# Touchdowns, Sacks and Income Tax –
# How the Taxman decides who wins the Super Bowl

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ABSTRACT

This paper analyses the 23-year history of salary cap regulations in the National Football League (NFL). While the aim of the salary cap is to ensure a level playing field this paper finds that the regulations are imperfect and the playing field is tilted towards teams in low-tax states. The results show a significant negative relation between the amount of the net (after-tax) salary cap represented by the personal income tax rate of the teams' home states and the success of the teams. Over the sample period (1994-2016), teams in high tax states win on average every season 0.2 games less per each percentage point of tax differential. A team from California (highest average tax rate) wins 2.75 games less per year than a team located in a no-tax state such as Florida or Texas. While the main focus of this paper is the salary cap regime of the NFL, the results of this research also draw inferences onto the corporate world where salary cap regulations have been introduced more frequently into the policy debate over the last several years. Previous literature however has largely ignored binding maximum wage rules and their effects on the regulated firms' performance.

**Keywords:** salary cap, income tax, professional sports

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## 1. Introduction

This paper investigates whether and to what extent state personal income taxes influence the success of professional football teams in the National Football League (NFL). To level the playing field among its teams the NFL employs the strictest salary cap regime of all four North American major sports leagues. Yet, the results of this paper show that the playing field is tilted towards teams in low-tax states. Over the sample period (1994-2016), teams in high tax states win on average 0.2 games less per each percentage point of tax differential. For example, a team from California which has the highest average state personal income tax rate over the whole observation period wins 2.75 games (or 17% of the 16 game season) less per year than a team located in a state without personal income tax such as Florida or Texas. Comparing the pre-salary cap era to the salary cap years shows that it is the interaction of the salary cap with the tax rate differential which influences a team's success. Prior to the salary cap's introduction the state personal income tax has no significant effect while afterwards it has.

This paper contributes to a small strand of literature focusing on the influence of personal income tax rates on labor mobility. While the existing literature has shown that personal income tax rates influence labor migration decisions and contract negotiations in particular of professional athletes and in general of high-skilled and highly mobile individuals, it has not focused on the effects of such tax induced migration decisions on the respective teams the professional athletes play for or the respective entities the individuals work for.

The most straightforward reason why personal income tax rates might affect team performance is that higher taxes on a mobile labor force is a negotiating disadvantage for teams in high tax states, hindering their ability to attract quality players. NFL players are paid very well and therefore have strong incentives to consider the tax implications of the teams they choose to play for. Additionally, the average NFL career is short (less than six seasons) and many athletes suffer from financial strains (40% of NFL players go bankrupt after retirement, Carlson et al. (2015)). So, when negotiating with high-tax teams players might ask for higher gross income to recapture the cost of paying higher personal income taxes. Under a strict salary cap teams might not be able to satisfy this demand and the players might choose to play for a team in a low tax state. While teams in both high tax and low tax

states have to respect the salary cap, the interaction of income taxes and salary cap tightens the restrictions of the salary cap for high tax teams. This reduces the average talent level of the whole roster of a team in a high tax state and diminishes its chances of winning.

The main focus of this paper is the interaction of the tax rate differences with the salary cap regime of the NFL which is found to be imperfect as it does not establish a level playing field. Yet, the results of this research also draw inferences for the corporate world where salary cap regulations have been introduced more frequently into the policy debate over the last several years. In a world of perceived growing inequality (Piketty 2014), this discussion has raised questions such as whether and how to regulate firms' payments to their executives. One of the discussed methods of regulating and reducing executive compensation is a mandatory upper boundary ("maximum wage") (Brockway 1984; Ramsay 2005; Friedman 2008; Rowlingson and Connor 2011; Blumkin et al. 2013) which is a similar concept to the NFL's salary cap.[1] The literature however has by and large ignored binding maximum wage rules and their effects on the market for managerial labor as well as the subsequent effects on the regulated firms' performance.

The remainder of the paper is structured as follows: section 2 provides an overview of the regulatory framework of the NFL, its salary cap and the taxation of professional athletes. Section 3 presents relevant related literature. The theoretical background, which motivates the empirical analysis and develops the hypotheses, is provided in section 4. Section 5 presents the empirical analysis, results and robustness checks; section 6 concludes.

## 2. The NFL salary cap

### 2.1. The National Football League

The National Football League (NFL) is one of the four major North American sports leagues. It was established in 1920. Currently, 32 teams play in the NFL, allocated in two conferences (American

[1] The idea of using maximum wage rules, however, is not a new one. It reaches back to Aristotle (see Miller (2008)), who suggested that no one should have more than five times the wealth of the poorest person. During the Second World War, U.S. president Franklin D. Roosevelt, concerned by war profiteering, proposed a maximum income of USD 25,000 in 1942 (13 times the average income), accompanied by a 100% tax on all income above this level (Blumkin et al. 2013).

Football Conference – AFC; National Football Conference – NFC) that are split up into four divisions each (AFC East, AFC North, AFC South, AFC West; NFC East, NFC North, NFC South, NFC West) with four teams per division. The regular season runs from early September to the end of December, followed by the post-season (Playoffs) with the finale ("Super Bowl") being played on the first Sunday in February. Every team plays 16 regular season games (six against teams in the same division, six against teams in the same conference but from different divisions, four against teams in the other conference). The standings (win-loss-record or winning percentage) at the end of the regular season determine the teams allowed to participate in the playoffs. In each conference six teams (four division champions plus the two best non-division champions) qualify for the conference playoffs. The two winners of the conferences play against each other in the Super Bowl to determine the overall champion ("World Champion").

While it is not necessary to know the difference between a mascot and a middle linebacker to follow the analysis in this paper, it is important to have some background regarding the fundamentals of the workings of the NFL and the labor market for professional football players. The Collective Bargaining Agreement ("CBA") between the NFL and the players' union ("NFLPA") constitutes the regulatory framework of the league. According to the CBA all teams have to comply with the same rules regarding player contract negotiations and contractual terms.[2] All teams are similar in size and activity; the number of players each team can add to its active roster (53 players) is regulated as is the number of games each team plays (16 in the regular season), and even the number and intensity of training and practice sessions is regulated.

New players ("rookies") are allocated to the teams via an annual draft. Teams take turns in selecting (college) players in an order determined by the previous year's record – in each round the worst team chooses first and the champion chooses last (Massey and Thaler 2013). The players selected are then signed to a four or five year contract. Players can only sign with the team that selected them. Because of the reduced bargaining power, rookies are usually remunerated below their market value.[3] After

[2] Player contracts have to be submitted in full to the league, and the details are made available to all the teams and registered player agents.

[3] See for example Russell Wilson (Quarterback of the Seattle Seahawks): In 2013 he was selected to the Pro Bowl (NFL All Star Game) for being one of the best quarterbacks in the league and led the Seattle Seahawks

four or five years, players are unrestricted free agents and can negotiate with any team. Even if the player eventually remains with its initial team, the team has to pay a salary commensurate with the market value of the player (Massey and Thaler 2013). When players are signed to multiple-year contracts, there is usually a guaranteed up-front bonus payment ("signing bonus") plus annual salaries.[4] A few other features of the league are worth noting (see Massey and Thaler (2013)): Teams earn most of their revenue from television contracts and these revenues are divided equally. Teams also share all revenues from stadium ticket sales and from the sales of team paraphernalia (jerseys, hats, t-shirts, etc.).

## 2.2. The Salary Cap

Following the 1993 season and effective 1994, the NFL introduced a salary cap, which limits the overall salary any team can pay out to its players per season. The term "salary cap" however is somewhat misleading as it is actually a cap on a team's entire payroll rather than a limit on the amount that an individual player can be paid. The salary cap of the NFL is regularly referred to as "hard cap" (Krautmann and Solow 2012; Leeds and Kowalewski 2001; Borghesi 2008; Nissim 2004). A hard cap is an absolute maximum amount that a team can spend over the course of each season with no exceptions while a "soft cap" would have several exceptions and loopholes such as crediting an overspending against the following year's salary cap (Nissim 2004).[5] The NFL has to approve all contracts between a team and a player to become effective; therefore, the salary cap cannot be exceeded. The annual salary cap figure is adjusted at the beginning of the league year and depends on the revenue of the whole league. The first salary cap in 1994 was set at USD 34.608 million and increased steadily by around 8.1% per year with the salary cap of the 2016 season being at USD 155.27 million. So, in 2016 every NFL team is allowed to pay every of its 53 players on average an annual (pre-tax) salary of USD 2,929,622.64 (1.88% of the salary cap).

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to win the Super Bowl. Because he was playing under his rookie contract, he earned USD 500,000, while the average pay among all NFL quarterbacks that year was USD 10 million.

4 Whenever player compensation is reported in this paper the official cap charge as reported to the league is used and not the annual cash payment.

5 The accounting for the NFL salary cap rule however allows the teams to allocate the signing bonus equally across the years of the contract.

The aim of the salary cap is to ensure competitive balance between all 32 teams. Competitive balance within a sports league is important for the overall attractiveness of the sports league and its games to fans, the general public and the media. The uncertainty of the outcome of a particular game is critical to spectator interest, which relates to media attention and commercial success of the whole sports league. It is thus in the overarching interest of the owners of the sports teams to ensure a certain level of competitive balance among all participating teams (Rosen and Sanderson 2001). There is wide agreement in the literature that salary caps can indeed mitigate competitive imbalances in sports leagues because they prevent wealthy clubs with high market potential from bidding the full marginal value for additional talent (Fort and Quirk (1995); Fort (2012); Rosen and Sanderson (2001); Dietl et al. (2011); Lee (2010)). This effect allows small market, less wealthy clubs to retain star players. And, salary caps can enhance social welfare when they limit large teams' spending (Dietl et al. (2011); Dietl et al. (2009); Mondello and Maxcy (2009); Dobson and Goddard (2001)).

Additionally, in theory a salary cap balances the salary distribution between players and limits the distance between the highest and the lowest paid player on the team (Késenne 2000). The NFL tries to achieve this aim by complementing the salary cap by a minimum salary scale depending on the individual experience of the respective player. In 2016, the minimum salary of a first time NFL player was USD 450,000 (0.29% of the salary cap) and for a player with more than ten years of experience was USD 985,000 (0.63% of the salary cap). In contrast however, the highest paid player in 2016 (Eli Manning, quarterback of the New York Giants) earned USD 24,200,000 (15.58% of the salary cap).[6] The highest paid player thus earns more than 53 times the salary of the lowest paid player.

## 2.3. Taxation of Athletes

The salary cap is a gross (pre-tax) amount. Because of the US tax system, which gives the US states the power to levy state personal income taxes (additionally to the federal income tax), the net income of any football player depends on the location where the player performs his services to the club. Two

[6] See www.spotrac.com (October 23, 2017).

factors predominately determine the individual tax burden: The location of the club and the locations where the games are played.

All states with an individual income tax reserve the right to tax any non-resident on professional income earned in the state. This policy (so called “jock tax”) applies to any non-resident, but it is regularly applied only to high-profile and high-income professional athletes like NFL players (Alm et al. 2012). The most commonly used allocation method is based on “duty days”, which is the number of days that the player spends in providing professional services in a state. The total salary of the player is then allocated across states in accordance with the proportion of the total duty days spent in each state (DiMascio 2006; Ekmekjian 1994; Ekmekjian et al. 2011; Farnsworth 2013; Nolan 2016). Usually, the total number of a NFL player’s duty days (pre-season and regular season practices, home games and away games, playoffs) is assumed to be between 150 and 200 per year (Pogroszewski 2008; Zelinsky 2015). Away games are usually counted as two duty days as teams travel to the location of the away game one day in advance and leave right after the game. In total, this amounts to not more than 16 duty days out of the home state (8%-10% of total duty days) per season.[7] The personal income tax rate of the home state is therefore (besides the federal income tax) the most important factor determining the tax burden of any NFL player as 90% of the player’s salary is taxable in that state.

