The Sports Labor Market

ECONOMICS OF SPORTS (ECON 325)

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Sports production function

"Americans love a winner. And will not tolerate a loser . . . ."

How do you produce a winning team?

Winning probability is a function of talent: $w_i = f(t_i, t_{-i})$.

- Therefore revenue is a function of talent.

Marginal Revenue Product as an upper bound on what a club will pay for talent.

Marginal revenue product

Marginal Revenue Product: the additional revenue earned by one additional unit of talent.

An upper bound on what a profit maximizing club will pay for talent.

Talent costs c per unit.

$$\pi_i = R(t_i, t_{-i}) - c_0 - ct_i; MRP \equiv \frac{dR}{dt_i}$$

$$\frac{d\pi_i}{dt_i} = 0 \rightarrow MRP = c.$$

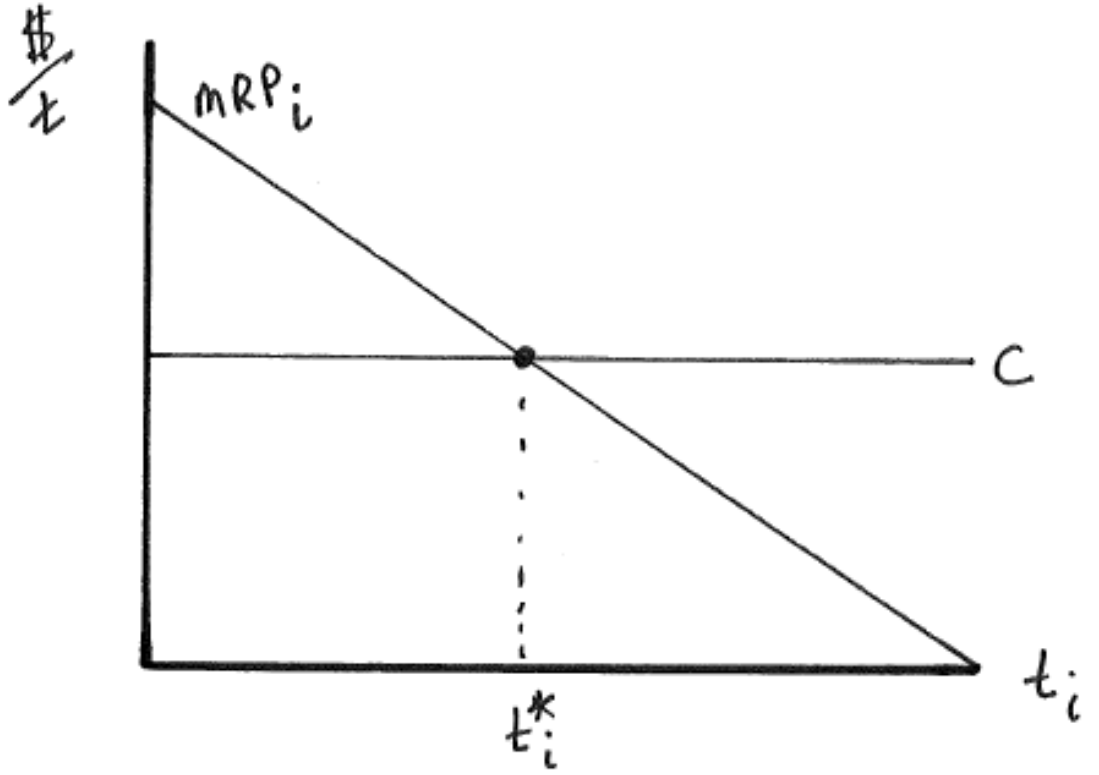
MRP is the club's demand function for talent.

Law of Demand

If, as is usually assumed about production functions, the marginal product of talent is diminishing . . .

MRP slopes downward.

- Or if fans are willing to pay less for the *marginal* win with more wins:
- "Who cares? We already clinched the playoffs!"



Diminishing marginal product

If win probability is (proportional to) the team's fraction of total league talent, it is diminishing:

$$w_i = \frac{t_i}{t_i + (n-1)\bar{t}}; \frac{dw_i}{dt_i} \equiv MPt_i = \frac{1}{t_i + (n-1)\bar{t}} - \frac{t_i}{(t_i + (n-1)\bar{t})^2};$$

And,

$$\frac{dMPt_i}{dt_i} = \frac{-2(t_i + (n-1)\bar{t})}{(t_i + (n-1)\bar{t})^3} < 0.$$

In equilibrium all teams would have the same marginal willingness to pay for talent.

