Competition Between Sports Leagues: Theory and Evidence on Rival League Formation in North America*

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Abstract

We analyze the formation of rival leagues and deterrence by incumbent leagues in professional team sports, which is one of the least studied forms of competition in sports. We first survey the economic history of professional sport leagues in North America and develop stylized facts about rival league formation. We then develop a game-theoretical model to explain some of these interesting stylized facts, showing that if the bargaining power of the incumbent league is sufficiently small, i.e., less than a certain cutoff, the incumbent should choose expansion to deter the rival league formation; otherwise, it is optimal for the incumbent league to allow a rival league formation and then merge with it, conditional on being successful. We further show that the incumbent league may pay players relatively high salaries as an alternative way to deter formation by a rival league.

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1 Introduction

Competition in sports takes many forms: competition between players, teams in a league during the regular and post-season, nations in international contests and others. Little research examines competition between leagues in the same sport. This lack of attention is curious, because many rival leagues have formed in North America.

Why are single dominant monopoly leagues observed when rival leagues periodically form? Despite increases in population and income, no competing dominant leagues exist in any professional team sport in North America. Firms in any industry would prefer to merge to monopoly, but antitrust laws prevent this outcome in other settings. Sports leagues enjoy special protection from antitrust laws through exemptions.[1] However, the presence of special antitrust treatment does not ensure that a single dominant league is an equilibrium outcome; it simply permits the firms in the industry to merge to monopoly without legal consequences.

We also address a related issue: why do monopoly leagues pay relatively high salaries to players? This question has received significant attention in the literature. The most common explanation is that professional athletes have rare abilities and high marginal revenue products (MRP). While both have appeal, the rare skill plus high MRP explanation appears incomplete in some respects; minor league players with skills similar to major leaguers earn much lower salaries, and professional sports teams are relatively small firms and often claim to generate little or no profits.

We develop a game-theoretic model to analyze rival sports league formation and deterrence by an incumbent league. We model the dominant league as a monopsonist facing an upward-sloping labor supply curve and a monopolist in the output market.[2] Without a rival, the incumbent league maximizes profits when the number of teams is less than the number

[1] In *Federal Baseball Club of Baltimore v. National League of Professional Baseball Clubs* the Supreme Court ruled that MLB was not engaged in interstate commerce and thus exempt from antitrust laws; this 1922 ruling was upheld in *Toolson v. New York Yankees* (1952) and *Flood v. Kuhn* (1972). The 1961 Sports Broadcasting Act (SBA) explicitly exempted the merger of the NFL and AFL from antitrust law. *Mid-South Grizzlies v. NFL* (1983) affirmed the NFL monopoly in the SBA and the NFL's ability to restrict entry. In *United States Football League v. National Football League*, the rival USFL sued the NFL on the grounds that the NFL monopolized football in the US. The jury found in favor of the USFL and awarded $1 in damages, trebled to $3 as required by the Clayton Act.

[2] Boal and Ransom (1997) survey models of monoposony in labor markets including models like the one developed here.

of cities that could support a team. The presence of a rival league, which successfully forms with some probability, drives up wages. The rival's probability of success depends on the effort (investment) and the number of teams in the rival league. Conditional on a successful rival league formation, to prevent an increase in players' wages, both the incumbent and the rival leagues have an incentive to merge.[3] After merger, the incumbent league shares revenues with the successful rival via a Nash bargaining.

We show that if the bargaining power of the incumbent league is greater than a certain cutoff value, the incumbent should optimally allow the rival league to form. Further, if the rival league formation is successful, the incumbent then chooses to merge with the rival. However, if the bargaining power of the incumbent league is less than a certain cutoff value, the incumbent should optimally choose to expand the current league to open cities to deter potential formation by a rival league. We also consider an alternative deterrent to rival league formation, where the incumbent league does not expand but pays relatively high salaries to players. This strategy sheds light on why monopoly sports leagues pay relatively high salaries to players.

Relatively little prior research focused on modeling rival league formation in professional sports. Quirk and Fort (1997) developed a model of profits earned by incumbent and rival leagues, and the interaction between these leagues, featuring host city heterogeneity in that some cities can support two teams while others only one. Their model features competition between leagues that reduces the profits earned by all teams due to competition for fans and players; it explains deterrence of rival league formation only through the presence of side payments from the incumbent league to potential rival league owners.

