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TAXATION AND INTERNATIONAL MIGRATION OF SUPERSTARS:  
EVIDENCE FROM THE EUROPEAN FOOTBALL MARKET

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Taxation and International Migration of Superstars: Evidence from the European Football Market

Henrik Kleven, Camille Landais, and Emmanuel Saez

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**ABSTRACT**

This paper analyzes the effects of top earnings tax rates on the international migration of football players in Europe. We construct a panel dataset of top earnings tax rates, football player careers, and club performances in the first leagues of 14 Western European countries since 1985. We identify the effects of top earnings tax rates on migration using a number of tax and institutional changes: (a) the 1995 Bosman ruling which liberalized the European football market, (b) top tax rate reforms within countries, and (c) special tax schemes offering preferential tax rates to immigrant football players. We start by presenting reduced-form graphical evidence showing large and compelling migration responses to country-specific tax reforms and labor market regulation. We then develop a multinomial regression framework to exploit all sources of tax variation simultaneously. Our results show that (i) the overall location responses to the net-of-tax rate is positive and large, with an elasticity of the number of foreign players to the net-of-tax rate around one (and an elasticity of the number of domestic players around .15), (ii) location elasticities are even larger at the top of the ability distribution, but negative at the bottom due to ability sorting effects, and (iii) cross-tax effects of foreign players on domestic players (and vice versa) are negative and quite strong due to displacement effects. Those results can be rationalized in a simple model of migration and taxation with rigid labor demand.

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# 1 Introduction

Tax-induced international mobility of talent is a crucial public policy issue when tax rates differ substantially across countries and migration barriers are low as in the case of the European Union. High tax rates on highly paid workers may induce such workers to migrate to countries where the tax burden is lower, hence limiting the ability of governments to redistribute income using progressive taxation. In fact, mobility responses to taxation often loom larger in the policy debate on tax progressivity than traditional within-country labor supply responses.

There are vast empirical literatures on labor supply and taxable income responses to taxation within countries (see surveys by Blundell and MaCurdy 1999; Saez, Slemrod, and Giertz 2012). There are also many studies on the effects of capital taxation on multinational corporations and international capital mobility that find substantial mobility effects (as surveyed by Gordon and Hines 2002; Devereux and Griffith 2002; Griffith, Hines, and Sørensen 2010). But there is very little empirical work on the effect of taxation on the spatial mobility of individuals, especially among high-skilled workers. While a small literature has considered the mobility of people across local jurisdictions *within* countries,<sup>1</sup> empirical work on the effect of taxation on international mobility appears to be virtually non-existent partly due to lack of micro data with citizenship information and challenges in identifying causal tax effects on migration.<sup>2</sup> This paper takes a first step to fill this gap in the literature by focusing on the specific labor market for professional football players in Europe.

The European football market offers three important advantages for the study of mobility and taxation. First, international mobility is high in the professional football market, making it a valuable and visible laboratory to study tax-induced mobility across countries. Hence, this study likely provides an upper bound on the migration response to taxation for the labor market as a whole.<sup>3</sup> Obtaining an upper bound is crucial to gauge the potential importance of this policy question, especially as labor markets become more internationally integrated.

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<sup>1</sup>See Kirchgassner and Pommerehne (1996) and Liebig et al. (2007) on mobility across Swiss Cantons in response to Canton taxes; Feldstein and Wrobel (1998), Bakija and Slemrod (2004), and Young and Varner (2011) on mobility across US states in response to state income taxes; Day and Winer (2006) on tax-induced mobility across Canadian provinces and Meyer (2000) on mobility across US states in response to state welfare programs.

<sup>2</sup>While there is almost no work tax-induced international migration, there is a large literature on the effects of wage differentials and welfare benefit differentials on international migration (see Borjas 1999 for a survey).

<sup>3</sup>Using Danish administrative data from Kleven et al. (2011), this paper provides direct evidence that mobility in the football market represents an upper bound on mobility for the labor market as a whole.

Second, extensive data on the careers and mobility of professional football players can be gathered for most countries over long time periods.<sup>4</sup> For this project, we have gathered exhaustive data on the career paths of all first-league football players (top 20 or so teams in each country) for 14 Western European countries from 1985 to 2008. We have also collected top earnings tax rate data across countries and over time, taking into account special tax rules applying to immigrant workers and sometimes to athletes specifically. As we show using actual individual earnings data for a large subset of players, because top football players are very highly paid, their average tax rate is well approximated by the top marginal tax rate when combining (a) the top individual income tax rate, (b) uncapped social security contributions, and (c) value-added taxes. As a result, empirical estimates are quite similar when using the top marginal tax rate vs. using the estimated average tax rate.

Third, we can exploit many sources of variation in both tax policy and labor market regulation to identify the effect of taxation on mobility in the football market: (a) Top tax rates vary across countries and over time. (b) Some countries have introduced preferential tax schemes to immigrant workers.<sup>5</sup> (c) The so-called Bosman ruling by the European Court of Justice in 1995 lifted pre-existing restrictions on player mobility, facilitating an analysis of the interaction between taxes and regulation on mobility. Together, these policy changes create compelling quasi-experimental variation to identify causal impacts of taxation on location choice.

We first set out a theoretical model of taxation and migration where we allow for rigid labor demand as both the number of professional football teams and the number of players per team are fairly rigid within each country. As countries can choose differential tax rates on domestic vs. foreign players, our model naturally defines two elasticity parameters of interest: (a) the elasticity of the number of foreign players with respect to the net-of-tax rate on foreign players, (b) the elasticity of the number of domestic players with respect to the net-of-tax rate on domestic players. In a standard flexible-demand model, cutting taxes on foreigners increases the number of foreign players at all ability levels and has no cross effect on the number of domestic players in equilibrium. By contrast, with rigid-demand, equilibrium employment is fixed in each country and therefore tax policy affects only the sorting of players across countries

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<sup>4</sup>By contrast, it is not possible to do a multi-country analysis of tax-induced international migration for all top earners in the labor market as administrative data with migration information is not shared between countries. Hence, the football market offers a unique opportunity for multi-country micro-data analysis of migration.

<sup>5</sup>For example, preferential tax schemes to foreigners have been implemented in the Netherlands (1980s), Denmark (1991), Belgium (2002), Spain (2004), and France (2008).

in equilibrium. We show that a tax cut to foreigners has two effects in equilibrium: (i) it attracts foreign players at high ability levels but crowds out foreign players at low ability levels (“ability sorting effect”), (ii) the total number of foreigners increases and this leads to displacement of domestic players (“displacement effect”).

Next, we present reduced-form graphical evidence showing clear effects of taxation on migration. We start by considering cross-country correlations between (a) the tax rate on foreign players and the fraction of foreigners in the national league, (b) the tax rate on domestic players and the fraction of native players playing in their home league, and (c) the average tax rate on foreign and domestic players and the performance of first-league teams in the country. We find strong negative correlations in all three cases, but only for the post-Bosman era when mobility was set free. Those correlations translate into large and significant elasticities. The elasticity of the fraction of foreign players with respect to the net-of-tax rate for foreign players is above one while the elasticity of the fraction of domestic players with respect to the net-of-tax rate for domestic players is around .2. We then turn to quasi-experimental evidence from preferential tax schemes to foreigners in Spain and Denmark. Using the synthetic control method of Abadie et al. (2010), we show clear graphical evidence that international mobility responds to taxation. For example, the fraction of foreigners in the Spanish league diverges from the synthetic comparison country quickly after the introduction of a preferential rate for foreigners. Consistent with our rigid-demand theoretical model, those effects are stronger for top-quality football players. The corresponding estimated elasticities of the fraction of foreign players with respect to the net-of-tax rate for foreign players are also above one.

Finally, we present results from multinomial micro-level regressions using all sources of variation in top earnings tax rates across countries and years in the post-Bosman era. The coefficients from the multinomial regression models allow us to estimate location elasticities for foreign players and domestic players. We can also test for differential responses among high vs. low quality players (ability sorting effects) and for cross-effects of the net-of-tax rate for foreign (domestic) players on the location of domestic (foreign) players (displacement effects). We obtain three main findings. First, the elasticity of the number of foreign players with respect to the net-of-tax rate for foreigners we estimate is around one, consistent with our reduced form results. The elasticity of the number of domestic players with respect to net-of-tax rate for domestic players is much smaller (but still significant), around .15 because on average about 90% of players still

play at home. Second, we provide evidence on ability sorting effects by showing that location elasticities are negative at the bottom of the ability distribution and strongly positive at the top. Third, we provide evidence on displacement effects by showing that the cross elasticity of the number of domestic players with respect to the net-of-tax rate on foreigners is negative. We outline in conclusion why such displacement effects are important for determining revenue maximizing tax policy on foreign players.

The paper is organized as follows. Section 2 describes the European football market and data, section 3 sets out a theoretical model guiding the empirical analysis, section 3 shows reduced-form graphical evidence, section 4 presents multinomial regression estimates, and section 5 concludes. Additional material is collected in appendix.

## 2 Context and Data

### 2.1 The European Football Labor Market

Football clubs are attached to a local city and stadium, and each club has about 25-40 players in its first team.<sup>6</sup> Within each country, there is a top national league including between 12 and 22 national clubs.<sup>7</sup> The year- $t$  season runs from August/September of year  $t$  to May/June of year  $t + 1$ . In contrast, taxes are typically assessed on an annual calendar basis. Because the composition of the team for the year- $t$  season is determined mostly before the beginning of the season, we assume that the relevant tax rate for the year- $t$  season is the calendar year  $t$  tax rate.

Football players and clubs sign contracts, which specify a duration (typically 2-4 years) and an annual salary. If a player under contract in club A wants to move to club B before the end of his contract, the two clubs can negotiate a transfer fee from club B to club A. This transfer is between clubs and is not paid by the player or to the player, and is therefore not part of the taxable compensation of the player. In addition to their salaries, the most famous players also obtain a share of club revenue from the sale of items carrying their image (“image rights”).

Before the so-called Bosman ruling in 1995, the market for football players was heavily regulated. Two rules are particularly important for our analysis. First, the *three-player rule* stipulated that no more than three foreign players could be aligned in any game in the Euro-

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<sup>6</sup>The game itself is played by 11 players, but the full team is much larger to allow for rotation of players.

<sup>7</sup>On top of these national championships, there are currently two European-wide competitions gathering a select number of the best clubs from each national league.

pean Football Association (UEFA) club competitions.<sup>8</sup> This rule sharply limited international mobility. Second, the *transfer-fee rule* allowed clubs to require a transfer fee when a player wanted to move to another club even at the end of the player’s contract. Hence, out-of-contract players were not allowed to sign a contract with a new club until a transfer fee had been paid or a free transfer had been granted by the original club.<sup>9</sup> This rule limited mobility—within and across countries—as any surplus resulting from a move had to be shared with the initial club.

The European Court of Justice made the landmark Bosman ruling in December 1995,<sup>10</sup> which eliminated the three-player rule and the transfer-fee rule for European clubs (where “European” is here defined as being a UEFA member). Foreign-player quotas still apply to non-European (e.g., South-American) players playing in European clubs. The first season for which the Bosman ruling can have an effect is the 1996 season. As the ruling applied only when existing contracts came to an end, it took a few years to reach its full impact. The existence of multi-year contracts also implies that we should expect gradual mobility responses to tax changes as it is less costly to move at the end of a contract than in the middle of a contract.

## 2.2 European Football Data

We have collected data on the universe of first-league football players and first-league clubs in 14 European countries since 1985 from online sources.<sup>11</sup> The countries are Austria, Belgium, Denmark, England, France, Germany, Greece, Italy, Netherlands, Norway, Portugal, Spain, Sweden, and Switzerland. This sample of countries includes all the top football leagues in Western Europe according to the official UEFA rankings. We have excluded Eastern Europe, Russia, Turkey, and Scotland (the only top-15 Western European football nation we exclude) because of lack of data before the late-1990s. For robustness checks, we have also collected data on the second leagues of the five top countries (England, France, Germany, Italy, and Spain), which may be of similar or higher quality than the first leagues of the smallest countries.

Individual player information in the data include name, nationality, date of birth, club affiliation, and national team selection of each person in each first-league club in all 14 countries from 1985 to present. The data therefore allow us to trace mobility patterns of players across countries over a long time period. Furthermore, we have obtained information on individual

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<sup>8</sup>The three-player rule was also imposed in most national competitions.

<sup>9</sup>A few countries such as France and Spain prohibited these out-of-contract transfer fees.

<sup>10</sup>Bosman was a Belgian player who sued his club, which was refusing to let him go at the end of his contract.

<sup>11</sup>The main online source is the website [playerhistory.com](http://playerhistory.com), with detailed information available since the 1970s.

player salaries for about half of our sample for the years 1999-2000 and 2004-2008.<sup>12</sup> We use those actual earnings to impute individual earnings and calculate average tax rates in our full sample for years 1996-2008.

We further restrict our sample to players who are citizens of one of the above-mentioned 14 countries and have played at least once in a first league of one of these countries. We exclude all other players (primarily from Africa, Eastern Europe, and South America), because tracking their careers prior to arrival and subsequent to departure from the countries in our sample is difficult, and we cannot compute proper counterfactual alternatives for their location choices and top earnings tax rates.<sup>13</sup> In the data analysis, we retain solely year $\times$ player observations when the player was playing in one of the first leagues of the 14 countries we consider (i.e., we discard years when individuals are playing in another country or a lower league).

The appendix provides additional details on our player and club data, including how we develop performance measures for clubs and players using official UEFA rankings. Descriptive statistics are presented in Appendix Table A1.

### 2.3 Top Marginal and Average Tax Rate Data

In contrast to many other sports, football players cannot live far away from their club as they have to train almost daily with their teammates. As income and social security taxes on labor earnings are generally assessed on a residence basis, professional football players almost always face the tax systems of the countries in which they work. For migration decisions, the relevant tax rate is the *average* tax rate on earnings.<sup>14</sup> Using the actual average tax rate is problematic for two reasons. First, the average tax rate depends on individual earnings since income taxes are nonlinear, creating an endogeneity issue. Second, the computation of average tax rates faces the issue that we only observe individual salaries for years 1999-2000 and 2004-2008, and only for 54% of our sample in those years.

However, because professional football players in top leagues earn very high salaries (relative

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<sup>12</sup>We thank Jori Pinje for sharing this data collected from various sources.

<sup>13</sup>Migration by non-European players into the European football market is in any case severely constrained, because such players are still subject to the foreign-player quotas that were imposed on all players in the pre-Bosman era. We also exclude players with multiple nationalities. The reason is that a number of scandals (especially in Italy) revealed that some players listed with multiple nationalities had fake European passports in order to get around the quotas applying to non-European players.

<sup>14</sup>For decisions to enter a football career vs. an alternative career, the relevant tax rate is the *marginal tax rate* on the difference in earnings between the two careers.

to the top bracket thresholds of income and payroll taxes), the average tax rate on their earnings is closely approximated by the top *marginal* tax rate on labor income, which we label the *top earnings tax rate* below. The top marginal tax rate has the double advantage of being easy to compute and exogenous to earnings. The similarity between average and top marginal tax rates for top football players is verified in Appendix Table A1, where average tax rates have been computed using our data on actual and imputed individual earnings for the post-Bosman era 1996-2008 along with *OECD Taxing Wages* tax calculators.<sup>15</sup> Our main empirical analysis therefore assumes equality between the average and top marginal tax rate.<sup>16</sup> As a robustness check, we also consider specifications using the average tax rates presented in Table A1 in order to verify that estimates are similar when using the top marginal vs. the actual average tax rate. As we shall discuss, endogeneity problem of the average tax rate is resolved by using a grouping estimator and estimating average tax rates by cells of country×year×foreign status×quality.

The top marginal tax rate is computed including all taxes on labor income: individual income taxes at the national and local level, uncapped payroll taxes (social security contributions on both employees and employers that do not have an earnings ceiling), and value-added taxes (VAT). We have computed such top earnings tax rates since 1985 in our 14 sample countries. Importantly, as several countries have special schemes offering preferential tax treatment to immigrant workers, we have also computed alternative series of top earnings tax rates on foreign players. We provide details on our sources and computations in appendix.

A fully documented excel database of these top earnings tax rates is available online. Appendix figures A1-A3 plot tax rates for the five largest European countries, the Scandinavian countries, and six smaller European countries, respectively. In each case, we depict tax rates in two panels: the top panel is for domestic players and the bottom panel is for foreign players. As already discussed, most of our analysis does not use individual salary data as such information is not available for most players and years. But our empirical analysis controls for potential non-tax differences in salary levels across countries, due for example to the different sizes of football markets and fan bases across countries. As we will show, our empirical strategy captures the reduced-form elasticity of migration with respect to the tax rate, which could be different from

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<sup>15</sup>Before Bosman, salaries were lower and tax systems had more brackets, so that our approximation is probably not as accurate, an important caveat to keep in mind in the specific instances where we use pre-Bosman data.

<sup>16</sup>Using the top marginal tax rate amounts to estimating the reduced-form effect of the top marginal tax rate on migration, which is slightly smaller than the actual effect of the average tax rate on migration as the average tax rate moves slightly less than one-for-one with the top marginal tax rate.

the elasticity of migration with respect to the net-salary if tax rates impact wages. As we will discuss, under some assumptions, our reduced-form elasticity is the relevant one for tax policy.

### 3 Theoretical Framework

This section develops a simple model of taxation and migration allowing for potentially rigid labor demand. The importance of demand rigidities in the football market is an open question *a priori*. On the one hand, the number of teams per league tends to be fixed and the number of players per team is constrained by the fact that the game involves exactly 11 players on the field and a maximum of 3 substitutions per game (although picked from a pool of potential substitutes that can be larger). This suggests that demand may be very rigid. On the other hand, clubs play many games over a season, and therefore require a much larger number of players to insure themselves against injuries and fluctuations in player performance over time. This implies that adding players does have value for the club, and therefore squad size may be flexible and respond to tax incentives. Indeed, Appendix Figure A4 shows that the average squad size is weakly negatively associated with top tax rates across countries and only in the post-Bosman period.

Based on these arguments, we first set out a classical baseline model with flexible demand and then extend the analysis to account for rigid demand. The two models lead to different theoretical predictions that we will test empirically. Because our models adopt a very simple and admittedly unrealistic wage determination process to simplify the exposition, we discuss generalizations and their empirical implications at the end of the section.

#### 3.1 A Baseline Model with Flexible Demand

There are  $N$  small countries  $n = 1, \dots, N$ . Each country has a continuum population of native potential football players, each of whom is endowed with football ability  $a \geq 0$ . If an individual with ability  $a$  plays football, he generates value  $a$  for his club. Total production in each club is given by the sum of abilities of all players in the club, i.e. we work with a linear perfect substitution technology as in the standard Mirrlees (1982) model of taxation and migration. Under this technology and assuming perfect competition, the before-tax wage of each player is

equal to ability  $a$  (horizontal demand).<sup>17</sup>

Besides ability  $a$ , a football player is characterized by a country of origin  $m$  and preference parameters  $\mu_m = (\mu_{1m}, \dots, \mu_{Nm})$  associated with each possible location  $1, \dots, N$ . A player characterized by  $(a, m, \mu_m)$  playing in country  $n$  obtains utility  $u(a(1 - \tau_{nm})) + \mu_{nm}$ , where  $u(\cdot)$  is increasing and  $\tau_{nm}$  is the tax rate in country  $n$  on a player from country  $m$ . The player therefore plays in country  $n$  iff

$$u(a(1 - \tau_{nm})) + \mu_{nm} \geq \max_{n'} \{u(a(1 - \tau_{n'm})) + \mu_{n'm}\}. \quad (1)$$

Among players from country  $m$ , there is a joint distribution of  $(\mu_m, a)$  described by a smooth density function  $g_m(\mu_m, a)$  on the domain  $D = (0, \infty)^{N+1}$ . The density distribution  $g_m(\mu_m, a)$  together with the condition for optimal location choice (1) determine the total number (measure) of players with ability  $a$  from native country  $m$  playing in country  $n$ . We denote this player supply function by  $p_{nma}$ .

In general,  $p_{nma}$  depends on the entire vector of net-of-tax wages  $(a(1 - \tau_{1m}), \dots, a(1 - \tau_{Nm}))$  and hence on the tax rates in all countries on players from country  $m$ . As each country is small (i.e.,  $N$  is large), the effect on  $p_{nma}$  of a tax change in another country  $n' \neq n$  will be negligible. This is because a tax change in country  $n' \neq n$  affects  $p_{nma}$  only through migration between  $n$  and  $n'$  by a small measure of people at the point of indifference between these two (small) countries. On the other hand, the effect on  $p_{nma}$  of changing the tax rate in country  $n$  itself will be non-negligible as this affects  $p_{nma}$  through migration between country  $n$  and every other country. Hence, under our small-country assumption, we may write  $p_{nma} = p_{nma}(a(1 - \tau_{nm}))$  where  $p_{nma}$  is increasing in  $a(1 - \tau_{nm})$ . We define the total number (measure) of players in country  $n$  native of country  $m$  across all ability levels as  $p_{nm}(1 - \tau_{nm}) \equiv \int_0^\infty p_{nma}(a(1 - \tau_{nm})) da$ .

Consistent with real-world tax policy, we allow each country to set separate tax rates on domestic and foreign players, i.e. tax rates in country  $n$  are given by  $\tau_{nn} = \tau_{nd}$  and  $\tau_{nm} = \tau_{nf}$  for all  $m \neq n$ . In this case, the number of domestic and foreign players in country  $n$  at ability  $a$  are given by  $p_{nda}(a(1 - \tau_{nd})) = p_{nna}(a(1 - \tau_{nn}))$  and  $p_{nfa}(a(1 - \tau_{nf})) = \sum_{m \neq n} p_{nma}(a(1 - \tau_{nm}))$ . The total number of domestic and foreign players in country  $n$  across all ability levels equal  $p_{nd}(1 - \tau_{nd}) \equiv \int_0^\infty p_{nda}(a(1 - \tau_{nd})) da$  and  $p_{nf}(1 - \tau_{nf}) \equiv \int_0^\infty p_{nfa}(a(1 - \tau_{nf})) da$ . In this simple baseline model, we can immediately state the following:

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<sup>17</sup>We discuss in section 3.3 the implications of generalizing the production technology to allow for decreasing returns (downward-sloping demand), imperfect substitutability, and productivity spillovers across players.