## 3. Literature Review

The primary motivation of this research is to contribute to a small but expanding strand of literature focusing on the influence of personal income tax rates on labor mobility. While the existing literature has shown that personal income tax rates influence migration decisions and contract negotiations of professional athletes it has not focused on the effects of such tax induced migration decisions on the success of the respective teams the athletes play for. Additionally, the interaction of tax rate

[7] As some states are home to more than one NFL team (for example in 2016 California: 4 teams; Florida: 3 teams; Ohio: 2 teams; Pennsylvania: 2 teams; New Jersey: 2 teams; Texas: 2 teams) away games are not automatically played in a different state.

differences and a salary cap regime as strict as the NFL's salary cap has not been extensively researched.

Alm et al. (2012) focus on Major League Baseball players and examine whether free agent contracts reflect, or incorporate, differences in state and local individual income taxes. They find that individuals who choose to play in cities with higher income taxes are paid higher pretax salaries. The additional salary ranges from USD 21,000 to USD 24,000 for each percentage point of state and local income tax difference. Thus, MLB teams in states with high income taxes have to increase significantly the pretax salaries in order to sign high quality players. Alm et al. (2012) provide evidence for professional athletes' awareness of income tax rate differences and those differences' influence on contract negotiations. That paper however does not focus on the success of the respective baseball team as the setting of the MLB is significantly different from the NFL. The MLB does not have a salary cap but a luxury tax (Kaplan 2004). Teams with a total annual payroll above a pre-defined threshold must pay a so called "luxury tax" on the excess payroll to the League. The League then distributes the luxury tax payments to the teams with the lowest total payrolls. Major League Baseball teams are therefore not bound to an upper limit when negotiating player contracts and teams in high-tax states can still attract high quality players as long as the teams compensate the players for their higher personal income tax dues.

Similar to the MLB, the National Basketball Association (NBA) also regulates player salaries using a luxury tax and not a salary cap (Kaplan 2004). The NBA luxury tax is a 100% surcharge for all payroll exceeding a pre-defined annual amount. As in the MLB the luxury tax payments are redistributed to the teams with the lowest total payrolls. Kopkin (2011) finds similar relations between tax rates and migration decisions of star players in the NBA as Alm et al. (2012) show for professional Baseball players. Zimmer (2011) finds a negative relation between income tax rates and team success which provides additional evidence for the influence of tax rate differentials in the migration decisions of NBA players. However, because of the different salary regulations in the NBA the findings by Zimmer (2011) cannot be transposed to the NFL.

The results by Kleven et al. (2013) investigating the mobility of European soccer players and by Hembre (2017) point in the same direction and provide evidence for tax motivated migration decisions of professional athletes. The recent working paper by Hembre (2017) also provides cursorily evidence for a negative relation between income tax rates and team success in the National Hockey League (NHL) and in the NFL.

The existing literature thus provides some insight into the (national and international) migration and contract negotiation decisions of professional athletes. They all show that in professional sports the traditional assumptions regarding the relative mobility elasticities of capital and labor are reversed (Hembre 2017). The labor force (the players) is highly mobile while the capital (the teams) is highly immobile. Once players become free agents, their location attachment is very small. In general professional athletes are aware of and react to tax rate differentials whether by migrating to low-tax locations or by negotiating the higher tax cost into their salary packages. This paper contributes to and expands this literature by examining the effects of the players' high mobility and their income tax sensitivity on their respective teams' success as this has not been studied extensively before.

## 4. Theoretical Model and Hypotheses

As prior literature shows professional athletes are trying to maximize their after tax (net) income:

$$\Pi(1-\tau)_i \rightarrow max \tag{1}$$

In the NFL players' salaries are in general based on the player's talent $t$ (i.e. the level of compatibility of the player's skills with the team's specific needs) and the effort $e$ the player provides for the team as the salary package usually contains a guaranteed amount and a performance based share. The team thus compensates the player for the cost of effort $EC(e)_i$ and for their talent $TC(t)_i$. Both the cost of effort and the cost of talent are assumed to have isoelastic supply functions (Dittmann et al. 2011) that relate the costs to the level of effort and talent respectively ($\varphi$ and $\delta$ are elasticities):

$$EC(e)_i = e^{\varphi}{}_i \tag{2}$$

$$TC(t)_i = t^{\delta}{}_i \tag{3}$$

The pre-tax compensation (Π) of any player thus depends on the effort provided to the team and on the player's individual talent level:

$$\Pi(1-\tau)_i = EC(e)_i + TC(t)_i \quad (4)$$

The team's performance (Number of Wins) on the other hand depends on the cumulative effort $e$ and the combined level of talent $t$ of its 53 players. $\kappa$ summarizes all other factors influencing the Number of Wins ($\beta$ and $\gamma$ are elasticities):

$$Wins = \kappa * \sum_{i=1}^{53} e^{\beta}{}_i * \sum_{i=1}^{53} t^{\gamma}{}_i \quad (5)$$

The football team is faced with the non-trivial task of assembling a 53-man roster that is as talented and as willing to provide a high level of effort as possible. And this under the strict constraint of the annual salary cap. In theory, the team is free to allocate the salary cap among various players and position groups as it feels fit. For instance the team could allocate 70% of the salary cap on one player and the rest among the remaining 52 players. In reality however the team's aim is to maximize the average talent and effort level of the whole roster and not the maximum talent and effort level of only one field position or only one player. This means the salary cap should be allocated among all players and field positions in order to acquire the best possible combination of players.

When assembling a team's roster the team negotiates with free agent players who aim at maximizing their after tax salary. For a team in a high tax state (Team A) to sign a free agent, who also has an offer from a team in a low tax state (Team B), Team A must compensate the player for the income tax rate differential.

$$\Pi(1-\tau_A)_i + \Pi(\tau_A - \tau_B) = \Pi(1-\tau_B)_i \rightarrow \Pi_A > \Pi_B \quad (6)$$

Because of the salary cap restrictions Team A however might not be able or allowed to compensate the player for the income tax rate differential (see also Kopkin (2011)). It could be expected that Team B will be able to sign the free agent. Indeed, Team B will likely be able to sign most of the highly talented free agents, and Team A will have to target the lower talented free agents which Team B has

no interest in. In this case, the average talent and effort of the players signed by Team A will be lower than the average talent and effort of the players signed by Team B.

$$e_A(\Pi(1-\tau_A)_i) < e_B(\Pi(1-\tau_B)_i) \quad (7)$$

$$t_A(\Pi(1-\tau_A)_i) < t_B(\Pi(1-\tau_B)_i) \quad (8)$$

Due to the rather direct relation between the average talent and effort level of a team's players and the team's level of success, the team located in a high tax state (Team A) can be expected to have fewer wins than the low tax team (Team B):

> *H1: The success of a NFL team is negatively related to the personal income tax rate of the team's home state.*

Without the salary cap, the high tax rate team would be able to compensate the players for the tax rate difference. So, there is an interaction between the tax rate and the salary cap. Without the salary cap the higher tax rate would not circumvent signing the most talented players as the high tax rate team could easily compensate the player for the tax differential (Alm et al. 2012). Therefore Team A could attract the same number of talented players as Team B and Team A's chances of winning would not be diminished. Therefore hypothesis H2 reads as follows:

> *H2: Without a salary cap the personal income tax rate of the team's home state does not influence the team's success. The interaction between the salary cap and the tax rate difference primarily causes the negative relation between tax rates and team success.*

# 5. Empirical Analysis

## 5.1. Model and Variables

To test the hypotheses, I collect performance data (wins, winning percentage) of all NFL teams over the time-span 1994-2016 for the regular season. The playoffs are excluded in the primary analysis because the salaries for the playoff games are paid by the NFL. These salaries therefore do not count against any team's salary cap and players usually do not get bonuses for playoff games from their

teams. Additionally, the playoff salaries paid by the league are relatively low compared to the regular season payments.[8]

The win-loss record measures the overall success of a football team while other team specific statistics such as the points scored, yards per game or yards allowed per game measure either the offensive or the defensive performance of the team. Winning an NFL game however demands success on offense, defense and special teams (kicking, punting, return game). The winning percentage covers all three phases of the game instead of focusing only on several aspects of it. Additionally, the NFL culture is based on winning as indicated by the following quotes of successful, highly regarded, respected and influential head coaches: "*Winning isn't everything, it's the only thing*" (Vince Lombardi);[9] "*You play to win the game. You don't play it to just play it*" (Herm Edwards);[10] "*You are what your record says you are*" (Bill Parcells).[11]

I estimate a within-group model that exploits the panel nature of the data and controls for team-fixed and time-fixed effects. The dependent variable in this estimation is the winning percentage (*WinningPercentage*). The explanatory variable of main interest is the state personal income tax rate (*StateTax*) of the team's respective home state during the regular season.

$$WinningPercentage_{i,t} = \alpha StateTax_{i,t} + \beta X_{i,t} + \mu_i + \eta_t + \varepsilon_{it} \qquad (9)$$

$X_{i,t}$ is a vector of control variables, $\mu_i$ are team-fixed and $\eta_t$ are time-fixed effects. The fixed-effects model seems appropriate for the analysis for two reasons. First, much of the variation in winning percentage is between the teams rather than within the same team over time. Although it would be difficult to specify all the characteristics that determine the differences across teams, one can capture permanent differences between teams with team-fixed effects. Similarly, there are many factors that may affect team wins over time, and those differences are captured with annual time effects. Second, the fixed-effects model is a within-group estimator that uses a weighted average of the within-team

[8] Depending on the playoff round players received in 2016 between USD 23,000 (Wild-Card round) and USD 102,000 (Super Bowl winner) per game (before taxes). During the regular season the average salary was USD 183,101 per game.

[9] http://www.vincelombardi.com/quotes.html (October 23, 2017).

[10] http://www.azquotes.com/author/26302-Herman_Edwards (October 23, 2017).

[11] https://www.goodreads.com/author/quotes/69012.Bill_Parcells (October 23, 2017).

and the across-team variation to form the parameter estimates. Therefore, the estimate of the effects of state income tax variations measures how team wins change within panels of teams due to the presence or absence of a state income tax.

Additionally, the model in equation (9) is estimated with an alternative tax rate measure: *TaxDiff*. *TaxDiff* measures the difference between the individually applicable tax rate and the average tax rate of all teams in the respective season. It thus represents the competitive advantage (disadvantage) of teams located in low tax (high tax) states.

$$WinningPercentage_{i,t} = \alpha TaxDiff_{i,t} + \beta X_{i,t} + \mu_i + \eta_t + \varepsilon_{it} \quad (10)$$

With respect to the control variables ($X_{i,t}$) I follow previous literature by including a number of variables that influence the success/performance of a football team. Previous literature and the general media have repeatedly focused on the importance of two distinct positions/functions in a football team and their influence on team success: the *quarterback* and the *head coach*.

The quarterback's position is the premier position on the team. Usually, he is responsible for delivering the ball to the appropriate teammate in hopes of advancing it. The majority of previous research on this topic focuses on the quality of defense and the quality of the individual opposing quarterback. The phrase "*offense wins games, defense wins championships*" is coined by coaches, players, and analysts. The study by Robst et al. (2011) however finds no evidence that improving the defense leads to more team success. According to a study by Moskowitz and Wertheim (2012), who investigated 427 playoff games between 1967 and 2012, the strength of the offense is more important. Out of these games, the higher ranked offensive team won 62% while the higher ranked defensive team won 58% of the time.[12]

With respect to the quarterback, previous research has shown that the two factors *stability* and *experience* are highly important and are positively related to team success. Wittke (2012) shows a significant negative relation between the number of starting quarterbacks (quarterbacks that start the

[12] The total exceeds 100% because sometimes the winning team is ranked higher in both offense and defense in comparison to its given opponent.

game) per season and winning percentage of all NFL teams over a ten-year period (2002-2011). Employing more than one starting quarterback means that the player designated as starting quarterback after training camp and pre-season games either got injured or performed poorly during the season. In both instances, the team's chances of winning games decrease dramatically. This finding by previous research is included as the control variable *QBstart*, which is the number of individuals starting a game at the quarterback position during the season. Regarding *experience* Wittke (2012), Leeds and Kowalewski (2001) and Simmons and Berri (2009) show that teams that employ a quarterback with more years of experience have a significantly higher chance of winning more games. The control variable *QBexp*, which is the number of years of experience of the quarterback who starts the majority of the games during the season, incorporates this finding in the study.

