Web Appendix of

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

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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×year fixed effects.

Top Marginal Tax Rate. We combine all three types of taxes into a single tax rate τ 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 τ_i, τ_{pw}, τ_{pf}, and τ_{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 planel 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.[40]

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.[41] Our club data include results from all games played in European competitions since 1975, along with results from the National Leagues of

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[40]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.

[41]In the period we consider, there are three major European championships: the Champions League, the UEFA Cup, and the Cup Winners Cup.

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 to various tournament stages.[42] 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.[43] Our results, presented in Figure 1, Panel C, are very robust to using different ranking measures.

Individual Quality Index. The empirical estimation of section IV 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

$$Q_{k,n,t} = \left[\frac{\max_k(league\_rank_{k,n,t}) - league\_rank_{k,n,t} + 1}{\max_k(league\_rank_{k,n,t})} \right]^2 \times country\_coef_{n,t} \qquad (A4)$$

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

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[42]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.

[43]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.

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 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 II, 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 C, and the empirical specifications in section IV 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.[44]

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 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.[45] 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

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[44]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.

[45]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).

payroll tax system in Greece allows us to analyze the mobility of Greek players.[46] 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[47] (labor costs are earnings 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.[48] 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

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[46]This reform has been analyzed by Saez, Matsaganis, and Tsakloglou (2012) for the full Greek population.

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

[48]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 significant drop after 1992.

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* τ_n^* *is given by*

$$\tau_n^* = \frac{1}{1 + \varepsilon_n}, \tag{A5}$$

where ε_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* (τ_{nd}, τ_{nf}), *the Laffer rates* $\left(\tau_{nd}^*, \tau_{nf}^*\right)$ *are given by*

$$\tau_{nd}^* = \frac{1}{1 + \varepsilon_{nd}}, \quad \tau_{nf}^* = \frac{1}{1 + \varepsilon_{nf}}, \tag{A6}$$

where ε_{nd} *(resp.* ε_{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

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

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

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

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 $\varepsilon_n \equiv \frac{\int_0^\infty a p_{na} \varepsilon_{na} da}{\int_0^\infty a p_{na} da}$. This corresponds to eq. (A5).

(b) Total revenue is given by

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

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

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

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 $\varepsilon_{nd} \equiv \frac{\int_0^\infty a p_{nda} \varepsilon_{nda} da}{\int_0^\infty a p_{nda} da}$. This corresponds to the first part of eq. (A6). The proof for τ_{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 τ_n^* is given by

$$\tau_n^* = \frac{1}{1 + \varepsilon_n}, \tag{A7}$$

where ε_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 (τ_{nd}, τ_{nf}), the Laffer rate on foreigners τ_{nf}^* given the tax rate on locals τ_{nd} is given by

$$\tau_{nf}^* = \frac{1}{1 + \varepsilon_{nf}} \left\{ 1 - \tau_{nd} \sigma_{nd} \left(\frac{z_{nd}}{z_{nf}} \right) \right\}, \tag{A8}$$

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 τ_{nd}^* at a given tax rate on foreigners τ_{nf} is given by a symmetric condition. The two conditions together describe a fully optimized tax system $\left(\tau_{nd}^*, \tau_{nf}^* \right)$.

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

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

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 $p_{na} (.)$. The Laffer rate τ_n^* satisfies

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

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 $\varepsilon_n \equiv \frac{\int_{s_n}^{\infty} a p_{na} \varepsilon_{na} da}{\int_{s_n}^{\infty} a p_{na} da}$. This corresponds to eq. (A7).

(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 (τ_{nd}, τ_{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

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

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 τ_{nf}^* given the tax rate on locals τ_{nd}. We can write the first-order condition as

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

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

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

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

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

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

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

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as in eq. (A8). The proof for τ^*_{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. (A7) 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. (A8) 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. (A8) 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 σ_{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 III, the special tax scheme for foreigners is not necessarily revenue raising. Finally, we may combine eq. (A8) with the symmetric equation for τ^*_{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 (A5). 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 (A7)-(A8).