**Proposition 1 (Comparative Statics)** *Assuming that the density  $g_m(\mu_m, a)$  is smooth and positive everywhere on its domain  $D$ , we have  $p_{nda}, p_{nfa} > 0$  for all  $n, a$  and*

- (a)  $p_{nda}$  is decreasing in  $\tau_{nd}$  and unaffected by  $\tau_{nf}$ ,
- (b)  $p_{nfa}$  is decreasing in  $\tau_{nf}$  and unaffected by  $\tau_{nd}$ .

Hence, in this baseline model with flexible demand, the own-tax effect on the number of domestic and foreign players locating in country  $n$  is negative at all ability levels, while the cross-tax effect between domestic and foreign players is zero. This model naturally leads to the definition of two key elasticities of interest

$$\varepsilon_{nf} = \frac{dp_{nf}}{d(1 - \tau_{nf})} \frac{1 - \tau_{nf}}{p_{nf}} \quad \text{and} \quad \varepsilon_{nd} = \frac{dp_{nd}}{d(1 - \tau_{nd})} \frac{1 - \tau_{nd}}{p_{nd}}, \quad (2)$$

where  $\varepsilon_{nf}$  ( $\varepsilon_{nd}$ ) is the elasticity of the number of foreign (domestic) players in country  $n$  with respect to the net-of-tax rate on foreign (domestic) players in country  $n$ . Those elasticities can also be defined at each ability level  $a$ . As about 85 to 90% of players play at home, it is natural to expect that  $\varepsilon_{nf} \gg \varepsilon_{nd}$ . Hence, cutting tax rates only on foreign players may attract a relatively large number of new players with very small revenue losses on infra-marginal (pre-existing) foreign players. We show formally in appendix A.4 that revenue-maximizing tax rates  $\tau_{nf}, \tau_{nd}$  take the standard inverse elasticity form  $1/(1 + \varepsilon_{nf}), 1/(1 + \varepsilon_{nd})$ .

### 3.2 Accounting for Rigid Demand

Starting from the framework above, rigid labor demand is incorporated by assuming that the football market in each country hires a continuum of measure one of players. Players are hired by a continuum of clubs of measure one (e.g., each club hires a single player), and importantly there is no entry of new clubs. It is further assumed that the population of potential native football players in country  $n$  has measure  $P_n > 1$ , so that not all potential football players will be able to play in equilibrium. Those who do not play football work in a regular labor market, and we normalize the regular wage outside football to zero.<sup>18</sup> As before, if a club hires a football player of ability  $a$ , this player generates total value added  $a$  in the club. The presence of rigid demand allows the club to extract positive surplus in equilibrium. We show that the value added  $a$  of a player-club relationship is divided between the player and the club in the following way:

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<sup>18</sup>This normalization is without loss of generality. The normalization of the regular wage to zero was implicit in the previous section as we assumed that all players with  $a > 0$  were willing to play football.

**Lemma 1 (Club Surplus and Wages)** *In any equilibrium, within any given country  $n$ , the surplus  $s_n \geq 0$  captured by each club is constant across all clubs and players in country  $n$ . Hence, the before-tax wage paid out to a player of ability  $a$  in country  $n$  is  $a - s_n$ . No player of ability below  $s_n$  plays in country  $n$ .*

**Proof:** Suppose the surplus is not equalized across clubs within a given country  $n$ . Then a low-surplus club can increase its surplus by hiring a player from a high-surplus club at a slightly higher wage, and the player would accept this job offer as his tax rate and location-specific utility are the same within country  $n$ . Hence, in equilibrium, the club surplus must be equalized within country  $n$ . As the total value of the player-club relationship is  $a$ , if the club gets surplus  $s_n$ , then the salary to the player equals  $a - s_n$ . The surplus  $s_n$  has to be non-negative, because otherwise clubs would not operate. No player of ability below  $s_n$  plays as he would be better off working in the regular labor market at a wage equal to zero.  $\square$

The characterization of preferences and optimization follows the earlier model, except that the before-tax salary is now  $a - s_n$  instead of previously  $a$ . From above, assuming that countries are small, the number of domestic and foreign players in country  $n$  at ability  $a$  can be written as  $p_{nda}((a - s_n)(1 - \tau_{nd}))$  and  $p_{nfa}((a - s_n)(1 - \tau_{nf}))$ , where both functions are increasing in their argument. The total number of domestic and foreign players in country  $n$  across all ability levels are obtained as  $p_{nd}(s_n, 1 - \tau_{nd}) \equiv \int_{s_n}^{\infty} p_{nda}((a - s_n)(1 - \tau_{nd})) da$  and  $p_{nf}(s_n, 1 - \tau_{nf}) \equiv \int_{s_n}^{\infty} p_{nfa}((a - s_n)(1 - \tau_{nf})) da$ . Both functions  $p_{nd}, p_{nf}$  are decreasing in  $s_n$ , while  $p_{nd}$  is increasing in  $1 - \tau_{nd}$  and  $p_{nf}$  is increasing in  $1 - \tau_{nf}$ .

While the effects of taxes in partial equilibrium (i.e., given  $s_n$ ) are qualitatively similar to the previous model, the general equilibrium will be different due to rigid demand. In the rigid-demand model, the equilibrium has to satisfy  $p_{nd}(s_n, 1 - \tau_{nd}) + p_{nf}(s_n, 1 - \tau_{nf}) = 1$ , which pins down the club surplus as  $s_n = s_n(1 - \tau_{nd}, 1 - \tau_{nf})$ . By inserting equilibrium surplus into the player supply functions  $p_{nda}, p_{nfa}, p_{nd}$  and  $p_{nf}$ , we obtain general equilibrium relationships that are functions of  $(1 - \tau_{nd}, 1 - \tau_{nf})$ . In the following, we work with these equilibrium relationships and contrast the results we obtain with those of the previously presented flexible demand model.

**Proposition 2 (Comparative Statics)** *Assume that countries are small and that the density  $g_m(\mu_m, a)$  is smooth and positive everywhere on its domain  $D$ . Then  $p_{nda}, p_{nfa} > 0$  for all  $a > s_n$ , and we have:*

- (a)  $s_n(1 - \tau_{nd}, 1 - \tau_{nf})$  decreases with  $\tau_{nd}$  and  $\tau_{nf}$ ,
- (b)  $p_{nda}(1 - \tau_{nd}, 1 - \tau_{nf})$  decreases with  $\tau_{nd}$  at high abilities, increases with  $\tau_{nd}$  at low abilities, and increases with  $\tau_{nf}$  at all abilities,
- (c)  $p_{nfa}(1 - \tau_{nd}, 1 - \tau_{nf})$  decreases with  $\tau_{nf}$  at high abilities, increases with  $\tau_{nf}$  at low abilities, and increases with  $\tau_{nd}$  at all abilities,
- (d)  $p_{nd}(1 - \tau_{nd}, 1 - \tau_{nf})$  decreases with  $\tau_{nd}$  and increases with  $\tau_{nf}$ ,
- (e)  $p_{nf}(1 - \tau_{nd}, 1 - \tau_{nf})$  decreases with  $\tau_{nf}$  and increases with  $\tau_{nd}$ .

**Proof:** (a) If  $\tau_{nd}$  (alternatively,  $\tau_{nf}$ ) increases, then  $p_{nd}(s_n, 1 - \tau_{nd})$  (alternatively,  $p_{nf}(s_n, 1 - \tau_{nf})$ ) falls, which leads to excess demand in country  $n$ . The only way equilibrium can be restored is by having  $s_n$  fall. As country  $n$  is small, this does not affect the equilibrium in other countries.

(b) Consider first the effect of  $\tau_{nd}$ . As  $\tau_{nd}$  increases and  $s_n$  falls as a consequence (part (a)), we have that the net-of-tax salary  $(1 - \tau_{nd})(a - s_n)$  increases for low-ability domestic players ( $a$  slightly above  $s_n$ ) and decreases for high-ability domestic players ( $a$  sufficiently above  $s_n$ ). Hence, country  $n$  attracts fewer high-ability domestic players and more low-ability domestic players in equilibrium. Consider then the effect of  $\tau_{nf}$ . An increase in  $\tau_{nf}$  affects domestic players only through  $s_n$ , which falls from part (a). The fall in  $s_n$  increases salaries of domestic players at any ability level, and hence attracts more domestic players at all abilities.

(c) Follows from a similar argument as in part (b).

(d, e) Consider first the effects of  $\tau_{nd}$ . From part (c), we know that  $p_{nfa}$  increases with  $\tau_{nd}$  at all abilities, and hence  $p_{nf}$  is necessarily increasing in  $\tau_{nd}$ . From the rigid-demand equilibrium condition  $p_{nd} + p_{nf} = 1$ , we then have that  $p_{nd}$  must be decreasing in  $\tau_{nd}$ . The effects of  $\tau_{nf}$  follows from a similar argument.  $\square$

Compared to the flexible demand model, we have two new sorting effects relating to the own-tax and the cross-tax effects, respectively. First, taxing foreign players no longer reduces the number of foreign players at all ability levels. In equilibrium, the effect is positive at low ability levels and negative at high ability levels, with the total effect being negative. Hence, the type of preferential tax schemes to foreigners discussed earlier will attract high-ability foreigners but push out low-ability foreigners, with the total amount of foreigners increasing. Second, due to equilibrium sorting, there is now a cross-effect from taxing one group of players on the other group of players. For example, if a country lowers the tax on foreigners and hence increases

the total amount of foreign players, domestic players will be displaced (at all ability levels). Displaced domestic players will either drop out of the football sector and take a regular job, or move and play in another country. We will present empirical evidence of both types of sorting.

Notice finally that, as high-ability players have  $a \gg s_n$  and therefore  $a - s_n \simeq a$ , their equilibrium response to taxation in the rigid-demand case is close to the response in the flexible-demand case. Hence, the mobility elasticity for high-ability individuals is the relevant upper bound that should apply to other high-income occupations where labor demand is flexible. We come back to this important point when interpreting our results.

### 3.3 Robustness to Generalizations

We have considered two simple benchmark models of wage determination in the football market: (i) assuming a linear production technology and flexible demand, before-tax salary is given by player ability  $a$ , (ii) adding a constraint on the number of players in each league, the before-tax salary is given by player ability minus club surplus  $a - s_n$ . While neither case is descriptively realistic, they demonstrate the sharply different effects of taxation on migration in markets where migration can affect overall employment compared to markets where migration can affect only sorting. As argued in the beginning, the football market is likely to be a mix of those two settings, but we focus on the polar models for simplicity.

Two generalizations of the linear production technology can be incorporated and will be allowed for in the empirical analysis. First, we may consider a concave production function that depends on the sum of abilities of all players. This would introduce downward-sloping demand, but maintain the assumption of perfect substitutability between players of different ability. In this case, it is easy to see that the equilibrium salary in country  $n$  of a player with ability  $a$  can be written as  $w_{na} = a \cdot w_n$ , where  $w_n$  reflects the overall wage level in country  $n$  and is endogenous to taxes. It is straightforward to incorporate this generalization into the theoretical analysis. Second, we may specify production as a general function of the number of players at each ability level, thereby allowing in a flexible way for imperfect substitution between different skill levels. This would include situations with skill complementarity in production such that tax-induced migration of high-quality players to one country may induce more high-quality players to move to the same country. In this general setting, the equilibrium salary  $w_{na}$  is no longer separable in ability as above, and taxes may affect not only the overall wage level but the wage distribution

in a country. This would be a general equilibrium model with many labor markets (one for each skill) that may interact depending on technological complementarities across skill levels, and it is extremely difficult to obtain analytical results on tax incidence in such general settings. While we do not pursue this general formulation analytically, the empirical analysis will in fact allow for a wage setting processes of this kind by including rich and flexible controls for wages varying by country and ability level.

Finally, another possibility is the presence of productivity spillovers across teammates. For example, in-migration of high-ability foreign players may raise the performance of pre-existing players in the country. In this case, a player's salary depends not only on his own ability, but on the abilities of all his teammates. With positive spillovers, an influx of high-ability foreigners may benefit domestic players, and hence lead to positive cross-effects between the two groups. This is in contrast to the negative cross-effect driven by displacement emphasized in the previous section. In the empirical section, we find a negative cross-effect between domestic and foreign players. If there are positive productivity spillovers between the two groups, the effect of such spillovers would be captured by our estimate and work against the negative effect we find.

## 4 Reduced-Form Graphical Evidence

We start the analysis by showing reduced-form graphical evidence of the impact of taxation on international migration. First, we study cross-country correlations between top earnings tax rates and location, using the pre-Bosman period (when regulation severely hindered tax-induced migration) to establish a counterfactual cross-country correlation with limited tax effects. This part provides suggestive evidence that taxes matter for country location in the long-run. Second, we consider country-specific tax reforms that create compelling identifying variation and provide conclusive evidence of the relationship between taxes and migration in the medium-run. For convenience, elasticities estimated from those case studies are presented in Table 1.

### 4.1 Cross-Country Correlations: Bosman Ruling

Figure 1 provides cross-country evidence on the relationship between the top earnings tax rate and in-migration of foreign players (Panel A), out-migration of domestic players (Panel B), and club performance (Panel C). Each panel consists of two graphs, with the pre-Bosman era (1985-1995) on the left and the post-Bosman era (1996-2008) on the right.

Panel A of Figure 1 plots the average fraction of foreign players in the first league against the average top earnings tax rate on foreigners in each country. There is a striking contrast between Panel A1 and Panel A2. In the pre-Bosman era, the fraction of foreigners is generally very low (5% or less for almost all countries), and there is no correlation between the fraction of foreigners and tax rates. In the post-Bosman era, the fraction of foreigners is much higher in every country (between 5% and 25%), and there is a significant negative correlation with the top earnings tax rate.<sup>19</sup> As shown in the figure and in Table 1 (Panel A), the implied elasticity of the fraction of foreigners with respect to the net-of-tax rate is zero in the pre-Bosman era, but very large at 1.22 (.45) in the post-Bosman era. The table also shows that using average tax rates (instead of top tax rates) generates a very similar elasticity of 1.33 (.37). Those elasticities are particularly large because the fraction of foreigners is small to start with.

Panel B of Figure 1 plots the average fraction of players of a given nationality playing in their home league against the average top earnings tax rate on domestic residents. In the pre-Bosman era, the fraction of players playing at home is very high in all countries (between 90% and 100% across the entire sample).<sup>20</sup> After Bosman, the fraction playing at home drops in almost all countries, and the negative correlation with tax rates becomes much stronger. As shown in the figure and in Table 1 (Panel A), the implied elasticity of the fraction playing at home with respect to the net-of-tax rate was modest pre-Bosman at .1 (.04) and much larger post-Bosman at .32 (.10). The post-Bosman elasticity for domestic players is much smaller than for foreign players, because the fraction playing at home is substantial to start with.

Panel C of Figure 1 explores whether tax-induced migration translates into an effect on club performance. It plots average club performance against the average top earnings tax rate (including both foreigners and locals) in each country before and after the Bosman ruling. As described in the appendix, country-level club performance is measured by the total number of points earned by all clubs in a given country in the UEFA competitions. In the pre-Bosman period, the correlation between tax rates and club performance is close to zero and insignificant, but becomes strongly negative and significant in the post-Bosman period. This suggests that

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<sup>19</sup>Recall that we only include nationals from the 14 European countries in the sample, and so the fraction of foreigners does not include nationals from outside this set of countries.

<sup>20</sup>The relatively low fraction of Dutch players playing at home may be due to the mandatory defined contributions Pension Fund System for football players instituted in 1972 (CFK), which requires compulsory pension contributions of 50% of earnings (and 100% of bonuses) above a relatively low threshold. Although contributions earn market rates of return, they may be perceived as forced savings and heavily discounted by players, which have indeed traditionally complained about the system.

low-tax countries experienced an improvement of club performance by being better able to attract good foreign players and keep good domestic players at home.

Although elasticities become much larger and strongly significant after the Bosman ruling, the standard errors are too large to detect a significant difference in estimates between the pre-Bosman and post-Bosman periods. The identifying assumption in this cross-country analysis is that the post-Bosman correlation between top earnings tax rates and mobility/performance is causal. Although the pre-Bosman period—when mobility was restricted—offers a successful placebo test of this causal interpretation, there are two threats to identification. First, the Bosman ruling could have had differential impacts on low-tax and high-tax countries for non-tax reasons. For example, taxation levels display some correlation with country size and therefore league quality, and if better leagues benefit more from the Bosman ruling than poorer leagues this would contribute to a spurious correlation between migration/performance and tax rates. Second, other factors could have changed from the pre-Bosman to the post-Bosman era that impacted low-tax and high-tax countries differentially.<sup>21</sup> Next, we consider quasi-experimental variation created by tax reforms, which allows us to fully control for these identification threats and provide conclusive evidence of a link between taxation and migration.

## 4.2 Country Case Studies: Tax Reforms

This section analyzes country-specific tax reforms in Spain and Denmark, which introduced preferential tax schemes for foreign residents creating sharp variation in the location incentives of football players.<sup>22</sup> In each case, we compare the treatment country to a synthetic control country using the method by Abadie et al. (2010). In the synthetic control approach, the weights on different countries in the construction of a synthetic control country are non-negative and chosen to minimize the pre-reform distance between treatment and control in terms of the outcome of interest and indexes of football league quality. Appendix Table A2 provides complete details and description of those weights. For each country event study, Table 1 presents elasticity estimates using a difference-in-differences comparison of the treatment country and the synthetic

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<sup>21</sup>One such factor is the ban on all English clubs from international competitions in the period 1985-1990 as a result of the 1985 Heysel Stadium disaster where a riot by English fans killed 39 people and injured 600. This biases down migration to and from England in the pre-Bosman era. However, eliminating England from the sample leaves those elasticity estimates virtually unchanged (results not reported).

<sup>22</sup>We provide further evidence on tax-induced mobility using a cohort-based payroll tax reform in Greece in appendix Figure A7.

control country before and after the reform. Those estimates capture medium-term responses as we are comparing outcomes a few years before the reform to a few years after the reform.

**Spanish reform in 2004: “Beckham Law”.** The “Beckham Law” (Royal Decree 687/2005) is a special tax scheme passed in 2005, applicable to foreign workers (not just football players) moving to Spain after January 1st, 2004.<sup>23</sup> The special tax scheme is a flat tax of 24% in lieu of the regular progressive income tax with a top rate of 43% in 2008 (45% when the Beckham Law was passed). Eligibility requires not having been a tax resident in Spain at any point during the preceding 10 years. Given the career span of football players, the scheme is primarily relevant for foreign players making their first move to Spain (after 2004).

Graphical evidence is presented in Figure 2. Panel A1 considers top-ability players and Panel A2 lower-ability players. Top-ability players are here defined as those who have been selected at least once for the national team of their home country, while lower-quality players are those who have not.<sup>24</sup> Each panel shows the evolution over time of the fraction of foreign players in the total number of players in Spain (treatment) and the synthetic control country on the left y-axis along with the top tax rate differential between Spain and the synthetic control on the right y-axis. This top tax rate differential is defined as  $\tau_{spain}/\tau_{synthetic} - 1$ . As shown in appendix Table A2, the synthetic Spain is mostly Italy. The two vertical lines in each panel denote the Bosman ruling in 1996 and the Beckham Law in 2004.<sup>25</sup> The figure shows that the top tax rates were about the same in Spain and the synthetic country in the period 1990 to 2003, but that a large 25% gap opened up when the Beckham law became effective in 2004.

For top-quality players in Panel A1, two findings are worth noting. First, there is a surge in the fraction of foreign players in both Spain and the synthetic control country immediately following the Bosman ruling. Spain experiences a larger surge but starts from a smaller base, so that the two countries have about the same post-Bosman fraction of foreigners. After the Bosman ruling and before the Beckham law, the fraction of foreigners evolve almost identically in Spain and the synthetic country (they both fall slightly). Second and most important, coinciding with the Beckham law, the two series diverge as the fraction of foreigners starts to

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<sup>23</sup>The scheme got its nickname after the superstar footballer David Beckham moved from Manchester United to Real Madrid, and became one of the first foreigners to take advantage of it.

<sup>24</sup>In the empirical estimation in section 5, we construct a more sophisticated continuous ability index using our exhaustive data on player careers.

<sup>25</sup>Although the Beckham Law was not passed until 2005 (but applying retroactively from 2004), the reform appears to have been anticipated earlier than this. Hence, the reform may have had an impact already from the 2004/2005 season, and we therefore define 2004 as the reform year.

increase in Spain while it continues to fall in the synthetic country. The gap stops increasing in 2007 and closes somewhat in 2008, suggesting that responses are relatively fast.

For lower-quality players in Panel A2, the effect is not as clear and strong as the effect on higher-quality players, which suggests that the scheme may have had different effects on different parts of the ability distribution, consistent with the rigid labor demand model presented in section 3. We come back to this question in much more detail in the following section.

As shown in the figure and in Table 1 (Panel B1), the difference-in-differences elasticity for top players is very large and significant (1.49(.33) when using top tax rates, 1.83(.57) when using average tax rates). For lower-quality players, the elasticity is smaller and insignificant.