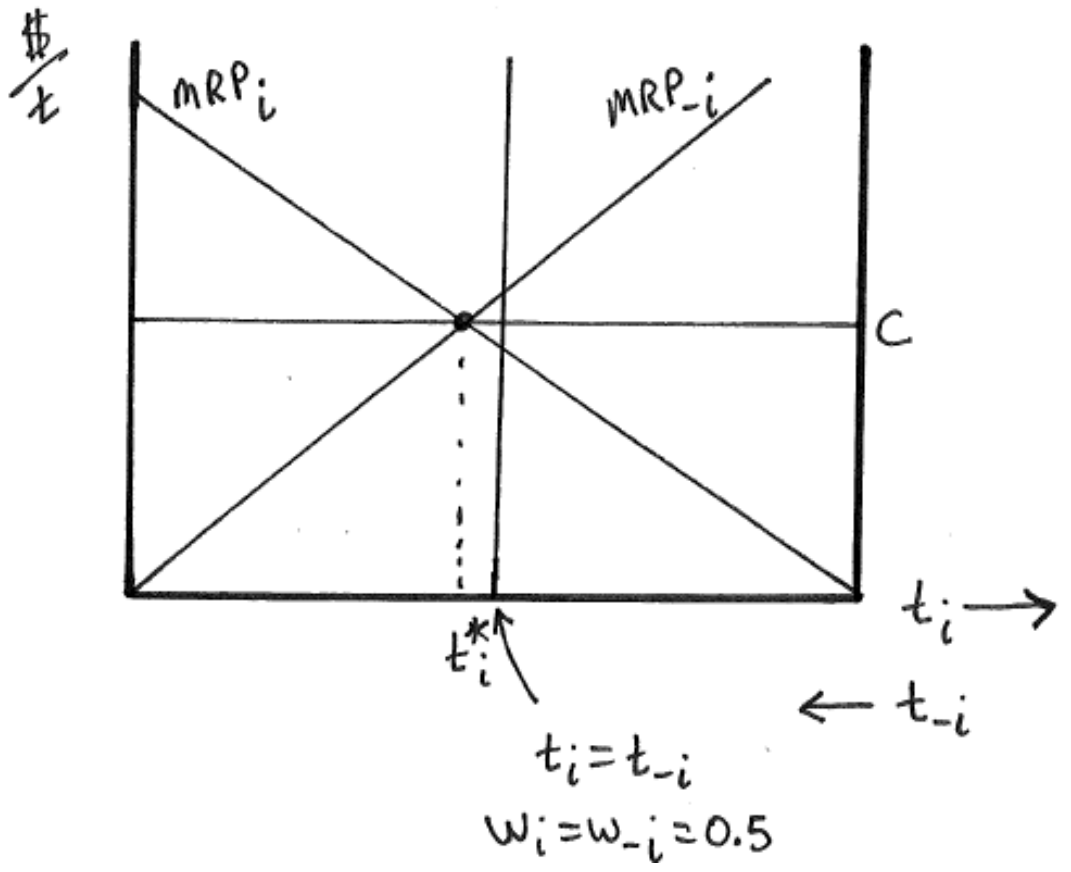
- Again this is easy to see in a 2 (representative) team league (next slide).

Equilibrium

Similar to the output market graphs, this depicts 2 teams with disparate values of winning.

- Team i hires less than ½ of the league's talent.
- This is the root of the competitive imbalance.
- *c* rises (falls) to ration the fixed supply of talent between (among) clubs.

Talent is inelastically supplied, though.

