Income Taxes and Team Performance: Do they matter?

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Abstract

State income tax rates differ across locations, giving low-tax teams a competitive advantage when bidding for players. I investigate the effect of income tax rates on professional team performance between 1977 and 2014 using data from professional baseball, basketball, football, and hockey in the United States. Regressing income tax rates on winning percentage, I find little evidence of income tax effects prior to 1994, but since then a ten percent increase in income taxes is associated with a three percent decline in winning percentage. A robustness check using within state variation in income taxes affirms this result. The income tax rate effect varies by league, with the largest effect in professional basketball, where teams in states without income tax win 4.5 more games each year relative to high-tax states. The income tax effect is smallest in major league baseball, which could be explained by greater team payroll disparity. Placebo tests using college team performance find no evidence of an income tax effect.

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Introduction

Is the playing field in professional sports level? That is certainly the goal behind many rules governing these sports. For instance salary cap restrictions are justified by disallowing teams from unfairly buying better players than their competitors. Player draft rules advantage worse teams to promote parity. There exist many dimensions on which teams could gain a competitive advantage over others, and this paper investigates one of them: state income tax rates.

Whether income taxes substantially affect team performance is a difficult question to answer. As anecdotal evidence, consider the performance of NBA teams in high income tax versus low income tax states. Between 1993 and 2015, the thirteen teams located in the highest tax states played in twelve NBA finals and won six championships (with five championships just by the Lakers). Over the same time period, the seven teams located in states without an income tax played in eighteen NBA finals and won eleven championships, with five of the seven teams winning at least one championship.[1] This means that low tax teams were roughly three times more likely to either play in a finals or win a championship as high tax teams.

How much do income tax rates impact professional team performance? This paper analyzes that question by looking at team winning percentages and income tax rates of the four major US sports leagues, the National Basketball Association (NBA), National Football League (NFL), National Hockey League (NHL), and Major League Baseball (MLB), over the past forty years.

To determine whether income tax rates affect team performance, I collect regular season win-loss records for the NBA, NFL, NHL, and MLB from 1977-2014 and add data on state top marginal income tax rates. Income tax rates are regressed on team winning percentage to estimate their effect. Different specifications allow for separate effects by league, by year, and by league-year to examine the role of income taxes over time and across leagues. Control variables are included for team characteristics which may influence team performance, such as franchise age, local population, average local income, and local amenity values. Robustness checks include regressing changes in winning percentage on changes in income taxes, checking for outliers, and using constant 1993 state income tax rates.

The most straightforward reason why income tax rates might effect team performance is that imposing higher taxes on a mobile labor force is a negotiating disadvantage for high-tax areas, hindering their

[1] The two teams not to have won an NBA finals are the Seattle Supersonics and the Memphis Grizzlies. The Sonics did make the 1996 NBA finals and relocated to Oklahoma City in 2008. The Memphis Grizzlies relocated to Memphis in 2001 and have made the playoffs in the nine of fifteen years since moving to Memphis. They never made the playoffs while located in Vancouver from 1995 to 2001.

ability to attract quality players. Players may be responsive to state income tax rates because while state income tax rates vary between zero and fourteen percent, after paying federal taxes combined with other standard expenses such as agent and financial advisor fees, the effective rate of state taxes may be more than twice as high as the nominal rate. Professional athletes are paid very well and therefore they have large incentives to consider the tax implications of the teams they choose to play for. For one, the average professional sports career is short. The median NFL and NBA players drafted in the 1990s, and playing at least one season, had a careers lasting six and seven seasons respectively. Many athletes suffer from financial strains. In a *Sports Illustrated* article, Torre (2009) claims that 78% of NFL players go bankrupt or commit suicide within two years of retirement and sixty percent of NBA players go bankrupt within five years.

Nearly all professional athletes currently pay the top marginal federal income tax rate of 39.6%, which applies to annual incomes above $466,950. For instance, the 2013 average salaries in the MLB, NBA, NFL, and NHL were $3.4, $4.8, $2.3, and $2.4 million respectively.[2] State jurisdictions set their own tax brackets, but no top bracket is currently higher than the average veteran salary in any professional sport. We should expect the effect of the top tax rates to have grown over time. Player salaries have significantly outpaced inflation over the past thirty years. The average NBA salary in 1987, inflation adjusted to 2016, was around a million dollars whereas the currently NBA average salary is $4.7 million. Player salaries grew particularly fast following a slew of collective bargaining disputes in the mid-1990s, including the 1994 strike-shortened MLB and NHL seasons, and the first-ever NBA player lockout in 1995. These combined with the 1993 NFL collective bargaining agreement all significantly increased the role of player free agency and allowed for larger player contracts.

Though higher income taxes almost certainly disadvantage a team, the magnitude of the effect is unclear. Players begin their careers with little choice over team location due to player drafts. It then takes several years before players earn the ability to freely change teams or renegotiate contracts. Though rules vary by league, the drafting team could be given bargaining powers, such as the ability to match outside offers to retain players. For MLB free agents, there are no salary cap restrictions, so teams in high-tax states can directly compensate their players for their expected income tax burden. Indeed Alm et al. (2011) analyze tax compensation in baseball and find evidence that much of the tax burden is offset by higher salary. However, teams in the NBA, NFL, and NHL operate under a salary cap. So if players are compensated for differential income taxes, teams in high-tax states have lower budgets to attract players. Teams in high tax states could mitigate high-tax effects by spending more on non-pecuniary benefits which are not subject to salary cap restrictions, such as nicer facilities and

[2]While the median player may make significantly less than the mean, note that tax rates should only affect free-agent choices, who are typically better-paid veterans, and that the minimum salary in any of the leagues is above this tax bracket threshold.

amenities for players, or investing more in player development and analysis through coaching, scouting, and front office spending. Additionally, since early career players are not able to respond to income tax rates, I check if teams in high-tax states structure their team around restricted-contract players more by testing if early-career players play more minutes for high-tax teams.

Ideally this paper would consider the full expected tax burden of each location when analyzing the effects of taxes on team performance. I focus only on the state top marginal income tax rates for ease and feasibility of data collection. Top income tax rates are readily available and observable over time and location. Income tax rates are also highly salient for professional athletes when choosing locations. Property tax or sales tax rates often include several overlapping tax districts and would require knowing more about player consumption habits. Many states have progressive tax systems, but since average player salary is well above the highest tax rate bracket for most states, this analysis only focuses on the top marginal income tax rate.

The analysis controls for additional observable team and location characteristics which could impact team performance. Local population and income may affect team performance by increasing demand and boosting team revenues and payrolls. Similar to income taxes, areas differ by their local amenity values such as better weather, entertainment, and nightlife which players value. I control for this using local amenity quality as estimated by Albouy (2015). Lastly, team age can impact team performance, as expansion teams typically take several years to assemble a winning team.

The main analysis finds that state income tax rates significantly impact team performance. Since the mid-1990s, a ten percentage point increase in income tax rates is associated with between a 1.2-3.0 percentage point decrease in winning percentage. Prior to the mid-1990s, the effect was not statistically significant. Estimating the income tax effect separately by league, the effect is greatest in the NBA and smallest in the MLB. Estimating the effect separately by league and year, the magnitude of the income tax effect has grown steadily over the past twenty years in the NBA while remaining relatively constant in the NFL and NHL. A placebo test using college sports, where players should not respond to income tax rates, instead of professional sports finds no evidence of an income tax on college team performance.

The income tax effect size is non-trivial. In the NBA, if a team moved from Minnesota (a high tax state) to Florida (a low tax state) they could expect to win an additional 4.5 games per year (out of 82). Using the Wins Above Replacement Player statistic developed by Kevin Pelton, this is of a similar value as adding a 2015 version of Marc Gasol or Draymond Green, both are all-star caliber players, in place of a mediocre bench player.[3] Conversely, I find only small effects of income taxes in the MLB,

[3]Details about the WARP statistic can be found at `http://www.sonicscentral.com/warp.html`.

where a similar location change would result in winning 1.6 fewer games per year (out if 162). Regressions of player salary controlling for player quality reveal teams in high-tax states pay more for players in both the NBA and MLB. I provide evidence that these differential effects by league are a direct response to variation in average player salaries, payroll variation, and free-agency rules. Further, I document that teams from higher income tax areas compensate for their disadvantage by not competing as much for free-agents but instead focusing on early-career players on restricted contracts. As a potential by-product of this income tax effect, the NBA has the most disparity in within- and across-season team quality among major sports leagues.

Further analysis strengthens the direct link between higher income taxes causing worse team performance. I show that the income tax effect grew much stronger in the 1990s alongside increased free-agent mobility, allowing players to respond and get compensated for increased income taxes. I then show that the cross-league income tax effect variation mirrors the differences in team spending between the NBA and MLB, so when teams have less ability to compete on payroll size, inherent location differences can still cause competitive disadvantages. I also show evidence of NBA teams responding income tax rates in roster construction. Teams in high tax states are less likely to rely on free-agent signings but instead rely more on early-career players on restricted contracts which do not compensate them for the increased tax burden.