The elasticity estimates above are based on the standard parallel-trends identifying assumption for difference-in-differences analysis.<sup>26</sup> We can relax this assumption by exploiting the 10-year eligibility rule in the Beckham Law. If our results are confounded by a differential change in non-reform related trends in the two countries, this would show up in the migration patterns of foreigners *not eligible* for the Beckham scheme. The bottom panels of Figure 2 test this hypothesis by considering foreigners eligible for the Beckham scheme in Panel B1 and foreigners not eligible for the Beckham scheme in Panel B2. Specifically, Panel B1 plots the fraction of foreigners playing in Spain (the synthetic country) in year  $t$  among those who never played in Spain (the synthetic country) before year  $t$ . Hence, Panel B1 captures the flow of foreigners starting to play in Spain in year  $t$ . By contrast, Panel B2 plots the fraction of foreigners playing in Spain (the synthetic country) in year  $t$  among those who played in Spain (the synthetic country) 5-10 years earlier.<sup>27</sup> Two points are worth noting. First, among players ineligible for the Beckham scheme, the fraction of foreigners playing in Spain and the synthetic country, respectively, evolve in parallel throughout the period and there is no visible indication of anything different happening around the 2004 reform. Second, among those who are eligible for the Beckham scheme, the fraction of foreigners playing in the two countries evolve in parallel until the introduction of the Beckham scheme and then starts to diverge. Following the Beckham Law, the fraction playing in Spain increases by about 50% while the fraction playing

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<sup>26</sup>Note that the graphs allow us to relax the parallel-trends assumption by controlling for potential differences in pre-trends (only relevant for lower-ability players), as in a triple-difference approach using a pre-reform placebo difference-in-differences. In that case, the identifying assumption would be that there is no contemporaneous change in the *differential* trend between Spain and the synthetic control country.

<sup>27</sup>The 5-10 year window in Panel B2 is chosen to ensure that we include only ineligible people even for the most recent years. If we considered the full 1-10 year window, we would include some people who arrived in Spain for the first time after 2004 and hence were eligible for the scheme.

in the synthetic country stays constant. As shown in the figure and in Table 1 (Panel B1), the corresponding difference-in-differences elasticity for eligible players is large and significant. The placebo elasticity for ineligible players is small and insignificant.<sup>28</sup> Due to large standard errors however, the difference between those two estimates is not statistically significant.

Additional evidence, presented in appendix Figure A5, shows that the influx of foreign players in Spain following the Beckham law did lead to a displacement of domestic players, consistent with our rigid demand model.

### **Danish reform in 1992: “Tax Scheme for Foreign Researchers and Key Employees”.**

In 1992, Denmark enacted a preferential tax scheme for foreign researchers and high-income foreigners in all other professions, who sign contracts for employment in Denmark after June 1st, 1991. The scheme is commonly known as the “Researchers’ Tax Scheme.” Under this scheme, a flat tax of 25% (30% from 1991 to 1995) is imposed in lieu of the regular progressive income tax with a top rate above 60% (68% when the scheme was introduced). The scheme can be used for a maximum period of 36 months after which the taxpayer becomes subject to the ordinary income tax schedule. There are two key requirements to become eligible for the preferential tax scheme. First, the taxpayer cannot have been tax liable in Denmark in the 3 years prior to going on the scheme. Second, for non-researchers, eligibility requires an annual income of at least 765,600 Danish kroner—about 103,000 Euros—as of 2009, where the threshold is indexed to average nominal wage growth in Denmark.

Figure 3 provides evidence on the effects of this scheme on migration into Denmark, using again the synthetic control method. As shown in appendix Table A2, the synthetic comparison is mainly Sweden with a smaller weight on Norway. The figure is constructed as the corresponding figure for the Spanish tax scheme: we split the sample into top-ability players (Panel A) and lower-ability players (Panel B), and show in each panel the evolution over time in the fraction of foreign players in the total number of players in Denmark and in the synthetic control country along with the top tax rate differential on foreigners between these two countries. The two vertical lines mark the Danish tax reform and the 1996 Bosman ruling. The Danish tax reform widened significantly the tax differential by about 25%. When interpreting the results, it is important to keep in mind that the Danish tax scheme (unlike the Beckham scheme considered

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<sup>28</sup>This placebo elasticity is estimated using the same tax differential as for eligible players in Panel B1 of Figure 2.

above) was introduced *before* the deregulation of player migration following the Bosman ruling. For top players in Panel A, there are three main findings. First, until the reform in 1991, there are very few top foreigners in Denmark and only slightly more in the synthetic country. Second, immediately following the reform, the fraction of top foreigners in the Danish league increases while the fraction of top foreigners in the synthetic league falls, so that Denmark overtakes the synthetic country in terms of attracting foreign players. But the short-run effect is not very large as the pre-Bosman rules imposes tight bounds on the potential migration impact of the Danish tax scheme. Third, after the Bosman ruling, the gap in the fraction of foreigners in the two countries substantially widens. By 2008, the fraction of top foreigners is about four times as large in Denmark as in the synthetic country.

In sharp contrast, for lower-ability players in Panel B, there is no visible evidence of a migration effect in Denmark. If anything, the share of lower-ability foreigners in Denmark dips below that of Sweden once the Bosman ruling allows the tax mechanism to take full impact.

Panels A and B together therefore suggest that the tax cut to foreigners in Denmark did two things: (i) it increased the total share of foreign players in the Danish league, (ii) it changed the ability composition of foreigners in favor of higher-ability players consistent with our model of rigid labor demand. We specifically estimate such sorting effects in section 5. As shown in the figure and in Table 1 (Panel B2), the implied difference-in-differences elasticity of the number of foreigners with respect to the net-of-tax rate is very large and highly significant for top players, 3.1 (0.75). It is negative, but insignificant for lower-quality players. The elasticity for top foreigners is particularly large in Denmark because the initial number of foreigners was extremely low before 1991.

Overall, the graphical evidence in this section shows that the Researchers' Tax Scheme has increased migration of football players into Denmark. We also show in appendix Figure A6 that the three-year duration limit in the Danish tax scheme had an impact on the intensive duration margin with excess bunching at a duration of three years (relative to the synthetic control).

**Footballers are more mobile: Evidence from the Danish 1992 reform.** It was argued in the introduction that football players are more mobile than the rest of the high-skilled labor market, so that our results provide an upper bound on tax-induced mobility. We can actually verify this hypothesis for the Danish tax scheme, using full population data from Denmark and comparing the migration response of football players to highly-paid workers in other sectors. The

exhaustive analysis of the Danish scheme is presented in Kleven et al. (2011). Figure 4 extends their main graphical evidence by splitting the full sample into the “Sports & Entertainment” industry in Panel A (the small industrial classification that includes football players) and all other industries in Panel B. Each panel plots the number of foreign workers from 1980 to 2005 (normalized to one in 1990, just before the scheme introduction) for foreigners with earnings above the scheme eligibility threshold (treatment) and foreigners with earnings between 80% and 99.5% of the scheme eligibility threshold (control). The figure shows very compellingly that the response in the Sports & Entertainment sector is much larger than in other sectors, and that the larger response in sports starts only after the Bosman rule came into effect in 1996.

These conclusions are corroborated by anecdotal evidence and popular opinion among Danish policy makers, debaters, and football managers. Indeed, the impact of the scheme on the football sector has been the subject of much public debate over the past 10-15 years (coinciding with the scheme taking full impact as shown in Figure 3). The view is that the scheme has been the key driver of the influx of high-ability foreign players into the Danish league over this period, with the point of contention being whether football players are worthy recipients of a scheme intended to attract foreign experts and scientists and whether the influx of foreign players creates new jobs or simply displaces domestic players. Moreover, Swedish clubs have frequently complained that they cannot compete with Danish clubs because of the scheme. It is also worth noting that the widespread use of the scheme by football players was an unintended consequence of the reform that has been criticized subsequently by some of the political parties responsible for passing the law in the first place.<sup>29</sup> This suggests that the reform could not have been an endogenous response to migration patterns in the football market.

## 5 Regression-Based Empirical Analysis

This section presents results based on a multinomial regression framework. As opposed to the graphical evidence presented above, the analysis here exploits all sources of variation in top earnings tax rates in all 14 countries over time (as shown in appendix Figures A1-A3). We focus primarily on the post-Bosman era (1996-2008) where mobility in the football market is

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<sup>29</sup>Recently, the Danish Minister of Taxation has been working on a reform proposal that would abolish the tax scheme specifically for athletes. The manager of FC Copenhagen, currently the highest-ranked football club in Denmark, has said that this would be “a disaster for the Danish Superleague.” (see “A bomb under the Superleague”, [www.sporten.dk](http://www.sporten.dk), 14 July 2010).

not constrained by regulation and where we can estimate average tax rates using actual and imputed individual earnings data. Appendix Table A1 provides summary statistics for the estimation sample. We first present baseline estimates ignoring labor demand rigidity and then turn to potential ability sorting and displacement effects arising from demand rigidity.

## 5.1 Baseline Model without Sorting and Displacement Effects

**Multinomial model.** We consider a multinomial discrete-choice model adopting the additive random-utility specification of the theoretical framework in section 3. Player  $i$  playing in country  $n$  at time  $t$  obtains utility

$$\begin{aligned} U_{nt}^i &= u((1 - \tau_{nt}^i)w_{nt}^i) + \mu_{nt}^i \\ &= \alpha \log(1 - \tau_{nt}^i) + \alpha \log(w_{nt}^i) + home_n^i + \beta_n x_t^i + \gamma_n + \nu_{nt}^i, \end{aligned} \quad (3)$$

where  $\tau_{nt}^i$  is the average tax rate on player  $i$  in country  $n$  at time  $t$ ,  $w_{nt}^i$  is the before-tax wage of player  $i$  in country  $n$  at time  $t$ , and  $\mu_{nt}^i$  is the idiosyncratic preference for country  $n$  at time  $t$ . Equation (3) specifies  $u(\cdot)$  as a log-function such that the tax and wage terms are additively separable. We allow the following factors to influence the idiosyncratic preference term  $\mu_{nt}^i$ : (a) a preference for home country captured by the dummy variable  $home_n^i$  equal to one if country  $n$  is the native country of player  $i$ , (b) individual characteristics  $x_t^i$  such as age and age-squared, the effect of which we allow to vary by country, and (c) unobservable characteristics of country  $n$  captured by a country fixed effect  $\gamma_n$ .

We first consider a specification that includes only the net-of-tax rate and the home dummy as explanatory variables in Table 2, column (1). The subsequent columns then consider specifications that include additional individual and country controls, and importantly investigate different strategies to control for variation in the wage variable  $w_{nt}^i$ . Although we observe actual individual wages for a large subsample and impute wages when we do not, we still cannot observe counterfactual wages in the countries where the individual does not play. For the flexible-demand model, we may distinguish between three cases.

First, in the simplest version of the model, there is a linear perfect substitution technology and the before-tax wage is then determined directly by player ability, i.e.  $w_{nt}^i = a_t^i$  where  $a_t^i$  is the ability of player  $i$  at time  $t$ . In this case, wages are fully controlled for by including in equation (3) a vector  $A_t^i$  of non-parametric controls for player ability, the effect of which we allow to vary by country. This specification corresponds to column (2) of Table 2.

Second, with a concave transformation of the perfect substitution technology, labor demand will be downward-sloping and wages will be given by  $w_{nt}^i = a_t^i \cdot w_{nt}$ , where  $w_{nt}$  captures the overall wage level in equilibrium in the football market of country  $n$  at time  $t$ . This specification also captures cross-country wage differences driven by differences in demand for football (some countries have a richer and bigger fan base than other countries due to heterogeneity in country size and preferences). Although we do not observe the wage level  $w_{nt}$ , any variation in this variable can be fully controlled for by including country $\times$ year fixed effects  $\eta_{nt}$  in the log-specification (3).<sup>30</sup> This specification corresponds to column (3) of Table 2.

Third, if the assumption of perfect substitution between ability levels is not satisfied (e.g., because of skill complementarity), the effect of taxes on individual wages is not simply channeled through a common wage term  $w_{nt}$ , but will be heterogeneous across individuals with different ability levels. To control for this type of wage variation, we further add country $\times$ year $\times$ ability fixed effects in equation (3). Such a specification is considered in column (4) of Table 2.

To implement those specifications, we construct a quality index described in appendix. Importantly, the quality index for individual  $i$  in year  $t$  is based solely on career outcomes up to year  $t - 1$  so as to avoid endogeneity with current location choices. We include a set of 4 dummy variables corresponding to each quartile of the quality distribution in the current year.

All specifications of our additive random-utility model in equation (3) can be estimated as a multinomial discrete choice model. Let  $P_{nt}^i = Pr(U_{nt}^i \geq U_{nt}^m, \forall m)$  be the probability that player  $i$  locates in country  $n$  at time  $t$ . If the error term  $\nu_{nt}^i$  is type I extreme value distributed, the multinomial logit model can be estimated by maximum likelihood.

Finally, we consider two measures of the tax rate  $\tau_{nt}^i$ . First, we use the top marginal tax rate, which has the advantage of being well-measured and independent of earnings. The drawback is that it provides only an imperfect measure of the actual average tax rate. Second, we use the average tax rate computed based on observed and imputed individual earnings, assuming that counterfactual wages are equal to actual wages using PPP exchange rates. As individuals are more likely to select countries offering the best wages, we likely overestimate counterfactual wages, and hence overestimate counterfactual average tax rates (as tax systems are progressive

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<sup>30</sup>Notice that a failure to control for unobserved wage variation through country $\times$ year fixed effects creates a *downward* bias on the estimated elasticity of location. Because an increase in the net-of-tax rate in country  $n$  leads to higher supply and therefore lower salaries in equilibrium, the variation in net-of-tax salaries is always smaller than the variation in net-of-tax rates alone. Without controlling for salary variation, we would overstate variation in incentives and hence understate elasticities.

and average tax rates grow with income). The simplest way to circumvent this endogeneity issue is to adopt a grouping estimator using the average tax rate by cells of year  $\times$  country  $\times$  foreign status  $\times$  quality.<sup>31</sup> As the expected average tax rate is estimated at the group level, the bias due to self-selection into countries that offer better wages is greatly attenuated.<sup>32</sup> As we shall see, estimates based on top marginal and average tax rates are quantitatively fairly close.

**Elasticities.** The utility coefficient  $\alpha$  determines mobility responses to the net-of-tax rate. A positive  $\alpha$  implies that an increase in the net-of-tax rate in a given country has a positive effect on the probability of a player locating in this country. From  $\alpha$ , we can derive the elasticity of the individual probability  $P_{nt}^i$  of locating in country  $n$  with respect to the individual net-of-tax rate in country  $n$ . In the multinomial model where  $U_{nt}^i = \alpha \log(1 - \tau_{nt}^i) + X_{nt}^i \gamma + \nu_{nt}^i$  and  $\nu_{nt}^i$  is type I extreme value distributed, we have the standard formula

$$P_{nt}^i = \frac{e^{\alpha \log(1 - \tau_{nt}^i) + X_{nt}^i \gamma}}{\sum_m e^{\alpha \log(1 - \tau_{mt}^i) + X_{mt}^i \gamma}} \quad \text{and} \quad \varepsilon_{nt}^i \equiv \frac{d \log P_{nt}^i}{d \log(1 - \tau_{nt}^i)} = \alpha \cdot (1 - P_{nt}^i),$$

where  $\varepsilon_{nt}^i$  is the individual elasticity of  $P_{nt}^i$  with respect to  $1 - \tau_{nt}^i$ .

Denoting by  $I_n$  (resp.  $I_n^C$ ) the set of all natives (resp. non-natives) from country  $n$ , we can define the country  $n$  level elasticities  $\varepsilon_{domestic}^n$  and  $\varepsilon_{foreign}^n$  from section 3, equation (2) as

$$\varepsilon_{domestic}^n = \frac{d \log(\sum_{i \in I_n} P_{nt}^i)}{d \log(1 - \tau_{nd})} = \frac{\sum_{i \in I_n} d P_{nt}^i / d \log(1 - \tau_{nd})}{\sum_{i \in I_n} P_{nt}^i} = \frac{\sum_{i \in I_n} \alpha \cdot (1 - P_{nt}^i) P_{nt}^i}{\sum_{i \in I_n} P_{nt}^i} = \alpha \cdot (1 - \bar{P}_n^d),$$

where  $\bar{P}_n^d$  is the average probability (weighted by  $P_{nt}^i$ ) of natives to play at home.

$$\varepsilon_{foreign}^n = \frac{d \log(\sum_{i \in I_n^C} P_{nt}^i)}{d \log(1 - \tau_{nf})} = \frac{\sum_{i \in I_n^C} d P_{nt}^i / d \log(1 - \tau_{nf})}{\sum_{i \in I_n^C} P_{nt}^i} = \frac{\sum_{i \in I_n^C} \alpha \cdot (1 - P_{nt}^i) P_{nt}^i}{\sum_{i \in I_n^C} P_{nt}^i} = \alpha \cdot (1 - \bar{P}_n^f),$$

where  $\bar{P}_n^f$  is the average probability (weighted by  $P_{nt}^i$ ) of non-natives to play in country  $n$ .

Globally, as summary statistics, we can define  $\varepsilon_{domestic}$  and  $\varepsilon_{foreign}$  as the weighted average elasticities across all countries.<sup>33</sup> In Table 2, we report both  $\alpha$  and the two average elasticities  $\varepsilon_{domestic}$  and  $\varepsilon_{foreign}$ . As most players play at home,  $P_{nt}^i$  is small for foreign countries and therefore  $\varepsilon_{foreign} \approx \alpha$ . By contrast,  $P_{nt}^i$  is large for home countries (around 90% as shown in appendix Table A1, column (2)) and therefore  $\varepsilon_{domestic} \approx \alpha/10 \ll \alpha$ .

<sup>31</sup>More precisely, the cell is chosen so that the top marginal tax rate is constant within a cell so that foreign status also captures eligibility of any special scheme affecting the top marginal tax rate.

<sup>32</sup>Such grouping procedures are commonly used in the labor supply literature to overcome measurement error or missing data in wage rates (see e.g., Blau and Kahn, 2007).

<sup>33</sup>To be precise, the country  $n$  weight for  $\varepsilon_{domestic}^n$  (resp.  $\varepsilon_{foreign}^n$ ) is  $\sum_{i \in I_n} P_{nt}^i$  (resp.  $\sum_{i \in I_n^C} P_{nt}^i$ ).

**Empirical results.** Table 2 presents estimation results using the top marginal net-of-tax rate  $\log(1 - MTR)$  in Panel A and the average net-of-tax rate  $\log(1 - ATR)$  in Panel B. Column (1) shows results for a basic specification without country fixed effects. This specification is similar in spirit to the cross-country correlations presented in Figure 1 for the post-Bosman era, and obviously does not control rigorously for non-tax characteristics of countries that may affect location decisions. The utility coefficient on  $\log(1 - MTR)$  in Panel A is very large and strongly significant at  $1.32(.07)$ . This translates into an equally large elasticity for foreigners,  $\varepsilon_{foreigner} = 1.31(.07)$ , and a more modest elasticity for domestic players,  $\varepsilon_{domestic} = .16(.01)$ . The estimates are slightly higher when using the average tax rate in Panel B with  $\varepsilon_{foreigner} = 1.60(.08)$  and  $\varepsilon_{domestic} = .18(.01)$ . These estimates are roughly comparable to the reduced-form estimates in Table 1, Panel A, and represent long-term migration responses to taxation under the strong identification assumption made by this specification.

Column (2) introduces country fixed effects as well as rich controls for ability and other individual characteristics whose effects are allowed to vary by country. This specification controls for all unobserved time-invariant country characteristics that affect location choice, and exploits primarily differential variation over time in the net-of-tax rates on different players across countries. This is the type of difference-in-differences approach exemplified by Figure 2, Panel A and Figure 3, which represent medium-term migration responses to taxation. The estimates are still large and strongly significant, but unsurprisingly somewhat smaller than in column (1). The utility coefficient on  $\log(1 - MTR)$  in Panel A is  $0.73(.12)$  while the coefficient on  $\log(1 - ATR)$  in Panel B is  $0.93(.14)$ . The corresponding elasticities are a bit below 1 for foreigners and around .1 for locals.

The specification in column (3) introduces country $\times$ year fixed effects, and therefore exploits variation *within* country and year in the net-of-tax rates on different players. This strategy is exemplified by Figure 2, Panel B (eligibility rule in the Beckham Law), appendix Figure A6 (duration rule in the Danish scheme), and appendix Figure A7 (cohort-based payroll tax reform in Greece). Controlling for unobserved time-varying country characteristics ensures that even if tax reforms were endogenous, this does not necessarily pose a threat to identification.<sup>34</sup>

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<sup>34</sup>Note though that this does not deal with every possible endogenous reform story. For example, it would still pose a threat to identification if the Spanish Beckham law was implemented in response to differential migration patterns between those types of foreigners who were made eligible for the scheme and those who were not made eligible.

Furthermore, as explained above, this specification also controls for potential general equilibrium effects of taxation on the wage level of football players in country  $n$ . As can be seen in column (3), the estimated coefficients when using either the top marginal or average net-of-tax rate become *larger* than the coefficients in column (2). Elasticities are now greater than 1 for foreigners and around 0.1-0.2 for locals. This suggests that general equilibrium effects do occur and is consistent with the earlier hypothesis that not taking them into account leads to downward bias in the estimated mobility response.

Column (4) adds controls for country $\times$ year fixed effects interacted with ability variables in order to test for potential general equilibrium effects on wages that vary by ability, as in a model with imperfect substitution across different ability levels. This reduces somewhat the estimated coefficients, although they are still large and strongly significant. For example, the mobility elasticity of foreigners equals .62(.13) when using top marginal tax rates and 1.10(.16) when using average tax rates.

Columns (5)-(6) provide robustness checks of the specification in column (3). Column (5) considers an alternative measure of player quality based on the average quality of a player's clubs over just the three preceding seasons, as opposed to over all preceding years. This does not have a large effect on the estimated coefficients. Column (6) relaxes the constraint we have imposed on the dynamics of location decisions. So far, we have taken a very myopic view on migration choices, implicitly assuming that a player makes a new location decision each year independently of previous choices. In such a setting, the only reason for path-dependence in choices is through serial correlation in the error terms, which we control for by clustering standard errors by player. But in practice, there will be path-dependence in location choice arising from factors such as costs of breaking long contracts, moving costs, and investments in location-specific human capital (such as language). To allow for such effects, column (6) shows results from a specification that controls for past choices by adding a dummy variable  $country_{t-1}$  equal to 1 for the country of location in the previous year, interacted with dummies for foreign and domestic country of the player. Results (not reported) show that past choices do matter for current location with large positive coefficients on  $country_{t-1} \times foreign$  and  $country_{t-1} \times domestic$ , and those variables absorb part of the effect of home bias (*home*).

