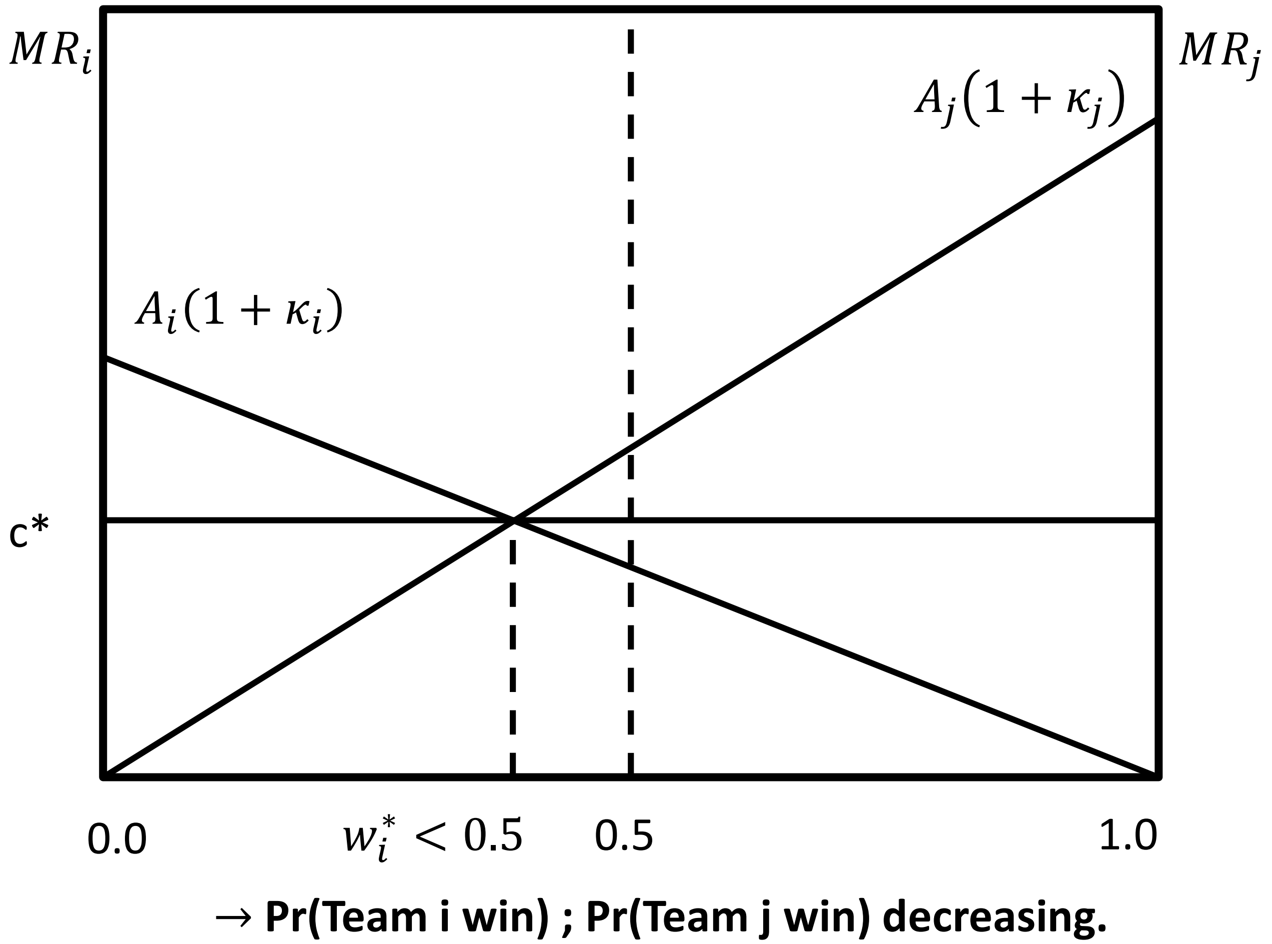
- This simplifies down to $(1 - w_i)$, if you normalize the total talent to 1.
- so you could draw any club's marginal revenue function as a downward sloping line.

# Investing in talent, equilibrium characterized

MR for a bigger market club is strictly higher than for a smaller club.

- Competition bids the price of talent up to the point ($c^*$) at which all (or both, in the simplified 2 team league picture) clubs marginal revenues are equal.
- If any club's MR were to exceed $c^*$, it would either outbid other clubs or bid up *c*, thus not equilibrium.

In equilibrium the talents and winning %s deviate from the balanced $(0.5\ \forall\ i, j)$ outcome.



# (broadcast) Revenue sharing

This is where it gets fun.

