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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 in professional team sports, one of the least studied forms of competition in sport. We survey the economic history of professional sports leagues in North America and develop stylized facts about rival league formation and develop a game-theoretic model of entry of a rival league to an existing market to explain these stylized facts. This model accounts for the strategic interaction between the incumbent and rival league and costs associated with acquiring new players from the incumbent league. The model predicts that either expanding to deter rival league formation, or allowing a rival league to form and then merging with that league is a subgame perfect equilibrium, and that incumbent leagues will pay players relatively high salaries to deter entry by a rival league.

JEL Codes: D42, L12, L83

Key Words: professional team sports, rival league, monoposony

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1 Introduction

Competition in sport takes a number of forms: competition between individuals, competition between teams in a league during the regular and post-season, competition between nations in international contests, competition for incoming and existing talent, and others. One of the least examined forms of competition in sport is competition between leagues in the same sport containing teams playing at the highest level for customers and players. The lack of attention to this type of competition is curious, because a relatively large number of rival leagues have formed in North America since the emergence of professional sports in the late 19th century.

In this paper, we focus on two questions raised by two commonly observed outcomes in professional sports leagues: first, the outcome of a single dominant monopoly league a specific sport in a market is often observed, even though rival leagues periodically form in all professional sports. Despite the significant increases in population and real income over time, no competing dominant leagues exist in any professional team sport in North America. Second, monopoly leagues clearly pay relatively high salaries to players.

The second point has received a significant amount of attention in the literature. The most common explanation for the high salaries paid to professional athletes is that they have rare abilities and high marginal revenue products. While both have considerable appeal – top professional athletes clearly possess exceptional physical characteristics like agility, coordination, balance, speed and size or body mass and professional sports teams earn large revenues relative to the characteristics they produce – the rare skill plus high marginal revenue product explanation still appears incomplete in some respects; minor league players with skills similar to major league professional athletes earn much lower salaries, and professional sports teams are relatively small firms in economic terms and often claim to generate small or no profits.

The first outcome has received almost no attention from economists. We do not know of any previously proposed explanation for why a single monopoly league in each professional team sport per integrated market should naturally emerge as a stable equilibrium outcome. The population of the United States and Canada exceeds 340 million, which seems large

enough to support multiple team sports leagues playing at the top level in any given team sport. The population of the US and Canada in 1901 was more than 80 million; in that year, there were two professional baseball leagues playing at the highest level in the integrated North American market. Nearly all of the teams playing in those two leagues are still playing baseball today at the highest level, despite vicious head-to-head competition between those two leagues for players and fans in 1901-1903. In addition, the sole source of revenue in 1901 was game day revenues, which was limited by the number of people who lived relatively close to the stadiums. 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 can generate ticket, broadcast and sponsorship revenues from many more residents support four leagues playing at the top level and competing with each other for fans and players? 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, a ratio of 0.043. Total attendance in the Major League Baseball in 2010 was 76 million and the combined population of the US and Canada was 343 million, a ratio of 0.21. Yet this market still contains only the NL and AL playing baseball at the highest level. 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 potential fans and in 2010 there was one top level baseball team for every 11.4 million fans.

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 last thirty years suggests that deterrence is an important factor rival league formation. Population and income has increased significantly over this period, and new media like 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 rich environment, incumbent leagues may be effectively deterring entry by rivals. Szymanski and Ross (2007) discuss the effect of horizontal anti-trust restraints on rival league formation, which may provide an alternative explanation.

We develop a game-theoretic model of entry and deterrence of rival professional sports leagues. The model contains strategic interaction between leagues, monoposony 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 or offering a relatively high wage to players by the incumbent league 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 North American professional sports leagues.

This model also includes interaction between an existing dominant league and a rival league. We model the dominant league as a monopsonist facing an upward-sloping and inelastic labor supply curve for players in a labor market and a monopolist in an output market.[1] The presence of a rival league, which successfully forms with some probability, dilutes the monopsony power of the dominant league, as the rival league gives an outside employment option to players, which drives up wages paid to players. The model predicts that, to prevent this increase in wages, both the dominant and rival leagues have an incentive to merge as a single unified league. The model also includes the nature of revenue sharing between the existing league and a successfully formed rival, in the form of a "take-it-or-leave-it" offer of revenue sharing made by the existing league.[2]

We analyze the strategic decisions made by the existing league to either expand the number of teams in the league or offer a relatively high wage to players to deter a new league from forming. We show that there exists a unique wage level such that the dominant league

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

[2]A large body of literature on entry and deterrence in a market exists in industrial organization. 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 (2012) for a discussion of mergers among firms.

prefers offering the relatively high wage to deter rival league formation if and only if the wage is not too high. Otherwise, league expansion to deter entry of a rival league will be the preferred choice of the existing league.

