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Migration and Tax Policy: Evidence from Finnish Full Population Data

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CENTRES OF EXCELLENCE IN RESEARCH

Migration and tax policy: Evidence from Finnish full population data*

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Abstract

While evidence on the impact of taxation on the international migration of certain special groups of workers has expanded, evidence on the links between taxes and migration of the general population is extremely limited. We aim to fill this gap by estimating the impact of taxation on the migration decisions of the entire working population in a high-tax source country, Finland. We find that the average domestic elasticity of migration with respect to the domestic tax rate is very small (around 0.001). This holds for various occupational and income groups of interest. We also provide a first empirical implementation of the theoretical results of Lehmann et al. (2014), who show that if a fully non-linear income tax schedule at the top is used, the key sufficient statistic for the optimal tax is a semi-elasticity of migration. Our estimates indicate that the migration responses increase for top earners, but remain very small, at least up to the top per mille of income earners.

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1 Introduction

Potential emigration of workers is a key policy concern for high-tax countries. The problem could be especially severe for the Nordic welfare states, because the policy package of free higher education and extensive public services financed by progressive taxation is not sustainable if a sizeable fraction of the high-income, high-skilled population emigrate. Emigration of these individuals would have negative consequences for tax revenue and human capital and hence for the productive potential of a country. Even further down the income distribution, potential emigration of certain occupational groups is of interest for policy-makers.

This study aims to answer a key question in both the academic and policy debate: How sensitive are the migration decisions of the working population, including high-income individuals and different occupational groups, to taxes? Despite the high policy significance of the topic, studies on migration responses to taxation have focused on very specific occupational groups or income groups. Empirical evidence on how migration of the working population at large is affected by cross-country tax-rate differentials remains scarce. This paper sets out to estimate the effect of changes in tax rates on individual migration decisions using administrative full-population data from Finland.

The second goal of the paper is to examine the income gradient of migration responses at the top of the income distribution. Lehmann et al. (2014) investigate the optimal income tax setting between competing governments with Rawlsian preferences when the population is mobile. They show that rather than migration elasticities, the sufficient statistic which needs to be estimated is the semi-elasticity of migration, defined as the percentage change in the share of the population residing in a country when the level of disposable income in the country increases marginally. Considering a fully flexible functional form of the income tax schedule, in order to set top tax rates optimally, one needs reliable information about this semi-elasticity and its gradient with respect to income. The simulation results presented in Lehmann et al. (2014) show that these theoretical insights may change policy lessons in important ways for a meaningful proportion of taxpayers, but the implications for tax policy remain an open empirical question.

While migration responses to taxation in destination countries are also of interest, our main interest lies in the domestic elasticity, i.e. the percentage change in the number of individuals residing in a country with respect to the percentage change in the net-of-tax share of earnings in that country, as well as the semi-elasticity defined above.

We use full-population individual-level administrative data on income, education and other socio-demographic characteristics for 2003—2015, combined with informa-

tion from emigration registers covering all migration events for the individuals in the data. In the case of emigration events, the register includes information on the date of emigration as well as the destination country. As we do not observe emigrants while they are residing in the destination country, a key challenge is to form estimates for the earnings and corresponding tax-rates in the actual as well as potential destination countries. For this purpose, we supplement the Finnish register data with micro-data from the Luxembourg Income Study (LIS) and EU-SILC. We run earnings regressions using data from potential destination countries and then use the regression results to predict earnings in different destination countries for each individual in the Finnish data.[1] We then utilize detailed information on the tax codes in destination countries, including information on preferential tax schemes for high-income foreign workers applied in many countries, to calculate the tax rate that an individual would face in each destination.

We analyze the relation between migration and income taxation on two levels. We start by a descriptive macro-level analysis of the relation between stocks of Finnish migrants by destination country and tax rates, analyzing separately those in the top 10% and the rest of wage earners. The relation between migration and the net-of-tax-rate is negative for both income groups, but imprecisely estimated for the top 10% of earners. Finnish migrants, including the top earners, seem to migrate to both low- and high-tax countries, and our findings rule out a clear positive relation between destination choice and net-of-tax rates.

We then proceed to an individual-level analysis and study in more detail whether individuals are more likely to migrate to low-tax destinations.

Our results indicate that the relationship between individual-level migration decisions and the net-of-tax rate is positive and statistically significant. However, the implied migration elasticities with respect to the home country net-of-tax-rate are very close to zero (in the order of 0.001), even for workers in the highest income decile as well as for all the different occupational groups that we analyze. Moreover, investigation of return migration patterns suggests that higher taxes at home do not reduce return migration. In line with earlier research, the cross elasticities are slightly higher, around 0.15, with the lower-income groups being somewhat less reactive.

In discussing the tax policy implications of migration, this paper is the first to provide an empirical implementation of the Lehmann et al. (2014) theoretical results. We find that the semi-elasticity of migration is very low up to the top per mille of the income distribution. However, comparing responses for the top per cent and top per mille, the semi-elasticity is increasing, and we cannot rule out the possibility of high semi-elasticities for the very richest income earners. Hence, the optimal marginal tax

[1] As a robustness check, we use an alternative method to predict earnings that explicitly accounts for the selection of emigrants.

rate may decline at the very top of the income distribution. However, up to the top per mille at least, our results indicate that the effect of migration concerns for setting the top tax rate is negligible.

In a recent survey, Kleven et al. (2020) note that more evidence on the impact of taxes on migration regarding new countries and, especially, new migrant groups, is needed. The impact of taxation on migration decisions has been examined by Kleven, Landais & Saez (2013), who study the international mobility of football players and find large elasticities (around 1) for foreign players. Akcigit, Baslandze & Stantcheva (2016) conduct a similar analysis of top inventors and find large elasticities for foreign inventors (close to unity), and very small elasticities for domestic inventors (0.03). Kleven, Landais, Saez & Schultz (2013) examine how foreign experts reacted to the foreigners' special tax scheme in Denmark. They also document a large elasticity for this group (around 1.5). Migration responses to taxation within a country have been examined by Agrawal & Foremny (2019) for Spain, Moretti & Wilson (2017) for the US, and Martinez (2022) and Schmidheiny & Slotvinski (2018) for Switzerland.

The paper closest to ours is Muñoz (2020). She studies whether the migration decisions of individuals in the top income decile in European countries react to top tax rates. Individuals in the other parts of the income distribution are used as controls. She does not directly observe or use more detailed income information than information on the income decile that individuals belong to, nor does she account for the effects of taxes at other parts of the income distribution. Another closely related paper is Corneo & Neidhöfer (2021). Their focus is different from ours: They examine how destination country redistribution (measured by the reduction in the Gini coefficient due to tax and benefit policies) influences the selection of Italian emigrants. Similar to our paper, they use LIS data to predict individuals' potential incomes in different countries. In explaining the choice of migration destinations, they use net incomes instead of focusing directly on tax rates (while separately accounting also for income differentials), as we do in our analysis.

We contribute to the literature on taxation and migration in the following ways. First, while previous literature has focused on relatively narrow occupational or income groups, we examine the relationship between taxes and emigration for the entire working-age, full-time working native population in a source country. Given that top-income individuals are of particular interest, we provide results separately for this group. However, it is not clear that emigration is a relevant issue only at the very top of the income distribution. Our descriptive analysis shows that the tendency to emigrate has actually increased notably among the bottom 90% of income earners. Further, in the policy discussion, there are often also concerns about the emigration of occupational groups such as healthcare professionals, not only top earners. We provide

elasticity estimates separately for a wide range of occupational groups. Second, we examine emigration patterns from Finland, a Nordic country with a heavily progressive income tax schedule, where the tax-related emigration incentives for high-income individuals are higher than in most countries. Finally, while all earlier papers have focused on estimating migration elasticities, ours is the fist study to investigate the shape of the theory-based semi-elasticity and its income gradient at the top of the income distribution, which speaks directly to setting the optimal non-linear income tax schedule.

The paper proceeds as follows. Section 2 provides a brief theoretical background to motivate our analysis. Section 3 introduces our data and provides descriptive evidence, including descriptives on the tax rate differences across and between countries which we use in the estimation. Section 4 examines macro responses on the basis of group-level migration flows from Finland, with the main interest in examining the connections between taxes and the mobility choices of individuals in the top decile of the income distribution. This section also covers an event analysis of reactions to changes in the tax system in Sweden, one of the main destination countries for Finns. Section 5 turns to individual-level analysis based on a framework where individual utility from locating in a given country depends, among other things, on the tax rate in that country. In this section we also examine migration decisions. The tax policy implications for setting the top tax rates are considered in Section 6, while Section 7 concludes.

2 Theoretical background

2.1 Individual behavior

We first consider individuals' migration reactions to tax policy. Denote the utility $U_{i,t}^c$ of a person i living in country c as

$$u\left((1-\tau_{i,t}^c)w_{i,t}^c\right)+\mu_{i,t}^c,$$

or, using log utility

$$ln\left(1-\tau_{i,t}^c\right)+ln\left(w_{i,t}^c\right)+\mu_{i,t}^c, \tag{1}$$

where $\tau_{i,t}^c$ is the average tax rate in the country for individual i and $w_{i,t}^c$ the individual's gross earnings level in period t. In addition, $\mu_{i,t}^c$ denotes the net value of all other amenities offered by the location in that period[2]. The net value may also be negative. Comparing the domestic country (d) and a foreign country (f), and normalizing utility

[2]This value is also net of migration costs.

so that $\mu^d_{i,t}$ is zero, the person chooses to reside in a foreign country[3] if

$$\mu^f_{i,t} > u\left((1-\tau^d_{i,t})w^d_{i,t}\right) - u\left((1-\tau^f_{i,t})w^f_{i,t}\right),$$

i.e. if the net benefit μ is large enough, exceeding a threshold value $\widetilde{\mu}^f_i$. This threshold value makes the individual indifferent between living abroad or in the domestic country, in our case Finland. When taxes stay constant, a person might still move abroad if the net non-monetary benefit abroad increases. In other words, if $\mu^f_{i,t-1} < \widetilde{\mu}^f_i$, but $\mu^f_{i,t} > \widetilde{\mu}^f_i$, the person moves to a foreign country in period t.

On the other hand, when other migration determinants remain the same, but the tax rate in Finland is reduced, fewer Finns move abroad. In addition, some Finns who used to reside abroad move back, since $(1-\tau^d_{i,t})w^d_{i,t}$ increases.

In the empirical part, we work with two samples, those initially residing in Finland and those resident abroad. Let us denote the fraction of Finns who stay in Finland by S_t and the fraction of those who return from abroad by R_t.

These fractions depend on the net-of-tax rate as follows:

$$\frac{\partial S_t}{\partial(1-\tau^d_t)} > 0, \ \frac{\partial R_t}{\partial(1-\tau^d_t)} > 0.$$

These give rise to elasticities $\eta^S_{d,(1-\tau^d_t)} = \frac{\partial S_t}{\partial(1-\tau^d_t)}\frac{(1-\tau^d_t)}{S_t}$ and $\eta^R_{d,(1-\tau^d_t)} = \frac{\partial R_t}{\partial(1-\tau^d_t)}\frac{(1-\tau^d_t)}{R_t}$. In order to assess how much the overall share of Finns in Finland ($N_t = S_t + R_t$) reacts to taxation, one should estimate the total elasticity (accounting for both staying and return migration)

$$\begin{aligned}
\eta^N_{d,(1-\tau^d_t)} &= \frac{\partial N_t}{\partial(1-\tau^d_t)}\frac{(1-\tau^d_t)}{N_t} = \frac{\partial S_t}{\partial(1-\tau^d_t)}\frac{(1-\tau^d_t)}{N_t} + \frac{\partial R_t}{\partial(1-\tau^d_t)}\frac{(1-\tau^d_d)}{N_t} \\
&= \frac{\partial S_t}{\partial(1-\tau^d_t)}\frac{(1-\tau^d_t)}{S_t}\frac{S_t}{N_t} + \frac{\partial R_t}{\partial(1-\tau^d_t)}\frac{(1-\tau^d_d)}{R_t}\frac{R_t}{N_t} \\
&= \frac{S_t}{N_t}\eta^S_{d,(1-\tau^d_t)} + \frac{R_t}{N_t}\eta^R_{d,(1-\tau^d_t)}. \qquad (2)
\end{aligned}$$

In other words, this is a weighted sum of the reactions of those staying in Finland and those returning from abroad. In practice, since a vast majority are stayers, the overall elasticity is governed by the reaction of the stayers. In what follows, we first focus on estimating the elasticity that captures the emigration decisions of those currently

[3]In practice, individuals choose between their home country and several potential foreign destinations. This is accounted for in our empirical analysis. Here, we simplify by modeling the choice between two countries, home and foreign, as the emigration decision is most crucial for our analysis and for domestic tax policy; see below. One may think of the foreign country here as the one yielding the highest utility among potential destination countries.

residing in Finland, $\eta^S_{d,(1-\tau^d_t)}$, but for completeness we also offer an investigation of return migration in Section 5.3.

While the domestic country cannot directly influence the way other countries set their taxes, the foreign elasticities of the type $\eta^S_{d,(1-\tau^f_t)} < 0$ are also of interest for understanding migration patterns.

2.2 Tax policy background

The key purpose of this paper is to estimate the net domestic elasticity, i.e. the percentage change in the probability of residing in a given country (in our case Finland), with respect to the change in the net-of-tax rate of earnings in that country. This parameter is of crucial interest for policy, as it is one of the key parameters for setting marginal income tax rates in the presence of tax-induced migration.

Typically, tax-induced migration has been discussed in the context of the taxation of top incomes. Brewer et al. (2010) and Piketty & Saez (2013) demonstrate that the revenue-maximizing top tax rate in the presence of migration is given by

$$\tau^* = \frac{1}{1 + a * e + \eta}, \tag{3}$$

where a is the Pareto parameter that describes the thickness of the top tail of the income distribution, e is the elasticity of taxable income, and η refers to the fraction of the population (net) staying in the domestic country, i.e. $\eta^N_{d,(1-\tau^d_t)}$ (cf. Equation (2)). Therefore, if the migration elasticity is significant and is not accounted for, top tax rates may be set too high from a welfare-maximizing point of view.

