SPORTS LEAGUE EXPANSION AND ECONOMIC EFFICIENCY: MONOPOLY CAN ENHANCE CONSUMER WELFARE

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Abstract

This paper studies optimal sport league size. League expansion lowers average player quality, reducing fans' utility in inframarginal locations, while fan utility in new locations rises. Welfare analyses of such expansions must compare these two effects. Using a model where fan demand depends on average player quality and locality-specific factors, I find that under various pricing schemes, optimal league size is smaller than under free entry: the marginal team ignores its effects on inframarginal fans' utility. In some cases, the monopoly outcome is optimal, while in others the optimum league size is between the competitive and monopoly solutions.

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I. Introduction

A large body of research and numerous Federal anti-trust court rulings have been concerned with monopoly sports leagues. Currently in North America, each of the four major team sports—baseball, basketball, football, and hockey—enjoys a monopoly position in that there is only one major league, or in the case of baseball, one entity comprised of the two major leagues. Monopoly sports leagues are said to impose major welfare costs on fans and the public in general through restrictions on supply and through subsidies for stadium construction and renovation (Ross 1989; Siegfried and Zimbalist 2000; Fort 2003; Leeds and von Allmen 2002; Noll 2003). These are the usual kinds of welfare losses associated with monopoly which antitrust policy can ameliorate.

While monopoly prices and high subsidies for stadiums may harm consumers and taxpayers compared to competitive alternatives, researchers and Federal courts have also recognized that sports leagues are unique among industries in that competition between businesses (teams) in the industry (league) is the product being sold. In sports, for example, industrywide rules on the allocation of players can enhance consumer welfare by improving the quality of entertainment. If one team is allowed to become much worse that the others, the industry's product is made worse, and even fans of other teams may prefer a more balanced league. In contrast, in an industry such as automobiles, the production of poor quality vehicles by one firm doesn't necessarily reduce the utility consumers receive from driving cars produced by a firm making high quality cars.

This difference between sports leagues and other industries has been noted by Federal courts, which have granted the leagues considerable leeway in setting up rules that other industries would not be allowed to enact. For example, sports leagues are allowed to decide how many teams there will be, as well as rules about how to conduct games and when in the season trades can be made between teams. In this paper, I am concerned with the welfare implications of one possible rationale for limiting the number of teams--the quality of play. Since athletic talent is scarce, at any time, the quality of games depends on how diluted the talent level is. A decision to expand a sports league by allowing a franchise in a new city will raise sports fans' utility in that city, since before the expansion, they had no live access to the sport. On the other hand, the fans in the existing cities may become worse off, since the entertainment they now see has been watered down. This tension forms the basis of my analysis.

To analyze the impact of sports league expansion on these two groups of fans—the ones in the expansion locations vs. the fans in the existing locations--I build a simple model of the demand for team sports entertainment. I then contrast the league size under competition and under monopoly. Under competition, the league is powerless to prevent new entry, and policies to break up sports leagues are a move in the competitive direction. Under monopoly, the league is allowed to decide its own size, and there is no anti-trust policy breaking it up into competing entities. The model shows, not surprisingly, that the league is smaller under monopoly than under competition. I then note that when the league expands and, assuming that athletic talent is scarce, takes in less talented players, utility of the existing fans is lowered, since the average quality of play has fallen. This result implies that the optimal size of the league is likely to be smaller than what we would find under competition.

In my simple but general model, I contrast two situations: i) all revenues come from national television and are shared equally; ii) all revenues are local and not shared. The National Football League (NFL), which among the major team sports has the largest revenue share coming from national television (55.3% as 1996), best fits the former model, while the National Hockey League (NHL), which has the smallest national television revenue share (14.9% in 1996), most closely fits the latter.[1] Moreover, there is a 60-40 gate split in the NFL but no gate sharing in the NHL, furthering bolstering my

[1] Revenue figures are taken from Leeds and von Allmen (2002), p. 74.

picture of the NFL's revenue as national and shared and the NHL's revenue as local and not shared (Fort 2003, pp. 158 and 160). Under either pricing model, the optimal league size is smaller than the competitive league size, due to the loss of consumers' surplus as the sport expands. In the national television model, in which it is assumed that the monopoly league cannot capture the inframarginal fans' consumer surplus, the optimal size is larger than the monopoly league size. Further, under some conditions in this model, the monopoly outcome is closer to the optimum than the competitive outcome is, and under other conditions, the competitive outcome is closer to the optimum. In general, the more rapidly the average talent level falls as the league expands, the more likely the monopoly solution is to be closer to the optimum. In the local revenue model, the optimal league size is the same as the monopoly league size. This is the case since the league's maximization of total profit takes into account the willingness to pay by fans of inframarginal teams in making its expansion decisions. This calculation can't be made when revenues and pricing decisions are determined nationally and must be uniform.