While the position of the quarterback is of outmost importance for the success of any football team, using the quarterback as a control variable introduces some endogeneity to the model. As one of the 53 players on the active roster of a NFL team, the quarterback's salary counts against the team's salary cap. However, prior research and public media suggest that quarterbacks are relatively unaffected by the compensation restriction put in place by the salary cap (Leeds and Kowalewski 2001; Borghesi 2008). Generally, starting quarterbacks are the highest paid players on any team and account for around 10%-15% of a team's salary cap.[13] Additionally, top quarterbacks only very rarely become free agents, change teams and negotiate salaries with different teams.[14] Using the importance of the quarterback position for the success of the team as control variable therefore outweighs the risk of endogeneity; however, as a robustness check the models are estimated without using the quarterback variables (see section 5.4. below).

With respect to the *head coach*, prior research also shows that stability and experience are significantly important for team success. The findings of Hadley et al. (2000) and Wittke (2012) suggest basically the same pattern as with quarterbacks. More experienced head coaches have

[13] See www.spotrac.com (October 23, 2017).

[14] One of these very rare exceptions is Peyton Manning, one of the statistically best quarterbacks in NFL history, who became a free agent in 2012. He left his previous team (Indianapolis Colts where he had played for 14 seasons) to play for the Denver Broncos. His salary in the last season with Indianapolis: USD 16,000,000 (13.33% of the salary cap); his salary in his first season with Denver: USD 18,000,000 (14.93% of the salary cap).

significantly more success, measured in wins per season. Hadley et al. (2000) find that more experienced coaches are more efficient, implying that coaching experience contributes positively to a team's number of wins during the regular season. They conclude that a more experienced head coach can contribute up to four additional wins to his team in a given season. Similar to the quarterback, a change at the position of head coach is significantly related to fewer team wins in the year of the coaching change. The control variable *CoachTenure,* which is the number of years of experience the head coach had with the respective team at the beginning of the season incorporates these findings into the model.

The control variables further consist of team-specific variables that influence the overall success of the team. *Division* is an indicator variable indicating the division of the team. The NFL is divided into two conferences and each conference is divided into four divisions. The division of the team decides which opponents the team faces during the season. Each team plays six games against the other three teams of its division, six games against other teams of the same conference and four games against teams from the other conference. Therefore the competitive strength of the team's own division (37.5% of games) and the strength of its own conference (75% of games) strongly influence the chances of winning games.[15]

With *LagWins* (number of wins in the previous season) and *5yearWins* (number of wins in previous five seasons) the previous success of the team is incorporated into the model (see Pitts (2016)). See Table 1 for an overview of the variables used in the empirical analysis.

*[Insert Table 1 about here]*

## 5.2. Data

As briefly addressed above, the empirical analysis is based on performance data (winning percentage) of all NFL teams over the time-span 1994-2016 (23 NFL seasons with 721 team-year observations).

[15] Note that the NFL realigned the divisions after the 2001 season to its current alignment (2x4 divisions with 4 teams each). Prior to that the NFL was aligned in two conferences with three divisions and each division had 5 teams (except for AFC Central having 6 teams). While the realignment changed the playing schedule to its current format, the previous scheduling format also put the emphasis on inter-division and inter-conference games.

As each team plays 16 regular season games the 721 team-year observations are based on 11,536 regular season games. The data form an unbalanced panel as four teams (so called expansion teams) in the sample did not play in all 23 NFL seasons of the sample period (the teams Carolina Panthers, Jacksonville Jaguars started to play in 1995; Cleveland Browns relocated after the 1995 season to Baltimore to become the Baltimore Ravens and was re-established as a new team in 1999; Houston Texans started to play in 2002). Table 2 provides a first overview of the teams, their success and the average state personal income tax rate of their respective home state over the whole observation period.

*[Insert Table 2 about here]*

*Average Tax Rate* is the average statutory personal income tax rate of the respective home state over the whole observation period. Since several teams relocated or started playing at some point during the sample period,[16] the average tax rate differs several times within the same state.[17] The data is very homogeneous and the degree of skewness is small. The mean of the average tax rates is 4.97% (median: 5.44%) with the minimum at 0.00% and the maximum at 11.28%.

The average wins per season per team amount to 7.97 (median: 7.86) with the minimum at 4.89 and the maximum at 11.09. The total winning percentage has an average of 0.498 (median: 0.491)[18] with the minimum at 0.306 and the maximum at 0.693. On average teams have 8.63 playoff appearances (median: 7.50) and 0.72 Super Bowl titles. The most successful team over the whole observation period is New England Patriots (winning percentage of 0.693, 18 playoff appearances and 5 Super Bowl titles). The least successful team on the other hand is Cleveland Browns (winning percentage of 0.306, one playoff appearance and no Super Bowl title).

*[Insert Table 3 about here]*

[16] Carolina Panthers, Cleveland Browns, Houston Texans, Jacksonville Jaguars were expansion teams; Baltimore Ravens, Tennessee Titans and Los Angeles Rams relocated.

[17] See California, Maryland, Ohio.

[18] The average (median) winning percentage is not 0.5 because of the unbalanced nature of the panel due to the expansion teams (Carolina Panthers, Cleveland Browns, Houston Texans, Jacksonville Jaguars); when excluding these teams the average and the median are 0.5.

Table 3 provides descriptive statistics on an observation-by-observation basis (721 team-years). The average wins per team is 8 (median: 8) with the maximum of 16[19] and the minimum of 0[20]. *StateTax* (the statutory personal income tax rate of the team's home state) has a mean (median) of 5.014 (5.150) with the minimum (maximum) at 0.00[21] (14.10[22]). The 32 NFL teams are located in 22 different states with 19 different tax rates (in 2016). Seven teams are located in states with no personal income tax (Florida, Tennessee, Texas, and Washington); four teams are located in California with the highest personal income tax rate of 14.10%. *TaxDiff* representing the difference between the applicable state personal income tax and the average of all teams' state personal income tax rates in a respective season has an average of 0.00 (median: 0.146). The minimum is -5.337 and the maximum is 8.913.

On average teams have 1.688 (median: 2) quarterbacks starting a game (*QBstart*) per season with the maximum being 4 (in 14 team-year observations). The main starting quarterbacks have an average experience (*QBexp*) of 5.535 (median: 5) years, the maximum is 20 and in 51 team-year observations rookies were the main starting quarterbacks (*QBexp* = 0). The experience of the head coach (*CoachTenure*) is similarly distributed (average: 3.115, median: 2, maximum: 26, minimum: 0 years).

*[Insert Table 4 about here]*

Table 4 provides an overview of personal state income tax rates of all 32 NFL teams in 2016. The table splits the teams between playoff teams and non-playoff teams. The difference in the average tax rates of playoff teams (4.62%) and non-playoff teams (5.93%), which amounts to 1.31 percentage points or 28.28% of the playoff teams' average tax rate, provides some intuition that the tax rate differences lead to competitive advantages and disadvantages.

After state personal income taxes (without accounting for federal income taxes and other charges), every playoff team can spend on average USD 2,794,274.08 for each of the 53 players and the non-playoff teams can spend on average USD 2,755,896.02, which is a difference of USD 38,378.06 per player per season. When focusing on the highest (California – 14.10%) and the lowest (Florida,

[19] New England Patriots in 2007.

[20] Detroit Lions in 2008.

[21] Florida, Tennessee, Texas, Washington (throughout the whole observation period).

[22] California (2012-2016).

Tennessee, Texas and Washington – 0.00%) personal income tax rates, the difference amounts to USD 413,076.79 per player per season. In total, the difference between teams in Florida, Tennessee, Texas and Washington on the one hand and California on the other is USD 21.8 Million per season.

### 5.3. Results

Table 5 reports the results of the primary analysis. It is a fixed-effects panel regression over the whole period 1994-2016 with *WinningPercentage* as the dependent variable. The table includes six different specifications. Specifications (1)-(3) use *StateTax* and specifications (4)-(6) use *TaxDiff* as main variable of interest. Specifications (2) and (5) include the number of wins of the previous season (*LagWins*) to control for the general competitiveness of the team while specifications (3) and (6) use the average number of wins over the last five seasons (*5yearWins*) as an indicator of the long-term success of the team.

*[Insert Table 5 about here]*

Specifications (1)-(3) report statistically significant relations between a team's home state's personal income tax rate and the team's winning percentage. In all three specifications, *StateTax* has a significant negative coefficient between -0.0123 and -0.0183. A one percentage point higher personal income tax rate leads to a reduced winning percentage between 0.0123 and 0.0183, which translates to around 0.2 games per season. The results therefore show that a team located in a state with a one percentage point higher tax rate than that of another team wins on average 0.2 games less per season. For example, over the whole observation period teams located in California (highest tax rate) win 2.75 games per year (or 17% of the 16 games season) less than teams located in Florida, Tennessee, Texas, or Washington (no personal income tax). Specifications (1)-(3) also provide evidence that the number of wins in previous years (*LagWins* and *5yearWins*), the number of starting quarterbacks and their experience as well as the experience of the head coach are significant indicators of future success.

Specifications (4)-(6) confirm these findings while using an alternative tax measure. *TaxDiff* measures the difference between the individually applicable tax rate and the average tax rate of all teams in the

respective season. It thus represents the competitive advantage (disadvantage) of teams located in low tax (high tax) states. The results are very similar to the results of specifications (1)-(3). *TaxDiff* has a statistically significant negative coefficient throughout all specifications. Teams located in states with relatively high taxes (states with tax rates above the annual mean) win on average 0.18 fewer games per season per percentage point of difference to the mean than teams located in low tax states. *TaxDiff*'s maximum (minimum) thus relates to 1.63 fewer (0.97 more) wins per season than the average tax rate. Again, the previous seasons' success (*LagWins* and *5yearWins*) is a significant indicator of future success as are the quarterback and the head coach. The results thus confirm hypothesis H1 and provide evidence that a higher personal income tax rate is statistically significantly related to fewer wins per season.

To investigate hypothesis H2 it is necessary to compare teams affected by the salary cap with teams that face no such restriction. Since the NFL constitutes a salary cap regime for all teams it is not possible to construct a control group for the salary cap era. However it is feasible to compare the teams' success before and after the introduction of the salary cap regime. For the 28 teams active in the NFL in 1994 additional data is gathered for a ten-year period before the introduction of the salary cap to construct a balanced panel of 28 teams for a ten-year period before (1984-1993) and a ten-year period after (1994-2003) the salary cap introduction (560 team-year observations; 280 uncapped and 280 capped team-years). This allows to specifically analyze the interaction between the salary cap restriction and the tax rate differential. From hypothesis H2 it can be expected that the tax rate has no significant effect prior to the year 1994 (introduction of the salary cap) while it has a significant negative effect afterwards.

