1. Rival sports league formation and competition

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1 INTRODUCTION

Relatively little past research modeled rival league formation in professional sports markets. Competition in sport takes several forms: competition between individual athletes, competition between teams in leagues, competition between national teams in international contests, competition for incoming and existing players, and so on. One of the least analyzed forms of competition is competition between leagues in the same sport. In this chapter, we develop a model of competition between sports leagues.

The only previous paper to examine league formation in sports was Quirk and Fort (1997), who developed a model of the profits earned by incumbent and rival leagues, and the interaction between them; this model featured heterogeneous cities; some cities can support two teams while other cities can support only one. The model by Quirk and Fort (1997) features competition between leagues in the form of a ‘war’ that reduces the profits earned by teams in both leagues due to competition for fans and players. In this model rival league formation is deterred only through the presence of side payments from the incumbent league to owners of teams in a rival league. In this sense, the model cannot explain why no rival league has emerged in any of the professional sports leagues in North America in past decades.

Here, we develop a model of competition and strategic interaction between professional sports leagues providing games in the same sport in a single market.1 Our model first focuses on the economic decisions made by an existing incumbent league and then introduces a rival league. The model assumes that a certain number of homogenous cities exist, and that the incumbent league places teams in a subset of these cities. We do not model the formation of incumbent leagues.

The question we focus on in the model is based on a common outcome in professional sports leagues: we often observe the outcome of a single dominant monopoly league a specific sport in a market and also observe
the periodic formation of rival leagues. Despite significant increases in population and real income over time, we do not observe competing dominant leagues in any professional team sport in North America.

The question we identify above has received almost no attention from economists. We see no previously proposed explanation for why a single monopoly league in each professional team sport per market should naturally emerge as a stable equilibrium outcome. North America should be able to support multiple competing leagues in the same sport. The population of the United States and Canada exceeds 340 million, which seems large enough to support multiple top-level leagues. The population of the US and Canada in 1901 was more than 80 million; in that year, two professional baseball leagues existed at the highest level. Nearly all of the teams playing in those two leagues are still playing baseball today at the top level, despite vicious head-to-head competition between those two leagues for players and fans over the period 1901–03. In addition, the sole source of revenue in 1901 was game-day revenues, which was limited by the number of people who lived near stadiums, since travel was slower and more difficult. If a market with more than 80 million potential fans can support two baseball leagues playing at the top level, an integrated market with almost 350 million potential fans that can generate ticket, broadcast and sponsorship revenues from many more residents might be expected to support four leagues playing at the top level and competing with each other for fans and players. Note that total attendance in the National League and American League in 1901 was 3.6 million and the combined population of the US and Canada was 82.8 million, or 43 attendees per 1000 population. Total attendance in the Major League Baseball in 2010 was 76 million and the combined population of the US and Canada was 343 million, or 21 attendees per 1000 population. The total population has increased by a factor of five over this period and the simple fraction of the population attending a game has increased by a factor of five, yet the two leagues have merged, so the unified leagues playing baseball at the highest level has decreased from two to one. The number of teams has only increased from 16 to 30; in 1901 there was one top-level baseball team for every 5.1 million North Americans; in 2010 there was one top level baseball team for every 11.4 million.

There has been no shortage of potential new competitors for Major League Baseball, and other professional team sports, in North America over the past century. Yet a single top-level league currently exists in professional football, basketball, baseball and hockey in North America. Much of the rival league formation in North America took place over the period 1880–1980. The lack of rival league formation in the past 30 years suggests that deterrence is an important factor in rival league formation.
Population and income has increased significantly over this period, and new media such as satellite and cable television and the Internet significantly increased the revenues earned by professional sports leagues. Since no rival leagues have formed in this seemingly lucrative environment, incumbent leagues may effectively deter entry by rivals.3

We develop a game-theoretic model of entry and deterrence of rival professional sports leagues. The model contains strategic interaction between leagues, monopsony power in the presence of a single league, expansion by the incumbent league, uncertain success by a rival, competition between leagues for players when rival leagues form, and the potential for a merger between the incumbent and rival league. The model predicts that the only observable outcomes will be expansion by the incumbent to deter the formation of a rival league, or a merger between the incumbent league and a successful rival. Competing rival leagues do not emerge as an equilibrium outcome in this model, consistent with observed outcomes in professional sports leagues.