Cyrenne (2009) develops a similar model to explain strategic interaction among teams in an existing professional sport league. Dietl, Franck, and Lang (2008) and Madden (2011) develop similar models of within-league strategic interaction. Grossmann, Dietl, and Lang (2010) develop a dynamic model of the behavior of teams in a sports league. In contrast to Grossmann, Dietl, and Lang (2010), our model generates deterrence of a rival league

[3]A large body of literature on entry and deterrence in a market exists in the industrial organization literature. More details on the theoretical analysis and applications of entry, deterrence, and accommodation can be found in chapter 8 of Tirole (1994). See Farrell and Shapiro (1990), McAfee and Williams (1992), Pesendorfer (2005), Nocke and Whinston (2010), and Nocke and Whinston (2013) for a discussion of mergers among firms.

as an equilibrium outcome through either league expansion by the incumbent or merger between the two leagues. Moreover, our model provides an additional explanation of why the incumbent league pays high salaries to players.

2 North American Leagues

There has been no shortage of new competitors for professional team sports in North America, yet a single top-level league currently exists in professional football, basketball, baseball, and hockey. The population of the United States and Canada exceeds 340 million, which seems large enough to support multiple leagues playing at the top level in any team sport. The population of the US and Canada in 1901 was more than 80 million and there were two professional baseball leagues, the National League (NL) and American League (AL), playing at the highest level at that time. The primary source of revenue in 1901 was game day attendance, which was limited by the number of people who lived nearby.

If a market with more than 80 million potential fans can support two baseball leagues playing at the top level, why can't an integrated market with almost 350 million potential fans that generates ticket, broadcast and sponsorship revenues support other leagues? Total AL and NL attendance in 1901 was 3.6 million, or 43 attendees per 1,000 population; total attendance in Major League Baseball (MLB), which consists of the now merged AL and NL, in 2010 was 76 million, or 210 per 1,000 population. The number of teams increased from 16 to 30 over this period; in 1901 there was one top level baseball team for every 5.1 million potential fans; in 2010 there was one for every 11.4 million.

In each of the four "major" professional team sports in North America, at least one rival league has formed to compete with the dominant league. Table 1 summarizes rival league formation and expansion. "Incumbent Players Hired" shows the number of players from the incumbent league who appeared on a roster in the rival league in the first season, a measure of how many players from the existing league were hired by teams in the rival league. When this column contains a "D" it means that, in addition to signing veteran players from the incumbent league, the rival league also operated a competing amateur player entry draft, a mechanism that assigns the rights of new players to specific teams, and competed with the

incumbent league for new talent.

Baseball was the first professional team sport in North America, and the first rival leagues also emerged in this sport. The first incumbent league in baseball was the National League (NL), formed in 1876. There were a number of rival baseball leagues formed in the 19th century, but we do not consider those leagues here. Quirk and Fort (1997) describe these early rival leagues. The rival American League (AL) formed in 1901. After only two seasons, the National League merged with all 8 AL teams to form Major League Baseball (MLB). MLB also faced a challenge from the rival Federal League (FL) early.

Consider deterrence and the Continental League (CL) episode in the late 1950s. The CL existed as a legal entity with eight prospective teams (New York, Minneapolis, Denver, Houston, Toronto, Buffalo, Atlanta and Dallas). New York City's population had 7.7 million residents and only one MLB team, the Yankees, after the Giants and Dodgers moved to San Francisco and Los Angeles in 1957. Faced with the credible prospect of a rival league forming, especially in New York City, MLB agreed to expand and specifically to put a new team in New York. The CL shut down without playing a game; team owners were given first opportunity to buy expansion teams. Three of the four MLB 1961-1962 expansion teams went to CL cities, including the New York Mets; all of the proposed hosts cities for CL teams eventually became the home of MLB teams except Buffalo, NY.

The National Football League (NFL) has been the incumbent football league since 1920. The NFL has faced many rival leagues over the years, and two of them succeeded in merging teams into the NFL. Four different rival leagues with the name American Football League (AFL) are identified by Roman numerals on Table 1. The NFL also faced a recent rival league challenge, the United States Football League, in 1983-1985.[4] The rival American Football League (AFL) I signed only one NFL player in 1926. That player, Red Grange, was the most talented and well known football player of that time; for this reason, the AFL I was regarded as a legitimate rival league.

Basketball was the last major team sport to professionalize in North America; the incumbent National Basketball Association (NBA) formed in 1949. Professional basketball teams

[4]The XFL, an 8 team league created by pro wrestling impresario Vince McMahon, played a single season in 2001 and is not generally regarded as a true rival league.