Finally, column (7) considers the pre-Bosman era (1985-1995) using the specification in

column (2).<sup>35</sup> The coefficient on the top marginal net-of-tax rate is still positive, but the estimate is much lower than for the post-Bosman era and not statistically significant. Consistent with our results in Table 1, Panel A, the lower estimate reflects the limited mobility permitted by UEFA legislation before the Bosman ruling.<sup>36</sup>

## 5.2 Rigid-Demand: Estimation of Ability Sorting and Displacement

As shown theoretically in section 3, rigid labor demand can create ability sorting and displacement effects. Because of the ability sorting effect, the impact of the net-of-tax rate in a given country on the probability of locating in this country is positive at high ability levels, but negative at low ability levels. Because of the displacement effect, an increase in the net-of-tax rate on foreign (domestic) players has a negative cross-effect on domestic (foreign) players. This section investigates the empirical importance of such effects. Importantly, sorting and displacement effects occur in the full professional football market and might be masked when focusing solely on the top leagues as we have done so far. In the largest countries, the second leagues are also professional and can be of similar or higher quality than the top leagues of the smallest countries. Hence, in this section, we add the second leagues from the top-five countries (England, France, Germany, Italy, and Spain) to our sample of interest. Because information on second leagues is only available since 1999, we will restrict our analysis to the 1999-2008 period. We will compare results when using only top leagues to results when including second leagues as well. We will use only top marginal tax rates because of lack of data on the earnings of second-league players.

To begin with, note that the model of individual location choice underlying the rigid-demand model is the same as the one underlying the flexible-demand model. As shown in section 3, the difference in the predictions of the two models is created entirely by general equilibrium effects on player salaries driven by the rigid-demand constraint. We therefore consider specifications that do not control for country $\times$ year fixed effects since such controls would absorb the equilibrium wage variation driving the effect we are trying to identify. For ability sorting, we allow the effect of the net-of-tax rate to vary with ability and test if the effect is positive at high ability levels and

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<sup>35</sup>In the pre-Bosman period, there is substantially less within-country variation in the net-of-tax rate, and so we cannot implement the specifications in columns (3) or (4) allowing for country, year, and quality fixed effects interacted.

<sup>36</sup>In addition, the top marginal tax rate is a less accurate proxy for the average tax rate in the pre-Bosman era where football wages were generally lower, which may create downward bias. We cannot use average tax rates for the pre-Bosman era due to a lack of individual earnings data for that period.

negative at low abilities. Notice that in the perfectly flexible demand model, the effect would always be positive at all ability levels even when including general equilibrium wage effects in the estimates. For displacement, we include in the specification both the net-of-tax rate on player  $i$  and the net-of-tax rate on the “opposite group” (foreign players if player  $i$  is domestic, and vice versa), and test if the cross-effect is negative.

The results are reported in Table 3. Panel A considers the first-league sample for the period 1999-2008, while Panel B adds the top-five second leagues to the sample. Columns (1)-(3) consider the same specifications as in the first three columns of Table 2. Two conclusions emerge. First, the results in Panel A show that the 1999-2008 period delivers results that are fairly similar (somewhat larger) to those obtained in Table 2 for the full period 1996-2008. Second, the results in Panel B show that including the five best second leagues has only a modest downward effect on the estimated coefficients, which is reassuring.

Starting from column (2) specification without country $\times$ year fixed effects, column (4) tests for ability sorting effects by interacting the net-of-tax rate variable with an indicator variable *low* (*top*) for the quality index being below (above) a given threshold. The threshold is the same in absolute value in Panels A and B (and corresponds roughly to the 25th and 50th percentiles of the quality distributions in Panel A and Panel B, respectively). Column (4) shows strong positive effects for top-quality players and significantly negative effects for lower-quality players. The results are similar when adding the second leagues in Panel B. Importantly, in the presence of rigid demand, the larger estimate for top-quality players is the one that should be used as the upper bound for top earners in other occupations where labor demand is likely to be flexible.

Starting from the specification in column (4) with ability sorting effects, column (5) tests for displacement effects by adding the net-of-tax rate on foreign players in player  $i$ 's country of citizenship ( $\log(1 - \tau^f) \times \textit{domestic}$ ) and the net-of-tax rate on domestic players in all countries where player  $i$  is not a citizen ( $\log(1 - \tau^d) \times \textit{foreign}$ ). Two points are worth noting. First, the coefficients interacted with quality dummies remain virtually unchanged relative to column (4). Second, consistent with the presence of displacement effects, we find negative cross-tax effects. The coefficient on  $\log(1 - \tau_f) \times \textit{domestic}$  is large in absolute value and strongly significant, while the coefficient on  $\log(1 - \tau_d) \times \textit{foreign}$  is smaller and statistically insignificant.<sup>37</sup> Again,

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<sup>37</sup>Notice that we have much more power in the estimation of cross-effects of  $\tau_f$  than in the estimation of cross-effects of  $\tau_d$ , because the strongest variation in the data comes from special tax schemes to foreigners that reduce  $\tau_f$  without affecting  $\tau_d$ . Hence, there may also be significant displacement effects of domestic players on

those displacement effects are very similar across Panels A and B.

To conclude, Table 3 provides strong evidence of ability sorting and displacement effects consistent with the rigid labor demand model in section 3. Reassuringly, the results are robust to the inclusion of lower leagues.

## 6 Conclusion and Policy Implications

This paper has analyzed the effects of top earnings tax rates on the international migration of top football players in Europe. The effects are identified using a number of tax and institutional changes: The 1995 Bosman ruling which liberalized the European football market, top tax rate reforms within countries, and special tax schemes offering preferential rates to immigrant workers. These variations create compelling sources of identification for the causal impact of taxation on location choice. We provide reduced-form graphical evidence showing transparent and significant migration responses to country-specific tax reforms and labor market regulation. Multinomial regression analysis using all sources of variation in the post-Bosman period confirms that the mobility response to tax rates is large. The elasticity of the number of foreign players with respect to the net-of-tax rate on foreigners is around one, and even larger for the highest-quality players. Hence, a country can successfully attract foreign players by providing foreigner-specific tax breaks. The elasticity of the number of domestic players with respect to the net-of-tax rate on domestic players is smaller, around .15, because the base of domestic players is much larger as most players play at home. Hence, cutting taxes on all players (foreigners and locals) is much less cost effective than cutting taxes on foreign players only. Consistent with our rigid labor demand theory, we find that location elasticities are largest at the top of the ability distribution and negative at the bottom due to ability sorting effects, and that cross-tax location elasticities between foreign and domestic players are negative due to displacement effects. To our knowledge, the paper provides for the first time compelling evidence of a link between taxation and international migration. As shown in the case of Denmark, football players are likely to be a particularly mobile segment of the labor market, and our study therefore provides an upper bound on the migration response for the labor market as a whole. The upper bound we find is large, suggesting that mobility could be an important constraint on tax progressivity.

Our estimates combined with our theoretical model can be used to estimate revenue max-  

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foreigners that we do not have sufficient power to estimate.

imizing tax rates (Laffer rates) and draw policy conclusions, especially with respect to the aggressive use in several countries of preferential tax schemes to foreigners. We propose such an analysis in appendix section A.4 that yields three main findings (appendix Table A3). First, in the baseline model with flexible demand, a uniform revenue-maximizing tax rate on all players (foreign and domestic) follows a classic inverse elasticity rule as in the Mirrlees (1982) model of optimal taxation with migration. It is around 81%, higher than actual top tax rates. This high tax rate is obtained because about 90% of players still play at home and the elasticity for home players is relatively small. Second, in the rigid-demand model, this uniform revenue maximizing tax rate on all players is even higher than in the baseline. This is driven by ability sorting: any in-migration of high-ability players comes with an offsetting out-migration of lower ability players, which reduces the ability-weighted average location elasticity in the rigid-demand setting compared to the baseline. Third, the selective revenue-maximizing tax rate on foreign players is lower than the uniform revenue maximizing tax rate and sometimes significantly so.

Importantly, these results are based on *uncoordinated* tax setting across countries. While our empirical results provide some normative support for preferential tax schemes to foreigners within this setting, these are beggar-thy-neighbor policies that are not optimal from the global perspective.<sup>38</sup> Another important rationale put forward by advocates of preferential tax rates for highly-paid foreigners is that high-skill workers generate positive externalities on their co-workers and the economy at large. If such spillovers exist, they would naturally further reduce the optimal tax rate on foreign workers. Such spillovers also typically benefit one country at the expense of others and hence cannot justify low tax rates from a coordinated tax setting perspective. We leave the estimation of such spillovers for future work.

From a methodological perspective, we hope that the combination of graphical evidence using tax reforms along with systematic multinomial regressions could be fruitfully used in other tax mobility contexts and in particular in the case of mobility of firms as richer international micro data on firms' locations become available.

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<sup>38</sup>Moreover, in the case of football players, even within the uncoordinated setting and despite the large migration responses we estimate, the Laffer rates are still quite high due to displacement effects driven by rigid demand in the football market.

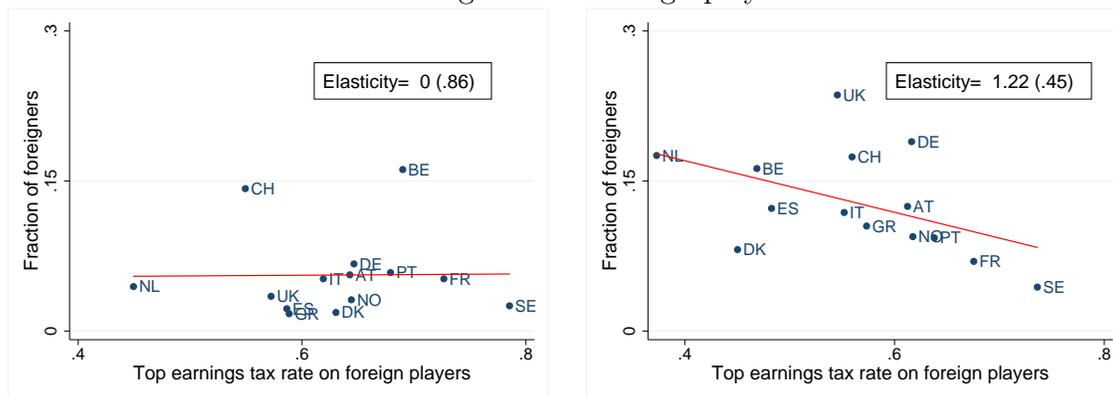
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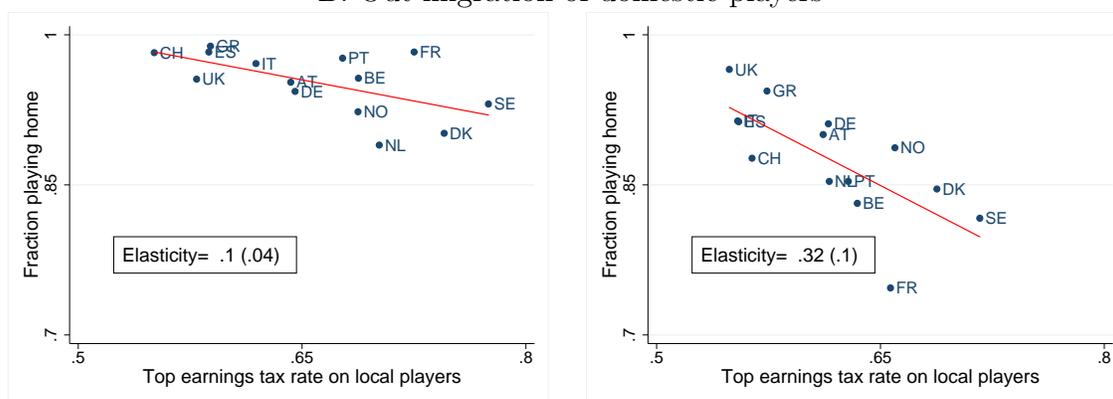
1. Before Bosman ruling  
1985-1995

2. After Bosman ruling  
1996-2008

A. In-migration of foreign players



B. Out-migration of domestic players



C. Club performance

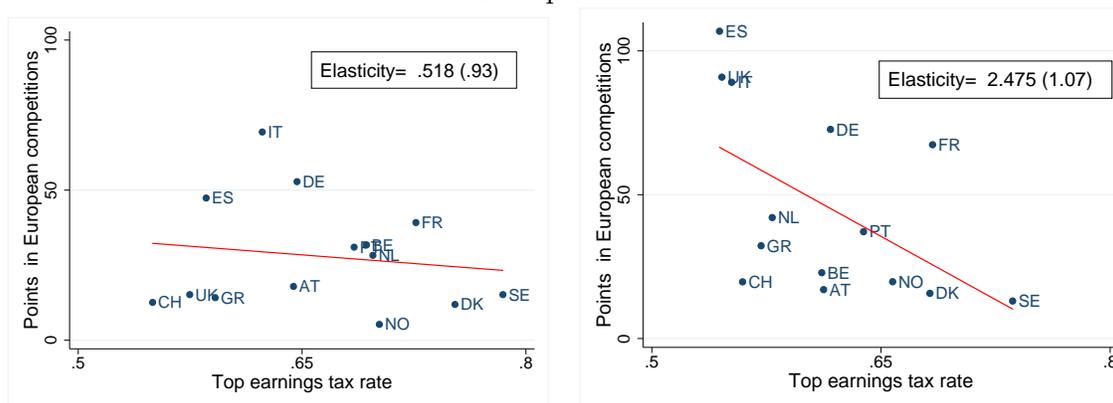


Figure 1: CROSS-COUNTRY CORRELATION BETWEEN TAX RATES, MIGRATION, AND PERFORMANCE

NOTES: Each dot stands for one country. AT=Austria, BE=Belgium, DK=Denmark, UK=England, FR=France, DE=Germany, GR=Greece, IT=Italy, NL=Netherlands, NO=Norway, PT=Portugal, ES=Spain, SE=Sweden, CH=Switzerland. Left panels (1) depict country averages for years 1985 to 1995 and right panels (2) for years 1996 to 2008 after the Bosman ruling on free mobility was enacted. Panel A (top) depicts the fraction of foreign players in the total number of players playing in the top league of a country against the average top earnings tax rate for foreign players in that country. Panel B (middle) depicts the fraction of all top league professional players nationals of a given country playing in the first league of their home country against the average top earnings tax rate for domestic players in that country. Panel C (bottom) plots the total number of points earned by all clubs in a given country in all European competitions against the weighted top earnings tax rate (computed as the weighted sum of the top earnings tax rate on foreign and domestic players weighted by the fraction of foreign and domestic players in the league). Total points are calculated according to UEFA's formula (see appendix for details). The regression line is depicted. Elasticity coefficients from the OLS regression of the log-outcome on  $\log(1 - \tau)$  (where  $\tau$  is top tax rate on the x-axis) are reported with standard errors.

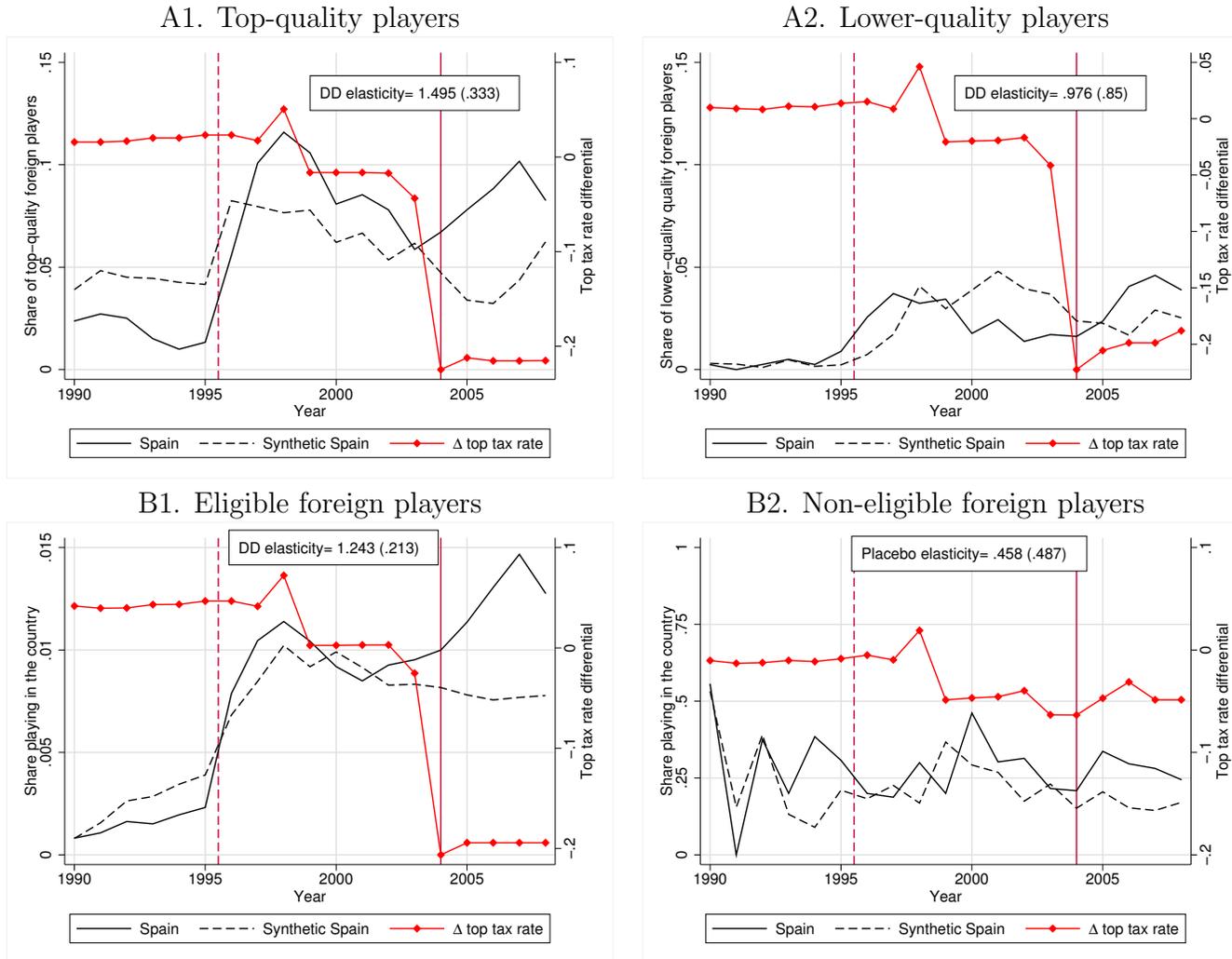
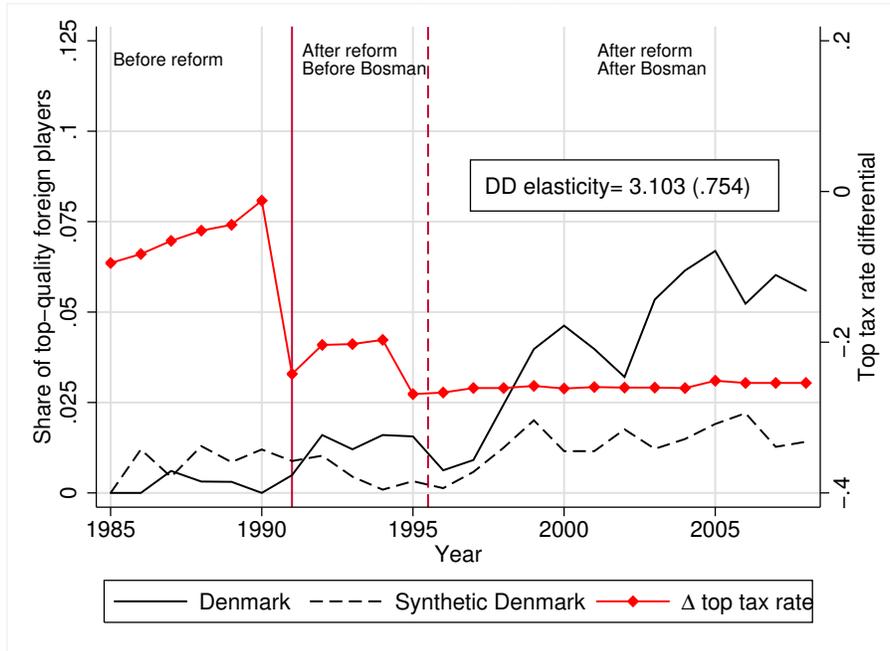


Figure 2: EFFECTS OF THE 2004 BECKHAM LAW IN SPAIN

NOTES: The 2004 “Beckham Law” tax reform, depicted by a vertical line, introduced a preferential tax treatment for foreign players in Spain (the 1995 dashed vertical line denotes the Bosman ruling). Each panel depicts the fraction of foreign players in the first league of Spain and in the synthetic control country average. The synthetic country weights are constructed to match Spain on pre-reform 1990-2004 variables (see text for details and appendix Table A2 for the composition of the synthetic country). Panel A1 displays the fraction of foreign top players, with top player defined as having played at least once over the career in the national team of one’s home country. Panel A2 displays the fraction of non-top foreign players. Panel B1 displays the fraction of top foreign players who never played in the country before year  $t$  and are therefore eligible for the Beckham tax regime in Spain after 2004. Panel B2 displays the fraction of foreign players who did played in the country in the window 5 to 10 years before year  $t$  and are therefore ineligible for the Beckham tax regime in Spain after 2004. The top earnings tax rate differential between Spain and the synthetic control (defined as  $\tau_{Spain}/\tau_{Synthetic} - 1$ ) is reported on right y-axis. The Diff-in-Diff elasticity estimates reported are the Wald estimators, using years 1990-2003 (pre-reform) and 2004-2008 (post-reform).