One paper with a similar model to ours is Che and Humphreys (2015). Although some of their results are similar to the results derived here, this model is based on a different set of assumptions and examines different questions. The main focus here is to analyze the entry or formation decision of the rival league, and unlike this model, Che and Humphreys (2015)’s analysis only focuses on North American sports markets. Here we focus on the optimal strategies for the incumbent league, in particular, whether or not the incumbent league should merge with the new entrant league after the entry of a rival league. Modeling this league-level behavior provides additional insights into economic behavior in these markets.

2 A MODEL OF LEAGUE BEHAVIOR AND INTERACTION

Consider the case where an incumbent dominant professional sports league exists in a certain market. This league operates as a monopolist, the sole provider of events in a professional sport in this market. The market contains \( N \) cities large enough to support a professional sports 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 only needs to determine 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. Each team operates as a monopolist in each city and faces a downward sloping demand curve for the service provided by the team, which can be interpreted as games. This leads to a downward
sloping market demand curve for the professional sport. The number of teams in the league \((n)\) determines the total revenue \(R(n)\) generated by the league. Given a downward sloping market demand curve, \(R'(n) > 0\) and \(R''(n) < 0\). We assume that the league operates as a syndicate, in that all revenues generated are shared equally by the teams in the leagues.\(^4\)

Assume that labor inputs consist entirely of players, rosters are fixed, and labor inputs are homogenous; under these assumptions the total wage bill for each team is \(w_o\) and the total wage bill for the league is \(w_o n\). The initial profit earned by the dominant league is given by:

\[
R(n) - w_o \cdot n > 0 \tag{1.1}
\]

The league chooses \(2 \leq n^* < N\) to maximize total league profits in this market, where \(n^*\) satisfies:

\[
R'(n^*) = w_o. \tag{1.2}
\]

We assume that \(n^* < N\), so the profit maximizing league size leaves some cities without a team. Kahn (2007) shows that this assumption is consistent with the presence of a fixed pool of talent spread over a potentially expanding monopoly league generating a negative externality on fans in the form of lower team quality. If \(n^* = N\) then the optimum league size features a team in every city in the market. In part, this assumption is needed to make the study of rival leagues a non-trivial exercise. When \(n^* = N\), the incentive for a rival league to form is significantly reduced. However, this assumption has empirical support in North America; every city large enough to support a professional sports franchise does not have one. For example, Los Angeles, the second largest metropolitan area in North America, has not had a professional football team since 1994. Based on the 2010 Census, 8 of the 50 largest Metropolitan Statistical Areas (MSAs) in the United States did not have a professional sports team (Riverside California, 4.3 million, Las Vegas, Nevada, 1.9 million, Austin, Texas, 1.7 million, Virginia Beach, Virginia, 1.7 million, Providence, Rhode Island, 1.6 million, Louisville, Kentucky, 1.3 million, Hartford, Connecticut, 1.2 million, and Birmingham, Alabama, 1.1 million). Birmingham has about 2000 fewer people than Buffalo, New York, the fiftieth largest MSA in the US, which is home to two professional sports teams.\(^5\) \(n^* < N\) appears to be a reasonable assumption based on the current distribution of teams across cities in North American professional sports leagues.

The incumbent league faces the following scenario: the \((N - n^*)\) cities without teams in the market represent a potentially profitable environment for a rival league to form and operate in. Assuming that adequate
facilities exist in these cities, a rival league could form and place teams in these \((N - n^*)\) cities without teams in the incumbent league. To simplify the analysis, we also assume that there is no overlap in cities between the two leagues, which ensures that each league is a monopolist in a specific region. This assumption implies no interaction between the two leagues in terms of demand by sports fans. In other words, the two leagues are not substitutes in consumption for fans.

We also assume that the supply of talent, in terms of players, is fixed. This assumption is consistent with the standard model of sports leagues (Fort and Quirk, 1995), and is referred to as the Walrasian fixed-supply conjecture in the literature. We note that this assumption is controversial. Szymanski (2004) shows that an alternative assumption based on a contest-Nash conjecture consistent with a variable supply of talent generates different predictions about league outcomes. We plan to relax this fixed talent assumption in future research. The assumption of fixed talent appears to be reasonable in the short run, as it takes time to acquire the skills to play a sport at the highest level.