The above formula is applicable when the policy-maker sets a fixed marginal tax rate for a group of top earners. In practice, tax schedules are indeed typically piecewise linear, i.e. the marginal tax rate is constant for a significant proportion of top earners above a given threshold. Lehmann et al. (2014), on the other hand, show that if a flexible functional form of the income tax schedule at the top can be used, and if migration responses are heterogeneous, knowledge of migration elasticities is no longer sufficient to determine the shape of the tax schedule. In this case, a key parameter to be estimated is instead a semi-elasticity, ξ, defined as the percentage change in the net share of people who stay in a country when consumption (c) or disposable income in a country increases, i.e:

$$\xi_{d,c^d_t} = \frac{\partial N_t}{\partial c^d_t} \frac{1}{N_t}. \tag{4}$$

They then link this semi-elasticity to a particular elasticity, namely $\nu_{d,c^d_t} = \xi_{d,c^d_t} * c^d_t$. The shape of the revenue-maximizing income tax schedule depends on how the semi-

elasticity changes with income.[4] If the semi-elasticity ξ decreases with income – which would be the case if the elasticity ν is constant – or constant, the marginal tax rate is always positive. However, if the semi-elasticity increases with income, the marginal tax rate may even turn negative after some income level. If the semi-elasticity tends to infinity when income becomes infinite, the marginal tax rate must be negative after a certain threshold. [5] Even though this result has not been investigated empirically in previous literature, the simulation results in Lehmann et al. (2014) show that the result is not a theoretical curiosity, in the sense that for sensible parameter values, it may imply profound changes to how taxes should be set for a meaningful proportion of top income earners. The practical significance for tax policy remains an open empirical question.

In order to obtain information about the revenue-maximizing top tax rate in this setting, one therefore needs knowledge about the income gradient of the semi-elasticity.

In our empirical analysis, we mostly concentrate on estimating the migration elasticity, η, for the population as a whole and for many subgroups. This also helps to compare our findings with those of the earlier literature on taxation and migration, which has solely focused on estimating elasticities. However, when considering the implications of migration on the revenue-maximizing top tax rate, we also estimate semi-elasticities given by (4).

3 Data and descriptives

3.1 Data on migration and individual background

Our analysis uses full population administrative data from Finland for the years 2003-2015. The main data source is the Finnish Longitudinal Employer-Employee Data (FLEED) provided by Statistics Finland. The data include information on the socio-economic characteristics of the population residing in the country. To focus on work related migration, the analysis is restricted to individuals between 25 and 54 years of age and who were registered as employed for 12 months during the year they were included in the data. We also dropped all observations that have missing information.[6]

[4]Lehmann et al. (2014) analyze optimal tax rates with Rawlsian governments, which for top incomes corresponds to the revenue-maximizing tax rate. This puts an upper bound on the optimal tax rate for other government objective functions.

[5]Lehmann et al. (2014) show that equation 3 is obtained as a special case of their optimal tax rule under the assumption of a constant migration elasticity for top earners. Blumkin et al. (n.d.) show, in turn, that the asymptotic marginal tax rate converges to zero when the migration costs are distributed identically and independently across income levels and the skill distribution is unbounded.

[6]Dropping missing variables is crucial when predicting earnings for potential destination countries. This restriction mainly concerns the year 2003 in the case of occupation and industry variables and missing education information for all years. In the years 2001-2003, the Statistics Finland data do not have occupation or industry information at all. To keep the year 2003 in our estimation sample, we

Table 1 compares the summary statistics for the whole population and the estimation sample with the age and employment restrictions mentioned above. Compared to the whole population data, the individuals in our estimation sample are somewhat younger, and are more likely to be married and have children. In addition, the individuals in the estimation sample are more highly educated.

The data are merged with information on emigrations from the Statistics Finland migration register using statistical IDs based on individual social security numbers. The migration data include information on the date of migration and the destination country. It is possible to migrate without registering, but we expect that the share of migrants who migrate without registering is small, as the laws concerning social security and taxation should induce individuals to register when they emigrate.

We define an individual as an emigrant if he or she is found in one of the cross-sections of our data, and emigrates from Finland during the following year, and stays abroad for at least one year. The rest of the observations are defined as non-migrants. In the obtained panel data set we have approximately 7 million male non-migrants, 7,000 male migrants, 7 million female non-migrants and 6,000 female migrants. As we are working in a full population panel setting, most individuals are included in the data multiple times.

Our data have information on all registered moves, but we focus on 16 OECD countries[7] as possible destination countries for reasons of data availability. After conducting the above restrictions, our estimation data cover approximately 75% of all registered moves. However, if we focus only on OECD countries, our estimation sample covers almost 85% of all emigrants. Thus, focusing on these 16 destination countries seems to cover a high share of relevant destination countries. Importantly, the data also cover several countries that are not popular as destination countries for Finnish emigrants.

To ease computation in our individual-level analysis, we take a 2.5% random sample of the remainers, which leaves us approximately with 359,000 remainers. The descriptive statistics of the whole estimation sample and the random sample are given in the second and third columns of Table 1. The whole sample and the random sample are almost identical in terms of observables, as expected. Columns 4 and 5 of the table, in turn, provide descriptive statistics on the remainers and movers. The comparison between the remainers and movers is based on our estimation sample. The table shows that the migrants are younger and more educated than those who stay, and they also earn more. The self-selection pattern is similar to that found by Borjas et al. (2019) for

used occupation information for the years 2000 or 2004. The missing education data, in turn, concern mainly foreign citizens whose education information is not registered with the Finnish authorities. The remaining missing education information is most probably for Finnish citizens whose highest completed education is comprehensive school.

[7]These countries are: Austria, Canada, Czech, Denmark, Estonia, France, Germany, Iceland, Ireland, Luxembourg, Netherlands, Norway, Spain, Switzerland, UK and US.

emigration from Denmark, which is also a country with relatively high income taxes.

Figure 1 depicts the migration flows from Finland for the whole estimation sample, as well as separately for the top 10% of income-earners and the rest. While there has been a general increase in emigration, this increase has tended to take place among the bottom 90% of income-earners rather than the top earners[8]. By the end of the analysis period, more than 1,500 Finns move abroad annually out of a population of around 5.5 million.

Figure 2 provides information on the main destination countries, again split by income. The countries are ordered on the basis of the average tax rates for the two groups (the lowest tax countries at the top). Bottom 90 migrants do not appear to move more often to low-tax destinations. For the top 10, some low-tax countries (such as the US) are among the main destination countries, but so are high-tax countries like Germany and Sweden.

3.2 Estimating earnings and taxes abroad

While we observe individuals in Finland before emigration, a key challenge is that we do not know how much they earn in their destination countries. Naturally, counterfactual earnings in potential destination countries that are not chosen would not be observed either under any circumstances. We therefore predict counterfactual earnings for all individuals in all the potential destination countries in our data.

For the main analysis, we use Luxembourg Income Study (LIS) data[9], which provide harmonized and representative individual-level data on incomes in OECD and some other countries. For the individual-level analysis, we estimate Mincer-type earnings regressions for each country covered by our analysis, and predict the earnings for each individual on the basis of their characteristics for every year during the analysis period. The earnings prediction procedure is described in more detail in Appendix A.

For the macro-level analysis, again using LIS data, we estimate earnings percentiles, i.e earnings in the bottom 90 decile and similarly earnings in the top 10 decile. Earnings are estimated again for each country and each LIS wave[10]. Earnings levels are converted into the same currency (USD 2017) using PPP exchange rates when they are used in regressions determining migration choices.

[8]It should be noted that the years 2003 and 2004 are not completely comparable due to the missing information on occupation and industry variables. Thus, the large increase in the number of migrants between these years is somewhat higher than if we used the entire data for these years (ignoring missing observations on some variables in 2003).

[9]Luxembourg Income Study (2020)

[10]Waves included in our analysis are: wave VI $\sim$ 2004, wave VII $\sim$ 2007, wave VII $\sim$ 2010 and wave IX $\sim$ 2013. For Sweden, there is only one data point (year 2005) available in the LIS data. If we were to use only this year in our analysis, we would highly underestimate earnings and taxes in Sweden. Consequently, for Sweden we use the European Union Statistics on Income and Living Conditions (EU-SILC) data when estimating macro-level earnings.

Another individual-level data set covering multiple countries is EU-SILC. As the name indicates, this data set does not cover countries outside of the EU, which is why we regard LIS as our main source. We use EU-SILC as a robustness check for providing alternative earnings predictions for a subset of destination countries. These predictions are not based on earnings regressions, but we rather extract earnings levels for the percentiles for each country and year, and assume a migrant in a given percentile in Finland would be located in the same percentile in the destination country. The benefit of this alternative approach is that the earnings predictions tend to compress the earnings distributions somewhat, whereas the percentile-based solution overcomes this issue. A potential worry might be that migrants may not necessarily reach the same income percentile in the destination. In the absence of actual earnings data for destinations, neither approach is perfect. If we find similar results with both methods, the actual method for obtaining earnings predictions is then arguably less important for the final conclusions[11].

Based on predicted gross earnings, we calculate the taxes that each individual would pay in each destination country. To determine the tax liabilities, we use the OECD tax-benefit calculation tools[12]. Taxes are then linked to the data using a percentage of average earnings variable that is available in the data set provided by the OECD tax calculator[13]. When calculating taxes, unlike some earlier papers, we also take into account the special tax regimes that are in place in some of the destination countries for foreign experts. Earlier studies have only used the top marginal tax rate for tax information; this approach would not be valid in our case, as we work with all potential migrants. That is why we use the actual (average) tax rate corresponding to each individual's level of predicted earnings.

Figure 3[14] depicts the differences in average tax rates between countries, again by income. Finland is one of the countries levying the highest taxes, especially for top earners. The differences are marked, exceeding 20 percentage points. It is also noteworthy that the ordering of countries by average tax rate differs notably between

[11]Ideally we would have done a similar alternative earnings prediction with LIS data as an additional robustness check. However, as the LIS database only provides results in ASCII form, all the results first have to be manually converted to another format such as csv files. To manually create a data set containing 100 rows for each country and year would be particularly time-consuming given the number of countries and years we have in our analysis.

[12]Codes for the calculation tools are publicly available at `www.oecd.org/els/soc/Models.zip`. We also utilized Alexandre Desbuquois's code written for the Stata package TAXBENEXTRACT. Unfortunately, the OECD has deleted this package and discontinued the maintenance of the TAXBEN model written for Stata due to the introduction of web calculators.

[13]To be more precise, first we link average earnings for each country each year to the data set. Based on these linked average earnings, we calculate the percentage of average earnings, which can then be used to link taxes.

[14]Figures 3-6 are constructed using macro analysis data where tax rates are calculated on the basis of estimated earning percentiles. These data produce higher earnings for top earners compared to LIS earnings predictions. Consequently, tax rates in this data set are slightly higher for the top group.

the top 10 and the rest. One factor behind this is the special tax treatment of high-income foreigners in some countries, which we account for in our analysis.

The average tax rates for the top and bottom group in Figure 3 are calculated based on earnings, as illustrated in Figure 4. In terms of average PPP-corrected earnings, Finland is ranked slightly below the middle. The differences between average earnings are notable, especially in the case of top earners, which creates yet another incentive to migrate.

In much of our analysis, identification is based on approaches where we control for country fixed effects, and hence the extent of variation in tax rates within countries over time is key. This variation is illustrated in Figure 5, which presents the change in the average tax rate for the two groups of income earners in each country from the start to the end of our data period. There have been some fairly large tax changes over time in some of the countries. For the top group especially, tax rates have typically been rising over time.[15] Figure 6 plots the distribution of annual changes in individual average tax rates within countries, which is the type of variation one would use in a specification with annual data with country fixed effects. There have been some tax changes, also some fairly sizeable ones, though there is also a considerable concentration around zero or small changes.

4 Macro analysis

This section examines macro-level trends in migration flows between Finland and destination countries. These trends are macro in the sense that the analysis is conducted at an aggregate group level: comparing migrants from the 10% of income distribution and migrants from the bottom 90% of the income distribution. The macro flows are interesting since they reveal whether there are general patterns among the groups that would suggest responses to taxes. They also offer a concise way of capturing both out-migration and return migration. Previous research in the area has also showed similar, stylized, country-level flows.

We estimate a discrete multinomial choice model of the following type:

$$\begin{aligned} ln\left(\frac{N_{f,t}}{N_{d,t}}\right) &= \beta\left[ln\left(1-T(Y)_{f,t}\right) - ln\left(1-T(Y)_{d,t}\right)\right] \\ &+ \gamma\left[lnY_{f,t} - lnY_{d,t}\right] + \delta_f + \delta_t + \varepsilon_{f,t}. \end{aligned} \tag{5}$$

The details of this analysis are described in Appendix B. We carry out the estimations separately for the top decile and the bottom 90%. Above, subscript d refers to domestic

[15] This tendency is more pronounced after the financial crisis of 2008.

country (always Finland) and f to a foreign destination. $\frac{N_{f,t}}{N_{d,t}}$ is the ratio between Finns in a particular group (top or bottom) residing in foreign country f in year t relative to those remaining in Finland. The log of this ratio is regressed on the log difference in the net-of-tax rate (i.e. 1 - the average tax rate) between the destination country and Finland, $[ln\,(1-T(Y)_{f,t}) - ln\,(1-T(Y)_{d,t})]$, and on the difference in gross earnings, $lnY_{f,t} - lnY_{d,t}$. In addition, the specification is run with or without country and year fixed effects. In some specifications, time-varying controls (GDP and the unemployment rate in the destination country) are added to the model.[16] Note that these ratios depict the stocks of Finns in various countries, thereby incorporating both emigration and return migration flows.

We present the evidence from these regressions in a visual format. Before that, Figures 7 and 8 offer cross plots between the log share of Finns abroad relative to Finland and the difference in the net-of-tax rate[17]. The different colours refer to different destination countries each year. There does not appear to be any clear pattern between the two, which reflects the fact that there are popular destination countries among low- and high-tax countries.

