Taxation and Migration: Evidence from Major League Baseball

Daniel Giraldo
Advisor: José Antonio Espín Sánchez

April 3, 2017

Abstract

Growing inequality in the developed world has led to calls for increasing countries' top marginal tax rates. Crucially, the optimal top marginal income tax rate depends on people's tendency to migrate in response to changes in the tax rate. Changes in tax rates and and tax policy must take into account that increases in income tax rates may compel people to leave a country or state. This paper studies how differences in the top marginal tax rates affect the team and migrational choices of Major League Baseball players. Their elasticity of migration with respect to the net of tax rate can be considered an upper bound for the same elasticity in the entire labor supply, giving policy makers a worst-case scenario for migration following a tax increase. I find that a 10% increase in the state and city's top marginal tax rate reduces a team's wins in a season by about 2 (out of 162). If the elasticities estimated represented the behavior of all of those in the top tax bracket, an increase of ten percentage points in the average state's top marginal tax rate would lead to a decrease of between 20 to 49 percent in the probability of a top income earner choosing to live in that state.

1 Introduction

Trends in inequality in developed nations have led to calls for increases in taxes on the wealthy. Popular support for more redistributive policies and taxation of the wealthy came to the fore in the wake of the Great Recession with the Occupy Wall Street movement. More recently, Bernie Sanders, candidate for the Democratic Party's 2016 presidential nomination, centered his campaign on redistribution and ensuring that the wealthiest Americans pay their "fair share" (Sanders, 2016). In the same spirit, Jeremy Corbyn, leader of the UK's Labour Party, has said he would raise taxes on the wealthy if elected Prime Minister (Wintour, 2015).

Some economists have added their voice to the growing chorus calling for higher taxes on the wealthy. In his book, *Capital in the Twenty-First Century*, Piketty (2014) called for a global wealth tax to combat increasing wealth inequality. With respect to income, Stiglitz (2015) has called for a 5% increase in the top marginal tax rate to help combat inequality in the United States. Piketty et al. (2014) argued that the optimal top marginal tax rate for the United States is around 70 to 80 percent, almost twice its current level.

Arguments for increased tax rates on the wealthy need any behavioral response to the increase in tax rates to not offset the increase in tax rates. Such a behavioral response could come in the form of less hours worked or increased tax avoidance. Knowing the elasticity of taxable income to the net of tax rate is crucial for assessing the effectiveness of an increase in the top marginal tax rate. Since the tax cuts of the 1980s, a rich set of literature has developed focused on estimating the elasticity of taxable income.[1] There has also been significant work in measuring capital mobility in response to changes international capital tax rates.[2] Not as much attention, however, has been focused on the migrational responses to changes in labor income tax rates. In part, this is probably because it is much harder for individuals to move than it is for capital and corporations. Increasing globalization and

[1] For review of this literature, see Saez et al. (2012).

[2] see Griffith et al. (2010)

ease of migration, however, may make it easier for people, especially the wealthy, to move in response to changes in tax rates.

In this paper, I study migrational responses to the net of tax rate using data on Major League Baseball players between 1995 and 2014 as well as data on the teams, cities, and states in which they are located. The quality of the individual level data on these players provides sufficient controls to adequately estimate a response to changes in the tax rates. I examine the effect of the top marginal tax rate on the salary of free agents and the ability levels of free agents signed by a team. I also use multinomial logit to estimate baseball players' elasticity of migration with respect to the net of tax rate.

While I find no evidence to indicate that a change in the top marginal tax rate affects the salary of free agents, I do find that an increase of 10 percentage points in the top marginal tax rate of a team's city and state of leads to a team signing players of lower quality, costing the team about two wins per season in a season of 162 games. I also find evidence for a migrational response with respect to a change in the net of tax rate and point estimates that serve as upper bounds for the elasticity of migration with respect to the net of tax rate.

I proceed as follows. In Section 2, I examine the previous literature on migration and taxation. Section 3 gives a brief overview of Major League Baseball. I specify the model for player migration in Major League Baseball in Section 4. Section 5 describes the collection and construction of the data. In Section 6, I explain the empirical methods and strategies used to study the effects of the top marginal tax rate on team choice and player migration. Section 7 details the results. Finally, Section 8 concludes by discussing the policy implications.

2 Migration and Taxation: Previous Literature

The optimal tax is a decreasing function in the tendency to migrate in response to increases in taxes (Mirrlees, 1982). Understanding people's migrational responses to tax changes, then, is important for setting tax rates. The previous work on the migrational effects of taxation has left a few gaps and open questions. My study addresses three deficiencies in the literature.

First, it provides another angle with which to examine the issue of whether U.S. states can redistribute and how responsive the wealthy are to changes in the tax rate. Second, it explicitly looks at the tax rate induced migration of wealthy and high-skilled laborers across many states over time; previous work has mostly focused on natural experiments in one or two states at a time and has had a difficult time using quality data at the individual level. Third, it provides an upper bound for the elasticity of migration to the net of tax rate within the United States, given the high mobility of baseball players.

With regards to state migration, there has been conflicting evidence on the effect of differences in state tax rates, though the more recent work has generally argued that there is not much migrational response to an increase in state top marginal tax rates. Feldstein and Wrobel (1998) echo Musgrave (1959) and Oates (1972) by arguing that, in the long run, state and local taxes cannot redistribute income because freedom to migrate implies that an increase in tax rates will lead to the out-migration of high income earners and an in-migration of low income earners. These migrations will drive up wages in high tax states and drive down wages in low tax states. For ease of reference, I will call this theory the *redistribution impossibility theory*. Feldstein and Wrobel empirically support this theory by regressing wage on the state's net of tax share and finding a positive relationship between the wage and the net of tax share. Young and Varner (2011) find this argument inadequate because it does not show that migration is actually occurring, does not account for possible reverse causation, and on some level simply demonstrates the definition of a progressive tax system- wealthier people face higher tax rates.

Other studies of tax-induced migration within the United States have found weaker migrational responses to tax changes. Leigh (2008) found that higher state taxes *do* have a post-tax redistributive effect and that changes in state taxes did not affect migration flows. Looking at multi-state Metropolitan Statistical Areas, Coomes and Hoyt (2008) find that there is a statistically significant but economically modest out-migration from states with higher taxes to states with lower taxes. Similarly, Bakija and Slemrod (2004) exploit differences in taxes faced by wealthy people in different states to find that states with higher taxes have fewer federal estate tax returns filed. The effect is strongest for estate and inheritance tax differences, but even these effects are relatively small when compared to the change in collected tax revenue.

Studies of other countries, too, have reached similar conclusions: migrational responses to differences in taxation within countries are small, especially when compared to what the *redistribution impossibility theory* would suggest. Day and Winer (2006) study Canadian aggregate migration data from 1974 to 1996 and analyze how differences in regional policies (including personal income taxes) affect inter-province migration. They find that variation in these regional policies had little, if any, impact on migration. In Switzerland, Liebig et al. (2006) find that differences in income taxes among Swiss cantons induce modest inter-canton migration, and that this induced migration is not enough to offset increased canton revenues from the taxes.

Young and Varner (2011) summarize the literature's hypotheses as to why there are no large migrational responses to changes in tax rates: commuting is costly, searching for and changing jobs is costly, people have friends and family they do not want to move away from, and higher taxes usually mean more public goods, which may counteract the migrational push effects of higher taxes. But maybe the wealthy are more responsive to tax changes; maybe the amount the wealthy lose from an increase in the top marginal tax rate is large relative to the commuting and moving costs associated with migration. A slew of recent work has focused on wealthy individuals' migrational responses to changes in tax rates. Alm and Wallace (2000) have argued that rich people are more responsive to tax changes than average people; their particular study looked at differences in reporting rates. By contrast, after exploiting the natural experiment induced by New Jersey's increase of the top marginal tax rate by 2.6 percentage points, Young and Varner (2011) conclude that the migrational response of the wealthy to changes in income tax rates is small; very little migration occurred.

Outside the U.S., researchers have found a stronger migrational response by the wealthy in response to changes in tax rates. Kleven et al. (2013) took one of the first steps in analyzing international migration in response to differential income tax rates by examining the professional football player market in Europe. They found that domestic players have a modest response to a change in the net-of-tax-rate and foreign players have a much larger elasticity with respect to the net of tax rate. Akcigit et al. (2016) found similar results for "superstar" inventors.

Previous work on the effect of the states' differences in top marginal income tax rates on sports salaries and migration in the United States shows a significant if modest effect. Alm et al. (2012) studied free agents in Major League Baseball and found that an increase in the top marginal tax rate of 1 percent increased a free agent's final salary by $21,000 to $24,000. In a study that explicitly considered the migrational effects of income tax rates, Kopkin (2011) found a behavioral response in basketball players to an increase in tax rates: teams with higher state and municipality top marginal income taxes had a lower average skill of signed free agents.

Looking only at players who actually finished a contract and reached free agency, however, would overestimate the tendency of players to move in response to changes in the net of tax rate. This is because an analysis that looks only at actual free agents excludes players who chose to stay on their team by signing a contract extension before the end of their contract. These players had a choice to make and chose to stay in the same team; their decision should be factored into any study that attempts to measure the tendency of players to move in response to changes in the tax rate. The multinomial regression that I use allows me to include not only free agents in the analysis, but also players who meet the experience requirements for free agent eligibility but are still under contract.

Focusing on the players of Major League Baseball presents several advantages for the study of migrational responses to differences in tax rates. First, if anybody is going to overcome the frictions that prevent people from moving in response to changes in tax rates, it would probably be professional athletes. Players are used to moving teams, earn almost all their income from labor, and will only earn large amounts of income for a short amount of time. In this respect, Major League Baseball players are probably more mobile than the football players studied in Kleven et al. (2013) because there are fewer language and cultural barriers in moving states than there are in moving countries.

Second, the nature of the data allows one to track individuals over a long period of time and control for quality, personal characteristics, and other factors. Issues stemming from lack of access to individual level data to track migration and control for different factors have plagued previous studies. Third, baseball players, particularly the top players that command high salaries, serve as a testing ground for what Young and Varner refer to as "permanent millionaires" (Young and Varner, 2011). They hypothesize that one of the reasons the increase in the New Jersey top marginal tax rate led to very little migration out of the state is that most people are "transitory millionaires," meaning that very few people actually face the top marginal tax rate year after year. Because they do not face the top marginal tax rate most of the time, a large portion of millionaires in any given year have little reason to move out of a state in response to an increase in the top marginal tax rate. In contrast, "permanent millionaires" may have a reason to move since they will face the top marginal rate year after year. I argue, in Section 5, that baseball players can be considered "permanent millionaires." This paper serves as a beginning step towards understanding the behavior of so-called permanent millionaires.

3 Major League Baseball, Economics, and Taxation

In this section, I give a brief overview of Major League Baseball (MLB) and touch on relevant economic and taxation issues in the league. There are 30 teams in Major League Baseball. One team is located in Canada, and the rest are in the United States. They are located in 18 U.S. states, the District of Columbia, and Ontario. Each team has a 25-man roster, which includes the players that are eligible to play in any given game. The 25 players can be changed day-to-day and are picked from the 40-man roster, which includes everyone on the team with a Major League Baseball contract.

A given season occurs entirely within a calendar year. The MLB season starts in March with what is known as Spring Training. Teams take this time to prepare for the regular season, and they usually spend this time in either Arizona or Florida. The regular season consists of 162 games and starts in late March and early April. It runs through late September or early October, depending on the year. The postseason takes place mostly in October and ends in early November.

MLB has two leagues: the American League and the National League. Each league is split into three divisions and each division has five teams.[3] To qualify for the playoffs, a team must either win their division or obtain one of two "wild-card" spots available to the two best non-division winners in each league. Teams mostly play against teams in their own league and division. Teams play 19 games against each opponent in their division and 20 games against teams in the opposite league. The rest of a team's games are against non-division opponents in the same league (Newman, 2012). While the two leagues have slight rule differences in how the game is played, they observe the same rules when it comes to free agency and contract bargaining.