Table 1: North American Rival Leagues and Incumbent League Expansion 1901-2010

Incumbent League	First Year	Event	Year	Seasons Played	Incumbent Players Hired	Outcome
NL	1876	**Rival**: AL	1901	2	113	Full merger
MLB	1903	**Rival**: Federal	1914	2	80	Bankrupt
(baseball)		**Rival**: Continental	1958	0	0	Deterred
		Expansion	1961, 1962			2 new teams
		Expansion	1969			4 new teams
		Expansion	1977, 1993, 1996			2 new teams
NFL	1920	**Rival**: AFL I	1926	1	1	Bankrupt
(football)		Expansion	1931			1 new team
		Expansion	1933			3 new teams
		Rival: AFL II	1936	2	1^D	Bankrupt
		Rival: AFL III	1940	2	0^D	Bankrupt
		Rival: AAFC	1946	4	132^D	4 of 9 teams merged
		Expansion	1960			1 new team
		Rival: AFL IV	1960	6	106^D	Full merger
		Expansion	1961, 1966, 1967			1 new team
		Rival: WFL	1974	2	73^D	Bankrupt
		Expansion	1976			2 new teams
		Rival: USFL	1983	3	222^D	Bankrupt
		Expansion	1995			2 new teams
		Expansion	1999, 2002			1 new team
NBA	1949	**Rival**: ABL	1961	2	< 10	Bankrupt
(basketball)		Expansion	1961			1 new team
		Rival: ABA	1967	9	30^D	4 of 6 teams merged
		Expansion	1970			3 new teams
		Expansion	1974, 1980			1 new team
		Expansion	1988, 1989, 1995			2 new teams
		Expansion	2004			1 new team
NHL	1917	Expansion	1924, 1925			2 new teams
(hockey)		Expansion	1926			3 new teams
		Expansion	1967			6 new teams
		Expansion	1970			2 new teams
		Expansion	1972			2 new teams
		Rival: WHA	1972	7	76^D	4 of 16 teams merged
		Expansion	1974			2 new teams
		Expansion	1991			1 new team
		Expansion	1992, 1993			2 new teams
		Expansion	1998, 1999			1 new team
		Expansion	2000			2 new teams

D: Rival league operated a competing entry draft for new players. Multiple years on a row identifies multiple expansions. For example, the NHL expanded by one team in 1998 and 1999.

existed prior to this, but were primarily short-lived leagues that were not generally regarded as dominant, incumbent leagues. The NBA faced two rival leagues, and one, the American Basketball Association, succeeded in merging four teams into the NBA in the 1970s. The National Hockey League (NHL), which formed at about the same time as the NFL, faced a single rival league, the World Hockey Association, that formed in the early 1970s, played seven seasons, and succeeded in merging four teams into the NHL.

From Table 1, rival leagues frequently compete with incumbent leagues for players. Many of these rival leagues hired a significant number of veteran players away from the incumbent league, and often operated rival entry drafts that allocated incoming players to teams in the new league. These competing entry drafts also lead to intense competition between the rival and incumbent league over new players. Most of the rival leagues shown on Table 1 formed before detailed data about player salaries were widely available. Kahn (2000) documents the changes in player compensation that took place in several incumbent leagues after the formation of a rival league.

Teams avoid competing for new players coming into leagues, either through tacit collusion or through institutional devices like the "reserve clause" and entry drafts. The "reserve clause" assigned each players' rights to the team that owns the contract in perpetuity up until 1976, and still applies to young players in all four leagues. The formation of a rival league leads to increased competition for players, driving up salaries for all professional players in the sport. Even under the reserve clause, a player could not be contractually prohibited from signing a contract with a rival league. Kahn (2000) reports significant increases in salaries in incumbent leagues after the formation of a rival league in all four professional team sports in North America. Table 2 summarizes the increases in average salaries in incumbent leagues in North America after the formation of a rival league, in nominal dollars.

Salaries in the NL and MLB increased by about 50% in the early part of the 20th century after rival leagues formed. In later instances where rival leagues formed, average salaries in the incumbent leagues by between about 200% in the NFL and more than 700% in the NBA. Only 30 former NBA players were on ABA rosters in the rival league's first season of operation, although a number of star players signed with the ABA, and this rival league also operated a successful rival draft. This suggests that a relatively small number of players

Table 2: Average Nominal Salary Increases Before and After Rival League Formation

Incumbent League	Rival League	Year	Average Incumbent League Salary Before	Average Incumbent League Salary After
NL (baseball)	American	1901	$2,000	$3,000
MLB (baseball)	Federal	1914	$3,000	$5,000
NBA (basketball)	ABA	1967	$20,000	$143,000
NHL (ice hockey)	WHA	1972	$25,000	$96,000
NFL (football)	USFL	1982	$55,288	$102,250

Source: Kahn (2000)

attracted from the incumbent league to play in the rival league can generate substantial increases in salaries. These increases in salaries would also be reflected in similar large increases in total team wage bills in the incumbent league.