The league can manipulate this equilibrium by dividing the revenue "v" from the collective sale of broadcasting rights:

- Equally among all teams, or
- Based on performance.

Equal sharing just means replacing the private revenue with the club's share of collective revenue:

$$R_i = A_i\left(\frac{t_i}{t_i + t_{-i}}\right) + \frac{v}{n}$$

.

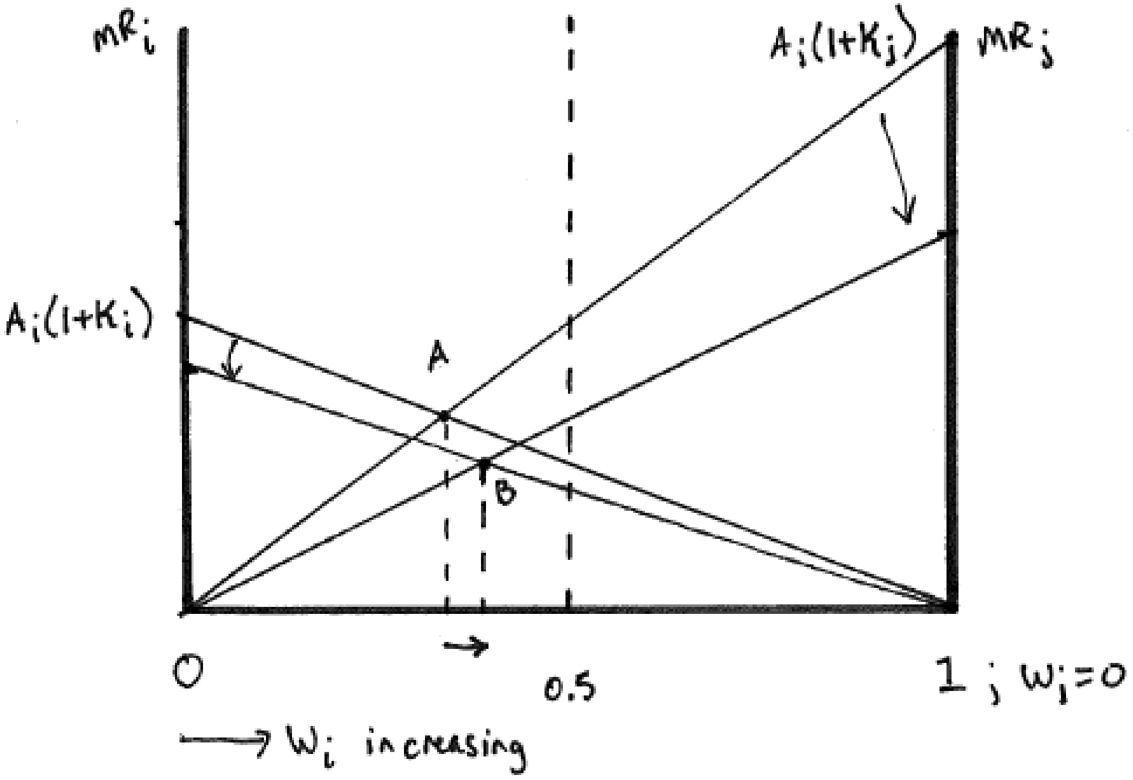
# Equal sharing

Sharing of broadcast revenue takes the broadcast audience out of the clubs' MRs.

- This diminishes the advantage of the bigger club(s).
- But they still have a MR advantage via ticket sales.

You get closer but not all the way to perfect competitive balance.

- Unless there is a sufficiently large prize (Falconieri, et al., p. 845), on top of local ticket revenue, for winning.



# Equal sharing, caveats

Investment in talent is lower because clubs cease to take into account their effects on "v".

- The free rider effect.

In terms of *total* revenue, this could get offset by a bargaining power effect.

- The league is a monopolist now that could extract more of the surplus from the sale to broadcasters.

Also (though it is not modeled here) competitive balance *may* have a net positive effect on $v$.

- The league gets more popular overall because the games are closer/more uncertain.

# Performance-based sharing

Equal sharing is a special case of this scenario, under which the league can designate a fraction of v, $(\theta)$, to go to clubs based on performance.

- Obvious to see why this *would* increase the incentive to invest in talent.

Revenue is:

$$R_i = A_i(1+\theta v)\left(\frac{t_i}{t_i + t_{-i}}\right) + \frac{(1-\theta)v}{n}$$

MR increases for both clubs and so does the equilibrium investment in talent.

Competitive balance in equilibrium is less clear.

# Performance-based sharing, continued

This is where it's important to consider clubs' effects on the league broadcast revenue.