Major League Baseball has experienced two waves of expansion since 1985. In 1993, the league added the Florida Marlins and the Colorado Rockies. In 1998, the Arizona Diamondbacks and the Tampa Bay Devil Rays (now just the Tampa Bay Rays) joined the league to bring the total number of teams up to 30. Teams have moved very little since these expansions. Only one team has moved states: in 2005, the Montreal Expos moved to Washington D.C. and became the Washington Nationals. In 2012, the Florida Marlins moved from Miami Gardens to a new stadium in downtown Miami and changed their name to the Miami Marlins.

In addition to the 30 MLB teams, Major League Baseball largely controls what is known as Minor League Baseball. Minor League Baseball consists of various leagues of descending

[3]This balance is a recent occurrence. Before 2013, the National League had 16 teams and the American League had 14 teams. The Houston Astros agreed to move to the American League in 2013.

quality such as Triple-A, Double-A, and Class-A. Each Major League Baseball team is affiliated to a team in each of the leagues in Minor League Baseball. MLB teams use their affiliated Minor League Baseball teams to develop young players. The players of each minor league team generally have a contract with the team's affiliated major league team.

MLB has a rich history of labor conflicts that has determined the current rules that constrain player movement and contract negotiations. Before 1975, MLB contracts contained what is known as the reserve clause. The clause stated that teams retained rights to a player even after the player's contract had expired. Players were not free to negotiate contracts with other teams after their contract expired. After years of legal struggles and negotiations, players finally obtained the right to free agency in 1975, although they had to have six years of major league experience, could not re-enter the free agency pool for five years, and were limited in the number of teams they could negotiate with (Pappas, 2002).

Currently, there are three mechanisms through which teams choose players and players move teams: the draft, trades, and free agency. Every year, teams select high school and college baseball players with no major league experience through the amateur draft. The order of the draft is determined by how the teams performed in the previous season. A team that drafts a player has exclusive negotiating rights with that player and the player cannot sign or negotiate with any other team. Once a player has a contract with a team, that team can choose to trade him to other teams in exchange for other players or money. Players have very little recourse in preventing a trade, although many top players usually have a no-trade clause in their contract that allows them to veto any trade they are a part of.

The final avenue for player movement is free agency. Although the exact rules of free agency have changed with different collective bargaining agreements between the Major League Baseball Player's Association (MLBPA) and the team owners, the basic framework of free agency has remained the same since 1985. Players who have at least six years of major league experience are eligible for free agency.[4] If a team loses a player to free agency,

[4] A player accumulates major league experience by being part of a major league team's 40-man roster. A player accumulates no major league experience when playing for a minor league team.

they are usually entitled to a compensatory draft pick. Players with less than six years of service are not eligible for free agency but can ask for salary arbitration if they have more than two years of experience.[5]

Two structures that constrain how much teams can spend on player salaries are the competitive balance tax and the minimum salary. Since 1997, the MLB has had a competitive balance tax. In its current form, there are certain thresholds to what teams may spend on player salaries. If a team exceeds this threshold, then they are taxed by the league for a portion of the amount for which they exceed the salary threshold (Cot's, 2016). Since 1968, the league has had a minimum salary. The current minimum salary for a player in a team's 40-man roster is $507,500 (Cot's, 2016).

One peculiar aspect of North American sports leagues is the jock tax. In the 1990s, there were a wave of states and municipalities that began to enforce their income tax laws on visiting athletes (Green, 1998). Though there have been multiple federal pushes for the curbing of the practice, 15 of the 20 states and provinces with an MLB team currently impose a jock tax (Hoffman and Hodge, 2004). States calculate the tax burden of non-resident athletes using the duty days method. This method counts the total number of days the athlete has spent inside the state and divides that number by the total number of "duty days." These include not only game days but also practice days, travel days, and preseason activities (DiMascio, 2007). Different states apply different deductions based on taxes payed in other localities, and I will take into account the details of the application of the jock tax when calculating the top marginal tax rate players face in different teams.[6]

4 Model

In the following section, I present the model for player team choice. The model is based on the migration models for football players and inventors presented in Kleven et al. (2013) and

[5] For a more detailed view of the history of collective bargaining agreements in MLB, see Cot's (2016)

[6] For a more detailed look at the intricacies of the jock tax see Hoffman and Hodge (2004)

Akcigit et al. (2016). There is a set J of teams, and there are n total teams in a particular league. I index the teams so that each team $j \in \{1, 2, ..., n\} = J$. At time t, the players in each team face tax rate $\tau_{jt} \in (0, 1)$. Each player p can earn wage ω_{jpt} with team j. A player receives utility from his after-tax income $(1 - \tau_{jt})\omega_{jpt}$ and utility $\mu_{jpt} \in \mathbb{R}$ from non-income factors that are player specific and team specific, such as market size or team ability. Let $u : \mathbb{R} \to \mathbb{R}$ be an increasing function of a player's after-tax income. Then player p's utility from playing on team j at year t is

$$U_{jpt} = u((1 - \tau_{jt})\omega_{jpt}) + \mu_{jpt}$$

The main difference between my model and those of Kleven et al. (2013) and Akcigit et al. (2016) is that the individuals are not deciding between countries. Instead, they are picking between different teams. The teams, depending on what state and city they are located in, will have different top marginal tax rates that factor into player choice. Each team also has different factors that add (or subtract) from the player's utility. The model I present retains from the other models the wage-and-tax-dependent component of utility and the additive, non-wage-dependent component of utility.

A team will want to maximize the sum of the talent a of all its players, subject to a budget constraint C on the sum of the salaries for its players. Assuming that at each time period t a player decides in which team he will play, he will choose team i if and only if

$$u((1 - \tau_{it})\omega_{ipt}) + \mu_{ipt} \geq u((1 - \tau_{jt})\omega_{jpt}) + \mu_{jpt}, \ \forall j \in J, j \neq i$$

In this model, a player's choice of team depends on other factors besides the tax rate. Any understanding of the effect of the tax rate on a player's choice of team, therefore, must take into account other factors that a player cares about when choosing a team, such as the ability to win, location, or endorsement opportunities.

If the incidence of the difference in income taxes falls entirely on the team, then one would expect that teams in locations with higher income taxes have to pay players of a given ability level more than teams in lower income tax states (Alm et al., 2012). On the other hand, if the luxury tax or other payroll restrictions prevent teams from fully compensating players for the income tax differential (Kopkin, 2011), or labor demand is rigid due to roster constraints and skill complementarity (Kleven et al., 2013), then higher ability players will tend to end up at teams with lower income taxes. I turn next to the issue of empirically estimating players' responsiveness to the tax rate.

5 Data

5.1 Baseball Statistics

The data gathered for this paper come from a diverse set of sources and are gathered for the years 1995 to 2014. Most of the data on player statistics, including salary, have been retrieved from the database maintained by Sean Lahman. Sean Lahman is a so-called "database journalist" who has downloadable data on player statistics and salaries. Using his database, I have been able to create datasets with batting, fielding, and pitching statistics for individual players for each year. I gathered data on player WAR statistics using the site Baseball-Reference.com. I am confident that both the Sean Lahman and Baseball-Reference data are comprehensive; out of 37,402 player-year observations between 1985 and 2015, only 15 player-years in the Baseball Reference data did not have a match in the Lahman data and only 1,352 player-years from the Lahman data did not have a match in the Baseball-Reference data. The Lahman database also contains information on player salary. This data are much less complete than the player performance data. Since 1995, there are 24,626 player-years for which there are salary data. The number of player-year observations of players with at least six years of service that have salary data since 1997 is 6,813. This translates to about 378 observations per year and 12 observations per team per year. I collected team winning percentages from Baseball-Reference. For some of the analyses run, I needed to know which athletes were free agents each year. For this information, I turned again to Baseball Reference, which has datasets of free agents for every year.

Above, I posited that baseball players can be considered "permanent millionaires." I examine the salary data collected to show that this is the case. Figure 1 shows the average, median, 25th percentile, and minimum salary of free-agency eligible baseball players by year for the data collected. The average salary has been above two million dollars each year since 1995. By 2009, the minimum salary of a baseball player was above $400,000. Since 1995, the 25th percentile salary of free-agency eligible player has been greater than or equal to $500,000 and by 1999 this figure had reached one million. Therefore, since 1999, at least 75% of free-agency-eligible baseball players' annual salary has exceeded one million dollars. Additionally, the median salary of free agency eligible baseball players has been above $1.5 million every year since 1995, meaning that at least 50% of free-agency-eligible baseball players' annual salary has exceeded one million dollars since 1995. These figures indicate that baseball players are indeed permanent millionaires whose salary regularly gets taxed at the top marginal tax rate. Studying their migrational responses to changes in the top marginal tax rate serves as a first step towards understanding the migrational responses of permanent millionaires to differences in the top marginal tax rate.

Looking at the salary summary statistics also allows me to validate the reliability of the data collected by comparing the data's summary statistics to official reports and estimates done by others. On this front, the Sean Lahman data, though it does not contain salary data for all players, appears to be representative of Major League Baseball salary. The minimum salary in the Sean Lahman data tracks the minimum salary as dictated by the different collective bargaining agreements agreed to since 1995. The average salary for all players by year also follows closely the average salary as reported by the MLB Players Association. I am therefore confident that the data collected is of good quality.

Figure 1: Selected Salary Summary Statistics for Free-Agency-Eligible Players

5.2 Tax Rate Data

I retrieved U.S. federal and state income tax data from the NBER's Taxsim site (Feenberg and Coutts, 1993). These tax rates take into account the different options taxpayers have in different states to deduct state taxes from federal taxes or vice-versa. For Canada, province and federal tax rates were obtained from the website of the Federal Revenue Agency. Some Quebec tax data was gathered from Finances of the Nation (Treff and Perry, 2002). A few of the cities and municipalities that have Major League Baseball teams in the United States charge an additional income tax on residents and non-residents. I collected the data on city and municipality tax rates by consulting the city websites and tax documents. For more details on the sources for city and municipality tax data, see Appendix A.