Kahn (2000) also documents that after the merger of the AL and NL in 1903, and after the demise of the Federal League in 1915, salaries in MLB returned to their pre-rival levels in real and nominal terms; the salary increases experienced by both leagues were temporary, and after the merger returned to a monoposony induced lower level. The Reserve Clause was in effect at this time, so teams could unilaterally increase or decrease salaries from year to year. Salaries did not decline much in the NBA, NHL and NFL after their rival league episodes. However, these rivals formed at the beginning of the free agency period in professional sports, which reduced the monoposony power wielded by leagues. In this environment, salaries would not be as flexible as they were in the early 19th century.

Several "stylized facts" emerge from this discussion. First, rival leagues periodically appear and challenge the supremacy of incumbent leagues. Second, the only observed outcomes from rival league formation are either the rival league fails or teams in the rival league merge into the incumbent league. Despite significant population and real income growth, no rival league formed and continued to operate in competition with the incumbent league; the co-existence of multiple dominant leagues does not appear to be an equilibrium outcome. Third, incumbent leagues periodically expand into cities without teams. We posit that this expansion attempts to deter the formation of rival leagues.[5] Finally, rival leagues hire

[5]Some expansion took place because jet air travel reduced the time required to cross the country. Congress has also periodically held hearings focused on expansion of the number of professional teams in US leagues, including in 1958, just before the New York Giants and Dodgers moved to California, and in 1995 after

players away from incumbent leagues, and often operate competing entry drafts, generating significant increases in salaries in incumbent leagues.

3 A Model of League Behavior and Interaction

Consider an existing incumbent sports league, which operates as a monopsonist, as the sole demander of professional athletes in the labor market and as a monopolist, as the sole provider of professional sports events in the product market. The market contains N cities large enough to support a team. To simplify the model, we assume that the N cities in this market are homogenous, in terms of their size, population, and revenue generating potential.

The league determines the number of teams in the league, not the allocation of teams to cities. Let $2 \leq n \leq N$ be the number of the teams in the league.[6] Each team operates as a monopolist in a city, earning revenues $P > 0$. The number of teams n in the league determines total revenues $R(n)$ generated by the league, $R(n) = P \cdot n$. We assume that the league operates as a syndicate, in that all revenues generated are shared equally by the teams in the leagues.[7] Let $W(n)$ denote the wage function, where $w > 0$ and $W(n) = w \cdot n$, and thus the total wage cost for the league is $W(n) \cdot n$.[8] The incumbent league's profit is

$$R(n) - W(n) \cdot n > 0, \ for\ all\ n \in [2, N]. \tag{1}$$

the Cleveland Browns moved to Baltimore to become the Ravens, and in several other instances. Congress has systematically upheld statutory exemptions from anti trust law granted to professional sports teams, although the possibility of statutorily ending this exemption has frequently been raised at hearings.

[6] All North American leagues limit the number of players each team can have under contract. The roster size limit is not under complete control of the league; this limit is set during collective bargaining between the league and player unions. Modeling this interaction is beyond the scope of this paper. To simplify the analysis, we assume that the number of players is identical across all teams, and only consider how many teams a league needs to maximize total revenue. Others have modeled the supply of players as a fixed pool of talent, see Kahn (2007).

[7] Quirk and Fort (1997) and Vrooman (1997) make a similar assumption. While this does not reflect the complexity of actual revenue sharing arrangements in professional sports leagues, it simplifies the analysis considerably.

[8] Besides the wage bill, teams also incur other operational costs, such as stadium expenses, advertising, etc. We here omit them to simplify the analysis. An examination of leaked audited financial data from professional sports teams and sporadically published expense estimates from various media sources suggests that payroll expenses account for about 2/3 of total expenses incurred by professional sports teams in North America. Administrative and general costs, including front-office costs, travel, and training expenses are the second most important expense. Stadium and arena expenses are generally low because of the large public subsidies that many teams receive for the construction and operation of facilities.

The league chooses n^* to maximize profit, where n^* satisfies

$$R'(n^*) - W'(n^*) \cdot n^* - W(n^*) = 0. \tag{2}$$

Simplifying shows $P = W'(n^*) \cdot n^* + W(n^*)$, or $n^* = \frac{P}{2w}$. We assume that $2 \leq n^* \leq N$, so the profit maximizing league size leaves $(N - n^*) \geq 2$ cities without teams.