Figure 9 provides a bin scatter of the residuals from regressions where the dependent variable of Equation (5) is regressed on country and year dummies. The relation illustrates the partial correlation between the share of Finns in a destination and the net-of-tax rate difference. The correlation is negative for both groups, but for top earners the slope is less negative. However, this analysis appears to rule out a clear positive link for the top group between the destination choice and the net-of-tax rate. This finding reflects the fact that Finns - also top earners - migrate to both high- and low-tax countries. This is in contrast to the results for top inventors in Akcigit et al. (2016), where a similar analysis revealed a positive and significant link between the migration choices of top inventors and the net-of-tax rate (see Akcigit et al. (2016), Figure 4).[18]

We also ran a regression corresponding to Equation 5, but with the log number of migrants in a group to a destination country as the dependent variable. This analysis is informative on the link between taxes and destination choices, conditional on moving. The results from this regression with fixed effects are plotted in Figure A6 and A7. Again, we note that there is no positive link between the destination choices and the net-of-tax rate for top-income migrants. Somewhat surprisingly, for the bottom migrants the correlation is positive, albeit not statistically significant. Similar results

[16]Since there are cases with very few migrants, we also run versions where countries to which there are fewer than 5 migrants in a given year are dropped.

[17]Both of these analyses are repeated by replacing the net-of tax rate with the difference in earnings in Appendix C.

[18]Adding destination country controls does not alter this result, see the additional chart in Figure A4 of Appendix C.

are found in the case of earnings differences, but the results are imprecise.

Event analysis

Earlier papers in the area of tax and migration have used events where certain countries have made large changes to their tax treatment. The adoption of special tax regimes for foreigners could provide a fruitful setting for an event analysis. Six countries introduced a special tax regime for foreigners during the time we have the data for Finnish migrants: France 2004, Italy 2011, Portugal 2009, Spain 2005, Sweden in 2001, and The Netherlands in 2012 (Kleven et al. (2020), Table 2). In the Italian, Portuguese and the Spanish cases, there are too few observations (sometimes as few as one top-10 mover from Finland) for a meaningful analysis. Also in the case of the French and Dutch reforms, there are only approximately ten top-10 migrants with now signs of an increase after the reform.[19]

In the Swedish case, 25% of the income of those earning more than 8,600 € or other key personnel became tax-free in 2001. Sweden also repealed its inheritance tax in 2004 and its wealth tax in 2007. Although the latter two reforms are not related to the taxation of labour incomes, there has been public discussion about the threat of some very wealthy individuals moving to Sweden because Finland still levies taxes on inheritances. The event analysis is complicated due to the fact that Finland also stopped taxing wealth around the same time, in 2005. Nonetheless, we examine migration flows to Sweden (the raw numbers are depicted in Figure 10) and also estimate event-type regressions, where the dependent variable is whether a person moves to Sweden and the independent variables include a dummy for belonging to the top decile, year dummies, and interaction between year dummies and the top decile indicator. These coefficients with their confidence intervals are reported in Figure 11. Neither the raw migrant numbers nor the event analysis indicate that high-income Finns started to move more often to Sweden in the years following the tax changes.[20]

5 Individual-level analysis

5.1 Econometric approach

Building on the theory background, an empirical counterpart of Equation (1) is

$$U_{i,t}^{c} = \beta ln\left(1-\tau_{i,t}^{c}\right) + \theta ln\left(w_{i.t}^{c}\right) + \alpha_i + \gamma_c + \delta_t + \zeta x_{c,t} + \eta y_t \gamma_c + \varepsilon_{i,t}^{c}, \tag{6}$$

[19] Results pertaining to emigration to these countries available upon request.

[20] The coefficient for the top group is statistically significant for 2001, but there are other statistically significant coefficients for years with no tax changes.

where α_i depicts individual fixed effects, γ_c country fixed effects, δ_t year fixed effects, $x_{c,t}$ other possible country-level time-varying controls and $\varepsilon^c_{i,t}$ is the error term. In addition, the model also contains country-wise linear year trends. These are denoted by $y_t\gamma_c$.

Following the empirical approach of Agrawal & Foremny (2019), we estimate the model as a linear probability model, where the dependent variable ($m_{c,i,t}$) is whether an individual i chooses to locate in a country c in year t. If they do, the variable is one and zero for all other cases. This variable replaces the left-hand side in Equation (6). One of the countries included in the choice set is Finland, i.e. the analysis is carried out using the data covering both movers and stayers.[21]

We modify the estimation equation by always including person-year dummies, $\alpha_{i,t}$. In other words, α_i is replaced by $\alpha_{i,t}$ and δ_t is dropped. The inclusion of the new dummies implies that we identify the effects of net-of-tax rates and gross earnings from variation in these variables between countries within a given year. Including these dummies also makes sure that despite the possibility that the estimated probability to locate in a single country may not lie between zero and one, the estimated probabilities sum up to unity for each individual-year observation.[22] Since these dummies capture all individual characteristics that are constant for the person in a given year, we do not include demographic controls like age, gender, or family status. However, country dummies can be included to control for permanent differences between countries.

The main identification strategy is, therefore, one where the impact of taxes on migration is identified from a model including country fixed effects, person-time fixed effects, countrywise trends, and country-level time-varying controls. This model corresponds to an estimation equation given by

$$m_{c,i,t} = \beta ln\left(1-\tau^c_{i,t}\right) + \theta ln\left(w^c_{i.t}\right) + \gamma_c + \alpha_{i,t} + \eta y_t\gamma_c + \zeta x_{c,t} + \varepsilon^c_{i,t}, \tag{7}$$

An alternative identification strategy is one where time-varying country-level controls and country dummies are replaced with country*year fixed effects, denoted by $\gamma_{c,t}$. This alternative yields an estimation equation given by

$$m_{c,i,t} = \beta ln\left(1-\tau^c_{i,t}\right) + \theta ln\left(w^c_{i.t}\right) + \gamma_{c,t} + \alpha_{i,t} + \varepsilon^c_{i,t}, \tag{8}$$

The two approaches in Equations (7) and (8) correspond to Identifications 1 and 2 in Akcigit et al. (2016), used in that paper as the main approaches to estimate the impact of taxes on the location decisions of inventors.

It is, however, not entirely clear whether including country fixed effects is always desirable. On the one hand, having them in the model takes into account such moving

[21] The analysis is also conducted for a sample consisting of movers only.

[22] For details, see Agrawal & Foremny (2019), footnote 20.

considerations that are related to, for example, the distance between a destination country and Finland and the language used in the destination. On the other hand, if moving decisions depend on more permanent differences in the tax rates across countries, those considerations are neglected if permanent differences are controlled for. For completeness, we also report results from a model without country dummies.

The coefficients of interest, β and also θ, are not elasticities. Instead, these coefficients measure the impact of a 1% change in the net-of-tax rate and gross earnings on the probability of moving to a destination or staying in Finland. The coefficients need to be divided by the migration probability to arrive at an elasticity of migration. Note that the probability of staying in Finland is close to unity for all groups, and hence the regression coefficient is very close to the domestic elasticity of staying in Finland when the net-of-tax rate and gross earnings in Finland change.

The model is estimated for all individuals in the estimation sample and for various groups, including the top decile in the income distribution. In addition, subgroup analyses are conducted for several groups that may differ in their degree of mobility: gender, language (Finnish vs. other), family status (singles vs. others) and different occupational sectors. The subgroup analysis is also conducted first for the whole sample and then separately for the top earners. The whole population analysis uses, again, a sample of remainers and all movers, whereas the top group analysis includes all remainers and movers in that group.

5.2 Results

Main results

Tables 2, 3 and 4 report the results for all individuals in the sample, those belonging to the top 10% of income earners, as well as the bottom 90% of income earners. In Columns (1) to (6) in each table, the main focus is on the log net-of-tax rate but all these models also include the log of gross earnings. What should matter most for people is the net earnings level, but it is useful to proceed with a more flexible approach allowing for different coefficients for the net-of-tax rate and gross earnings. Models (1) to (6) all include the person-year dummies. Model (2) adds a home country fixed effect, whereas Models (3) to (5) add country fixed effects. Model (4) contains, in addition, time-varying macro controls and Model (5) adds country*linear year trends. In Column (6), we replace all the above with country*year fixed effects. Models (5) and (6) correspond, therefore, to the main identification strategies in Equations (7) and (8) spelled out above. The subgroup analyses are carried out using Model (4) as the sample sizes are smaller and a more parsimonious approach is valuable.

The results suggest that without country fixed effects, the coefficient of the log net-of-tax rate is negative, probably because most people choose to locate in high-tax

countries, including Finland. When the home country fixed effect is added, the effect is still negative but very close to zero. With a full set of country fixed effects, the impact of the net-of-tax rate on migration is positive and highly significant, but the magnitude is very small. Adding more controls, or replacing the added controls with country*year fixed effects, does not change this finding. The pattern in the results is the same in the separate analyses for the top decile and the rest of the population. However, those in the top decile appear to be somewhat more responsive to the net-of-tax rate, but the absolute impact remains small.

The domestic elasticity, i.e. the elasticity of the probability of locating in Finland when the home country net-of-tax rate changes, can be obtained by dividing the obtained regression coefficient by the probability of staying in Finland. These probabilities amount to 0.997 for the top 10 and 0.999 for the bottom 90, and hence the regression coefficient and the elasticity are almost equal. The main finding is that the impact of taxes on the probability of moving out of the home country is minimal.

The foreign elasticity, that is, the elasticity of the probability of Finns locating in a foreign country when the foreign country net-of-tax rate changes, is calculated as a weighted average of country-specific foreign elasticities. The obtained foreign elasticity is higher than the domestic elasticity which is in line with the previous literature. In addition, the foreign elasticity is higher for the top earners. However, the foreign elasticity is still rather small even for the top earners, approximately 0.15.

The results of the subgroup analyses are reported in Figures 12, 13 and 14. In all these figures, panel A shows the results for the whole sample and panel B shows the results for the top 10 earners. What stands out in Figure 12, Panel A, is the higher coefficient for the Swedish-speaking Finns. This effect is also seen for the top earners in Panel B. However, the standard errors are quite large for this smaller group. While the effect is larger for this subgroup, the magnitude again remains small. One of the subgroups consists of Finnish citizens only, and for this group, the estimate is the same as for all, which is natural since there are not many foreigners.

The results for different sectors in Figure 13 do not show evidence of individuals in some sectors being significantly more mobile than in others. The point estimates for finance are larger, but the confidence bands are wide. The result holds for the whole sample in Panel A and for the top earners in Panel B. Not much can be said about education fields either in Figure 14. The least mobile field for the whole sample is services and the largest point estimates are for natural sciences and humanities. Nevertheless, the confidence intervals overlap for most of the coefficients. Most of the estimates for the top group are not statistically significantly different from zero. Exceptions include engineering as well as humanities and social sciences, but the point estimates remain small for these groups, too.

It is also of interest to know whether the reactions in the top 10 group are different for those at the upper end of the group. This question is addressed by the analysis reported in Tables 5 and 6. The models there include interaction terms for the take-home rate and an indicator of whether the person's income is in the top 5 or top 1 group. The results indicate that the responses for the top earners are, indeed, concentrated in the top 10 group. The coefficient for the top 1 group increases from 0.0004 (Column 6 of Table 3) to 0.001 (the same Column of Table 6). This supports the notion that the top 1 earners are more mobile than others in the top 10 group, but for both the link between taxation and migration is weak in economic terms.

Additional results

It is useful to consider the implications of the role of different earnings prediction methods. For this purpose, Tables (A1)-(A3) in Appendix D report regression results when using earnings predictions based on LIS data but for the subsample of countries for which we also have SILC data. The results are quite similar to the main results described above; the main change is that the elasticities for the top 10 group appear to be lower for the SILC countries. Tables (A4) to (A6) report, in turn, the results for the same sample using earnings calculated on the basis of the percentiles in EU-SILC. The results for the population as a whole remain very similar, but the estimate for the top group in Column (6) of Table (A2) is almost three times greater than the corresponding estimate in Table (3). A possible reason for this could be that the tax rate is higher for many of the destinations when using income percentiles rather than for earnings levels stemming from the Mincerian earnings regressions. This reduces the net-of-tax differences between these destination countries and Finland, which works towards increasing the coefficient estimate. However, its magnitude is still very small, approximately 0.0015. This discussion suggests that changing the earnings prediction method does not drive the conclusions that can be made on the basis of the results.

One related worry is that since the tax rates in destination countries are calculated on the basis of earnings predictions, they may contain measurement error. This may lead to attenuation bias, in other words the coefficients of the take-home rate could be artificially low. To explore how severe this matter is, we also use an IV approach, where the take-home rate, calculated using an average tax rate, is instrumented by (1 - marginal tax rate), where the marginal tax rate is the rate at a given income level. Since the marginal tax rate is constant across an income band, it is arguably less susceptible to measurement errors.

The results from these IV regressions are presented in Tables A8 and A10 for the whole sample and for the top 10 income earners, respectively. The first thing to note is that the null hypothesis according to which the first stage would be underidentified

is clearly rejected based on the Kleibergen-Paap test, and the first-stage F test also indicates that the instruments are strong. The coefficients for the take-home rate are barely affected for the population as a whole, whereas they increase somewhat for the top 10 group. This can be seen by comparing the coefficient of Column 6 between Tables 3 and A10, which rises from 0.0004 to 0.0015.[23]

5.3 Return migration

In the analysis above, we defined a person as an emigrant if they stay abroad for more than a year. Obviously, from the point of view of the sending country, it matters a great deal whether the migrants stay abroad more permanently or whether they return fairly rapidly after the first year abroad. This section therefore examines whether the return migration patterns of Finns are related to tax rates.

Annual migration flows are depicted in Figure 15[24]. The number of emigration events always exceeds return migration of Finnish citizens, but the difference is much larger for those in the bottom 90% of the income distribution. The net loss of this group also seems to increase towards the end of the analysis period. The annual net outflow of the top 10 population is only around 50 persons a year. Figure 16 provides information about the shares of Finnish emigrants who have stayed in their destination country for more than five years. As before, the countries are ordered by the average tax rate for the group, with high-tax countries at the bottom. Migrants do not appear to stay longer in lower-tax countries.[25]

We now turn to the actual regression analysis related to return migration. While we do not have access to the full population of Finns residing in foreign countries, we can capture a large part of the risk group since we have annual data on emigration at the individual level starting from 1997. We can also observe, starting from the same year, those returning to Finland and the country that they come from. We can therefore calculate stocks of Finns in different foreign countries for the period of our analysis (2003 onward), which capture – given that few migrants stay abroad for a long period (Figure 16) – a very large share of those Finns staying in country c who could move back to Finland in year t.[26]

[23]We also estimated the analysis corresponding to that in Table 7 using IV. The instrument for disposable income is constructed using (1-marginal tax rate) times gross earnings. The results confirm the qualitative pattern from the linear probability model estimated using OLS: The coefficient (estimated to be 0.030 in the model with country*year fixed effects) for the top 1% exceeds the average among the top 10 (0.010), and the the coefficient for the top per mille (0.038) is again greater. The estimates are larger than those in Table 7. These results are available by request.