Data

To determine the effects of state tax rates on winning, I collect historical data on state top marginal tax rates and compare it to team performance data while controlling for other local economic and demographic variables. I restrict my analysis to teams playing in the United States both because of data limitations in tracking Canadian tax history data and other factors which might differ across countries such as the exchange rate.[4]

Top state marginal tax rate data from 1977-2014 are taken from the NBER taxsim program.[5] Figure 1 shows the average top tax rate across states which have a professional sports team. Top marginal income tax rates do not vary much within a state over time. Only ten percent of the variation in annual top tax rates is within states as opposed to between states. Between 1977-2014, the average top

[4] One should expect inclusion of Canadian data to strengthen the findings that income taxes influence team performance. Canadian effective income tax rates are higher than most all US locations. The seven NHL Canadian hockey teams have not won a Stanley Cup since 1993. No Canadian NBA team has ever reached the NBA finals. The Canadian MLB team, the Toronto Blue Jays, did not make the playoffs for twenty-one consecutive years following their 1993 World Series win.

[5] Available at `http://users.nber.org/~taxsim/state-rates/`.

marginal tax rate is 5.5%. Several states have never had state income tax, including Florida, Tennessee, Washington, and Texas. Currently, the highest marginal state income tax rate is in California at 13.3%, followed Oregon at 9.9% and Minnesota at 9.85% . Since 1977 is the earliest year that income tax rates are reported, tax rates for prior periods are assumed unchanged from 1977.

The income taxation of athletes is a complicated matter. Green (1998) and Fratto (2007) provide a summary of the important income taxation issues at hand for professional athelets. Tax issues could arise from the supplemental income athletes often earn from sponsorship deals or appearance fees, from spending several months of an offseason living in state different than where they are employed, and from playing away games in more than twenty states. In recent years, professional athletes have increasingly been assessed a "jock tax", or an income tax targeting short-term entertainers, from playing games in the states of their opponent. This politically popular tax can be high, with its legal and fairness issues layed out in Ekmekjian (1994) and DiMascio (2006). DiMascio (2006) points out that as a result of a jock tax, the Seattle Seahawks players were required to pay an estimated $300,000 in income taxes to Michigan as a result of the 2006 Super Bowl being played at Ford Field in Detroit. To show how arduous tracking jock taxes could be, in 1992 the state of Illinois, angered over other states claiming income taxes from their players, proposed a bill informally known as "Michael Jordan's Revenge" which levied an income tax on visiting athletes, but only if their state collected income taxes from Illinois athletes. As the expected tax burden of these would vary little across teams, since they play a similar set of opponents, I do not consider this factor in the analysis, however a detailed review of the issue can be found in DiMascio (2006). Tracking the residency and effective tax rates these athletes face would be a nearly impossible task without access to confidential tax records. Instead this paper simply views the top marginal tax rate as a proxy for the effective income tax rate paid by athletes, with the assumption that athletes playing for teams in higher income tax rate states expect to pay more in taxes than athletes playing in lower income tax states.

Team performance is assessed using regular season data on wins and losses (or points in hockey). Historical team records for the MLB, NFL, NBA, and NHL are collected from Sports-Reference at `http://www.sports-reference.com/`. Team records are available for the MLB from 1901-2014, the NBA from 1949-2014, the NFL from 1971-2014, and the NHL from 1917-2014. Regression analysis is restricted to when tax rate data is available, from 1977-2014. I through out strike-shortened seasons, including 1994, 2004, and 2012 for the NHL and 1998 for the NBA. Franchise data from Sports-Reference is recorded to compute franchise age each year. For all leagues but the NHL, regular season team win-loss records are used to create winning percentages. For the NHL, which uses a points system instead of wins and losses, winning percentage is derived by taking a team's season points and dividing them by the average points for the year. To standardize winning percentage across

leagues, I adjust winning percentages to be mean 50 and have a standard deviation of 15.55 (the winning percentage standard deviation from the NBA). This adjustment ensures that tax effect size is weighed equally and comparably across leagues.

To account for other potential factors in winning, regressions include control variables for metro area population, average income, quality-of-life, and franchise age. Table 1 displays summary statistics of these variables. Annual average income data comes from the Bureau of Economic Analysis, and metropolitan-area population estimates come from the US Census Bureau. Income and population may affect winning by increasing demand for tickets and in turn increase the marginal profit of a win. These variables are standardized by year given that winning is a zero-sum outcome variable. Although note that these averages appear slightly off since I drop Canadian teams.

Similar to income taxes, local amenities could matter for team performance. In standard labor market models such as Rosen (1979) and Roback (1982), workers consider wages, house prices, and amenity values when selecting where to reside, with wages compensated for variation in amenities across locations. However, when teams are competing with a fixed salary cap, high amenity values could serve as a bargaining advantage for some places (or disadvantage in areas with low amenity values). So a player valuing warm weather or a more active nightlife may sacrifice salary to play in a place like Miami, FL relative to Buffalo, NY. Amenity values are difficult to directly measure and quantify. Albouy (2015) estimates local amenity values using data on local wages, population, and home values. That is, given local wages and population he predicts home values. The difference between observed and expected home values is then taken to be a measure of local amenities.

Lastly, I consider team age. As leagues have grown, new expansion teams often perform poorly in their first few years of existence. This can be because these teams begin centered around young players they draft and which take several years to develop. Figure 2 displays a smoothed polynomial of the average winning percentage of franchises by team age, among franchises originating after 1970.[6] Note that team age is determined by first year of existence, and so does not reset if a team relocates. This figure displays a sharp learning curve during the first five years after expansion, that levels off over the next ten years. I include dummy variables in the regression to reflect this trend.

[6]Prior to 1970, expansion teams may have included the founding teams of the league. Founding teams would not have been at a relative disadvantage to other teams, which is what this variable is attempting to capture.

Summary of theoretical model

There is good reason to believe that state income tax rates might effect team performance. As discussed in Wallace (1993), the incidence of differential state income taxes can be investigated using a general Harberger model allowing the tax to affect the various factors of production in McClure (1970). A main implication of the model is that the share of income tax burden borne by the labor market (in this case, the athletes) depends on the elasticity of labor mobility relative to the elasticity of capital.

The professional sports market differs from traditional goods markets in a few important ways. One difference is that new workers (rookies) typically have little input on who they play for and little negotiating power of their contract, playing under a "restricted" contract dictated by a collective bargaining agreements. As an example, in 2013 Russell Wilson was selected to the Pro Bowl for being one of the top quarterbacks in the league and led the Seattle Seahawks to win the Super Bowl. Because he was playing under his rookie contract, Russell only earned $500,000, while the average pay among the ninety-three NFL quarterbacks that year was $10 million.[7] As a result, in professional sports the traditional assumptions regarding the relative mobility elasticities of capital and labor are reversed. The labor force, the players, are highly mobile while the capital, the teams, are highly immobile. Once players become free agents, their location attachment is often small relative to the potential to gain millions of dollars by changing locations. Conversely, the teams can not easily switch locations in response to high income taxes and rarely do so. Another difference is that the good is primarily sold on a local market through ticket sales or local television contracts instead of at a national level. This implies that team investment will depend on the local ticket prices, and in turn we expect more investment (i.e. higher team salaries) in areas with greater population and with higher incomes. Lastly, the competition between teams is to produce a zero-sum good: wins. Professional sports leagues strictly regulate both the number games played and number of players on each team. Instead, teams can increase the quality of their labor force to win more often and in turn increase demand for tickets. Since the number of wins league-wide is fixed (every game must end in a win or a loss), we will only consider the relative value of input variables.

The relatively elastic mobility of athletes predicts the state income tax burden will be borne primarily by the teams instead of the players. This provides some implications for empirical research. One implication is that conditional on quality, players in high-income tax states should receive higher pre-tax income. Indeed, a recent study by Alm et al. (2011) regresses MLB player performance and state taxes on free agent contract value to find a nearly dollar-for-dollar compensation for variation in

[7] NFL Salary data according to `http://www.spotrac.com/`.

income tax rates. Given this, a team in a high-tax state can respond in two possible ways: either pay a higher team salary for a given level of wins or trade-off paying less in salary for winning fewer games. The ability to choose first response, to raise team salary, is restricted depending on the league. For example, in the MLB, teams have no limit on team salary, although the highest spending teams must pay a "luxury tax" on a portion of their payroll. In contrast, in order to promote a competitive balance, the NFL and NHL impose spending restrictions through a "hard cap" on an upper bound to team payroll, while the NBA has a "soft cap" with a luxury tax, allowing teams to potentially spend above a capped amount, but penalizing them for doing so. Lastly, we expect teams in high tax states to focus more on utilizing players on restricted contracts relative to free agents, all else equal. Though rules vary by league, the negotiating power of early-career players is severely limited and are typically seen as being very team-friendly. Importantly, these early career contracts are not adjusted for state income taxes. Since teams in high-tax locations must compensate free agents for their income tax burden, but do not compensate early-career players for taxes, the relative value of players on restricted contracts is greater in high-tax locations.