This assumption has empirical support. In North America, not every city large enough to support a professional sports franchise has one. Los Angeles has not had an NFL team since 1994. In 2010, 8 of the 50 largest Metropolitan Statistical Areas (MSA) in the US did not have a pro sports team (Riverside CA, population 4.3 million, Las Vegas, NV, 1.9m, Austin, TX, 1.7m, Virginia Beach, VA, 1.7m, Providence, RI, 1.6m, Louisville, KY, 1.3m, Hartford, CT, 1.2m, and Birmingham, AL, 1.1m). Birmingham has 2,000 fewer people than Buffalo (50th largest MSA), home to NFL and NHL teams. Green Bay, WI, population 309,000 (152nd largest MSA) and home to an NFL team, is an exception. $n^* < N$ appears to be a reasonable assumption based on the distribution of teams across cities.

The incumbent league faces a scenario where $n^* > (N - n^*) \geq 2$ cities without teams represent a potentially profitable environment for a rival league. The incumbent league faces two choices: either expand into cities with no teams to deter a rival league from forming or do not expand and let a rival league form.

If the incumbent league chooses to expand into the $(N - n^* - 1)$ cities without teams, profits are $R(N-1) - w(N-1) \cdot (N-1)$, and rival league formation does not occur.[9] If the incumbent league chooses to allow a rival league to form, then the rival league places teams in the $(N - n^*)$ open cities. To simplify the analysis, we assume that there is no overlap in cities between the two leagues, which ensures that each team is a monopolist, implying no interaction between the two leagues in terms of demand by local fans.

Whether or not a rival league succeeds depends on two factors. First, compared to the incumbent league, a rival league may lack sufficient organization, marketing, or team quality to attract fans. The rival league invests effort into league formation; intuitively, the more effort the rival league invests, the greater the probability of success. Second, the

[9] A one team league is impossible, so the incumbent league only needs to expand to $N - 1$ cities to deter rival league formation.

number of teams in the rival league affects success; more teams make the rival league more attractive, increasing the probability of success. Assume rival league formation succeeds with probability $0 \leq q(e,k) \leq 1$, where $e \in [0,\infty)$ reflects effort or investment by the rival league, and k is the number of teams.

Assumption (1a.): For $k \in [2,N]$, $q(0,k) = 0$, and $q(\infty,k) = 1$, $\partial q(e,k)/\partial e > 0$, and $\partial^2 q(e,k)/\partial e^2 < 0$.

Assumption (1b.): For $e > 0$, $q(e,k=1) = q(e,k=0) = 0$, and for $k \geq 1$, $q(e,k+1) > q(e,k)$.

If unsuccessful, the rival league earns zero revenues and the incumbent league earns $R(n^*) - w(n^*) \cdot n^*$. If successful, both leagues operate concurrently and the incumbent and rival earn $R(n^*)$ and $R(N-n^*)$, respectively. Since $q(e,k+1) > q(e,k)$ and $n^* > (N-n^*) \geq 2$, $N-n^*$ is the optimal number of teams in the rival league.

Successful rival league formation increases demand for players. With N teams the wages increase to $W(N)$ and payoffs become $R(n^*) - W(N) \cdot n^* > 0$ and $R(N-n^*) - W(N) \cdot (N-n^*) > 0$ for the incumbent and rival, respectively. To ensure that the rival league has an incentive to form, given n^* teams in the incumbent league, we assume

Assumption 2: $q(e, N-n^*)\Big[R(N-n^*) - W(N) \cdot (N-n^*)\Big] - e \geq 0$ for $e > 0$.

To reduce salaries, the incumbent and successful rival leagues merge and form a single united league. This merger will benefit both by reducing the number of teams; clearly, it is optimal for the merged league to reduce the number of teams to n^*, reducing wages to $W(n^*)$. [10] In the merged league, the incumbent divides the benefits from the merger with the rival league via a Nash bargaining game, where δ and $1-\delta$ reflect bargaining power for the incumbent and rival, respectively, and $\delta \in (0,1)$.

Given this setup, the timing of the game consists of three stages:

Stage One: The incumbent decides to either expand or let a rival league form;

[10] In Section 4, we discuss how dynamic entry from rival leagues affects the number of teams in the merged league. This provides insight into why a merged league may contain some or all of the teams from the rival league.

Stage Two: After observing the incumbent's decision, if the incumbent chooses to expand to new cities, the rival is deterred; if the incumbent league chooses not to expand, the rival forms a new league and invests effort e;

Stage Three: If the rival league is not successful, the rival exits and the incumbent league maintains its monopoly position in the market. If the rival league is successful, both leagues can choose to either operate concurrently or merge.

3.1 Rival league formation

We solve the game by backward induction. We examine the strategies (merger or competition) the incumbent and the rival leagues play in Stage Three and then characterize the optimal effort level e chosen by the rival league after formation in Stage Two.