These results imply that in some cases, using antitrust policy to break up a sports league actually hurts consumers, while in others such policies help. Moreover, suppose the talent level becomes more elastic in the national television model (i.e., the talent level falls off less quickly as the number of players expands). This could have happened when, for example, baseball, hockey and basketball recruited more and more foreign players. Then the optimal league size in this case moves toward the competitive outcome, and antitrust enforcement has a larger chance of enhancing consumer welfare. However, under the local revenue model, allowing more foreign players has no influence on the conclusion that the monopoly outcome is the optimal one, although the optimal and monopoly league size will increase. Further, technological changes that increase the fraction of nationally-shared revenues in a sport decrease the likelihood that the monopoly outcome is near the optimal outcome and thus enhance the rationale for antitrust intervention.

Finally, allowing teams to relocate at will does not alter my basic conclusion that the competitive league size is too large. Moreover, a regulation allowing free team mobility but league-controlled size produces the highest overall welfare. This is the case since the league can account for inframarginal fans' utility but free mobility allows an efficient allocation of the teams across locations.

II. The Basic Models

In this section, I set up the basic model and derive implications about the relative size of a sports league under competition and monopoly as well as the optimal league size. I contrast two types of revenue arrangement. First, I assume that all revenues originate from national television contracts and are shared equally (the "national television model"). Second, I assume that all revenues are local and are not shared across teams (the "local revenue model").

A. The National Television Model

In this model, assume that all revenues originate from national television contracts and are split equally across the teams. Suppose that the league consists of T teams, one per location, which have equal populations and identical consumers within each location, although across locations, consumer incomes and tastes can differ.[2] Suppose the teams are arranged in decreasing order of their markets' willingness to pay to see games, through cable television subscriptions, for instance. This willingness to pay can be a function of income, tastes, or the local availability of substitutes. And assume, for

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[2] The assumption about equal city size is made for analytical convenience in order to allow me to focus on price rather than quantity within cities. Below, I discuss the possibility of multiple teams locating in the same city. Specifically, in section III I show that the same results about the non-optimality of the free entry equilibrium hold even when teams are free to locate in any city they want. And possible heterogeneity of fan preferences within cities is discussed in section III as well.

simplicity, that there is a continuum of teams, although the basic logic of the models holds even with a discrete number of teams. Assume also that average player quality in the league positively affects each locality's demand price and that player quality declines as league size increases.

In accordance with these assumptions, let the following function summarize the fans' willingness to pay to see games for team t in a league with T teams, where $t<T$:

(1) $P(t) = At^{-a}T^{-q}$,

where P is the aggregate willingness of team t's fans to pay to have a local franchise, A is a scaling factor, -a reflects the elasticity of the willingness to pay with respect to an increase in the team index, where $0<a<1$, and -q is the elasticity of the fan value placed on average player quality with respect to league size. The assumption that $0<a<1$ implies that demand elasticity for the league as a whole is greater than one in absolute value, a condition we expect to hold in a monopoly equilibrium.

Equation (1) abstracts from issues of competitive balance. I assume that embedded in equation (1) is an optimal allocation of player talent across teams, decided upon either by the league through policies such as a team salary cap or through unrestricted Coasian player movement. This implies that the ranking of franchises with respect to demand prices incorporates both the local fans' demand for teams of a given quality and the impact on demand price of the specific allocation of talent. Teams in the locations with lower values of t—that is, teams with a higher local demand for teams—are likely to be better than teams with a higher value of t, and fan desires to see winning teams as well as high quality competition are likely to both be reflected in the demand function. This reasoning implies that as the league expands into presumably less lucrative locations, the expected winning percentage of team t increases (Noll 2003), and it is therefore theoretically possible that the fans in location t actually increase their demand price when T rises, contrary to the assumption in equation (1). On the other hand, with rising league size, the probability that team t wins the championship or advances deep into the playoffs falls, and this impact could in principle outweigh the positive impact of a higher T on team t's in-season winning percentage. Moreover, as discussed by Noll (2003), it is plausible that the team with the least favorable market also has the smallest fan responsiveness to own team quality, implying that competitive balance will fall when new teams are added. This latter effect also serves to lower the demand price for team t when T rises.

Noll's (2003) analysis suggests that rising T has opposing effects on the entertainment value of the competition in city t, although the effect on the absolute quality of play is unambiguously negative. Therefore, to highlight the impact of talent dilution, I assume that the negative effect of T on P(t) through i) the reduction in overall talent, ii) reduction in the probability of winning the championship and iii) reduction of competitive balance outweighs any possible positive impact of T on P(t) through the increase in location t's winning percentage. In other words, a maintained hypothesis of this model is that the net effect of expansion on inframarginal fans' demand price is negative. As long as this assumption holds, then the results discussed below will hold.

