State Income Taxes and Team Performance: Do Teams Bear the Burden?

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Abstract

I investigate the effect of income tax rates on professional team performance using data from professional baseball, basketball, football, and hockey leagues. Regressing income tax rates on winning percentage between 1995 and 2017, I find robust evidence of a negative income tax effect on team performance. Extending the analysis back to 1977, I then show that the income tax effect only arose after players gained unrestricted free agency, allowing them to shift the income tax burden on to teams. A placebo test using college team performance find no evidence of an income tax effect.

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Introduction

Do higher state income taxes harm firms? Though income taxes are levied on households, Wallace (1993) shows that state income tax incidence depends on the mobility elasticity of capital relative to labor. While plenty of research has analyzed state income taxes effect on households, little evidence exists of the state income tax burden on firms. This paper considers a unique market, professional sports, where teams are highly immobile and players are highly mobile, to test whether the state income tax burden is borne by teams.

Anecdotal evidence suggests higher state income taxes disadvantage professional sports teams. In the NBA, among the ten worst teams since 1995, eight were also among the ten highest taxes teams. And across all sports, the forty-nine franchises with long championship droughts, only four are from the nine states without an income tax while twenty are from nine highest taxed states.[1]

To test the link of state income taxes to team performance, this paper analyzes team performance in the four major US sports leagues: the National Basketball Association (NBA), National Football League (NFL), National Hockey League (NHL), and Major League Baseball (MLB). Combined federal and state top marginal income tax rates are regressed on team winning percentage to determine if there is a link between taxes and team performance. Since player mobility is a key component of shifting the income tax burden on to teams, I begin focused on the period 1995 to present since all four leagues allowed unrestricted free agency.

Higher income taxes may negatively affect team performance if teams must compensate players for the increased tax burden, however this effect could be mitigated through several avenues. For instance, if higher taxes increase local amenities which player's value, then tax rates may in fact boost team performance. Alternatively, teams could increase spending on other inputs such as coaching, scouting, or team amenities to offset lower player quality. Lastly, in other markets, teams could spend more on payroll to compensate for the increased tax burden, though they may be constrained from doing so by salary cap policies.

The initial analysis finds that state income tax rates significantly influence team performance, with each percentage point increase in marginal income tax rates being associated with between a -0.58 to -0.91 percentage point decrease in winning percentage. Estimating the tax rate effect separately by league, the magnitude of the income tax effect is largest in the NBA to being slightly positive in the MLB.

[1] Long championship drought defined as twenty-five years or greater, among United States teams only according to `https://www.businessinsider.com/longest-championship-droughts-pro-sports-2017-8`.

Addressing concerns that the association between team performance and income tax rates since 1995 may be coincidental, I then consider how the tax rate effect changed with the adoption of unrestricted free agency. Achieving unrestricted free agency has been a milestone for each league's players association, paramount both for increasing player mobility across teams and forcing teams to compete for player services without restrictions.[2] Since this team competition over players is crucial for the income tax burden to be shifted onto teams, I extend the sample period back to 1977 and interact the income tax effect with an indicator for if the league allowed unrestricted free agency. Using this time variation, I show that the association between income taxes and team performance only existed after unrestricted free agency was introduced into each league, suggesting a causal link.

Further investigating the identification concern that unobserved heterogeneity in sports enthusiasm may be correlated with income tax rates, I run a placebo test using college sports. If states without income taxes such as Texas and Florida have particularly strong tastes for sporting events, this could advantage teams in the same way that income or population differences. Since college athletes are unpaid, they should not respond to income taxes, and I find no evidence of income taxes affecting college team performance.

The estimated income tax effect size is non-trivial. Using the main analysis effect size of -0.58, this translates a standard deviation increase in tax rate to 1.0 fewer wins in the NBA, 0.90 in the MLB, 0.25 in the NFL, and 1.3 in the NHL.[3] At its extreme, a team moving from a high tax state such as California to a no tax state such as Texas could expect to win 4.0 more games each year. Using the "Wins Above Replacement Player" statistic, meant to capture player marginal productivity, this move is similar to adding $6.06 million spending. Given a 2014 average team payroll of $63.4, the analogous expected difference in player income taxes is $5.4 million suggesting that the full income tax incidence is borne by teams.

This is the first paper examine the income tax effect on professional team performance but it builds upon several papers looking at income taxes and sports. Kleven et al. (2013) finds evidence that foreign soccer players are more responsive to national tax rates than domestic players and Driessen and Sheffrin (2017) examine choices of professional racecar drivers and golfers with the conclusion that golfers have a strong mobility response to variation in state income taxes, while racecar drivers benefit from agglomeration effects in high income tax states and therefore have lower a mobility elasticity. Alm et al. (2011) and Ross and Dunn (2007) both analyze tax compensation of MLB players by comparing salaries to player metrics such as home runs and earned run average. Both find

[2]While all leagues currently allow unrestricted free agency, each league also their own rules about which players are eligible for free agency. Unrestricted free agency is typically earned after playing for several years.