If unsuccessful, the rival league earns zero profits and the incumbent league earns $R(n^*) - w(n^*) \cdot n^*$. We focus on the case where the rival league succeeds. When the rival and the incumbent leagues choose to merge, it is optimal for the merged league to reduce the number of teams to n^*. The gain from the merger is

$$\left[\Big(R(n^*) - W(n^*) \cdot (n^*)\Big) - \Big(R(N) - W(N) \cdot N\Big)\right].$$

Let Π denote this benefit. After a merger, the profits for the incumbent and the rival are

$$\delta \cdot \Pi + \Big[R(n^*) - W(N) \cdot n^*\Big], \tag{3}$$

and

$$(1-\delta) \cdot \Pi + \Big[R(N-n^*) - W(N) \cdot (N-n^*)\Big]. \tag{4}$$

The payoffs for the incumbent and rival leagues are strictly larger under a merger than without merging, conditional on the rival league formation being successful. The following lemma summarizes decisions made by the rival and incumbent leagues in Stage Three.

Lemma 1. *Once the rival league formation is successful, the incumbent and the rival leagues are strictly better off when merging.*

We next solve the second stage of the game. If the incumbent league expands into the $(N - n^* - 1)$ cities with no teams, a rival will optimally choose not to form. However, if the incumbent league chooses not to expand, the rival will choose to enter the market. Thus, we only need to focus on the effort level e chosen by the rival league, given $N - n^*$. The expected payoff from rival league formation is

$$q(e, N - n^*)\Bigg\{(1 - \delta) \cdot \Pi + \Big[R(N - n^*) - W(N) \cdot (N - n^*)\Big]\Bigg\} - e. \tag{5}$$

From Assumption (2), Equation (5) is strictly greater than zero. Further, differentiating with respect to e yields

$$\frac{\partial q(e^*, N - n^*)}{\partial e^*} = \frac{1}{(1 - \delta) \cdot \Pi + \Big[R(N - n^*) - W(N) \cdot (N - n^*)\Big]}. \tag{6}$$

The rival league's strategy can be characterized by the following lemma.

Lemma 2. *The rival league invests e^* given by Equation* (6) *when forming.*

3.2 Incumbent league expansion

Now consider the first stage of the game. Given the strategies from Stages two and three, we characterize how the incumbent league decides whether to expand to deter rival league formation or allow a rival league to form, conditional on rival league success. From Assumptions (1.b) and (2), it is optimal for the incumbent league to expand to $N - 1$ open cities.

Outcome 1: The incumbent league chooses to expand. Total profits are

$$R(N - 1) - W(N - 1) \cdot (N - 1). \tag{7}$$

Outcome 2: The incumbent league allows a rival league to form and then merges with

the rival league, conditional on rival league success. The merged league reduces the number of teams to n^*. Total expected profits are

$$q(e^*, N - n^*)\left\{\delta \cdot \Pi + \left[R(n^*) - W(N) \cdot n^*\right]\right\} + \left(1 - q(e^*, N - n^*)\right)\left[R(n^*) - W(n^*) \cdot n^*\right]. \tag{8}$$

Clearly if the profits earned by the incumbent league under Outcome 1 exceed the profits earned under Outcome 2, then the incumbent league will choose to expand to deter rival league formation; otherwise, the incumbent league will allow a rival league to form and then merge with that rival if and only if the new league is successful. The equilibrium in this game is

Proposition 1. *There exists a unique bargaining power δ^* such that if $\delta < \delta^*$, the incumbent chooses to expand to deter rival league formation. If $\delta \geq \delta^*$, the incumbent allows a rival league to form; the rival league invests e^* in forming the new league; conditional on success, the two leagues merge.*

Proof. There must exist a unique bargaining power δ^* for which the profits earned under Outcome 1 equal the profits earned under Outcome 2:

$$R(N-1) - w(N-1) \cdot (N-1) = q(e^*, N - n^*)\left\{\delta^* \cdot \Pi + \left[R(n^*) - W(N) \cdot n^*\right]\right\} + \left(1 - q(e^*, N - n^*)\right)\left[R(n^*) - W(n^*) \cdot n^*\right]. \tag{9}$$

If $\delta < \delta^*$, implying that the profits earned by the incumbent league are greater under Outcome 1 than under Outcome 2, then it will be optimal for the incumbent league to expand into the other $(N - n^* - 1)$ cities to deter rival league formation. A rival league will not form.