[24]The same problem with missing occupation and industry variables for the year 2003 is also present in this figure.

[25]The high share of long-term migrants in some countries is due to a small number of Finns residing in these countries, some of whom choose to stay abroad for a long time.

[26]Admittedly, we cannot observe whether individuals who stay abroad move to another foreign

For this sample we run regressions similar to the estimation equations in (7) and (8), but now the dependent variable is whether the person chooses to stay in a foreign country or move back to Finland. Again, we use predicted earnings levels[27] at the individual level and average tax rates calculated using the predicted earnings levels. This is done for two countries, the country where the individual currently resides and Finland.

The results are reported in Tables 9, 10 and 11 for the whole sample as well as the top 10 and the bottom 90 groups. The columns correspond to the same specifications as those that were used above for the analysis of emigration. These results are much more volatile with respect to the chosen specification, probably because of the much smaller sample size. In the preferred specification, there is no support – in fact the opposite holds – that return migration is related to the net-of-tax rate for any of the groups examined. This also means that the net elasticity derived in Equation (2) is in fact lower than the elasticity of staying in the home country.

Quite why this result emerges is unclear; one hypothesis is that many Finns choose to come back despite the high tax rate at home. This could be the case, for instance, for those who work for a subsidiary of a Finnish company abroad for a fixed period. One additional explanation could be that special tax reforms aimed at foreign specialists are usually in force for a fixed period only. After the preferential tax scheme has ended, the incentives for staying in the destination country relative to returning to the home country worsen; this type of a tax rate change will not be captured in our data as we do not allow for individual-specific tax rates contingent on the length of stay abroad.

The fact that many individuals return makes brain drain concerns related to out-migration less pronounced. In addition, it does not seem to be the case that return migration is deterred by the high tax rate in the home country. Of course, a separate issue, and one that would be an interesting topic for further research, is how much people gain from migration also in terms of greater earnings and the associated tax revenue impacts when they return.

6 Policy implications

In this Section, we discuss the implications of our findings for tax policy. As we find small migration elasticities for a wide range of different income and occupational groups, concerns about migration do not appear to provide a reason to reconsider tax policy lessons in general. In this regard, our results are well in line with earlier empirical literature, surveyed in Kleven et al. (2020); Muñoz (2020) finds slightly

country, but this restriction arguably only affects a small group of people.

[27]Notice that now we are using covariates from the year of emigration as we cannot observe their characteristics after leaving Finland.

higher but still modest migration elasticities.

Nevertheless, top income taxes warrant a separate and more detailed analysis. We provide two types of analyses. First, we consider a piece-wise linear income tax schedule, and use our empirical results together with the theoretical formulae provided by Brewer et al. (2010) and Piketty & Saez (2013) to analyze the implications for setting the top tax rate. Second, we provide a first empirical implementation of the theoretical results of Lehmann et al. (2014), who show that the optimal shape of the income tax schedule at the top depends on the gradient of the semi-elasticity of migration, as discussed in subsection 2.2. Previous empirical evidence on the relevant parameters for this type of analysis do not exist; indeed, it is a tremendous empirical challenge to estimate the relevant parameters for very top earners. With full-population data on migration, we are able to estimate the relevant elasticity and semi-elasticity up to the top per mille of income earners, and derive (under certain assumptions that we discuss below) the policy implications from this approach.

Turning to the first approach, i.e. considering the tax rate in the top bracket of a piece-wise linear income tax schedule, the relevant elasticity for this calculation is reported in Columns (5) and (6) in Table 6. The results indicate an elasticity of 0.001 for the top 1% of income earners. Given the discussion that this could be downwards-biased due to possible measurement error, one could also consider, for example, an elasticity twice as high, 0.002. Even this greater elasticity would imply a very small adjustment to the revenue-maximizing top tax rate, given by Equation 3. With a Pareto parameter a equal to 2 and an elasticity of taxable income e of 0.25, the revenue-maximizing top tax rate would amount to 66.7% without migration concerns. This would decline only marginally to 66.6% with a migration elasticity of 0.002. The effect of migration responses on the revenue-maximizing top tax rate is therefore negligible.

The second approach, however, indicates that if a more flexible functional form for the tax schedule at the top is used, we need knowledge about the shape of the semi-elasticity of migration at the top. That is why we proceed by estimating the reaction to disposable income (or consumption possibilities)

$$m_{c,i,t} = \beta c^c_{i,t} + \gamma_c + \alpha_{i,t} + \eta y_t \gamma_c + \zeta x_{c,t} + \varepsilon^c_{i,t}, \tag{9}$$

where c indicates disposable income, equal to one minus the tax rate times earnings. This equation corresponds to Identification 1 (i.e. Eq. 7). The corresponding change is made to Equation (8). The results of these regressions are reported in Table 7.

The estimations, conducted for the top 10 group, include interaction terms of the consumption term and whether the person belongs to the top per cent or top per mille of income earners. The results indicate that the consumption term and its

interactions are statistically significant and increasing in size. In these results, the coefficient for consumption is somewhat higher when only the Finland fixed effect is added, suggesting that longer run tax differences may have a stronger link with migration choices.[28]

The implications for the domestic semi-elasticity – which can be obtained by dividing the coefficient by the share of population in the home country – are depicted in Table 8. The semi-elasticities are expressed as an increase in income of 100,000 € in the home country, and they are very small. Therefore, this exercise points to a similar conclusion as above: migration concerns are inconsequential for tax policy, at least up to the top per mille of income earners.

Due to data reasons, it is clear that obtaining reliable estimates of semi-elasticities for higher-income groups is not possible. (Indeed, no paper will be able to estimate an elasticity for the top earner.) To derive policy implications for top taxes on the richest individuals, further assumptions need to be imposed. Using a linear extrapolation for higher incomes on the basis of the semi-elasticity for the top per cent and the top per mille indicates that the semi-elasticity is increasing and tends to infinity. If the linear extrapolation were reliable, this would imply that despite the small semi-elasticity, the revenue-maximizing marginal tax rates at the very top would decline.

Given that this is the first paper attempting an empirical implementation of the theoretical results of Lehmann et al. (2014), we find this type of analysis intriguing and important. The analysis points to the possibility that the semi-elasticity of migration may be increasing at the very top of the income distribution, which may call for a reconsideration of policy conclusions at least for this small group of income earners. Several caveats need to be borne in mind. First, the analysis is based on an extrapolation of elasticity estimates for the top per cent and per mille of income earners, with the latter group already involving a small number of emigrants. Second, the linear extrapolation itself can of course be contested. Third, as elasticities are very small at least up to the top per mille, this means that the result of a potentially declining marginal tax rate applies to a very small group of individuals, and one may therefore question its relevance for aggregate tax policy. Nevertheless, the emigration of even a few very rich individuals for tax reasons may have significant revenue consequences. Finally, a further question is whether it would be politically feasible to lower marginal tax rates for the very richest individuals only, keeping taxes almost intact for people with high but not extremely high incomes. To reiterate, if one is constrained to set a constant top tax for the top 1% (or even top per mille), our results indicate that

[28]We also estimated a version where the net-of-tax rate (in levels) and gross earnings enter independently, with interactions. The interaction terms of the net-of-tax rate and top 1 or 0.1% indicators are significant and are larger, the higher up the person is in the income distribution. These results are available on request.

migration responses for this group are very small on average, and do not provide a reason to lower the current top tax rate.

7 Conclusion

While the literature on the impacts of taxation on migration has expanded rapidly, earlier work has mostly focused on special groups, rather than the general population. We set out to fill this gap by examining the impact of taxation on the migration patterns of the general population of workers. This is done in the context of Finland, a Nordic country where the tax-related motives for migration are high in international comparison. We also provide estimates for the income gradient of the semi-elasticity of migration.

We use administrative data covering all Finnish full-time workers and their migration choices. We combine these data with predicted counterfactual earnings and net-of-tax rates in a number of potential destination countries. For each individual-year-observation, we calculate the earnings predictions for a destination on the basis of individual characteristics and coefficients from earnings regressions that use data from the destination country. Information about the tax system in each destination, including special tax treatment of high-income foreigners, is used to calculate the average tax rates that the individuals would face if they were to migrate to a particular destination.

The macro-level results suggest that taxes and migration patterns are not related, whereas a positive and significant impact of the net-of-tax rate on migration is found in the individual-level analysis. However, the migration elasticity with respect to the domestic net-of-tax rate is very close to zero (0.001 or smaller) for the population as a whole or for various subgroups. In line with previous research, the foreign elasticities are much larger, approximately 0.15, with a slightly more muted reaction among those below the top 10% of income earners. Our investigation of return migration decisions at the individual level also indicates that the return migration choices of Finns are not related to tax levels.

We also find, however, that at the very top of the income distribution, the migration elasticity and the semi-elasticity both increase. If this increase holds above the income levels for which estimates can be obtained, this would imply that the revenue-maximizing marginal tax rate would decline at the top. This finding arises despite a very small migration elasticity even for the top 1% or per mille of income earners, and highlights the fact that relying on a low domestic elasticity may lead to misleading implications for setting taxes at the very top. While the potential importance of these considerations has been shown in theory work, ours is the first study to provide – at

least suggestive – evidence of its real-world implications.

Our analysis has concentrated on taxes as a migration determinant of the general population, while controlling for various other factors. There remain features which merit additional work: Our analysis pertained to those who are already in the work force, and examining the migration decisions of university students just at the time of graduation could be interesting. At the top of the distribution, the tax treatment of capital income will probably also matter, and including capital income in the analysis is a relevant avenue for future research. Finally, it is worth noting that tax rates are not the only public policy choice that influences migration patterns. It is likely that the other side of the coin – namely what people gain by paying taxes in terms of public services – also influences their choices, hence mitigating the possible negative impact of taxation.