In equation (1), the assumption about equal-sized fan bases across teams allows me to interpret (1) as a price equation for the representative fan, by normalizing the number of potential fans in an area to 1. Below, I discuss the possibility of within-city heterogeneity of fan preferences and therefore downward sloping fan demand within a city to have a franchise. Equation (1) implies that the local fans' willingness to pay to see the marginal team in a T team league is:

(2) $P(T) = AT^{-a}T^{-q} = AT^{-(a+q)}$.

Assume that the costs of a T team league, including both nonplayer costs and the opportunity costs of the players' time are:

(3) $C(T) = T^c$,

where c>=1, and any scaling factor in league costs is subsumed without loss of generality in A. To abstract from issues of bargaining between players and owners, we can visualize either a sport where teams are directly owned by players or where the teams and the players arrive at an efficient bargain over the surplus the enterprises earn over their nonplayer costs and the opportunity costs of the players' time. Note that as the league expands, it may bring in players with a lower opportunity of cost of their time, since they are less skilled than the incumbent players. It is therefore theoretically possible that marginal opportunity costs could fall, implying that c could be less than one. In such a case, all of the results of my models would still hold as long as marginal costs don't fall faster with league size than the fans' willingness to pay. On the other hand, marginal costs could rise if new teams are located in costlier sites. The assumption that c>=1 is a sufficient condition for my basic results but is not necessary.

In this model, the league must contract with a national television network to show the games. I make two alternative pricing assumptions in this framework. First, suppose that the network must sell subscriptions to the games at a uniform national price and that the league will not accept any of its local fans being priced out of the market. This implies that the national price of games to fans will be P(T), and that competition among the networks will lead the net revenue per team to be P(T) as well (broadcast production costs are assumed away here). I also note that, given the assumption that 0<a<1, even if the network chose an unconstrained, profit-maximizing uniform price, this would still be

P(T).[3] Second, assume that the networks can charge different prices to different markets and that competition again erodes the networks' profits. This implies that the league will earn the total net revenue from these local contracts, and below, I also analyze the implications of this pricing model.

Taking the uniform national pricing model first, I now contrast league size (T) under free entry, monopoly (i.e. where the league chooses T to maximize total league profits), and the league size that would maximize the difference between the fans' willingness to pay and the total (opportunity) cost of the league—i.e. the optimal league size.

Competition

Under competition, entry occurs until the price P(T) equals marginal cost:

(4) $AT^{-(a+q)} = cT^{c-1}$.

Solving for the log of competitive league size, we have:

(5) $\ln T_{comp} = (c-1+a+q)^{-1} [\ln(1/c) + \ln A]$, where T_{comp} is the competitive league size and $(c-1+a+q)>0$.

Monopoly

Under monopoly, the league chooses the size T that maximizes the surplus over costs. Although this decision may involve adding new teams who will share in the surplus, with an appropriate entry fee, the existing teams can always be made better off

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3 To see this, consider a network choosing a profit-maximizing, single price to charge national subscribers. If this price is $At^{-a}T^{-q}$, then t consumers will pay for the broadcasts (recall that the size of each market is 1, and with identical consumers within markets, either they all buy the broadcasts or they all do not). Assuming zero marginal cost of broadcasting (a reasonable assumption for television viewers), the network will choose $t<=T$ to maximize $At(t^{-a}T^{-q})=At^{1-a}T^{-q}$. Since $1-a>0$, revenue and therefore profits will be maximized at t=T.

by expanding to the league size that maximizes total surplus. And sports leagues regularly charge expansion fees to new entrants, making such an assumption realistic.[4] Given the pricing assumption in equation (2), the league maximizes total surplus:

(6) $\Pi = P(T)T - C(T) = AT^{1-a-q} - T^{c}$, where Π is league profit (i.e. the surplus over opportunity costs).

The first order condition for maximizing profit leads to a log of monopoly league size of:

(7) $\ln T_{mon} = (c-1+a+q)^{-1}\,[\ln(1/c) + \ln(1-a-q) + \ln A]$, where T_{mon} is monopoly league size, and $(1-a-q)>0$ for an interior optimum.[5]

Comparing (6) and (7), we have:

(8) $\ln T_{comp} - \ln T_{mon} = (1-c-a-q)^{-1}\,[\ln(1-a-q)]>0$.

Competitive league size, not surprisingly, is larger than monopoly league size.

Optimal League Size

To compute the optimal league size, we need to take into the consumers' surplus of all fans. For any league size T, the surplus of fan utility over cost is:

(9) $\left(\int_0^T At^{-a}T^{-q}\,dt\right) - T^{C}$

[4] For example, the new Houston Texans NFL team in 2000 paid a $700 million expansion fee to the league (Fort 2003, p. 142).

[5] The assumption of c>=1 is sufficient for the second order condition to hold, although it will still hold for some values of c<1 (i.e. declining marginal costs).