Empirical Model

To estimate the effect of income tax rates on team performance, I estimate the following regression equation.

$$Y_{it} = \beta_0 + \beta_1 \tau_{it} + \beta_2 X_{it} + \varepsilon_{it} \tag{1}$$

The winning percentage, Y_{it} for team i in year t is modeled as a function of the state top marginal income tax rates, τ_{it}, and other team and location characteristics, X_{it}, including population, average income, quality-of-life estimate, and franchise age. In some specifications, β_1 is modified to allow for separate effects by league, β_1^L, by year β_1^t, or league-by-year effects, β_1^{Lt}.

Identification of the income tax effect, β_1, comes from the variation in income tax rates τ_{it} over time and across locations and the corresponding variation in winning percentage, Y_{it}. Since only ten percent of the variation in income tax rates comes from within-states over time as opposed to between states, β_1 is primarily identified by cross-state income tax variation. This estimation strategy assumes that income tax rates are set exogenously relative to sports teams interests. Bias in estimated coefficients could arise if income tax rates are set in direct response to influence professional team performance or if income tax rates are correlated with factors influencing team performance not controlled for in the

regression. Given the relatively minor role of professional sports on local budgets, it seems unlikely that tax rates are altered to help local teams.

Perhaps the biggest unobserved team characteristic that could affect team performance is local demand for sports. If people in places with no or low income taxes, such as Florida and Texas, were also to have a differential preference for sports than people in high income states, such as California and New York, our income tax estimates may be bias.

Our analysis takes two steps to investigate the potential confounding influence of such unobserved factors. First, we run a robustness check on our results using a differenced version of Equation (1):

$$Y_{it} - Y_{it-1} = \beta_0 + \beta_1(\tau_{it} - \tau_{it-1}) + \beta_2(X_{it} - X_{it-1}) + (\varepsilon_{it} - \varepsilon_{it-1}) \tag{2}$$

This regression identifies β_1 only using changes in income tax rates within the same state from one year to the next. The downside to this approach is that tax rates do not change very often within the same state, leaving limited variation to identify the income tax effect. As a result, there will not enough power to check similarly for league or league-by-year income tax effect. Secondly, we run a placebo test to check whether state income tax rates influence college team performance. Since college athletes are unpaid, we should expect income tax rates to either a very small or no influence on team performance, but if areas with low income taxes also have a high demand for sports, we would expect to find a negative relationship between income taxes and winning.[8]

Results

This section investigates the effect of top income tax rates on team performance. I begin by considering all leagues and time periods. The tax effect is then separately estimated by league and by league-year to test for differential effects leagues over time.

Table 2 displays regression results from estimating Equation (1). The table is split by estimation time period, with columns (1) through (3) displaying results from the full sample period 1977 through 2014, and columns (4) through (6) include only the modern period of 1994 through 2014.[9] Columns

[8] Income taxes could still affect college coaches and administrators, but this effect is likely to be small.

[9] I choose 1994 as the starting point of the modern period since each sport had significant labor strikes near this time. Both the MLB and NHL striked in 1994, and the NBA players were locked out for part of the 1995 season. These labor disputes resulted in changes to collective bargaining agreements and, importantly,allowed for easier player movement and increases to in player salaries. Similarly, the 1993 NFL collective bargaining agreement was the first to include unlimited free agency by players and resulted in a 38 percent increase to player salaries the following season Quinn (2012).

(1) and (4) run a bivariate regression of income tax rate on team winning percentage, while columns (2), (3), (5), and (6) add control variables. All specifications use robust standard errors. Team age is revealed to be an important control variable because on average, teams in their first four years of existence win eleven percent fewer games in the full time period, and seven percent fewer games in the modern period. Neither population nor income are statistically significant predictors of winning, but local amenities are positively associated with winning. More populated areas and areas with greater amenities are more likely to have winning teams.

Focusing on the modern period, the income tax effect ranges from from -0.121 to -0.310 and is statistically significant once team age is controlled for. The strongest income tax effect predicts that a team moving from a state with no income taxes to one with a ten percent income tax decreases their adjusted winning percentage by almost three percentage points, or a fifth of a standard deviation. Translating this effect to the unadjusted winning percentage implies an MLB team would lose 2.1 more games, an NBA team would lose 2.4 more games, an NFL team would lose 0.57 more games, and an NHL team would lose 3.0 more games each season.[10]

While this study focuses on state income tax rates, several cities with professional sports teams also impose income taxes on residents and workers. As a researcher, it is difficult to know what the effective rate professional athletes pay at the city level, as it depends on whether they decide to live in the city or if how much of their work is done in the city proper. The size of these rate are small relative to state income taxes, ranging between one and four percent. Tables in the appendix details these cities and rates as of 2008 and replicate Table 2 using combined state and local income tax rates. Including local tax rates does not substantively change any of the main results, though including local taxes lowers the magnitude of the income tax effect size.

Figure 3 displays the annual income tax effects when estimating Equation (1) with β_1^t, both with and without control variables. The figure highlights the importance of controlling for location characteristics when estimating the income tax effect. Beginning in the late 1980s, when the income tax effect is near zero both with and without controls, the income tax effect becomes steadily stronger through the 1990s and has consistently remained below -0.2 since 2000.

Table 3 displays results from estimating Equation (1), allowing for separate income tax effects by league, β_1^L. As with Table 2, controlling for location characteristics and team age boosts the income tax effect across all leagues. Three trends stand out Table 3. First is that the magnitude of the income tax effect is greatest in the NBA. The largest NBA income tax effect of Table 3 in column (6) predicts

[10]The change in wins by league is based on a 162 game MLB season, 82 game NBA season, 16 game NFL season, and an 82 game NHL season.

that a income tax rate change of ten percentage points would result in losing an additional 4.5 games each season. Second is that the income tax effect is the smallest in the MLB. At most, these results predict a similar ten percentage point change in income tax rate would result in a team losing only 0.77 more games each season. And lastly, the income tax effect becomes substantially more negative in the modern period, columns (4) through (6), for all four major sports leagues. This is a large effect, trumping the effects of income, population, or local amenities.

Figure 4 displays estimation results from Equation (1) allowing league-by-year income tax effects, β_1^{Lt}. These results reinforce the findings in Table 3 but show interesting time trends by league. For instance, both the NFL and NHL display distinctly different patterns before and after 1994, with both leagues having negative income tax effects in the modern period, especially in the NFL, as opposed to often displaying a positive association between income taxes and winning in the pre-1994 period. While the MLB has hovered near a zero effect throughout the sample period, the NBA has shown a constantly growing negative impact of income taxes on winning. In no year since 1994 has the NBA had even a slightly positive association between income taxes and winning.

Mechanisms and Implications

In this section I evaluate several potential mechanisms driving the income tax effect on team performance and explore the implications of my findings. The main takeaways from my analysis are that higher income taxes have a modest and statistically significantly negative effect on team performance, that this effect varies by league with the MLB having much smaller effect than the NHL, NFL, or NBA, and that this effect has been growing over time. To provide further evidence of the direct link between income taxes and these three takeaways, I first test for evidence teams directly compensate players for taxes and examine the feasibility of the effect magnitude relative to player salaries. Then, using salary data from the NBA and MLB, reveal why the difference across leagues is so large. And lastly, to support the increasing trend, I show evidence that there was a substantial shift in the mid-1990s which allowed players to move more freely between teams and in turn make teams compensate them for increased income taxes and additionally show evidence in the NBA and MLB that teams have differentially responded to the increasing relative value of restricted players to unrestricted players over time.

A key assumption of the theoretical model that income taxes impact team performance is that teams must directly compensate players for the expected income tax burden. Previous research by Alm et al. (2011) regressed player salary on tax rates and player characteristics and performance, revealing

evidence of teams compensating players for taxes. I repeat this exercise, but build on it in several important ways. First I expand my analysis to consider both MLB and NBA data, with MLB salary data provided by Seah Lahman and NBA salary data coming from Patricia Bender.[11] I expand the time range in Alm et al. (2011) from 2001-2011 to include all years between 1994-2014. Lastly, instead of controlling for each observable statistic, such as home runs or points per game, I use a statistic known as "Wins Above Replacement" (WAR) which calculates the additional value a player adds to the team in terms of wins relative to a replacement level player. Since teams should only consider home runs or points in how they relate to increased wins, it is the natural measure to use.