The primary implication of a fixed pool of talent is that a rival league must hire players from the incumbent league. North American professional sports leagues have significant monopsony power (Kahn, 2000), so the salary paid to players can be well below players’ marginal revenue product. This monopsony power comes from entry drafts, salary caps, and limited free agency. The presence of a rival league will reduce the monopsony power of the incumbent league, as teams in the rival league will bid players away from teams in the incumbent league. This will increase salaries of players in both leagues, as players will have an outside option when bargaining with team owners over salaries.

Under this scenario, the incumbent league faces two choices: either expand into cities with no team to deter a rival league from forming or not expand and let a rival league form. Vrooman (1997) develops a model of league expansion, although this model does not consider expansion in the context of rival league formation. We assume that any rival league that forms will succeed with a positive probability \(q(e)\), where \(e\) is the effort level the entrant invests into the rival league. Not all rival leagues succeed; in some cases, a rival league lacks sufficient organizational ability, coordination, marketing or quality to attract fans. Quirk and Fort (1997) discuss the features of rival leagues formed in North America over the past 150 years in detail. We assume that the effort variable, \(e\) reflects all of these factors.

If the incumbent league chooses to expand into the \((N - n^*)\) cities without teams, the total league wage bill increases to \(w_e \cdot N > w_o \cdot n^*\). The wage bill of each team also increases \((w_o < w_e)\) as additional teams implies
increased competition for a fixed pool of talent. After expansion, total league profits are $R(N) - w_e \cdot N$.

If the incumbent league chooses to allow a rival league to form, then the rival league places teams in the $N - n^*$ cities with no teams in the incumbent league. The rival league can affect the probability that it succeeds and becomes an established league by choosing an investment level $e$. This $e$ captures resources put toward marketing, promoting and publicizing the new league, as well as resources devoted to other joint-venture activities that would help to promote successful establishment of a new sports league.

If the league is unsuccessful, which happens with probability $1 - q(e)$, then the incumbent league still obtains the profit characterized by equation (1.1) with $n^*$ teams in the incumbent league. If the rival league is successful, both leagues will exist concurrently in the market; the incumbent and the entrant will earn $R(n^*)$ and $R(N - n^*)$, revenues respectively. However, the successful formation of the rival league creates an outside option for talent moving between the leagues, which will drive up salaries, and the wage bill for each team in the league to a higher level $w_r$, because of the fixed supply of talent.

To improve their bargaining position with players and reduce salaries, the incumbent and successful rival league can merge and form a single united league. The merged league would contain some or all of the teams from the rival league. This merger will benefit both leagues by reducing the bargaining power of the players and increasing the monopsony power of the merged leagues. The merger will result in a lower team wage bill ($w_m$) than under the outcome with two competing leagues ($w_m < w_r$). However, in this merged league, the incumbent has to divide total revenue with teams in the rival league. We assume that the incumbent league offers a ‘take-it-or-leave-it’ revenue sharing offer with proportions $\delta$ and $1 - \delta$ between the incumbent and the rival, respectively, where $0 \leq \delta \leq 1$. The profits for the incumbent and rival are $\delta R(N) - w_m n^*$ and $(1 - \delta) R(N) - w_m (N - n^*)$, respectively.

The actual details from mergers that took place between incumbent and rival leagues contain significant heterogeneity. In a few cases, all teams in the rival league were merged into the incumbent league, but in most cases only a subset of the teams in the rival league successfully merged. In some cases, the owners of rival league teams that did not merge were compensated with cash payments. The mergers frequently involve lump-sum payments from merging rival teams to existing incumbent teams, in the form of side payments for reduction of monopoly power in certain cities, expansion fees, player transfer and other arrangements. Mergers also contain agreements about limited sharing of revenues generated by national broadcast rights, licensed merchandise and other commonly
shared revenue streams in North American professional sports leagues for some specified period. We assume that the ‘take-it-or-leave-it’ revenue sharing offer of $\delta$ and $1 - \delta$ captures all of these myriad details in a single parameter.