In expression (9), we integrate across locations, where the willingness to pay is influenced by a location's inherent demand for the sport (indexed by t^{-a}) and the quality of the league. Maximizing (9) with respect to league size T, we obtain the following first order condition for optimal league size:

(10) $(-qT^{-q-1}\int_0^T At^{-a}dt) + AT^{-(a+q)} = cT^{c-1}$

Solving for the log of the optimal league size, we have:

(11) $\ln T_{opt} = (c-1+a+q)^{-1} [\ln(1/c) + \ln(1-a-q)-\ln(1-a)+\ln A]$,

where T_{opt} is the optimal league size. Comparing the three solutions for league size in equations (6), (7), and (11), we see that the optimal league size is between the competitive and the monopoly league sizes:

(12) $\ln T_{comp} - \ln T_{opt} = (c-1+a+q)^{-1} [\ln(1-a)-\ln(1-a-q)] >0$ and
(13) $\ln T_{opt} - \ln T_{mon} =(c-1+a+q)^{-1} [-\ln(1-a)] >0$.

A necessary and sufficient condition for the optimal league size to be closer (in relative terms, since we are comparing logs) to the monopoly than to the competitive league size is:

(14) $[\ln(1-a)-\ln(1-a-q)] > [-\ln(1-a)]$, or equivalently,

(15) $q > a(1-a)$.

According to expression (15), if the rate at which talent falls with league expansion (q) is large as we go down the ranking of locations, then monopoly brings us closer to the optimal league size. Breaking up a monopoly under such circumstances would actually hurt economic efficiency. We can also interpret a large q as indicating that talent is very scarce, since the average quality of play would fall rapidly with expansion under a large q. If a new source of talent opens up, lowering q, then according to (15), the likelihood that the optimum is closer to the competitive outcome increases.[6]

The results so far are based on the uniform national pricing assumption exemplified by equation (2). An alternative, plausible pricing assumption is to allow the network that buys the rights to sell different packages to fans in different cities. Again, if there is competition among potential networks, then the league can charge a price equal to the networks' net revenue from these separate deals. Specifically, if the league has T teams, then the total revenue a network can collect from fan subscriptions, which will also be the equilibrium fee collected by the sports league, is:

(16) $(\int_0^T At^{-a}T^{-q}dt) = A(1\text{-}a)^{-1}T^{1-a-q}$, which implies that under a league rule requiring equal sharing of revenues, each team will receive the following revenue:

(17) Revenue per team= $A(1\text{-}a)^{-1}T^{-a-q}$

I now contrast the competitive, monopoly and optimal league sizes under this pricing model. First, under competition, T will expand until the revenue per team just equals marginal cost:

(18) $A(1\text{-}a)^{-1}T^{-a-q} = cT^{c-1}$, implying that log league size under competition in this model (T_{comp*}) has the following solution:

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[6] This example assumes that the league opportunity cost function remains unchanged even though the talent supply has become more elastic. More realistically, if the identification of new sources of talent has a sufficiently larger effect on q than on c, then the conclusions stated above hold. This assumption is highly likely for sports, since differences in sports productivity among athletes or potential athletes are probably much larger than differences in productivity in alternative occupations (and thus differences in the opportunity costs of their time) for these individuals. In addition, as expressions (12)-(15) also show, raising a (i.e. raising the elasticity of demand price with respect to location) has ambiguous effects on the relative sizes of the optimal, competitive and monopoly leagues.

$$(19)\ \ln T_{comp*} = (c-1+a+q)^{-1} [\ln(1/c) - \ln(1-a)+\ln A].$$

Comparing equations (5) and (19) shows that competitive league size is larger under the pricing arrangement where local cable deals can be written because these increase potential profitability and attract more entrants than under the national one-price scheme. The model with local cable deals therefore leads to a competitive outcome with a larger efficiency loss than the uniform pricing model, since competitive league size is larger when local cable deals can be made, and the earlier analysis showed that even the smaller competitive size under equation (5) was too large.

Monopoly league size can be determined by maximizing league surplus Π^*:

$$(20)\ \Pi^* = A(1-a)^{-1}T^{1-a-q} - T^{c}.$$

This is the same maximand as was the case for finding the optimal league size. This conclusion holds since the revenue received in allowing local cable deals exhausts the fans' willingness to pay. By making a leaguewide decision, the teams can take account of the effect of diminishing talent levels on fans' demand for games. In contrast, with free entry, new entrants don't take into account their effects on the inframarginal fans' consumer surplus. Therefore, under the local cable pricing policy, we have the following solution for both monopoly (T_{mon*}) and optimal (T_{opt}) league size:

$$(21)\ \ln T_{mon*} = \ln T_{opt} = (c-1+a+q)^{-1} [\ln(1/c) + \ln(1-a-q)-\ln(1-a)+\ln A].$$

Inspection of this result and equation (19) shows again that the monopoly and optimal league size is less than the competitive league size.