[3]Note that this statistic uses the within-year tax variation standard deviation of 2.1 percent.

evidence that state income tax burden is largely offset by higher salary. Kopkin (2012) studies NBA free agent signings between 2001 to 2008 and finds that low tax teams sign higher quality free agents. A natural conclusion from these papers is that if teams must compensate players for income taxes, and greater spending leads to more wins, then higher taxes must lead to fewer wins. Alternatively stated, results from this paper provide an estimate to the marginal return to spending in professional sports.

More broadly, this paper contributes to the literature on state income tax effects. Recent work by Moretti and Wilson (2017) and Moretti and Wilson (2014) reports a high elasticity of mobility among star scientists in response to state income tax rates. Similarly, Bakija and Slemrod (2004) use federal estate tax returns to find evidence of wealthy elderly households avoiding high state income tax rates. However, other work such as Young and Varner (2011) and Conway and Rork (2012), find only small migration responses to state income tax rates among high earners and the elderly respectively. I contribute to this literature by focusing on the producer burden of state income taxation. These results may help inform other similar industries where capital mobility is much lower than labor mobility such as among hospitals and physicians, universities and star academics, or star scientists and large engineering firms.

Data

To determine the tax rate effect on winning, I collect top marginal tax rates and compare it to team performance data.[4] Combined state and federal top marginal tax rate data from 1977 to 2017 come from the NBER Taxsim program.[5] Figure 1 shows the average top tax rate across states which have a professional sports team. Between 1977 and 2017, the average combined top marginal tax rate is 44.0% with state top marginal tax rates averaging 5.5%. While top tax rates have declined over time, this is due to changes at the federal level in the 1980s. Several states have never had a state income tax, including Florida, Tennessee, Washington, and Texas. Conversely, the current highest marginal income tax rates are in California at 49.3%, followed by Minnesota at 46.9% and Oregon at 46.8%.

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/`. To avoid complications arising from including expansion teams, which often take several years before acquiring enough talent to become competitive, the

[4]This paper focuses on income taxes, as opposed to sales or property taxes which may also vary by location. Players may also respond to sales or property taxes, however their effective rates are complicated to compute.

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

primary analysis restricts the sample to teams in existence by 1977.[6] For all leagues but the NHL, regular season team win-loss records are used to create winning percentages. The NHL uses a points system instead of wins and losses so winning percentage is derived by taking a team's season points and dividing them by the NHL average points for the year. To make winning percentage comparable across leagues, I adjust winning percentages to be mean 50 and have a standard deviation of 15.66 for each league.[7]

Since player movement and negotiation is an important requirement to shifting the income tax burden onto teams, regression analysis begins by considering the 1995-2016 period when all four leagues had unrestricted free-agency. Further analysis then expands data back to 1977 to consider the tax rate effect evolution over time. For many years players could only change teams through a trade or teams were given large negotiating advantages in retaining players though the "reserve clause". A major push for unrestricted free agency, evidenced by the 1972 *Flood vs Kuhn* Supreme Court gave enough momentum to the cause that by 1976 unrestricted free agency began in the MLB. While in theory unrestricted free agency allowed teams to compete for players, teams were resistant to free agency and in 1985, 1986, and 1988 the players union filed and won grievances for collusion by teams in not signing free agents. Unrestricted free agency in other leagues during the late 19880s and 1990s through new collective bargaining agreements, with the NBA in 1988, NFL in 1994, and NHL in 1995. As a result of free agency, player mobility and in turn negotiating power and salaries rose sharply in the 1990s and beyond. Figure 3 displays average player mobility and Figure 4 displays average player salaries by league and year. The effect of free agency can be easily seen as mobility rates increased forty percent between the 1980s and 1990s, and average NBA and MLB salaries tripled from 1988 to 1998.

This paper focuses on the effect of income tax rates on winning because in a "wins" production function, team payroll may be an important factor and higher income taxes increase the price of labor. However, other location factors may influence the price of labor or the financial return to winning, such as population, household income, and local amenities. Annual average income data comes from the Bureau of Economic Analysis, and metropolitan-area population estimates come from the US Census Bureau. Control variables are standardized by league-year for interpretability because winning is a zero-sum outcome. As such, if a population increase increases a team's expected winning percentage it must simultaneously decrease the winning percentage of other teams.

Similar to income taxes, local amenities could matter for team performance in that higher amenities

[6] The year 1977 is convenient both because it is directly after the NBA-ABA merger and because it is the earliest year that state income tax data is available.