We now have enough analytic framework to specify a sequential game-theoretic model of rival league formation that captures the strategic interaction between the incumbent league and a potential rival summarized above. Solving the model requires some additional assumptions. Without loss of generality, we assume that:

**Assumption 1:** $R(n^*) - w_n n^* > R(N) - w_N N > 0$. This assumption implies that given $w_n$, the incumbent does not have an incentive to expand the current league to other cities in the market. This is equivalent to assuming $n^* < N$.

**Assumption 2:** $q(e)R(N - n^*) - w_r (N - n^*) \geq 0$ and $R(x) - w_r(x) \leq R(N) - w_m N$, where $2 \leq x \leq N$. The first inequality implies that, given that there are $n^*$ teams in the incumbent league, the new entrant has an incentive to form a rival league, although the salaries and team’s wage bills become higher after the rival league has formed. The second inequality reflects the fact that when either the incumbent league chooses to expand or the two leagues choose to merge, the increase in the league’s bargaining power with players will produce higher expected profits, even though there are more teams in the merged league.

**Assumption 3:** $q(e)$ is increasing and concave in $e$, and $q(e) = 0$. This assumption reflects how the effort level the rival invests will affect the probability of a rival league succeeding.

These assumptions allow us to model the interaction between an incumbent league and a potential rival league as a sequential multi-stage game that reflects the important roles of expectations and deterrence in rival league formation. The timing of the game played by the incumbent and rival league can be characterized by the following three stages:

**Stage One:** The incumbent decides to either expand the current league or not expand and let a rival league form.

**Stage Two:** After observing the incumbent’s decision, the entrant is deterred if the incumbent chooses to expand to include teams in new cities; the rival chooses to form a new league, enter the market, and invest effort $e$ if the incumbent league chooses not to expand.
Stage Three: If the new league is not successful, the entrant leaves the market and the incumbent league maintains its monopoly position in the market. If the new league is successful, both leagues exist concurrently and can choose to merge, reducing salaries and team payrolls by increasing their monopsony power and reducing the bargaining power of players. However, the incumbent league has to offer a revenue sharing rule, \( \delta \), to the entrant, splitting the total profits earned in the market.

2.1 The Rival League Formation Game

In this section, we solve the three-stage game by backward induction. We first characterize the conditions under which a rival league will merge with the incumbent league in Stage Three. Next, we derive an expression for the optimal strategy, characterized by an effort level \( e \), chosen by the rival league after entry in Stage Two. If the new league is not successful, the rival league earns zero profits and the incumbent league’s profits are \( R(n^*) - w_n^* \). Thus, we restrict our attention on the case where the rival league succeeds. In this case, the incumbent offers a ‘take-it-or-leave-it’ revenue sharing arrangement where the rival league gets \( 1 - \delta \) of the profits and the incumbent league keeps \( \delta \). Under these conditions, the payoffs of the entrant are such that, if the rival league does not accept the offer revenue sharing offer, rival league profits are \( R(N - n^*) - w_r(N - n^*) \); if the offer is accepted, the profits earned by teams in the (former) rival league are \( (1 - \delta)R(N) - w_r(N - n^*) \) and profits earned by teams in the incumbent league are \( \delta R(N) - w_m(n^*) \). The key factor in this stage is the size of the revenue sharing rule offered by the incumbent league to the rival league if they merge.

The decisions made by the rival and incumbent leagues in Stage Three of the game can be summarized by the following lemma, which describes the optimal revenue sharing offer made by the rival league.

Lemma 1
There exists a ‘take-it-or-leave-it’ revenue sharing offer \( \delta^* \) such that if the incumbent league offers \( \delta \) in the interval \([\delta^*, 1]\), the two leagues will exist concurrently in a same market; otherwise, the rival and incumbent league will choose to merge. The ‘take-it- or-leave-it’ revenue sharing offer is:

\[
\delta = 1 - R(N - n^*) - (w_r - w_m)(N - n^*) / R(N)
\]

The proof is straightforward. If \( R(N - n^*) - w_r(N - n^*) < (1 - \delta)R(N) - w_m(N - n^*) \), the rival league will accept the revenue sharing offer from the
incumbent; otherwise, the rival league rejects. The threshold value for the ‘take-it-or-leave-it’ revenue sharing offer, $\delta^*$, is consistent with $R(N - n^*) - w_r(N - n^*) = (1 - \delta)R(N) - w_m(N - n^*)$. If the incumbent league makes an offer above the threshold value, the rival league will choose not to merge, because it will not get a large enough share of the profits in the merged league. If no merger takes place, two leagues will operate concurrently in the market and salaries and team wage bills will increase as a result of the reduced bargaining power in each league because of the outside option available to players.