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Figures

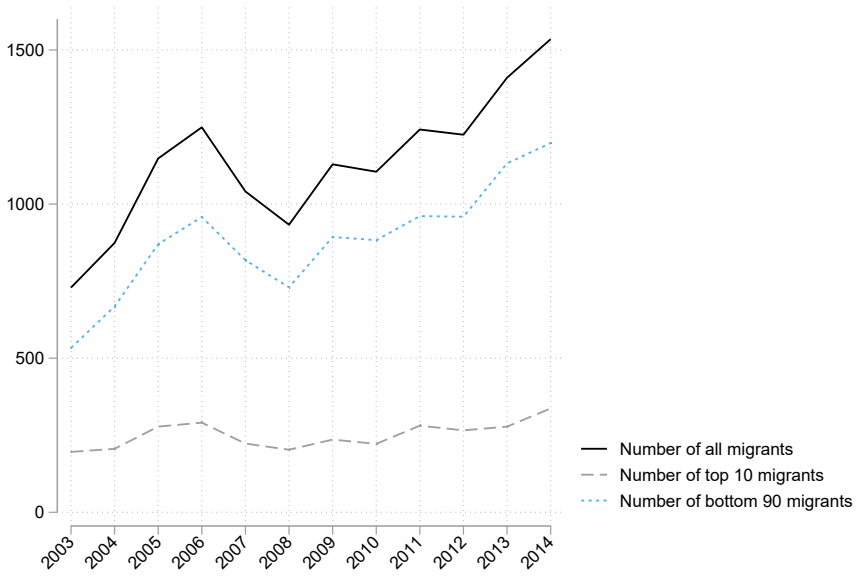


Figure 1: Migration flows from Finland

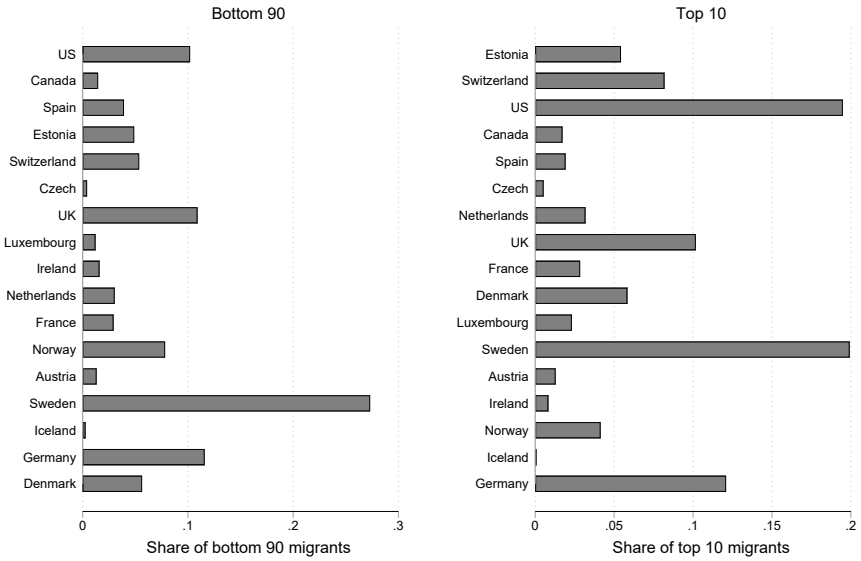


Figure 2: Main destination countries

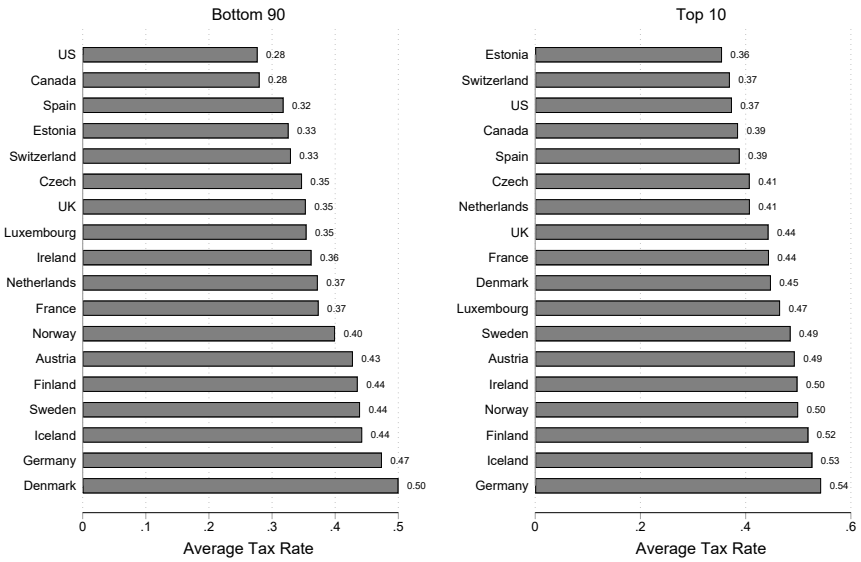


Figure 3: Average tax rates across countries

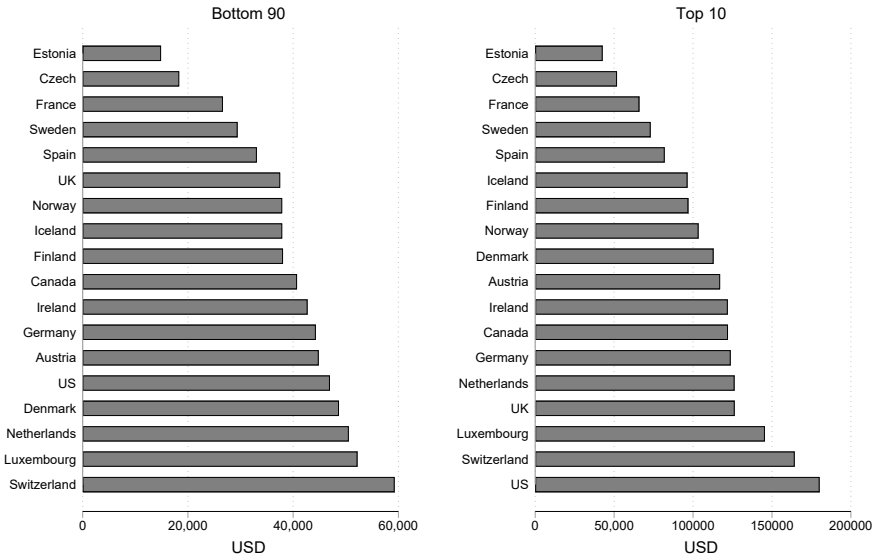


Figure 4: Earnings across countries

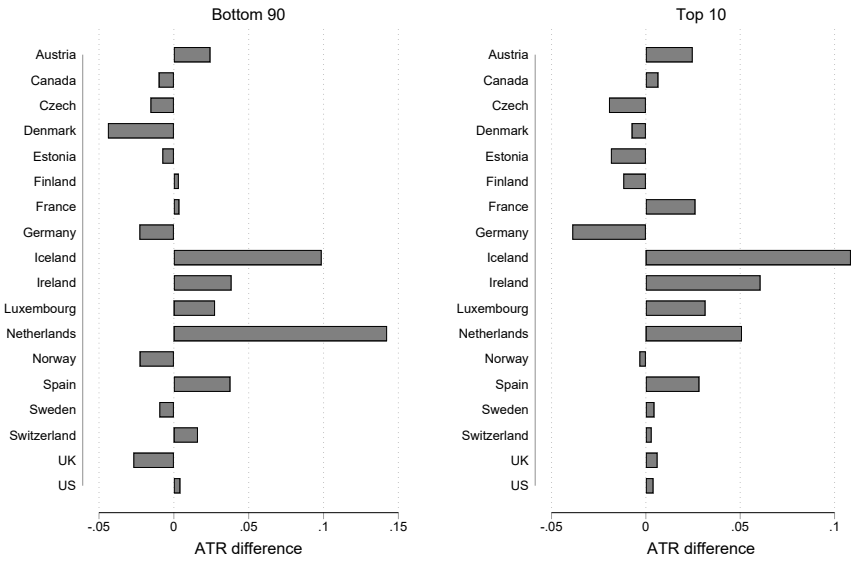


Figure 5: Difference in average tax rates across countries

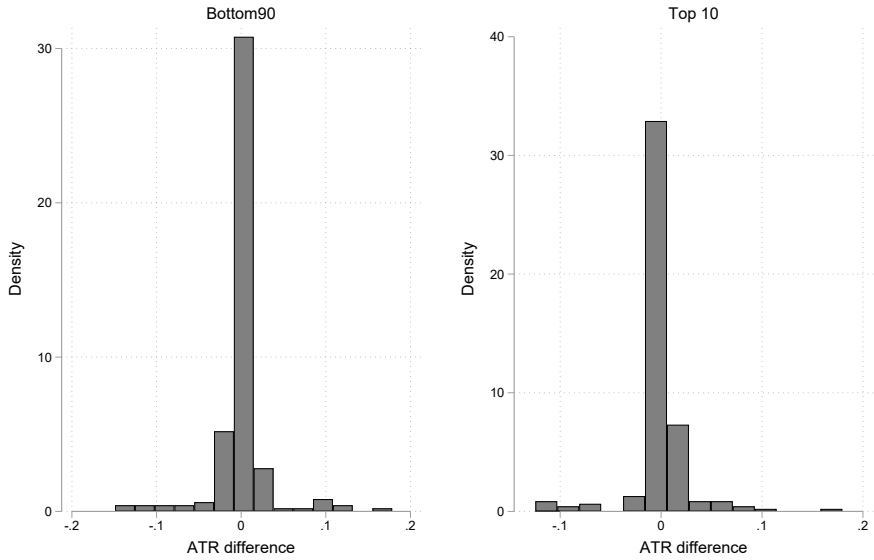


Figure 6: Year-to-year variation by countries in average tax rates

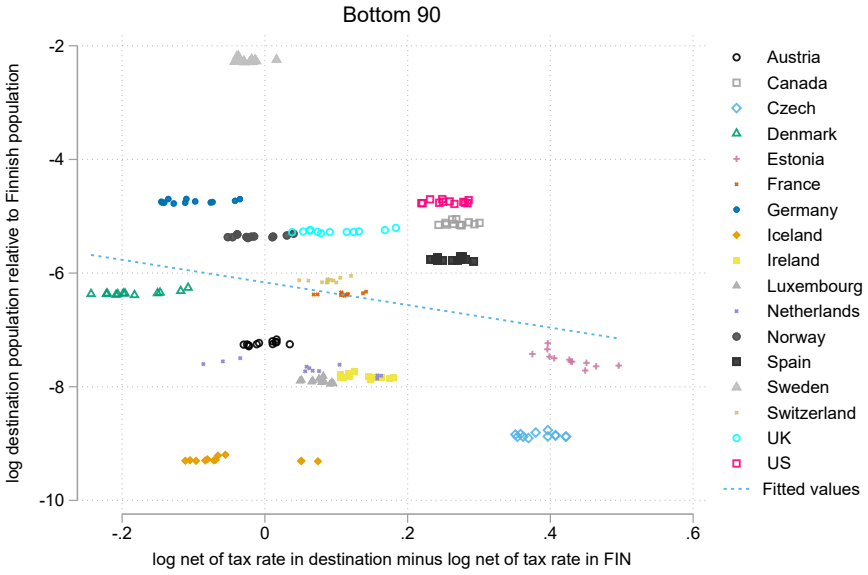


Figure 7: Relation between the differences in (1-ATR) and stock of Finns abroad relative to at home, bottom 90

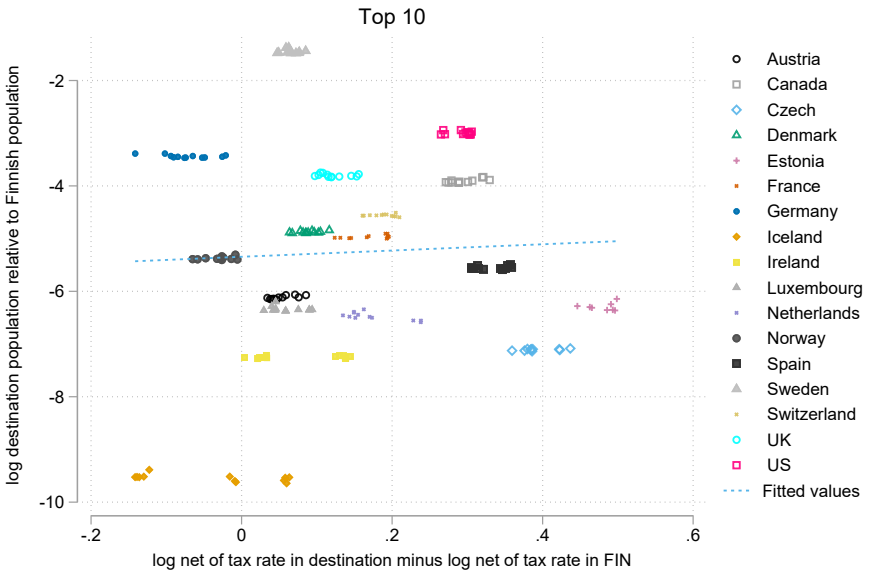
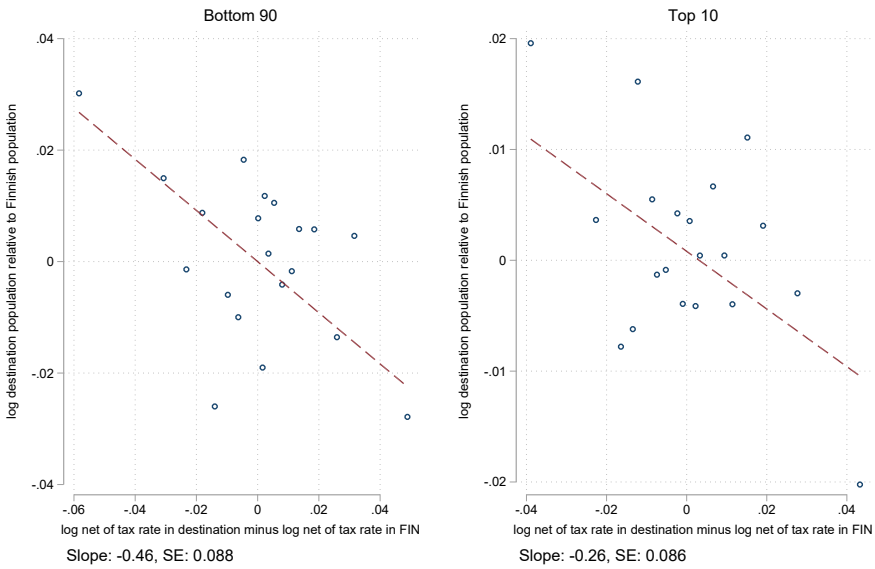


Figure 8: Relation between the differences in (1-ATR) and stock of Finns abroad relative to at home, top 10



Notes: The charts depict binned residuals from a regression where the log ratio of Finns abroad relative to home is regressed on country and time fixed effects.

Figure 9: Relation between the differences in (1-ATR) and stock of Finns abroad relative to at home

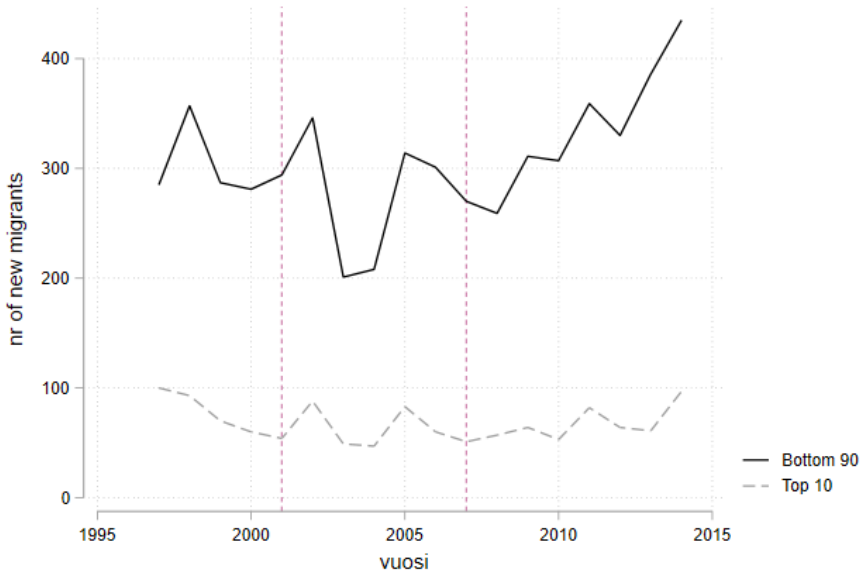
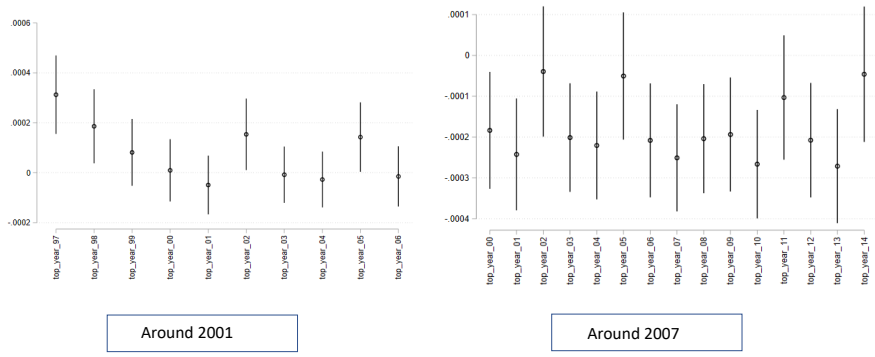
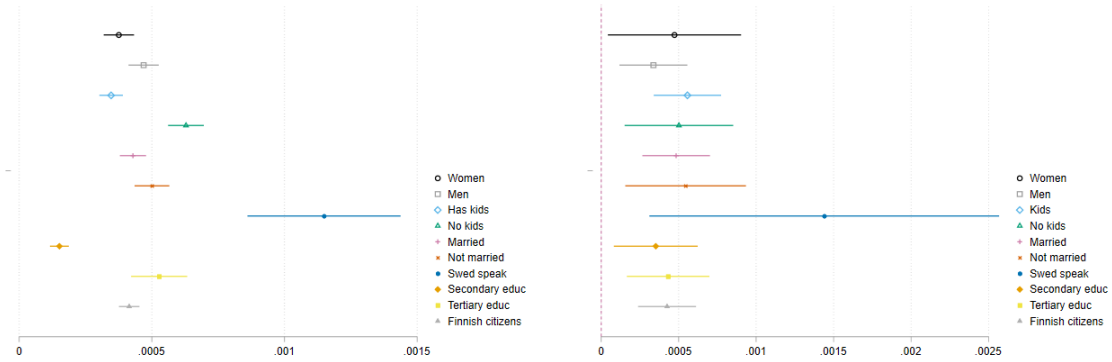