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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A. Local players
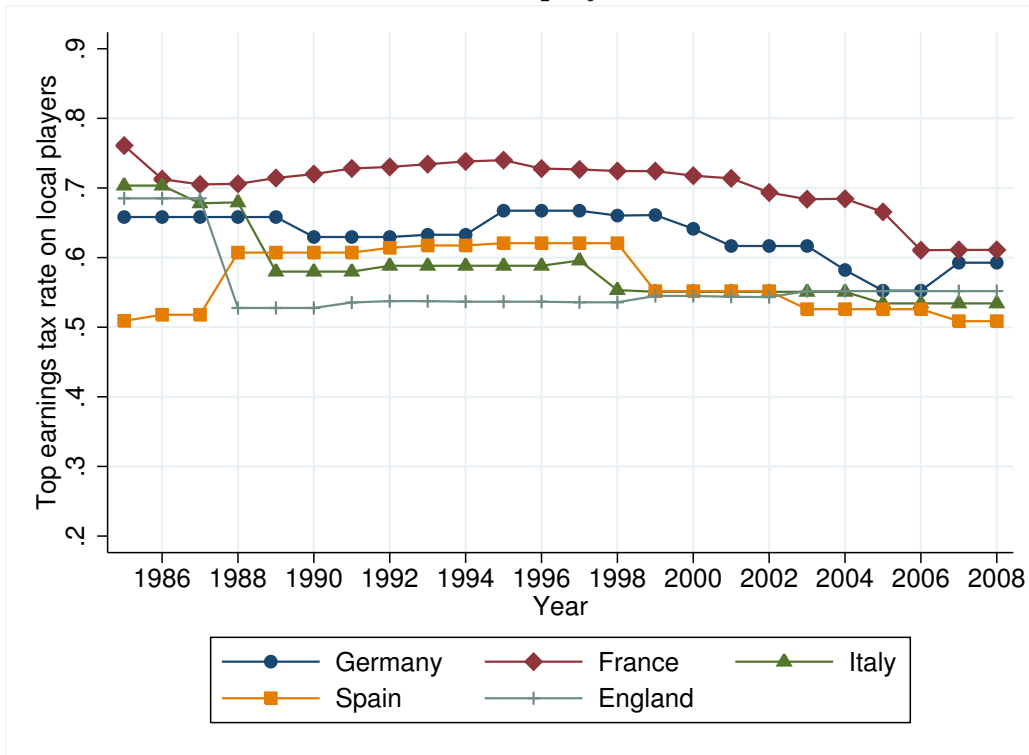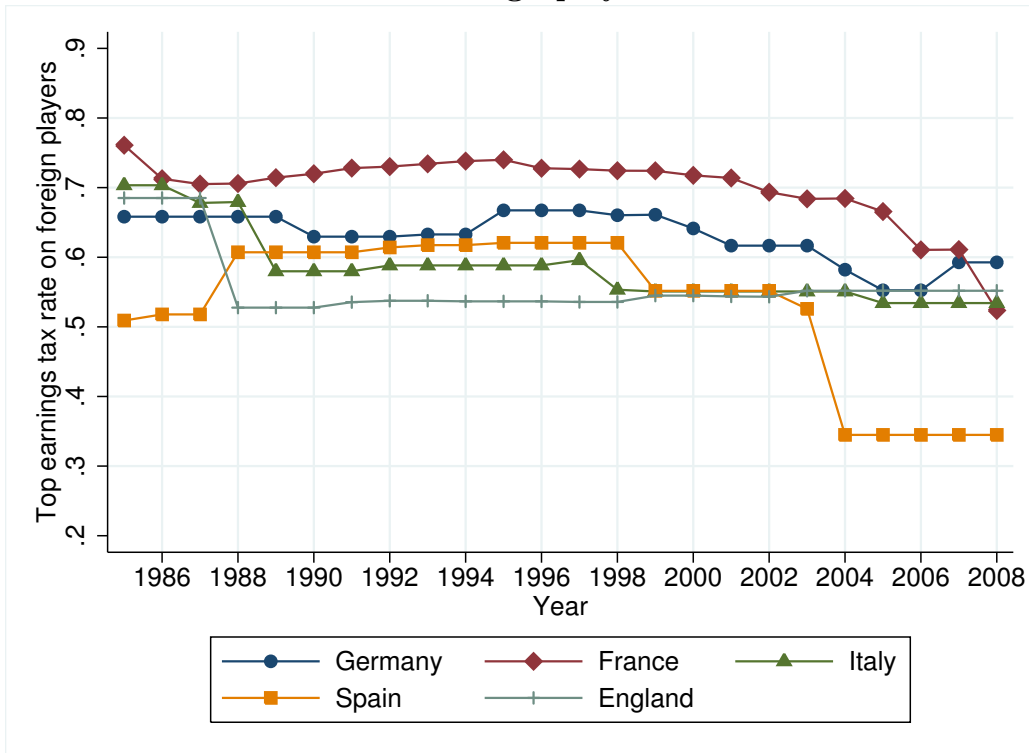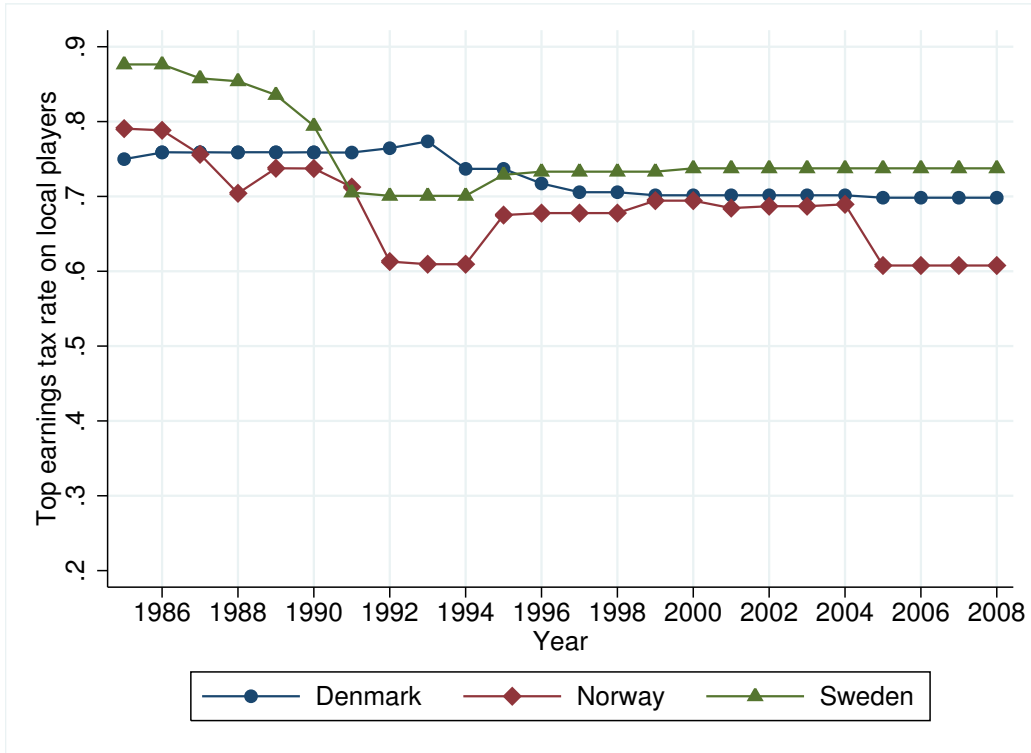