We next characterize the conditions under which the incumbent league is willing to merge when a rival league successfully forms. If the incumbent league chooses not to merge with the rival, the incumbent leagues’ profits are $R(n^*) - w_r n^*$; if the merger takes place, the rival league’s profits are $\delta R(N) - w_m n^*$. When these two payoffs are equal, there exists a threshold value $\delta^{**}$ for the incumbent league such that the incumbent league will not merge with the rival if $\delta^* < \delta^{**}$, and the incumbent league offers $1 - \delta^*$ to theentrant league; the incumbent league will merge if $\delta^* \geq \delta^{**}$.

Given the optimal strategies of the incumbent and rival league, conditional on the success of the rival league, we move backward to solve the second stage of the game. If the incumbent league expands into the $N - n^*$ cities with no teams, it is obvious that the rival league will optimally choose not to form. However, if the incumbent league chooses not to expand, from Assumption 2, it will be profitable for the rival to enter the market and form the league. Thus, we only need to focus on the effort level $e$ chosen by the rival league.

The effort level $e$ the rival will invest depends on whether, in equilibrium, the incumbent will make a revenue sharing merger offer above or below the cutoff value $\delta^*$. Thus, we separately analyze two cases that define two reaction functions:

1. If the rival league expects that the incumbent league will choose to merge and offer $1 - \delta^*$, conditional on the rival league being successful, the $\delta^* \geq \delta^{**}$ and the expected profits of the rival league are:

$$q(e)(1 - \delta^*)R(N) - w_m(N - n^*).$$

Differentiating equation (1.3) with respect to $e$ yields:

$$q'(e^*)(1 - \delta^*)R(N) = 1$$

where $e^*$ is the ex-ante effort level the rival league invests, if a merger will be offered conditional on the new league being successful.
2. If the entrant expects that the incumbent will choose not to merge, then $\delta^* < \delta^{**}$ and the expected profits of the rival league are:

$$q(e^{**})R(N - n^*) - w_r(N - n^*). \quad (1.5)$$

Differentiating equation (1.5) with respect to $e$ yields:

$$q'(e^{**})R(N - n^*) = 1 \quad (1.6)$$

where $e^{**}$ is the _ex-ante_ effort level the rival league invests, if merger will not be offered conditional on the new league being successful.

Based on the two reaction functions for the rival league in the two cases above, the rival league’s optimal strategy can be characterized by the following lemma:

**Lemma 2**
Suppose that Assumptions 1–3 hold.

I. If $\delta^* \geq \delta^{**}$, then the rival league invests $e^*$ in forming the new league; conditional on being successful, the incumbent league offers $(1 - \delta^*)$ to the rival.

II. If $\delta^* < \delta^{**}$, then the rival league invests $e^{**}$ in forming the new league; the incumbent league will never choose to merge with the entrant.

The proof for Lemma 2 is straightforward. Lemma 2 shows an important implication that when an entrant decides to enter the market and form a new league, his effort on the formation depends on whether or not the incumbent has an incentive to merge conditional on the new league being successful. Furthermore, given that $R(N - n^*) > (1 - \delta^*)R(N)$, we have that $e^* < e^{**}$, which indicates that the opportunity of merger with the incumbent benefits the entrant, as he can lower his investment in the new league formation.

### 2.2 The Incumbent League’s Optimal Strategy

In this section we move backward to the first stage of the game and, given the rival league’s strategy identified for Stage Two, characterize how the incumbent league decides whether to expand to deter new league formation or allow a new league to form and potentially merge with this new league, conditional its success.