Table 4 reports the results of regressing salary (in thousands of dollars) on WAR, income taxes, and local characteristics among veteran players. Columns (1) through (3) report results from the NBA and Columns (4) through (6) the MLB. Previous year WAR is a strong predictor of salary, explaining thirty-seven percent of salary alone. Columns (2) and (5) use current year WAR instead if salary is meant to reflect expected future production more than past production. Including controls for tax rate, income, population, and amenities, Table 4 suggest that an additional win in the NBA cost $1.4 million and $0.75 million in the MLB. All salary regressions indicate that teams in higher-tax states pay higher salaries, conditional on player quality. Once other local control variables are included, Table 4 indicates that in response to an increase of state taxes by one percent, NBA teams and MLB teams pay $23,090 and $8,650 for each additional win a player bring them respectively. This is equivalent to paying $1.6 and $1.1 dollars per expected dollar of tax burden. While higher than dollar-for-dollar compensation, which is unlikely, we coefficients would not reject the dollar-for-dollar hypothesis given relatively high standard errors.

In evaluating the validity of the income tax effect size, consider the NBA, where a ten percent income tax increase could translate into losing an additional 4.5 games. To frame the size of this effect between 2010-2015, players adding 4.5 wins to their teams, not on restricted rookie contracts, averaged making $13 million each year.[12] The average 2015 NBA payroll is $70 million, meaning a ten percent tax rate could give a team a $7 million spending disadvantage. The average NBA player salary not under a rookie contract in 2015 was $7 million. The income tax effect size is thus in the reasonable range values and indicates that the majority of the income tax burden is borne by teams choosing to win less as opposed to spending more on payroll to offset the income tax.[13]

[11] NBA and MLB salary data can be found at `https://www.eskimo.com/~pbender/`, `http://www.seanlahman.com/baseball-archive/statistics/`. NFL and NHL player salaries are not consider both due to inability of finding historical player salary data and these sports lack good player value metrics.

[12] For reference 2015 NBA players that contributed between 4.3-4.6 wins above replacement are Marc Gasol, Draymond Green, Rudy Gobert, and DeAndre Jordan.

[13] Technically, the Wins Above Replacement metric is designed to be based relative to a replacement-level as opposed to league average player, with replacement level being designated as a player at the 17th percentile in player quality. However,

A striking result of the analysis is that the income tax effect in the NBA is at least five times as large as in the MLB. This magnitude difference is plausible if NBA teams are more constrained through salary cap restrictions in their ability to directly compensate players for their increased income tax burden. While directly measuring the relative binding costs that the NBA and MLB salary cap limits and luxury tax penalties impose on teams, Figure 5 displays the distribution of team spendings by league over time. In addition to NBA and MLB player salary data mentioned previously, NHL data comes from USA today, and NFL data comes from Spotrac.[14] Here we see clear evidence that MLB teams have roughly quadruple the variation in team spending that NBA, NFL, or NHL teams have. This disparity in payroll variation clearly justifies our differential income tax finding between the NBA and MLB. With no salary cap, MLB team spending variation swamps out variation in income tax rates and results in only a small income tax effect. For example, the MLB team the Dodgers spent 450 percent more on payroll in 2015 than the Marlins, more than mitigating the 14 percent income tax advantage Florida has relative to California. Further, comparing the NBA and MLB history in Figure 5 to the league-by-year income tax effects in Figure 4 we find the difference in payroll variation only began in the mid-1990s, around the same time that the the two leagues began to differ in the income tax effect size.

The increasing income tax effect over time may also be a direct result of the increasing salaries of professional athletes, shown in Figure 6. For instance, between 1986 and 2015, the average inflation-adjusted veteran NBA player salary increased by 12% annually from $1.02 million to $6.27 million. The higher a players income, the larger their incentive to respond to top marginal income tax rates. Accordingly, the ranking of average player salary between the NBA, NFL, and NHL mirrors the income tax effect size by league as yet more evidence justifying the analysis.

A justification for splitting the sample in the mid-1990s was the increased ability of players to respond to income tax rates through free-agency. This is an important point for the mechanism of higher income taxes to be the direct cause of poorer team performance. The income tax burden will be borne more by the team as the elasticity of mobility for players increases relative to teams. Older collective bargaining agreements restricted much of the free movement of players between teams, and reduced their negotiating power to be compensated for higher income taxes. Evidence of this mechanism is

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the metric is, understandably, flawed as a team replacing say Marc Gasol with a replacement-level player would not give all his minutes to the player but instead would mostly go to the backup player already on the team. This is why I view a league average player to be a better proxy for what a team loses in the absence of Marc Gasol. A replacement-level player in the NBA made $2.8 million on average in 2015. Further details of the Wins Above Replacement metric can be found at `http://sonicscentral.com/warp.html`. Similar value metrics to the WAR have not yet been well developed for the NFL or NHL.

[14] These data can be found at `https://www.usatoday.com/sports/nhl/salaries/`, and `http://www.spotrac.com/nfl/` respectively.

provided in Figure 7. Using annual player roster data, this graph displays the percent of players switching teams each season. Though this data do not distinguish movements as a result of free-agency relative to trades or firings, it does reveal a steady increase in the movement of players between teams throughout the 1990s and levelling off since.

While higher income taxes may put teams as a competitive disadvantage in bidding for free agents, a mitigating response could be to construct teams more around early career players who typically have little negotiating power in their contracts. In all four major sports league, new players are drafted onto their initial team with little say, and are not able to gain much negotiating power until they become free agents typically after four years or more of experience. I check for this mitigating response using NBA historical salary, player value, and playing time data. Figure 8 displays player salary and value as a function of experience by decade, with value reported as the Wins Above Replacement Player measure. Looking at salary, there is a large increase in the 2000s and 2010s of the average relative salary of veteran players, earning more than twice as much, relative to early career players, than in the 1980s and 1990s. This greater return to experience could have been driven by increasing value of veteran players, however the righthand panel of Figure 8 shows this not to be the case, where on average veteran players have only become slightly more valuable than early career players. The differential trend is likely the result of more recent collective bargaining agreements which gave veteran free agents more rights, while putting more restrictions on younger players. This means that the relative value of restricted contract players has been growing in recent history. Since higher-tax NBA teams are at a competitive disadvantage of luring free-agents, but not so for restricted contract players, we would expect higher-tax teams to construct more of their roster around these players. Table 5 reports results of regressing income tax rates on the number and share of minutes played by restricted contract NBA players. As expected, since 1994 teams in high tax states have a greater share of player minutes given to restricted contract players. On average, teams with high income tax rates had a 4.93 percentage point increase in the share of minutes going to restricted players relative to free agent eligible players. This result remains true even after controlling for the number of team wins in column (4).

Lastly in this analysis, I consider the potential effects that income taxes have on the competitive balance of leagues. Competitive balance is the goal which often justifies the use of capping player salaries in the NBA, NFL, and NHL. In theory this will not allow larger or wealthier cities to simply outspend smaller cities, destroying a healthy competitive balance. However, even when teams are restricted from competing on salary, each location has variation other inherent characteristics such as income taxes and local amenities which players value and for which teams must provide compensating differentials.

I consider two measures of league competitive balance: within-year and across-year. Figure 9 displays the history of within-year variation in team winning percentages also known as league parity. This figure shows a clear widening of the gap between good teams and bad teams in the NBA over the past thirty years, while the NHL has moved in the opposite direction and the MLB and NFL display no clear pattern.

To compare cross-year competitive balance, I regress previous year end-of-season ranking on the following year ranking to reveal the level of churn among quality of teams. Higher churn, or autocorrelation, may indicate a higher degree of randomness or parity but could also indicate a greater impact of newly drafted players (as better drafting position is awarded to teams with worse records). Alternatively, higher churn could result from fundamental team dynamics which may vary by sport. For instance, baseball is more often considered an individual game played by teams while in basketball or hockey team performance relies more on player coordination, which takes time to evolve. The team-specific human capital could make dynasties easier to sustain in basketball and hockey relative to baseball. Figure 10 displays the churn level by year and league and shows the NBA to be the most dynastic league. However, over the past twenty years, the MLB has decreased its churn level, while the other three leagues have increased churn.

Robustness

To test the validity of the claims that state income tax rates directly influence professional sport team performance, I run a placebo test on college team performance. Since college athletes are not paid taxable income by their universities, state tax rates should not affect college athletes school choice or performance.[15] Considering college team performance should capture otherwise unobservable local variables that may impact team performance such as regional variation in enthusiasm for each sport and could potentially be correlated with tax rates. I gather college football records from 1980 through 2011 for 155 teams and college basketball records from 1986 through 2015 for 347 teams using `http://www.sports-reference.com/`. I match each team to its state and bring in annual top marginal income tax rates. Table 8 report results from regressing income tax rates on winning percentage. Columns (1) and (3) report the income tax effect over the full time period for college football and basketball respectively, while columns (2) and (4) restrict the sample to only 1994-present. None of these specifications yields a statistically significant coefficient, and the results from the modern period are near zero. Changing from the largest income tax state to the smallest would not even predict half a percent point increase in winning percentage.