B. Foreign players

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.

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A. Local players
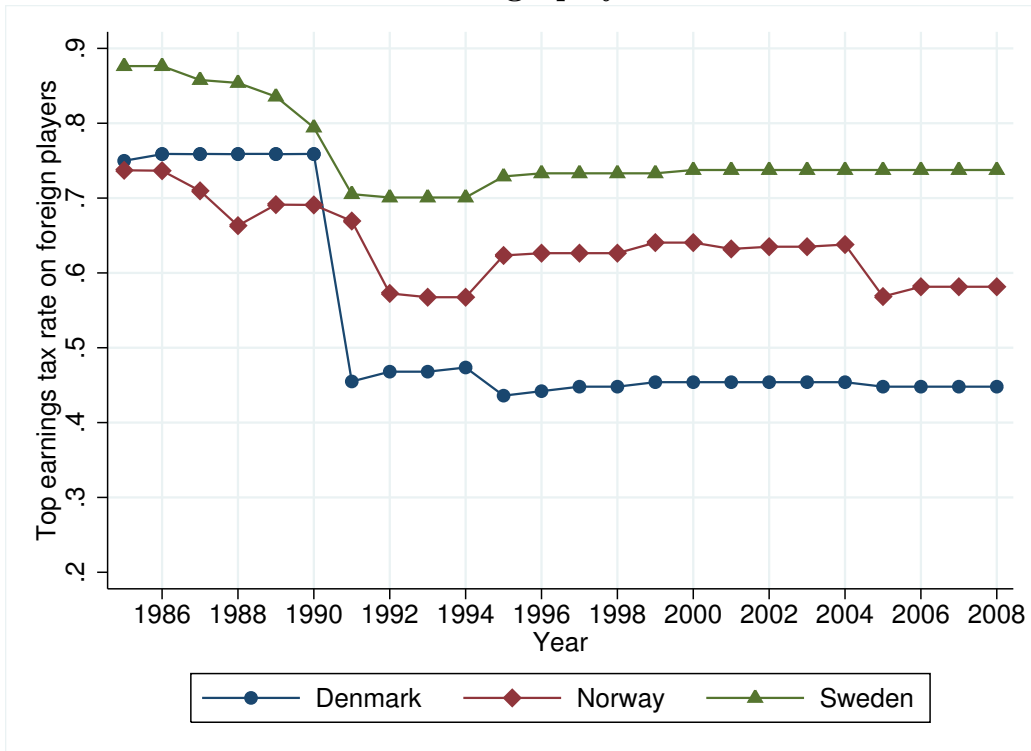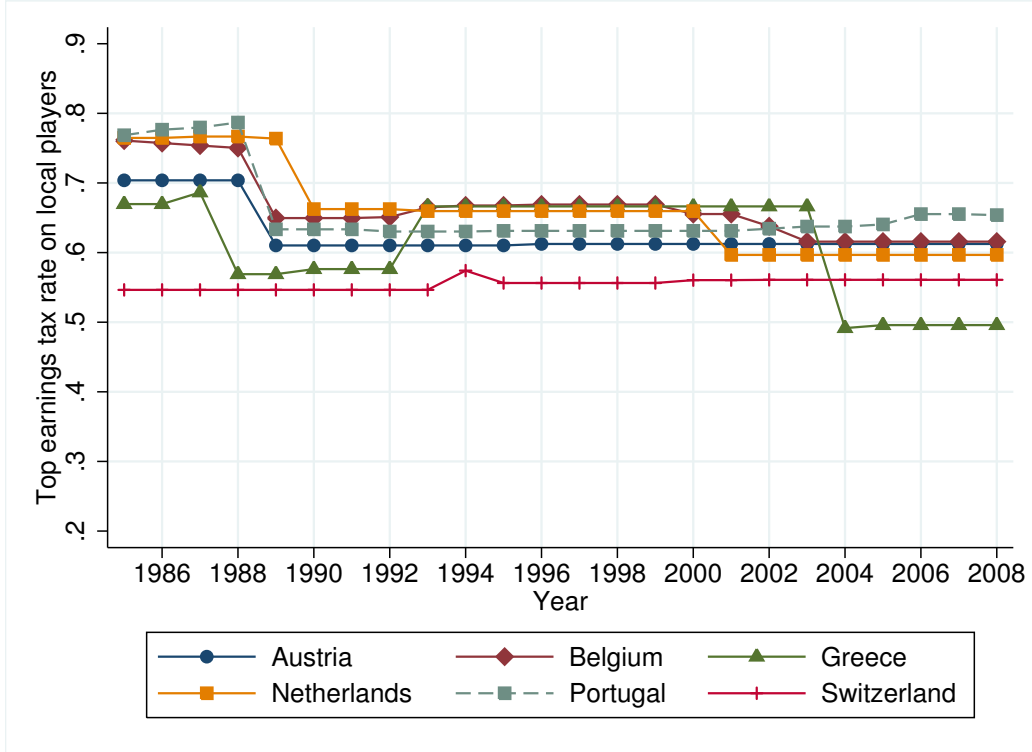