In the literature, 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. Our model includes the economic decisions made by an existing incumbent league and then introduces a rival league. The model assumes that a 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 an incumbent league.

Relatively little past research has focused on modeling rival league formation in professional sport. Quirk and Fort (1997) develop; a model of the profits earned by an incumbent and rival league, and the interaction between these leagues; this model features heterogeneity in host cities in that some cities can support two teams in a league while other cities can support only one team. The model developed 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. This model explains deterrence of rival league formation only through the presence of side payments from the incumbent league to potential owners of teams in a rival league. In this sense, the model developed by Quirk and Fort (1997) cannot explain why no rival league has emerged in any of the four professional sports leagues in North America since the USFL in 1982, or why no rival professional baseball league has formed since the Federal League in 1914. Our model generates deterrence of rival league as an equilibrium outcome, through strategic interaction.

2 Rival Leagues and Expansion in North America

A large number of rival professional sports leagues have formed in North America over the past 110 years. In each of the four "major" professional team sports, at least one rival league has formed to compete with the dominant league at some point. Tables 1 and 2 summarize some relevant information about the formation of rival professional sports leagues

and expansion by incumbent leagues in professional baseball and football in North America. The column headed "seasons" is the number of seasons a rival league played. "Players hired" is the number of players from the incumbent league who appeared on a team roster in the rival league in the first season. This is a measure of how many players from the existing league were hired by teams in the rival league. When this column contains the word "Draft" it means that, in addition to signing veteran players from the incumbent league, the rival league also operated a competing amateur player entry draft and competed with the incumbent league for new talent. Baseball was the first professional sport to emerge in North America, and the first rival leagues also emerged in this sport. The first incumbent league in baseball was the National League, 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 in professional baseball.

An incumbent professional baseball league faced only one serious rival over this period. The National League, the first professional sports league in North America, formed in 1876. After a number of rivals formed and failed in the late 19th century, the rival American league formed in 1901. After only two seasons, the National League merged with all 8 teams in the American League to form Major League Baseball (MLB). MLB also faced a challenge from the rival Federal League early in the century. The Continental league episode in the late 1950s is an interesting case of potential rival league deterrence. The Continental league existed as a legal entity and had eight prospective teams (New York, Minneapolis, Denver, Houston, Toronto, Buffalo, Atlanta and Dallas). Also, at this time New York City had a population of 7.7 million and only one MLB team, the Yankees. Faced with the credible prospect of a rival league forming in these eight cities, and especially in the valuable New York City market, MLB agreed to expand, and specifically to put a new team in New York City. The Continental league shut down without playing a game. Continental league team owners were given first opportunity to buy expansion teams, three of the four expansion teams added in 1961-1962 went to cities that would have had Continental League teams, including the New York Mets. In this instance, the subsequent MLB expansion can be thought of as a *de facto* merger without the rival league forming.

The National Football League (NFL) has been the incumbent professional football league

Table 1: North American Rival Leagues and Expansion 1901-2010, MLB & NFL

Incumbent League	Year Founded	Event	Year	Seasons	Players Hired	Outcome
NL (baseball)	1876	**Rival**: AL	1901	2	113	All 8 merged
MLB (baseball)	1903	**Rival**: Federal	1914	2	80	Bankrupt
		Rival: Continental	1958	0	0	Deterred
		Expansion	1961			2 Teams
		Expansion	1962			2 Teams
		Expansion	1969			4 Teams
		Expansion	1977			2 Teams
		Expansion	1993			2 Teams
		Expansion	1998			2 Teams
NFL (football)	1920	**Rival**: AFL I	1926	1	1	Bankrupt
		Expansion	1931			1 Team
		Expansion	1933			3 Teams
		Rival: AFL II	1936	2	1/Draft	Bankrupt
		Rival: AFL III	1940	2	0/Draft	Bankrupt
		Rival: AAFC	1946	4	132/Draft	4 of 9 merged
		Expansion	1960			1 Team
		Rival: AFL IV	1960	6	106/Draft	8 of 8 merged
		Expansion	1961			1 Team
		Expansion	1966			1 Team
		Expansion	1967			1 Team
		Rival: WFL	1974	2	73/Draft	Bankrupt
		Expansion	1976			2 Teams
		Rival: USFL	1983	3	222/Draft	Bankrupt
		Expansion	1995			2 Teams
		Expansion	1999			1 Team
		Expansion	2002			1 Team