[7] A standard deviation of 15.66 is chosen to make the NBA the benckmark league.

may lower labor cost. 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. A player valuing warm weather may sacrifice salary to play in a place like Miami, FL relative to Buffalo, NY. While amenity values cannot be directed observed, Albouy (2015) estimates local amenity values using data on local wages, population, and home values. While this provides only a static measurement of amenity values, a primary component of the amenity value is local climate which is a mostly fixed characteristic.

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 **??** displays the average winning percentage of franchises by team age, among franchises originating after 1970.[8] 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.

Table 1 displays summary statistics between 1977 and 2017 among franchises in existence by 1977, separated in columns by teams above and below the median average tax rate of 44.67%. On average, teams in above median tax states have 3.4% higher marginal income tax rates and win 2.6% less games than those in below median states. Higher tax rates are more common in more populous and higher income areas with greater local amenities.

Summary of theoretical model

There is good reason to believe that state income tax rates should affect team performance. As discussed in Wallace (1993), the incidence of differential state income taxes can be investigated using a general Harberger model allowing taxes 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 labor markets in a few important ways. One difference is that new workers (rookies) typically have little control over on who they play for and

[8] 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.

have 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.[9] 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 franchises, 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 and rarely do so.[10] 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. One implication of this is that conditional on quality, players in high-income tax states should receive higher pre-tax income. 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 income tax rates. Given this, teams in high-tax states can face the choice of either increasing payroll or win fewer games. The ability to increase payroll is restricted depending on the league. For example, in the MLB, teams have no limit on team payroll, although the highest spending teams are penalized by paying a "luxury tax". In contrast, the NFL and NHL impose spending restrictions through a "hard cap" or 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, all else equal, we expect teams in high tax states to focus more on utilizing players on restricted contracts relative to free agents. 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

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

[10] Since 1990, there have been sixteen official franchise relocations meaning the relocation rate is around half a percent each year.

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 combined state and federal 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 change in winning percentage, Y_{it}. 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 is 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, the income tax estimates may be bias.

I takes several steps to investigate the confounding influence of these potentially unobserved factors. First, I modify Equation (1) to allow the income tax effect to vary depending on whether the league allows for unrestricted free-agency:

$$Y_{it} = \beta_0 + \beta_1^a \tau_{it} \mathbb{1}_{FA=0} + \beta_1^b \tau_{it} \mathbb{1}_{FA=1} + \beta_2 X_{it} + \varepsilon_{it} \tag{2}$$

where β_1^a and β_1^b represent the effect of income tax rate τ_{it} on winning percentage Y_{it} when unrestricted free-agency is not allowed and allowed respectively. Unrestricted free agency allows every team to compete on a equal footing for eligible players, a key element in salary competition for players to be compensated for higher income tax rates. As such, one would expect the income tax effect to be greater as restrictions on free agency are lessened. While many other aspects of player negotiations may similarly affect the tax rate effect, such as time to free agency, team salary caps, and average salaries, unrestricted free agency is crucial to player leverage in negotiations and has been a major milestone for each players union in collective bargaining agreements.

Second, I run a robustness check which includes a team fixed-effect of Equation (1):

$$Y_{it} = \beta_0 + \beta_1 \tau_{it} + \beta_2 X_{it} + \gamma_i + \varepsilon_{it} \tag{3}$$

where γ_i is a team fixed-effect. This regression identifies β_1 only using changes in income tax rates within the same state over time. The downside to this approach is that state tax rates do not change very often, leaving limited variation to identify the income tax effect.

Lastly, I run a placebo test to check whether state income tax rates influence college team performance. Since college athletes are unpaid income tax rates should have a small or no influence on team performance. However, if areas with low income taxes also have a high sports demand, we would expect to find a negative relationship between income taxes and college team performance.[11]

Results

This section investigates the effect of income tax rates on team performance. Since the ability to move freely between teams is crucial in being compensated for state income taxes, I begin the analysis focused on the period 1995 to 2017, when all four leagues allow for unrestricted free agency. Unless otherwise specified, the sample consists of teams in existence by 1977 to avoid complications arising from expansion team performance.

Table 2 displays regression results from estimating Equation (1), with all specifications including league-by-year fixed effects and cluster standard errors at the state level. The income tax rate is both statistically significant and sizeable in magnitude. Column (1), the main specification, shows the income tax effect is -0.576, meaning that each relative one point increase in the combined federal and state top marginal income tax rate decreases team performance by 0.576 percentage points. Columns

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

(2) and (3) add in metro-area covariates which in turn increase the tax rate effect magnitude to -0.841 and -0.913 respectively. Adding in expansion teams, along with a quadratic term in franchise age, in Column (4) similarly increases the income tax magnitude to -0.670. This range of estimates suggests that between 1995 and 2017, a standard deviation increase in a team's marginal tax rate decreases their expected winning percentage from between 1.25 and 1.98 percentage points. While winning one extra NFL game every five years may appear to be a modest effect, it is worth considering at its extreme a team moving from a high income tax state to a no income tax state, such as the recent Oakland Raiders relocation to Las Vegas, could expect to win an extra game every year.