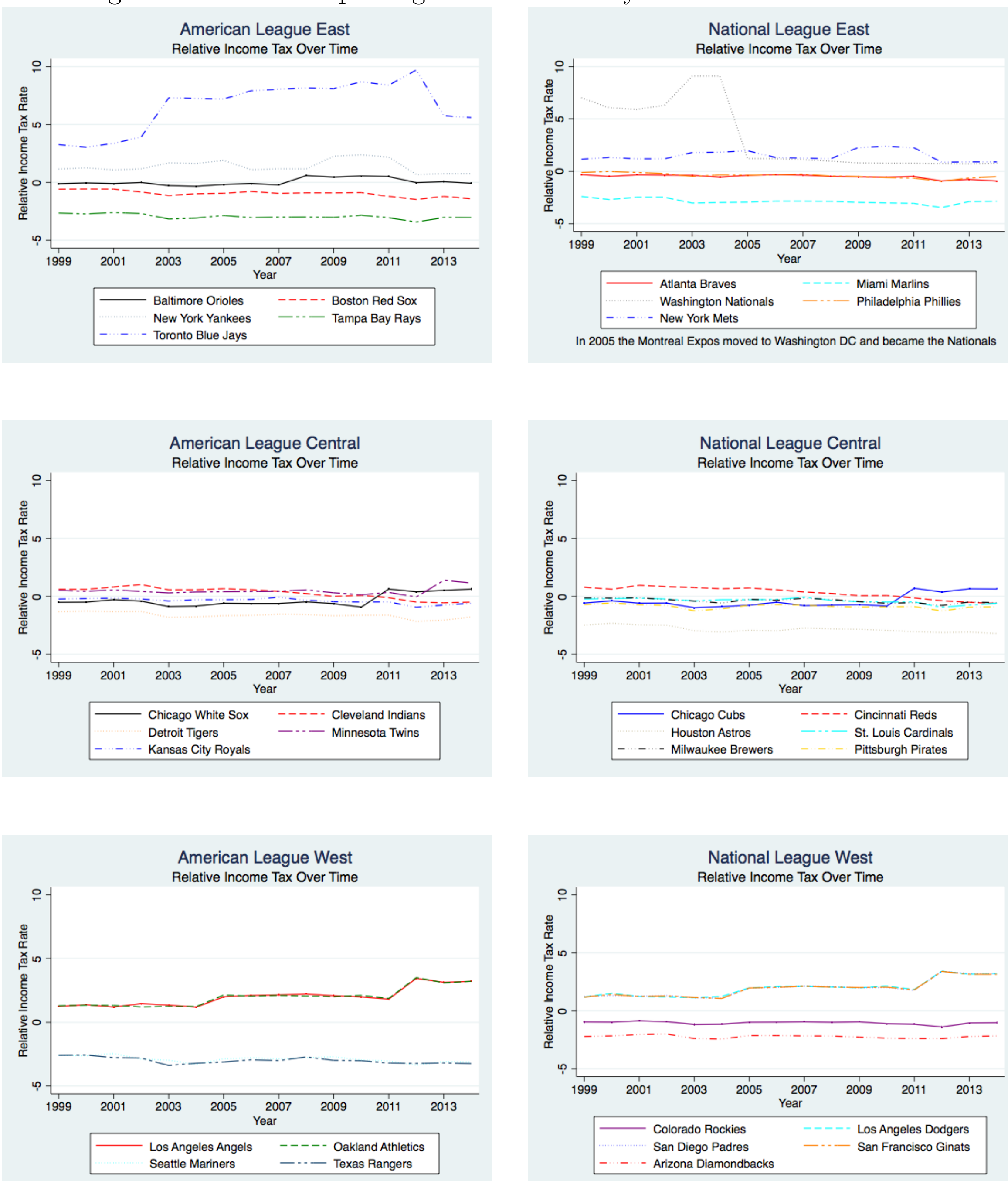
As has been noted above, players do not simply face the tax rate from the state and city in which their home team is located. Instead, sometimes, when a player's team plays an away game, both the city and the state of the team which the player is visiting tax the visiting player for the portion of his income that is earned at that game. This means that a player's top marginal tax rate is actually a complicated linear combination of the tax rates of his home state and city and the tax rates of the states and cities at which his team plays away games. To account for this, I gathered data on every team's schedule since 1995 from the website Retrosheet. I used this information and the details on the jock tax found in Hoffman and Hodge (2004) to calculate a true top marginal tax rate for every team-year. See Appendix B for more details on how these top marginal tax rates were calculated.

Figure 2 shows my calculations for the relative top marginal tax rate for each team over time by Major League Baseball division. These top marginal tax rate figures take into account the intricacies of the jock tax. Some of the biggest differences in relative income tax rates throughout the years come from Canadian teams.

In 2012, the AL East panel of Figure 2 shows that the relative top marginal income tax rate for the Toronto Blue Jays almost reached 10 percentage points. The NL East panel of Figure 2 shows the precipitous fall in relative top marginal tax rate faced by players playing for the Washington Nationals, as the team moved from Montreal, Canada to Washington D.C. in 2005.

Figure 2 also serves as a way to check that the calculated top marginal tax rates are correct, because they can be checked against Figure 2 in Kopkin (2011), which looks at the relative top marginal tax rate for NBA teams between 2001 and 2007. For corresponding years and cities, the top marginal tax rate in the Kopkin (2011) data and my own calculations for the top marginal tax rate largely match up. Of course, some differences are present because the distribution of the location of away games is different in MLB and the NBA.

Figure 2: Relative Top Marginal Tax Rates by Team from 1999 to 2014



5.3 Controls

In order to control for other factors, I collected data about the particular metropolitan area of each team. For teams in the United States, I retrieved information about the population and total employment of each team's Metropolitan Statistical Area (MSA) from the Bureau of Economic Analysis. I retrieved Canadian Census Metropolitan Statistical Area employment and population data from the CANSIM database created by Statistics Canada. I was only able to gather this data for the years after 2000.

5.4 Summary Statistics and Data Overview

Before turning to estimating the different models, I examine summary statistics of the data to evaluate relationships between variables and ensure that the data fit expectations. Full summary statistics for all the variables can be found in Appendix C. For all of these tables, a given performance statistic will have either the suffix"-Y" or "-C." A performance statistic with the suffix "-Y" indicates that it was a player's statistic in the previous year. Performance statistics with the suffix "-C" refer to a player's career totals and averages to that point in his career. Tables 7 and 8 summarize all of the variables for nonpitchers and pitchers who are eligible for free agency i.e. have more than five years of MLB experience. These players were not all necessarily free agents because some may have had years remaining on their contract. Each variable is summarized for all years available (1995-2014), as well as for the years 1999-2014 (years during which no new expansion teams joined) and for the years 1995-2001. The years 1995-2001 correspond to the years before the imposition of strong competitive balance luxury taxes.

Analogously, tables 9 and 10 in Appendix C summarize the variables for all free agent nonpitchers and pitchers. The definition of free agent that I used excluded players whose contract was up but had played in the minor leagues the previous year. I excluded those players because, since the players had not spent the previous year MLB, they did not have comparable previous year statistics that could be used as controls.

Figure 3: Income Tax and Free Agent Distribution

Figure 3 plots the distribution of the relative income tax of the teams that free agents signed with, the distribution of the relative income tax among all teams, and a superimposition of the kernel densities of the two histograms. The latter provides preliminary evidence for the effect of the relative marginal income tax rate on player migration and team choice. It shows that free agents disproportionately sign with teams with the lowest relative marginal income tax rate, though the phenomenon is not visually dramatic.

Tables 11 and 12, found in Appendix C, give another preliminary glance at the relationship between the top marginal tax rate and free agency choices. These two tables summarize the different available statistics by tax quartile for nonpitcher and pitcher free agents, respectively. Average salaries for nonpitchers tend to increase as one moves from the highest quartile of relative marginal income tax to the lowest quartile of relative marginal income tax. Moreover, many of the average performance statistics for nonpitchers, such as slugging percentage, on-base percentage, and runs batted in (RBI), do not vary much by tax quartile; theoretically, low relative marginal income taxes attract high-skill players, so one would expect the average of these performance statistics to decrease as one moved to higher quartiles. Notably, teams in the top quartile tend to have much bigger Metropolitan Statistical Area population size and employment. Controlling for these factors may be important, as metropolitan areas with high populations and employment may bring greater opportunities for lucrative endorsements, attracting players to those cities.

In contrast to nonpitchers, the average salary for pitchers tends to decrease as one moves from high relative marginal income tax quartiles to low relative marginal income tax quartiles. Additionally, it appears that the average of pitcher performance statistics tends to improve as one moves to higher relative marginal income tax quartiles. Earned run average, a measure of how many runs a pitcher allows, is lowest in the highest quartile, indicating that high-skill pitchers tend to sign with teams with high marginal income tax rates. Similarly, the average number of games won the previous year is highest in the highest quartile. Although the results of this exploratory data analysis seem to contradict the expected trends, this approach is far from rigorous.

6 Empirical Strategy

My goal is to estimate the effect of a change in tax rates on the migration and team choice of a given player. I estimate this effect using three different methods. The first estimates the effect of the top marginal tax rate on player salary and is similar to the empirical strategy used in Alm et al. (2012) and Kopkin (2011). For players with more than six years of major league experience, I will estimate the following equation for free agents

$$S_{jpt} = \beta_0 + \beta_1 \tau_{jt} + \beta_2 X_{pt} + \mu_t + \eta_p + \epsilon_{jpt} \tag{1}$$

S_{jpt} refers to the salary of player p in team j at time t. I control for skill and player statistics X_{pt} in the estimation. I also include individual fixed effects η_p and time fixed effects μ_t. The error term is ϵ_{jpt}. I include individual fixed effects to capture unobserved characteristics of each player that influence his salary. Time fixed effects help account for changes in salary from unobserved U.S. and MLB economic trends.

The coefficient of interest is β_1, the effect of a one percentage point increase in the top marginal tax rate on a player's salary. This will provide an indication as to how an increase in marginal tax rate affects salaries, which provides preliminary evidence on the effects of tax rates on team choice and migration. If β_1 is positive, then teams with high tax rates must offer more money to players to compensate for the higher tax rate. For the estimation, I use the top marginal tax rate, because baseball players, especially free agents, earn far above the threshold for the top bracket in the income tax schedule. The top marginal tax rate will approximate their average tax rate relatively well.

The second equation I want to estimate looks at the effect of the top marginal tax rate on the skill of players on a team. For free agents, I would estimate

$$A_{jpt} = \delta_0 + \delta_1 \tau_{jt} + \beta_2 N_{pt} + \phi_t + \psi_p + \xi_{jpt} \tag{2}$$

where A_{jpt} is the skill level of player p at time t playing for team j. In this estimation, I also control for player characteristics N_{pt}, time fixed effects ϕ_t, and team fixed effects ψ_j. Here, ξ_{jpt} is the error term. Team fixed effects control for unobserved team characteristics that give teams differential abilities to sign high-quality free agents. The coefficient of interest in equation 2 is δ_1, which measures the effect of a one percentage point increase in the marginal tax rate on the skill of a players signed by team j in year t. Following the logic of Kopkin (2011) and Kleven et al. (2013), if changes in the marginal tax rate are not fully compensated by additional salary and affect migration, then δ_1 will be negative, as more talented players choose to go to teams with lower marginal tax rates.

Because skill level is difficult to measure precisely, I will try various specifications for skill level. First, I will use average yearly WAR over the past three years. WAR, wins-above-replacement, is a metric that attempts to capture a player's total contributions to the team. WAR is part of a relatively new wave of baseball statistics that aims to capture an individual's total contribution to a team. It measures the number of wins a given player contributed to a team over what an easily available player (a "replacement" player) would have contributed. An average player contributes about 2 WAR per season, and a superstar player will contribute about 5 WAR. Although the calculation of WAR is different for pitchers and nonpitchers, the statistic is intended to be comparable across pitchers and nonpitchers.[7]

I then run the same regressions using only the previous year's WAR. For batters, I use on-base percentage plus slugging (OPS), a measure of batting performance, as another skill measure. For pitchers, I use earned-run average (ERA) as a separate skill measure. Finally, I use three-year average yearly WAR but restrict the sample to just pitchers, to see if the first results hold for only pitchers. For all of these estimations, I calculate two-way clustered standard error on team and year by modifying code and methods developed by Cameron et al. (2011).

I highlight at this point that taking into account the jock tax adjustment is critical for recovering reliable estimates for the coefficients on the top marginal tax rate, β_1 and δ_1. By the structure of existing tax law, for any given game, a visiting player pays either the home team tax rate or the visiting team tax rate, whichever is higher. Therefore, the actual top marginal tax rate a player faces is higher than the top marginal tax rate faced by any other resident of the city of the player's team. If players react to the top marginal rate they actually face, then, in a case of omitted variable bias, estimates for β_1 and δ_1 using top marginal tax rates that do not take into account the jock tax will be biased away from zero.

My final estimation will attempt to exploit all player data, not just that of free agents, to estimate the elasticity of migration to the net of tax rate. The model is a multinomial

[7] For more information about the WAR used in this paper and its calculation, see Baseball-Reference.com WAR Explained http://www.baseball-reference.com/about/war_explained.shtml

discrete choice model. From the theoretical model, I have that, at year t with team j, a player p has utility

$$U_{jpt} = u((1 - \tau_{jt})\omega_{jpt}) + \mu_{jpt}$$

Assuming that utility is a logarithmic function, and allowing for some possible factors beyond the after-tax wage that may affect a player's utility at a given team, the equation becomes

$$U_{jpt} = \gamma_1 \log(1 - \tau_{jt}) + \gamma_1 \log(\omega_{jpt}) + \gamma_2 X_{pt} + \gamma_j + \nu_{jpt} \tag{3}$$

where $(1 - \tau_{jt})$ is the net of tax rate. X_{pt} are player characteristics such as age, which may affect a player's decision to play in a given team, or a team's willingness to hire him. Finally, γ_j is a team fixed effect, and ν_{jpt} is the error term.