in North America since its founding in the 1920s. The NFL has faced a large number of rival leagues over the years, and two of them succeeded in merging teams into the NFL. Four different rival leagues went by the name American Football League (AFL) and these independent rival leagues are identified by Roman numerals of Table 1. The NFL also faced the most recent serious rival league challenge in North America, the United States Football League, in 1983-1985. The XFL, an 8 team league created by pro wrestling impresario Vince McMahon, played a single season in 2001, but this is not generally regarded as a true rival league. Note that the rival American Football League I in 1926 signed only one NFL player. 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.

Table 2 summarizes some relevant information about the formation of rival professional sports leagues and expansion by incumbent leagues in professional basketball and ice hockey in North America. Basketball was the last team sport to professionalize in North America; the incumbent National Basketball Association did not form until after the Second World War. Professional basketball teams existed prior to this founding, but these were primarily short-lived leagues that are not regarded as true dominant, incumbent professional 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, 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 Tables 1 and 2, rival leagues frequently compete with incumbent leagues for players. Many of the rival leagues shown on these tables 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 Tables 1 and 2 formed before detailed data about player salaries were widely available. However, Kahn (2000) documents the changes in player compensation that took place in several incumbent leagues after the formation of a rival league.

Kahn (2000) points out that professional sports leagues in North America enjoyed signif-

Table 2: North American Rival Leagues and Expansion 1901-2010, NBA & NHL

Incumbent League	Year Founded	Event	Year	Seasons	Players Hired	Outcome
NBA (basketball)	1949	**Rival**: ABL	1961	2	< 10	Bankrupt
		Expansion	1961			1 Team
		Rival: ABA	1967	9	30/Draft	4 of 6 merged
		Expansion	1970			3 Teams
		Expansion	1974			1 Team
		Expansion	1980			1 Team
		Expansion	1988			2 Teams
		Expansion	1989			2 Teams
		Expansion	1995			2 Teams
		Expansion	2004			1 Team
NHL (ice hockey)	1917	Expansion	1924			2 Teams
		Expansion	1925			2 Teams
		Expansion	1926			3 Teams
		Expansion	1967			6 Teams
		Expansion	1970			2 Teams
		Expansion	1972			2 Teams
		Rival: WHA	1972	7	76/Draft	4 of 16 merged
		Expansion	1974			2 Teams
		Expansion	1991			1 Team
		Expansion	1992			2 Teams
		Expansion	1993			2 Teams
		Expansion	1998			1 Team
		Expansion	1999			1 Team
		Expansion	2000			2 Teams

Table 3: 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)

icant monoposony power in the labor market for players since the founding of the National League in 1876. The most important source of this monoposony power is the "reserve clause" an actual clause in the standard labor contract between all players and teams that assigns the rights to each player to the team that owns the contract in perpetuity. The reserve clause was in full effect up until 1976, and still applies to players with relatively little experience in all four leagues; this generates significant monoposony power for teams, and reduces salaries to levels lower than would prevail under competition for players, since players under the reserve clause can negotiate with only one team. In addition, entry drafts that assign the rights to incoming players to specific teams, salary caps, and other institutional arrangements also generate monoposony power for teams. Even after the reserve clause was abolished for players with a specific amount of service time in 1976 in MLB and later in the other leagues, the presence of long term contracts and other institutional arrangements continued to generate monoposony power for teams.

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 3 summarizes the increases in average salaries in incumbent leagues in North America after the formation of a rival league, in nominal dollars. Recall that the American League, the ABA and the WHA were successful in that some of the teams from these rival leagues merged into the incumbent league, and the Federal League and USFL went bankrupt.