### A. Top-quality players



### B. Lower-quality quality players

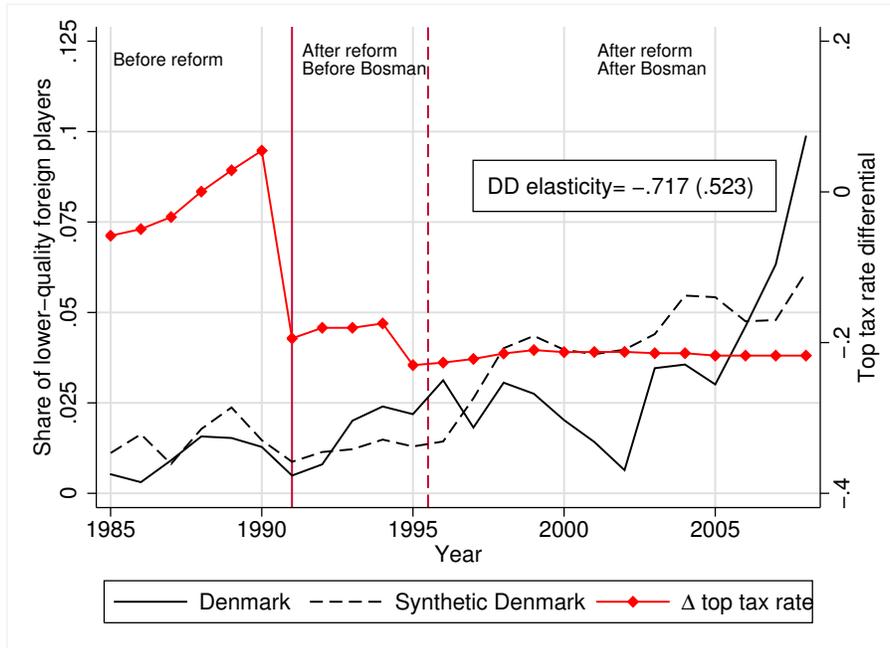
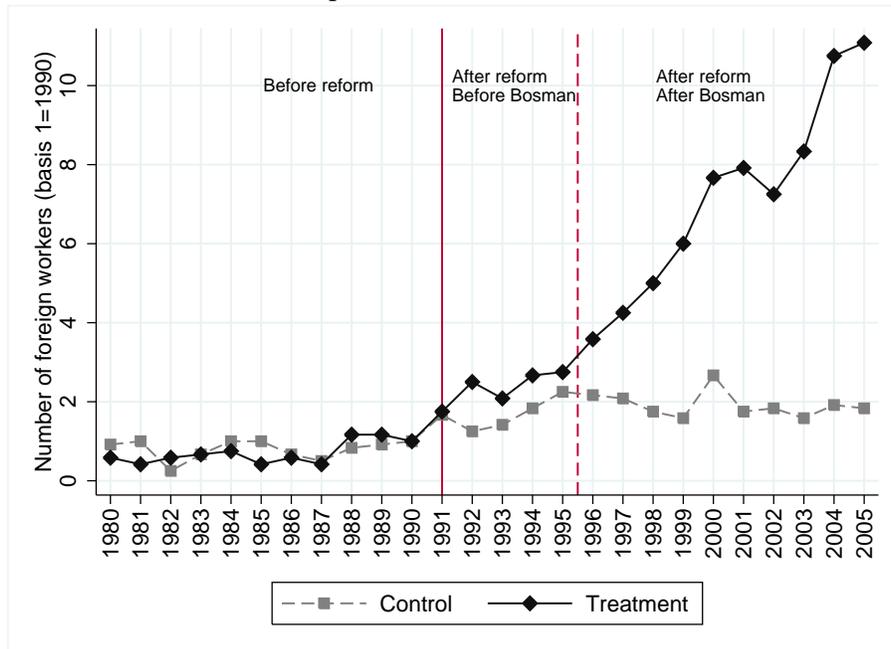


Figure 3: EFFECTS OF THE DANISH FOREIGNER TAX SCHEME

NOTES: The 1992 Danish tax reform, depicted by a vertical line, introduced a preferential flat tax scheme for highly-paid foreign workers arriving in Denmark in 1991 or after (the 1995 dashed vertical line denotes the Bosman ruling). Each panel depicts the fraction of foreign players in the first league of Denmark and in the synthetic control country average. The synthetic country weights are constructed to match Denmark on pre-reform 1985-1990 variables (see text for details and appendix Table A2 for the composition of the synthetic country). Panel A1 displays the fraction of foreign top players, with top player defined as having played at least once over the career in the national team of one's home country. The top earnings tax rate differential between Spain and the synthetic control (defined as  $\tau_{Denmark}/\tau_{Synthetic} - 1$ ) is reported on right y-axis. The Diff-in-Diff elasticity estimates reported are the Wald estimators, using years 1985-1990 (pre-reform) and 1991-2008 (post-reform).

### A. Sports & Entertainment



### B. All other industries

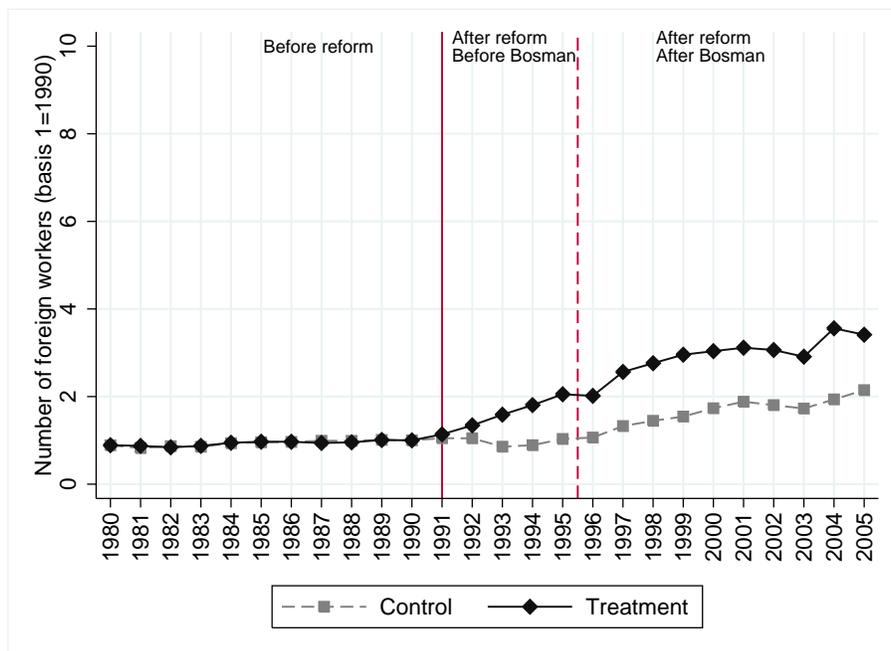


Figure 4: EFFECTS OF THE DANISH FOREIGNER TAX SCHEME BY INDUSTRY

NOTES: The 1992 Danish tax reform, depicted by a vertical line, introduced a preferential flat tax scheme for highly-paid foreign workers arriving in Denmark in 1991 or after (annualized earnings above 103,000 Euros as of 2009). The 1995 dashed vertical line denotes the Bosman ruling. Each panel reports the number of foreign workers in Denmark with earnings above the scheme eligibility threshold (treatment series) from 1980 to 2005. As a control group, it reports the number of foreigners in Denmark with earnings between 80% and 99.5% of the threshold (control series). Panel A is for workers in the Sports & Entertainment sector (smallest industrial classification including football players). Panel B is for workers in all other industries. Treatment and control series are normalized to one in 1990 the year before the scheme was first implemented. All numbers are weighted by duration of stay during the year for part-year residents and earnings are also annualized for part-year residents. Data based on full population provided by Statistics Denmark.

Table 1: REDUCED FORM ELASTICITY ESTIMATES

| Description   |                        | Elasticity<br>w.r.t (1- MTR) | Elasticity<br>w.r.t (1-ATR) |
|---|------------------------|------------------------------|-----------------------------|
|   |                        | (1)                          | (2)                         |
| <b>A. Bosman ruling</b>   |                        |                              |                             |
|   |                        | <b>A1. Foreign players</b>   |                             |
| Bosman ruling removed barriers to migration in the football labor market from 1996 on. Estimates capture cross-country correlation between top earnings tax rate and location decisions before and after the Bosman ruling as in Figure 1 (no control for country fixed effects).             | Pre-Bosman             | .00<br>(.86)                 |                             |
|   | Post-Bosman            | 1.22<br>(.45)                | 1.33<br>(.37)               |
|   |                        | <b>A2. Domestic players</b>  |                             |
|   | Pre-Bosman             | .10<br>(.04)                 |                             |
|   | Post-Bosman            | .32<br>(.10)                 | .17<br>(.07)                |
| <b>B. Country case studies</b>  |                        |                              |                             |
| <b>B1. Spanish 2004 “Beckham law”</b>   |                        |                              |                             |
| Flat tax rate for foreign players arriving in Spain on or after 2004. DD estimation using the synthetic control approach of Abadie et al. (2010) and comparing 1990-2003 (1996-2003 for average tax rates) to 2004-2008. Identification relies on a parallel trend assumption as in Figure 2. | Top-quality players    | 1.49<br>(.33)                | 1.83<br>(.57)               |
|   | Lower-quality players  | .98<br>(.85)                 | 1.10<br>(.78)               |
|   | Eligible players       | 1.24<br>(.21)                | 1.45<br>(.31)               |
|   | Non-eligible (placebo) | .46<br>(.49)                 | .45<br>(.72)                |
| <b>B2. Danish tax scheme for foreigners</b>   |                        |                              |                             |
| Flat tax rate for foreign players arriving in Denmark on or after 1991. DD estimation comparing 1985-1990 to 1991-2008. Identification relies on a parallel trend assumption as in Figure 3.  | Top-quality players    | 3.10<br>(.75)                |                             |
|   | Lower-quality players  | -.71<br>(.52)                |                             |

NOTES: The table presents elasticity estimates from the reduced form case studies presented in Section 4. Column (1) presents elasticity estimates using the top marginal tax rate while column (2) presents elasticity estimates using the actual average tax rate (calculated using individual earnings data available or imputed for the period 1996-2008). Panel A presents elasticity estimates based on cross-country comparisons before and after the Bosman ruling of 1996 from Figure 1. Panel A1 presents the elasticity of the fraction of foreign players with respect to the net-of-tax rate applicable to foreign players (assuming eligibility for preferential treatment when applicable) while Panel A2 presents the elasticity of the fraction of domestic players with respect to the net-of-tax rate applicable to domestic players. Panels B1 and B2 present elasticity estimates from the country case studies tax preferential schemes introduced in Spain in 2004 and Denmark in 1991 (corresponding to Figures 2 and 3). Those elasticities are always for foreign players. Average tax rate elasticities are not presented for the pre-Bosman period and the Danish case studies because of lack of individual earnings data before 1996. Similarly, the average tax rate elasticity for Spain is based on the 1996-2003 vs. 2004-2008 comparison.

Table 2: DISCRETE CHOICE MODEL ESTIMATES

|   | Post-Bosman (1996-2008)            |                     |                     |                     |                                   |                                | Pre-Bosman       |
|---|------------------------------------|---------------------|---------------------|---------------------|-----------------------------------|--------------------------------|------------------|
|   | (1)                                | (2)                 | (3)                 | (4)                 | Alternate<br>quality index<br>(5) | Control<br>past choices<br>(6) | (7)              |
| <b>A. Specifications with top marginal tax rates</b>                    |                                    |                     |                     |                     |                                   |                                |                  |
|   | <b>Utility parameter estimates</b> |                     |                     |                     |                                   |                                |                  |
| $\log(1 - MTR)$   | 1.323***<br>(0.0732)               | 0.729***<br>(0.116) | 1.089***<br>(0.159) | 0.634***<br>(0.132) | 1.034***<br>(0.156)               | 1.311***<br>(0.139)            | 0.202<br>(0.160) |
|   | <b>Implied elasticities</b>        |                     |                     |                     |                                   |                                |                  |
| $\varepsilon_{domestic}$  | .156<br>(.009)                     | .074<br>(.012)      | .121<br>(.018)      | .07<br>(.015)       | .112<br>(.017)                    | .089<br>(.009)                 | .011<br>(.009)   |
| $\varepsilon_{foreigner}$   | 1.308<br>(.072)                    | .704<br>(.112)      | 1.057<br>(.154)     | .621<br>(.13)       | .991<br>(.15)                     | .747<br>(.079)                 | .199<br>(.158)   |
| <b>B. Specifications with grouped average tax rates</b>                 |                                    |                     |                     |                     |                                   |                                |                  |
|   | <b>Utility parameter estimates</b> |                     |                     |                     |                                   |                                |                  |
| $\log(1 - ATR)$   | 1.599***<br>(0.0787)               | 0.931***<br>(0.138) | 1.721***<br>(0.197) | 1.123***<br>(0.161) | 1.772***<br>(0.192)               | 1.746***<br>(0.172)            |                  |
|   | <b>Implied elasticities</b>        |                     |                     |                     |                                   |                                |                  |
| $\varepsilon_{domestic}$  | .184<br>(.009)                     | .093<br>(.014)      | .184<br>(.021)      | .122<br>(.017)      | .19<br>(.021)                     | .116<br>(.011)                 |                  |
| $\varepsilon_{foreigner}$   | 1.582<br>(.078)                    | .9<br>(.133)        | 1.654<br>(.19)      | 1.1<br>(.157)       | 1.698<br>(.184)                   | .989<br>(.098)                 |                  |
| Country F-E   | NO                                 | YES                 | YES                 | YES                 | YES                               | YES                            | YES              |
| Age, age squared, exp., and quality dummies interacted with country F-E | NO                                 | YES                 | YES                 | YES                 | YES                               | YES                            | YES              |
| Year×country F-E  | NO                                 | NO                  | YES                 | YES                 | YES                               | YES                            | NO               |
| Age, age squared, exp., quality interacted with year×country F-E        | NO                                 | NO                  | NO                  | YES                 | NO                                | NO                             | NO               |
| Observations  | 55225                              | 55225               | 55225               | 55225               | 55225                             | 55225                          | 45577            |

NOTES: Multinomial Logit regressions. Robust s.e. clustered at individual level in parentheses. \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ . Regression based on 1996-2008 individual micro-data described in appendix Table A1. The data include players in 14 countries: Austria, Belgium, Denmark, England, France, Germany, Greece, Italy, Portugal, Netherlands, Norway, Sweden, Spain, and Switzerland. All regressions include a home country dummy. Specification in column (1) refers to the identification strategy with no country fixed-effect as in Figure 1. Specification in column (2) refers to the identification with country fixed-effects, i.e., Difference-in-Differences strategy as in Figures 2A, and 3. Specification in column (3) refers to the identification with country×year fixed-effects and therefore exploits within country×year variation in tax rates as in Figures 2B, A6, and A7. Column (4) introduces country×year×ability fixed effects, to account for possible variations in the shape of the wage distribution by country over time. Column (5) repeats the specification of column (3) with an alternative quality index. Column (6) repeats the specification of column (3) but adds a dummy for country of play in year  $t-1$  interacted with foreign status. Column (7) estimates the model of column (2) on pre-Bosman years (1985 to 1995). The top Panel A uses the top marginal tax rate while Panel B uses the average tax rate. The average tax rate is estimated based on actual and imputed individual earnings and averaged at the country×year×foreign status×quality level to avoid endogeneity issues. The first row in each panel reports the coefficient  $\alpha$  from the multinomial regression. The next two rows report the corresponding elasticities. The first is the elasticity of domestic players with respect to a change in the domestic net-of-tax rate. The second is the elasticity of foreign players with respect to a change in the foreign net-of-tax rate.

Table 3: SORTING EFFECTS, CROSS-EFFECTS, AND SECOND LEAGUES

|   | (1)                  | (2)                 | (3)                 | (4)                  | (5)                  |
|---|----------------------|---------------------|---------------------|----------------------|----------------------|
| <b>A. Top leagues (1999-2008)</b>                                       |                      |                     |                     |                      |                      |
| $\log(1 - \tau)$  | 1.795***<br>(0.0647) | 1.138***<br>(0.118) | 1.433***<br>(0.155) |                      |                      |
| $\log(1 - \tau) \times low$   |                      |                     |                     | -0.512***<br>(0.149) | -0.529***<br>(0.145) |
| $\log(1 - \tau) \times top$   |                      |                     |                     | 1.409***<br>(0.136)  | 1.301***<br>(0.132)  |
| $\log(1 - \tau^f) \times domestic$                                      |                      |                     |                     |                      | -0.618***<br>(0.119) |
| $\log(1 - \tau^d) \times foreign$                                       |                      |                     |                     |                      | -0.149<br>(0.178)    |
| <b>B. Adding the five best second leagues (1999-2008)</b>               |                      |                     |                     |                      |                      |
| $\log(1 - \tau)$  | 1.334***<br>(0.0771) | 0.995***<br>(0.128) | 1.226***<br>(0.169) |                      |                      |
| $\log(1 - \tau) \times low$   |                      |                     |                     | -0.391*<br>(0.158)   | -0.448**<br>(0.154)  |
| $\log(1 - \tau) \times top$   |                      |                     |                     | 1.494***<br>(0.136)  | 1.409***<br>(0.133)  |
| $\log(1 - \tau^f) \times domestic$                                      |                      |                     |                     |                      | -0.635***<br>(0.134) |
| $\log(1 - \tau^d) \times foreign$                                       |                      |                     |                     |                      | -0.201<br>(0.192)    |
| Country F-E   | NO                   | YES                 | YES                 | YES                  | YES                  |
| Age, age squared, exp., and quality dummies interacted with country F-E | NO                   | YES                 | YES                 | YES                  | YES                  |
| Year $\times$ country F-E   | NO                   | NO                  | YES                 | NO                   | NO                   |

NOTES: Multinomial Logit regressions. Robust s.e. clustered at individual level in parentheses. \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ . Panel A includes all top leagues from the 14 countries for years 1999-2008 (sample size is 47,727). Panel B adds the second leagues from the top five countries—England, France, Germany, Italy, and Spain—for years 1999-2008 (sample size is 70,703). Compared to Table 2, years 1996-1998 are excluded in both panels because of lack of second league data for those years. Columns (1), (2), and (3) correspond to the specifications of columns (1), (2), and (3) of Table 2. Column (4) uses the specification of column (2) and adds the interaction of the log-net-of-tax rate with indicators of players' quality (based on prior years of each individual career, see text for details). *top* (*low*) is an indicator variable for quality index above (below) a given threshold of the quality index. The threshold is the same in both panels A and B (and corresponds to the 25th percentile of the quality distribution in Panel A, and approximately the 50th percentile of the quality distribution in Panel B). Higher coefficients for top quality players is evidence of sorting effects. Column (5) further adds interactions of foreign vs. domestic dummy. *domestic* (*foreign*) is a dummy equal to one if the individual plays (does not play) in his home country.  $\tau^f$  is the tax rate that applies in country  $c$  to foreign players and  $\tau^d$  is the tax rate on local players in country  $c$ . Those coefficients capture the displacement effects that arise in the rigid labor demand model.

# A Appendix (not for publication)

## A.1 Top and Average Tax Rate Computations

**Individual Income Tax.** For the individual income tax, we use the top statutory marginal income tax rate taking into account all the tax rules and deductions that may apply in the calculation of the top income tax rate. In cases where local income taxes apply (Belgium, Denmark, Portugal, and Switzerland), we have used the average top local income tax rate. We have used as sources OECD (annual): *Taxing wages* for the period 1980-present, OECD (1986): *Personal income tax systems* for the period 1975-1983, PriceWaterhouseCoopers (annual): *Worldwide Tax Summaries*, and International Bureau of Fiscal Documentation (2008): *The International Guide to the Taxation of Sportsmen and Sportswomen*. The latter source is particularly helpful for determining specific rules applying to foreign football players. Because tax rules are complex, it is essential to cross-validate various sources to create an error-free database. In particular, we investigated thoroughly situations where discrepancies arose between our sources and used additional country-specific data obtained directly from domestic sources to resolve such discrepancies.

**Payroll Taxes.** Payroll tax rates include *uncapped* social security contributions both at the employer and employee level as well as some additional specific taxes on wage earnings. For payroll tax rates, we have used as sources OECD (annual): *Taxing wages*, MISSOC (annual): *La protection sociale dans les Etats membres de l'Union européenne*, along with direct information from the Social Security administrations covering football players in different countries (e.g., IKA in Greece and ENPALS in Italy). For our analysis, the critical aspect of such social security taxes is whether they apply only up to a cap, in which case we assume that the relevant payroll tax rate is zero (as the amount of earnings below the cap is small relative to the very large football players earnings).

**Valued Added Taxes.** Finally, we include VAT rates in our computations, using the standard VAT rate applying to the broadest set of goods. Our source for VAT rates is the European Commission (2009): *Taux de TVA appliqués dans les Etats membres de la Communauté européenne*. If players consume most of their income in the country in which they live and play, then it is correct to include the VAT rate in the tax calculation. On the other hand, if players consume most of their income abroad or save most of it for future consumption outside the country in which they play, then the VAT rate should not be included. Whether or not the VAT rate is included does not significantly impact our findings, because VAT rates are fairly similar across European countries and because VAT variation is national and therefore fully controlled for in specifications using country $\times$ year fixed effects.

**Top Marginal Tax Rate.** We combine all three types of taxes into a single tax rate  $\tau$  capturing the total tax wedge: when the employer labor cost increases by 1 Euro, the employee can increase his consumption by  $1 - \tau$  Euros. Denoting by  $\tau_i$ ,  $\tau_{pw}$ ,  $\tau_{pf}$ , and  $\tau_{VAT}$ , the top tax

rates on earnings due to the income tax, the employee (worker) portion of the payroll tax, the employer (firm) portion of the payroll tax, and the VAT, respectively, we have

$$1 - \tau = \frac{(1 - \tau_i)(1 - \tau_{pw})}{(1 + \tau_{VAT})(1 + \tau_{pf})},$$

in the most typical case where the employer and employee payroll taxes apply to earnings net of the employer payroll tax but before the employee payroll tax has been deducted, and where the income tax applies to earnings net of all payroll taxes. We have adapted the computation for each country to capture exactly the rules in that country.