B. The Local Revenue Model

Analytically, a model where each team keeps 100% of its revenue and all revenues are local can be analyzed similarly to the two national television models discussed above. Under the local revenue model, the monopoly and optimal outcomes are the same, and league size under competition is too large. To see this, note that if all revenues are local and kept by the local team in question, the local fans' willingness to pay at location t in a league of size T can be expressed by equation (1) above, which is reproduced here:

(1') $P(t) = At^{-a}T^{-q}$.

The marginal team's revenue is therefore the same as under the first uniform national pricing model in which the network had to charge the same price to everyone:

(2') $P(T) = AT^{-a}T^{-q} = AT^{-(a+q)}$.

As in the uniform pricing model above, under free entry, the league expands until the demand price equals the marginal cost:

(4') $AT^{-(a+q)} = cT^{c-1}$,

implying that the competitive league size is:

(5') $\ln T_{comp} = (c-1+a+q)^{-1} [\ln(1/c) + \ln A]$,

the same as in the uniform pricing national television model because the marginal team faces the same entry decision calculation in either case.

When the league gets to choose its surplus-maximizing size, the result is analytically the same as the outcome under the national television model in which the network charges a different price to each locality. Specifically, league surplus, as well as the aggregate surplus for society is:

(20') $\Pi^* = A(1-a)^{-1}T^{1-a-q} - T^c$.

And the monopoly and optimal league sizes are the same and expressed as:

(21') $\ln T_{mon*} = \ln T_{opt} = (c-1+a+q)^{-1} [\ln(1/c) + \ln(1-a-q)-\ln(1-a)+\ln A]$.

This analysis thus shows that in a model where all revenues are local, letting the league decide on its size based on team-player surplus will lead to efficient league size, balancing out fan desires for high quality and high quantity of athletic competition.

III. Extensions and Implications

In this section I discuss several extensions and caveats regarding the basic framework of section II. These include the possibility of multiple teams locating in the same city, heterogeneity of local fan preferences, the impact of opponent quality on fan demand, changing sources of revenue in professional sports, and the applicability of this analysis to the NCAA.

A. Multiple Teams in the Same City

This subsection shows that my basic result about competition leading to an excessively large league size holds even when teams are allowed to freely locate wherever they want. To see this, let us modify the basic local fan demand price equation to reflect the number of teams in the city:

$$(22)\ P(t) = At^{-a}f(t)^{-n}T^{-q},$$

where f(t) is the number of teams in location t and n >0. Equation (22) assumes that demand price in city t is a positive function of the inherent demand for sports in the city (negatively indexed by t through the term t^{-a}) and a negative function of the number of teams f(t) in the city. The models of section II assumed that f(t) could be at most 1, reflecting for example technological or political constraints on the number of teams a city can have. For instance, a locality may only give permission or subsidies for a limited number of stadiums or arenas; once this limit is set, there may be scheduling constraints preventing the number of teams from increasing beyond a certain limit. In this subsection, I relax this assumption and allow franchises to locate wherever they want.

I now compare competitive, monopoly and optimal outcomes under this model. I first note that whatever the number of franchises T, the assumption of free relocation implies that the demand price facing each team must be the same. If this were not true, then teams would relocate until it became true. The demand price in the high price cities would fall as teams relocated there, according to equation (22). This means that, given the total league size T, for all locations t with teams:

$$(23)\ t^{-a}f(t)^{-n} = K(T).$$

The function K(-) falls as T rises: K'<0. To see this, consider the discrete version of the model and suppose that there are four potential locations: $t_0 < t_1 < t_2 < t_3$. Suppose further that the total number of teams is such that there is exactly one franchise in location 2 and therefore none in location 3 and more than one in each of locations 0 and 1. In the free location model, we have:

(24) $t_0^{-a}f(t_0)^{-n} = t_1^{-a}f(t_1)^{-n} = t_2^{-a} > t_3^{-a}$.

Now if we let the league size grow by a sufficiently small amount, the three existing locations indexed by t_0, t_1, and t_2 will absorb the increase. This means that with a higher T, $t_i^{-a}f(t_i)^{-n}$ has fallen for i=0, 1 and 2. If T keeps increasing, then eventually, $t_2^{-a}f(t_2)^{-n}$ will equal t_3^{-a}, and the location indexed by t_3 will become viable. The same reasoning holds under the continuous version of the model, implying that K'<0. We therefore write the following function for K(-):

(25) $K(T)=BT^{-k}$ for some k>0 and scaling factor B>0.

In this model, for larger values of n relative to a, then expanding to a new location leads to a smaller falloff in consumer demand relative to adding franchises to existing locations. Therefore, with a large n and a small a, league expansion will take place primarily through adding new locations.