Salaries in the National League 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 like Julius "Dr. J" Erving and David Thompson signed with the ABA, and this rival league also operated a successful rival draft. This suggests that a relatively small number of players attracted from the incumbent league to play in the rival league can generate substantial increases in average salaries. Clearly, these increases in average 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 full effect at this time, and teams could unilaterally decide to increase or decrease salaries from year to year. Given this power to set salaries, teams could easily cut salaries that were bid up during the rival league's raid on incumbent league players. Salaries did not decline so much in the NBA, NHL and NFL after their rival league episodes. However, these rival leagues formed at the beginning of the free agency period in professional sports, which corresponded to a decline in the monoposony power wielded by leagues. In this environment, salaries would not be as downwardly flexible as they were in the early 19th century.

Based on 110 years of economic history of these four professional team sports in North America, several regularities or "stylized facts" emerge. First, rival leagues periodically appear to challenge the supremacy of dominant incumbent leagues in all four sports. Second, these rival leagues hire players away from the dominant league, and often operate competing entry drafts, generating significant increases in average salaries and total team wage bills in the incumbent league. Third, the only outcomes from the formation of a rival league observed are that the rival league fails, or some or all of the teams in the rival league merge into the incumbent league. Despite significant population and real income growth in North America over the past 110 years, in no instance has a 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 in this setting. Finally, incumbent leagues periodically expand into cities with no current team in the incumbent league. We posit that this expansion can be interpreted as attempts to deter the formation of a rival league by preemptively filling open markets.

Clearly, significant strategic interaction takes place between an incumbent league and a potential rival league. The outcome in the case of the Continental League suggests that this strategic interaction has important economic consequences, even if no games are actually played by a rival league. In the next section, we develop a game-theoretic model of strategic interaction between an incumbent league and a potential rival league in order to explain these stylized facts about rival league formation in North America.

3 A model of league behavior and interaction

Consider the case where an incumbent dominant professional sports league exists in a specific market. This league operates as a monopsonist, 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 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 and 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 a 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. 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.

Assume that labor inputs are homogenous and the supply of players is inelastic; under these assumptions the total wage bill for each team is w_o and the total wage bill for the league is $w_o \cdot n$. The initial profit earned by the dominant league is given by

$$R(n) - w_o \cdot n > 0 \tag{1}$$

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

$$R'(n^*) = w_0. \tag{2}$$

We assume that $n^* < N$, so the profit maximizing league size leaves some cities $(N - n^*) \geq 2$ 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 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 2,000 fewer people than Buffalo, New York, the 50th largest MSA in the US, which is home to two professional sports teams.[3] $n^* < N$ appears to be a reasonable assumption based on the current distribution of teams

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

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. 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 monoposony power (Kahn, 2000), so the salary paid to players can be well below players' marginal revenue product. This monoposony power comes from entry drafts, salary caps, and limited free agency. The presence of a rival league will reduce the monoposony 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 last 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 an inelastic pool of talent. After expansion, total league profits are $R(N) - w_e N$.

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. 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) 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 inelastic 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 monoposony 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 δ 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 merchandize, 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 δ 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. While the model is sequential, it is not an infinite horizon dynamic model; Grossmann et al. (2010) develop a fully dynamic model of the behavior of teams in a sports league. Solving the model requires some additional assumptions. Without loss of generality, we assume that

Assumption 1: $R(n^*) - w_o n^* > R(N) - w_e N > 0$. This assumption implies that given w_o, 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: $q(e)R(N - n^*) - w_r(N - n^*) - e \geq 0$ 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 monoposony power and reducing the the bargaining power of players. However, the incumbent league has to offer a revenue sharing rule, δ, to the entrant, splitting the total profits earned in the market.