From the previous analysis of the rival league’s optimal response to a
potential merger offer, the incumbent’s strategy in the first stage depends on three possible outcomes:

Outcome 1: If the incumbent league chooses to expand, total profits are

\[ R(N) - w^0 N. \] (1.7)

Outcome 2: If the incumbent league allows a rival league to form and then merges with the rival league, and if the new league is successful, the incumbent league’s expected profits are

\[ q(e^*)[\delta^* R(N) - w^m n^*] + (1 - q(e^*))[R(n^*) - w^p n^*]. \] (1.8)

Outcome 3: If the incumbent league allows a rival league to form and does not merge with the rival league, and if the new league is successful, the incumbent league’s expected profits are

\[ q(e^{**})[R(n^*) - w^p n^*] + (1 - q(e^{**}))[R(n^*) - w^p n^*]. \] (1.9)

Given the profits earned by the incumbent league in these three outcomes, if \( \delta^* \geq \delta^{**} \), it is straightforward to see that, from Assumption 1, the profits earned by the incumbent league in Outcome 2 is strictly greater than the profits earned in Outcome 3; in other words, Outcome 3 is dominated by Outcome 2. Thus, our analysis needs only to focus on comparing Outcomes 1 and 2. It is obvious that if the profits earned by the incumbent league under Outcome 1 are greater than the profits earned by the incumbent league under Outcome 2, 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.

Thus, given the response of the incumbent, the effort chosen by the rival league, \( e^* \), and the revenue sharing offer made by the incumbent league, \( \delta^* \), we can characterize the equilibrium in this game.

Proposition 1: Suppose that \( \delta^* \geq \delta^{**} \). If \( [(1 - q(e^*))\delta^* R(N) - (N - n^* q(e^*))w^m]/(1 - q(e^*)) \leq R(n^*) - n^* w^p \), there exists a subgame perfect equilibrium where the incumbent allows a rival league to form; the rival league invests \( e^* \) in forming the new league; conditional on being successful, the incumbent league offers \( 1 - \delta^* \) to the entrant and the two leagues merge. Otherwise, the incumbent chooses to expand the current league to deter rival league formation.
\textit{Proof}. Given that $\delta^* \geq \delta^{**}$, if the profits earned by the incumbent league in Outcome 1 are less than the profits earned in Outcome 2, then
\[
[(1 - q(e^*)\delta^*R(N) - (N - n^*q(e^*))w_m)] / (1 - q(e^*)) \leq R(n^*) - n^*w_m.
\]
This expression shows that it is optimal for the incumbent league to expand to deter a rival league from forming. Given that expansion is chosen by the incumbent league, the entrant invests $e^*$ in the $N - n^*$ cities to form a new league with a probability of success $q(e^*)$. Then, as shown in Lemma (1) and part I of Lemma 2, if the rival league is successful, then the incumbent league offers $(1 - \delta^*)$ to the rival league in the subgame perfect equilibrium; the two leagues will merge. However, if the new league is unsuccessful, the current league still operates with teams in $n^*$ cities in the market.

If 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 $N - n^*$ cities in the market. A rival league will not form under this condition, as expected profits from the rival league are negative.

We next turn to the case where $\delta^* < \delta^{**}$. From part II of Lemma 2, Outcome 3 is strictly greater than Outcome 2, which implies that it is optimal for the incumbent league to not merge with the rival, even if the rival league is successful. Thus, in the following, our analysis must only focus on the incumbent’s decision to expand or not expand. We state the result as follows

\textbf{Proposition 2}: Suppose that $\delta^* < \delta^{**}$. There exists a rival league investment level $e$ such that if $e^{**} < e$, the incumbent allows a rival league to form; in this case, the rival league invests $e^{**}$ in the new league with a success probability ($e^{**}$). Otherwise, the incumbent chooses to expand.

\textit{Proof}. If $\delta^* < \delta^{**}$, the incumbent league will not choose to merge even if the rival league is successful. Thus, we restrict our attention to the incumbent league’s choice in stage one. Given Assumptions 1 and 2, we know that $R(n^*) - w_m n^* < R(N) - w_m N < R(n^*) - w_m n^*$ and thus there should exist an optimal rival league investment choice $e$ to ensure that equation (1.6.) equals equation (1.8). As a result, there exists a subgame perfect equilibrium in which the incumbent league expands to deter new league formation if $e^{**} \geq e$ and allows a new league to form if $e^{**} < e$.