In evaluating the plausibility of the income tax effect size, I consider the NBA where I have player salary and value data. To find the cost for a team to buy an extra win I regress the "Wins Above Replacment" statistic on player salary data. Appendix Table A.2 shows that each win costs $1.5 million. Using the main result estimate, a one percentage point increase in the marginal tax rate should reduce winning by 0.576 percentage points or 0.47 NBA games. In 2014, the average NBA payroll was $63.4 million meaning that a one percent increase in income taxes translates into $0.634 million less in spending power. Using the cost-per-win estimate, one would have guessed a priori that $0.634 million should buy 0.43 wins if the full income tax burden was borne by teams. This estimate is indeed very close to 0.47 wins estimate using income tax and team performance data.

Table 3 displays results from estimating Equation (1), allowing for separate income tax effects by league, β_1^L. The tax rate effect is largest in the NBA, and for the NBA, NFL, and NHL, the tax rate effect is always negative and statistically significant for at least half of the specifications. In only the MLB is the tax rate effect positive, though only statistically significant when not controlling for any covariates. Figure 2 displays annual income tax effects, β_1^{Lt}, and 95% confidence intervals by league between 1995 and 2017. While the large standard errors reject a negative income tax effect in any given league-year, the point estimate is remarkably consistently in the NBA, NHL, and NFL being negative in 59 of 68 league-years.

While the income tax effect league variation may be attributed to randomness, it may also hint at some underlying mechanisms driving the result. The theoretical basis for income taxes affecting team performance rests both on the ability of players to be compensated for income tax burden and the performance returns to increased spending and the magnitude of these factors likely differs by league. A primary reason to expect that income taxes would affect team performance the least in the MLB is because it is the only league not to have a salary cap and so the coefficient of variation in team payroll in the MLB over this time period is 0.39 compared to 0.29 in the NBA, 0.23 in the NHL, and 0.13 in the NFL. Nearly double the spending variation in the MLB diminishes the income tax variation and allows teams more flexibility to directly compensate players for income taxes.

Robustness Checks

Table 4 presents tax rate effect estimates using a variety of robustness checks. Since there are several definitions of marginal tax rates that could have been used, Columns (1) through (3) use alternative measures of the marginal tax rate, including using the state-only top marginal tax rate, combined state and federal statutory top marginal tax rates, and adding in city-level income tax rates respectively.[12] Each alternative measure either increases has no change in the tax rate effect size and all specifications remain statistically significant. To show exclusion of Canadian team are not driving results, Column (4) includes Canadian teams with combined provincial and federal marginal tax rates, lowering the effect size slightly.

To dampen the influence of outlier or overly influential observations, Column (5) of Table 4 reports the tax rate effect using a robust regression. This change increases the tax rate effect magnitude by sixty percent. An identification concern is that changes in tax rates may be correlated with other factors that determine team performance. For example, 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 the results towards a larger income tax effect. This concern is addressed in Column (6), where 1995 team tax rates are held constant throughout the sample period. Alternatively, Column (7) allows only within-team tax rate variation to identify the effect by including a team fixed-effect. Both modifications to the source of identification increase the tax rate effect size.

Overall, these alternative specifications provide evidence that income tax effects on team performance are robust to the choice of tax rate definition, including Canadian Teams, removing outliers. Further, the effect size remains negative and significant whether identified solely on within-team or cross-team variation over time.

Free Agency Effect

Analysis of the income tax rate effect on team performance has so far relied on data associations. While the effect has remained under a variety of model specifications, it could still be argued that results are simply correlational and that other factors associated with high income tax states have driven the relationship with lower performing professional sports teams. To provide causal evidence of the income tax effect, I consider the effect of unrestricted free agency on the link between team performance and income taxes. As argued earlier, for players to shift the income tax burden on to

[12] A list of city-level income tax rates is in Appendix Table A.1.

teams they must have the ability to negotiate with multiple teams through free agency. And while unobserved location factors may be correlated with both taxes and team performance, there is little reason to believe these factors would change over time.

Table 5 displays analogous results to Table 2 but extending the time period to 1977 and interacting the tax rate effect with an dummy variable for if the league allows unrestricted free agency. Adding credibility to our earlier findings, these results show that the association between income tax rates and winning is only a recent phenomenon and that prior to free agency higher taxes correlated with better team performance. Viewing free agency as a policy change that enabled players to be compensated for a state's income tax burden, Table 5 suggests a causal and statistically significant link between team performance on income tax rates. While the determinants of income tax rates could be correlated with other factors influencing team performance, when holding the set of teams fixed, the negative association between winning and tax rates is non-existent in the 1970s and 1980s, only growing since then as players gained negotiating power with multiple teams.