3.1 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 $R(n^*) - w_o n^*$. 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 δ. 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 $(1-\delta)R(N)-w_m(N-n^*)$ 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 δ^* such that if the incumbent league offers δ 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*

$$\delta^* = 1 - \frac{R(N-n^*)-(w_r-w_m)(N-n^*)}{R(N)}.$$

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, δ^*, 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 wage 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 $R(n^*)-w_r n^*$; of the merger takes place, the dominant league's profits are $\delta R(N)-w_m n^*$. When these two payoffs are equal, there exists a threshold value δ^{**} 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 the entrant 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 a 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 δ^*. 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

$$q(e)(1 - \delta^*)R(N) - w_m(N - n^*) - e. \tag{3}$$

   Differentiating Equation (3) with respect to e yields

$$q'(e^*)(1 - \delta^*)R(N) = 1 \tag{4}$$

   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

$$q(e)R(N - n^*) - w_r(N - n^*) - e. \tag{5}$$

   Differentiating Equation (5) with respect to e yields

$$q'(e^{**})R(N - n^*) = 1 \tag{6}$$

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.

3.2 The incumbent league's 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

$$R(N) - w_e N. \tag{7}$$

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

$$q(e^*)[\delta^* R(N) - w_m n^*] + (1 - q(e^*))[R(n^*) - w_o n^*]. \tag{8}$$

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

$$q(e^{**})[R(n^*) - w_r n^*] + (1 - q(e^{**}))[R(n^*) - w_o n^*]. \tag{9}$$

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, δ^*, we can characterize the equilibrium in this game.

Proposition 1. *Suppose that $\delta^* \geq \delta^{**}$. Then there exists a unique wage w_e^* such that if $w_e \geq w_e^*$, there also 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. If $w_e < w_e^*$, the incumbent chooses to expand the current league to deter rival league formation.*

Proof. Given that $\delta^* \geq \delta^{**}$, there will exist some w_e^* satisfying the condition that Outcome 1 is equal to Outcome 2.

If $w_e \geq w_e^*$, indicating that the profits earned by the existing league under Outcome 1

are less than the profits earned under Outcome 2, 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 $w_e < w_e^*$, 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 $N - n^*$ 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 the rival league is successful. Thus, in the following, our analysis only must focus on the incumbent's decision to expand or not expand. We state the result as follows

Proposition 2. *Suppose that $\delta^* < \delta^{**}$. Then there exists a wage w_e^{**} such that if $w_e \geq w_e^{**}$, the existing league allows a rival league to form; in this case, the rival league invests e^{**} in the formation of the new league with a success probability $q(e^{**})$. If $w_e < w_e^{**}$, the existing league chooses to expand to deter rival league formation.*

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, there should exist a unique wage w_e^{**} to ensure that equation (7) equals equation (9). As a result, the optimal strategy for the existing league is to expand to deter rival league formation if $w_e \geq w_e^{**}$, and allow a rival league to form if $w_e < w_e^{**}$. □

Propositions 1 and 2 characterize observed outcomes in terms of rival league formation in markets for professional sports in North America since the formation of the first professional team sports league in the late 19th century. We observe that leagues operate as monopolists

in the North American market. Even though rival leagues occasionally form, in long run these rival leagues either merge with the incumbent league or fail. This demonstrates that it is very likely that $\delta^* \geq \delta^{**}$. The main reason why the incumbent leagues are willing to merge may be because of the inelastic supply of talent and the existing monoposony 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, 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 payroll because of the outside option provided to players.

4 Salaries, bargaining and deterrence

In sports markets, we observe that players earn large annual salaries. In literature, this phenomena is frequently explained as a result of players' high marginal revenue product. However, this explanation may not be complete. As we have shown above, sports leagues often have monoposony power which provides them with an advantage when bargaining with players over compensation. Firms with monoposony power exercise this power by paying as low a wage as will be accepted by workers to maximize profits. In this section, we extend the analysis from the previous section to include bargaining between the league and players over compensation. Our results show why the an incumbent league is willing to pay a high salary to players in order to deter entry by a rival league. We do not address the issue of allocation of players across teams in this analysis; Schmidt (2011) addresses this issue.

What is the optimal strategy for an incumbent league to keep its monopoly power and deter the entry of a rival league? We consider two options choices for an incumbent league: either expand and put new teams in the $N - n^*$ cities with no team, or increase the salaries of players in the current league. Expansion will increase salaries because of assumption of a fixed supply of talent, so some increase in salaries may still maximize profits relative to the profits earned after expansion.