Figure 10: Finnish migrants to Sweden



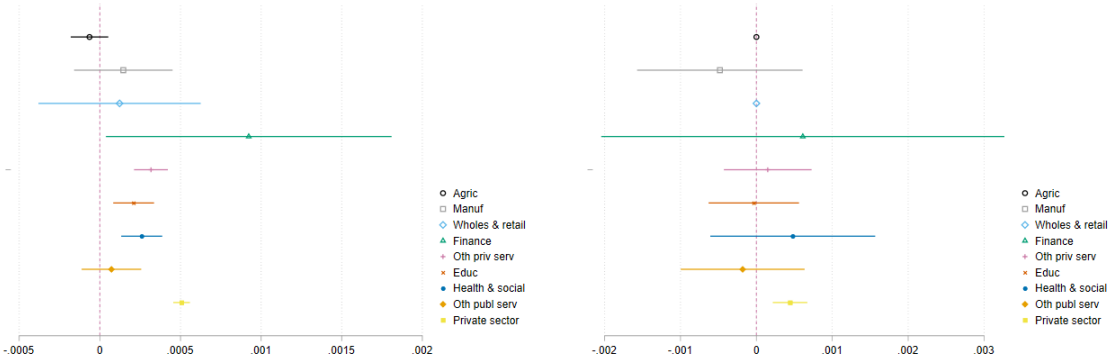
Notes: The charts depicts estimates with 95 per cent confidence intervals from a regression where the dependent variable is whether a person has moved to Sweden and the independent variables are year dummies, a dummy of belonging to the top 10 group and their interactions.

Figure 11: Top10% x year estimates



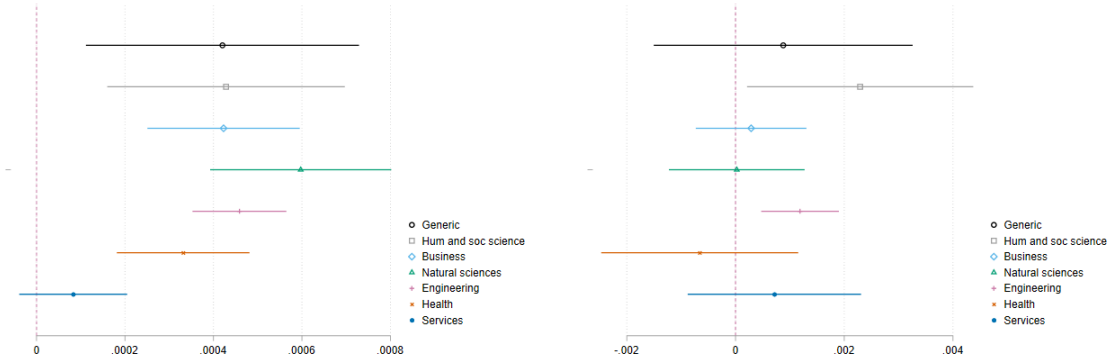
(a) Whole sample **(b)** Top 10%

Figure 12: Subgroup analysis: demographics



(a) Whole sample **(b)** Top 10%

Figure 13: Subgroup analysis: sectors



(a) Whole sample **(b)** Top 10%

Figure 14: Subgroup analysis: education fields

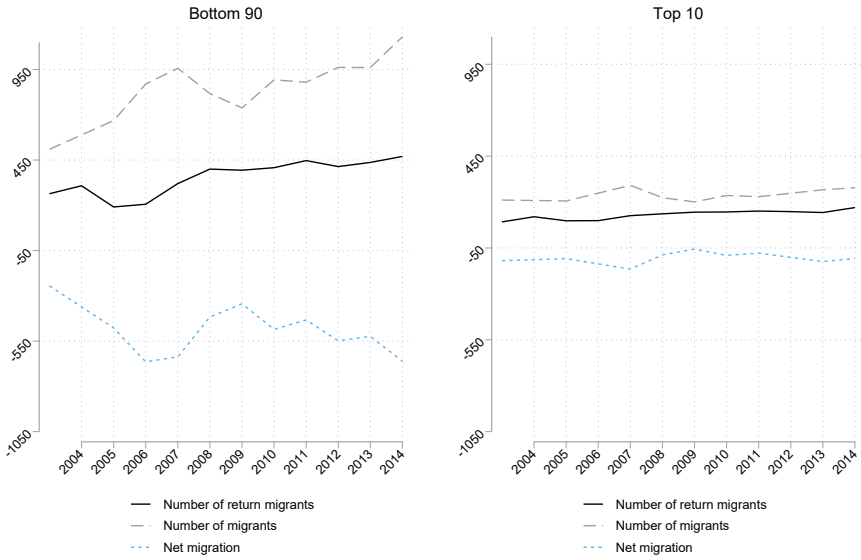


Figure 15: Net migration by income decile

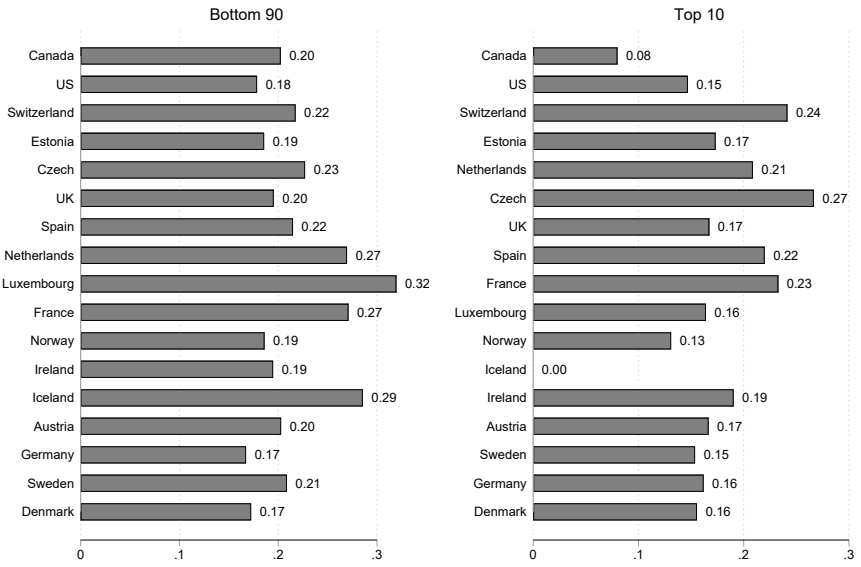


Figure 16: Share of migrants who stay abroad over 5 years

Tables

	(1) Whole population	(2) Full sample: all	(3) 2.5% sample: all	(4) 2.5% sample: stayers	(5) Full sample: migrants
Male	0.50	0.50	0.50	0.50	0.54
	(0.500)	(0.500)	(0.500)	(0.500)	(0.499)
Age	42.57	40.31	40.11	40.31	34.43
	(15.69)	(8.381)	(8.405)	(8.374)	(7.189)
Married	0.45	0.55	0.54	0.55	0.45
	(0.497)	(0.498)	(0.498)	(0.498)	(0.497)
Has children	0.60	0.70	0.70	0.70	0.69
	(0.491)	(0.459)	(0.459)	(0.459)	(0.463)
Number of children	0.86	1.17	1.17	1.18	0.96
	(1.181)	(1.166)	(1.162)	(1.163)	(1.126)
Comprehensive	0.29	0.00	0.00	0.00	0.00
	(0.454)	(0)	(0)	(0)	(0)
Vocational	0.34	0.42	0.42	0.43	0.15
	(0.473)	(0.494)	(0.493)	(0.494)	(0.354)
High School	0.08	0.06	0.06	0.06	0.11
	(0.276)	(0.240)	(0.243)	(0.240)	(0.312)
Lowest Tertiary	0.11	0.19	0.18	0.19	0.08
	(0.318)	(0.389)	(0.386)	(0.389)	(0.269)
Bachelor	0.09	0.16	0.16	0.16	0.23
	(0.284)	(0.366)	(0.368)	(0.366)	(0.419)
Master	0.08	0.15	0.16	0.15	0.38
	(0.271)	(0.361)	(0.368)	(0.361)	(0.485)
PhD	0.01	0.01	0.02	0.01	0.06
	(0.0900)	(0.119)	(0.125)	(0.118)	(0.242)
Earnings	25345.42	37960.39	38243.17	37916.71	47350.73
	(26056.4)	(25905.5)	(25560.3)	(24699.6)	(42122.7)
Migrant	0.00	0.00	0.03	0.00	1.00
	(0.0469)	(0.0347)	(0.183)	(0)	(0)
Observations	46 362 792	14 357 969	371 368	358 517	12 851

mean coefficients; sd in parentheses

Table 1: Descriptive statistics of whole population and the estimation sample.

	(1) decision b/se	(2) decision b/se	(3) decision b/se	(4) decision b/se	(5) decision b/se	(6) decision b/se
Log net-of-tax rate	-0.4225***	-0.0001***	0.0004***	0.0005***	0.0012***	0.0005***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Log earnings	-0.0545***	0.0000***	0.0001***	0.0001***	0.0002***	0.0001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Finland FE	No	Yes	No	No	No	No
Country FE	No	No	Yes	Yes	Yes	No
Country*Year FE	No	No	No	No	No	Yes
Country-trends	No	No	No	No	Yes	No
GDP	No	No	No	Yes	Yes	No
Unemployment rate	No	No	No	Yes	Yes	No
Domestic elasticity	-0.4484	-0.0001	0.0005	0.0005	0.0012	0.0005
Foreign elasticity	-140.6201	-0.0340	0.1456	0.1554	0.3858	0.1563
N	6189714	6189714	6189714	6189714	6189714	6189714
R-squared	0.040	0.998	0.998	0.998	0.998	0.998

The table reports individual-level linear probability model regressions where the outcome is whether the person moves to a particular country. All models include person-year fixed effects. Model (2) adds a home country fixed effect whereas models (3) to (5) add country fixed effects. Model (4) contains, in addition, time-varying macro controls and model (5) country-year linear trends. Base categories for year and country are not included in column (5). In column (6), the covariates in (1) to (5) are replaced with country-year fixed-effects. Individual-year-clustered standard errors are in parenthesis. The analysis uses a 5% random sample of non-migrants and corresponding inverse-probability weights for non-migrants. * p<0.10, ** p<0.05, *** p<0.010.)

Table 2: Individual-level estimates: whole sample

	(1) decision b/se	(2) decision b/se	(3) decision b/se	(4) decision b/se	(5) decision b/se	(6) decision b/se
Log net-of-tax rate	-0.3965***	-0.0000	0.0004***	0.0004***	0.0005***	0.0004***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Log earnings	-0.0554***	0.0001***	0.0000**	0.0000**	0.0000*	0.0001**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Finland FE	No	Yes	No	No	No	No
Country FE	No	No	Yes	Yes	Yes	No
Country*Year FE	No	No	No	No	No	Yes
Country-trends	No	No	No	No	Yes	No
GDP	No	No	No	Yes	Yes	No
Unemployment rate	No	No	No	Yes	Yes	No
Domestic elasticity	-0.4208	-0.0000	0.0004	0.0005	0.0005	0.0004
Foreign elasticity	-147.8018	-0.0010	0.1482	0.1628	0.1726	0.1482
N	25822980	25822980	25822980	25822980	25822980	25822980
R-squared	0.043	0.996	0.996	0.996	0.996	0.996

Notes: The table reports individual-level linear probability model regressions where the outcome is whether the person moves to a particular country. All models include person-year fixed effects. Model (2) adds a home country fixed effect whereas models (3) to (5) add country fixed effects. Model (4) contains, in addition, time-varying macro controls and model (5) country-year linear trends. In column (6), the covariates in (1) to (5) are replaced with country-year fixed-effects. Individual-year-clustered standard errors are in parenthesis. * p<0.10, ** p<0.05, *** p<0.010.

Table 3: Individual-level estimates: annual earnings in the top decile

	(1) decision b/se	(2) decision b/se	(3) decision b/se	(4) decision b/se	(5) decision b/se	(6) decision b/se
Log net-of-tax rate	-0.4258***	-0.0001***	0.0003***	0.0004***	0.0003***	0.0003***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Log earnings	-0.0542***	0.0000***	0.0001***	0.0001***	0.0001***	0.0001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Finland FE	No	Yes	No	No	No	No
Country FE	No	No	Yes	Yes	Yes	No
Country*Year FE	No	No	No	No	No	Yes
Country-trends	No	No	No	No	Yes	No
GDP	No	No	No	Yes	Yes	No
Unemployment rate	No	No	No	Yes	Yes	No
Domestic elasticity	-0.4519	-0.0001	0.0004	0.0004	0.0003	0.0003
Foreign elasticity	-137.7057	-0.0393	0.1085	0.1157	0.1047	0.1025
N	5544324	5544324	5544324	5544324	5544324	5544324
R-squared	0.040	0.998	0.998	0.998	0.998	0.998

Notes: The table reports individual-level linear probability model regressions where the outcome is whether the person moves to a particular country. All models include person-year fixed effects. Model (2) adds a home country fixed effect whereas models (3) to (5) add country fixed effects. Model (4) contains, in addition, time-varying macro controls and model (5) country-year linear trends. In column (6), the covariates in (1) to (5) are replaced with country-year fixed-effects. Individual-year-clustered standard errors are in parenthesis. The analysis uses a 5% random sample of non-migrants and corresponding inverse-probability weights for non-migrants. * p<0.10, ** p<0.05, *** p<0.010.