Propositions 1 and 2 characterize observed outcomes in terms of rival league formation in markets for professional sports since the formation of the first professional team sports league in the late nineteenth century. Sports leagues operate as monopolists in the North American market. Even though rival leagues occasionally form, in the long run these rival
leagues either merge with the incumbent league or fail. This demonstrates that it is very likely that $\delta^* < \delta^{**}$.

The main reason why the incumbent leagues are willing to merge may be because of the fixed supply of talent and the existing monopsony power of sports leagues. A merged league will have a lower salary level and team wage bill than two competing dominant leagues. In our model, this implies that the benefit from low wages outweighs the costs of the merger, through revenue sharing with new teams. If the incumbent league and a successful rival do not choose to merge, both will be worse off as it drives up salaries and team payrolls because of the outside option provided to players.

3 CONCLUSIONS

We develop a game-theoretic model of strategic interaction between competing professional leagues to explain observed patterns in rival league formation. Relatively little research has focused on explaining a key puzzle in rival league formation: why do we observe only a single, dominant monopoly league in all North American professional team sports? This market appears to be large enough to support more than one league playing at the highest level in each sport, both in terms of the number of consumers and the number of athletes. The model predicts that this is a subgame perfect equilibrium outcome. Based on expected outcomes related to revenue sharing, bargaining over players, and the probability of a rival league succeeding, no other outcome would be observed even though competing professional leagues can potentially exist. The model is also sufficiently general to include the possibility of a merger between the incumbent and rival league, another commonly observed outcome.

The model also explains the high salaries paid to professional athletes in team sports. One common explanation for the high salaries earned by professional athletes is that they possess relatively scarce abilities and their employers earn high revenues, suggesting a very high marginal revenue product for professional athletes. The model developed here predicts that an incumbent league will pay high salaries to existing players to deter rival league formation. A potential rival league will realize that attracting high-quality players from the incumbent league will be very expensive, and will choose not to form because of the negative expected profits generated by high wage bills. This prediction is broadly consistent with outcomes observed in professional sports markets.

This model can be extended in several directions. While this is an initial effort at modeling rival league formation, several important assumptions could be relaxed to make the model sufficiently general to explain
the rich variety of economic behavior observed in sports leagues. First, rather than assume that salaries and total wage bills increase when two dominant leagues compete, bargaining between teams and players under a single incumbent league and two competing leagues could be added to the model. This would relax a key assumption made here. Second, the assumption of a fixed number of homogenous cities capable of supporting a professional sports team could be relaxed. Heterogeneity clearly exists among cities in terms of their ability to generate revenues and support professional sports teams. New York, Chicago, and Los Angeles currently support more than one team in Major League Baseball, the National Basketball Association, the National Football League, and the National Hockey League. Heterogeneity in the ability to support teams might generate different predictions, and help explain why rival leagues sometimes place teams in the same city as incumbent leagues. In a related point, population growth continually produces new cities capable of supporting a professional team. If incumbent monopoly leagues will not expand into these cities, this generates a significant incentive for a rival league to form. The current model includes only competition for a fixed number of heterogeneous cities with a single team. Increases in the number of potential host cities could generate different predictions about optimal strategies for incumbent and rival leagues.

Finally, this analysis does not examine the welfare implications of rival league expansion. Fans represent only a source of revenue in this model. However, the limited supply of teams provided 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 existed. An extended model including consumer preferences and budget constraints can shed additional light on the key issue of the welfare implications of dominant monopoly sports leagues that successfully deter entry by rival leagues.

NOTES

1. Cyrenne (2009) develops a similar model to explain strategic interaction among teams in an existing professional sports league. Dietl et al. (2008) and Madden (2011) develop similar models of within-league strategic interaction.
2. Che and Humphreys (2015) provide details about rival league formation in North America over this period.
3. Szymanski and Ross (2007) discuss the effect of horizontal anti-trust restraints on rival league formation, which may provide an alternative explanation.
4. While this does not reflect the complexity of actual revenue sharing arrangements in professional sports leagues, it simplifies the analysis considerably. Quirk and Fort (1997) and Vrooman (1997) make a similar assumption.

5. The only exception in North America is Green Bay, Wisconsin, population 309,000, ranked 152nd largest MSA in the US and home to the Green Bay Packers.

REFERENCES