*[Insert Table 6 about here]*

Table 6 reports the results of the fixed effects panel regression for the period 1984 to 2003 (ten years prior and ten years after the salary cap introduction). The control variables remain largely the same as in Table 5 yet to avoid any distortions of the tax effect from the uncapped years the variables *LagWins* and *5yearWins* are removed. The variable of main interest is the interaction between *SalaryCap* (an indicator variable taking on the value 1 in years after 1993 and 0 otherwise) and the employed tax

measure (*StateTax* in specifications (1) and (2); *TaxDiff* in specifications (3) and (4)). Specifications (1) and (3) employ *WinningPercentage* as performance measure and specifications (2) and (4) us the number of wins.

The results show the expected effects: For uncapped years (*SalaryCap 0#Tax*) the coefficient is negative but not significant and for capped years (*SalaryCap 1#Tax*) the coefficient is negative and significant throughout all four specifications. Over the first ten years after the introduction of the salary cap teams located in high tax states have a 0.0224 smaller winning percentage per every percentage point of tax rate differential, which translates to 0.36 wins less per season per every percentage point tax difference. This is an even stronger effect than for the period 1994-2016 as shown in Table 5. The introduction of the salary cap therefore led to a reaction that benefitted teams located in low tax rate states and reduced the chances of winning for high tax rate teams. During the uncapped years the tax rate difference has some although not statistically significant influence which can be attributed to the naturally finite amount of money a team could spend on its players. Before 1994 teams in high tax states were allowed but only to a certain extend economically able to compensate players for their higher personal income tax dues. After 1993 the salary cap regime prohibits or at least hinders this compensation and the influence of tax rate differences becomes statistically significant. This provides evidence for the negative influence of personal income tax rates on the ability to attract high quality players under a salary cap regime.

The fixed effects panel regression reported in Table 7 expands the observations to the postseason ("playoffs"). When doing so the specifics of the NFL playoff seeding procedure need to be considered. Every season twelve teams (six per conference) qualify for the playoffs. While qualifying for the playoffs is closely related to the number of wins (winning percentage), the playoff seeding process of the NFL cannot guarantee that the twelve teams with the best regular season record receive a playoff berth. The winners of the eight divisions and the other two best teams of either conference make the playoffs. Thus, playoff seeding also depends on the overall strength of the division. Even without having one of the six best win-loss-records in a conference a team can still make the playoffs if it wins

its division.[23] Yet, even if the NFL playoff seeding procedure cannot guarantee that the best twelve teams play in the playoffs, it can be expected that in general the teams with the highest overall quality of players play in the postseason.

*[Insert Table 7 about here]*

Analyzing the postseason winning percentage with the model of the primary analysis in Table 5 shows that the significant negative relation between a team's home state's personal income tax rate and the team's success vanishes in the playoffs. While there is still a negative relation between high tax rates and team success this relation is not statistically significant. This however is not very surprising. As described above, only the best twelve teams (with few exceptions) play in the playoffs. The overall quality of these teams is already above the league average. Also the nature of playoff games as one shot games where sometimes the luckier team and not the better team wins might diminish the tax rate effect on the success of the teams. Hence, the negative relation between high tax rates and the teams' ability to attract quality players primarily affects the regular season with its multiple games.[24]

## 5.4. Robustness Checks

The analysis reported in Table 5 estimates a fixed-effects model. While, as addressed above, the fixed-effects model seems appropriate for the analysis, I also estimate the same specifications with a random effects model – see Table 8.

*[Insert Table 8 about here]*

[23] See for example NFC Playoffs in 2010: Seattle Seahawks win the division with a 7:9 win-loss-record (qualifying for the playoffs), which was the eighth best record and New York Giants with a 10:6 win-loss-record did not make the playoffs (second in the division and none of the top two non-division-winners). Usually ten or more wins[23] in a season secure a playoff spot. Only eleven teams in the sample did not make the playoffs when winning 10 games, yet 60 teams made the playoffs with less than ten wins. (see also Hadley et al. (2000)).

[24] When analyzing the different stages of the playoffs – Wild Card round, Divisional playoffs, Conference finals, Super Bowl – (not tabulated) the tax effect gradually diminishes (effect size, significance) in each round. Using tax rate differences to predict the Super Bowl participants or the winner is thus not possible.

The results are largely unaffected: the coefficients of the tax variables have the same sign and similar significance levels. However, the Hausman (1978) specification test (not tabulated) indicates that the fixed-effects model is a better fit than the random effects model.

Additionally, since the performance measure of the teams (winning percentage) is based on the number of wins which is a count variable, the robustness checks reported in Table 9 employ a fixed effects Poisson panel regression (Panel A) and a fixed effects negative binomial panel regression (Panel B). These alternative econometric models are specifically designed to analyze count data. The dependent variable in all specifications in Table 9 is number of wins instead of winning percentage as in Table 5. In general the result are the same as in the primary analysis which shows that the results presented in Table 5 are not sensitive to alternative econometric models nor biased by the econometric model employed in the main analysis.

*[Insert Table 9 about here]*

Table 10 and Table 11 report results of additional robustness checks that use various sub-samples of the main sample using the same specifications as in Table 5. Table 10 employs *StateTax* as tax measure and Table 11 uses *TaxDiff*. Specifications (1)-(3) of both tables focus on the unbalanced nature of the main sample. The main sample includes all teams that were active in 2016; however, four of these teams did not play during the whole sample period. Newly established teams (so-called "expansion teams") are generally not as competitive as existing teams. On average, the expansion teams record 6.71 wins per season (compared to 7.97 average wins per season for the whole sample). To check whether the results of the primary analysis are distorted by expansion teams, observations of these teams are removed from the sample in specifications (1)-(3) of Table 10 and Table 11 but the results remain unchanged.

Specifications (4)-(12) of Table 10 and Table 11 remove the historically best team (New England Patriots – specifications (4)-(6)), the historically worst team (Cleveland Browns – specifications (7)-(9)) and both, the best and the worst teams (specifications (10)-(12)). The models remain the same as in the analysis reported in Table 5. Again, the results remain largely unchanged. The statutory personal

income tax rate of the team's home state has a statistically significant negative effect on the respective team's performance measured in winning percentage (Table 10).

*[Insert Table 10 about here]*

The difference between the home state's personal income tax rate and the average personal income tax rate of all teams during the respective season (*TaxDiff*) (Table 11) is negatively related to a given team's performance (winning percentage) and the relation is statistically significant throughout almost all specifications.

*[Insert Table 11 about here]*

The relations reported in the primary analysis might be skewed by observations of teams that are located in states that do not apply a personal income tax at all. Four states in the sample do not apply such a tax (Florida, Tennessee, Texas, and Washington) and seven NFL teams[25] are located in these states. These teams have a strong competitive advantage compared to the average tax rate (6.36 %) of teams located in states that levy a personal income tax. The estimations reported in Table 12 remove observations of these seven teams. The results (sign and significance level) are very similar to the results reported in Table 5. The effect size, however, is bigger throughout all specifications, which can be explained by the fact that two of the four expansion teams[26], which are not as competitive and successful as the pre-existing teams, are located in the no-tax states. Thus 28.6% of the no-tax states' teams are expansion teams, while only 8% of the other teams are expansion teams. The average wins of no-tax state teams is therefore downward skewed (average wins of no-tax state teams including expansion teams is 7.80 and without expansion teams: 8.10), which explains the bigger effect size.

*[Insert Table 12 about here]*

Two of the control variables (*QBstart* and *QBexp*) represent the importance of the quarterback for the team's success. Yet, the quarterback's salary, as every other player's salary on the 53-man roster, is subject to the salary cap restrictions. Including these control variables introduces a level of

[25] Florida: Jacksonville Jaguars, Miami Dolphins, Tampa Bay Buccaneers; Tennessee: Tennessee Titans; Texas: Dallas Cowboys, Houston Texans; Washington: Seattle Seahawks.

[26] Jacksonville Jaguars (Florida); Houston Texans (Texas).

endogeneity to the model that could distort the results of the estimations. Therefore, the robustness check reported in Table 13 excludes *ceteris paribus* the quarterback variables from the model. The results remain largely unchanged. But, comparing the R-squared values of the estimations reported in Table 13 to those of Table 5 provides further evidence for the importance of the quarterback and underpins the necessity of using these control variables in the primary analysis.

*[Insert Table 13 about here]*

The theoretical analysis in section 4 and the primary analysis reported in Tables 5 and 6 relate the success of an entity to the personal income taxation of its employees. The taxation of the entity itself, the corporate income tax, is not covered. The success of the entity however could also be influenced by corporate income taxation. Additionally, state personal income tax rates are often correlated with state corporate income taxes. To test for any confounding effects caused by variations of the teams' state corporate income taxes the robustness check presented in Table 14 employs a similar model as the main analysis in Table 5 but uses the state corporate income tax rate (*CIT*) and the difference between the local CIT and the average CIT for the whole league (*CITDiff*) as explanatory tax variables. As expected the corporate income tax rate of the home state of the NFL team has no significant relation to the performance of the team measured in winning percentage.

*[Insert Table 14 about here]*

## 6. Conclusion

The results show a significant negative relation between the success (performance) of NFL teams and the personal income tax rate of the team's home state. This relation is attributable to the interaction of the very strict salary cap and the tax rate differential. Because of the existence of the salary cap high tax teams are not allowed to compensate players for the higher personal income taxes they face. Thus high tax teams are disadvantaged when pursuing the best players. Overall the average quality of the whole roster of a high tax team tends to be lower which results in diminished chances to win games.

This effect is consistent over the whole salary cap era and robust to various alternative analyses using different control variables, sub-samples and econometric models.

The results of this paper are primarily important for professional sports leagues which regulate athletes' salaries. However the empirical analysis also allows to draw inferences for the corporate world where regulations of especially directors' and top managers' salaries have been introduced to the public and political debate since the recent financial crisis. Against the backdrop of the results from the NFL one is inclined to expect negative effects on the market for managerial labor after the introduction of a mandatory maximum compensation. For the regulated entities the probability of hiring the most compatible individual for the respective position might decrease, which subsequently affects the firm's performance negatively. Similar to NFL teams, business entities that have a stronger regulatory salary restriction would thus be less successful than entities with weaker regulatory salary restrictions.

When transposing the empirical results of this study to and drawing conclusions for the corporate sector several aspects need to be considered as the professional team sports industry differs from traditional business sectors in a number of ways. First, there is a difference in professional sports between athletic and economic competition (Fort and Quirk 1995; Szymanski 2003; Dietl et al. 2011). While from an athletic perspective opposing teams are competitors, they are complementors from an economic perspective. A single team cannot produce a marketable product. It needs at least one opponent. Fans prefer to attend games with an uncertain outcome and enjoy close championship races. Unlike enterprises such as Google, Apple or Microsoft, which benefit from weak competitors in their respective industries, the professional sports teams need strong competitors to maximize their revenues. Therefore, NFL teams maintain self-imposed restrictions. This self-regulation is effective because first, the NFL focusses on a small, homogeneous geographic region and second, team composition within the league is very stable. Competition from outside the NFL is very weak and almost non-existing.

Because of the non-existence of serious outside competition, the NFL is in a unique position with respect to employment opportunities for star athletes. No American Football league outside the NFL

can compete with the league financially and with respect to public attention. Consequently, star players do not have significant outside options. Tom Brady of the New England Patriots cannot leave the NFL and join another league without suffering major income losses. Teams outside the NFL simply cannot offer the same level of compensation.[27] In contrast, an executive could easily escape compensation regulation by starting to work for a company which is not regulated (either in a different location or in a different industry). Additionally, the CEO compensation literature regularly assumes that the actual effort level of the CEO cannot be observed. The compensation is thus based more heavily on the talent level than the (perceived) effort level. In the NFL, the actual effort carried out by the player is visible and measurable. By reducing the actual effort, the player runs the risk of being released ("getting cut"). Therefore, professional athletes show lower salary elasticity than executives, and a decrease in salary does not necessarily lead to an immediate reduction in playing effort nor to an immediate exit to a foreign league.