B. Foreign players

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.
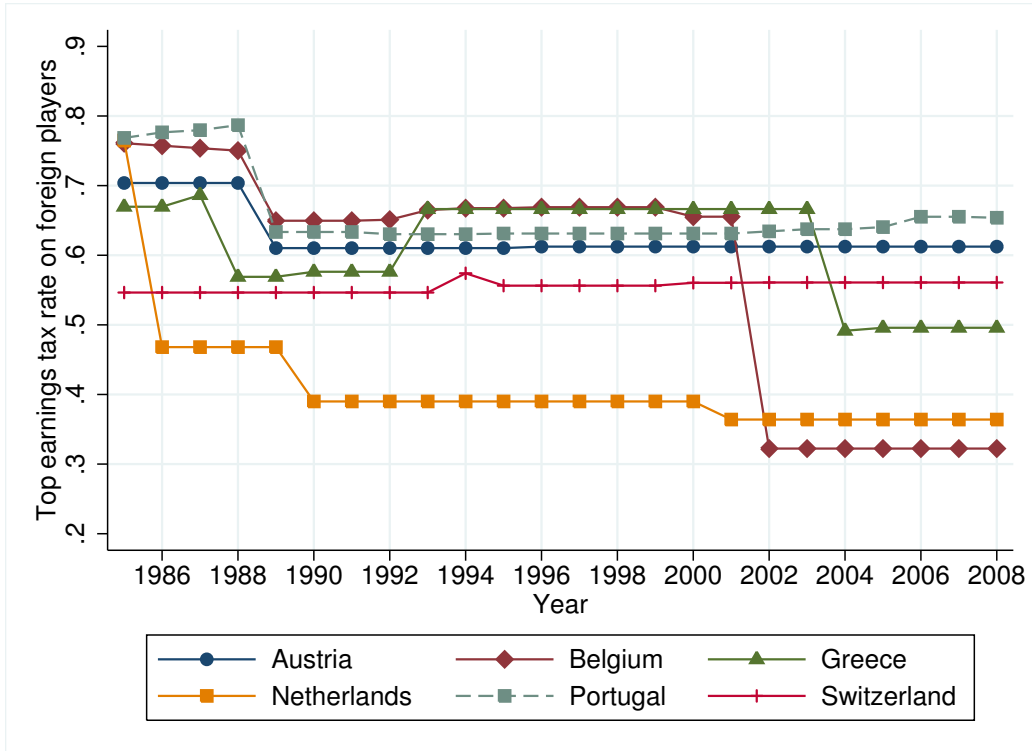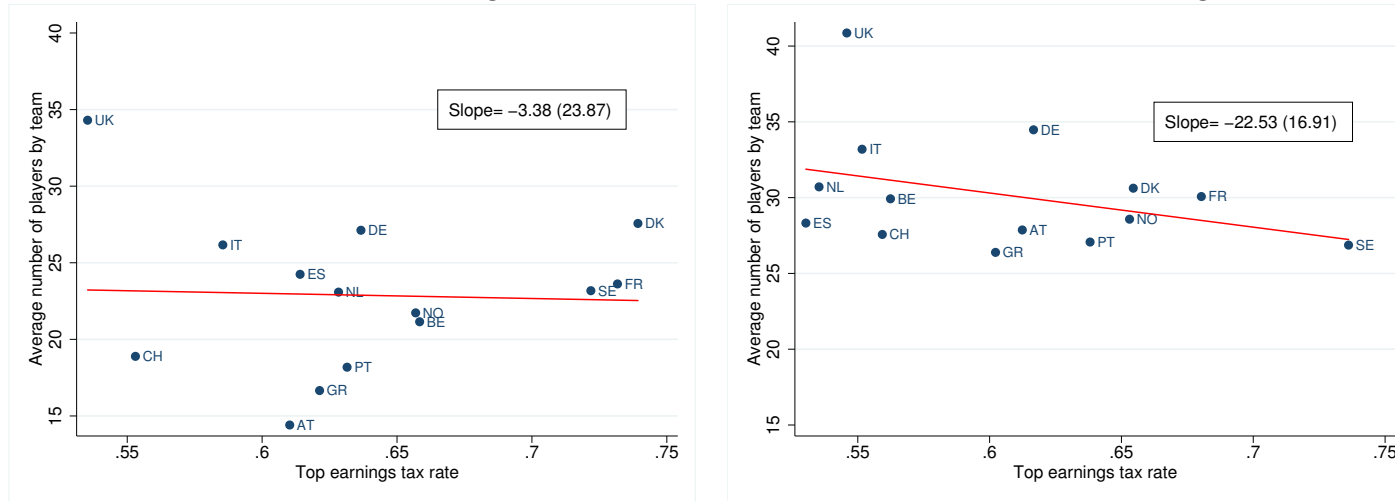
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A. Local players