First, let e denote the equilibrium investment effort made by a rival league, and w_d is the team wage bill that satisfies

$$q(e)R(N-n^*) - w_d(N-n^*) - e = 0. \tag{10}$$

Equation (10) shows that if the wage bill increases to w_d, it becomes unprofitable for a rival league to form, because the wage bill will be too high for the rival league to earn a positive profit. In other words, the new league formation will be deterred if the wage bill of teams in the rival league is greater than or equal to w_d.

Given the model developed above and the assumption of a fixed supply of talent, we can analyze the wage bargaining between the incumbent league and players. We state the result as follows:

Proposition 3. *For some value $C^*(C^{**}) \geq 0$, there exists a unique team wage bill $\bar{w}_d$ such that if $w_d \geq \bar{w}_d$, then the incumbent league will deter any rival league from forming because the salary paid by teams in the rival league to players in the incumbent league to switch leagues will be high enough to make forming a rival league unprofitable; if $w_d < \bar{w}_d$, it is optimal for the incumbent league to allow a new rival league formation. If $C^*(C^{**}) < 0$, expanding the incumbent league is the optimal strategy.*

Proof. Since the incumbent's optimal strategies different in Propositions 1 and 2, we separately prove Proposition 3 for the following two cases:

I. Suppose that $\delta^* \geq \delta^{**}$. From Proposition 1 we can define a value

$$C^* = q(e^*)[\delta^* R(N) - w_m n^*] + (1 - q(e^*))[R(n^*) - w_o n^*] - [R(N) - w_m N].$$

If C^* is less than zero, then we know that the incumbent strictly prefers to deter the entry of a rival league expanding into the cities with no teams. However, if $C^* \geq 0$, we can further have a $\bar{w}_d$ satisfying $R(n^*) - \bar{w}_d n^* = C^*$. Thus, if $w_d \geq \bar{w}_d$, the incumbent will optimally choose to increase the salary paid to players, and each team's wage bill, to deter entry of a rival league; otherwise, it is optimal for the incumbent league to let a rival league form in the market.

II. Suppose that $\delta^* < \delta^{**}$. Following the same logic as in part I, from Proposition 2, we can define

$$C^{**} = q(e^{**})[R(n^*) - w_r n^*] + (1 - q(e^{**}))[R(n^*) - w_o n^*] - [R(N) - w_m N].$$

If C^{**} is less than zero, then the incumbent league strictly prefers to deter the entry of a rival league by expanding into the open cities. However, if $C^{**} \geq 0$, we further have a $\bar{w}_d$ satisfying $R(n^*) - \bar{w}_d n^* = C^{**}$. Thus, if $w_d \geq \bar{w}_d$, the incumbent will optimally choose to increase salaries paid to players, and team wage bills, to deter entry of a rival league; otherwise, it is optimal to let the rival league form and enter the market.

□

The result in Proposition 3 explains why we observe that a monopoly sports leagues expand very slowly but pay high salaries to players. An incumbent monopoly league is maximizing profit, and wants to pay as low a salary as players will accept. If the incumbent league is willing to pay players a higher salary, it is only to deter the formation of a rival league that will provide an outside option for players which will reduce the league's bargaining position. Thus, in order to deter rival league formation, the incumbent league pays high salaries to the players, increasing the cost of rival league formation.

5 Conclusions

We develop a game-theoretic model of strategic interaction between competing professional team sports leagues to explain observed patterns in rival sports league formation in North America. 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 team playing at the highest level, 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 when competing professional leagues can exist. The model is also sufficiently general to include the

possibility of a merger between the incumbent and rival league, another commonly observed outcome in this setting.

The model also provides a novel explanation for the high salaries paid to professional athletes. The most common explanation for the relatively high salaries paid to professional athletes is that their relatively scarce abilities, coupled with the high revenues earned by professional sports teams, implies a very high marginal revenue product for these workers. Alternatively, 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 payrolls. This prediction is broadly consistent with the fact that no rival league has formed in North America since the early 1980s, and salaries earned by players in professional team sports increased rapidly beginning in the late 1980s.