I fit McFadden's choice model (McFadden, 1974), which takes into account the factors that vary across teams in any given year as well as the changes for a given player's characteristics across years. This multinomial logit estimation allows me to take into account the counterfactual top marginal tax rate the player would have faced had he chosen to play at one of the other 29 teams. Adding controls to the estimation model allows me to take into account other team characteristics that affect team choice as well.

The most important counterfactual comparison that cannot be made is that of salary. I can only observe the actual salary of the player and not the salary that the player would have earned had they chosen a different team. I attempt various specifications to try to make up for this deficiency. In the first specification, I use only the net of tax rate, $\log(1 - MTR)$, as the explanatory variable for team choice in the multinomial logit model. I expect this estimation to yield an ambiguously signed or even negative coefficient on the net of tax rate, because as the summary statistics show, wealthier teams tend to be located in places with high top marginal tax rates. To control for this issue, I run a variety of specifications that control for player abilities and characteristics, team fixed effects, and year-variant team characteristics.

Let $P_{jpt} = \mathbb{P}(U_{jpt} > U_{j'pt}, \forall\ j' \in J)$ be the probability that player p plays with team j at time t. I assume that the error ν_{jpt} is type I extreme value distributed. Then, maximum likelihood can estimate the multinomial logit. An estimation of γ_1 allows me to estimate the elasticity of the probability that player p plays with team j at time t with respect to the net of tax rate $(1 - \tau_{jt})$. In particular, if ε is this elasticity, then, following the calculations in Kleven et al. (2013) and Akcigit et al. (2016), the elasticity for player p of the probability of locating at team j on year t is

$$\varepsilon_{jpt} = \frac{d\log P_{jpt}}{d\log(1-\tau_{jt})} = \gamma_1(1 - P_{jpt}).$$

By modifying calculations from the authors and by denoting I as the set of all players, I can define team j level elasticities, ϵ_j, as the sum, weighted by P_{jpt}, of the elasticities for all players for that team,

$$\varepsilon_j = \frac{\gamma_1 \sum_{i\in I}(1 - P_{jpt})P_{jpt}}{\sum_{i\in I} P_{jpt}}$$

I can then define the average elasticity of the probability of choosing a team to the net of tax rate as the average weighted elasticities across the teams:

$$\varepsilon = \sum_{j=1}^{30} \Big(\frac{\gamma \sum_{i\in I}(1 - P_{jpt})P_{jpt}}{\sum_{j=1}^{30}\sum_{i\in I} P_{jpt}} \Big)$$

This ε is the parameter of interest, as it measures the migratory responsiveness of players to changes in the net-of-tax rate. I calculate the average elasticity from the results of the multinomial logit regression by modifying code from Kleven et al. (2013).

7 Results

7.1 Salary Effects

I first examine the effects of the top marginal tax rate on the salary paid to free agents by estimating equation 1. I estimate the equation separately for pitchers and nonpitchers. For both types of players, I include experience and experience squared in the equation, as experience may be valuable for a team but in a nonlinear fashion; after a while, experience signifies age, diminished performance, and a shorter playing horizon. Because one year's statistics may be a very different from a player's overall career statistics, I include career averages as well as previous year's averages in estimating the salary equation.

Following Alm et al. (2012), I include both on-base plus slugging percentage and fielding percentage as controls for nonpitchers. On-base plus slugging is a metric that quantifies both a player's ability to get on base and a player's ability to hit well and run the bases. It summarizes the offensive contributions of a player and so serves as a good metric for controlling for player offensive ability. Fielding percentage measures the defensive effectiveness of a player and so serves to control for player defensive ability.

For pitchers, I use wins, win/loss average, innings pitched, earned-run average, saves, and strikeout-walk ratio as controls for non pitchers. I include saves to account for the differences in the salary equations for starting pitchers and relief pitchers, as done in Krautmann et al. (2003). Wins and losses are a common metric used to measure the success of a pitcher's outing, so I include wins and win/loss average. However, wins are dependent on the pitcher's team's offensive and defensive ability. For this reason, I also include earned-run average, strikeout-walk ratio, and innings pitched; these statistics are are much less influenced by team ability.

Tables 1 and 2 show the results of the estimation for nonpitchers and pitchers, respectively. The standard errors displayed are robust standard errors. I first run the estimation using all of the player data for free agents that I have from 1995 to 2014. As noted above, I

Table 1: Salary Regression for Nonpitcher Free Agents

	FE 1995-2014 Salary (000s)	FE 1995-2001 Salary (000s)	RE 1995-2014 Salary (000s)	RE 1995-2001 Salary (000s)
MTR	-14.81	-6.040	-16.24	-32.52
	(23.95)	(24.52)	(22.54)	(23.17)
Experience	649.3	364.7	195.1	513.7***
	(414.6)	(229.5)	(168.1)	(173.5)
Experience Squared	-22.85***	-33.17***	-18.58**	-34.49***
	(8.398)	(8.330)	(7.782)	(8.094)
On-Base Plus Slugging-Y	3469.9***	571.0	4603.6***	1755.6***
	(875.5)	(643.2)	(823.5)	(590.5)
On-Base Plus Slugging-C	35147.4***	25440.2***	23190.7***	18068.5***
	(7041.9)	(7256.0)	(2025.0)	(2853.8)
Fielding Percentage-Y	846.4	3736.3	4331.5	1815.7
	(4307.5)	(3854.7)	(3592.4)	(3093.3)
Fielding Percentage-C	-7222.8	-56639.5*	1554.5	-405.6
	(46102.0)	(33325.6)	(9635.7)	(9735.4)
Observations	1286	429	1286	429
Individuals	625	241	625	241
R-squared Overall	0.141	0.318	0.399	0.393

Standard errors in parentheses

* $p<0.10$, ** $p<0.05$, *** $p<0.01$

exclude from the sample of free agents all players who had played the previous year in the minor leagues, as they do not have a comparable set of previous year's statistics. Column 1 of Table 1 shows the results for a fixed effect model, while column 3 shows the results for a random effects model. The coefficient on the top marginal tax rate is negative but very far from significant at the 10 percent level. It is -14.81 (23.95) for the fixed effects model and -16.24 (22.54) for the random effects model. Most of the coefficients of the other variables are of the expected magnitude for both models. There is a positive coefficient on experience, the previous year's on-base plus slugging, the career average of on-base plus slugging, and the previous year's fielding percentage. Surprisingly, the coefficient on the career fielding percentage is very negative for the fixed effects model.

Because Major League Baseball instituted more stringent luxury tax penalties for teams with high payrolls starting with the 2001 Collective Bargaining Agreement, perhaps teams could no longer spend to compensate free agents for lost wages due to differences in income taxes. I therefore restricted my analysis to the years 1995-2001 in Columns 2 and 4, which use fixed effects and random effects, respectively. The magnitude of the coefficient on the top marginal tax rate decreases in the fixed effects model and increased in the random effects model, though both coefficients remained negative and insignificantly different from zero at the 10 percent level.

Table 2 shows the analogous results for pitchers. The specification shown in Column 1, which is the fixed effects estimation that includes all free agents form 1995 to 2014, yields a negative point estimate for the coefficient of MTR of higher magnitude than that for Column 1 for nonpitchers. However, when I restrict the sample to free agents form 1995 to 2001, the coefficient becomes 42.20 (45.67), yet is still insignificant at the ten percent level. The random effects results for all pitchers from 1995 to 2014 are in Column 3 and show a small positive coefficient of 7.888 (30.46) on the top marginal tax rate. This coefficient shrinks 2.037 (39.14) when I restrict the sample to free agents from 1995 to 2001. Again, none of the point estimates for the coefficient of interest are significant at the 10 percent level, or

Table 2: Salary Regression for Pitcher Free Agents

	FE 1995-2014 Salary (000s)	FE 1995-2001 Salary (000s)	RE 1995-2014 Salary (000s)	RE 1995-2001 Salary (000s)
MTR	-33.68	42.20	7.888	2.037
	(41.28)	(45.67)	(30.46)	(39.14)
Experience	-110.4	-577.1	-146.0	-216.5
	(405.3)	(887.8)	(132.6)	(278.6)
Experience Squared	-0.930	9.744	0.00874	3.371
	(7.822)	(16.89)	(5.759)	(14.84)
Earned Run Average-Y	-260.2***	-139.5	-25.90	-6.035
	(60.21)	(91.64)	(36.52)	(9.548)
Wins-Y	78.88*	159.2**	129.3***	178.2***
	(46.23)	(68.54)	(37.80)	(50.78)
Wins-C	20.31**	40.30***	15.27***	12.16***
	(9.808)	(13.14)	(3.601)	(4.407)
Win-Loss Percentage-Y	102.9	-172.0	300.9	-283.3
	(381.5)	(382.4)	(301.7)	(316.6)
Innings Pitched-Y	13.49***	-0.877	14.59***	6.540*
	(3.652)	(5.180)	(2.702)	(3.413)
Strikeout-Walk Ratio-C	4759.4***	5238.6***	1164.7***	632.9***
	(1026.6)	(1232.7)	(231.2)	(236.9)
Saves-Y	57.82***	24.15**	77.39***	50.40***
	(11.87)	(10.14)	(8.506)	(10.78)
Observations	997	309	997	309
Individuals	509	188	509	188
R-squared Overall	0.337	0.223	0.560	0.542

Standard errors in parentheses

* p<0.10, ** p<0.05, *** p<0.01

even the 15 percent level.

The coefficients on performance metrics for pitchers are of the expected direction. As wins, strikeout-walk ratio, innings pitched, and saves increase, there is an associated increase in average in player salary. On the other hand, an increase in earned run average leads to an associated decrease in average salary. The coefficients on experience are negative, which falls in line with results seen in the literature, such as in Alm et al. (2012).

7.2 Average Ability of Free Agents

If teams in cities and states with higher income taxes do not compensate free agents for the increased tax burden, then perhaps free agents respond to higher income taxes by migrating or choosing to play for teams with lower top marginal income taxes. Since high-skilled players can choose where to play more easily by virtue of their scarcity, this migration effect would show up in that, all else held equal, teams in locations with higher top marginal income taxes would sign less talented free agents. An estimation of equation 2 would yield a negative coefficient on the top marginal tax rate.

Table 3 displays the results of these estimations. The player-years included are from 2001 to 2014, as these are the years for which I have MSA controls. Column 1 regresses Average WAR only on the relative income tax rate, team controls, and year controls. The resulting coefficient of -0.05 is statistically significant at the 10% level. The coefficient becomes slightly more negative, -0.053, when I introduce position controls in Column 2. It is also significant at the 5 percent level.

Similarly, the coefficient moves little when I add at first just the logarithm of the Metropolitan Statistical Area population in Column 3. All else held equal, a free agent may prefer one team over another if the team has a larger market size and therefore more opportunities for income through endorsements and other media avenues. Metropolitan Statistical Area log population can serve as a proxy for the team's market size. In Column 4, I add log MSA employment, the number of games the team won the previous year, and

Table 3: Regression on Average Yearly WAR Over the Last 3 Seasons 2001-2014

	(1) Average WAR	(2) Average WAR	(3) Average WAR	(4) Average WAR
Relative Income Tax Rate	-0.0509*	-0.0526**	-0.0610	-0.0514
	(0.0280)	(0.0245)	(0.0450)	(0.0461)
Log MSA Population			-0.182	-0.157
			(0.564)	(1.840)
Log MSA Employment				0.0609
				(1.677)
Wins				0.00728
				(0.00501)
Contract				-0.0753
				(0.106)
Team F-E	Yes	Yes	Yes	Yes
Year F-E	Yes	Yes	Yes	Yes
Position Controls	No	Yes	Yes	Yes
Observations	2008	1988	1988	1988
R-squared	0.0643	0.103	0.103	0.107

Standard errors in parentheses

* p<0.10, ** p<0.05

whether the free agent chose to renew with the same team, but the coefficient moves little.