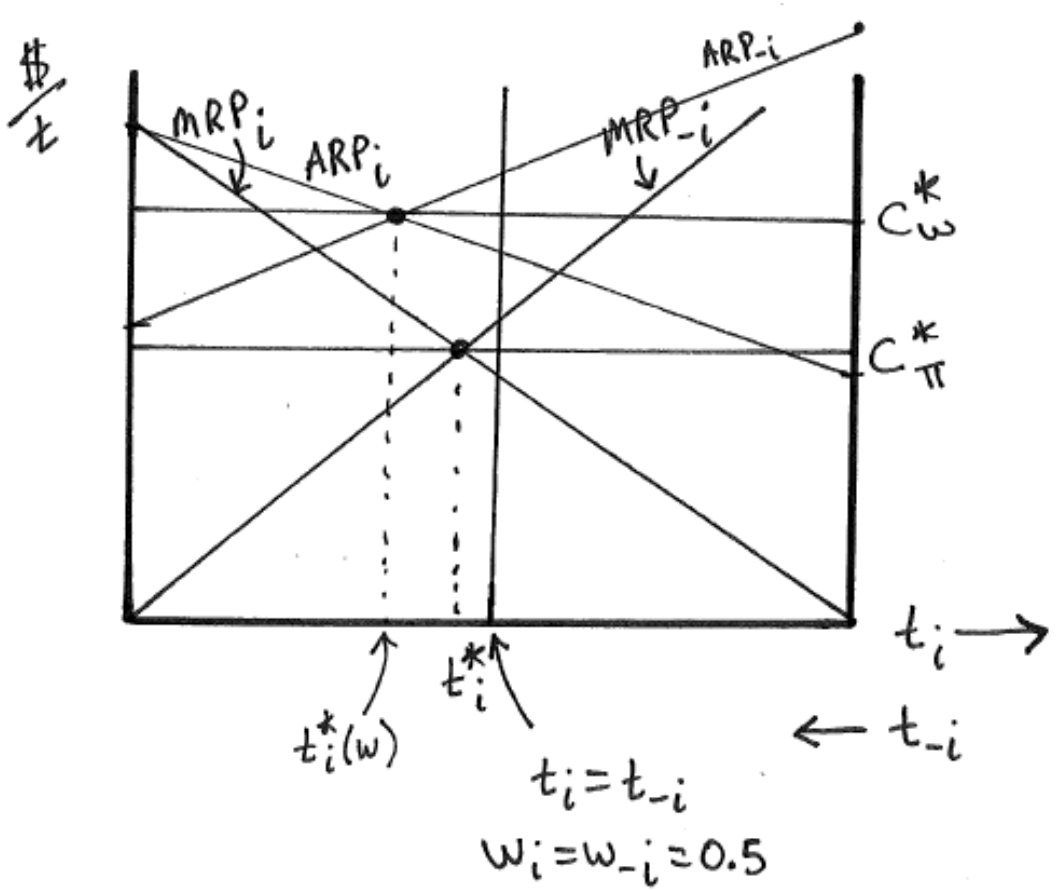


Sportsmen leagues

If clubs don't maximize profits and instead break even while maximizing wins . . .

They bid up the price of talent until it equals their Average Revenue per unit of talent.

- Again this means higher salaries for players,
- But more imbalanced league performance, as the bigger club exerts its advantage more.



More elastic talent supply

If you lift the assumption that the total league talent is constant, you can no longer show equilibrium on the box diagram.

- Because it's not known where the second axis will intersect.
- Total talent employed depends on how the other team(s) respond to my team's hiring choice.

$$MPt_i = \frac{t_{-i}}{(t_i + t_{-i})^2} \text{ and } MPt_{-i} = \frac{t_i}{(t_i + t_{-i})^2},$$

in the 2 team league.

Making the same (strong) assumption as before: that fans value wins and uncertainty of outcome with the same weight, then the marginal revenue of a win for a team with market size *m* is:

$$\frac{dR_i}{dw_i} = m_i(1 - w_i).$$

Reaction functions: how I respond to the competitor's choice

When you set $MR_i * MPt_i = c$, for both teams, you can write team *i*'s optimal talent choice as a function of team –*i*'s.

- And vice versa.

$$m_i(1 - w_i)\frac{t_{-i}}{(t_i + t_{-i})^2} = m_i\frac{t_{-i}}{t_i + t_{-i}}\frac{t_{-i}}{(t_i + t_{-i})^2} = c,$$

So t_i is an implicit (increasing) function of t_{-i}.

- And vice versa.
- Moreover the club's reaction is concave, i.e., it responds by hiring more talent at a diminishing rate.

Nash equilibrium

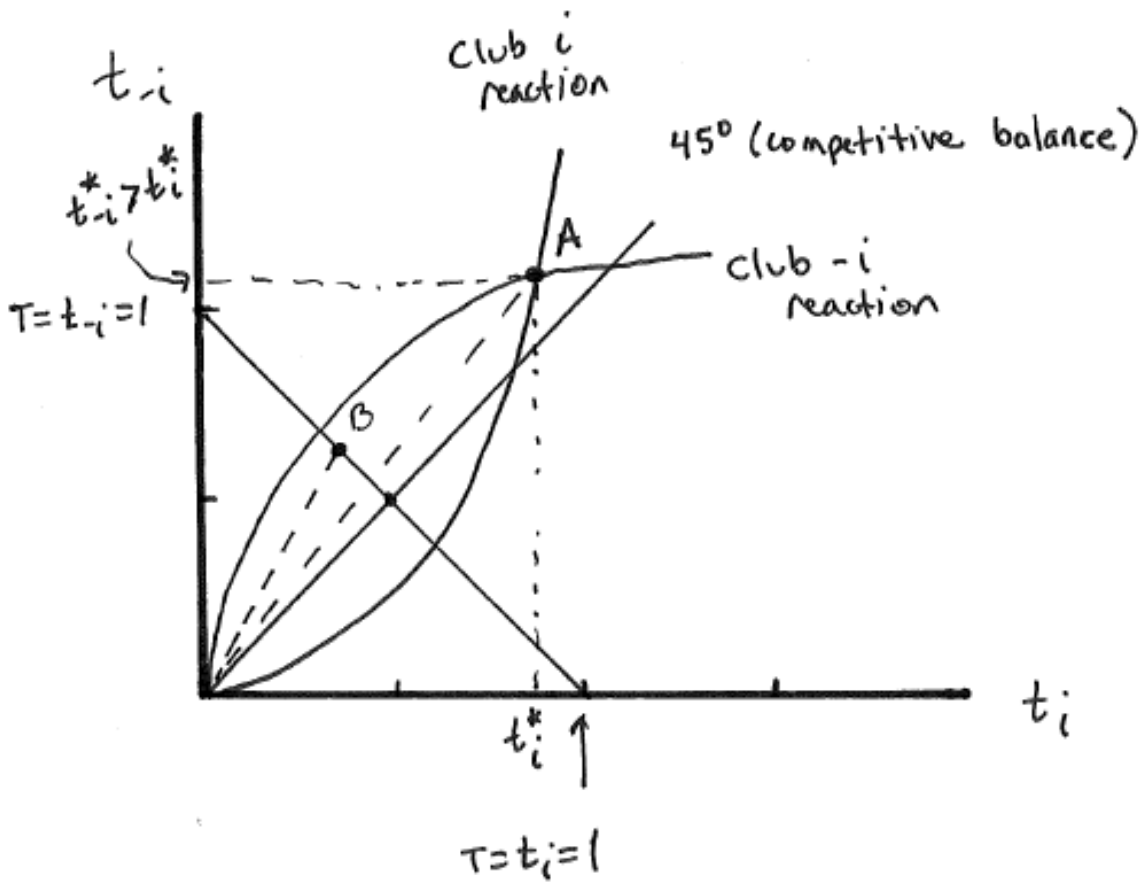
Sounds like one club could just “muscle” the other one out.