From Tables 1 and 2, rival leagues appeared periodically in all four North American professional sports leagues over the past 110 years. The period after the Second World War up to roughly the advent of free agency in the mid-1970s was the heyday of rival league formation; many of the rival leagues formed in this period successfully merged multiple teams into the dominant league, including the owners of potential Continental League teams who were awarded expansion MLB teams, a de facto merger. No rival league has formed since the USFL in 1983, and no successful rival league has formed since the WHA in 1972. The model explains these outcomes in two ways. One explanation, based on Proposition 1, is that the increased broadcast rights media earned by leagues beginning in the 1980s has effectively increased δ, the "take-it-or-leave-it" revenue sharing offer made by the incumbent league, which makes expansion to deter rival league formation the profitable strategy for the incumbent league. Broadcast revenues are currently 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 more members of a rival league. This would imply a larger δ, the share kept by the incumbent league, a smaller $1 - \delta$, the revenue share offered to the rival league, and the expansion option becoming relatively more attractive then the merger option, relative to the 1940s, 1950s, and 1960s, when broadcast rights fees were smaller. All

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.

Alternatively, from Proposition 3, 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 very costly to raid teams in the incumbent league for players. This would be more effective a deterrent in the NFL, which has a 45 player roster, MLB, which has a 25 player roster, and the NHL, which has a 23 player roster. 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.

This model can be extended in several useful ways. While this is an initial effort at modeling rival league formation, several important assumptions need to be relaxed to make the model sufficiently general to explain the rich variety of economic behavior observed in this setting. First, rather than assume that salaries and total wage bills will be higher with two competing dominant leagues, 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 in the current approach. 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 MLB, the NBA, NFL, and NHL. 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 heterogenous 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 leaves the welfare implications of rival league expansion, and the related issue of anti-trust 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 anti-trust 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.

References

Boal, W. M. and Ransom, M. R. (1997). Monopsony in the labor market. *Journal of Economic Literature*, 35(1):pp. 86–112.

Cyrenne, P. (2009). Modelling professional sports leagues: An industrial organization approach. *Review of Industrial Organization*, 34(3):193–215.

Dietl, H. M., Franck, E., and Lang, M. (2008). Overinvestment in team sports leagues: A contest theory model. *Scottish Journal of Political Economy*, 55(3):353–368.

Farrell, J. and Shapiro, C. (1990). Horizontal mergers: An equilibrium analysis. *The American Economic Review*, pages 107–126.

Fort, R. and Quirk, J. (1995). Cross-subsidization, incentives, and outcomes in professional team sports leagues. *Journal of Economic Literature*, 33(3):1265–1299.

Grossmann, M., Dietl, H., and Lang, M. (2010). Revenue sharing and competitive balance in a dynamic contest model. *Review of Industrial Organization*, 36(1):17–36.

Kahn, L. M. (2000). The sports business as a labor market laboratory. *The Journal of Economic Perspectives*, 14(3):75–94.

Kahn, L. M. (2007). Sports league expansion and consumer welfare. *Journal of Sports Economics*, 8(2):115–138.

Madden, P. (2011). Game theoretic analysis of basic team sports leagues. *Journal of Sports Economics*, 12(4):407–431.

McAfee, R. and Williams, M. (1992). Horizontal mergers and antitrust policy. *The Journal of Industrial Economics*, pages 181–187.

Nocke, V. and Whinston, M. (2012). Merger policy with merger choice. *forthcoming, American Economic Review*.

Nocke, V. and Whinston, M. D. (2010). Dynamic merger review. *Journal of Political Economy*, 118(6):1201 – 1251.

Pesendorfer, M. (2005). Mergers under entry. *RAND Journal of Economics*, pages 661–679.

Quirk, J. P. and Fort, R. D. (1997). *Pay dirt: The business of professional team sports*. Princeton University Press, Princeton, NJ.

Schmidt, M. B. (2011). Institutional change and factor movement in major league baseball: An examination of the coase theorems invariance principle. *Review of Industrial Organization*, 39(3):187–205.

Szymanski, S. (2004). Professional team sports are only a game: The walrasian fixed-supply conjecture model, contest-nash equilibrium, and the invariance principle. *Journal of Sports Economics*, 5(2):111–126.

Szymanski, S. and Ross, S. F. (2007). Governance and vertical integration in team sports. *Contemporary Economic Policy*, 25(4):616–626.

Tirole, J. (1994). *The theory of industrial organization*. MIT press.

Vrooman, J. (1997). Franchise free agency in professional sports leagues. *Southern Economic Journal*, pages 191–219.

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