[15] Although state income tax rates could still affect coaches and administrators.

To test the robustness and validity of the income tax effect findings, I run several robustness checks on the main result reported in Table 2. All checks are only run on the modern time period, since this is when the income tax effect is present. Columns (1) and (2) of Table 7 presents results from estimating Equation (2), regressing changes in winning percentage on changes income tax rates. As mentioned previously, state income tax rates rarely change resulting in large standard errors and no statistical significant in these regressions, however the sign and magnitude of the effect is similar to the main results.

Instead of a standard ordinary least squares regression, Columns (3) and (4) of Table 7 report estimated coefficients from a robust regression, which ignores outliers and overly influential observations. Both with and without control variables, the income tax effect increases in magnitude, suggesting that outliers are not driving the results but instead reducing the effect size.

Columns (5) and (6) of Table 7 keep constant each state's income tax rate as of 1993. One could be concerned that changes in tax rates are correlated with unobservables not already accounted for which may be related to team performance. Keeping tax rates steady from the year prior to my estimation period of 1994-2014 eliminates this issue. For instance, suppose that income tax cuts are more likely to occur in republican states and republicans support their professional teams more than democrats. This could bias our results towards a larger income tax effect. However, both specifications using constant 1993 tax rates report similar but larger income tax effect sizes.

Lastly, to check whether the income tax effect is confined to regular season success, Table 6 replicates Columns (4) through (6) in Table 2 but changes the outcome variable from winning percentage to a binary indicator for winning the championship in Columns (1) through (3) and for playing in the finals in Columns (4) through (6). Both with and without control variables, these regressions find a negative correlation between income tax rates and playoff success. Including control variables Table 6 suggests that a ten percentage point increase in income tax rate increase the probability of winning a championship by three percentage points or playing in the finals by four percentage points.

Overall these robustness checks validate the assumption that the income tax effects in professional sports are not being driven by unobserved local sports enthusiasm, permanent state characteristics, outliers, changes in tax rates, or playoff success.

Discussion

This paper investigated the effects of state income tax rates on team performance over the past forty years and found a modest overall effect with substantial variation across leagues. Considering all four major sports leagues across four decades, I find convincing evidence that until the mid-1990s income tax rates had little effect on competitive balance in sports. However, as both player salaries and player mobility have risen over the past twenty years, income taxes now factor into team performance. This effect is concentrated among the NBA, NFL, and NHL, which has more restrictions on player contracts and team spending than MLB. The effect in the NBA is especially large, where moving from a high-tax state to a low-tax state has a similar effect on winning as upgrading a bench player to an All-Star.

These results hold up under a variety of robustness checks, including using combined state and local income tax rates, regressing a differenced equation, ignoring outliers, and using 1993 state income tax rates.

The analysis provides additional evidence that these main findings are supported by plausible mechanisms relating income taxes to team performance. I show that the tax effect has grown alongside similar growth in player salaries and increased player mobility. The tax effect divergence between the NBA and MLB also occurs alongside a divergence in the variation of team payroll, so as NBA teams became more relatively more spending constrained than MLB teams, differential tax rates matter more. I document that teams in both the NBA and the MLB directly compensate players for increased tax burden by regressing player salary on player quality and income taxes. Lastly, we see evidence in the NBA that as players on restricted contracts became relatively more valuable, teams in higher tax states structured their teams around them more.

The policy implications of these findings are clear. To promote competitive balance, leagues should base any salary cap restrictions on expected post-tax dollars as opposed to pre-tax dollars. While the direct cost to competitive balance of differential income tax rates is not directly quantified here, it does not seem coincidental that the league with the largest income tax effects, the NBA, is also the league with the most in-season and cross-season team quality disparity.

From a state finance standpoint, the influence of income taxes across professional sports leagues supports the notion that raising state top marginal tax rates would not result in an exodus of high-earning individuals. The clear contrast of the large negative income tax effects in the NBA, NFL, and NHL relative to the minimal effects in the MLB, which more closely resembles standard labor market competition, shows that even for highly-paid, highly-mobile individuals, shows how it is easy

for firms to compensate workers for the additional tax burden. This would be especially true when capital is relatively immobile, such as big corporations, education or hospital systems.

While this paper has provided clear evidence of the increasing impact of income taxes in professional sports, future research could build upon this finding in a few aspects. First, a deeper investigation into the mechanisms driving the cross-league differences in income tax effects could reveal the extent to which teams are able to mitigate higher income taxes by investing in higher quality team capital, such as coaches, scouting, front-office staff, or team amenities. Another interesting extension would be considering how income taxes affect expansion or relocation choices of teams, as several recent expansion teams have located in no income tax states.[16] A similarly interesting question yet to be answered is how state income tax rates get capitalized into team value.

Overall, income tax rates has been shown here to significantly influence team performance. Though effect sizes vary by league, if player salaries continue to rapidly increase we should expect the impact of income taxes to rise with it. This may force leagues to confront the competitive disadvantage this puts teams in high income tax states.

[16]These now include the Las Vegas Raiders (2020), Houston Texans (2002), Memphis Grizzlies (2000), Tampa Bay Rays (1998), Florida Marlins (1993), and the Florida Panthers (1993).

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Table 1: Summary Statistics

	(1) All	(2) High Tax	(3) Low Tax
Winning Percentage	50.20	49.77	50.80
	(15.36)	(15.19)	(15.58)
Top Marginal Income Tax Rate	5.52	7.77	2.48
	(3.71)	(2.84)	(2.32)
Population	0.00	0.05	-0.07
	(1.00)	(1.16)	(0.71)
Income	0.06	0.25	-0.19
	(0.95)	(1.05)	(0.73)
Franchise Age	37.53	40.93	32.92
	(29.41)	(30.12)	(27.77)
Local Amenities	-0.00	0.09	-0.13
	(0.99)	(1.09)	(0.84)
Observations	3815	2196	1619

Note: Winning percentage adjusted to have the same standard deviation across leagues. Income tax rates are combined state and local. Population and Income variables standardized across years. Local amenities estimates come from Albouy (2015).

Table 2: Effect of Local Income Taxes on Winning Percentage

	(1)	(2)	(3)	(4)	(5)	(6)
Income Tax Rate	0.010	-0.086	-0.158**	-0.121	-0.205**	-0.310***
	(0.068)	(0.068)	(0.080)	(0.090)	(0.091)	(0.107)
Team Age 1-4 Years		-10.852***	-10.923***		-6.889***	-6.944***
		(1.310)	(1.319)		(1.943)	(1.943)
Team Age 5-14 Years		-2.093***	-2.088***		-3.337***	-3.496***
		(0.640)	(0.655)		(1.057)	(1.086)
Population			0.270			0.162
			(0.280)			(0.356)
Income			0.030			0.033
			(0.324)			(0.413)
Local Amenities			0.488*			0.729*
			(0.290)			(0.381)
Observations	3,815	3,815	3,814	2,228	2,228	2,228

* p<0.10, ** p<0.05, *** p<0.010

Note: Columns (4) through (7) restrict time period to 1994 to present. Winning percentage adjusted to have the same standard deviation across leagues. Income tax rates are combined state and local. Population and Income variables standardized across years. Local amenities estimates come from Albouy (2015).

Table 3: Effect of Local Income Taxes on Winning Percentage, By League

	(1)	(2)	(3)	(4)	(5)	(6)
MLB Tax Effect	0.112	-0.028	-0.106	0.068	-0.036	-0.138
	(0.089)	(0.090)	(0.102)	(0.117)	(0.118)	(0.135)
NBA Tax Effect	-0.098	-0.200**	-0.284***	-0.305**	-0.404***	-0.513***
	(0.093)	(0.092)	(0.101)	(0.127)	(0.128)	(0.139)
NFL Tax Effect	-0.033	-0.125	-0.175*	-0.199	-0.300**	-0.376***
	(0.093)	(0.094)	(0.100)	(0.127)	(0.128)	(0.138)
NHL Tax Effect	0.057	0.039	-0.038	-0.056	-0.085	-0.184
	(0.100)	(0.097)	(0.107)	(0.118)	(0.116)	(0.130)
Team Age 1-4 Years		-10.967***	-11.078***		-7.077***	-7.208***
		(1.317)	(1.325)		(1.953)	(1.954)
Team Age 5-14 Years		-2.112***	-2.164***		-3.347***	-3.641***
		(0.646)	(0.662)		(1.079)	(1.116)
Population			0.229			0.080
			(0.281)			(0.359)
Income			-0.019			-0.048
			(0.322)			(0.410)
Local Amenities			0.540*			0.763**
			(0.292)			(0.383)
Observations	3,815	3,815	3,814	2,228	2,229	2,228

* p<0.10, ** p<0.05, *** p<0.010

Note: Columns (4) through (7) restrict time period to 1994 to present. Winning percentage adjusted to have the same standard deviation across leagues. Income tax rates are combined state and local. Population and Income variables standardized across years. Local amenities estimates come from Albouy (2015).