Placebo Test: College Sports

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.[13] 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. College records for 1995 through 2016 are collected for 155 football and 347 basketball from the Sports-Reference website. Each team is matched its state and the same combined federal and state top marginal income tax rates are utilized along with population, income, and quality of life measures.

Table 6 report results from regressing income tax rates on winning percentage. The specifications vary whether control variables are included, restricting the sample to the modern 1995-2016 period, and whether I only include the six "Power" conferences of the Big Ten, Big 12, Pac-12, SEC, and Big East.[14]. None of these specifications yields a statistically significant result, all small in magnitude, and only one of the four specifications is negative in direction. These results reinforce the assumption that unobserved heterogeneity in sports preference is not driving the link between state income taxes and

[13] State income tax rates could still affect paid employees such as coaches and administrators, but is likely to be a small contribution to overal team performance.

[14] The names and compositions of these leagues has changed over time

professional team performance.

Discussion

This paper investigated the income tax rate effect on team performance and find robust evidence that over the past twenty years teams in higher income tax states win less often. Evidence of a causal connection between taxes and performance is strengthened by this negative association only existing after players in each league gained unrestricted free agency giving players more negotiating power and allowing them to shift the tax burden onto teams.

The findings of this paper should be of interest to economists, policymakers, and sports league officials. For economists and policymakers, professional sports is one of the few markets where labor is more mobile than capital, providing a test to the theory of state income tax incidence. My results validate this theory and lend insights into other markets where labor is more mobile than capital, including the market for physicians, star scientists, and CEOs. Finding that the state income tax burden is fully shifted onto producers in a market with a highly mobile workforce is a novel finding which should be explored deeper in future work. Other industries such as healthcare and science may be particularly burdened by increasing state income taxes.

For sports leagues, the paper shows that differential income tax rates undermines a level playing field. This is particularly true for teams in high-tax states without compensating qualities such as large populations or warm weather, such as Sacramento, Minneapolis, Portland, Buffalo, or most Canadian teams. Possible solutions include adjusting the salary cap for income taxes or allowing for an income tax adjustment in revenue sharing agreements.

While this paper has provided clear evidence of the increasing impact of income taxes in professional sports, future research could build upon this work in a several 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.[15] A similarly interesting and plausible question is if state income tax rates are capitalized into team value.

[15]These now include the Las Vegas Raiders (2020), Las Vegas Knights (2017), Houston Texans (2002), Memphis Grizzlies (2000), Tampa Bay Rays (1998), Florida Marlins (1993), and the Florida Panthers (1993).

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.

References

Albouy, David, "What are cities worth? Land rents, local productivity, and the total value of amenities," *Review of Economics and Statistics*, 2015, (0).

Alm, James, William H Kaempfer, and Edward Batte Sennoga, "Baseball salaries and income taxes: The home field advantage of income taxes on free agent salaries," *Journal of Sports Economics*, 2011, p. 1527002511422567.

Bakija, Jon and Joel Slemrod, "Do the rich flee from high state taxes? Evidence from federal estate tax returns," Technical Report, National Bureau of Economic Research 2004.

Conway, Karen Smith and Jonathan C Rork, "No country for old men (or women) - do state tax policies drive away the elderly?," *National Tax Journal*, 2012, *65* (2), 313–356.

Driessen, Grant A and Steven M Sheffrin, "Agglomeration, Tax Differentials, and the Mobility of Professional Athletes," *Public Finance Review*, 2017, *45* (2), 283–302.

Henchman, Joseph and Jason Sapia, *Local Income Taxes: City-and County-Level Income and Wage Taxes Continue to Wane*, Tax Foundation, 2011.

Kleven, Henrik Jacobsen, Camille Landais, and Emmanuel Saez, "Taxation and international migration of superstars: Evidence from the European football market," *The American Economic Review*, 2013, *103* (5), 1892–1924.

Kopkin, Nolan, "Tax Avoidance How Income Tax Rates Affect the Labor Migration Decisions of NBA Free Agents," *Journal of Sports Economics*, 2012, *13* (6), 571–602.

McClure, C.E., "Taxation, substitution, and industrial location.," *Journal of Political Economy*, 1970, *78*, 112–132.

Moretti, Enrico and Daniel J Wilson, "State incentives for innovation, star scientists and jobs: Evidence from biotech," *Journal of Urban Economics*, 2014, *79*, 20–38.