The top marginal tax rates for years 1985-2008 are depicted in Figures A1-A3 in all 14 countries. Each figure has two panels. The top panel depicts top tax rates applying to domestic players and the bottom panel depicts top tax rates applying to foreign players when they are eligible for a preferential tax scheme.

**Individual Earnings: Actual Data and Imputations.** Individual earnings information for football players have been collected by Jori Pinge at the Copenhagen University for his Ph.D. research. We are very grateful to him for sharing his data with us. The data were provided to Jori Pinge by Sports Interactive, a company that created the game Football Manager and still owns all property rights on the individual earnings dataset that they have gathered from various undisclosed sources. Analysis of the data shows that the numbers are reasonable and very highly correlated with league and club quality suggesting that the data quality is reasonably high. The earnings data cover years 1999-2000 and 2004-2008. For those years, the earnings data cover 54% of our main sample of top league players in our 14 European countries (Table A1, column (7)).

For players in our main dataset for whom we do not have direct earnings information, we impute individual earnings using a simple one-to-one propensity score matching as follows. First, we estimate a probability model of having a wage record in our dataset on a set of observable characteristics (experience, age, country fixed effects, various quality indexes and a linear time trend). Second, we impute earnings of individual  $j$  using the earnings of individual  $i$  (with non missing earnings) that has the closest score  $X_i\hat{\beta}$  to the score  $X_j\hat{\beta}$  of individual  $j$ . We have tried various other matching methods (kernel, radius, Mahalanobis) without loss of robustness.

Note that the imputation of individual earnings does introduce measurement error. As a result, our individual earnings data would not be suited to evaluate tax incidence. However, they are precise enough to evaluate average tax rates and to understand how average earnings tax rates depart from top earnings tax rates. Using the top individual tax rate as instrument for the average tax rate, we can eliminate the bias that arise from measurement error.

Note also that we can only observe earnings where the individual plays. We cannot observe counterfactual earnings that the player would have if he played in another country. Hence, to compute average tax rates counterfactuals that the player would face in other countries, we need to make an assumption on counterfactual earnings. The simplest assumption is that counterfactual earnings are the same as actual earnings using PPP exchange rates across countries. This

assumption further introduces measurement error in our average tax rate measurement but our grouping strategy can eliminate this bias.

**Average Tax Rate Computations.** We have computed average tax rates using the OECD *Taxing Wages* simulators available online at <http://www.oecd.org/dataoecd/52/52/42629461.zip>. Those programs are only available for 2001 and after. We have used the publications OECD *Taxing Wages* for 1996-2000 to extend the simulators back to year 1996. Our average tax rate calculation includes the individual income tax both at the central and local level, payroll taxes, as well as the Value-Added-Tax as described above. We have also created alternative tax calculators to take into account all the special tax schemes for foreigners that we described above.

We assume in the average tax rate calculation that the player salary is his only source of income and that football players are single filers with no dependents.<sup>39</sup>

Table A1 reports the top marginal and average tax rates for domestic and foreign players in each country (averaged over the period 1996-2008) in columns (8)-(11). The top row displays the 14 country average (weighted by sample size). The average tax rate is slightly lower than the top marginal tax rate. The average tax rate differs by more than 10% of the top marginal tax rate in about 32% of cases with significant variation across countries depending on the progressivity of their tax structure and the level of football players salaries. Switzerland is the country with the largest discrepancy at it has a slowly progressive income tax schedule combined with low football salaries. In contrast, Italy has a very small gap between the average tax rate and the marginal tax rate as the top bracket is reached at a relatively low income level and football salaries are high.

## A.2 Performance Measures

**Club Level Performance.** Results from European competitions are used by UEFA to develop official rankings of all European clubs each year.<sup>40</sup> Our club data include results from all games played in European competitions since 1975, along with results from the National Leagues of the 14 countries in the data set. These data allow us to construct the so-called UEFA team and country coefficients that form the basis for UEFA's official rankings, along with alternative ranking measures based on different formulas. Our analysis below will be based on the following measure of club performance in a country: total points earned by all clubs in a given country and year in all European competitions, where total points are calculated according to UEFA's formula and gives 2 points for each win, 1 point for each draw, and bonus points for advancing

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<sup>39</sup>Most European income tax systems are individual based (instead of family based), so that the marital assumption does not affect the average tax rate in most countries.

<sup>40</sup>In the period we consider, there are three major European championships: the Champions League, the UEFA Cup, and the Cup Winners Cup.

to various tournament stages.<sup>41</sup> Using total points for ranking is different than using UEFA’s country coefficient, which is based on the average amount of points earned by clubs participating in the European competitions in a given year.<sup>42</sup> Our results, presented in Figure 1, Panel C, are very robust to using different ranking measures.

**Individual Quality Index.** The empirical estimation of section 5 uses an individual player quality index. The computation of this index requires the following three steps.

(i) For each club  $k$  in country  $n$  in year  $t$ , we compute a club quality measure ( $Q_{k,n,t}$ ) based on the ranking of the club in the national league of country  $n$  ( $league\_rank_{k,n,t}$ ) combined with a country coefficient measuring the international standing of the league ( $country\_coef_{n,t}$ ). As described above, the country coefficient is equal to the total number of points earned by all clubs in the country in a given year in all UEFA competitions. Club quality is then measured as

$$Q_{k,n,t} = \left[ \frac{\max_k(league\_rank_{k,n,t}) - league\_rank_{k,n,t} + 1}{\max_k(league\_rank_{k,n,t})} \right]^2 \times country\_coef_{n,t} \quad (4)$$

The term in brackets term runs from 1 for the best club to  $1/\max_k(league\_rank_{k,n,t})$  for the worst club in the league. We square this term to account for skewness in the distribution of club quality within countries. We have checked that our results are robust to a club-quality index that does not square the league ranking term.

(ii) We then assign to each player in year  $t$  a value  $V_t^i$  given by the average quality of all the clubs he has played for from the beginning of his professional career until year  $t - 1$ . Importantly, the quality index depends only on prior years performance (and not current or future years) so that it is not endogenous to current mobility decisions. For robustness, we also construct a measure of  $V_t^i$  equal to the average quality of the clubs he has played for during the three preceding seasons  $t - 3$ ,  $t - 2$ , and  $t - 1$ . We include club points only until year  $t - 1$  to avoid correlation between the quality index  $V_t^i$  of player  $i$  in year  $t$  and the migration choice of this player in year  $t$ . Notice also that averaging club quality over a career of course does not eradicate a correlation between our player quality index and age, because players tend to advance to better clubs over the career path. This is the reason why we always control directly for age and experience in our regressions.

(iii) We finally rank all players in year  $t$  according to  $V_t^i$ , and assign to each player his quantile position in the distribution of  $V_t^i$ . As mentioned earlier, we have data on player salaries for a large subset of players. Hence, we can check the correlation between our ability index and actual salaries. Even without controlling for the other quality measures (age, experience, and

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<sup>41</sup>Points earned in qualification stages are weighted by 0.5. This weighting scheme has been used by UEFA only since 1999. For comparability of performance over time, we use this weighting throughout the period.

<sup>42</sup>The UEFA country coefficient is conceptually problematic, because successful leagues get more teams into the European competitions. Thus, the UEFA measure effectively compares top teams in weak leagues to upper-middle and top teams in strong leagues, which biases down performance differences across countries.

national team selection), our quality index is strongly positively correlated with player salaries, suggesting that we measure player ability quite well.

### A.3 Additional Reduced Form Empirical Evidence

**Rigid Labor Demand: Team Size and League Size.** Figure A4 provides some descriptive cross-country evidence on whether labor demand in the football market is flexible or rigid. Panel A plots the average number of players per team against the top earnings tax rate across different countries. The left-hand-side panel is for the pre-Bosman period while the right-hand-side panel is for the post-Bosman period. The figure shows that team size does vary across countries (from about 25 to 40 players across the entire sample). Team size is uncorrelated with tax rates in the pre-Bosman period. It is weakly negatively correlated with tax rates in post-Bosman period but the coefficient is not significant. A caveat is that this result is strongly affected by England, where the number of players per team is much higher than elsewhere and taxes are relatively low. If we exclude England, the variation is between 25 and 35 players and is no longer correlated with tax rates. Panel B plots the average number of teams per league in each country against the tax rate. There is considerable variation, which is also weakly negatively correlated with tax rates in post-Bosman period. However, the variation is also strongly correlated with country size, with large countries having more teams than small countries. The number of teams does not vary much for any given country over time.

Overall, this evidence is mixed: there is clearly some flexibility in demand, mainly because the number of players per club can vary, but this variation is not very large and therefore demand rigidities may be important. That is why in section 3, we first set out a classical baseline model with flexible demand, and then we extended the analysis to account for rigid demand.

Importantly, because our empirical analysis focuses on the effect of taxation on migration, and does not explicitly incorporate salary levels, the goal of the theoretical models is to link tax rates and migration rather than providing a realistic theory of salary determination. Therefore, our models adopt a very simple and admittedly unrealistic wage determination process. The models can be generalized to a more complex wage determination process, although this would come at the cost of complicating the theoretical exposition. We discuss the implications of different generalizations of the theory in section 3.3, and the empirical specifications in section 5 are robust to such generalizations. In particular, the empirical analysis includes rich non-parametric controls for unobserved wage variation that allow for a very general wage determination process. A more elaborate theory of the effects of taxes on wages along with an empirical estimation using actual wage data is left for future work.<sup>43</sup>

**Displacement Effects Following the Spanish Beckham Law.** Figure A5 analyzes whether tax-induced migration of foreign players leads to displacement of domestic players. The figure

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<sup>43</sup>Ross and Dunn (2007) propose a useful first step in this direction in the case of the US baseball players, where individual earnings data are available, using tax rate variation across states.

shows the evolution over time in the total number of foreign and domestic players in the Spanish league. There are three points to note about this figure. First, in the years leading up to the Beckham Law, the number of domestic players is increasing while the number of foreigners is falling. Then around the time of the Beckham Law, the two series break: the number of foreign players starts to increase and the number of domestic players starts to fall. These observations suggest that there is scheme-induced displacement of domestic players by foreign players. Second, the fall in domestic players after the Beckham law is larger than the increase in foreign players, which would seem to suggest that not all of the effect can be driven by scheme-induced displacement. However, it is important to keep in mind that our dataset includes only players from 14 European countries. The Beckham scheme may have attracted players from all over the world, and in particular the Spanish league tend to attract many top players from South-America. Hence, the relatively large drop in domestic players could have been driven entirely by tax-induced displacement. Third, across the entire period since the mid-1980s, there is a negative covariance between the number of domestic and foreign players, with the number of domestic players over-adjusting somewhat as discussed above. This suggests that labor demand may be quite rigid in the football sector.

**Duration of Stay of Foreign Players in Denmark.** Figure A6 provides evidence on the effects of the tax scheme on duration of stay in Denmark, using again a synthetic control country. Recall that the Danish tax scheme for foreigners applies only for first three years (36 months), after which the foreigner is subject to regular Danish taxes. The figure shows the density distribution of duration among foreign players arriving between the 1992 and 2002 seasons in Denmark and the synthetic control. Two points are worth noting. First and most important, the graph shows that there is excess of duration at three years in Denmark (relative to the synthetic control), evidence of a behavioral response to the preferential tax scheme along the intensive margin. Second, fewer foreign players stay in Denmark (relative to the synthetic control) beyond year 3 when the preferential tax treatment ceases to apply.<sup>44</sup> As shown on the figure, the difference between Denmark and other the synthetic country in the probability in staying more than three years is significant.

**Greek Reform in 1993: A Cohort-Based Tax Change.** A cohort-based reform of the payroll tax system in Greece allows us to analyze the mobility of Greek players.<sup>45</sup> Payroll taxes are high in Greece. In the 1990s the combined payroll tax wedge including both employer and employee payroll was about 22.5% of labor costs for football players<sup>46</sup> (labor costs are earnings

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<sup>44</sup>Those intensive duration responses to the tax scheme are confirmed by Kleven et al. (2011), Figures 11-12, for the full population of foreigners in Denmark. There is a clear bunching spike in the density of durations exactly at 36 months among eligible foreigners (relative to a control of foreigners slightly below the eligibility threshold).

<sup>45</sup>This reform has been analyzed by Saez, Matsaganis, and Tsakloglou (2012) for the full Greek population.

<sup>46</sup>The combined payroll tax wedge including both employer and employee payroll tax has been about 35% for regular workers, and for football players since 1999. Before 1999, football players were only covered for pension

inclusive of both employer and employee payroll taxes). Before 1993, these payroll taxes applied only up to a cap and therefore did not affect the top earnings tax rate. In late 1992, Greece passed a reform removing the cap on payroll taxes, but only for workers entering the system (i.e., starting to have covered earnings) after January 1, 1993. There were no changes for workers already in the system.<sup>47</sup> As a result, cohorts of Greek football players who started their career before 1993 face much lower top earnings tax rates than the cohorts that entered on or shortly after 1993 (as those players faced uncapped payroll taxes during most of their careers). When analyzing this reform, it is important to keep in mind that the performance of a typical football player peaks at an age from the mid-20s to about 30 (5-10 years into a typical professional career), and this is the time when players are most likely to get attractive offers from abroad.

Figure A7 depicts, by entry date on the professional football market from 1981 to 2000, the probability that the football player will ever play abroad by the eighth year of his professional football career. The graph depicts such series for Greek players and all 13 other nationalities in our sample separately. Each dot combines two annual cohorts to smooth out noise.

For players entering the labor market before 1993, the trends in Greece versus other countries are very parallel—both are flat, and the fraction of players ever playing abroad is almost exactly the same in Greece as in the rest of Europe (roughly 10%). In the Greek series however, there is a clear jump upward exactly after the reform kicks in for cohorts entering the profession on or after January 1st, 1993. The fraction ever playing abroad almost doubles immediately. The divergence between Greece and other countries grows even further in subsequent years. For 1999-2000 cohorts, 33% of Greek players will play abroad while only 15% of players from other countries will. The basic Difference-in-Differences estimate comparing Greece to other countries before and after the reform generates a 10 percentage point estimate, which translates into a .44 elasticity of the probability of ever playing abroad with respect to the net of tax rate, that is highly significant. Therefore, this evidence suggests that the top earnings tax rate within a country has a significant and negative impact on the migration of domestic football players.

Note also that in principle, the cohort based reform in Greece should have discouraged foreigners to start playing in Greece from years 1993 to 2003 (relative to 1992 and before). Unfortunately, the number of foreign players in Greece in the early 1990s is too small to detect a significant drop after 1992.

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purposes and not for sickness and unemployment, hence a lower wedge of 22.5%.

<sup>47</sup>In 2004, the cap was re-introduced for all workers having entered the system since January 1993. The new cap for the post-1993 entrants was set at a level 2.3 times higher than the cap for pre-1993 entrants, but even the higher cap is small compared to the income levels at the top of the distribution and therefore does not affect the top earnings tax rate of first-league football players.

## A.4 Tax Revenue Maximizing Laffer Rates and Policy Implications

### A.4.1 Theoretical Revenue Maximizing Tax Rates

#### Flexible Labor Demand.

In the flexible labor demand model, we obtain the following revenue-maximizing tax rates (Laffer rates) on domestic and foreign football players given by the standard inverse elasticity rule.

**Proposition 3 (Laffer Rates)** (a) For a uniform tax system ( $\tau_{nd} = \tau_{nf} = \tau_n$ ), the Laffer rate  $\tau_n^*$  is given by

$$\tau_n^* = \frac{1}{1 + \varepsilon_n}, \quad (5)$$

where  $\varepsilon_n$  is the ability-weighted average elasticity of the total number of players in country  $n$  with respect to  $1 - \tau_n$ .

(b) For a selective tax system ( $\tau_{nd}, \tau_{nf}$ ), the Laffer rates ( $\tau_{nd}^*, \tau_{nf}^*$ ) are given by

$$\tau_{nd}^* = \frac{1}{1 + \varepsilon_{nd}}, \quad \tau_{nf}^* = \frac{1}{1 + \varepsilon_{nf}}, \quad (6)$$

where  $\varepsilon_{nd}$  (resp.  $\varepsilon_{nf}$ ) is the ability-weighted average elasticity of the total number domestic (resp. foreign) players in country  $n$  with respect to  $1 - \tau_{nd}$  (resp.  $1 - \tau_{nf}$ ).

#### Proof:

(a) Total revenue is given by

$$R_n = \tau_n \int_0^\infty ap_{na} da,$$

where  $p_{na} = p_{na}(a(1 - \tau_n)) \equiv p_{nda}(a(1 - \tau_n)) + p_{nfa}(a(1 - \tau_n))$ . The Laffer rate  $\tau_n^*$  satisfies

$$\frac{dR_n}{d\tau_n} = \int_0^\infty ap_{na} da - \frac{\tau_n^*}{1 - \tau_n^*} \int_0^\infty ap_{na} \varepsilon_{na} da = 0,$$

where  $\varepsilon_{na} \equiv \frac{\partial p_{na}}{\partial(1 - \tau_n)} \frac{1 - \tau_n}{p_{na}}$ . Hence,

$$\frac{\tau_n^*}{1 - \tau_n^*} = \frac{1}{\varepsilon_n},$$

where  $\varepsilon_n \equiv \frac{\int_0^\infty ap_{na} \varepsilon_{na} da}{\int_0^\infty ap_{na} da}$ . This corresponds to eq. (5).

(b) Total revenue is given by

$$R_n = \tau_{nd} \int_0^\infty ap_{nda} da + \tau_{nf} \int_0^\infty ap_{nfa} da,$$

where  $p_{nda} = p_{nda}(a(1 - \tau_{nd}))$  and  $p_{nfa} = p_{nfa}(a(1 - \tau_{nf}))$ . For the Laffer rate  $\tau_{nd}^*$ , we get

$$\frac{dR_n}{d\tau_{nd}} = \int_0^\infty ap_{nda} da - \frac{\tau_{nd}^*}{1 - \tau_{nd}^*} \int_0^\infty ap_{nda} \varepsilon_{nda} da = 0,$$

where  $\varepsilon_{nda} \equiv \frac{\partial p_{nda}}{\partial(1-\tau_{nd})} \frac{1-\tau_{nd}}{p_{nda}}$ . Hence,

$$\frac{\tau_{nd}^*}{1-\tau_{nd}^*} = \frac{1}{\varepsilon_{nd}},$$

where  $\varepsilon_{nd} \equiv \frac{\int_0^\infty ap_{nda}\varepsilon_{nda}da}{\int_0^\infty ap_{nda}da}$ . This corresponds to the first part of eq. (6). The proof for  $\tau_{nf}^*$  follows symmetrically.  $\square$

### Rigid Labor Demand.

We now turn to the tax revenue maximizing Laffer rates in the rigid-demand model. We obtain the following results:

**Proposition 4 (Laffer Rates)** *Assuming that the tax rate on club surplus  $s_n$  equals the (average) tax rate on player salaries (so that there are no mechanical revenue effects of a change in  $s_n$ ). In this case,*

(a) *For a uniform tax system ( $\tau_{nd} = \tau_{nf} = \tau_n$ ), the Laffer rate  $\tau_n^*$  is given by*

$$\tau_n^* = \frac{1}{1 + \varepsilon_n}, \quad (7)$$

where  $\varepsilon_n$  is the ability-weighted average elasticity in general equilibrium of the total number of players in country  $n$  with respect to  $1 - \tau_n$ .

(b) *For a selective tax system ( $\tau_{nd}, \tau_{nf}$ ), the Laffer rate on foreigners  $\tau_{nf}^*$  given the tax rate on locals  $\tau_{nd}$  is given by*

$$\tau_{nf}^* = \frac{1}{1 + \varepsilon_{nf}} \left\{ 1 - \tau_{nd} \sigma_{nd} \left( \frac{z_{nd}}{z_{nf}} \right) \right\}, \quad (8)$$

where  $\varepsilon_{nf} \geq 0$  (resp.  $\sigma_{nd} \leq 0$ ) is the ability-weighted average elasticity in general equilibrium of the number of foreign (resp. domestic) players in country  $n$  with respect to  $1 - \tau_{nf}$ , and  $z_{nd}, z_{nf}$  denote total value-added from domestic and foreign players respectively. The Laffer rate on locals  $\tau_{nd}^*$  at a given tax rate on foreigners  $\tau_{nf}$  is given by a symmetric condition. The two conditions together describe a fully optimized tax system  $(\tau_{nd}^*, \tau_{nf}^*)$ .

### Proof:

(a) Given the presence of positive club surpluses, we have to make an assumption about the taxation of these surpluses. We assume that club surplus is taxed at the same rate as player earnings, so that the division of value added into club surplus  $s_n$  and player earnings  $a - s_n$  has no mechanical impact on government revenue (note though that changes in  $s_n$  does have a behavioral revenue effect from changed migration). Under this simplifying assumption, total tax revenue collected from the football sector is given by

$$R_n = \tau_n \int_{s_n}^\infty ap_{na}da,$$

where  $p_{na} = p_{na}(1 - \tau_n) = p_{nda}(1 - \tau_n) + p_{nfa}(1 - \tau_n)$ . We work with general equilibrium relationships, which is why  $s_n$  does not appear as an argument in  $p_{na}(\cdot)$ . The Laffer rate  $\tau_n^*$  satisfies

$$\frac{dR_n}{d\tau_n} = \int_{s_n}^{\infty} ap_{na}da - \frac{\tau_n^*}{1 - \tau_n^*} \int_{s_n}^{\infty} ap_{na}\varepsilon_{na}da = 0,$$

where  $\varepsilon_{na} \equiv \frac{\partial p_{na}}{\partial(1-\tau_n)} \frac{1-\tau_n}{p_{na}}$ . Hence,

$$\frac{\tau_n^*}{1 - \tau_n^*} = \frac{1}{\varepsilon_n},$$

where  $\varepsilon_n \equiv \frac{\int_{s_n}^{\infty} ap_{na}\varepsilon_{na}da}{\int_{s_n}^{\infty} ap_{na}da}$ . This corresponds to eq. (7).