- But they’re <u>both</u> reacting to each other.
- Equilibrium is where their reaction functions intersect.
- Point A in the diagram.

If the 2 clubs are of unequal market size, A will be off the 45° line, i.e., competitive imbalance.

It’s also entirely possible this results in more <u>T</u>otal talent than the fixed supply assumed (point B)

- B lies further from the 45° line, too.



Extensions

More overall talent in the league could feed back into the revenue function, incentivizing investment even more.

- What is the effect of league quality on competitive balance?

What is the reservation "price" of talent, assuming elastic supply?

- Salary players could earn in a different league/sport?

Team sports involve specialization. A basketball team would consider $\{t_{i1}, t_{i2}, t_{i3}, t_{i4}, t_{i5}\}$ and the complementarity among the 5 positions in making its demands for talents.

- Maybe there is more complementarity in some sports (think Offensive Line in NFL) than others (think Pitching rotation in MLB).
- The properties of the winning production function are empirical questions, which we will return to at length.

Urgently needed extensions

In sports: very small number of people with the special skills to play each position/sport.

Roster size has a maximum: hiring one more player means cutting another (hopefully the least valuable): the "replacement level" player.

- Fair to assume there's an elastic supply of these at the league minimum salary.

When negotiating with a single player, his/her MRP is large.

- Especially compared to an average human that is less than "replacement" caliber.
- What would they have to pay to get a talented player?

To examine player salaries, we need a model that considers:

- The MRP relative to alternatives, and
- The willingness of players to accept salary offers less than MRP, i.e., their labor supply.

Supply of talent

In Labor Economics, the supply of hours increases with the wage because the wage is the opportunity cost of leisure, i.e., the alternative use of one's time.

- The higher your wage, the more you give up to have leisure, the less leisure you will choose.
- There's a reservation wage below which one will supply zero hours.

For the market as a whole, supply slopes up because (at a higher wage):

- More individuals' reservations will be met (extensive margin), and
- Incumbents supply more hours (intensive margin).

What's the relevant opportunity cost for sports players?

Players' opportunity costs

Getting a job in another industry?

- Probably pretty low (at least relative to their MRP as an athlete).
- Especially if they're not good at *other* sports.

What another team would pay them.

- As long as it's $\leq MRP$, they should bid player salaries up.

Whatever the answer: that determines the lower bound on salary.

- Players won't play baseball if they can earn more money working as a high school gym teachers.
- Clubs shouldn't pay more than MRP, unless they're victims of the winner's curse.

Bargaining: both sides have market power

The solution could be anywhere between: $\$HScoach \leq w^* \leq MRP$.

- That really narrows it down.
- The size of the pie ($MRP - \$HScoach$) is usually called monopoly rents.

The rules of the bargaining process really affect how this pie is divvied up between player and club. The spectrum extends from:

- Unrestricted free agency (player should get all/most of the rents) to
- The Reserve system: players can't negotiate with other clubs than the one that "owns" their contract (club should get all/most rents).
- The latter is the subject (in MLB before 1980) of one of the earliest sports econ papers: Rottenberg (1956).

Getting a compromise

Even under a Reserve system, players can get a more equal share of the rents if the salary is determined by final offer arbitration.

- The player and club each submit a proposed salary $(w_p,\ w_c)$, and
- A 3rd party chooses which of the 2 is fairer, i.e., closer to an objective, say $\frac{(\$HScoach+MRP)}{2}$.
- Over- (under-) bidding decreases the probability that the arbiter will choose your proposal.
- Both proposals should converge on $\frac{(\$HScoach+MRP)}{2}$.