It is natural under this model to assume for any league size T, that the actual price charged to see games is the common demand price, which is the same everywhere (price will clearly be no higher than this, and there is no gain to teams or television networks to charging below the demand price). Under competition, there is free entry into the league until price equals marginal cost:

(26) $K(T_{comp**})A(T_{comp**})^{-q} = ABT^{-(q+k)} = c(T_{comp**})^{c-1}$, or

(27) $\ln T_{comp**} = (c-1+q+k)^{-1} (\ln A+\ln B - \ln c)$, where

T_{comp**} is competitive league size under these assumptions.

Now suppose the league is allowed to set its profit-maximizing size but cannot prevent teams from locating where they want. Then the league chooses T to maximize total league surplus:

(28) $\Pi = ABT_{mon**}((T_{mon**})^{-(q+k)}) - (T_{mon**})^{c}$, where

T_{mon**} is monopoly league size under this model.

Maximizing (28), we find:

(29) $AB(1-q-k)(T_{mon**})^{-(q+k)} = c(T_{mon**})^{c-1}$, and solving for T_{mon**}, we have:

(30) $\ln T_{mon**} = (c-1+q+k)^{-1}(\ln A + \ln B + \ln(1-q-k) - \ln c)$.

Since $0<(q+k)<1$ (to guarantee an interior monopoly solution), monopoly league size is again smaller than competitive league size.

Now consider the optimal league size, which will take into account the negative effects of expansion on the inframarginal fans' utility. Given league size T, the total league surplus is identical to the monopolist's surplus:

(31) $ABT(T^{-(q+k)}) - (T)^{c}$,

implying that the league size that maximizes net welfare is the monopoly league size, as was the case in the price discriminating cable operator and local revenue models discussed above. This is the case for the same reasons as in section II: the surplus-maximizing monopolist is able to exhaust all of the consumers' surplus.

It is interesting to compare league size and total welfare if we allow teams to locate anywhere they want vs. allowing only one franchise per location. For any given league size T, we have the following expressions for net societal surplus under these two models:

(32) Surplus| only one team per location = $(\int_0^T At^{-a}T^{-q}dt)$ - T^c

(33) Surplus| teams can locate where they want = $(\int_0^L At^{-a}T^{-q}f(t)^{-n}dt)$ - T^c,

where L<=T is the number of locations where the T franchises play, and L is strictly less than T as long as fan demand within a city doesn't decline too fast as the number of franchises in the city rises (i.e. n is small enough):

(34) $(\int_0^L f(t)dt)$ = T.

Given league size T, comparing (32) and (33), it is easy to see that the total surplus is larger in (33), because in this model, we let teams relocate from low demand to high demand cities. This means that the marginal city in the free mobility equilibrium has a larger willingness to pay to see exactly one franchise than in section II's model of one team per city (L is strictly less than T). Allowing teams to move out of the locations where t>L into locations where t<=L raises the total willingness to pay to see the sport. Therefore, the social (and monopoly) optimum in the free mobility equilibrium involves more teams than in the one team per city model. Letting teams move provides greater gains for the fans in the high demand locations than the losses experienced by fans in the low demand locations. But once we allow free location, for a social optimum, the league should be allowed to decide its overall size.

B. Heterogeneous Local Fan Preferences

In two of the models presented in section II—the national television model in which the network can charge a different price for each location and the local revenue model—the optimal league size is the same as the monopoly league size. This result depends in both cases on the seller's (either the television network or the team itself) ability to extract all of the local fans' consumer surplus. This result occurs in these models because I have assumed that within each location, all fans have the same income and tastes. Charging the marginal local fan his/her demand price allows the full consumers' surplus to be captured, since each fan is the "marginal" fan. In contrast, in a model with heterogeneous local fans, networks and teams may not be able to capture the consumers' surplus, implying that the monopoly outcome may not be optimal. However, the basic point about player quality and monopoly vs. competitive league size remains. Even with heterogeneous local fans, the marginal team only considers its own profit-loss calculation in deciding whether to enter. As long as the fans care about player quality and as long as the player quality declines as the league expands (i.e., the demand price P(t) in area t declines as T rises), then the basic result that optimal league size is smaller than the free entry equilibrium league size remains.

While it may be difficult to imagine local cable television contracts that can capture heterogeneous fans' consumer surplus, the increasing use of "Personal Seat Licenses" by sports teams suggests that teams may in fact be able to at least partially do so. Personal Seat Licenses are rights to buy a season ticket, and these rights are sold by local sports teams to fans. They have become popular since 1993 when the NFL's Carolina Panthers used them in connection with their new stadium (Leeds and von Allmen 2002, p. 119). Analytically, Personal Seat Licenses can be seen as a component of a two part pricing scheme in which fans first buy the license and then buy their tickets. In principle, a team can charge the competitive price for tickets and then a Personal Seat License fee that exhausts all of the local consumers' surplus (Leeds and von Allmen 2002, p. 120). Therefore the model of local team revenues in which the monopoly league size equaled the optimal league size still can hold even with heterogeneous local consumers, as long as teams can issue these Licenses. Of course, this conclusion must be tempered by the fact that local television deals will likely not be able to exhaust heterogeneous local consumers' surplus.