(b) As above, we eliminate mechanical revenue effects of changes in  $s_n$  by assuming that the tax rate on club surplus corresponds to the (average) tax rate on earnings. For the case of a selective tax system  $(\tau_{nd}, \tau_{nf})$  and denoting the tax rate on club surplus by  $t_n$ , we assume  $t_n = \tau_{nd} \cdot p_{nd} + \tau_{nf} \cdot p_{nf}$ . Under this simplifying assumption, total tax revenue collected from the football sector can be written as

$$R_n = \tau_{nd} \int_{s_n}^{\infty} ap_{nda}da + \tau_{nf} \int_{s_n}^{\infty} ap_{nfa}da,$$

where  $p_{nda} = p_{nda}(1 - \tau_{nd}, 1 - \tau_{nf})$  and  $p_{nfa} = p_{nfa}(1 - \tau_{nd}, 1 - \tau_{nf})$ . Consider the Laffer rate on foreigners  $\tau_{nf}^*$  given the tax rate on locals  $\tau_{nd}$ . We can write the first-order condition as

$$\int_{s_n}^{\infty} ap_{nfa}da - \frac{\tau_{nf}^*}{1 - \tau_{nf}^*} \int_{s_n}^{\infty} ap_{nfa}\varepsilon_{nfa}da - \frac{\tau_{nd}}{1 - \tau_{nf}^*} \int_{s_n}^{\infty} ap_{nda}\sigma_{nda}da = 0,$$

where  $\varepsilon_{nfa} \equiv \frac{\partial p_{nfa}}{\partial(1-\tau_{nf})} \frac{1-\tau_{nf}}{p_{nfa}} \geq 0$  and  $\sigma_{nda} \equiv \frac{\partial p_{nda}}{\partial(1-\tau_{nf})} \frac{1-\tau_{nf}}{p_{nda}} \leq 0$ . Defining ability-weighted average elasticities

$$\varepsilon_{nf} \equiv \frac{\int_{s_n}^{\infty} ap_{nfa}\varepsilon_{nfa}da}{\int_{s_n}^{\infty} ap_{nfa}da}, \quad \sigma_{nd} \equiv \frac{\int_{s_n}^{\infty} ap_{nda}\sigma_{nda}da}{\int_{s_n}^{\infty} ap_{nda}da},$$

as well as total value-added generated by domestic and foreign players

$$z_{nd} \equiv \int_{s_n}^{\infty} ap_{nda}da, \quad z_{nf} \equiv \int_{s_n}^{\infty} ap_{nfa}da,$$

we obtain the following expression

$$1 - \frac{\tau_{nf}^*}{1 - \tau_{nf}^*} \varepsilon_{nf} - \frac{\tau_{nd}}{1 - \tau_{nf}^*} \frac{z_{nd}}{z_{nf}} \sigma_{nd} = 0,$$

which can be rewritten to

$$\tau_{nf}^* = \frac{1}{1 + \varepsilon_{nf}} \left\{ 1 - \tau_{nd} \sigma_{nd} \left( \frac{z_{nd}}{z_{nf}} \right) \right\},$$

as in eq. (8). The proof for  $\tau_{nd}^*$  follows symmetrically.  $\square$

Consider first the uniform tax system in part (a). This result is relevant for countries introducing special schemes for all football players, not distinguishing between domestic and

foreign tax residency status. For a uniform tax system, the Laffer rate is given by the same formula under rigid and flexible demand, but with the important qualification that the result in eq. (7) is based on a general equilibrium elasticity. This general equilibrium elasticity is different from the partial equilibrium elasticity because of general equilibrium effects due to changing club surplus under rigid demand.

Consider then a selective tax system in part (b), in particular the Laffer rate on foreigners in eq. (8) taking as given the tax rate on domestic residents. This result is relevant for countries such as Spain, Denmark and Belgium, which have introduced preferential tax schemes to foreign residents (specifically foreign footballers in the Belgian case) without changing the taxation of domestic residents. The terms outside the brackets in eq. (8) correspond to the result for the flexible-demand model (except that elasticities includes general equilibrium effects), while the bracketed term is a new effect that captures displacement of local players. As  $\sigma_{nd} \leq 0$ , the bracketed term is always larger than 1 and therefore this effect raises the Laffer rate on foreigners. For example, if country  $n$  attracts more foreign players by lowering their tax rate, this will displace some domestic players and thereby reduce revenue collected from domestic residents. For a given  $\sigma_{nd}$ , the displacement effect is larger in countries where the domestic tax rate is large and where the value-added share of foreigners is relatively low. This captures roughly the situation in a country such as Denmark. Hence, despite the large migration into Denmark documented graphically in section 4, the special tax scheme for foreigners is not necessarily revenue raising. Finally, we may combine eq. (8) with the symmetric equation for  $\tau_{nd}^*$  to get two simultaneous equations determining separate Laffer rates on foreign and domestic football players. This type of result would be relevant for countries combining a separate tax treatment for football players (regardless of nationality) with a Spain/Denmark/Belgium-style policy (separate tax treatment for foreign vs. domestic residents), but we are not aware of any country currently implementing such a policy.

#### A.4.2 Calibration

Next, we calibrate revenue-maximizing tax rates (Laffer rates) based on our estimated location elasticities and the theoretical framework presented above. Laffer rates are central to the policy implications of our study because they represent an upper bound on the optimal tax rates on football players, and corresponds to the actual optimum if policy makers puts a zero weight on the marginal consumption of (top) football players. Results are shown in Table A3 for all 14 countries in our sample. Columns (1)-(2) display the actual top earnings tax rates in 2008 on domestic and foreign players, respectively. Column (3) considers the flexible demand model and shows Laffer rates under uniform tax treatment of domestic and foreign players. These results are based on the empirical specification in column (2) of Table 2 and the theoretical result in Proposition 3, equation (5). Columns (4)-(5) turns to the rigid-demand model, and show Laffer rates on all players (uniform taxation) and on foreign players only (selective taxation) taking as

given the tax rate on domestic players. These results are based on the empirical specification in column (5) of Table 3 and the theoretical results in Proposition 4, equations (7)-(8).

There are three main findings in the table. First, in the baseline model with flexible demand where the location elasticity is around 0.2 on the whole sample (a weighted average of a domestic elasticity of around .1 and a foreign elasticity of 1 with 90% domestic weight), the Laffer rate on all players falls in the interval 70-90% across all countries. This is higher than the current top earnings tax rates on both domestic and foreign players in every country. Second, in the rigid-demand model, the Laffer rate on all players is higher than in the baseline and falls in the interval of 84-98% across all countries. This is driven by ability sorting: any in-migration of high-ability players comes with an offsetting out-migration of low-ability players, which reduces the ability-weighted average location elasticity in the rigid-demand setting compared to the baseline. But even under completely rigid demand, the total revenue effect of these offsetting migration responses is not zero as the in-migration and out-migration occur at different ability levels, and therefore Laffer rates are always below one. Third, the selective Laffer rate on foreign players tends to be lower than the uniform Laffer rate (sometimes significantly so).

The difference between the uniform Laffer rate and the foreigner Laffer rate reflects a tension between ability sorting and displacement effects. On the one hand, lowering the tax rate on foreign players leads to displacement of domestic players, which raises the Laffer rate *ceteris paribus*. On the other hand, the ability-weighted elasticity for foreigners is higher than for the whole population for two reasons. First, foreign players tend to be of higher ability than domestic players in any country, and so the positive sorting effect at the top has much more force for foreign players. Second, the stock of foreigners is much lower than the stock of locals in any country (due to home bias), and therefore a given estimated parameter on the net-of-tax rate converts into a larger elasticity for foreigners. For those two reasons, the ability-weighted location elasticity for foreigners is typically much higher than for the whole population, and this effect dominates the displacement effect in most countries and makes Laffer rates lower. This explains why the foreigner Laffer rate is particularly low in countries such as England, Germany, Italy and Spain. These are countries with an ability distribution among foreigners that is strongly skewed towards the top, and therefore the positive sorting effect at the top has a large effect in those countries.

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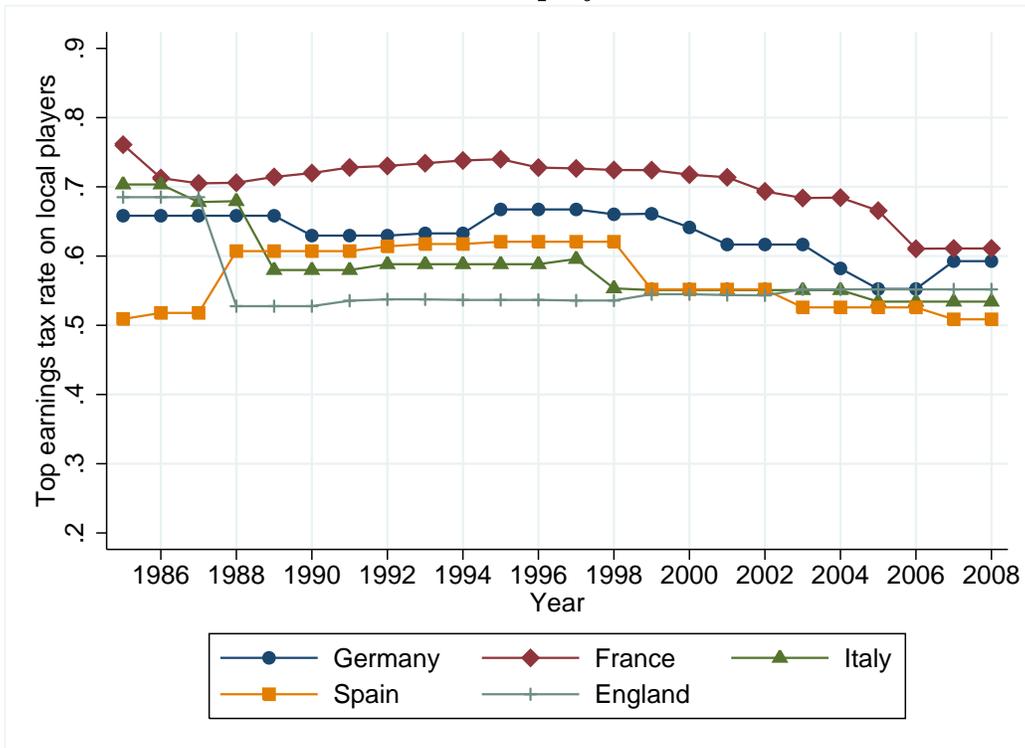
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### A. Local players



### B. Foreign players

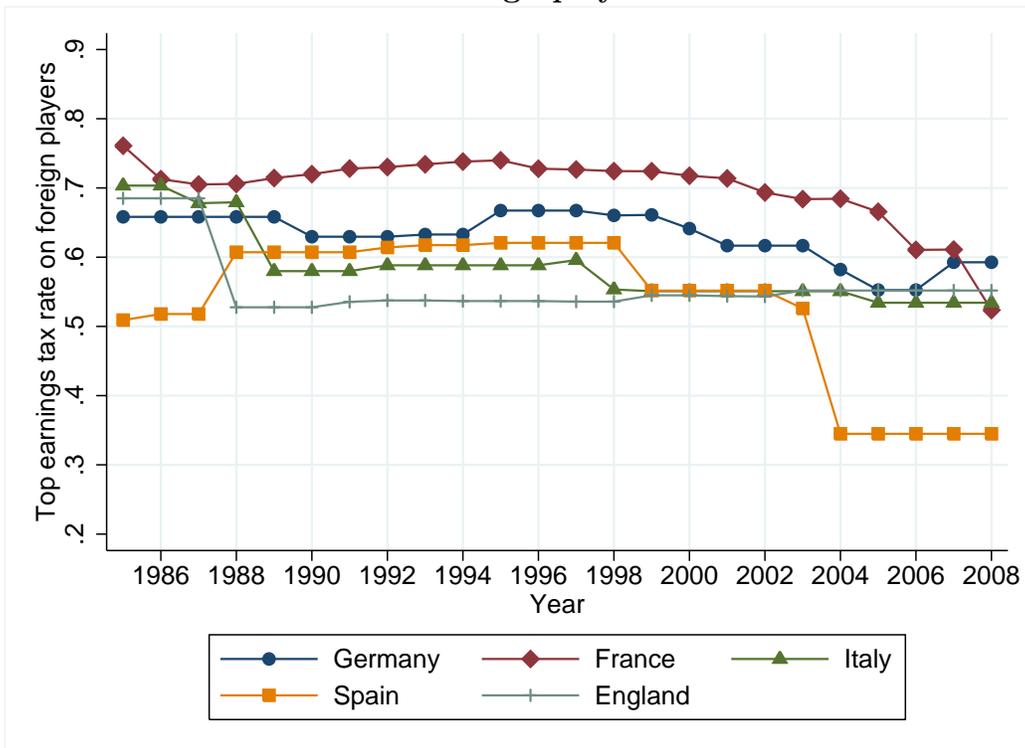
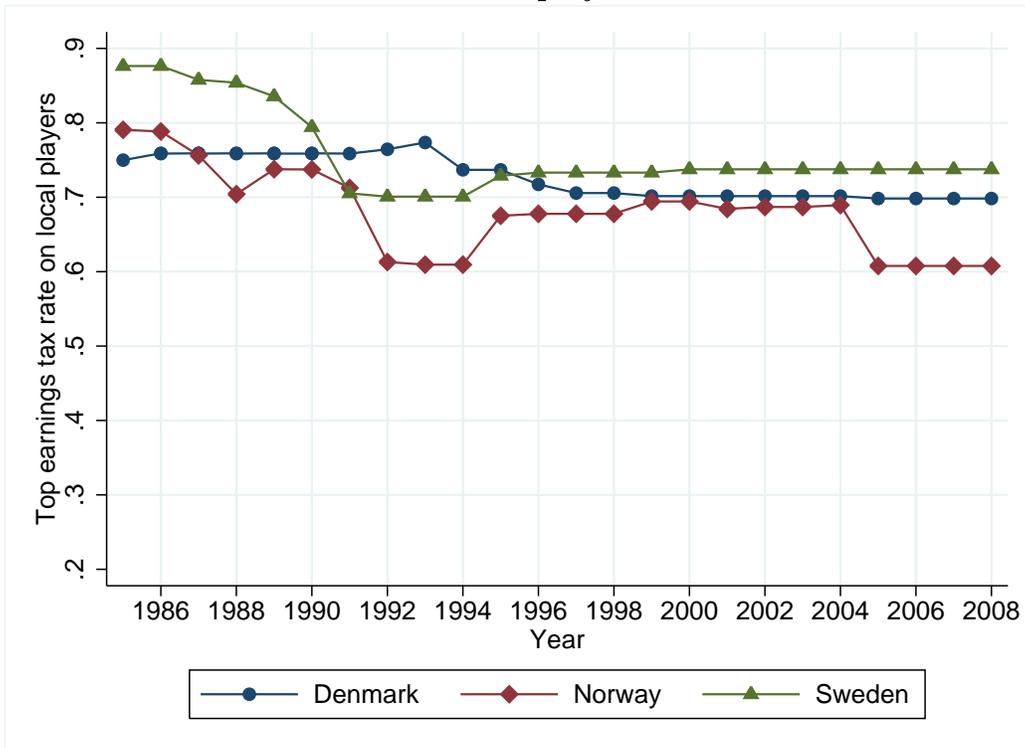


Figure A1: TOP EARNINGS TAX RATES IN THE TOP 5 EUROPEAN LEAGUES

NOTES: Statutory top earnings tax rates on earned income of year  $t$  for a player entering the football market on year  $t$ . Top tax rates include central and local individual income taxes, all uncapped payroll taxes (both employer and employee contributions), and the Value Added Tax (normal rate). When preferential tax regimes apply for foreign players, the statutory rate is the rate for a foreigner who is eligible for the preferential tax treatment.

### A. Local players



### B. Foreign players

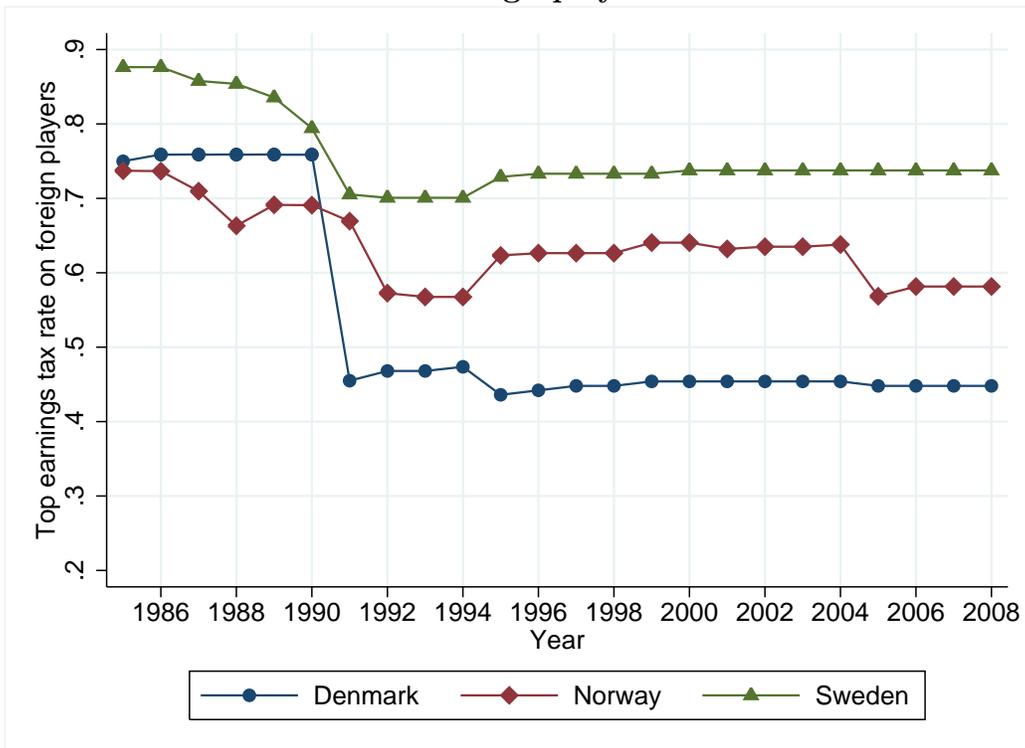
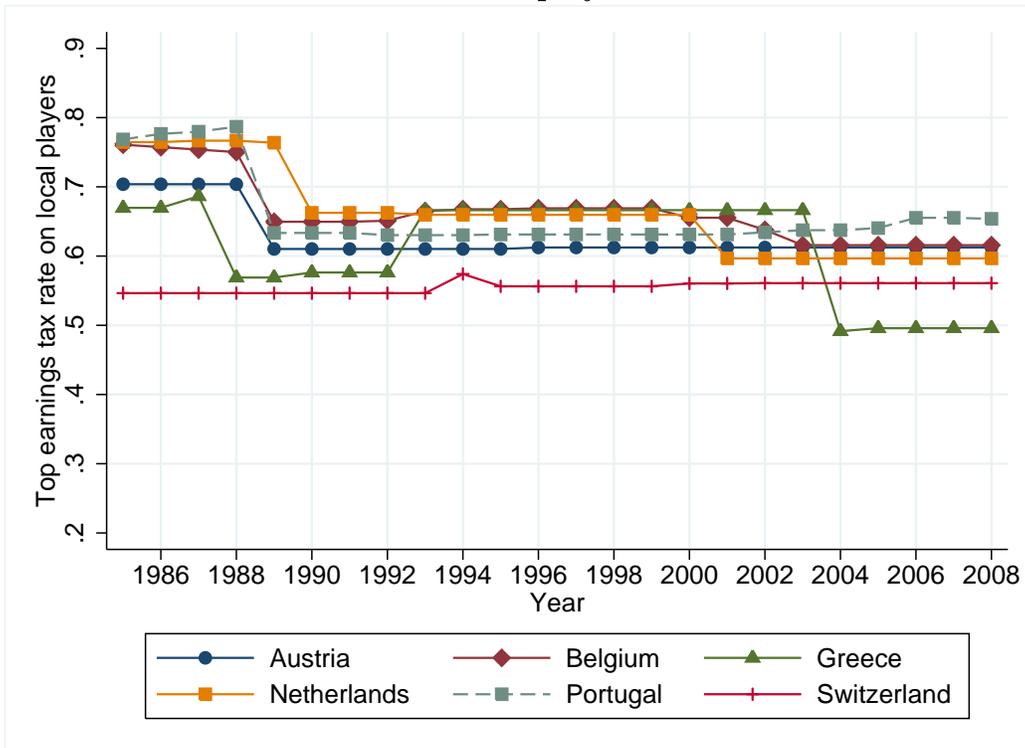


Figure A2: TOP EARNINGS TAX RATES IN NORDIC COUNTRIES

NOTES: Statutory top earnings tax rates on earned income of year  $t$  for a player entering the football market on year  $t$ . Top tax rates include central and local individual income taxes, all uncapped payroll taxes (both employer and employee contributions), and the Value Added Tax (normal rate). When preferential tax regimes apply for foreign players, the statutory rate is the rate for a foreigner who is eligible for the preferential tax treatment.