If the player and club don't know *exactly* what the arbiter's objective is:

- Players will propose a little more than $\frac{(\$HScoach+MRP)}{2}$, and
- Clubs will propose a little less.
- Both trying to get bigger slices in the event the arbiter is generous toward them.

Scully's milestone AER (1974) paper

Measure the exploitation of players: what fraction of their MRP is retained by their clubs?

- Back before MLB players won salary arbitration and the reserve clause went the way of the dodo.
- Okay so what's their MRP?

Regress team revenue on team win %.

- Get the marginal value of a win to the club.

Regress team win % on team slugging % (total bases/AB) and (strikeouts/walks) by the team's pitchers.

- Get the marginal products of hitters and pitchers.

Multiplying is a crude estimate of MRP:

- \$9,504 per 0.001 increase in slugging, Hank Aaron (1968)$\approx \$520{,}000$,
- \$9,297 per 0.01 increase in K/BB ratio by pitchers, Sandy Koufax (1966)$\approx \$725{,}000$.

Scully's paper, continued

Then compare the estimated MRPs to the actual player salaries.

Conclusion (p. 929), emphasis added:

> ". . . average players receive salaries equal to about 11 percent of their gross and about 20 percent of their net marginal revenue products. Star players receive about 15 percent of their net marginal revenue products."

Huge exploitation of MLB players!

How was this still happening in 1972!?

U.S. courts repeatedly upheld, e.g., the Supreme Court in 1922, that the AL and NL were not engaged in "interstate commerce" and thus exempt from the Sherman Anti-Trust Act.

- Baseball could govern itself with respect to labor policy like the reserve clause.
- Confirmed in 1953 and 1972.
- Even though the NFL and NBA did not enjoy the same privilege.

How did MLB swing this, in the court of public opinion?

- Competitive balance: "This defense is founded on the premise that there are rich baseball clubs and poor ones and that, if the players' market were free, the rich clubs would outbid the poor for talent, taking all the competent players for themselves and leaving only the incompetent for the other teams." – Rottenberg, p. 246.

Economists, including Rottenberg, have always been critical of this defense.

Hmm

The Yankees had a prettygood run while the reserve clause was in effect.

- It started in 1920 with a run of 4 straight +90 win seasons and World Series appearances in 1921-23 (winning in ‘23).
- This lagged, by 2 years, their acquisition of pitcher-outfielder Babe Ruth’s contract from the Boston Red Sox—sometimes remembered as “The Curse of the Bambino”—for the sum of $100,000.

You see . . . free agency is not the *only* way to move talent from low MRP to high MRP clubs.

Harry Frazee: the anti-Mark Cuban

"Harry Frazee became the owner of the Red Sox in 1917, and before long he sold off all our best players and ruined the team. Sold them all to the Yankees—Ernie Shore, Duffy Lewis, Dutch Leonard, Carl Mays, Babe Ruth . . .

"The Yankee dynasty of the twenties was three-quarters the Red Sox of a few years earlier.

"He was short of cash and he sold the whole team down the river to keep his dirty nose above water. What a way to end a wonderful ball club!"

– Harry Hooper (Red Sox player) in The Glory of Their Times by L.S. Ritter.

And occupational licensing is intended to protect the consumer, too

". . . Players will be distributed among teams so they are put to their most 'productive' use . . . exactly the result which would be yielded by a free market . . . only that . . . the price for the player's services is paid to the team that sells his contract . . . in the free market the player gets his full value." – Rottenberg, p. 256.

What happened after the advent of free agency in MLB is fascinating in its own right:

- Very rapid increase in salary, as proportion of revenue (17.8% in 1974, 41.4% in 1982)*,
- The owners try to collude and not bid on free agents during 1985-1987.
- Free agents no longer exploited, rookies are: Humphreys & Pyun (2016).

* Source Zimbalist, Baseball and Billions, quoted in Kahn (2000).

Better balance through labor rules?

A league that wants more balance could also try to accomplish it by:

- Capping team salaries,
- “Taxing” teams with high salaries (“luxury” taxes),
- Reverse-order-of-finish drafting,

But how do they balance the objectives of “uncertainty of outcome” against non-exploitation of players?

Salary caps

1983: NBA adopts team salary cap, combined with promise of a lucrative share of league revenue devoted to player salaries.

1993: NFL adopts a similar salary cap.