I add log MSA employment to include a different dimension of market size, as there will probably be more opportunities for income in MSAs where there are more people earning a labor income. I add the number of wins the team won the previous year to control for the team's quality, as a free agent may prefer, all else held equal, playing with a better team rather than a worse team. Finally, I include the indicator for contract because a player may be emotionally attached to his current team and be more inclined to sign with it, all else held equal. Unfortunately, the addition of these controls in Column 3 and 4 increase the standard error of the coefficient of relative income tax rate to the point where it is no longer statistically significant at the 10% level.

As a robustness check, I run the above regressions using different measures for abilities. The results can be seen in Appendix E. For all of the measures of ability, the coefficient on the top marginal tax rate is negative, with varying levels of significance. The only exception is when earned run average (a measure of pitcher performance) is used as the measure of skill. However, the higher the earned run average, the worse the pitcher performance, so the coefficient is also of the expected sign. When I used the average yearly WAR over the past three years and restricted the sample only to pitchers, I once again obtained a negative coefficient on the top marginal tax rate.

7.3 Multinomial Estimation

Finally, I turn to consider the estimation of the multinomial discrete choice model. I use player-years between 1999 and 2014. In these years, no new expansion teams were formed. In the first specification, I use only the net of tax rate as the explanatory variable. In the second specification, I include team fixed effects and the interaction of team fixed effects with individual player characteristics such as ability (WAR), experience, and experience squared. These variables help control for unobserved characteristics in teams that affect player choice, as well as for how the influence of these factors may vary with individual player characteristics and ability. In the third specification, I use an alternate set of individual player characteristics: WAR, age, age squared, and experience.

I control for an observed team characteristic that may affect player choice in the fourth specification: the number of wins in the previous season. Finally, I control for another observed team characteristic in the fifth specification, the logarithm of the Metropolitan Statistical Area's population. This could help control for factors such as city and market size which may attract free agents because of endorsement or lifestyle considerations. In this specification, I only use observations after the year 2001 because those are the ones for which I have data on MSA population size.

Table 4: Multinomial Discrete Choice Estimations 1999-2014

	(1)	(2)	(3)	(4)	(5)
log(1-MTR)	-0.413	1.554	1.841*	1.734*	0.748
	(0.433)	(1.009)	(1.024)	(1.026)	(1.327)
Wins				0.00239*	0.00230
				(0.00137)	(0.00142)
Log MSA Population					0.281
					(0.330)
Team F-E	No	Yes	Yes	Yes	Yes
Characteristics 1 x team F-E	No	Yes	No	No	No
Characteristics 2 x team F-E	No	No	Yes	Yes	Yes
Elasticity	-0.40	1.50	1.77	1.67	0.72
	(0.418)	(1.009)	(1.024)	(0.989)	(1.28)
Observations	214230	214020	214020	214020	201810
Cases	7141	7134	7134	7134	6727

Standard errors in parentheses
* p<0.10, ** p<0.05

Table 4 shows the results for the multinomial logit estimation using data from 1999 to 2014 on players who are free agency eligible but not necessarily free agents. The reported elasticities are only for the year 2014 as the elasticities are very similar across years and computing for only one year greatly reduces computation time. As expected, the coefficient of $\log(1-MTR)$ in column 1 is of ambiguous sign, as the standard error is of larger magnitude than the point estimate.

Once I control for unobserved team characteristics and their interaction with player characteristics in column 2, the coefficient of $\log(1 - MTR)$ becomes positive (1.554), as expected, and its magnitude is larger than any of the estimates in Kleven et al. (2013), suggesting that indeed MLB players can serve as an upper bound for the migrational elasticity of the wealthy with respect to the net of tax rate. In column 2, the coefficient is still not statistically significant at the 10 percent level and the implied elasticity is 1.50. In column 3, I use different individual characteristics as controls and obtain a coefficient of higher magnitude at 1.841, which is statistically significant at the 10 percent and implies an elasticity of 1.77. The statistical significance of the coefficient remains once I control for team wins in the previous year, while the coefficient falls to 0.748 once I control for the logarithm of MSA population, loses statistical significance at the 10 percent level, and implies a much smaller elasticity of 0.72.

The estimations in Table 4 assume that each player who is free agency eligible is making a choice about where to play every year. That assumption is obviously not true, as players have contracts that prevent them from moving in any given year. In Table 5, I restrict the multinomial logit estimation to only consider free agent players. The estimations in this case show a much higher coefficient for the net of tax rate than those in Table 4, giving an even higher bound for the migrational elasticity of baseball players with respect to the net of tax rate. Moreover, the coefficient for the net of tax rate is now statistically significant at the 10 percent level for the second specification and is statistically significant significant at the 5% level for the third and fourth specification. The coefficients for the second and fifth specifications range from 2.171 to 2.979 and the elasticities range from 2.09 to 2.86.

Table 5: Free Agent Multinomial Discrete Choice Estimations 1999-2014

	(1)	(2)	(3)	(4)	(5)
log(1-MTR)	-0.168	2.344*	2.883**	2.979**	2.171
	(0.497)	(1.310)	(1.339)	(1.345)	(1.674)
Wins				-0.00205	-0.00269
				(0.00213)	(0.00221)
Log MSA Population					0.207
					(0.441)
Team F-E	No	Yes	Yes	Yes	Yes
Characteristics 1 x team F-E	No	Yes	No	No	No
Characteristics 2 x team F-E	No	No	Yes	Yes	Yes
Elasticity	-0.16	2.26	2.77	2.86	2.09
	(0.480)	(1.260)	(1.287)	(1.293)	(1.609)
Observations	74340	73860	73860	73860	69960
Cases	2478	2462	2462	2462	2332

Standard errors in parentheses

* $p<0.10$, ** $p<0.05$

8 Discussion and Policy Implications

In this paper, I have have estimated three different equations to analyze how the differences in the top marginal tax rates in different states and cities affect the migratory and team decisions of Major League Baseball players. First, I analyzed how the top marginal tax rate affected the salary paid to free agents and found little to no effect. However, I did find that an increase in the top marginal tax rate led to a decrease in the average ability of a team's free agent signees. Moreover, a multinomial logit estimation found that baseball players show a large mobility response to changes in top marginal income tax rate.

Previously, Alm et al. (2012) had found that, for the years between 1995 and 2001, a one percentage point increase in the top marginal tax rate was associated with an increase in average free agent salary of $24,000. This result contrasts significantly with mine, since I found a noisy, mostly negative, effect of top marginal tax rate on free agent salary. There may be a couple of factors driving these difference is results. For years after 2001, perhaps the imposition of more stringent luxury tax penalties prevented teams from fully compensating free agents for differences in income tax rates. That is the hypothesis Kopkin (2011) puts forth for why he estimates little to no effect of top marginal tax rate on the salary of basketball free agents. The National Basketball Association has a salary cap and a luxury tax.

However, my results diverge from those of Alm et al. (2012) even for the years between 1995 and 2001. This seems especially strange because the group of players used to estimate the equation seem to be very to similar their group of players, as shown by the summary statistics. The results, however, are not directly comparable because we used different numbers of free agents. I used 429 nonpitcher observations between 1995 and 2001 (vs. 360) and 309 pitcher observations (vs. 267). I do not know which free agents they picked and how specifically they picked them. I contacted the authors, but they unfortunately were not able to assist me in finding out exactly which free agents they used.

In an attempt to replicate their results, I made two changes that may explain, though not fully, the discrepancy. Tables 13 and 14 in Appendix D show the results of the modified regressions. I made two modifications. The first was to exclude from the sample of free agents all free agents who re-signed with their previous team. I did this because it is likely that these players re-signed early in the free agency period and so may have been missed by Alm et al. (2012). This modification brought the size of my sample of nonpitchers closer to the size of Alm et al. (2012), as I had 297 observations. However, the size of pitcher sample was still far from theirs (217 vs. 267).

The second change I made was motivated by an apparent error I noted in Alm et al. (2012). They note that, in 2001, the top marginal tax rate in Toronto was 40.16% and 53.5% in Quebec. This is the top marginal rate one obtains if one makes two errors. First, it doesn't take into account the fact that Toronto charges an additional surtax on income tax paid that would bring its 2001 top marginal tax rate to 46.41%. Second, the Quebec top marginal tax rate assumes that Quebec faces the same federal income tax rate as the rest of country. However, Quebec residents are taxed differently by the Canadian federal government than the rest of the residents. As a result, the actual federal top tax rate in Quebec in 2001 was not 29% but rather 24.2%, bringing the total top marginal tax rate in Quebec in 2001 down to 48.72%

This combination of adjustments produce a coefficient of 26.47 on the top marginal tax rate in the fixed effects model, suggesting that these changes help produce results closer to Alm et al. (2012). However, the random effects model produces a negative coefficient, and the results for pitchers are not closer to the results in Alm et al. (2012). See Appendix D for more details.

The point estimates of the regressions from Table 3 suggest that free agents do respond migrationally to the top marginal tax rate. An increase in the top marginal tax rate is associated with a decrease in the average skill of the free agents a team signs. In particular, a 10 percentage point increase in the top marginal tax rate is associated with a decrease of 0.5 in the average WAR of free agents signed by a team. Considering that most starters have a yearly WAR of around 2, the effect seems to be economically significant as well. For example, in 2010 the difference in relative income tax rate between the Toronto Blue Jays and the Texas Rangers was around 10%. Toronto signed around six free agents in 2010. According to my estimates, Toronto's relative top marginal income tax rate meant that, had the Blue Jays been located in Texas, they would have, on average, been able to sign players that would have added between two and three more wins in 2010 than the players they actually signed. This finding mirror findings in other sports, such as those in Kopkin (2011), who looked at free agent mobility in basketball.

The multinomial estimations retrieved elasticity estimates that ranged from 0.72 to 1.77 for all free-agency eligible players. These are larger than the range of 0.6 to 1.3 in Kleven et al. (2013) for foreign football players and the range of 0.63 to 1.04 in Akcigit et al. (2016) for foreign inventors. Although my data did not have the number of observations to achieve the precision of these other studies, my point estimates suggest that indeed, baseball players in the United States are a more mobile labor population between U.S. states than are international football players and international investors between different countries.

My results when looking at free agents exclusively reveal, unsurprisingly, even higher elasticities, which range from 2.09 and 2.86. These estimates are probably among the highest that can be found for any group of laborers, as there are few laborers with the mobility freedom of baseball free agents, who are freed of any contracts and previous commitment, high-income earners, and psychologically prepared to move teams and cities. My estimates for the mobility of baseball players can serve as an upper bound for the migrational response to changes in income tax rates of the entire labor market. My results strengthen the finding in Kleven et al. (2013) that "mobility could be an important constraint on tax progressivity" (page 1923). They also provide a first glimpse into the migrational behavior of "permanent millionaires" between U.S. states.

To put the elasticity numbers in perspective, suppose that all permanent millionaires in the United States had the elasticity of migration probability with respect to the net of tax rate that I have found in baseball players. Suppose that the average city saw its top marginal tax rate decrease from 46 percent (the average top marginal tax rate in the sample) to 36 percent. Then the percentage increase in a permanent millionaire's probability of choosing to live in the average city would be

$$\frac{\log(1 - 0.46) - \log(1 - 0.36)}{\log(1 - 0.46)} \times \epsilon$$

where ϵ refers to the elasticity. Using the range of estimates produced by free agents would suggest that the 10% decrease in top marginal tax rate would increase the probability that millionaires would choose to live in that city by around 58% to 79%. If instead I used the range of estimates produced by free agency eligible players, the probability would increase by around 20% to 49%.