Table 4: Individual-level estimates: annual earnings below the top decile

	(1) decision b/se	(2) decision b/se	(3) decision b/se	(4) decision b/se	(5) decision b/se	(6) decision b/se
Log net-of-tax rate	-0.3964***	-0.0003***	0.0001	0.0001	0.0000	0.0000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Top 5 % × Log net-of-tax rate	0.0001	0.0005***	0.0005***	0.0005***	0.0005***	0.0005***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Log earnings	-0.0593***	0.0000***	-0.0000	-0.0000	-0.0000	-0.0000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Top 5 % × Log earnings	0.0076***	0.0001***	0.0001***	0.0001***	0.0001***	0.0001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Finland FE	No	Yes	No	No	No	No
Country FE	No	No	Yes	Yes	Yes	No
Country*Year FE	No	No	No	No	No	Yes
Country-trends	No	No	No	No	Yes	No
GDP	No	No	No	Yes	Yes	No
Unemployment rate	No	No	No	Yes	Yes	No
N	25822980	25822980	25822980	25822980	25822980	25822980
R-squared	0.043	0.996	0.996	0.996	0.996	0.996

Notes: The table reports individual-level linear probability model regressions where the outcome is whether the person moves to a particular country. All models include person-year fixed effects. Model (2) adds a home country fixed effect whereas models (3) to (5) add country fixed effects. Model (4) contains, in addition, time-varying macro controls and model (5) country-year linear trends. In column (6), the covariates in (1) to (5) are replaced with country-year fixed-effects. Individual-year-clustered standard errors are in parenthesis. The analysis uses a 5% random sample of non-migrants and corresponding inverse-probability weights for non-migrants. * p<0.10, ** p<0.05, *** p<0.010.

Table 5: Individual-level estimates: annual earnings in the top decile with top 5 % interactions

	(1) decision b/se	(2) decision b/se	(3) decision b/se	(4) decision b/se	(5) decision b/se	(6) decision b/se
Log net-of-tax rate	-0.3962***	-0.0001***	0.0002***	0.0003***	0.0002	0.0002
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Top 1 % × Log net-of-tax rate	-0.0024***	0.0011***	0.0010***	0.0010***	0.0010***	0.0010***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Log earnings	-0.0562***	0.0001***	0.0000	0.0000	0.0000	0.0000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Top 1 % × Log earnings	0.0077***	0.0003***	0.0003***	0.0003***	0.0003***	0.0003***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Finland FE	No	Yes	No	No	No	No
Country FE	No	No	Yes	Yes	Yes	No
Country*Year FE	No	No	No	No	No	Yes
Country-trends	No	No	No	No	Yes	No
GDP	No	No	No	Yes	Yes	No
Unemployment rate	No	No	No	Yes	Yes	No
N	25822980	25822980	25822980	25822980	25822980	25822980
R-squared	0.043	0.996	0.996	0.996	0.996	0.996

Notes: The table reports individual-level linear probability model regressions where the outcome is whether the person moves to a particular country. All models include person-year fixed effects. Model (2) adds a home country fixed effect whereas models (3) to (5) add country fixed effects. Model (4) contains, in addition, time-varying macro controls and model (5) country-year linear trends. In column (6), the covariates in (1) to (5) are replaced with country-year fixed-effects. Individual-year-clustered standard errors are in parenthesis. The analysis uses a 5% random sample of non-migrants and corresponding inverse-probability weights for non-migrants. * p<0.10, ** p<0.05, *** p<0.010.

Table 6: Individual-level estimates: annual earnings in the top decile with top 1 % interactions

	(1) decision b/se	(2) decision b/se	(3) decision b/se	(4) decision b/se	(5) decision b/se	(6) decision b/se
Consumption	-0.2741***	0.0003***	0.0000	0.0000	0.0001*	0.0001*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Top1 ×cons	0.0648***	0.0008***	0.0008***	0.0008***	0.0008***	0.0008***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Top0.1 × cons	0.0275***	0.0012**	0.0012**	0.0012**	0.0012**	0.0012**
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Finland FE	No	Yes	No	No	No	No
Country FE	No	No	Yes	Yes	Yes	No
Country*Year FE	No	No	No	No	No	Yes
Country-trends	No	No	No	No	Yes	No
GDP	No	No	No	Yes	Yes	No
Unemployment rate	No	No	No	Yes	Yes	No
N	25822980	25822980	25822980	25822980	25822980	25822980
R-squared	0.013	0.996	0.996	0.996	0.996	0.996

Notes: The table reports individual-level linear probability model regressions where the outcome is whether the person moves to a particular country. All models include person-year fixed effects. Model (2) adds a home country fixed effect whereas models (3) to (5) add country fixed effects. Model (4) contains, in addition, time-varying macro controls and model (5) country-year linear trends. In column (6), the covariates in (1) to (5) are replaced with country-year fixed-effects. Individual-year-clustered standard errors are in parenthesis. The analysis uses a 5% random sample of non-migrants and corresponding inverse-probability weights for non-migrants. * p<0.10, ** p<0.05, *

Table 7: The response of migration to consumption (=disposable income), in 100,000 euro

Top	Earnings	Coeff	N	Semi-elast, in 100,000 €	Cons	Semi-elast, in €	Elasticity
10	64,755	0.0001	0.9931	0.00010	33,549	1.00697E-09	0.0000
1	112,043	0.0009	0.9928	0.00091	56,149	9.06556E-09	0.0005
0.1	367,400	0.0021	0.9933	0.00211	178,267	2.11414E-08	0.0038
0.01	547,621	0.0030*	0.9933	0.00299*	265,776	2.98638E-08	0.0079
0.001	1,650,000	0.0091*	0.9933	0.00914*	820,248	9.14431E-08	0.0750
max	12,000,000	0.0571*	0.9933	0.05751*	5,400,000	5.71248E-07	3.0847

Notes: The earnings levels are computed directly from the data. The corresponding consumption levels (Cons) are calculated using the tax calculator. The coefficients and the corresponding semi-elasticities are based on estimates until the top 0.1% income level and extrapolated linearly for income levels exceeding 0.1. The extrapolated semi-elasticities are marked with *. The semi-elasticity reported in Column 5 is from estimations where incomes are expressed in hundred thousand euro, and the semi-elasticity in euro is depicted in Column 6. The corresponding elasticity is calculated by multiplying the semi-elasticity with the consumption level.

Table 8: Semi-elasticity at the top of the distribution

	(1) decision b/se	(2) decision b/se	(3) decision b/se	(4) decision b/se	(5) decision b/se	(6) decision b/se
Log net-of-tax rate	2.4504***	0.0087	0.1904***	-0.0679	-0.3062***	-0.3072***
	(0.021)	(0.020)	(0.067)	(0.078)	(0.083)	(0.098)
Log earnings	1.1652***	-0.0097	0.0092	-0.0206	-0.0665***	-0.0599***
	(0.011)	(0.008)	(0.017)	(0.018)	(0.019)	(0.021)
Finland FE	No	Yes	No	No	No	No
Country FE	No	No	Yes	Yes	Yes	No
Country*Year FE	No	No	No	No	No	Yes
Country-trends	No	No	No	No	Yes	No
GDP	No	No	No	Yes	Yes	No
Unemployment rate	No	No	No	Yes	Yes	No
N	119710	119710	119710	119710	119710	119710
r2	0.270	0.648	0.649	0.650	0.651	0.654

Notes: The table reports individual-level linear probability model regressions where the outcome is whether the person stays in their residence country or moves back to Finland. All models include the person-year fixed effects. Model (2) adds a home country fixed effect whereas Models (3) to (5) add country fixed effects. Model (4) contains, in addition, time-varying macro controls and Model (5) adds country*linear year trends. In Column (6), all the above are replaced with country*year fixed effects. Individual year clustered standard errors are in parentheses.*p<0.10 **p<0.05 ***p<0.01.

Table 9: Return migration results for all

	(1) decision b/se	(2) decision b/se	(3) decision b/se	(4) decision b/se	(5) decision b/se	(6) decision b/se
Log net-of-tax rate	2.1484***	0.0542	-0.1806	-0.4171**	-0.5386***	-0.5591**
	(0.039)	(0.039)	(0.165)	(0.186)	(0.204)	(0.245)
Log earnings	0.8957***	-0.0159	-0.0576	-0.0752*	-0.0903*	-0.0840
	(0.024)	(0.017)	(0.041)	(0.043)	(0.046)	(0.052)
Finland FE	No	Yes	No	No	No	No
Country FE	No	No	Yes	Yes	Yes	No
Country*Year FE	No	No	No	No	No	Yes
Country-trends	No	No	No	No	Yes	No
GDP	No	No	No	Yes	Yes	No
Unemployment rate	No	No	No	Yes	Yes	No
N	26516	26516	26516	26516	26516	26516
r2	0.250	0.582	0.582	0.584	0.585	0.592

Notes: The table reports individual-level linear probability model regressions where the outcome is whether the person stays in their residence country or moves back to Finland. All models include the person-year fixed effects. Model (2) adds a home country fixed effect whereas Models (3) to (5) add country fixed effects. Model (4) contains, in addition, time-varying macro controls and Model (5) adds country*linear year trends. In Column (6), all the above are replaced with country*year fixed effects. Individual year clustered standard errors are in parentheses.*p<0.10 **p<0.05 ***p<0.01.

Table 10: Return migration results for the top 10

	(1) decision b/se	(2) decision b/se	(3) decision b/se	(4) decision b/se	(5) decision b/se	(6) decision b/se
Log net-of-tax rate	2.6203***	0.0178	0.3575***	0.1103	-0.1776*	-0.1682
	(0.025)	(0.023)	(0.075)	(0.088)	(0.093)	(0.112)
Log earnings	1.2597***	-0.0048	0.0314*	0.0010	-0.0573***	-0.0509**
	(0.013)	(0.009)	(0.018)	(0.020)	(0.021)	(0.023)
Finland FE	No	Yes	No	No	No	No
Country FE	No	No	Yes	Yes	Yes	No
Country*Year FE	No	No	No	No	No	Yes
Country-trends	No	No	No	No	Yes	No
GDP	No	No	No	Yes	Yes	No
Unemployment rate	No	No	No	Yes	Yes	No
N	93194	93194	93194	93194	93194	93194
r2	0.281	0.668	0.669	0.669	0.671	0.674

Notes: The table reports individual-level linear probability model regressions where the outcome is whether the person stays in their residence country or moves back to Finland. All models include the person-year fixed effects. Model (2) adds a home country fixed effect whereas Models (3) to (5) add country fixed effects. Model (4) contains, in addition, time-varying macro controls and Model (5) adds country*linear year trends. In Column (6), all the above are replaced with country*year fixed effects. Individual year clustered standard errors are in parentheses.*p<0.10 **p<0.05 ***p<0.01.

Table 11: Return migration results for bottom 90 migrants

Appendices

A Earnings Predictions

In the individual-level analysis, to be able to predict earnings for each individual in each possible destination country, we first need to estimate an augmented Mincerian earnings regression:

$$lnw_i = \beta_0 + \beta_1 education_i + \beta_2 X_i + \epsilon_i, \tag{A1}$$

where lnw_i is the logarithm of annual earnings for individual i, $education_i$ is a dummy variable for primary, secondary or tertiary education, X_i is a set of covariates and ϵ_i is the disturbance term of the earnings regression, which includes all the unobservable characteristics. The covariates included are age, age squared, gender, whether married, whether any dependent children, industry[29], occupation[30] and an interaction term[31] between occupation and education. In addition, a year dummy is included for each LIS wave year. Equation A1 is estimated separately for each country using LIS data. The coefficients estimated from Equation A1 are then linked to FLEED data to obtain a prediction of earnings for each individual in each possible destination country.

[29]Industry categories are: agriculture, mining, construction, retail, transport, financial, real estate, public administration, other community. Norway, Canada and Estonia do not have an industry variable available or the information on industry is missing in LIS

[30]The categories are based on the ISCO-10 occupation classification and are: managers, professionals, technicians, clerical, service, agricultural, forestry, craft, plant and machine operators, elementary occupations, and armed forces occupations. Sweden, Norway, Canada and Estonia do not have an occupation variable available or information on occupation is missing in LIS.

[31]If occupation is missing, the interaction term is taken between industry and occupation. If both occupation and industry are missing, there is no interaction term for the country.

B Multinomial macro analysis

Following the same principles as Berry (n.d.), we estimate a multinomial discrete choice model using aggregate data. This model can be derived from an additive random utility framework. Individual i derives utility from staying in country k in year t as follows:

$$U_{ikt} = V_{ikt} + \epsilon_{ikt}, \tag{A2}$$

where V_{ikt} is the part of utility that is observable and ϵ_{ikt} is the unobservable part. We assume that there are no random coefficients and the disturbance term ϵ_{ikt} has a type I extreme value distribution.

There is a natural mapping from individual migration probabilities to macro-level migration shares. This comes from summing up all individual probabilities P_{ikt} of migrating to country k in year t, which results in a share of migrants in country k in year t:

$$\mathbb{E}[N_{kt}] = \sum_i P_{ikt}. \tag{A3}$$

Given our assumptions, the migration shares follow the well-known Logit formula:

$$N_{k,t} = \frac{e^{V_{kt}+\epsilon_{kt}}}{\sum_i e^{V_{it}+\epsilon_{it}}}. \tag{A4}$$

The outside option for migrating to a foreign country is to stay in the home country. Denote next $k = f$ when referring to foreign country and $k = d$ when referring to home country. In addition, specify the observable part of utility to be of the following form:

$$V_{kt} = \beta \left[ln\left(1 - T(Y)_{f,t}\right) - ln\left(1 - T(Y)_{d,t}\right)\right] + \gamma \left[lnY_{f,t} - lnY_{d,t}\right], \tag{A5}$$

where the first term is the difference between the log net-of-tax rates in the foreign and home country and the second term is the difference between log earnings. Taking the logs of Equation A4 (when $k = d$ and $k = f$) and normalizing the utility of the outside option ($k = d$) to zero, we arrive at:

$$ln(N_{d,t}) = -ln(1 + \sum_i e^{V_{it}+\epsilon_{it}}) \tag{A6}$$

and

$$ln(N_{f,t}) = ln(e^{V_{kt}+\epsilon_{kt}}) - ln(1 + \sum_i e^{V_{it}+\epsilon_{it}}). \tag{A7}$$

Subtracting Equation A6 from Equation A7, rearranging and substituting the observ-

able part of utility, V_{kt}, from Equation A5, we arrive at our estimation equation:

$$ln(\frac{N_{f,t}}{N_{d,t}}) = \beta \left[ln\left(1 - T(Y)_{f,t}\right) - ln\left(1 - T(Y)_{d,t}\right)\right] + \gamma \left[lnY_{f,t} - lnY_{d,t}\right] + \epsilon_{f,t}). \quad \text{(A8)}$$

C Additional macro-level analyses

In Section 4 we showed macro-level correlations between the share of Finns in a destination and the net-of-tax rate differences separately for the bottom 90 and top 10 migrants. It could, however, be the case that people react to gross earnings rather than taxes. To explore this possibility, the counterparts of Figures 7 to 9 are shown in Figures A1 to A3. In addition, all the other additional analyses covered in this appendix are also performed by replacing the difference in the net-of-tax rate with the difference in earnings.