If $\delta \geq \delta^*$, indicating that the profit earned by the existing league under Outcome 1 is less than the profit earned under Outcome 2, it is optimal for the incumbent league to allow

a rival league to form. The rival invests e^* and enters $(N - n^*)$ cities to form a new league with a probability of success $q(e^*, N - n^*)$. If the rival league succeeds, the two leagues merge; if the rival league is unsuccessful, the incumbent league still operates with teams in n^* cities. □

Given Proposition (1), we have seen that the incumbent's expansion strategy crucially depends on whether his bargaining power is less or greater than a certain cutoff value. Further, we are interested in examining how changes in other variables will affect the cutoff value of the bargaining power.

Let q^* denote the equilibrium probability of success $q(e^*, N - n^*)$. Differentiating Equation (9) with respect to q^* yields

$$\frac{\partial \delta^*}{\partial q^*}\Pi \cdot q^* = \left[R(n^*) - W(n^*) \cdot n^*\right] - \left\{\delta^* \cdot \Pi + \left[R(n^*) - W(N) \cdot n^*\right]\right\}$$

indicating that $\frac{\partial \delta^*}{\partial q^*} > 0$. Further, from Equation (6), it is obvious to have that $\frac{d\delta^*}{de^*} = \frac{\partial \delta^*}{\partial q^*} \cdot \frac{\partial q^*}{\partial e^*} > 0$. These imply that in equilibrium, when the probability of success increases or the equilibrium effort e^* which the rival is willing to invest increases, the cutoff value increases and therefore it becomes more likely for the incumbent to choose to expend the other $(N - n^* - 1)$ cities and deter the rival league formation.

Finally, we investigate the impacts of variables P and w on the cutoff value of the bargaining power. Given $n^* = \frac{P}{2w}$, it is easy to check that when P decreases and/or w increases, the equilibrium probability of success q^* increases and thus the incumbent will be more possible to choose league expansion in the sports market.

3.3 Salaries and deterrence

Professional athletes earn large salaries, perhaps because of their rare skills and high MRP. However, this explanation may not be complete. In this section, we provide another reason why an incumbent league would pay high salaries to players by considering an alternative strategy in this model: increasing players' salaries instead of expanding to deter a

rival league in Stage one.[11] [12]

Let e^* denote a rival league's equilibrium investment. There exists a unique wage level w^{**} satisfying

$$q^*\left\{(1-\delta)\cdot\Pi+\left[R(N-n^*)-w^{**}\cdot(N-n^*)\right]\right\}-e^*=0. \tag{10}$$

From Equation (10), when the wage level is w^{**}, a rival league is indifferent about formation. Rival league formation will be deterred if the wage level is greater than w^{**}. There also exists another unique wage level $\widehat{w}$ satisfying

$$\left[R(n^*)-\widehat{w}\cdot n^*\right]=q^*\left\{\delta\cdot\Pi+\left[R(n^*)-W(N)\cdot n^*\right]\right\}+(1-q^*)\left[R(n^*)-W(n^*)\cdot n^*\right]. \tag{11}$$

Given the expression above

Proposition 2. *If $w^{**}\geq\widehat{w}$, it is optimal for the incumbent league to allow a rival league to form and then choose to merge conditional on successful formation; if $w^{**}<\widehat{w}$, the incumbent league prefers to increase wages to w^{**} to deter rival league formation.*

Proof. Equations (10) and (11) show that if $w^{**}\geq\widehat{w}$, it is optimal for the incumbent league to let a rival league form and merge with the rival league, if the rival succeeds. However, if $w^{**}<\widehat{w}$, deterring rival league formation generates a higher payoff to the incumbent; the incumbent strictly prefers to deter by increasing salaries. □

Proposition 2 predicts that in order to deter rival league formation, the incumbent league may pay high salaries to players, increasing the cost to potential rivals. Note that this also mitigates the tendency for monopoly leagues to pay salaries below marginal revenue product, increasing the welfare of players even without the presence of free agency.

[11] This can be interpreted as an application of "raising rivals' costs", see Salop and Scheffman (1987), and Scherer (1980).

[12] Note that we do not address the issue of allocation of players across teams in this analysis. See Schmidt (2011) for the discussion of the issue of the allocation of players across teams.

4 Discussion

Repeated rival league formations. From Table 1, rival leagues repeatedly formed in all four leagues and mergers involved some or all of the teams from rival leagues, which is not consistent with the prediction of our model. However, in a dynamic model of rival league formation, the merged league would not be reduced to n^* teams. Under assumption (1b) a merged league with $N-1$ teams is the only effective deterrent to any future rival league formation; under a less restrictive assumption about the relationship between rival league investment and the probability of success, a merged league with fewer than N-1 teams would deter any future rival league formation, consistent with the fact that past merged leagues contained more teams than the existing league prior to the merger.