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.
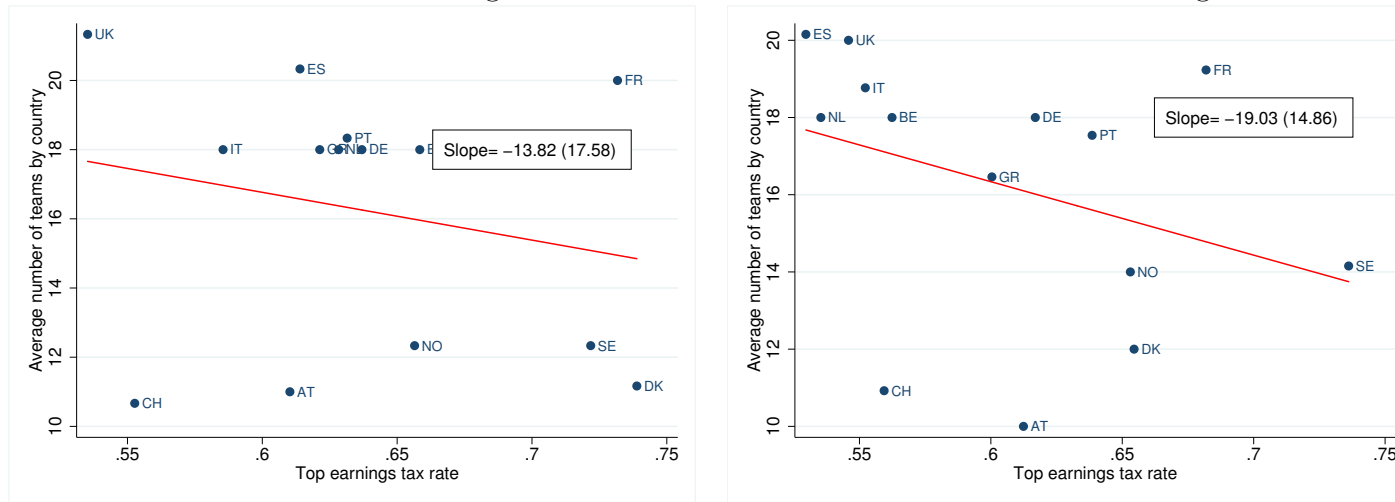
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Figure A4: DECREASING LABOR DEMAND FOR FOOTBALL PLAYERS

NOTES: Each dot represents a country (see Figure 1 for list of acronyms). Panel A shows the average number of players per team (in the top league of each country) and the weighted average of top earnings tax rate for local and foreign players for years 1985-1995 (before Bosman ruling) on the left-panel and for years 1996-2008 (after Bosman ruling) on the right-panel. In Panel B shows the average number of teams per top league in each country and the weighted average of top earnings tax rate for local and foreign players for years 1985-1995 (before Bosman ruling) on the left-panel and for years 1996-2008 (after Bosman ruling) on the right-panel. The red line in each graph displays the regression fit. Coefficients and standard errors are reported.
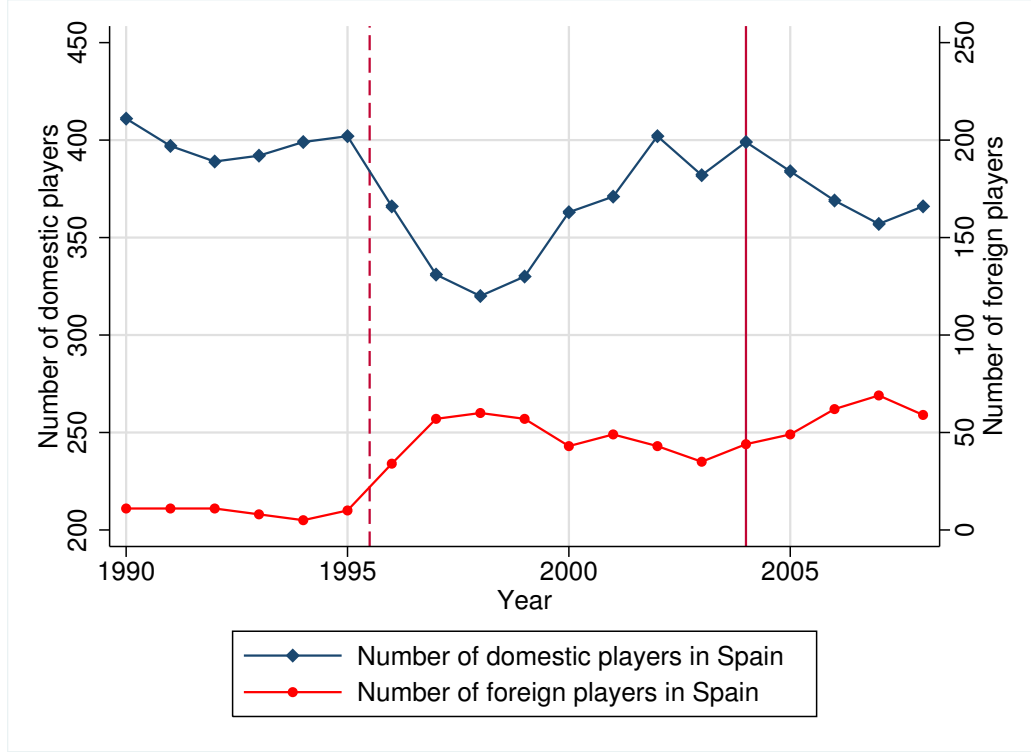
Figure A5: DISPLACEMENT EFFECTS OF THE BECKHAM LAW IN SPAIN