Table 4: Player Salary and Income Tax Regression Results

	(1)	(2)	(3)	(4)	(5)	(6)
WAR	1,327.50***	1,335.97***	1,434.37***	857.92***	612.86***	746.52***
	(69.00)	(75.11)	(79.70)	(46.86)	(48.85)	(48.23)
Tax Rate * WAR	44.27***	11.38	23.05*	8.20	7.87	8.65
	(10.91)	(12.42)	(13.53)	(7.30)	(7.85)	(7.75)
Income * WAR		32.51	60.28		90.28***	89.15***
		(52.51)	(56.09)		(30.39)	(30.17)
Population * WAR		143.42***	149.38***		322.18***	312.40***
		(48.27)	(50.11)		(33.16)	(31.99)
Amenities * WAR		96.01**	34.72		-138.50***	-138.37***
		(45.84)	(49.49)		(27.68)	(28.02)
Observations	3,041	3,918	3,041	8,299	10,499	8,299

* p<0.10, ** p<0.05, *** p<0.010

Note: This table displays results of regressing NBA and MLB player salary (in thousands of dollars) on value-added measures and income tax rates for 1994-2014. All specifications include year fixed-effects. NBA player results in Columns (1) through (3), MLB in (4) through (6). Only players with four years experience included. Control variables interacted with Wins Above Replacement measure. Winning percentage adjusted to have the same standard deviation across leagues. Income tax rates are combined state and local. Population and Income variables standardized across years. Local amenities estimates come from Albouy (2015).

Table 5: Income Tax Rates and Share of NBA Minutes by Restricted Contract Players

	(1)	(2)	(3)	(4)
Income Tax Effect, Pre-1994	0.125	-0.181	-0.187	-0.283
	(0.258)	(0.386)	(0.413)	(0.409)
Income Tax Effect, Post-1994	0.368*	0.457**	0.478**	0.295
	(0.192)	(0.209)	(0.239)	(0.240)
Post-1994 Dummy		-3.358	-3.514	-3.677
		(3.155)	(3.311)	(3.272)
Population			-0.774	-0.587
			(0.879)	(0.869)
Income			-0.218	-0.890
			(0.937)	(0.938)
Local Amenities			2.180	5.117
			(17.604)	(17.406)
Team Age 1-4 Years			1.409	-2.889
			(4.488)	(4.543)
Team Age 5-14 Years			-2.838	-4.125*
			(2.466)	(2.454)
Observations	744	744	744	744

* p<0.10, ** p<0.05, *** p<0.010

Note: This table displays results of regressing income tax rates on the share of minutes played by players with four years or less experience in the NBA. Winning percentage adjusted to have the same standard deviation across leagues. Income tax rates are combined state and local. Population and Income variables standardized across years. Local amenities estimates come from Albouy (2015).

Table 6: Effect of Local Income Taxes on Probability of Championship or Finals Appearance

	(1)	(2)	(3)	(4)	(5)	(6)
Income Tax Rate	-0.001	-0.002	-0.003**	-0.002*	-0.003**	-0.004**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Team Age 1-4 Years		-0.013	-0.008		-0.021	-0.014
		(0.021)	(0.022)		(0.029)	(0.027)
Team Age 5-14 Years		-0.024*	-0.021		-0.034*	-0.029*
		(0.013)	(0.014)		(0.018)	(0.016)
Population			0.010**			0.014**
			(0.004)			(0.007)
Income			0.001			-0.001
			(0.005)			(0.007)
Local Amenities			0.005			0.002
			(0.004)			(0.005)
Observations	2,228	2,228	2,228	2,228	2,228	2,228

* p<0.10, ** p<0.05, *** p<0.010

Note: Outcome for columns (1)-(3) is winning championship and for columns (4)-(6) is playing in championshiop. Income tax rates are top marginal state tax rate. Time period restricted to 1994 to present. Population and Income variables standardized across years. Local amenities estimates come from Albouy (2015).

Table 7: Effect of Income Taxes Rates on Winning Percentage Robustness Checks

	(1)	(2)	(3)	(4)	(5)	(6)
Change in Income Tax Rate	-0.250	-0.247				
	(0.758)	(0.769)				
Income Tax Rate			-0.154	-0.334***	-0.217**	-0.381***
			(0.096)	(0.114)	(0.088)	(0.104)
Control Variables	No	Yes	No	Yes	No	Yes
Observations	2,120	2,119	2,228	2,228	2,228	2,228

* p<0.10, ** p<0.05, *** p<0.010

Note: Columns (1) and (2) use differenced variables. Columns (3) and (4) use robust regression. Columns (5) and (6) hold constant 1993 state income rates. Time period restricted to 1994 to present. Winning percentage adjusted to have the same standard deviation across leagues. Income tax rates are combined state and local. Population and Income variables standardized across years. Local amenities estimates come from Albouy (2015).

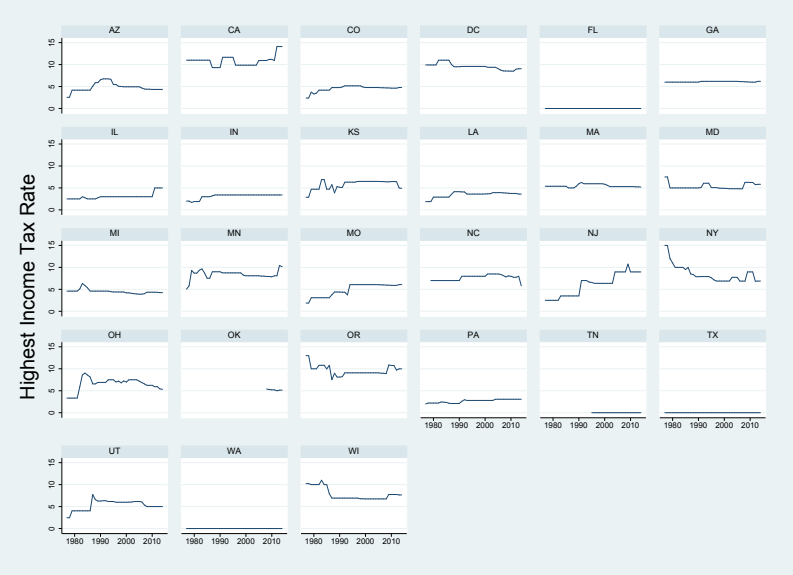
Table 8: Effect of Income Taxes Rates on College Football and Basketball Winning Percentage

	(1)	(2)	(3)	(4)
Income Tax Rate	-0.173	-0.014	0.082	-0.022
	(0.125)	(0.156)	(0.061)	(0.070)
Observations	3,070	2,055	9,178	7,005

* p<0.10, ** p<0.05, *** p<0.010

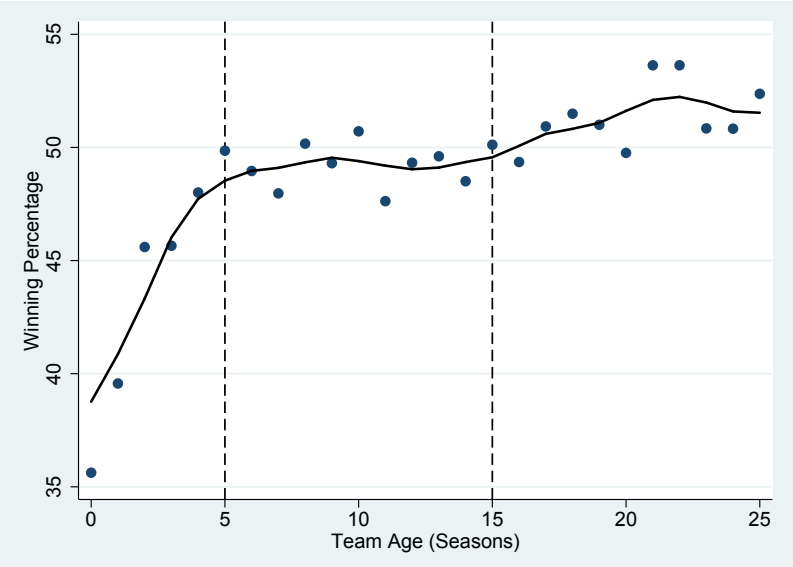
Note: This table presents results from regressing state income tax rates on team winning percentages in men's college football in Columns (1) and (2), 1980-2011, and basketball in Columns (3) and (4), 1986-2015.