- If they completely ignore this, because their slice of the pie is so small (1/n), competitive balance is the same as under equal sharing.
- Big and small market clubs proportionally increase their investments in talent, leaving the ratios unchanged.
- Or even if they *do* consider this, but in the identical way so: $\frac{dv}{dt_i} = \frac{dv}{dt_j} \forall\ i, j.$

But if big clubs have a (and recognize their) bigger effect on the "size of the pie," they invest proportionally more in talent (like private sale), and balance is worse.

- More will tune in to see a big club in the championship?

# Performance-based sharing, continued

Or the opposite could be the case if big (small) clubs recognized their negative (positive) effect on balance and invested proportionally less (more).

- In 2016 people actually tune in to watch their team play the Kansas City Royals!
- Conversely fans are reluctant to watch their home team get whomped by the "Yankees" yet again.

This is called the rent-seeking effect by Falconieri, et al., the added incentive to win created by revenue sharing.

- It gets larger, the larger is the league's bargaining power effect.  Assuming $\theta > 0$.

# Performance-based sharing is a substitute for a large prize ("z")



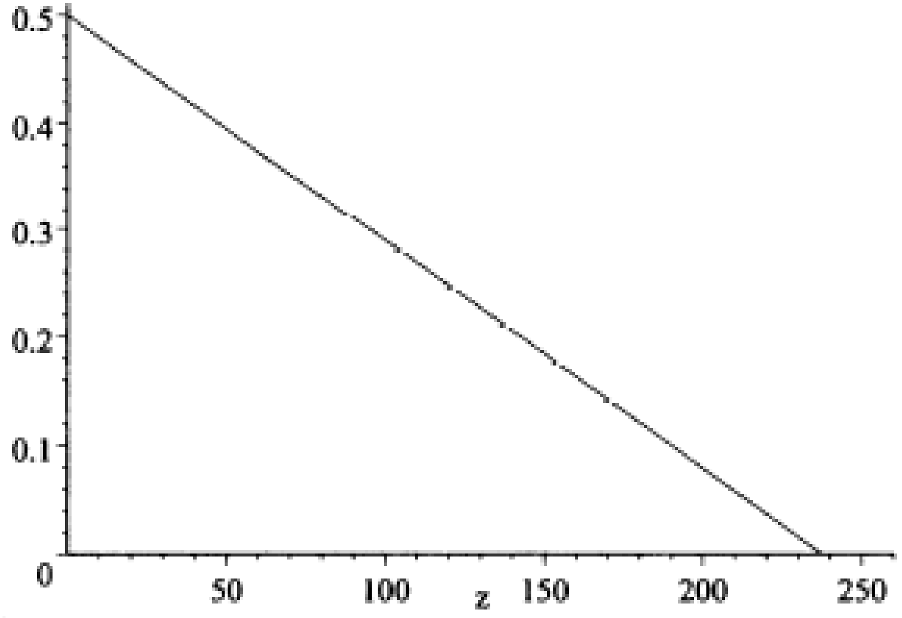



FIGURE 2. The optimal level of revenue sharing ($\theta^*$) as a function of $z$.

# Broadcast rights, empirical literature

Noll (2007): collective sale is a bad idea. It doesn't help balance, makes it more expensive to consumers.

- Peeters (2011) agrees. Even the rent-seeking effect helps stronger drawing teams in the UEFA.

Szymanski (2001): increases in revenue dispersion have not affected balance.

Vrooman (2009): autoregressive process estimation to infer competitive balance.

# Demand for tickets

The population of potential attendees has diverse preferences for going to any given game. Formally this is represented by each person's (indexed by *i*) utility function:

$$U_i = v_i - p; v \equiv \text{person } i'\text{s value placed on attending the game.}$$

Each person will attend if $U > 0 \rightarrow v_i > p$.

*v* is assumed to have a probability distribution in the population, e.g., uniform, normal, exponential, such that for any $v_i$, $\mathrm{F}(v_i) = \Pr(v \leq v_i) \in [0,1]$ gives the share of people who value attendance less than or equal than person *i* does.

For a population of *N* people, when the club sets price *p*, the quantity that will demand tickets is:

$$A = [1 - F(p)] * N; \text{since} \frac{\mathrm{dF}}{\mathrm{dp}} > 0,$$

this quantity falls with *p*. As the Law of Demand would predict. Back.

# Extension: non-ticket revenue is proportional to attendance.

If the proportionality is $\kappa$, profit is:

$$\pi = (p + \kappa) * A(p) - C.$$

The maximum implies:

$$A + (p + \kappa)\frac{dA}{dp} \rightarrow 1 - \frac{\kappa}{p} = -\frac{1}{\varepsilon}; \varepsilon^* = \frac{p}{p + \kappa} < 1,$$

i.e., optimal ticket pricing in the inelastic region of the demand curve.

Back.