Therefore, the negative relation between payment restrictions (interaction between salary cap and tax rate) and performance of the regulated entity would be even stronger in settings where income elasticities are higher and competition from outside the regulated industry sector and/or geographical region is more profound.

[27] According to Forbes.com (https://www.forbes.com/profile/tom-brady/ (October 23, 2017)) Tom Brady earned USD 44 million in 2016, of which USD 29 million (66%) were salaries paid by his team.

## Table 1 – Definition of Variables

| Variable | Description | Source |
|---|---|---|
| StateTax | State personal income tax rate of the home state of the respective team | NBER |
| TaxDiff | Difference between applicable state personal income tax and the average of all teams' state personal income tax rates in a respective season. | NBER (own calculation) |
| WinningPercentage | Percentage of games won per season: $\frac{number\ of\ wins}{number\ of\ games\ played}$ (with a tie being counted as 0.5 win) | www.pro-football-reference.com/ |
| LagWins | Number of wins in the previous season (with a tie being counted as 0.5 win) | www.pro-football-reference.com/ |
| 5yearWins | Number of wins in the previous five seasons (with a tie being counted as 0.5 win) | www.pro-football-reference.com/ |
| QBstart | Number of Quarterbacks starting a game during the season | www.pro-football-reference.com/ |
| QBexp | Years of experience of the Quarterback who starts the majority of games during the season | www.pro-football-reference.com/ |
| CoachTenure | Years of experience of the head coach with the respective team | www.pro-football-reference.com/ |
| Division | Indicator variable of the division of the team | www.pro-football-reference.com/ |

## Table 2 – NFL Teams (1994-2016)

Table 2 reports descriptive statistics on each NFL team during the observation period (1994-2016). "Wins" include all wins in a regular season game with a tie being counted as 0.5 wins. "Playoffs" counts the number of overall playoff appearances per team. Average Tax Rate is the average of the state personal income tax applicable in the respective year. The teams "Carolina Panthers", "Jacksonville Jaguars", "Cleveland Browns" and "Houston Texans" were newly established, the teams "Baltimore Ravens", "Los Angeles Rams", "Tennessee Titans" relocated during the observation period.

| Team | State | Average Tax Rate | Games (Total) | Wins (Total) | Average Wins (season) | Winning Percentage (Total) | Playoffs | Super Bowl | Super Bowl (Wins) | Sample Period |
|---|---|---|---|---|---|---|---|---|---|---|
| Arizona Cardinals | AZ | 4.80 | 368 | 159.5 | 6.93 | 0.433 | 5 | 1 | 0 | 1994-2016 |
| Atlanta Falcons | GA | 6.14 | 368 | 185.5 | 8.07 | 0.504 | 9 | 2 | 0 | 1994-2016 |
| Baltimore Ravens | MD | 5.56 | 368 | 197.5 | 8.59 | 0.537 | 11 | 2 | 2 | 1994-2016 |
| Buffalo Bills | NY | 7.36 | 368 | 166 | 7.22 | 0.451 | 4 | 0 | 0 | 1994-2016 |
| Carolina Panthers | NC | 7.80 | 352 | 172.5 | 7.84 | 0.490 | 7 | 2 | 0 | 1995-2016 |
| Chicago Bears | IL | 3.41 | 368 | 171 | 7.43 | 0.465 | 5 | 1 | 0 | 1994-2016 |
| Cincinnati Bengals | OH | 6.62 | 368 | 163.5 | 7.11 | 0.444 | 7 | 0 | 0 | 1994-2016 |
| Cleveland Browns | OH | 6.45 | 288 | 88 | 4.89 | 0.306 | 1 | 0 | 0 | 1999-2016 |
| Dallas Cowboys | TX | 0.00 | 368 | 199 | 8.65 | 0.541 | 11 | 1 | 1 | 1994-2016 |
| Denver Broncos | CO | 4.83 | 368 | 224 | 9.74 | 0.609 | 13 | 4 | 3 | 1994-2016 |
| Detroit Lions | MI | 4.24 | 368 | 142 | 6.17 | 0.386 | 7 | 0 | 0 | 1994-2016 |
| Green Bay Packers | WI | 7.11 | 368 | 236.5 | 10.28 | 0.643 | 18 | 3 | 2 | 1994-2016 |
| Houston Texans | TX | 0.00 | 240 | 106 | 7.07 | 0.442 | 4 | 0 | 0 | 2002-2016 |
| Indianapolis Colts | IN | 3.39 | 368 | 221 | 9.61 | 0.601 | 16 | 2 | 1 | 1994-2016 |
| Jacksonville Jaguars | FL | 0.00 | 352 | 155 | 7.05 | 0.440 | 6 | 0 | 0 | 1995-2016 |
| Kansas City Chiefs | MO | 6.04 | 368 | 192 | 8.35 | 0.522 | 9 | 0 | 0 | 1994-2016 |
| Los Angeles Rams | CA | 6.38 | 368 | 159.5 | 6.93 | 0.433 | 5 | 2 | 1 | 1994-2016 |
| Miami Dolphins | FL | 0.00 | 368 | 186 | 8.09 | 0.505 | 9 | 0 | 0 | 1994-2016 |
| Minnesota Vikings | MN | 8.58 | 368 | 195.5 | 8.50 | 0.531 | 11 | 0 | 0 | 1994-2016 |
| New England Patriots | MA | 5.48 | 368 | 255 | 11.09 | 0.693 | 18 | 8 | 5 | 1994-2016 |
| New Orleans Saints | LA | 3.71 | 368 | 178 | 7.74 | 0.484 | 6 | 1 | 1 | 1994-2016 |
| New York Giants | NJ | 7.94 | 368 | 191.5 | 8.33 | 0.520 | 9 | 3 | 2 | 1994-2016 |
| New York Jets | NJ | 7.94 | 368 | 171 | 7.43 | 0.465 | 7 | 0 | 0 | 1994-2016 |
| Oakland Raiders | CA | 11.28 | 368 | 152 | 6.61 | 0.413 | 4 | 1 | 0 | 1994-2016 |
| Philadelphia Eagles | PA | 2.95 | 368 | 201 | 8.74 | 0.546 | 12 | 1 | 0 | 1994-2016 |
| Pittsburgh Steelers | PA | 2.95 | 368 | 232.5 | 10.11 | 0.632 | 14 | 5 | 2 | 1994-2016 |
| San Diego Chargers | CA | 11.28 | 368 | 181 | 7.87 | 0.492 | 8 | 0 | 0 | 1994-2016 |
| San Francisco 49ers | CA | 11.28 | 368 | 181.5 | 7.89 | 0.493 | 10 | 2 | 1 | 1994-2016 |
| Seattle Seahawks | WA | 0.00 | 368 | 198.5 | 8.63 | 0.539 | 12 | 3 | 1 | 1994-2016 |
| Tampa Bay Buccaneers | FL | 0.00 | 368 | 169 | 7.35 | 0.459 | 7 | 1 | 1 | 1994-2016 |
| Tennessee Titans | TN | 0.00 | 368 | 179 | 7.78 | 0.486 | 6 | 1 | 0 | 1994-2016 |
| Washington Redskins | MD | 5.39 | 368 | 158 | 6.87 | 0.429 | 5 | 0 | 0 | 1994-2016 |
| Average | | 4.97 | 360.50 | 180.25 | 7.97 | 0.498 | 8.63 | 1.44 | 0.72 | |
| Median | | 5.44 | 368.00 | 180.00 | 7.86 | 0.491 | 7.50 | 1.00 | 0.00 | |
| Min | | 0.00 | 240.00 | 88.00 | 4.89 | 0.306 | 1.00 | 0.00 | 0.00 | |
| Max | | 11.28 | 368.00 | 255.00 | 11.09 | 0.693 | 18.00 | 8.00 | 5.00 | |

## Table 3 – Descriptive Statistics

Table 3 reports descriptive statistics for 1994-2016; for a description of the variables, see Table 1.

| Variable | Mean | Std. dev. | Min | 25th perc. | Median | 75th perc. | Max | Obs |
|---|---|---|---|---|---|---|---|---|
| Wins | 8 | 3.040 | 0 | 6 | 8 | 10 | 16 | 721 |
| WinningPercentage | 0.5 | 0.190 | 0 | 0.375 | 0.5 | 0.625 | 1 | 721 |
| StateTax | 5.014 | 3.465 | 0 | 3.0 | 5.150 | 6.890 | 14.1 | 721 |
| TaxDiff | 0.0 | 3.459 | -5.337 | -2.038 | 0.146 | 2.026 | 8.913 | 721 |
| QBstart | 1.688 | 0.775 | 1 | 1 | 2 | 2 | 4 | 721 |
| QBexp | 5.535 | 4.055 | 0 | 2 | 5 | 8 | 20 | 721 |
| CoachTenure | 3.115 | 3.603 | 0 | 1 | 2 | 4 | 26 | 721 |

## Table 4 – State Personal Income Tax Rates (2016)

Table 4 reports state personal income taxes for each NFL team for 2016 comparing teams that made the playoffs (playoff teams) and teams that did not make the playoffs (non-playoff teams).

| **Playoff-Teams** | **State** | **Tax Rate** | **Non-Playoff-Teams** | **State** | **Tax Rate** |
|---|---|---|---|---|---|
| Miami Dolphins | FL | 0.00% | Buffalo Bills | NY | 6.89% |
| New England Patriots | MA | 5.15% | New York Jets | NJ | 8.97% |
| Pittsburgh Steelers | PA | 3.07% | Baltimore Ravens | MD | 5.83% |
| Houston Texans | TX | 0.00% | Cincinnati Bengals | OH | 5.00% |
| Kansas City Chiefs | MO | 6.08% | Cleveland Browns | OH | 5.00% |
| Oakland Raiders | CA | 14.10% | Indianapolis Colts | IN | 3.30% |
| Dallas Cowboys | TX | 0.00% | Jacksonville Jaguars | FL | 0.00% |
| New York Giants | NJ | 8.97% | Tennessee Titans | TN | 0.00% |
| Detroit Lions | MI | 4.25% | Denver Broncos | CO | 4.77% |
| Green Bay Packers | WI | 7.65% | San Diego Chargers | CA | 14.10% |
| Atlanta Falcons | GA | 6.18% | Philadelphia Eagles | PA | 3.07% |
| Seattle Seahawks | WA | 0.00% | Washington Redskins | MD | 5.83% |
| | | | Chicago Bears | IL | 3.75% |
| | | | Minnesota Vikings | MN | 10.15% |
| | | | Carolina Panthers | NC | 5.75% |
| | | | New Orleans Saints | LA | 3.60% |
| | | | Tampa Bay Buccaneers | FL | 0.00% |
| | | | Arizona Cardinals | AZ | 4.34% |
| | | | Los Angeles Rams | CA | 14.10% |
| | | | San Francisco 49ers | CA | 14.10% |
| **Average** | | **4.62%** | **Average** | | **5.93%** |

## Table 5 – Fixed effects regression results (winning percentage)

Table 5 reports results of the fixed effects panel regression over the period 1994-2016. The dependent variable is WinningPercentage. The variables are defined in Table 1. Robust standard errors are in parentheses; year-fixed effects are included. Coefficients significant at the 10%, 5% and 1% levels are marked with *, ** and ***, respectively.