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.

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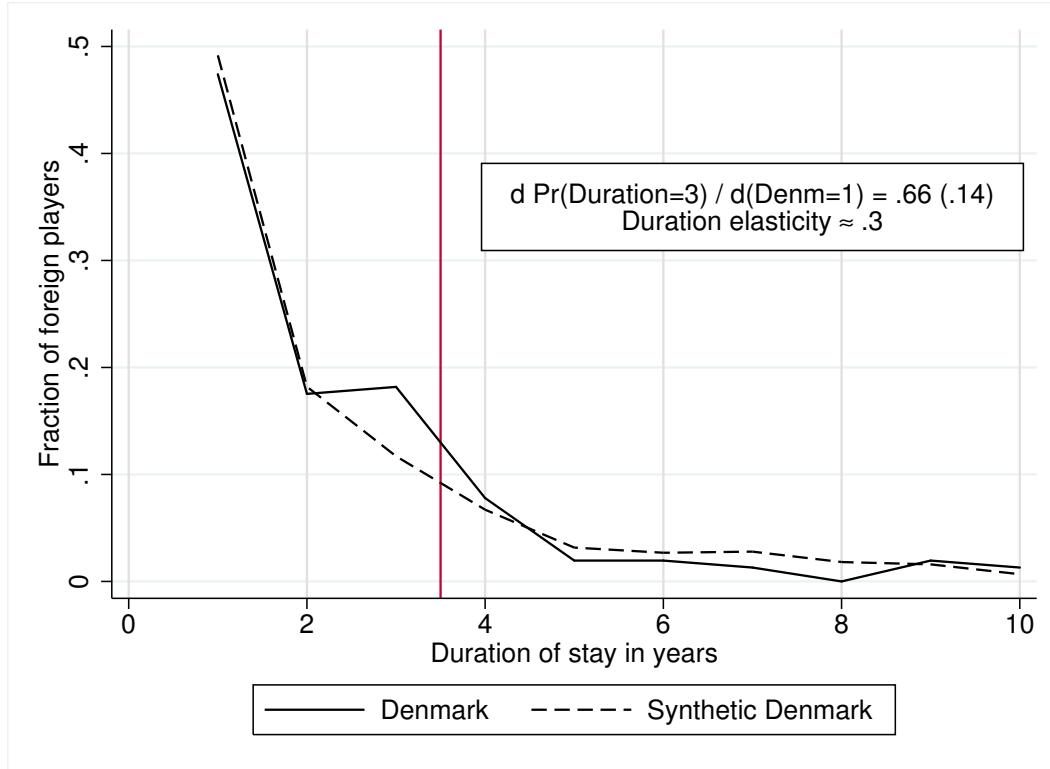
Figure A6: DURATION OF STAY IN DENMARK

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.