C. Competitive Balance, Opposition Quality and Local Fan Demand

In 2002, Major League Baseball nearly eliminated two teams, the Montreal Expos and the Minnesota Twins, on financial grounds, and Noll (2003) presents an analysis of the economics of baseball contraction that bears some similarities to the approach I have taken here. His analysis suggests that league contraction will some have positive and some negative effects on the net welfare produced by the remaining teams. On the positive side is a rise in average team quality, the effect I have emphasized here, although he doesn't incorporate this into his theoretical model. Ross (2003) also speculates that unlimited expansion, while bringing a sport to new fans, could lead to reductions in the utility of existing fans, as "talent is diluted and the chance to see storied and talented teams decreases" (p. 326). Presumably, the opposite effects would be realized under contraction. On the other hand, Noll (2003) argues that under contraction, each remaining team's winning percentage is likely to fall, since the weaker teams are likely to be slated for contraction (notwithstanding the success of the Minnesota Twins!). This effect will lower fans' willingness to pay. Finally, Noll (2003) surmises, as mentioned earlier, that eliminating weak teams will improve competitive balance, on the assumption that these teams had the weakest incentive to be good teams. And this effect will raise demand in the other locations.

To try to determine whether the opponent quality effect on fan demand is large, Noll (2003) compares 2002 Major League Baseball road attendance figures for strong and weak teams. He estimates that the difference in drawing power on the road between strong and weak teams is 100,000-200,000 fans per season (the average road attendance of the weakest and strongest teams was 2.1-2.45 million); however, home attendance for the better teams averaged 700,000 fans per season more than for the weakest teams (home attendance among these teams averaged 2.11-2.83 million). This difference leads Noll (2003) to conclude that the fans' demand to see high quality opposition is relatively weak, although it is still positive. Moreover, the degree to which the absolute quality of one's home team affects consumer demand, controlling for the team's place in the standings, is not observable in this analysis.

In contrast to this seemingly weak effect of opposition team quality on fan demand in baseball, Hausman and Leonard (1997) find an extremely large effect on NBA local television ratings of playing against a team with superstars such as Michael Jordan, Magic Johnson, or Larry Bird. They in fact estimated that in the 1992 period, Michael Jordan generated roughly $53 million of revenue for other teams in the NBA in addition to his own team! This bonanza came about through local attendance, television ratings, and shared revenues from merchandise sales. Hausman and Leonard's (1997) results imply that if the NBA had only 16 teams instead of its current 29, then fans in the remaining 16 locations would enjoy much greater exposure to other teams' superstar players on average than they do now, and their utility could very likely be much higher. Suppose that at the margin, fans in the weakest markets have a smaller willingness to pay to see games than fans in the strongest markets (this of course assumes that the league or other cost barriers prevent teams from flooding the strong locations). Taking the opportunity to see the league's stars away from the weakest franchises by eliminating them and increasing the chances of fans in the strongest franchise areas to see stars would then raise overall consumer welfare, as long as the gain in the strong markets outweighs the loss in the weak markets.

This contrast between the effect of opposition quality in baseball and basketball suggests that the relevance of the model I have presented here is an empirical question.

In basketball, Hausman and Leonard's (1997) findings suggest that monopoly may be especially welfare-enhancing in the NBA. While Noll's (2003) results for baseball suggest that the impact on demand of falling opposition quality with free entry is less important in baseball, it still has an effect on fan attendance. And if rising baseball league size either reduces competitive balance, reduces individual franchises' chances of winning the championship, has only small positive effects on individual franchises' winning percentage, or raises fan demand everywhere by raising each team's absolute quality, then the model also has relevance for baseball as well.

D. Revenue Sources: Television vs. Gate

As mentioned earlier, most hockey revenues are local, while the share of football revenues that is national is large and growing. My analysis therefore suggests that monopoly is more likely to lead to the optimal outcome in hockey than in football, although as shown earlier, there are cases in which monopoly could lead to the optimal outcome in a sport with only national, equally-shared revenue sources. Moreover, to the extent that a larger portion of revenues in each sport comes from nationally-shared television contracts, the national pricing model in which it is possible that the competitive outcome is closer to the optimum than the monopoly outcome is becomes more relevant. Whether national sources will become more important in the future is of course an empirical question. While the global television market is likely to be growing, teams are becoming more sophisticated at using local venues such as luxury boxes to raise non-shared revenues.