Fort & Quirk (1995) theorize about the effect of a salary cap of this type.

$$\text{cap in year } t \equiv \bar{c}_t = \frac{\beta}{n}\sum_{i=1}^{n} R_{i,t-1}\,;\beta < 1.$$

If the cap also implies a floor for the poor teams, you get each team's payroll to be the same,

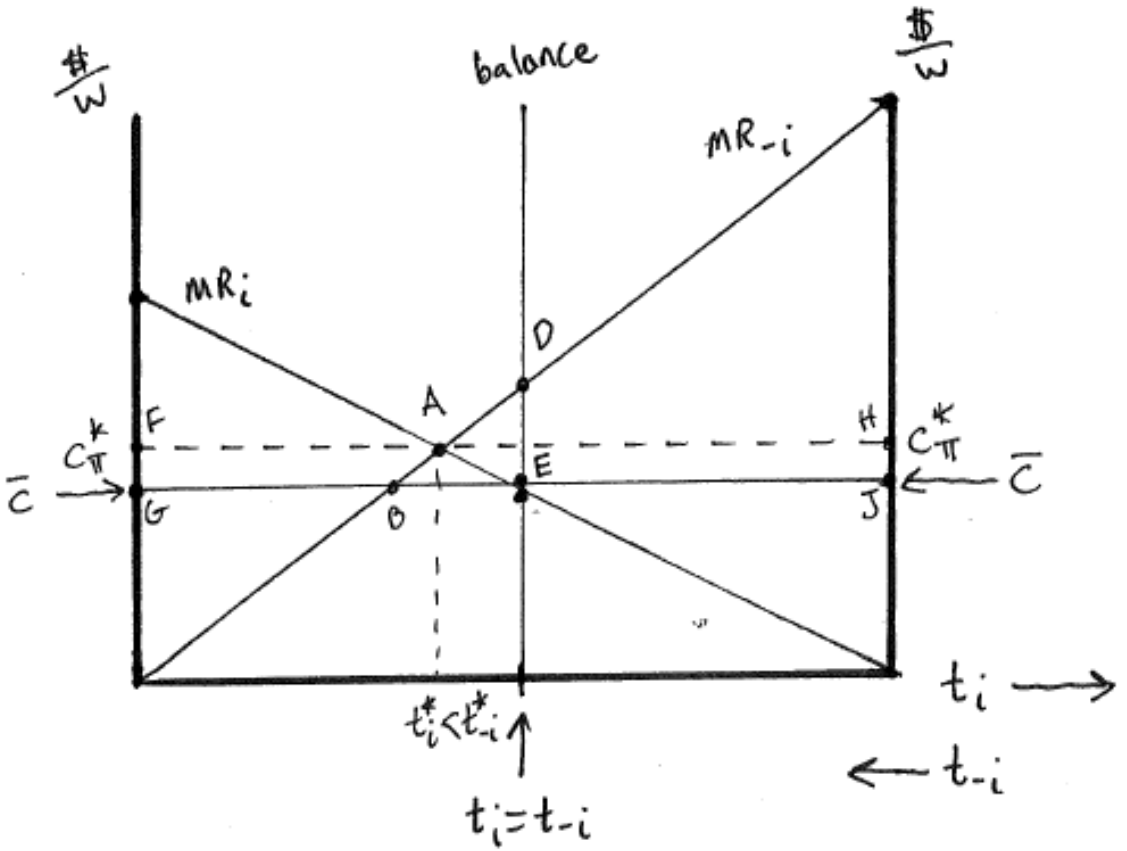
- talent levels across teams will converge and the long run equilibrium is competitive balance.

Salary caps, continued

If competitive balance is achieved in equilibrium, however, $MR_i(\text{"poor"}) < \bar{c}$ and $MR_{-i}(\text{"rich"}) > \bar{c}$.

The profits of the 2 types of clubs also change:

- Increase for the “poor” team and
- probably decrease for the “rich” team.
- Unless the league sets the cap low by taking it out of the players’ share (small β).