Table 1 also shows several different outcomes after rival-league mergers. The NBA and NHL followed policies of franchise expansion following mergers in the late 1960s and early 1970s and saw no additional rival leagues emerge, while the NFL had to fight off two additional rival leagues after the AFL merger in the early 1960s. These outcomes suggest that dynamics play an important role in rival league formation. Future research should extend this model to include dynamic strategic interaction between dominant and rival leagues.

Media revenues. The significantly larger broadcast rights fees earned by leagues beginning in the 1980s increased profits, which also increases the incentive for the incumbent league to deter rival league formation. National broadcast revenues are shared equally in North American professional sports leagues, and existing leagues may be unwilling to give up a significant share of these revenues to one or rival league members, implying that the expansion option became relatively more attractive than the merger option, relative to earlier times when broadcast rights fees were smaller. All of four leagues have continued to expand periodically in the past 30 years, which is consistent with the prediction that expansion to deter rival league formation is a sub-game perfect equilibrium.

Players' Compensation. From Proposition 2, the incumbent league can also deter rival league formation by increasing the salaries paid to players. Higher player salaries means that a rival league will find it costly to raid teams in the incumbent league for players. This explanation is consistent with the fact that real salaries have risen rapidly in these leagues

since the mid 1980s and no rival league has been formed since this salary increase began. Moreover, this would be a more effective deterrent in the NFL, which has a 45 player roster, than in MLB, which has a 25 player roster, or in the NHL, which has a 23 player roster. However, increases in player compensation in the 1980s and beyond also reflects the legal erosion of the reserve clause and the advent of free agency in all four leagues.

Supply of players and league structure. The model assumes an upward sloping labor supply function, implying that salaries rise when leagues expand. This may not be the case in other contexts, for example in professional football in Europe, where a large pool of players exists around the world and the labor supply curve may be flat.[13]

Rival league formation has never taken place in European football and league expansion rarely occurs, because the promotion and relegation system (a chain of inter-related domestic sports leagues in which the bottom three or four teams in each higher league are demoted to the next lower league and the top three or four teams in the lower league are promoted to the higher league at the end of each season) in Europe acts as an alternative deterrent to rival league formation, reducing expansion pressure. When population growth generates a city capable of supporting a team in the top league, a team can form in that city, join the system at the lowest level, and over time become a member of the top league through promotion. Promotion and relegation distributes teams across cities in the top domestic league in a way that reduces the number of potential hosts for a rival league.

Empirical extensions. The model generates empirically testable predictions. The more cities without teams, the larger the incentive for a rival league to form and the greater the pressure for an existing league to expand to deter rival league formation. Annual population estimates exist for major cities in North America, so the number of viable open cities at any point in time can be determined. The number of viable open cities, along with other factors like income and the number of available players, should explain both the observed formation of rival leagues and league expansion.

[13]The labor supply curve in MLB and the NBA may have also gotten flatter over time. MLB has extensively expanded its recruiting in Latin America in the last few decades and also draws players from Japan, Korea, and even Europe and Australia. Players from Europe, South America, and China now appear on NBA rosters.

5 Conclusions

We develop a game-theoretic model to explain why we observe a single professional sports league in a market that appears to be large enough to support more than one. We characterize the incumbent league's strategy in equilibrium, showing that if the bargaining power is sufficiently high (i.e., greater than a cutoff value), allowing a rival league to form and then merging with it is optimal for the incumbent league; otherwise, the incumbent should expand into cities with no teams. Our model also provides an additional explanation for the high salaries paid to professional athletes; the incumbent league can pay high salaries to players to deter rival league formation. These two predictions are broadly consistent with the fact that no rival league formed in North America since the early 1980s and salaries increased rapidly beginning in the late 1980s.

The model suggests some interesting extensions. First, the assumption of a fixed number of homogenous cities capable of supporting teams could be relaxed. Heterogeneity clearly exists among cities in terms of their ability to generate revenues and support teams. Thus, it would be interesting to see if these results still hold when introducing heterogeneity in host cities.

Second, this analysis leaves the welfare implications of rival league expansion, and the related issue of antitrust oversight of professional sports leagues, unexamined. Consumers appear only as sources of revenue in this model. However, the limited supply of teams by existing monopoly leagues leads to welfare losses for residents of cities without teams. The formation of a rival league will generate welfare gains for these consumers, based on increased access to teams and greater variety in entertainment options in cities that did not have a team when only a single dominant league exists. This observation makes the current antitrust exemption enjoyed by professional team sports in North America difficult to motivate. An extended model including consumer preferences and budget constraints can shed additional light on this issue.

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