DD elasticity= .451 (.136)
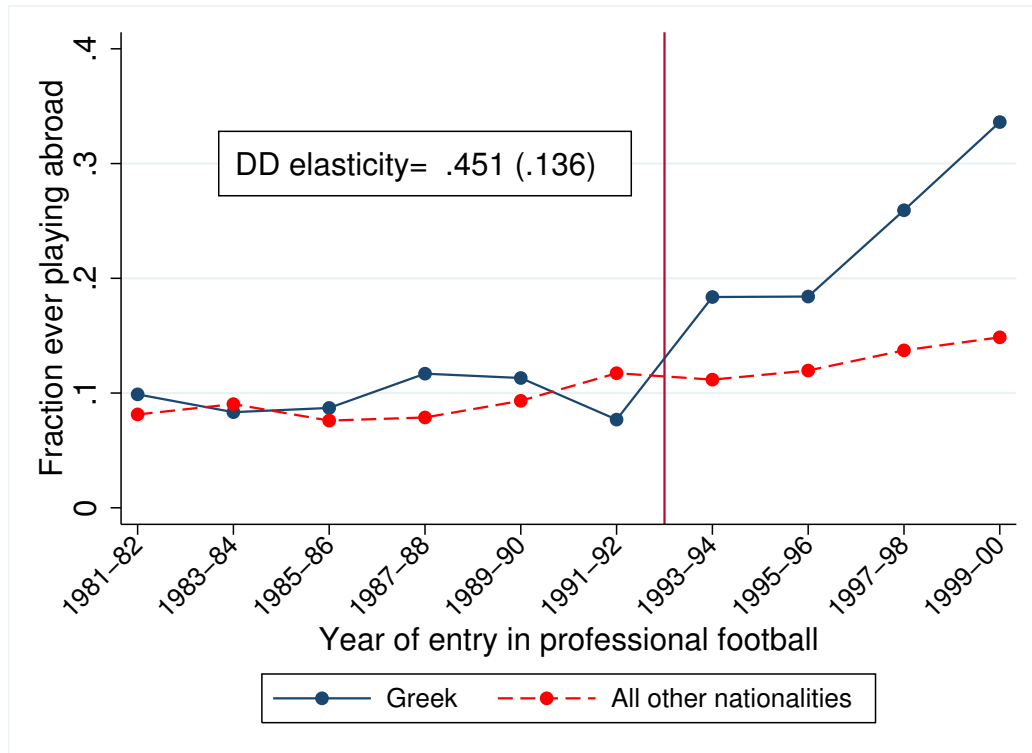
Figure A7: Fraction of Greek Players Ever Playing Abroad by Cohort

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 $\tau_{domestic}$	$\tau_{foreigner}$	Average tax rate $t_{domestic}$	$t_{foreigner}$	Fraction with $\frac{\tau-t}{\tau} > .1$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
All countries	55225	.11	25.0	6.1	.25	211,341	.54	.62	.58	.56	.54	.32
Austria	2125	.11	25.0	5.8	.13	140,346	.50	.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	.60	.50	.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	.00
Netherlands	4845	.15	24.5	5.5	.24	222,981	.54	.62	.52	.60	.52	.10
Norway	3938	.07	25.2	5.6	.11	144,796	.53	.66	.61	.56	.55	.66
Portugal	2926	.09	25.5	6.5	.20	159,530	.37	.64	.64	.61	.61	.21
Spain	4951	.10	25.7	6.8	.57	316,012	.43	.55	.51	.51	.47	.30
Sweden	3182	.05	24.6	5.6	.10	149,988	.63	.74	.71	.69	.68	.22
Switzerland	2129	.18	24.1	5.9	.03	89,060	.43	.56	.56	.39	.40	.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			.674	0	0	0	0
Italy	0	.169	0	.784	.876	.724	.659
Netherlands	0	0	0	0	0	0	0
Norway	.227	0	.263	0	0	0	0
Portugal	0	0	0	.216	0	0	0
Spain	0	0	.053	.	.	.	.
Sweden	.773	.63	.01	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 Tax Rates (2008)		Revenue Maximizing Tax Rates		
			Flexible Labor Demand	Rigid Labor Demand	
	Domestic	Foreign	τ^*	τ^*	τ_f^*
	(1)	(2)	(3)	(4)	(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	.940	.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.