_ **and Daniel J. Wilson**, "The Effect of State Taxes on the Geographical Location of Top Earners: Evidence from Star Scientists," *American Economic Review*, July 2017, *107* (7), 1858–1903.

Roback, Jennifer, "Wages, rents, and the quality of life," *The Journal of Political Economy*, 1982, pp. 1257–1278.

Rosen, Sherwin, "Wage-based indexes of urban quality of life," *Current issues in urban economics*, 1979, *3*.

Ross, Justin M and Robert R Dunn, "The income tax responsiveness of the rich: evidence from free agent major league baseball all-stars," *Contemporary Economic Policy*, 2007, *25* (4), 639–648.

Wallace, Sally, "The effects of state personal income tax differentials on wages," *Regional Science and Urban Economics*, 1993, *23* (5), 611–628.

Young, Cristobal and Charles Varner, "Millionaire migration and state taxation of top incomes: Evidence from a natural experiment," *National Tax Journal*, 2011, *64* (2), 255.

Table 1: Franchise Summary Statistics

	High Tax	Low Tax
Winning Percentage	49.49	52.12
	(15.10)	(15.13)
Tax Rate	46.55	43.12
	(8.59)	(8.75)
Population	0.15	0.02
	(1.23)	(0.70)
Income	0.35	-0.20
	(1.09)	(0.80)
Local Amenities	0.35	-0.34
	(1.10)	(0.75)
Franchise Age	31.78	31.50
	(13.10)	(13.42)
Observations	1,763	1,707

Note: High and low tax franchise defined in relation to the median average top marginal tax rateof 46.74 percent. Winning percentage adjusted to have the same standard deviation across leagues. Population and Income variables standardized by league-year. Tax rates are combined top marginal income state and federal tax rate. Local amenities estimates come from Albouy (2015). Sample period is 1995 to 2017.

Table 2: Income Tax Rates and Team Performance

	(1)	(2)	(3)	(4)
Tax Rate	-0.576**	-0.841**	-0.913***	-0.670**
	(0.261)	(0.344)	(0.326)	(0.319)
Population		-0.312		-0.386
		(0.679)		(0.565)
Income		-0.232		0.242
		(0.798)		(0.764)
Local Amenities		1.115*		0.736
		(0.603)		(0.555)
Age				0.360**
				(0.137)
Age $\times$ Age				-0.004
				(0.002)
League Varying Coefficients	No	No	Yes	No
Observations	1930	1930	1930	2524

* p¡0.10, ** p¡0.05, *** p¡0.010

Note: This table displays estimates of regressing tax rates on team winning percentage between 1995 and 2017. Tax rates are combined top marginal state and federal income tax rate. Sample for columns (1) through (3) exclude expansion teams since 1977, column (4) includes all teams. All specifications include league-by-year fixed effects. Column (3) includes league varying coefficients on population, income, and local amenities which are not shown. Population and income variables standardized by league-year. Local amenities estimates come from Albouy (2015).

Table 3: Income Tax Rates and Team Performance, By League

	(1)	(2)	(3)	(4)
Tax Rate*MLB	0.608*	0.310	0.275	0.363
	(0.295)	(0.368)	(0.462)	(0.316)
Tax Rate*NBA	-1.521**	-1.813**	-1.817***	-1.830***
	(0.717)	(0.783)	(0.640)	(0.558)
Tax Rate*NFL	-0.663	-0.840	-1.322**	-0.918**
	(0.419)	(0.535)	(0.541)	(0.428)
Tax Rate*NHL	-1.362**	-1.607**	-0.677	-0.112
	(0.532)	(0.609)	(0.901)	(0.535)
Covariates	No	Yes	Yes	Yes
League Varying Coefficients	No	No	Yes	No
Observations	1,930	1,930	1,930	2,524

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

Note: This table displays estimates of regressing tax rates on team winning percentage between 1995 and 2017. Tax rates are combined top marginal state and federal income tax rate. Sample for columns (1) through (3) exclude expansion teams since 1977, column (4) includes all teams. All specifications include league-by-year fixed effects. Column (3) includes league varying coefficients on population, income, and local amenities which are not shown. Population and income variables standardized by league-year. Local amenities estimates come from Albouy (2015).

Table 4: State Income Taxes Rates and Team Performance Robustness Checks

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Tax Rate	-0.525**	-0.724***	-0.987***	-0.493**	-0.903***	-0.808**	-7.774*
	(0.213)	(0.255)	(0.307)	(0.205)	(0.216)	(0.324)	(3.810)
Observations	1,930	1,930	1,928	2,051	1,930	1,930	1,930

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

Note: This table provide robustness checks the of tax rate effect on team performance. Tax rates are combined top marginal state and federal income tax rate. Columns (1) through (3) alter the tax rate to be defined as the state-only rate, the combined state, federal and local rate, and the statutory combined state and federal tax rate respectively. Column (4) inludes Canadian teams. Column (5) uses a robust regression to lessen the impact of outlier observations. Column (6) holds 1995 tax rates constant throughout the time period and Column (7) includes a team fixed-effect.