E. The NCAA and Economic Efficiency

Several aspects of the regulation of college sports have relevance to the model presented here. First, professional sports league rules and Federal court anti-trust rulings on the eligibility of players who have not finished (or in some cases not even started) college affect the supply of professional athletes and are therefore related to the models I have presented here. For example, in 1971, a Federal Court struck down the NBA's rule prohibiting college underclassmen from entering the league (Staudohar 1996, p. 117). And in September 2003, a player for Ohio State University, Maurice Clarett, sued the NFL on anti-trust grounds over its rule that prevents players from entering the league until they have been out of high school at least three years.[7] Allowing these younger players to enter the league is similar to allowing foreign players to enter the league and serves to reduce q, making the supply of talent more elastic. As we have seen, in the uniform pricing version of the national television models, a falling q increases the likelihood that the competitive outcome will be closer to the optimum than the monopoly outcome will be.

Second, the ideas in this paper can potentially be applied to the normal operations of the NCAA, which in the view of some acts as a traditional cartel to restrict output and payments to factors of production. For example, the case just discussed in which a Federal court allowed underclassmen to enter the NBA draft has very likely reduced the supply of scarce stars to the NCAA. Our model suggests that this will increase the likelihood that restricting the quantity of college sports entertainment raises consumer welfare. For instance, in the 1950s, the NCAA reduced the number of football bowl games from over 50 to 9, presumably to increase revenues net of costs (Fleisher, Goff and Tollison 1992). However, according to the logic of this paper, if the nine matchups involved better teams than the 50, then quality may have increased as the number of bowl games was cut, and consumer surplus may have been enhanced. Moreover, when the

[7] See, http://www.msnbc.com/news/969764.asp?0sl=-12, accessed October 20, 2003.

NCAA instituted its current system of IA and I-AA, etc., designations, by limiting the number of schools in the top tier (I-A), quality again may have been enhanced. It is possible though not necessarily certain that the gains to the fans of I-A teams outweighed the losses to fans of teams eliminated from consideration as I-A schools. NCAA membership restrictions, according to the logic of this paper, have the greatest chance of enhancing efficiency the more localized the revenue sources are. Moreover, the frequent conference realignments we observe in college sports are similar to team relocations within the context of a constant total league (i.e. NCAA division I-A) size. Therefore, these realignments may be moving us closer to a nationwide optimum. However, it should also be noted that the NCAA's restrictions on player pay reduce the quantity and quality of athletic talent competing in college sports and may cause an inefficient reallocation of talent, if pay restrictions cause athletes to play elsewhere (e.g. in Europe), even though their marginal revenue products may be higher playing US college sports.

IV. Conclusions

In this paper I have argued that unlike the usual welfare analysis of competition, in professional sports leagues, the optimal industry size may be less than what would be observed under free entry. This is the case because athletic competition between business enterprises is the product. As a sports league expands, the average quality of playing talent on the court or in the field falls. Therefore, fans in inframarginal locations will view lower quality sports entertainment as a sports league expands, all else equal. The welfare consequences of such expansions depend on the size of these losses relative to the gains the fans in new locations will realize.

To analyze these issues, I built a simple model of sports leagues in which fan demand depends on the average quality of the league's players and locality-specific factors such as income and tastes. Under various pricing schemes, I compared league size under free entry and monopoly (in which the league decides on the profit-maximizing league size), and the optimal league size that maximizes the total utility net of team opportunity costs. Under a pricing scheme in which all revenues are national and split evenly and where a broadcast network charges a uniform national price to viewers, the optimal league size is between the larger competitive size and the smaller monopoly league size. The more elastic the supply of talent, the closer the competitive size is to the optimum. However, if the network can charge a different price to each location or if all revenues come from local sources such as gate receipts and local media, then the optimal league size is the same as the monopoly league size that maximizes total league profits, but the competitive league size is again too large. In this case, maximizing league profits perfectly takes into account inframarginal fans' lower willingness to pay for lower quality games, while the competitive outcome only depends on the marginal location's fans' willingness to pay and thus does not account for the inframarginal fans' losses.

An implication of these results is that anti-trust policy should not necessarily aim, at least on efficiency grounds, toward free entry into sports leagues. For example, 1966 Congressional legislation approving the merger between the NFL and the American Football League (Fort 2003, p. 384) may have raised economic efficiency; and the players' acceptance of the National Basketball Association-American Basketball Association merger in 1976 (in return for collective bargaining concessions) and the NHL-World Hockey Association merger in 1979 (Staudohar 1996, p. 157) may have been efficient as well. While this analysis implies that leagues should be allowed to determine their own size, I also found that the teams should be allowed to locate where they want. Thus, the Oakland Raiders decision in which the NFL was not allowed to prevent the Raiders from moving to Los Angeles may have enhanced overall efficiency (Lehn and Sykuta 1997). Of course, equity issues must also be considered as well. And allowing teams to leave particular areas may result in large utility losses if there is an endowment effect or accumulated loyalty effects. But if efficiency is to be a criterion of anti-trust policy, then this paper suggests that encouraging free entry into new areas may under some circumstances not be good policy. In calculating the efficiency gains or losses entailed by league expansions, one must compute their effects on existing fans' welfare as well as the value of the expansion franchises to the fans in the new locations.

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