Ultimately, I do find evidence for strong tendencies by high-income individuals to move states and cities in response to differences in top marginal income taxes. While the elasticities suggest that baseball players and perhaps permanent millionaires are very migrationally responsive to changes to the net of tax rate, because, as Young and Varner (2011) note, the number of permanent millionaires is very small, the implications for tax policy are far from clear. If the baseline probability that a permanent millionaire chooses to live in a city is small to begin with, then the decrease in top marginal tax rate may not attract enough permanent millionaires to a city or state to offset the decrease in tax revenues that come from reducing the top marginal tax rate. A good course for future study would be to study these baseline probabilities and calculate the number of permanent millionaires in each state.

Taken altogether, my results also suggest that it is not sufficient to simply look at how wages and salaries respond in order to analyze the migrational effects of changes in the top marginal tax rate. In industries with rigid and inelastic demand for high-skill laborers, salaries may not be able to fully compensate for differences in tax rates between states. Instead, firms may see a change in the composition of their laborers without seeing much change in the salary of their laborers- high skill workers will tend to move towards the places with lower tax rates. Therefore, looking only at salaries may lead one underestimate the migrational effects of a change in top marginal tax rates and to miss the worker composition effects that result from changes in tax rates.

I found no evidence to indicate that the salaries of baseball players adjust in response to changes or differences in the top marginal tax rate; although states and cities have to consider many more dimensions and people when weighing changes to tax policy, states could increase top marginal tax rate and increase the tax revenue collected from baseball players. The one caveat to increases in revenues comes from the jock tax. Because of the jock tax, the true percentage collected from the top margin of the player's salary by a state will not increase one-to-one with the increase in top marginal tax rate. Since most states credit players for tax paid to other states for visiting games, they will not be able to tax the player's salary earned in visiting games. On the other hand, the state also captures more tax from visiting players, which may offset the losses from home players playing away games.

The results presented in this paper show that baseball players and the wealthy can display significant migratory responses to changes in income tax rates. Governments at all levels must take into account these responses when considering increasing top marginal tax rates. Failure to take these responses could lead to lower tax revenue from loss of tax base or lower economic productivity from the loss of skilled workers. The estimates made in this paper can serve to calibrate policy or models to the worst-case scenario, because there is good reason to believe that MLB baseball players can serve as an upper bound case for the elasticity of migration with respect to the net of tax rate.

Acknowledgements

I would like thank my advisor, Professor José Antonio Espín Sánchez, for his guidance and time. I would also like to thank Professor John Roemer and Professor Ebonya Washington for their advice early on in the research process. I am also grateful to Sean Lahman, Retrosheet, Baseball Reference, and the NBER for collecting and making publicly available some of the data I used in this paper.

References

Akcigit, Ufuk, Salom Baslandze, and Stefanie Stantcheva, "Taxation and the International Mobility of Inventors," *American Economic Review*, October 2016, *106* (10), 2930–81.

Alm, James and Sally Wallace, "Are the Rich Different?," in Joel Slemrod, ed., *Does Atlas Shrug?*, Russell Sage Foundation at Harvard University Press, 2000, chapter 6, pp. 165–187.

_ **, William H. Kaempfer, and Edward Batte Sennoga**, "Baseball Salaries and Income Taxes: The Home Field Advantage of Income Taxes on Free Agent Salaries," *Journal of Sports Economics*, 2012, *13* (6), 619–634.

Bakija, Jon and Joel Slemrod, "Do the Rich Flee from High State Taxes? Evidence from Federal Estate Tax Returns," Technical Report, National Bureau of Economic Research 2004.

Cameron, A. Colin, Jonah B. Gelbach, and Douglas L. Miller, "Robust Inference with Multiway Clustering," 2011, *29* (2), 238–249.

Coomes, Paul A. and William H. Hoyt, "Income Taxes and the Destination of Movers to Multistate MSAs," *Journal of Urban Economics*, 2008, *63* (3), 920 – 937.

Cot's Baseball Contracts, "CBA History," 2016. https://www.baseballprospectus.com/compensation/cots/league-info/cba-history/

Day, Kathleen M. and Stanley L. Winer, "Policy-induced Internal Migration: An Empirical Investigation of the Canadian Case," *International Tax and Public Finance*, 2006, *13* (5), 535–564.

DiMascio, John, "The Jock Tax: Fair Play or Unsportsmanlike Conduct?" *University of Pittsburgh Law Review*, 2007, *68* (4).

Feenberg, Daniel and Elisabeth Coutts, "the TAXSIM Model," *Journal of Policy Analysis and management*, 1993, *12* (1), 189–194.

Feldstein, Martin and Marian Vaillant Wrobel, "Can State Taxes Redistribute Income?," *Journal of Public Economics*, 1998, *68* (3), 369–396.

Green, Richard E, "Taxing Profession of Major League Baseball: A Comparative Analysis of Nonresident Taxation, The," *Sports Law. J.*, 1998, *5*, 273.

Griffith, Rachel, James Hines, and Peter Birch Srensen, "International Capital Taxation," in Stuart Adam, Timothy Besley, Richard Blundell, Stephen Bond, Robert Chote, Malcolm Gammie, Paul Johnson, Gareth Myles, and James Poterba, eds., *Dimension of Tax Design: The Mirrlees Review*, Oxford: Oxford University Press, 2010, pp. 914–96.

Hoffman, David K. and Scott A. Hodge, "Nonresident State and Local Income Taxes in the United States: The Continuing Spread of "Jock Taxes"," resreport 130, Tax Foundation July 2004.

Kleven, Henrik Jacobsen, Camille Landais, and Emmanuel Saez, "Taxation and International Migration of Superstars: Evidence from the European Football Market," *The American Economic Review*, 2013, *103* (5), 1892–1924.

Kopkin, Nolan, "Tax Avoidance : How Income Tax Rates Affect the Labor Migration Decisions of NBA Free Agents," *Journal of Sports Economics*, 2011.

Krautmann, Anthony C., Elizabeth Gustafson, and Lawrence Hadley, "A Note on the Structural Stablity of Salary Equations," 2003, *4*, 56–63.

Leigh, Andrew, "Do Redistributive State Taxes Reduce Inequality?," *National Tax Journal*, 2008, *61* (1), 81–104.

Liebig, Thomas, Patrick A. Puhani, and Alfonso Sousa-Poza, "Taxation And Internal Migration - Evidence From The Swiss Census Using Community-Level Variation In Income Tax Rates," Hannover Economic Papers (HEP) dp-348, Leibniz Universitt Hannover, Wirtschaftswissenschaftliche Fakultt October 2006.

McFadden, Daniel L., "Conditional Logit Analysis of Qualitative Choice Behavior," in Paul Zarembka ed., *Frontiers in Economics*, Academic Press, 1974, chapter 4, pp. 105 –142.

Mirrlees, J. A., "Migration and Optimal Income Taxes," *Journal of Public Economics*, August 1982, *18* (3), 319–341.

Musgrave, Richard, *The Theory of Public Finance*, McGraw-Hill, 1959.

Newman, Mark, "MLB releases 2013 schedule with new wrinkles," Online, MLB.com, 2012, http://m.mlb.com/news/article/38287660/

Oates, Wallace E, *Fiscal Federalism*, Harcourt Brace Jovanovich, 1972.

Pappas, Doug, "A Contentious History: Baseball's Labor Fights," Online, ESPN.com, 2002, http://static.espn.go.com/mlb/columns/bp/1427632.html

Piketty, Thomas, *Capital in the Twenty-First Century*, The Belknap Press of Harvard university, 2014.

_ **, Emmanuel Saez, and Stefanie Stantcheva**, "Optimal Taxation of Top Labor Incomes: A Tale of Three Elasticities," *American Economic Journal: Economic Policy*, February 2014, *6* (1), 230–71.

Saez, Emmanuel, Joel Slemrod, and Seth H. Giertz, "The Elasiticity of Taxable Income with Respect to Marginal Tax Rates: A Critical Review," *Journal of Economic Literature*, 2012, *50* (1), 3–50.

Sanders, Bernie, "The Transcript of Bernie Sanders Victory Speech," *The Washington Post* 2016, https://www.washingtonpost.com/news/post-politics/wp/2016/02/10/the-transcript-of-bernie-sanderss-victory-speech/

Stiglitz, Joseph E., *Rewriting the Rules of the American Economy*, W.W. Norton & Company, 2015.

Treff, Karin and David B. Perry, "Finances of the Nation," resreport, Canadian Tax Foundation 2002.

Wintour, Patrick, "Jeremy Corbyn vows to raise taxes for the rich if elected prime minister," Online, *The Guardian*, 2015, https://www.theguardian.com/politics/2015/jul/22/jeremy-corbyn-vows-to-raise-taxes-for-the-rich-if-elected-prime-minister

Young, Cristobal and Charles Varner, "Millionaire Migration and State Taxation of Top Incomes: Evidence from a Natural Experiment," *National Tax Journal*, 2011, *64* (2), 255–284.

Appendices

A Sources for the City Tax Rates

There are a total of nine cities that have a Major League Baseball team and levy an income tax on residents and non-residents. For 2014, the cities had the following top marginal tax rate for residents: Philadelphia 3.92%; New York City, 3.88%; Baltimore, 3.2%; Pittsburgh, 3%; Detroit, 2.4%; Cincinnati, 2.1 %; Cleveland 2%; Kansas City, 1%; and St. Louis 1%. The data for top marginal tax rates in these cities between the years was collected from the corresponding city websites, state tax documents, and city tax documents. Table 6 details the exact sources used.[8]

Table 6: City Tax Rate Sources

City	Source
Philadelphia	City of Philadelphia website[8]
New York City	NYC Office of Management and Budget, "Tax Revenue Forecasting Documentation: Financial Plan Fiscal Year 2015-2019," 2015
Baltimore	Individual income tax forms retrieved from the Comptroller of Maryland website, taxes.marylandtaxes.com
Pittsburgh	Pittsburgh Department of Finance website, pittsburghpa.gov/finance/earned-income-tax
Detroit	Citizens Research Council of Michigan, "Detroit Government Revenues," 2013
Cincinnati	City of Cincinnati website, http://cincinnati-oh.gov/finance/income-taxes/
Cleveland	Division of Taxation, Department of Finance, City of Cleveland website, http://ccatax.ci.cleveland.oh.us/?p=effective
Kansas City	Kansas City Star, "Kansas City voters overwhelmingly approve earnings tax renewal," April 5, 2016
St. Louis	The PFM Group, "Earnings Tax Study City of St. Louis," 2011, and the City of St. Louis website

[8]The City of Philadelphia website used to contain a page listing wage taxes for residents and non-residents dating back to 1995. I was able to access this page on January 7, 2017. The City of Philadelphia has since revamped its webpage, removing the page with wage tax data

B Constructing Marginal Tax Rates in Accordance with Jock Tax

A majority of the teams in Major League Baseball are located in states or cities that institute a "jock tax." Under the jock tax, athletes playing a game in a state that is not their home state are required to pay a tax on the income they earned while playing the away game to the state they are visiting. It is not a special tax levied only to athletes, but rather the application of the state or city's existing income tax to the visiting athlete. The states and cities charge visiting athletes based on the number of games that they played at that state or city and the total number of "duty days". A duty day refers to a day in which an athlete is required to go to work. For baseball players, this includes Spring Training games, practices, home games and away games. For most teams, the number of duty days is around 207. To determine the tax a visiting athlete owes, a state or city counts the number of games the visiting athlete played there and divides this by the number by the number of duty days. The jurisdiction then multiplies this fraction by the athlete's total salary to get the total income on which the jurisdiction will apply the tax. The only teams that were in jurisdictions that did not charge a jock tax are the Toronto Blue Jays, the Montreal Expos, the Washington Nationals, the Texas Rangers, the Florida Marlins, and the Seattle Mariners. Both cities with income taxes and states with income taxes charge visiting athletes.