Table 5: Income Tax Rates, Team Performance, and Free Agency

	(1)	(2)	(3)	(4)
Pre-Free Agency Tax Rate	0.371	0.298	0.260	0.105
	(0.353)	(0.438)	(0.428)	(0.373)
Post-Free Agency Tax Rate	-0.522**	-0.634**	-0.695**	-0.583**
	(0.228)	(0.293)	(0.282)	(0.270)
Population		0.153		-0.015
		(0.447)		(0.458)
Income		-0.350		-0.201
		(0.522)		(0.437)
Local Amenities		0.614		0.736
		(0.520)		(0.476)
Age				0.566***
				(0.127)
Age $\times$ Age				-0.007***
				(0.002)
League Varying Coefficients	No	No	Yes	No
Observations	3,470	3,470	3,470	4,142

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

Note: This table displays estimates of regressing tax rates interacted with whether the league allowed unrestricted free agency on team winning percentage between 1977 and 2017. Tax rates are combined top marginal state and federal income tax rate. Sample for columns (1) through (3) exclude expansion teams since 1977, column (4) includes all teams. First years for free agency are 1988 for MLB and NBA, 1993 for NFL and 1995 for NHL. While MLB unrestricted free agency officially began in 1976, I use 1988 due to collusion cases brought by players union between 1985 and 1987. All specifications include league-by-year fixed effects. Column (3) includes league varying coefficients on population, income, and local amenities which are not shown. Population and income variables standardized by league-year. Local amenities estimates come from Albouy (2015).

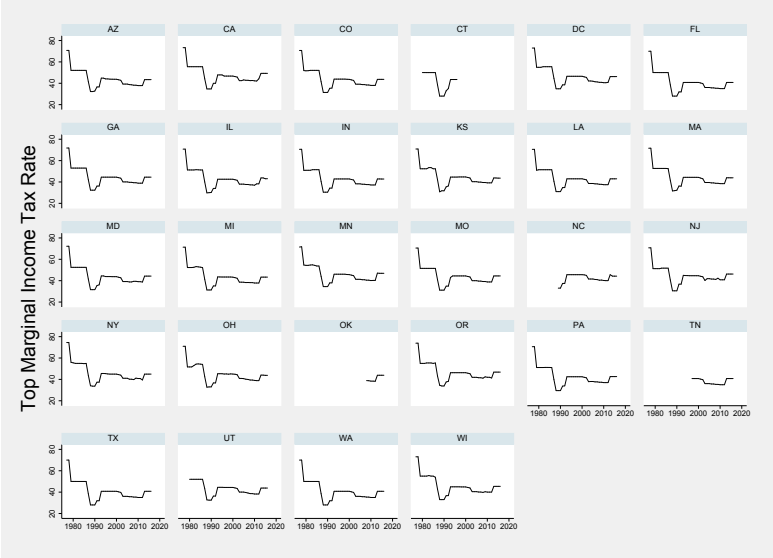
Table 6: State Income Taxes Rates and College Team Performance

	(1)	(2)	(3)	(4)
Tax Rate	-0.047	0.103	0.094	0.260
	(0.183)	(0.362)	(0.189)	(0.422)
Controls	No	No	Yes	Yes
Power Conferences	No	Yes	No	Yes
Observations	8,914	2,550	8,252	2,410

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

Note: This table presents results from regressing combined state and federal to marginal income tax rates on team winning percentages in men's college football and basketball 1995-2017. Control variables include area population, income, and local amenities. Power conferences include the Big Ten, Big 12, Pac 12, SEC, and Big East. Tax rates are top marginal state income tax rates.

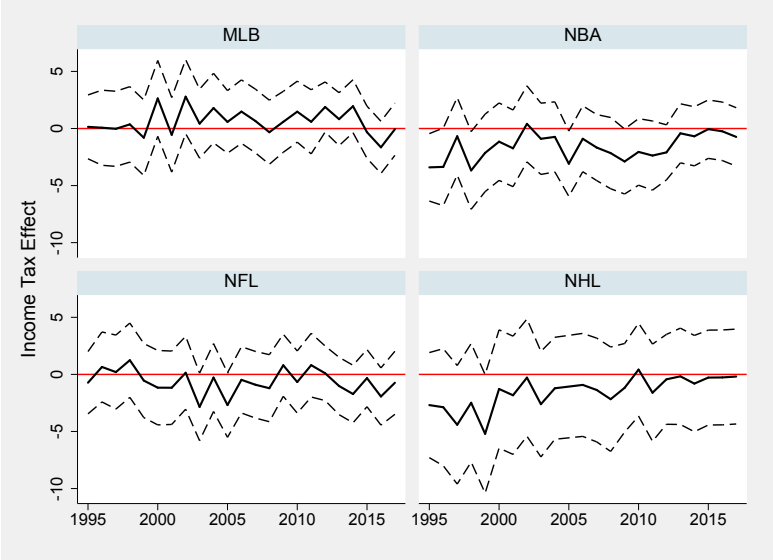
Figure 1: Top Marginal Income Tax Rates, 1977-2016



Source: NBER Taxsim.