| | exp. sign | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|---|
| StateTax | - | -0.0124** | -0.0123* | -0.0183** | | | |
| | | (0.0058) | (0.0062) | (0.0069) | | | |
| TaxDiff | - | | | | -0.0114* | -0.0108* | -0.0168** |
| | | | | | (0.0066) | (0.0070) | (0.0074) |
| LagWins | | | -0.0064** | | | -0.0064** | |
| | | | (0.0027) | | | (0.0027) | |
| 5yearWins | | | | -0.0216*** | | | -0.0215*** |
| | | | | (0.0068) | | | (0.0068) |
| QBstart | | -0.0829*** | -0.0842*** | -0.0972*** | -0.0827*** | -0.0839*** | -0.0968*** |
| | | (0.0111) | (0.0113) | (0.0114) | (0.0111) | (0.0112) | (0.0113) |
| QBexp | | 0.0038* | 0.0034* | 0.0025 | 0.0038* | 0.0033* | 0.0025 |
| | | (0.0020) | (0.0019) | (0.0020) | (0.0020) | (0.0020) | (0.0020) |
| CoachTenure | | 0.0054** | 0.0053** | 0.0044 | 0.0053** | 0.0053** | 0.0044 |
| | | (0.0022) | (0.0024) | (0.0030) | (0.0022) | (0.0024) | (0.0030) |
| Division | | 0.0000 | 0.0002 | -0.0005 | 0.0002 | 0.0005 | -0.0001 |
| | | (0.0018) | (0.0020) | (0.0029) | (0.0018) | (0.0019) | (0.0029) |
| Constant | | 0.6641*** | 0.7186*** | 0.9053*** | 0.6003*** | 0.6547*** | 0.8096*** |
| | | (0.0472) | (0.0590) | (0.0662) | (0.0282) | (0.0356) | (0.0546) |
| *N* | | 721 | 689 | 561 | 721 | 689 | 561 |
| r2 | | 0.1325 | 0.1489 | 0.1861 | 0.1319 | 0.1480 | 0.1845 |

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

## Table 6 – Interaction Salary Cap and Tax Rates

Table 6 reports results of a fixed effects panel regression over the period 1984 to 2003. The dependent variable is WinningPercentage (Specifications (1) and (3)) and Wins (Specifications (2) and (4)). The variables of main interest is the interaction between SalaryCap (an indicator variable taking on the value 1 for years with the salary cap in place and 0 otherwise) and StateTax (Specifications (1) and (2)) and TaxDiff (Specifications (3) and (4)) respectively. The other variables are defined in Table 1. Robust standard errors are in parentheses; year-fixed effects are included. Coefficients significant at the 10%, 5% and 1% levels are marked with *, ** and ***, respectively.

| | exp. sign | State Tax | | Tax Diff | |
|---|---|---|---|---|---|
| | | (1) PERCENTAGE | (2) WINS | (3) PERCENTAGE | (4) WINS |
| SalaryCap#Tax | | | | | |
| SalaryCap 0#Tax | non sig | -0.0151 | -0.2454 | -0.0152 | -0.2454 |
| | | (0.0098) | (0.1568) | (0.0098) | (0.1568) |
| SalaryCap 1#Tax | - | -0.0224** | -0.3637** | -0.0226** | -0.3638** |
| | | (0.0114) | (0.1825) | (0.0114) | (0.1825) |
| QBstart | | -0.0651*** | -1.0368*** | -0.0651*** | -1.0369*** |
| | | (0.0104) | (0.1658) | (0.0104) | (0.1658) |
| QBexp | | 0.0042** | 0.0679** | 0.0042** | 0.0678** |
| | | (0.0021) | (0.0329) | (0.0021) | (0.0329) |
| CoachTenure | | 0.0024 | 0.0381 | 0.0024 | 0.0380 |
| | | (0.0031) | (0.0501) | (0.0031) | (0.0502) |
| Division | | 0.0002 | 0.0037 | 0.0002 | 0.0033 |
| | | (0.0154) | (0.2469) | (0.0154) | (0.2469) |
| Constant | | 0.6931*** | 11.0889*** | 0.6164*** | 9.8544*** |
| | | (0.1934) | (3.0930) | (0.1796) | (2.8732) |
| *N* | | 560 | 560 | 560 | 560 |
| r2 | | 0.2315 | 0.2324 | 0.2317 | 0.2326 |

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

## Table 7 – Postseason (winning percentage)

Table 7 reports results of the fixed effects panel regression over the period 1994-2016 for the winning percentage of the postseason. The dependent variable is winning percentage. The variables are defined in Table 1. Robust standard errors are in parentheses. Coefficients significant at the 10%, 5% and 1% levels are marked with *, ** and ***, respectively.

| | exp sign | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|---|
| StateTax | - | -0.0016 | -0.0032 | -0.0091 | | | |
| | | (0.0111) | (0.0105) | (0.0141) | | | |
| TaxDiff | - | | | | -0.0009 | -0.0023 | -0.0081 |
| | | | | | (0.0110) | (0.0107) | (0.0143) |
| LagWins | | | -0.0033 | | | -0.0033 | |
| | | | (0.0041) | | | (0.0041) | |
| 5yearWins | | | | -0.0285** | | | -0.0284** |
| | | | | (0.0130) | | | (0.0130) |
| QBstart | | -0.0625*** | -0.0616*** | -0.0637*** | -0.0625*** | -0.0615*** | -0.0635*** |
| | | (0.0174) | (0.0176) | (0.0197) | (0.0173) | (0.0176) | (0.0196) |
| QBexp | | 0.0056 | 0.0055 | 0.0048 | 0.0056 | 0.0055 | 0.0048 |
| | | (0.0044) | (0.0044) | (0.0041) | (0.0045) | (0.0044) | (0.0041) |
| Coach | | 0.0062 | 0.0047 | 0.0034 | 0.0062 | 0.0047 | 0.0034 |
| Tenure | | (0.0044) | (0.0047) | (0.0053) | (0.0043) | (0.0047) | (0.0053) |
| Division | | 0.0024 | 0.0021 | 0.0017 | 0.0024 | 0.0022 | 0.0019 |
| | | (0.0022) | (0.0022) | (0.0039) | (0.0022) | (0.0022) | (0.0039) |
| Constant | | 0.2069** | 0.2467** | 0.4945*** | 0.1986*** | 0.2301*** | 0.4465*** |
| | | (0.0782) | (0.0918) | (0.1480) | (0.0412) | (0.0526) | (0.1201) |
| *N* | | 721 | 689 | 561 | 721 | 689 | 561 |
| r2 | | -57.8174 | -54.6647 | -34.9703 | -57.8227 | -54.6800 | -35.0284 |

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

## Table 8 – Random effects regression (winning percentage)

Table 8 reports results of the random effects panel regression over the period 1994-2016. The dependent variable is winning percentage. The variables are defined in Table 1. Robust standard errors are in parentheses. Coefficients significant at the 10%, 5% and 1% levels are marked with *, ** and ***, respectively.

| | exp. sign | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|---|
| StateTax | - | -0.0037* | -0.0036* | -0.0055** | | | |
| | | (0.0023) | (0.0022) | (0.0026) | | | |
| TaxDiff | - | | | | -0.0036 | -0.0034* | -0.0053** |
| | | | | | (0.0024) | (0.0022) | (0.0027) |
| LagWins | | | -0.0070*** | | | -0.0070*** | |
| | | | (0.0022) | | | (0.0022) | |
| 5yearWins | | | | -0.0210*** | | | -0.0209*** |
| | | | | (0.0068) | | | (0.0068) |
| QBstart | | -0.0830*** | -0.0841*** | -0.0968*** | -0.0830*** | -0.0840*** | -0.0966*** |
| | | (0.0101) | (0.0101) | (0.0102) | (0.0101) | (0.0101) | (0.0102) |
| QBexp | | 0.0048** | 0.0044** | 0.0034* | 0.0048** | 0.0044** | 0.0034* |
| | | (0.0020) | (0.0019) | (0.0020) | (0.0020) | (0.0019) | (0.0020) |
| CoachTenure | | 0.0074*** | 0.0079*** | 0.0085*** | 0.0074*** | 0.0079*** | 0.0085*** |
| | | (0.0024) | (0.0025) | (0.0028) | (0.0024) | (0.0025) | (0.0028) |
| Division | | 0.0010 | 0.0011 | 0.0009 | 0.0010 | 0.0011 | 0.0010 |
| | | (0.0016) | (0.0018) | (0.0026) | (0.0016) | (0.0018) | (0.0026) |
| Constant | | 0.6011*** | 0.6593*** | 0.8083*** | 0.5820*** | 0.6410*** | 0.7797*** |
| | | (0.0366) | (0.0400) | (0.0700) | (0.0298) | (0.0342) | (0.0651) |
| *N* | | 721 | 689 | 561 | 721 | 689 | 561 |
| r2 (overall) | | 0.1733 | 0.1948 | 0.1732 | 0.1946 | 0.1936 | 0.2379 |

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

## Table 9 – Poisson Regression & Negative Binomial Regression

Table 9 reports results of the fixed effects Poisson panel regression (Panel A) and of the fixed effects Negative Binomial Regression (Panel B) over the period 1994-2016. The dependent variable is number of wins. The variables are defined in Table 1. Robust standard errors are in parentheses. Coefficients significant at the 10%, 5% and 1% levels are marked with *, ** and ***, respectively.

| Panel A – Poisson Regression – number of wins | | | | | | | |
|---|---|---|---|---|---|---|---|
| | exp sign | (1) | (2) | (3) | (4) | (5) | (6) |
| StateTax | - | -0.0255** | -0.0244* | -0.0376** | | | |
| | | (0.0129) | (0.0135) | (0.0158) | | | |
| TaxDiff | - | | | | -0.0232** | -0.0209** | -0.0345** |
| | | | | | (0.0148) | (0.0154) | (0.0168) |
| LagWins | | | -0.0120** | | | -0.0121** | |
| | | | (0.0054) | | | (0.0054) | |
| 5yearWins | | | | -0.0424*** | | | -0.0422*** |
| | | | | (0.0133) | | | (0.0133) |
| QBstart | | -0.1772*** | -0.1797*** | -0.2097*** | -0.1768*** | -0.1792*** | -0.2090*** |
| | | (0.0252) | (0.0260) | (0.0276) | (0.0251) | (0.0259) | (0.0275) |
| QBexp | | 0.0079** | 0.0068* | 0.0050 | 0.0078** | 0.0067* | 0.0049 |
| | | (0.0037) | (0.0037) | (0.0038) | (0.0037) | (0.0037) | (0.0038) |
| Coach | | 0.0095** | 0.0096** | 0.0081 | 0.0095** | 0.0096** | 0.0080 |
| Tenure | | (0.0039) | (0.0042) | (0.0054) | (0.0039) | (0.0042) | (0.0054) |
| Division | | 0.0005 | 0.0010 | -0.0005 | 0.0008 | 0.0015 | 0.0003 |
| | | (0.0035) | (0.0039) | (0.0057) | (0.0034) | (0.0038) | (0.0056) |
| *N* | | 721 | 689 | 561 | 721 | 689 | 561 |
| ll | | -1612.1347 | -1531.5083 | -1214.3827 | -1612.3695 | -1531.7863 | -1214.7646 |

| Panel B – Negative Binomial Regression – number of wins | | | | | | | |
|---|---|---|---|---|---|---|---|
| | exp sign | (1) | (2) | (3) | (4) | (5) | (6) |
| StateTax | - | -0.0255* | -0.0244* | -0.0376** | | | |
| | | (0.0178) | (0.0182) | (0.0200) | | | |
| TaxDiff | - | | | | -0.0232* | -0.0209* | -0.0345** |
| | | | | | (0.0183) | (0.0187) | (0.0206) |
| LagWins | | | -0.0120** | | | -0.0121** | |
| | | | (0.0048) | | | (0.0048) | |
| 5yearWins | | | | -0.0424*** | | | -0.0422*** |
| | | | | (0.0136) | | | (0.0136) |
| QBstart | | -0.1772*** | -0.1797*** | -0.2097*** | -0.1768*** | -0.1792*** | -0.2090*** |
| | | (0.0201) | (0.0207) | (0.0236) | (0.0201) | (0.0207) | (0.0236) |
| QBexp | | 0.0079** | 0.0068* | 0.0050 | 0.0078** | 0.0067* | 0.0049 |
| | | (0.0035) | (0.0035) | (0.0040) | (0.0035) | (0.0036) | (0.0040) |
| Coach | | 0.0095** | 0.0096** | 0.0081 | 0.0095** | 0.0096** | 0.0080 |
| Tenure | | (0.0041) | (0.0044) | (0.0054) | (0.0041) | (0.0044) | (0.0054) |
| Division | | 0.0005 | 0.0010 | -0.0005 | 0.0008 | 0.0015 | 0.0003 |
| | | (0.0032) | (0.0034) | (0.0048) | (0.0032) | (0.0033) | (0.0047) |
| *N* | | 721 | 689 | 561 | 721 | 689 | 561 |
| ll | | -1612.1347 | -1531.5083 | -1214.3827 | -1612.3694 | -1531.7862 | -1214.7646 |