Salary caps, continued

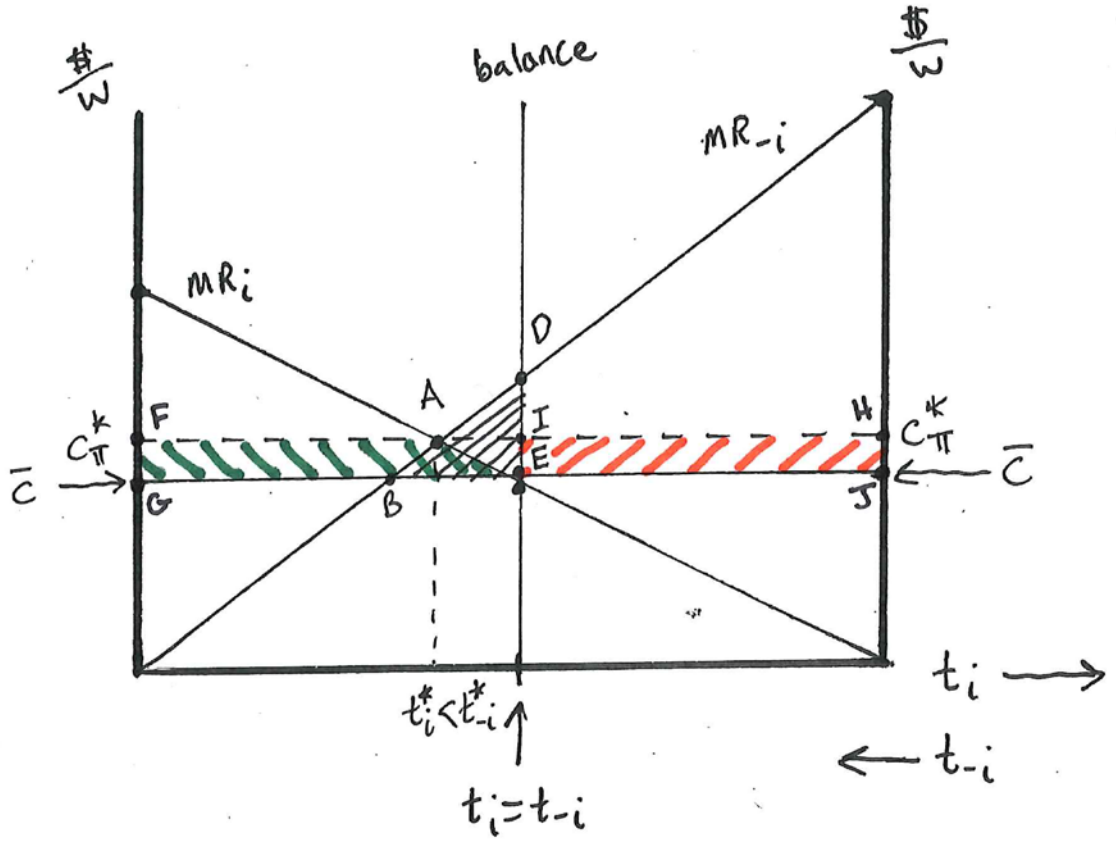
The "poor" (*i*) team's profit increases by the area of the trapezoid, $AEFG$.

The "rich" (-*i*) team's profit changes by the area of rectangle $EIHJ$, minus the area of triangle BED.

- Not obvious whether this will be positive or negative on net.

Interestingly, F&Q did not observe the predicted competitive balance in the NBA in the years following the cap.

- Either in standard deviation among win % or the Gini coefficient with respect to number of Finals appearances.



Salary caps, concluded

The primary explanation for non-improved balance in the NBA, offered by F&Q, is that the cap was not really binding, even in the late 80s.

- E.g., the Lakers' pre-cap roster, which was exempted from the rule, still had them over the cap by 50% in 1989.
- And they had the success to match during the 1980s!
- Not until 1999 did the NBA's cap become a "hard" cap.

Analogous study of the NFL after its cap in 1993: Lee (2010). It was hard/binding. Balance did improve.

Reverse-order-of-finish drafting

F&Q consider this method of amateurs entering a league

- In tandem with a salary cap (it should accelerate the cap's accomplishment of competitive balance), and
- In its own right (just like the reserve clause):
- "With no restrictions on cash sales of players, including draft choices, the rookie draft should have no effect on competitive balance." – Fort & Quirk, p. 1282.

Formally the major leagues have outlawed cash sales of player contracts since, e.g., the 1960s (NFL) and 1976 (MLB).

What about "unbalanced" trades, though?

- Stars for prospects (Cole Hamels for Nick Williams, Jorge Alfaro, et al. in 2015),
- Stars for draft picks (Herschel Walker for 8 picks in 1989, Kobe Bryant for Vlade Divac in '96?).

F&Q do observe increased balance in MLB after their draft began in 1964.

No change in the NFL following the introduction in 1936.

Drafting, concluded

There is only limited empirical research on the effects of draft rules.

- Leagues don't change them often, so hard to measure.

Rules discouraging the sale of player contracts, or capping team payrolls, combined with a reverse-order draft probably has the intended effect of increasing competitive balance.

But it also has the (intended?) effect of tamping down salaries for young players.

F&Q conclusion (after considering the various revenue-sharing schemes as well):

> "an enforceable salary cap is the only one of the cross-subsidization schemes currently in use that can be expected to [help weak-drawing teams] while improving competitive balance in a league." – p. 1296.

Luxury taxes: cap 2.0?

Instead of an absolute cap, a threshold. Beyond which clubs pay a tax to the league proportional to their payroll.

- NBA: $119 million, tax rate increases with times exceeded and the margin by which you exceed it.
- MLB: $195 million, tax rate increases with how many consecutive years you've exceeded threshold.

Sources: Marburger (1997), Gustafson (pp. 652-660 in the Handbook).

Luxury taxes, continued

The league can adjust the parameters (threshold and tax rate) according to how much balance it wants.

- Think of a hard cap as a luxury threshold equal to the league average, with a prohibitively high rate.

For a team exceeding the threshold, the marginal cost of talent becomes: $c(1 + l)$.

Equilibrium when one team exceeds the threshold is:

$$MR_i = \frac{MR_{-i}}{1 + l} = c, \text{with team } -i \text{ being assessed the luxury tax.}$$

The threshold is modeled as a discontinuity in the revenue function at $t_{-i} = t_l$.