A hypothetical example may help clarify the way the jock tax works. Suppose player A, who earns a salary of \$20 million, plays for the Florida Marlins. Suppose that in 2014, the Marlins played 6 away games against the Cincinnati Reds. The state of Ohio had a top marginal rate on wages of 5.3% and the city of Cincinnati had an earnings tax of 2.1%. The player has spent $\frac{6}{207} \approx 0.0299$ of their duty days in Cincinnati. Cincinnati and Ohio will levy their respective income tax on an income of $20,000,000 \times \frac{6}{207} \approx \$579,710$. Cincinnati will end up charging $\$579,710 \times 0.021 \approx \$12,174$ and Ohio will end up charging $\$579,710 \times 0.053 \approx \$30,725$. In total, player A ends up paying about $\$42,899$ in taxes to Ohio and Cincinnati for playing six games there.

One final wrinkle that enters the calculation of tax paid by a player is the possibility of double taxation. Most states account for the possibility of double taxation and credit the player for taxes paid to other states. That is, the home state, which would normally charge an income tax based the player's full salary, credits the player for the amount of tax they have already paid, and charges the player the difference between the tax charged by the visiting state and the full tax the home state would have charged if no visiting state had levied the jock tax. The issue of double taxation also extends to cities that impose income taxes. A player's home city will not credit the player for taxes paid to outside states, but will credit the player for taxes paid to outside cities.

Only Illinois engages in double taxation. If a player who plays for an Illinois plays an away game at a jurisdiction that levies a jock tax, Illinois will not take into account the amount of tax the player has already paid. Instead, Illinois will charge that player the full tax the player would have had to pay had the game been a home game. Illinois is also the only state that has in place a retaliatory jock tax. The state only levies a jock tax on players who play for teams whose states also impose a jock tax. Visiting players from states like Texas, Florida, or Washington, which do not have an income tax, do not get charged a jock tax by Illinois.

To calculate the actual top marginal tax rate faced by each player in each team-year, I downloaded full team schedules for each year from 1999 to 2014 from the website Retrosheet. For each team-year, I calculated the number of away games they played at different locations, and, using the duty days method, calculated the tax rate on the total salary that these away games accounted for. I then added this to the home tax rate on the total salary for the 81 home games. I also added the tax rate that corresponds to the 45 spring training and practice days, taking into account that Arizona and Michigan do not charge a state income tax on spring training days. These tax rates, all added together, became the calculated top marginal tax rate for each team-year.

C Summary Statistics

Below are different sets of summary statistics for the data I used.

Table 7: Summary Statistics for Nonpitchers Eligible for Free Agency

	(1)		(2)		(3)	
	1995-2014		1995-2001		1999-2014	
Salary (in thousands)	4694.4	(4759.8)	2922.2	(2677.9)	5272.0	(5047.1)
MTR	6.553	(2.355)	6.864	(2.349)	6.334	(2.227)
Relative Income Tax	-0.00551	(2.174)	-0.165	(1.881)	0.0389	(2.208)
MTR-Alternate	6.380	(2.216)	6.736	(2.451)	6.152	(2.044)
Experience	9.422	(2.906)	9.045	(2.384)	9.614	(3.064)
On-Base Percentage-Y	0.339	(0.0452)	0.346	(0.0475)	0.338	(0.0442)
On-Base Percentage-C	0.339	(0.0307)	0.337	(0.0317)	0.340	(0.0304)
Slugging Percentage-Y	0.429	(0.0882)	0.433	(0.0956)	0.429	(0.0865)
Slugging Percentage-C	0.429	(0.0624)	0.418	(0.0628)	0.434	(0.0620)
On-Base Plus Slugging-Y	0.768	(0.124)	0.779	(0.132)	0.767	(0.122)
On-Base Plus Slugging-C	0.768	(0.0861)	0.755	(0.0860)	0.774	(0.0858)
Batting Average-Y	0.268	(0.0374)	0.273	(0.0386)	0.268	(0.0367)
Batting Average-C	0.271	(0.0224)	0.269	(0.0228)	0.272	(0.0220)
Home Runs-Y	13.39	(11.40)	13.24	(12.15)	13.73	(11.36)
Home Runs-C	114.2	(102.3)	96.24	(86.79)	121.4	(106.6)
Runs Batted In-Y	54.50	(32.69)	54.53	(35.18)	55.41	(32.38)
Runs Batted In-C	474.0	(319.7)	423.4	(275.5)	495.3	(332.1)
Fielding Percentage-Y	0.982	(0.0218)	0.980	(0.0310)	0.983	(0.0146)
Fielding Percentage-C	0.981	(0.0111)	0.979	(0.0121)	0.981	(0.0107)
Observations	4124		1480		3294	

Table 8: Summary Statistics for Pitchers Eligible for Free Agency

	(1)		(2)		(3)	
	1995-2014		1995-2001		1999-2014	
Salary (in thousands)	4355.0	(4183.3)	2728.3	(2397.6)	4813.5	(4402.7)
MTR	6.601	(2.346)	6.929	(2.358)	6.388	(2.196)
Relative Income Tax	0.0703	(2.139)	-0.0652	(1.859)	0.0974	(2.151)
MTR-Alternate	6.388	(2.111)	6.748	(2.403)	6.172	(1.895)
Experience	9.219	(3.008)	8.801	(2.345)	9.358	(3.164)
Earned Run Average-Y	4.148	(2.413)	4.409	(3.622)	4.131	(2.580)
Earned Run Average-C	4.021	(0.634)	3.952	(0.636)	4.066	(0.634)
Wins-Y	6.733	(5.129)	6.967	(5.202)	6.730	(5.145)
Wins-C	60.74	(48.11)	59.99	(43.01)	60.76	(49.76)
Win-Loss Percentage-Y	0.508	(0.208)	0.514	(0.211)	0.508	(0.206)
Win-Loss Percentage-C	0.516	(0.0744)	0.516	(0.0705)	0.516	(0.0757)
Innings Pitched-Y	111.0	(67.41)	114.4	(68.13)	110.7	(67.32)
Innings Pitched-C	997.3	(691.2)	990.0	(639.8)	996.5	(709.5)
Strikeout-Walk Ratio-Y	2.428	(1.225)	2.209	(1.138)	2.464	(1.236)
Strikeout-Walk Ratio-C	2.156	(0.632)	2.040	(0.613)	2.178	(0.631)
Saves-Y	4.373	(10.47)	4.195	(9.954)	4.402	(10.60)
Saves-C	32.57	(72.03)	32.05	(68.08)	32.25	(72.32)
Observations	3056		1044		2511	

Table 9: Summary Statistics for Nonpitcher Free Agents

	(1)		(2)		(3)	
	1995-2014		1995-2001		1999-2014	
Salary (in thousands)	2565.7	(3285.2)	1655.6	(2133.5)	2899.3	(3541.7)
MTR	6.518	(2.347)	6.859	(2.311)	6.322	(2.251)
Relative Income Tax	-0.0130	(2.229)	-0.177	(1.928)	0.0401	(2.264)
MTR-Alternate	6.312	(2.120)	6.655	(2.279)	6.133	(2.019)
Experience	10.26	(2.942)	9.711	(2.270)	10.50	(3.120)
On-Base Percentage-Y	0.331	(0.0439)	0.336	(0.0451)	0.330	(0.0435)
On-Base Percentage-C	0.332	(0.0278)	0.329	(0.0294)	0.333	(0.0272)
Slugging Percentage-Y	0.411	(0.0841)	0.412	(0.0867)	0.411	(0.0839)
Slugging Percentage-C	0.413	(0.0558)	0.399	(0.0546)	0.418	(0.0557)
On-Base Plus Slugging-Y	0.741	(0.117)	0.749	(0.119)	0.740	(0.118)
On-Base Plus Slugging-C	0.745	(0.0751)	0.728	(0.0736)	0.751	(0.0750)
Batting Average-Y	0.263	(0.0394)	0.267	(0.0385)	0.262	(0.0397)
Batting Average-C	0.266	(0.0209)	0.264	(0.0217)	0.266	(0.0207)
Home Runs-Y	10.12	(9.434)	9.417	(9.465)	10.55	(9.628)
Home Runs-C	103.0	(93.00)	83.59	(78.55)	110.5	(96.55)
Runs Batted In-Y	43.70	(28.39)	42.62	(29.24)	44.74	(28.64)
Runs Batted In-C	456.0	(301.9)	396.9	(258.5)	479.4	(313.3)
Fielding Percentage-Y	0.983	(0.0158)	0.980	(0.0192)	0.983	(0.0146)
Fielding Percentage-C	0.981	(0.0107)	0.979	(0.0122)	0.982	(0.0103)
Observations	1286		429		1022	

Table 10: Summary Statistics for Pitcher Free Agents

	(1)		(2)		(3)	
	1995-2014		1995-2001		1999-2014	
Salary (in thousands)	2949.4	(3096.7)	1977.6	(2061.6)	3236.3	(3285.0)
MTR	6.568	(2.308)	7.007	(2.499)	6.318	(2.108)
Relative Income Tax	-0.0142	(2.082)	-0.175	(1.866)	0.00890	(2.090)
MTR-Alternate	6.438	(2.093)	6.956	(2.575)	6.177	(1.787)
Experience	10.01	(3.144)	9.385	(2.168)	10.21	(3.319)
Earned Run Average-Y	4.341	(3.612)	4.879	(6.095)	4.323	(3.937)
Earned Run Average-C	4.076	(0.601)	3.959	(0.604)	4.137	(0.597)
Wins-Y	5.795	(4.504)	6.278	(4.565)	5.731	(4.493)
Wins-C	62.39	(48.53)	63.27	(40.73)	62.29	(50.74)
Win-Loss Percentage-Y	0.497	(0.211)	0.507	(0.203)	0.497	(0.211)
Win-Loss Percentage-C	0.504	(0.0686)	0.506	(0.0657)	0.504	(0.0705)
Innings Pitched-Y	100.1	(62.31)	107.0	(64.49)	99.20	(61.76)
Innings Pitched-C	1046.3	(696.9)	1071.5	(623.1)	1041.7	(720.6)
Strikeout-Walk Ratio-Y	2.234	(1.055)	2.035	(1.001)	2.247	(1.041)
Strikeout-Walk Ratio-C	2.070	(0.584)	1.984	(0.623)	2.069	(0.557)
Saves-Y	3.366	(8.842)	3.049	(8.041)	3.255	(8.716)
Saves-C	37.62	(78.46)	36.38	(75.22)	36.67	(77.61)
Observations	997		309		815	

Table 11: Summary Statistics for Nonpitcher Free Agents by Tax Quartile 1999-2014