Figure 1: Top Income Tax Rates by State, 1977-2014



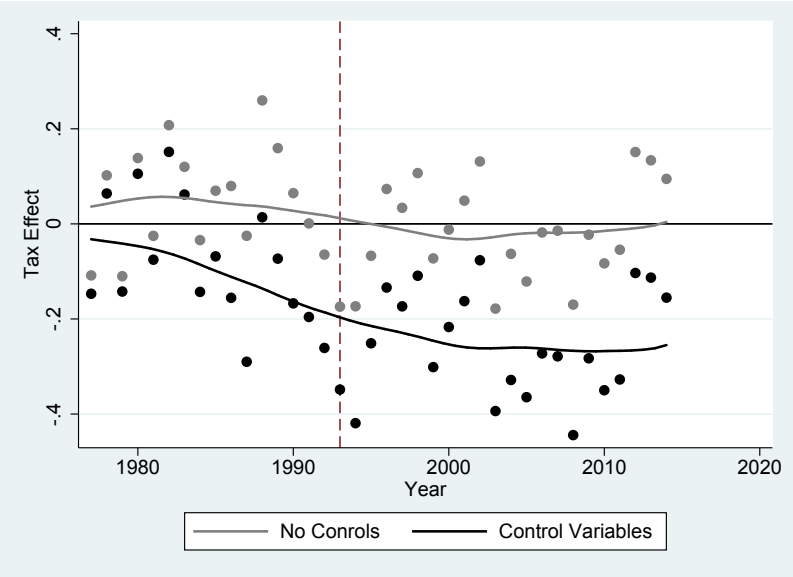
Source: NBER Taxsim.
Notes: This graph displays the top marginal income tax rate on earned income for each state and year. Restricted to years in which each state had a professional sports team.

Figure 2: Franchise Age and Team Winning Percentage, 1977-2014



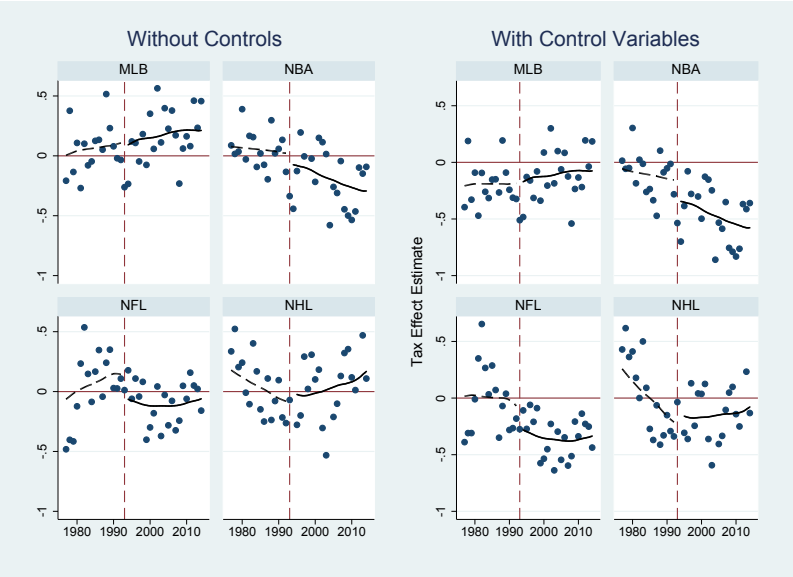
Source: Author's calculations based on data from SportsReference.com.
Note: This graph displays the average winning percentage of teams by the number of years the franchise has existed for NBA, NFL, MLB, and NHL teams 1977-2014. Teams changing locations remain the same franchise and are treated as such.

Figure 3: Income Tax Effect, by Year



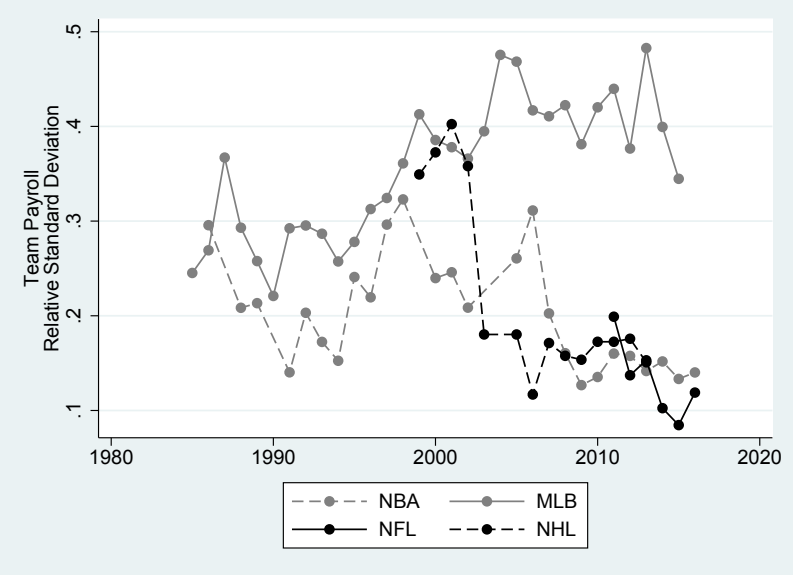
Source: Author's calculations based on data from SportsReference.com.
Note: This graph displays point estimates of regression of income tax rates on winning percentage by year for 1977-2014. Dotted line set at the year 1994. Control variables include MSA average income, population, amenities, and franchise age.

Figure 4: Income Tax Effect, by Year and League



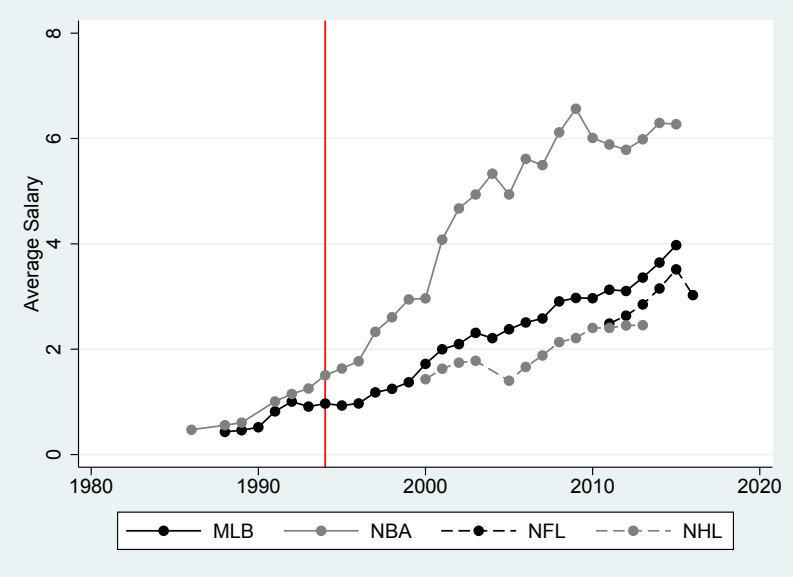
Source: Author's calculations based on data from SportsReference.com.
Note: This graph displays point estimates of regression of income tax rates on winning percentage by league and year for 1977-2014. Dotted line set at the year 1994. Control variables include MSA average income, population, amenities, and franchise age.

Figure 5: Team Payroll Relative Standard Deviation, by Year



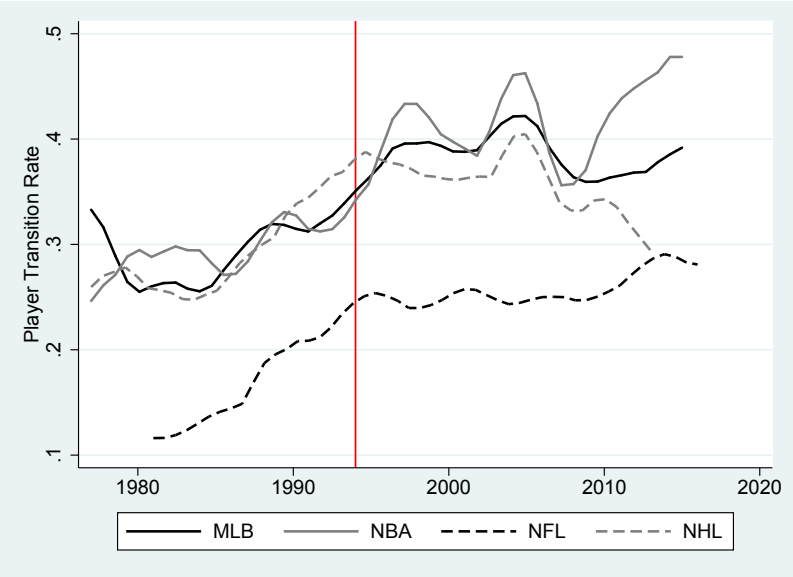
Source: Salary data from Sean Lahman (MLB), Patricia Bender (NBA), USA Today (NHL), SportTrac (NFL).
Note: Relative standard deviation is the standard deviation of team payroll divided by the average payroll.