- Equilibrium at point B on the next slide.

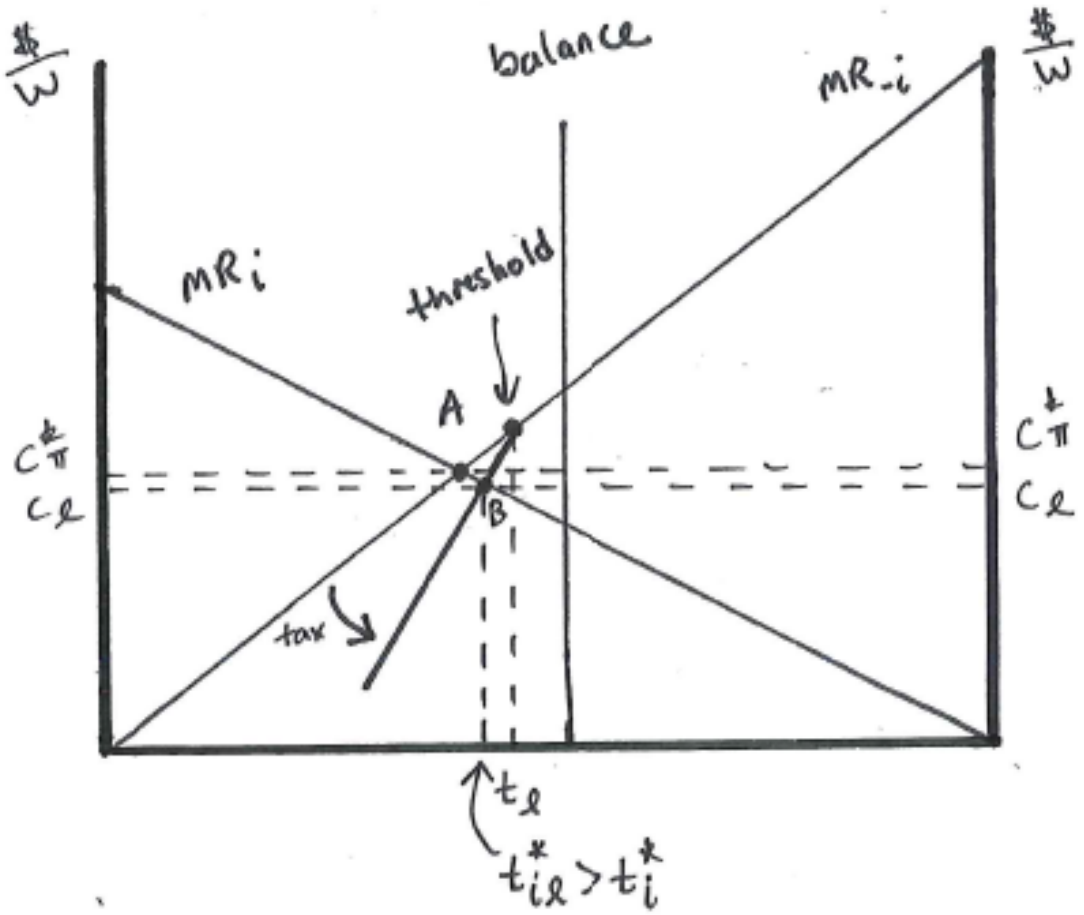
Luxury taxes, continued

Luxury tax equilibrium:

- More balance.
- Lower salaries.

What does the league do with tax revenue generated?

- MLB gives some back to the players and uses the rest for “industry development.”
- NBA’s analogous vague term is “league purposes.”



Labor rules, concluded

An intelligent combination of labor rules can improve league competitive balance.

There is tension between competitive balance and players, though.

- The effective measures, i.e., caps and luxury taxes, work because they restrain the strongest teams from bidding all-out on talent.

Conclusions

The mainstream theories of sports labor markets suggest a number of empirical questions (that the next classes will investigate):

- How to measure performance of players?
- Same question but field managers/coaches?
- What does the team production function look like, i.e., positional or quality complementarity? Does "stars and scrubs" work? Forthcoming JoLE article about NBA: Arcidiacono, et al. (2016).
- To what degree are players exploited?

Conclusions

A big one, not yet addressed: what happens when talent is only imperfectly observable?

- Salary should reflect expected MRP in the future. How well can clubs/economists predict future MRP?
- The winner's curse again! The team that's the most optimistic wins the bidding war.
- Some information sets are more perfect than others.

How do they become so?

> "By [2001] most organizations in baseball . . . Had hired a full-time employee . . . To form their front office's statistical research division. Many of the in-house guys were assistant general managers out of the [Paul] DePodesta* mold: 20-something kids from top schools with majors in economics and minors in self-taught sabermetrics." – Schwarz, The Numbers Game, p. 232.

- Sound like anyone you know?