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

## Table 10 – Robustness Checks (StateTax)

Table 10 reports results of the fixed effects panel regression over the period 1994-2016 for four different sub-samples: specifications (1)-(3) exclude teams that did not play throughout the whole observation period (expansion teams); specifications (4)-(6) exclude observations regarding the most successful team throughout the whole observation period (New England Patriots); specifications (7)-(9) exclude observations regarding the least successful team throughout the whole observation period (Cleveland Browns); and specifications (10)-(12) exclude observations regarding both the most and the least successful team. The dependent variable is winning percentage. The variables are defined in Table 1. Robust standard errors are in parentheses; year–fixed effects are included. Coefficients significant at the 10%, 5% and 1% levels are marked with *, ** and ***, respectively.

| | exp. | without expansion teams | | | without best team (New England) | | | without worst team (Cleveland) | | | without best and worst team | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | sign | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| StateTax | - | -0.0146** | -0.0157** | -0.0188** | -0.0109* | -0.0109 | -0.0169** | -0.0132** | -0.0134** | -0.0192** | -0.0116* | -0.0118* | -0.0178** |
| | | (0.0059) | (0.0063) | (0.0072) | (0.0060) | (0.0065) | (0.0071) | (0.0060) | (0.0063) | (0.0070) | (0.0062) | (0.0066) | (0.0072) |
| LagWins | | | -0.0072** | | | -0.0057** | | | -0.0062** | | | -0.0055* | |
| | | | (0.0029) | | | (0.0027) | | | (0.0028) | | | (0.0028) | |
| 5yearWins | | | | -0.0180** | | | -0.02*** | | | -0.0208*** | | | -0.0195** |
| | | | | (0.0074) | | | (0.0071) | | | (0.0068) | | | (0.0071) |
| QBstart | | -0.0796*** | -0.081*** | -0.0966*** | -0.084*** | -0.086*** | -0.099*** | -0.0827*** | -0.0837*** | -0.0976*** | -0.0841*** | -0.0854*** | -0.1003*** |
| | | (0.0120) | (0.0120) | (0.0124) | (0.0113) | (0.0114) | (0.0114) | (0.0114) | (0.0116) | (0.0116) | (0.0115) | (0.0117) | (0.0116) |
| QBexp | | 0.0040* | 0.0035 | 0.0022 | 0.0037* | 0.0033 | 0.0025 | 0.0039* | 0.0034* | 0.0026 | 0.0038* | 0.0033 | 0.0026 |
| | | (0.0022) | (0.0021) | (0.0023) | (0.0020) | (0.0020) | (0.0021) | (0.0020) | (0.0020) | (0.0020) | (0.0020) | (0.0020) | (0.0021) |
| Coach | | 0.0048** | 0.0047* | 0.0043 | 0.0042* | 0.0041* | 0.0032 | 0.0053** | 0.0052** | 0.0042 | 0.0041* | 0.0040 | 0.0029 |
| Tenure | | (0.0022) | (0.0024) | (0.0031) | (0.0021) | (0.0024) | (0.0030) | (0.0022) | (0.0024) | (0.0030) | (0.0021) | (0.0024) | (0.0031) |
| Division | | -0.0001 | 0.0001 | -0.0006 | 0.0006 | 0.0008 | 0.0003 | 0.0002 | 0.0002 | -0.0005 | 0.0008 | 0.0009 | 0.0002 |
| | | (0.0020) | (0.0022) | (0.0032) | (0.0018) | (0.0020) | (0.0029) | (0.0018) | (0.0020) | (0.0029) | (0.0018) | (0.0020) | (0.0029) |
| Constant | | 0.6747*** | 0.739*** | 0.8828*** | 0.654*** | 0.705*** | 0.887*** | 0.6691*** | 0.7233*** | 0.9061*** | 0.6588*** | 0.7092*** | 0.8875*** |
| | | (0.0492) | (0.0600) | (0.0692) | (0.0490) | (0.0615) | (0.0688) | (0.0482) | (0.0597) | (0.0666) | (0.0501) | (0.0622) | (0.0692) |
| *N* | | 634 | 606 | 494 | 698 | 667 | 543 | 703 | 672 | 548 | 680 | 650 | 530 |
| r2 | | 250.3723 | 246.3100 | 213.8616 | 0.1312 | 0.1463 | 0.1893 | 0.1320 | 0.1472 | 0.1856 | 0.1308 | 0.1447 | 0.1891 |

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

## Table 11 – Robustness Checks (TaxDiff)

Table 11 reports results of the fixed effects panel regression over the period 1994-2016 for four different sub-samples: specifications (1)-(3) exclude teams that did not play throughout the whole observation period (expansion teams); specifications (4)-(6) exclude observations regarding the most successful team throughout the whole observation period (New England Patriots); specifications (7)-(9) exclude observations regarding the least successful team throughout the whole observation period (Cleveland Browns); and specifications (10)-(12) exclude observations regarding both the most and the least successful team. The dependent variable is winning percentage. The variables are defined in Table 1. Robust standard errors are in parentheses; year-fixed effects are included. Coefficients significant at the 10%, 5% and 1% levels are marked with *, ** and ***, respectively.

| | exp. | without expansion teams | | | without best team (New England) | | | without worst team (Cleveland) | | | without best and worst team | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | sign | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| TaxDiff | - | -0.0146** | -0.0151** | -0.0179** | -0.0100 | -0.0095 | -0.0155* | -0.0128* | -0.0124* | -0.0183** | -0.0113 | -0.0111 | -0.0169** |
| | | (0.0066) | (0.0070) | (0.0077) | (0.0070) | (0.0074) | (0.0077) | (0.0068) | (0.0071) | (0.0075) | (0.0072) | (0.0075) | (0.0078) |
| LagWins | | | -0.0072** | | | -0.0057** | | | -0.0062** | | | -0.0055* | |
| | | | (0.0029) | | | (0.0027) | | | (0.0028) | | | (0.0028) | |
| 5yearWins | | | | -0.0179** | | | -0.0202*** | | | -0.0207*** | | | -0.0193** |
| | | | | (0.0074) | | | (0.0071) | | | (0.0068) | | | (0.0071) |
| QBstart | | -0.0792*** | -0.0803*** | -0.0961*** | -0.0840*** | -0.0855*** | -0.0994*** | -0.0824*** | -0.0833*** | -0.0972*** | -0.0839*** | -0.0851*** | -0.0998*** |
| | | (0.0119) | (0.0119) | (0.0124) | (0.0112) | (0.0113) | (0.0113) | (0.0114) | (0.0115) | (0.0116) | (0.0115) | (0.0116) | (0.0115) |
| QBexp | | 0.0039* | 0.0035 | 0.0022 | 0.0037* | 0.0033 | 0.0025 | 0.0038* | 0.0034* | 0.0025 | 0.0037* | 0.0033 | 0.0026 |
| | | (0.0022) | (0.0021) | (0.0023) | (0.0020) | (0.0020) | (0.0021) | (0.0020) | (0.0020) | (0.0021) | (0.0020) | (0.0020) | (0.0021) |
| Coach | | 0.0047** | 0.0046* | 0.0043 | 0.0042* | 0.0040* | 0.0032 | 0.0052** | 0.0052** | 0.0042 | 0.0041* | 0.0039 | 0.0029 |
| Tenure | | (0.0022) | (0.0024) | (0.0031) | (0.0021) | (0.0024) | (0.0031) | (0.0022) | (0.0024) | (0.0030) | (0.0021) | (0.0023) | (0.0031) |
| Division | | 0.0001 | 0.0004 | -0.0003 | 0.0008 | 0.0010 | 0.0006 | 0.0003 | 0.0005 | -0.0002 | 0.0009 | 0.0011 | 0.0006 |
| | | (0.0020) | (0.0022) | (0.0032) | (0.0017) | (0.0019) | (0.0029) | (0.0018) | (0.0020) | (0.0029) | (0.0018) | (0.0020) | (0.0029) |
| Constant | | 0.6002*** | 0.6590*** | 0.7848*** | 0.5982*** | 0.6485*** | 0.7983*** | 0.6014*** | 0.6542*** | 0.8060*** | 0.5992*** | 0.6478*** | 0.7942*** |
| | | (0.0304) | (0.0375) | (0.0574) | (0.0290) | (0.0367) | (0.0573) | (0.0286) | (0.0359) | (0.0547) | (0.0295) | (0.0370) | (0.0574) |
| *N* | | 634 | 606 | 494 | 698 | 667 | 543 | 703 | 672 | 548 | 680 | 650 | 530 |
| r2 | | 250.2699 | 246.0743 | 213.4880 | 0.1306 | 0.1457 | 0.1880 | 0.1316 | 0.1465 | 0.1843 | 0.1304 | 0.1442 | 0.1879 |

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

## Table 12 – Robustness Check – Without teams in states with no personal income tax

Table 12 reports results of the fixed effects panel regression over the period 1994-2016 for a sub-sample excluding teams that are located in states that do not apply a personal income tax (Florida, Tennessee, Texas, Washington = total of seven teams and 152 team-year observations). The dependent variable is winning percentage. The variables are defined in Table 1. Robust standard errors are in parentheses; year-fixed effects are included. Coefficients significant at the 10%, 5% and 1% levels are marked with *, ** and ***, respectively.

| | exp. sign | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|---|
| StateTax | - | -0.0143** | -0.0148** | -0.0211*** | | | |
| | | (0.0057) | (0.0060) | (0.0070) | | | |
| TaxDiff | - | | | | -0.0151** | -0.0151** | -0.0223*** |
| | | | | | (0.0060) | (0.0065) | (0.0072) |
| LagWins | | | -0.0070** | | | -0.0070** | |
| | | | (0.0034) | | | (0.0034) | |
| 5yearWins | | | | -0.0247*** | | | -0.0247*** |
| | | | | (0.0079) | | | (0.0079) |
| QBstart | | -0.0886*** | -0.0899*** | -0.0980*** | -0.0884*** | -0.0896*** | -0.0976*** |
| | | (0.0102) | (0.0106) | (0.0111) | (0.0101) | (0.0105) | (0.0110) |
| QBexp | | 0.0035 | 0.0029 | 0.0025 | 0.0034 | 0.0029 | 0.0023 |
| | | (0.0023) | (0.0023) | (0.0021) | (0.0023) | (0.0023) | (0.0021) |
| CoachTenure | | 0.0047 | 0.0048 | 0.0024 | 0.0046 | 0.0047 | 0.0022 |
| | | (0.0030) | (0.0031) | (0.0033) | (0.0030) | (0.0030) | (0.0033) |
| Division | | -0.0017 | -0.0019 | -0.0033 | -0.0016 | -0.0017 | -0.0031 |
| | | (0.0020) | (0.0021) | (0.0031) | (0.0019) | (0.0021) | (0.0031) |
| Constant | | 0.7198*** | 0.7852*** | 0.9978*** | 0.6486*** | 0.7101*** | 0.8927*** |
| | | (0.0542) | (0.0696) | (0.0780) | (0.0310) | (0.0446) | (0.0609) |
| *N* | | 569 | 544 | 444 | 569 | 544 | 444 |
| r2 | | 0.1445 | 0.1654 | 0.1966 | 0.1446 | 0.1652 | 0.1968 |