### A. Local players



### B. Foreign players

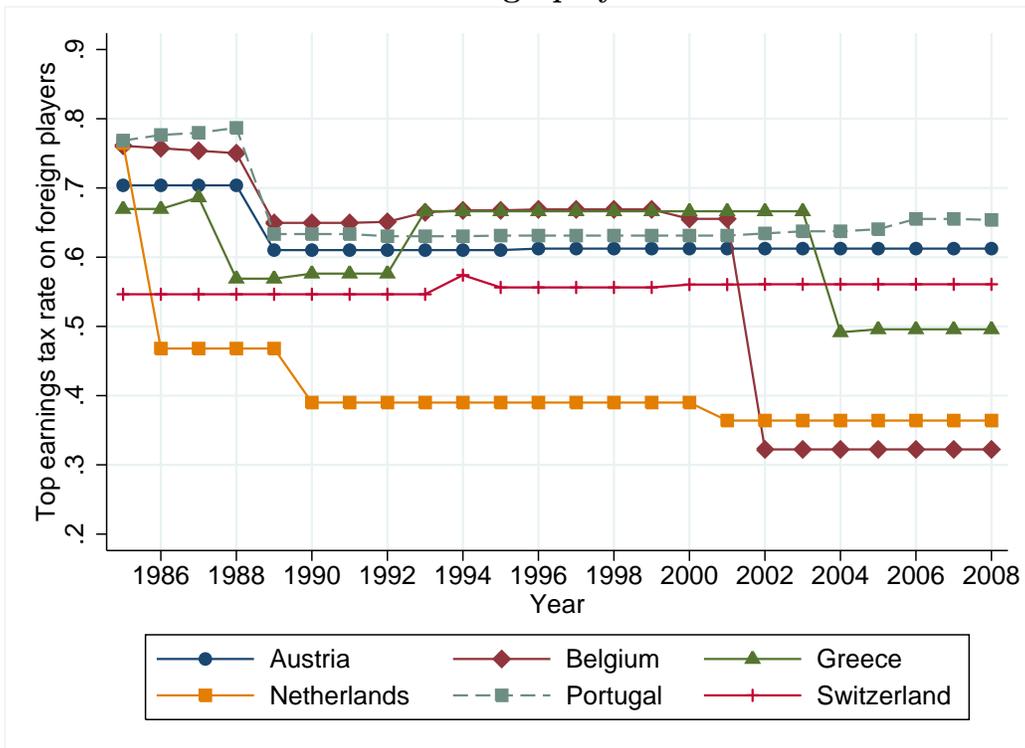


Figure A3: TOP EARNINGS TAX RATES IN THE SMALLER EUROPEAN LEAGUES

NOTES: Statutory top earnings tax rates on earned income of year  $t$  for a player entering the football market on year  $t$ . Top tax rates include central and local individual income taxes, all uncapped payroll taxes (both employer and employee contributions), and the Value Added Tax (normal rate). When preferential tax regimes apply for foreign players, the statutory rate is the rate for a foreigner who is eligible for the preferential tax treatment.



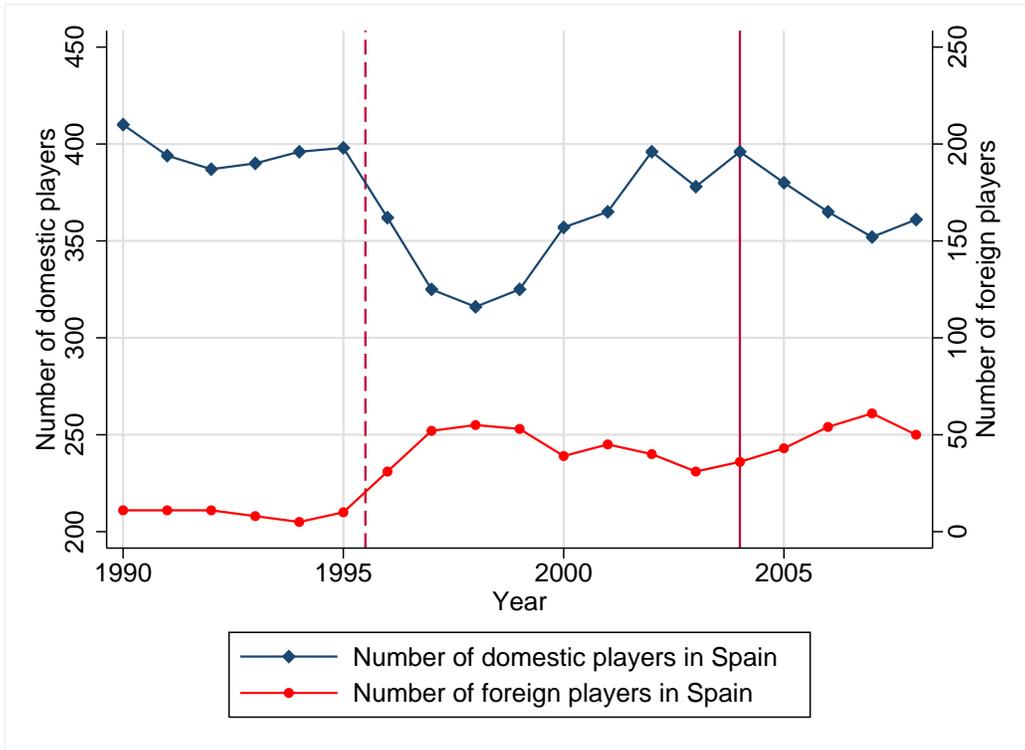


Figure A5: DISPLACEMENT EFFECTS OF THE BECKHAM LAW IN SPAIN

NOTES: The dataset is restricted to all players from our 14 countries of interest. A 2005 tax reform (“Beckham law”), depicted by a vertical line, introduced a preferential tax treatment for foreign players in Spain arriving in 2004 or after. The Bosman ruling is also depicted by a vertical dashed line. Year  $t$  is for season running from September year  $t$  to July year  $t + 1$ . The graph displays the total number of local players who play in the first league of Spain and also the total number of foreign players (from the 14 European countries of interest) playing in the first league in Spain. Consistent with the existence of labor demand rigidity creating displacement effects, the total number of Spanish players decreases after the Bosman ruling, and then after the introduction of the Beckham Law in 2004, while the total number of foreign player increases. The Bosman Ruling and the Beckham Law have attracted foreign players who have partially crowded-out local players. In 1995 and 1996, the Spanish League had 22 teams instead of the traditional 20 teams. To control for this variation in the size of the League, we removed from the sample the 2 lowest ranked teams in Spain in 1995 and 1996, that would not have been part of the League had the number of teams remained the same.

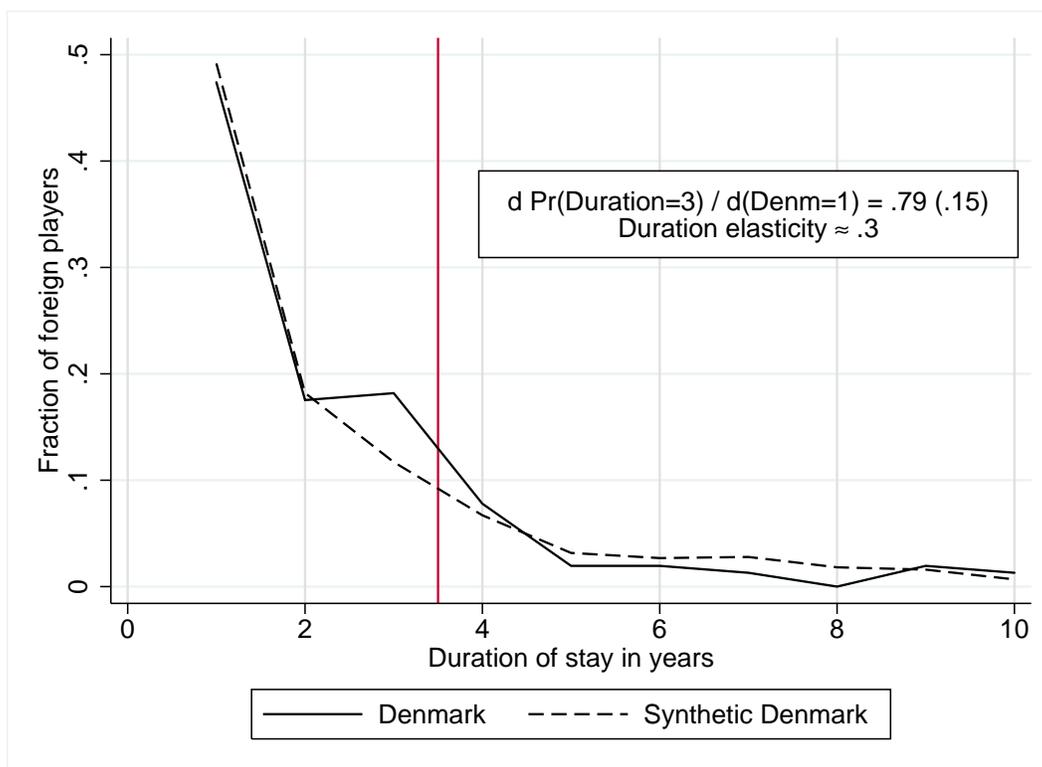


Figure A6: DURATION OF STAY IN DENMARK

NOTES: The 1991 Danish tax reform introduced a preferential flat tax scheme for highly-paid foreign workers in Denmark. Foreign workers are eligible for the scheme for a maximum duration of three years, after which the tax rate jumps back to the regular progressive Danish tax schedule. The graph depicts the density of durations of stay of foreign players in Denmark (resp. the synthetic control country) for foreign players starting to play in Denmark (resp. the synthetic control country) in 1992 to 2002. The synthetic country weights are constructed to match Denmark on pre-reform 1985-1990 variables (see text for details and appendix Table A2 for the composition of the synthetic country). The maximum 3 year duration of eligibility is depicted by the vertical line. The graph shows that there is excess of duration at three years in Denmark, evidence of a behavioral response to the preferential tax scheme along the intensive duration margin.

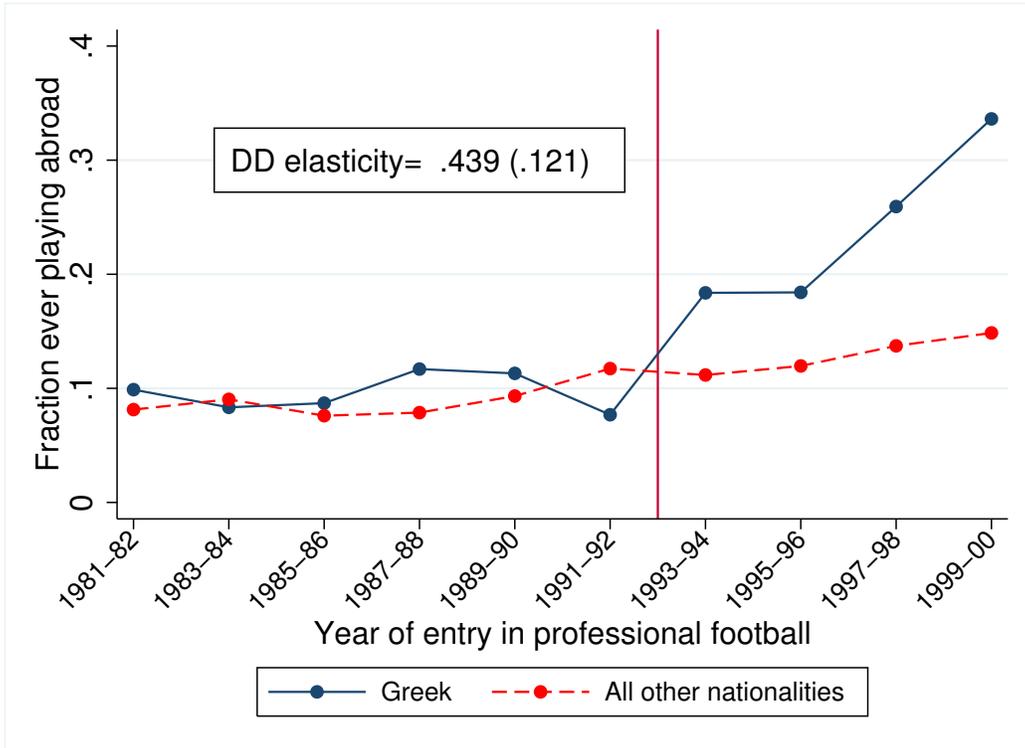


Figure A7: FRACTION OF GREEK PLAYERS EVER PLAYING ABROAD BY COHORT

NOTES: The graph displays the fraction of top league players who are Greek nationals playing abroad by eighth year of professional career. As a control, it also displays the fraction of top leagues players who are nationals from the other 13 nationalities of our sample playing abroad by eighth year of professional career. In Greece, cohorts entering the professional football market before 1993 face lower top earnings tax rates because of an earnings cap on the payroll tax base. Cohorts entering the professional football market after 1993 face a much higher top earnings tax rates because the payroll tax cap was removed from 1993 to 2003 for all workers starting their career on or after 1993 (in 2004, a cap was re-introduced so that cohorts entering the labor market at the beginning of the 2000s face again lower top earnings tax rates at earlier stages of their career). The discontinuity of 1993 in top tax rates is depicted by a vertical line. The DD elasticity estimate is reported comparing 1981-1992 cohorts to 1993-2000 cohorts.

Table A1: DESCRIPTIVE STATISTICS, ESTIMATION SAMPLE

|               | N     | Foreigner (%) | Age  | Experience (years) | Quality index | Earnings (2008 £) | % with observed earnings | Top MTR           |                    | Average tax rate |                 | Fraction with $\frac{\tau-t}{\tau} > .1$ |
|---------------|-------|---------------|------|--------------------|---------------|-------------------|--------------------------|-------------------|--------------------|------------------|-----------------|--|
|               | (1)   | (2)           | (3)  | (4)                | (5)           | (6)               | (7)                      | $\tau_{domestic}$ | $\tau_{foreigner}$ | $t_{domestic}$   | $t_{foreigner}$ | (12)                                     |
| All countries | 55225 | .11           | 25   | 6.1                | .25           | 211,341           | .54                      | .62               | .58                | .56              | .54             | .32                                      |
| Austria       | 2125  | .11           | 25   | 5.8                | .13           | 140,346           | .5                       | .61               | .62                | .59              | .61             | .12                                      |
| Belgium       | 3845  | .13           | 24.4 | 5.8                | .14           | 162,319           | .61                      | .64               | .49                | .55              | .45             | .48                                      |
| Denmark       | 3473  | .05           | 24.6 | 5.1                | .11           | 143,310           | .57                      | .69               | .52                | .6               | .5              | .53                                      |
| England       | 6610  | .18           | 24.1 | 5.8                | .41           | 370,450           | .56                      | .55               | .56                | .49              | .52             | .39                                      |
| France        | 4212  | .07           | 24.8 | 6.8                | .36           | 234,645           | .68                      | .69               | .68                | .66              | .66             | .04                                      |
| Germany       | 4319  | .17           | 27.1 | 7.3                | .42           | 328,288           | .63                      | .62               | .62                | .53              | .55             | .32                                      |
| Greece        | 3311  | .09           | 25.5 | 5.5                | .15           | 149,400           | .44                      | .57               | .57                | .54              | .55             | .19                                      |
| Italy         | 5359  | .09           | 25.4 | 7.7                | .49           | 347,652           | .69                      | .55               | .55                | .55              | .55             | 0  |
| Netherlands   | 4845  | .15           | 24.5 | 5.5                | .24           | 222,981           | .54                      | .62               | .52                | .6               | .52             | .1                                       |
| Norway        | 3938  | .07           | 25.2 | 5.6                | .11           | 144,796           | .53                      | .66               | .61                | .56              | .55             | .66                                      |
| Portugal      | 2926  | .09           | 25.5 | 6.5                | .2            | 159,530           | .37                      | .64               | .64                | .61              | .61             | .21                                      |
| Spain         | 4951  | .1            | 25.7 | 6.8                | .57           | 316,012           | .43                      | .55               | .51                | .51              | .47             | .3                                       |
| Sweden        | 3182  | .05           | 24.6 | 5.6                | .1            | 149,988           | .63                      | .74               | .71                | .69              | .68             | .22                                      |
| Switzerland   | 2129  | .18           | 24.1 | 5.9                | .03           | 89,060            | .43                      | .56               | .56                | .39              | .4              | .84                                      |

NOTES: This table reports summary statistics for our multinomial regression sample covering years 1996 to 2008. The sample includes all top league players of those 14 countries who are also citizens of those 14 countries. Column (1) reports the number of player×year observations. Column (2) reports the fraction playing in a foreign country. Columns (3) and (4) report age and professional football experience in years. Column (5) reports the quality index (see appendix for complete details). Column (6) reports average earnings in 2008 British pounds. Earnings are imputed for the full sample based on actual earnings collected for years 1999-2000 and 2004-2008 for a subsample. Column (7) reports the fraction of players in those years with observed earnings. Columns (8) and (9) report the top earnings marginal tax rate for home players and foreign players in each country. Columns (10) and (11) report the average earnings tax rate for home players and foreign players in each country. Column (12) reports the fraction of players for whom the applicable average tax rate differs by more than 10% from the applicable top marginal tax rate.

Table A2: WEIGHTS FOR THE SYNTHETIC CONTROL FOR EACH EVENT STUDY

| Country     | Denmark |        |        | Spain   |         |         |         |
|-------------|---------|--------|--------|---------|---------|---------|---------|
|             | Fig 3A  | Fig 3B | Fig A6 | Fig 2A1 | Fig 2A2 | Fig 2B1 | Fig 2B2 |
|             | (1)     | (2)    | (3)    | (4)     | (5)     | (6)     | (7)     |
| Austria     | 0       | 0      | 0      | 0       | 0       | 0       | 0       |
| Belgium     | 0       | 0      | 0      | 0       | 0       | 0       | 0       |
| Denmark     | .       | .      | .      | 0       | 0       | 0       | 0       |
| England     | 0       | .2     | 0      | 0       | 0       | .276    | .053    |
| France      | 0       | 0      | 0      | 0       | .124    | 0       | .288    |
| Germany     | 0       | 0      | 0      | 0       | 0       | 0       | 0       |
| Greece      | 0       | 0      | .67    | 0       | 0       | 0       | 0       |
| Italy       | 0       | 0      | 0      | .784    | .876    | .724    | .659    |
| Netherlands | 0       | 0      | 0      | 0       | 0       | 0       | 0       |
| Norway      | .227    | .169   | .263   | 0       | 0       | 0       | 0       |
| Portugal    | 0       | 0      | 0      | .216    | 0       | 0       | 0       |
| Spain       | 0       | 0      | .01    | .       | .       | .       | .       |
| Sweden      | .773    | .63    | .05    | 0       | 0       | 0       | 0       |
| Switzerland | 0       | 0      | 0      | 0       | 0       | 0       | 0       |

NOTES: We follow Abadie and al. (2010) to construct synthetic country weights. Weights are estimated by minimizing the following distance  $\|X_1 - X_0W\|_V$  where  $X_1 = (Z'_1, \bar{Y}_1)$  is a  $(k \times 1)$  vector of pre-reform characteristics of the treated country. More precisely,  $Z'_1$  is a vector of pre-reform characteristics of the treated country and  $\bar{Y}_1$  is the average outcome of interest for the treated country in the pre-reform period. We include in  $Z'_1$  the yearly average quality index of the players playing in the country, and two different indexes of league quality: the first one is the UEFA country coefficient, and the second is the sum of the relative points earned by all the clubs of the League in all UEFA competitions for a given year.  $X_0$  is the  $(k \times n)$  vector of the same pre-reform characteristics for all countries in the comparison pool (where  $n$  is the number of countries in the comparison pool). The weights obtained from this procedure for all case studies analysis are reported in the table. Each column corresponds to a specific event study. The fact that the synthetic country includes only a small number of countries (2-4) is standard (see Abadie and al., 2010).

Table A3: REVENUE MAXIMIZING TAX RATES ON FOOTBALL PLAYERS

|               | Top Earnings<br>Tax Rates<br>(2008) |          | Revenue Maximizing<br>Tax Rates |                 |      |
|---------------|-------------------------------------|----------|---------------------------------|-----------------|------|
|               | Domestic                            | Foreign  | Flexible                        | Rigid           |      |
|               |                                     |          | Labor<br>Demand                 | Labor<br>Demand |      |
| (1)           | (2)                                 | $\tau^*$ | $\tau^*$                        | $\tau_f^*$      | (5)  |
| Austria       | .612                                | .612     | .765                            | .961            | .765 |
| Belgium       | .616                                | .322     | .764                            | .942            | .704 |
| Denmark       | .698                                | .448     | .741                            | .949            | .797 |
| England       | .552                                | .552     | .855                            | .966            | .622 |
| France        | .611                                | .524     | .865                            | .913            | .917 |
| Germany       | .593                                | .593     | .874                            | .964            | .647 |
| Greece        | .496                                | .496     | .805                            | .975            | .623 |
| Italy         | .534                                | .534     | .888                            | .956            | .707 |
| Netherlands   | .597                                | .364     | .859                            | .953            | .664 |
| Norway        | .608                                | .582     | .747                            | .978            | .718 |
| Portugal      | .654                                | .654     | .828                            | .94             | .802 |
| Spain         | .509                                | .345     | .873                            | .956            | .716 |
| Sweden        | .738                                | .738     | .799                            | .955            | .839 |
| Switzerland   | .561                                | .561     | .713                            | .844            | .613 |
| All countries | .598                                | .523     | .813                            | .947            | .724 |

NOTES: Columns (1) and (2) report the top earnings tax rate in each country in 2008 that apply to domestic and foreign players respectively. Column (3) computes the revenue maximizing tax rate on all football players (where both domestic and foreign players face the same tax rate) in the case of perfectly elastic labor demand. In this case, as shown in Proposition 3, the standard inverse supply elasticity rule applies. We compute the wage weighted supply elasticity according to our baseline estimates in column (2) of Table 2. The aggregate elasticity is the weighted average of the elasticity for the different quality groups. Column (4) computes the revenue maximizing tax rate on all football players (where both domestic and foreign players face the same tax rate) taking into account displacement and sorting effects, following the formula presented in Proposition 4. The aggregate elasticity is the wage weighted average of the elasticity of foreigners and domestic players taking into account sorting effects and displacement effect estimates of column (5) of Table 3 (and assuming that tax rates in other countries stay the same). Column (5) computes the revenue maximizing tax rate on foreign players specifically (and assuming that the tax rate on domestic players stays the same as it is in 2008 in each country) taking into account displacement and sorting effects, following the formula presented in Proposition 4. The elasticities of foreign and domestic players w.r.t foreigner tax rates are also wage weighted, and computed according to estimates of column (5) of Table 3.