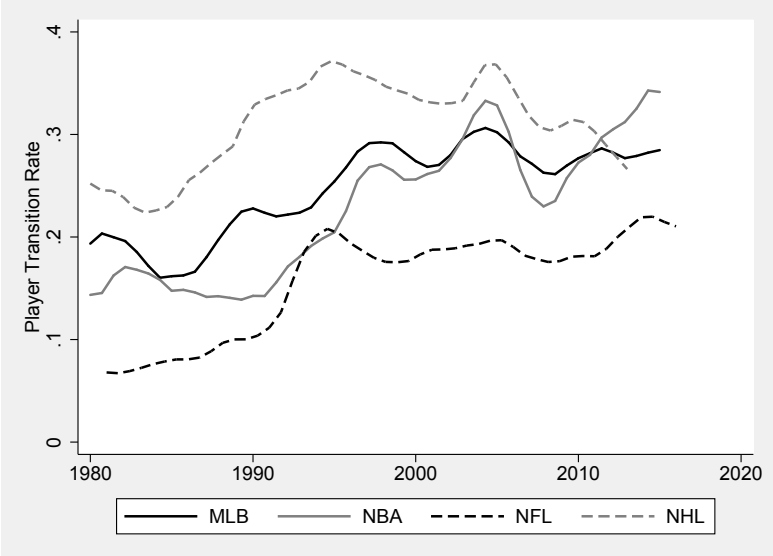
Notes: This graph displays the combined federal and state top marginal income tax rate on earned income. Sample restricted to years in which each state had a professional sports team.

Figure 2: State Income Tax Effect On Team Winning Percentage, by League



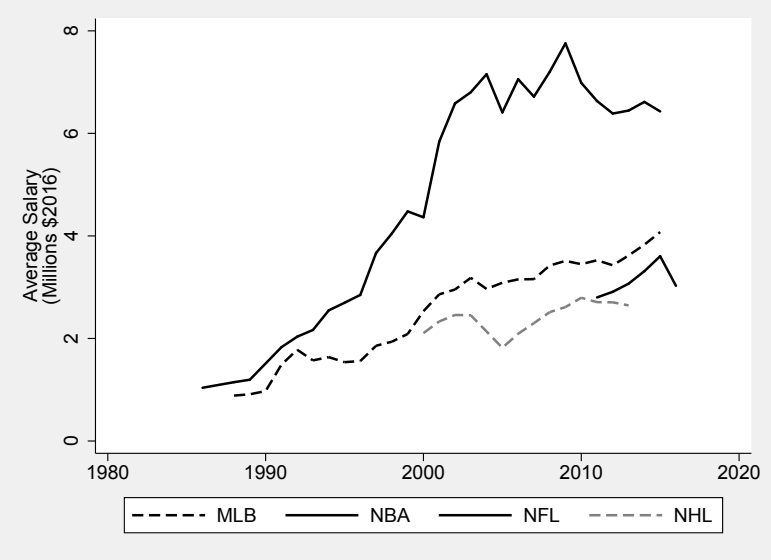
Source: Author's calculations based on data from SportsReference.com.
Note: This graph displays point estimates and 95% confidence intervals from regressing income tax rates on winning percentage by league and year for 1995 to 2017. Control variables include MSA average income, population, amenities, and franchise age.

Figure 3: Player Transition Rates by League



Source: Author's calculations based on data from SportsReference.com.
Note: This graph displays the rate of player movement between teams each year by league. Among players with at least four years experience and on rosters in both the current and previous year.

Figure 4: Average Veteran Player Salary by League



Source: Sean Lahman (MLB), Patricia Bender (NBA), USA Today (NHL), SportTrac (NFL).
Note: Average player salary (in millions of constant 2016 dollars) among players with at least four years experience by league.

A Appendix

Table A.1: 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 A.2: NBA Player Salary and Value, 1995-2017

	(1)
WARP	1,518***
	(47)
Observations	4,513

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

Note: This table presents results from regressing NBA player value on salary. Year fixed-effects not shown. Sample excludes players with less than four years experience. A guide to the definition and interpretation of the player value statistic can be found here: `http://www.sonicscentral.com/warp.html`.