Figure 6: Average Player Salary by League and Year



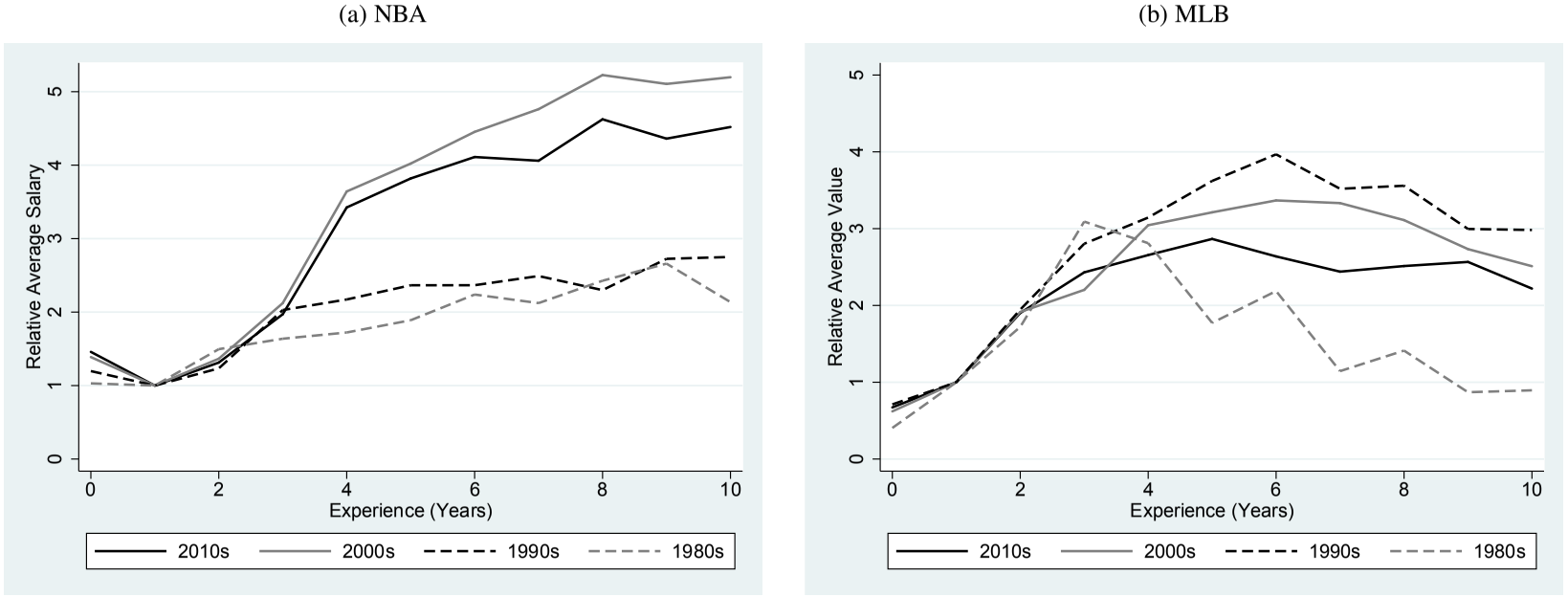
Source: Sean Lahman (MLB), Patricia Bender (NBA), USA Today (NHL), SportTrac (NFL).
Note: Average player salary among players with at least four years experience. Dotted line at 1994.

Figure 7: Player Transition Rate, by League



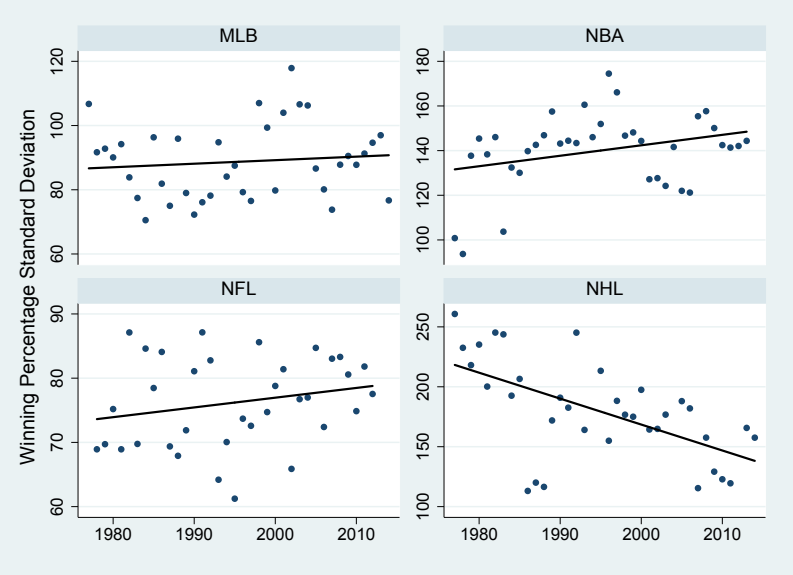
Source: Author's calculations based on data from SportsReference.com.
Note: This graph displays regression estimates of income tax rates on college football and basketball winning percentages. Dotted line at 1994.

Figure 8: NBA Player Salary and Value Profile by Decade



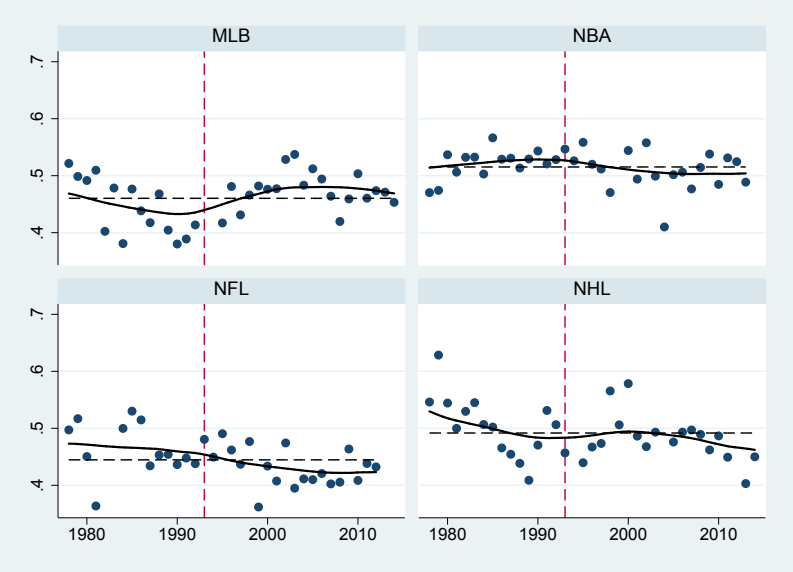
Source: Player value and experience data from SportsReference.com. Player salary data from Patricia Bender.
Note: This graph displays average player salary and value by years of experience separately by decade. Value is the Wins Above Replacement statistic, represented the marginal wins a player contributes relative to an average player. Average salary and value indexed to an experience of one year.

Figure 9: Parity by League and Year



Source: Author's calculation from SportsReference.com.
Note: This graph displays the standard deviation of winning percentages by year and league.

Figure 10: Autocorrelation of Regular Season Final Ranking, by League and Year



Source: Author's calculation from SportsReference.com.
Note: Horizontal lines reflect league average. Vertical dotted line at 1994.

1 Appendix

Table 9: City Income Tax Rates

City	Income Tax Rate
Philadelphia, PA	3.9%
Pittsburgh, PA	3%
Cleveland, OH	2%
Cincinnati, OH	2.1%
New York City, NY	3.8%
Newark, NJ	1%
Kansas City, MO	1%
St. Louis, MO	1%
Detroit, MI	2.5%
Baltimore, MD	3.05%
Indianapolis, IN	1.62%
Columbus, OH	2%

Source: Henchman and Sapia (2011).
Note: This table displays the highest marginal income tax rate for city residents in 2008 for US cities which have a professional sports team.

Table 10: Effect of State and Local Income Taxes on Winning Percentage

	(1)	(2)	(3)	(4)	(5)	(6)
Income Tax Rate	0.014	-0.086	-0.139**	-0.101	-0.190**	-0.254***
	(0.063)	(0.063)	(0.069)	(0.083)	(0.084)	(0.094)
Team Age 1-4 Years		-10.900***	-10.898***		-6.952***	-6.878***
		(1.312)	(1.318)		(1.944)	(1.943)
Team Age 5-14 Years		-2.118***	-2.075***		-3.419***	-3.444***
		(0.642)	(0.654)		(1.063)	(1.083)
Population			0.358			0.313
			(0.278)			(0.355)
Income			0.014			0.007
			(0.322)			(0.413)
Local Amenities			0.390			0.517
			(0.275)			(0.358)
Observations	3,815	3,815	3,814	2,228	2,228	2,228

* p<0.10, ** p<0.05, *** p<0.010

Note: Columns (4) through (7) restrict time period to 1994 to present. Winning percentage adjusted to have the same standard deviation across leagues. Income tax rates are combined state and local. Population and Income variables standardized across years. Local amenities estimates come from Albouy (2015).