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

## Table 13 – Robustness Check – Without Quarterbacks

Table 13 reports results of the fixed effects panel regression over the period 1994-2016. The variables controlling for the position of Quarterback are excluded. The dependent variable is winning percentage. The variables are defined in Table 1. Robust standard errors are in parentheses; year-fixed effects are included. Coefficients significant at the 10%, 5% and 1% levels are marked with *, ** and ***, respectively.

| | exp. sign | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|---|
| StateTax | - | -0.0107* | -0.0097* | -0.0172** | | | |
| | | (0.0059) | (0.0065) | (0.0073) | | | |
| TaxDiff | - | | | | -0.0110* | -0.0099* | -0.0178** |
| | | | | | (0.0071) | (0.0077) | (0.0082) |
| LagWins | | | -0.0084*** | | | -0.0108*** | |
| | | | (0.0030) | | | (0.0030) | |
| 5yearWins | | | | -0.0244*** | | | -0.0243*** |
| | | | | (0.0080) | | | (0.0080) |
| CoachTenure | | 0.0060** | 0.0056** | 0.0047 | 0.0060** | 0.0056** | 0.0046 |
| | | (0.0024) | (0.0027) | (0.0030) | (0.0024) | (0.0026) | (0.0030) |
| Division | | -0.0005 | -0.0002 | -0.0012 | -0.0004 | -0.0000 | -0.0009 |
| | | (0.0022) | (0.0024) | (0.0034) | (0.0022) | (0.0024) | (0.0033) |
| Constant | | 0.5388*** | 0.6012*** | 0.7768*** | 0.4841*** | 0.5513*** | 0.6882*** |
| | | (0.0387) | (0.0544) | (0.0745) | (0.0201) | (0.0326) | (0.0595) |
| *N* | | 721 | 689 | 561 | 721 | 689 | 561 |
| r2 | | 0.0149 | 0.0306 | 0.0341 | 0.0148 | 0.0305 | 0.0341 |

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

## Table 14 – Robustness Check – Corporate Income Tax

Table 14 reports results of the fixed effects panel regression over the period 1994-2016. The dependent variable is winning percentage. The variables of main interest are CIT (state corporate income tax) in specifications (1)-(3) and CITDiff (Difference between applicable state corporate income tax and the average of all teams' state corporate income tax rates in a respective season) in specifications (4)-(6). The other variables are defined in Table 1. Robust standard errors are in parentheses; year-fixed effects are included. Coefficients significant at the 10%, 5% and 1% levels are marked with *, ** and ***, respectively.

| | exp. sign | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|---|
| CIT | non sig | 0.0004 | -0.0006 | -0.0043 | | | |
| | | (0.0062) | (0.0065) | (0.0066) | | | |
| CITDiff | non sig | | | | 0.0001 | -0.0009 | -0.0050 |
| | | | | | (0.0062) | (0.0065) | (0.0066) |
| LagWins | | | -0.0065** | | | -0.0065** | |
| | | | (0.0027) | | | (0.0027) | |
| 5yearWins | | | | -0.0208*** | | | -0.0208*** |
| | | | | (0.0070) | | | (0.0070) |
| QBstart | | -0.0825*** | -0.0837*** | -0.0968*** | -0.0825*** | -0.0837*** | -0.0968*** |
| | | (0.0110) | (0.0112) | (0.0113) | (0.0110) | (0.0111) | (0.0113) |
| QBexp | | 0.0039* | 0.0034* | 0.0027 | 0.0039* | 0.0034* | 0.0027 |
| | | (0.0020) | (0.0020) | (0.0021) | (0.0020) | (0.0020) | (0.0021) |
| CoachTenure | | 0.0055** | 0.0055** | 0.0045 | 0.0055** | 0.0055** | 0.0044 |
| | | (0.0023) | (0.0024) | (0.0030) | (0.0023) | (0.0024) | (0.0030) |
| Division | | 0.0004 | 0.0007 | 0.0004 | 0.0004 | 0.0006 | 0.0002 |
| | | (0.0017) | (0.0019) | (0.0028) | (0.0018) | (0.0019) | (0.0028) |
| Constant | | 0.5949*** | 0.6564*** | 0.8271*** | 0.5974*** | 0.6530*** | 0.8005*** |
| | | (0.0512) | (0.0580) | (0.0674) | (0.0279) | (0.0353) | (0.0551) |
| *N* | | 721 | 689 | 561 | 721 | 689 | 561 |
| r2 | | 0.1295 | 0.1458 | 0.1797 | 0.1294 | 0.1458 | 0.1800 |

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

## References


Alm, J., W. H. Kaempfer, and E. Batte Sennoga. 2012. Baseball Salaries and Income Taxes. *Journal of Sports Economics* 13 (6):619-634.

Blumkin, T., E. Sadka, and Y. Shem-Tov. 2013. A case for maximum wage. *Economics Letters* 120 (3):374-378.

Borghesi, R. 2008. Allocation of scarce resources: Insight from the NFL salary cap. *Journal of Economics and Business* 60 (6):536-550.

Brockway, G. P. 1984. Executive Salaries and Their Justification. *Journal of Post Keynesian Economics* 7 (2):168-176.

Carlson, K., J. Kim, A. Lusardi, and C. F. Camerer. 2015. Bankruptcy Rates among NFL Players with Short-Lived Income Spikes. *The American Economic Review* 105 (5):381-384.

Dietl, H., T. Duschl, and M. Lang. 2011. Executive Pay Regulation: What Regulators, Shareholders, and Managers Can Learn from Major Sports Leagues. *Business and Politics* 13 (2):6.

Dietl, H., M. Lang, and A. Rathke. 2009. The effect of salary caps in professional team sports on social welfare. *The B.E. Journal of Economic Analysis & Policy* 9 (1):1-23.

DiMascio, J. 2006. The Jock Tax: Fair Play or Unsportsmanlike Conduct. *U. Pitt. L. Rev.* 68:953.

Dittmann, I., E. Maug, and D. Zhang. 2011. Restricting CEO pay. *Journal of Corporate Finance* 17 (4):1200-1220.

Dobson, S., and J. A. Goddard. 2001. *The economics of football*: Cambridge University Press Cambridge.

Ekmekjian, E. C. 1994. The jock tax: State and local income taxation of professional athletes. *Seton Hall J. Sport L.* 4:229.

Ekmekjian, E. C., J. C. Wilkerson, and R. W. Bing. 2011. The jock tax contest: Professional Athletes vs. the states-background and current developments. *Journal of Applied Business Research* 20 (2).

Farnsworth, A. L. 2013. NFL Expansion into Europe: Necessary Changes in the Taxation of International Athletes before the Big Move. *Va. Sports & Ent. LJ* 13:77.

Fort, R. 2012. Competitive Balance in the NFL. In *The Economics of the National Football League: The State of the Art*, edited by K. G. Quinn. New York, NY: Springer New York, 207-224.

Fort, R., and J. Quirk. 1995. Cross-Subsidization, Incentives, and Outcomes in Professional Team Sports Leagues. *Journal of Economic literature* 33 (3):1265-1299.

Friedman, M. 2008. Living Wage and Optimal Inequality in a Sarkarian Framework. *Review of Social Economy* 66 (1):93-111.

Hadley, L., M. Poitras, J. Ruggiero, and S. Knowles. 2000. Performance Evaluation of National Football League Teams. *Managerial and Decision Economics* 21 (2):63-70.

Hausman, J. A. 1978. Specification tests in econometrics. *Econometrica: Journal of the Econometric Society*:1251-1271.

Hembre, E. 2017. Income Taxes and Team Performance: Do They Matter? In *University of Illinois Working Paper*.

Kaplan, R. A. 2004. The NBA luxury tax model: A misguided regulatory regime. *Colum. L. Rev.* 104:1615-1650.

Késenne, S. 2000. The Impact of Salary Caps in Professional Team Sports. *Scottish Journal of Political Economy* 47 (4):422-430.

Kleven, H. J., C. Landais, and E. Saez. 2013. Taxation and International Migration of Superstars: Evidence from the European Football Market. *The American Economic Review* 103 (5):1892-1924.

Kopkin, N. 2011. Tax Avoidance: How Income Tax Rates Affect the Labor Migration Decisions of NBA Free Agents. *Journal of Sports Economics* 13 (6):571-602.

Krautmann, A. C., and J. L. Solow. 2012. Salary Caps in a Model of Talent Allocation. In *The Economics of the National Football League: The State of the Art*, edited by K. G. Quinn. New York, NY: Springer New York, 159-171.

Lee, T. 2010. Competitive Balance in the National Football League After the 1993 Collective Bargaining Agreement. *Journal of Sports Economics* 11 (1):77-88.

Leeds, M. A., and S. Kowalewski. 2001. Winner Take All in the NFL. *Journal of Sports Economics* 2 (3):244-256.

Massey, C., and R. H. Thaler. 2013. The Loser's Curse: Decision Making and Market Efficiency in the National Football League Draft. *Management Science* 59 (7):1479-1495.
Miller, F. 2008. *Aristotle's political theory*: Stanford Encyclopedia of Philosophy.
Mondello, M., and J. Maxcy. 2009. The impact of salary dispersion and performance bonuses in NFL organizations. *Management Decision* 47 (1):110-123.
Moskowitz, T. J., and L. J. Wertheim. 2012. Does defense really win championships? *Freakonomics - http://www.freakonomics.com/2012/01/20/does-defense-really-win-championships/ (October 23, 2017)*.
Nissim, A. 2004. The Trading Game: NFL Free Agency, the Salary Cap, and a Proposal for Greater Trading Flexibility. *Sports Law. J.* 11:257.
Nolan, B. 2016. Unfair Play: Tax Application in Professional Sports. In *DePaul University - Working Paper*.
Piketty, T. 2014. *Capital in the 21st Century*. Cambridge: Harvard University Press.
Pitts, J. D. 2016. Determinants of Success in the National Football League's Postseason. *Journal of Sports Economics* 17 (1):86-111.
Pogroszewski, A. 2008. When is a CPA as Important as Your Era-A Comprehensive Evaluation and Examination of State Tax Issues on Professional Athletes. *Marq. Sports L. Rev.* 19:395.
Ramsay, M. 2005. A modest proposal: the case for a maximum wage. *Contemporary Politics* 11 (4):201-216.
Robst, J., J. VanGilder, D. J. Berri, and C. Vance. 2011. 'Defense Wins Championships?': The Answer from the Gridiron. *International Journal of Sport Finance* 6 (1):72.
Rosen, S., and A. Sanderson. 2001. Labour Markets in Professional Sports. *The economic journal* 111 (469):47-68.
Rowlingson, K., and S. Connor. 2011. The 'deserving'rich? Inequality, morality and social policy. *Journal of Social Policy* 40 (3):437-452.
Simmons, R., and D. J. Berri. 2009. Gains from Specialization and Free Agency: The Story from the Gridiron. *Review of Industrial Organization* 34 (1):81-98.
Szymanski, S. 2003. The Economic Design of Sporting Contests. *Journal of Economic literature* 41 (4):1137-1187.
Wittke, J. P. 2012. The Relationship of Quarterback Stability and Success in the NFL, University of Arkansas Fayetteville.
Zelinsky, E. A. 2015. Hillenmeyer, Convenience of the Employer, and the Taxation of Nonresidents' Incomes. *Clev. St. L. Rev.* 64:303.
Zimmer, T. E. 2011. Implications of state income tax policy on NBA franchise success: tax policy, professional sports, and collective bargaining. *The Sport Journal* 14 (1).