	(1)		(2)		(3)		(4)	
	Top 25%		25%-50%		50%-75%		Lower 25%	
Salary (in thousands)	2997.1	(3902.1)	2735.4	(3145.7)	3029.5	(3564.8)	3009.2	(3687.2)
MTR	8.897	(2.192)	6.527	(0.647)	5.562	(0.487)	3.685	(0.582)
Relative Income Tax	2.688	(2.152)	0.271	(0.509)	-0.730	(0.313)	-2.682	(0.462)
MTR-Alternate	8.242	(1.971)	6.527	(0.647)	5.562	(0.487)	3.685	(0.582)
Experience	10.90	(3.528)	10.45	(3.095)	10.08	(2.771)	10.66	(3.127)
On-Base Percentage-Y	0.331	(0.0496)	0.330	(0.0357)	0.328	(0.0407)	0.328	(0.0440)
On-Base Percentage-C	0.335	(0.0296)	0.333	(0.0243)	0.331	(0.0267)	0.333	(0.0260)
Slugging Percentage-Y	0.415	(0.0841)	0.406	(0.0799)	0.412	(0.0778)	0.410	(0.0907)
Slugging Percentage-C	0.423	(0.0572)	0.415	(0.0543)	0.416	(0.0545)	0.419	(0.0556)
On-Base Plus Slugging-Y	0.745	(0.124)	0.736	(0.107)	0.740	(0.107)	0.738	(0.127)
On-Base Plus Slugging-C	0.758	(0.0790)	0.749	(0.0716)	0.747	(0.0737)	0.752	(0.0737)
Batting Average-Y	0.262	(0.0449)	0.264	(0.0340)	0.261	(0.0347)	0.259	(0.0423)
Batting Average-C	0.268	(0.0209)	0.266	(0.0194)	0.265	(0.0207)	0.266	(0.0211)
Home Runs-Y	10.92	(9.789)	9.886	(8.912)	10.68	(9.304)	10.29	(9.668)
Home Runs-C	122.4	(107.0)	107.9	(99.17)	102.3	(85.76)	111.6	(94.01)
Runs Batted In-Y	45.81	(28.67)	43.43	(26.34)	44.95	(27.66)	43.24	(29.93)
Runs Batted In-C	521.1	(343.7)	471.1	(317.2)	444.1	(281.2)	486.6	(311.2)
Fielding Percentage-Y	0.982	(0.0147)	0.986	(0.0108)	0.984	(0.0139)	0.985	(0.0146)
Fielding Percentage-C	0.981	(0.0101)	0.983	(0.00929)	0.982	(0.0100)	0.983	(0.0103)
WAR	0.740	(1.529)	0.715	(1.538)	0.727	(1.672)	0.843	(1.755)
MSA Population (000)	9807.5	(6449.2)	5091.8	(5219.3)	4681.6	(2657.5)	4364.2	(1159.7)
MSA Employment (000)	5773.8	(3556.7)	3092.4	(2976.8)	2877.5	(1551.7)	2587.7	(731.2)
Team Payroll (000000)	98.45	(43.84)	84.90	(40.53)	91.15	(37.47)	75.68	(27.58)
Team Wins	84.02	(9.827)	78.26	(12.43)	82.04	(10.98)	79.33	(12.39)
Observations	274		211		250		215	

Table 12: Summary Statistics for Pitcher Free Agents by Tax Quartile 1999-2014

	(1)		(2)		(3)		(4)	
	Top 25%		25%-50%		50%-75%		Lower 25%	
Salary (in thousands)	3906.8	(3834.4)	3272.3	(3375.0)	2857.2	(2830.5)	3005.8	(2847.2)
MTR	8.682	(1.838)	6.611	(0.631)	5.564	(0.454)	3.633	(0.582)
Relative Income Tax	2.393	(1.809)	0.296	(0.488)	-0.746	(0.279)	-2.688	(0.494)
MTR-Alternate	8.151	(0.875)	6.611	(0.631)	5.564	(0.454)	3.633	(0.582)
Experience	10.48	(3.504)	10.03	(3.136)	9.903	(3.253)	10.47	(3.541)
Earned Run Average-Y	3.953	(1.224)	4.174	(1.444)	4.372	(1.610)	4.188	(1.304)
Earned Run Average-C	4.046	(0.585)	4.161	(0.618)	4.189	(0.563)	4.182	(0.615)
Wins-Y	6.434	(4.757)	5.365	(4.443)	5.454	(3.949)	5.348	(4.579)
Wins-C	69.17	(60.70)	57.05	(41.75)	59.35	(46.31)	60.76	(49.72)
Win-Loss Percentage-Y	0.528	(0.188)	0.482	(0.224)	0.493	(0.224)	0.477	(0.212)
Win-Loss Percentage-C	0.514	(0.0693)	0.492	(0.0663)	0.505	(0.0686)	0.500	(0.0743)
Innings Pitched-Y	106.7	(63.85)	96.99	(62.08)	95.47	(57.02)	94.54	(61.84)
Innings Pitched-C	1118.1	(822.3)	980.2	(606.4)	1004.8	(689.0)	1021.6	(714.7)
Strikeout-Walk Ratio-Y	2.382	(0.936)	2.184	(0.853)	2.265	(1.339)	2.165	(0.957)
Strikeout-Walk Ratio-C	2.133	(0.567)	2.067	(0.538)	2.084	(0.580)	2.021	(0.528)
Saves-Y	3.420	(9.668)	3.545	(8.857)	2.730	(7.206)	3.534	(9.362)
Saves-C	35.18	(84.61)	44.32	(89.11)	28.79	(53.71)	41.71	(80.02)
WAR	0.816	(1.460)	0.545	(1.330)	0.726	(1.386)	0.635	(1.551)
MSA Population (000)	10958.2	(6564.3)	4703.3	(4807.4)	4592.1	(2579.1)	4506.4	(1159.3)
MSA Employment (000)	6424.0	(3643.4)	2837.1	(2704.8)	2829.5	(1503.6)	2695.7	(747.9)
Team Payroll (000000)	105.2	(51.02)	80.21	(34.12)	89.83	(35.99)	78.52	(27.62)
Team Wins	84.13	(10.04)	77.58	(11.39)	83.19	(11.11)	79.52	(10.78)
Observations	226		189		196		161	

D Salary Regression Modifications

Below are the salary regressions on the modified sample of free agents. Tables 13 and 14 are for nonpitchers and pitchers, respectively. Column 1 shows the results for fixed effects, removing all of the free agents that signed with their previous team. Column 2 shows the estimation for the same sample, except with random effects. Column 3 does not use my calculated top marginal tax rates for teams, but instead runs the regression using an alternate top marginal tax rate that does not take into account the Toronto income surtax and the Quebec federal tax adjustment.

The adjustments for previous team signings brings the observations number closer to that in Alm et al. (2012) for nonpitchers, but brings the pitcher observations far below that of Alm et al. (2012). The coefficient on top marginal tax rate (MTR) does not change much in Columns 1 and 2 compared to the specifications that do not remove free agents who signed with their previous team. However, when I used the adjusted top marginal tax rate instead (MTR-Alternate), the coefficient became positive and close to that of Alm et al. (2012) for nonpitchers. The results may help explain the difference between my results and that of Alm et al. (2012). However, the divergence of results is still puzzling, because our summary statistics are very similar.

Table 13: Salary Regression for Nonpitcher Free Agents 1995-2001

	(1)	(2)	(3)	(4)
	Salary (000s)	Salary (000s)	Salary (000s)	Salary (000s)
MTR	7.681	-33.31		
	(28.74)	(26.50)		
MTR-Alternate			26.47	-8.514
			(26.31)	(26.96)
Experience	959.0***	903.7***	954.2***	883.4***
	(224.7)	(195.3)	(223.5)	(195.1)
Experience Squared	-48.03***	-52.35***	-47.33***	-51.45***
	(9.819)	(8.960)	(9.719)	(8.937)
On-Base Plus Slugging-Y	1020.0	2644.5***	987.9	2576.3***
	(769.9)	(772.6)	(748.3)	(778.0)
On-Base Plus Slugging-C	38232.6***	19241.9***	38968.0***	19429.5***
	(10214.7)	(3394.6)	(10062.7)	(3399.4)
Fielding Percentage-Y	1175.5	-322.0	1527.8	-382.1
	(6206.5)	(4637.8)	(6153.0)	(4691.4)
Fielding Percentage-C	-40332.2	5158.0	-40666.4	5251.0
	(45489.3)	(10552.7)	(44992.1)	(10670.7)
Observations	297	297	297	297
Individuals	200	200	200	200
R-squared Overall	0.363	0.439	0.360	0.434

Standard errors in parentheses

* $p<0.10$, ** $p<0.05$, *** $p<0.01$

Table 14: Salary Regression for Pitcher Free Agents 1995-2001

	(1)	(2)	(3)	(4)
	Salary (000s)	Salary (000s)	Salary (000s)	Salary (000s)
MTR	-18.29	-9.788		
	(45.83)	(49.12)		
MTR-Alternate			-29.36	-33.71
			(58.10)	(48.11)
Experience	-23.29	102.3	-10.28	108.2
	(956.4)	(317.1)	(971.8)	(313.7)
Experience Squared	-1.641	-14.72	-3.032	-14.97
	(19.50)	(16.45)	(20.94)	(16.27)
Earned Run Average-Y	10.97	-50.84	22.53	-41.89
	(78.65)	(58.93)	(90.57)	(57.08)
Wins-Y	54.56	148.0***	53.07	146.8***
	(61.61)	(56.69)	(60.25)	(56.34)
Wins-C	38.87**	13.48***	39.06**	13.56***
	(15.23)	(4.804)	(15.28)	(4.775)
Win-Loss Percentage-Y	434.0	-287.0	470.5	-212.9
	(433.4)	(451.9)	(456.0)	(460.7)
Innings Pitched-Y	6.359	8.244**	6.598	8.196**
	(4.702)	(3.463)	(4.758)	(3.399)
Strikeout-Walk Ratio-C	5478.3***	483.9*	5444.0***	490.8*
	(1371.5)	(257.8)	(1379.8)	(256.9)
Saves-Y	54.90***	55.02***	51.28**	54.14***
	(20.94)	(13.20)	(23.66)	(13.02)

E Ability Regression Robustness Checks

Below are various tables that serve as robustness checks for the regressions run on Table 3

Table 15: Regression on Previous Year's WAR 2001-2014

	(1)	(2)	(3)	(4)
	WAR	WAR	WAR	WAR
Relative Income Tax Rate	-0.0617	-0.0637	-0.0585	-0.0240
	(0.0522)	(0.0584)	(0.0646)	(0.0644)
Log MSA Population			0.113	-0.322
			(0.492)	(2.110)
Log MSA Employment				0.702
				(1.924)
Wins				0.0220**
				(0.00574)
Contract				-0.0703
				(0.0882)
Team F-E	Yes	Yes	Yes	Yes
Year F-E	Yes	Yes	Yes	Yes
Position Controls	No	Yes	Yes	Yes
Observations	2008	1988	1988	1988
R-squared	0.0395	0.0487	0.0487	0.0689

Standard errors in parentheses

* $p<0.10$, ** $p<0.05$

Table 16: Regression on Previous Year's OPS 2001-2014

	(1)	(2)	(3)	(4)
	OPS	OPS	OPS	OPS
Relative Income Tax Rate	-0.00234	-0.00318	-0.00299	-0.000706
	(0.00415)	(0.00439)	(0.00568)	(0.00729)
Log MSA Population			0.00365	-0.130
			(0.0711)	(0.230)
Log MSA Employment				0.141
				(0.237)
Wins				0.000576
				(0.000799)
Contract				0.0231
				(0.0151)
Team F-E	Yes	Yes	Yes	Yes
Year F-E	Yes	Yes	Yes	Yes
Position Controls	No	Yes	Yes	Yes
Observations	1100	1080	1080	1080
R-squared	0.0651	0.123	0.123	0.128

Standard errors in parentheses

* $p<0.10$, ** $p<0.05$

Table 17: Regression on Previouse Year's ERA Over the Last 3 Seasons 2001-2014

	(1)	(2)	(3)
	ERA	ERA	ERA
Relative Income Tax Rate	0.378	0.182	0.120
	(0.291)	(0.174)	(0.204)
Log MSA Population		-5.605**	-1.586
		(1.593)	(4.052)
Log MSA Employment			-4.467
			(2.875)
Wins			-0.0204*
			(0.0113)
Contract			-0.591**
			(0.196)
Team F-E	Yes	Yes	Yes
Year F-E	Yes	Yes	Yes
Observations	907	907	907
R-squared	0.102	0.112	0.134

Standard errors in parentheses

* $p<0.10$, ** $p<0.05$

Table 18: Regression on Average Yearly WAR Over the Last 3 Seasons for Pitchers 2001-2014

	(1)	(2)	(3)
	Average WAR	Average WAR	Average WAR
Relative Income Tax Rate	-0.0420	-0.0279	-0.00724
	(0.0643)	(0.0677)	(0.0595)
Log MSA Population		0.407	0.0198
		(0.739)	(2.613)
Log MSA Employment			0.545
			(2.149)
Wins			0.0111*
			(0.00572)
Contract			-0.0214
			(0.131)
Team F-E	Yes	Yes	Yes
Year F-E	Yes	Yes	Yes
Observations	908	908	908
R-squared	0.0950	0.0953	0.104

Standard errors in parentheses

* $p<0.10$, ** $p<0.05$