In the raw data in Figures A1 and A2, in contrast to Figures 7 and 8, there is some evidence supporting a small positive correlation between earnings and shares of Finns in destination countries.

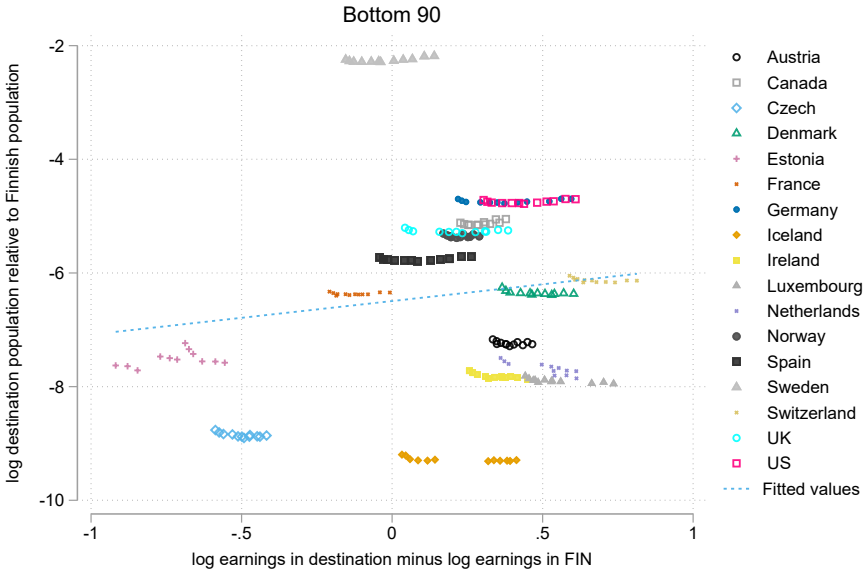


Figure A1: Relation between differences in earnings and stock of Finns abroad relative to at home, bottom 90

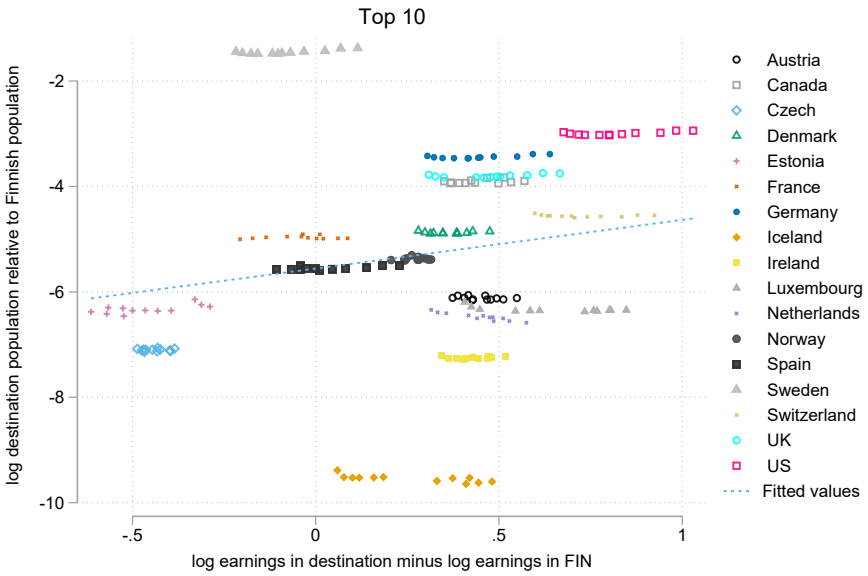
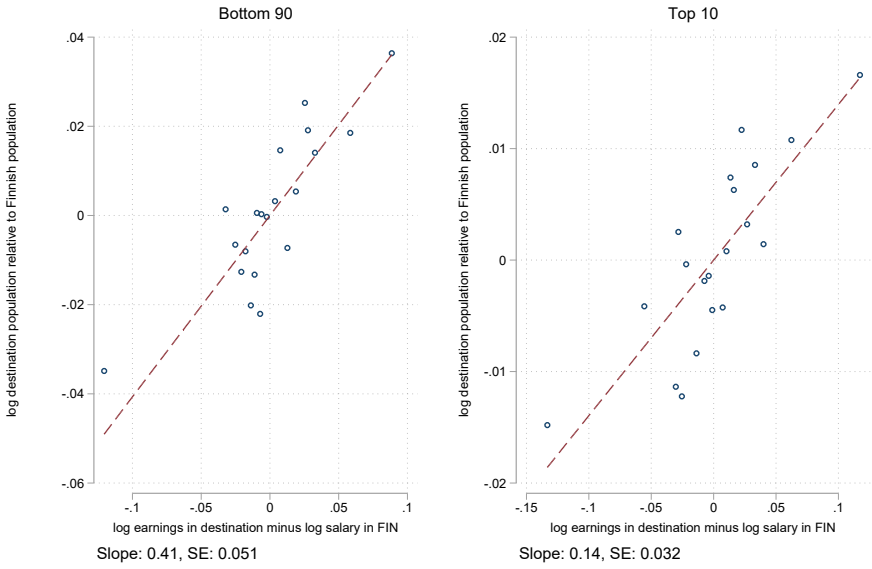


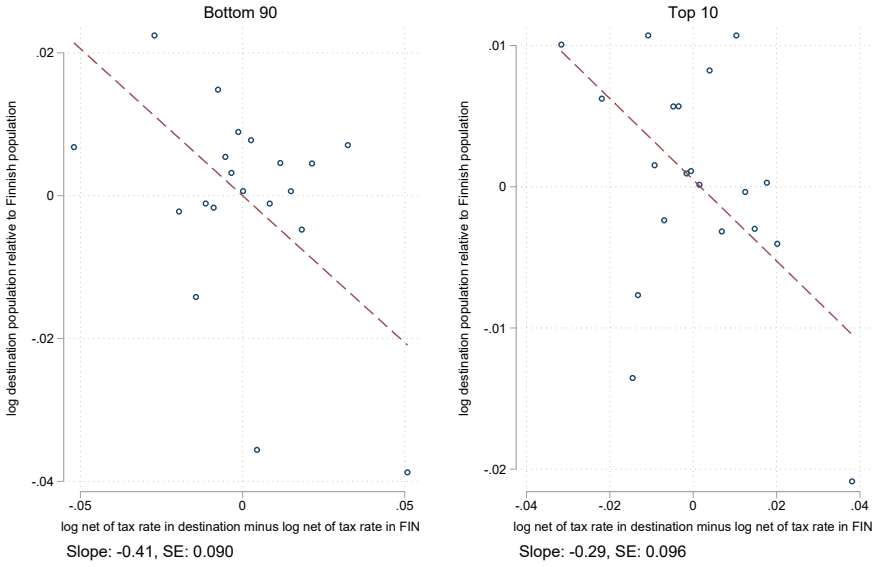
Figure A2: Relation between differences in earnings and stock of Finns abroad relative to at home, top 10

In Figure A3 we run the same analysis as in Figure 9, but the coefficient of interest is now the difference in earnings between the destination and home country. Contrary to the results for the net-of-tax-rate, the correlation is positive for both bottom and top earners. These results suggest that Finns tend to move to countries where their gross salary is higher than in their home country.



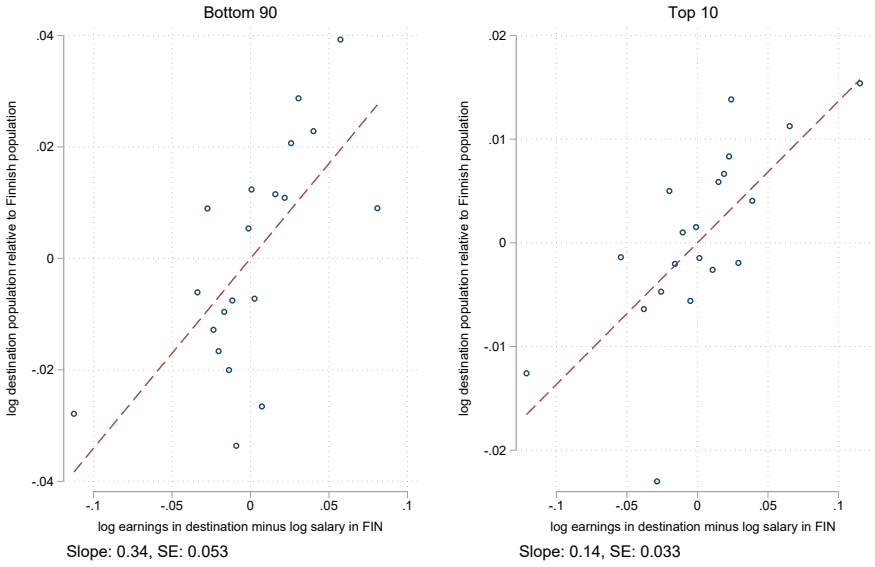
Notes: The charts depict binned residuals from a regression where the log ratio of Finns abroad relative to at home is regressed on country and time fixed effects.

Figure A3: Relation between the differences in earnings and stock of Finns abroad relative to at home



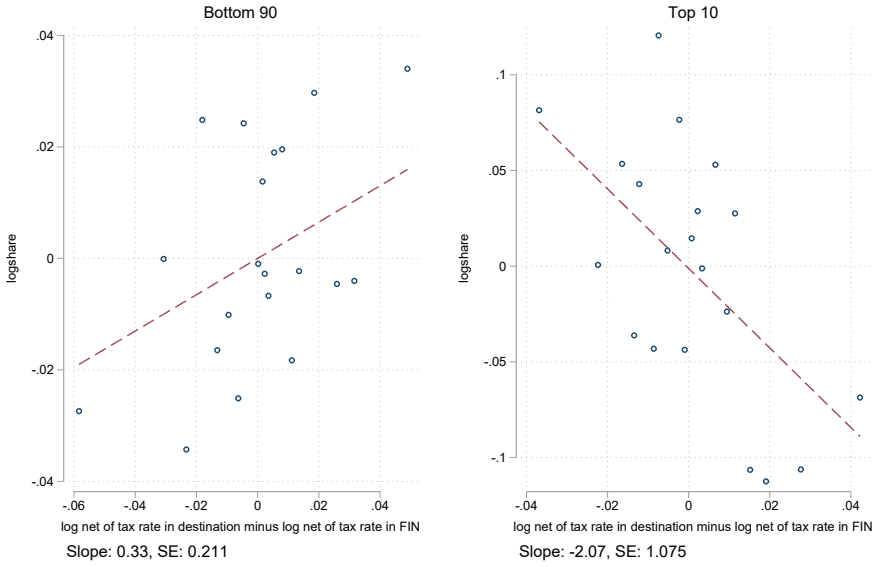
Notes: The charts depict binned residuals from a regression where the log ratio of Finns abroad relative to at home is regressed on country and time fixed effects and country-level controls (GDP and unemployment).

Figure A4: Relation between the differences in (1-ATR) and stock of Finns abroad relative to at home



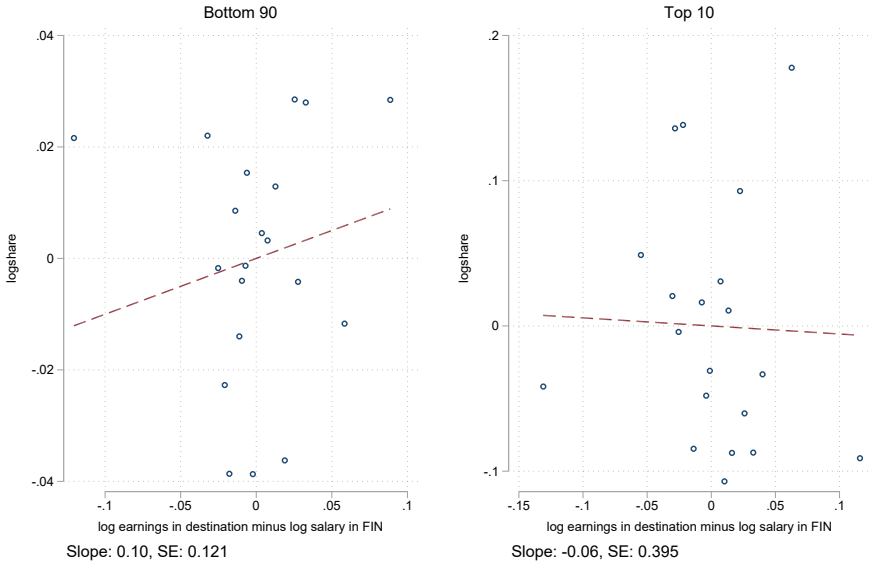
Notes: The charts depict binned residuals from a regression where the log ratio of Finns abroad relative to at home is regressed on country and time fixed effects and country-level controls (GDP and unemployment).

Figure A5: Relation between the differences in earnings and stock of Finns abroad relative to at home



Notes: The charts depict binned residuals from a regression where the log ratio of Finns abroad relative to home is regressed on country and time fixed effects. (Only movers included in estimation).

Figure A6: Relation between the differences in (1-ATR) and stock of Finns abroad relative to at home



Notes: The charts depict binned residuals from a regression where the log ratio of Finns abroad relative to home is regressed on country and time fixed effects. (Only movers included in estimation).

Figure A7: Relation between the differences in earnings and stock of Finns abroad relative to at home

D Additional micro-level analyses

	(1) decision b/se	(2) decision b/se	(3) decision b/se	(4) decision b/se	(5) decision b/se	(6) decision b/se
Log net-of-tax rate	-0.5230***	-0.0002***	0.0004***	0.0004***	0.0004***	0.0004***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Log earnings	-0.0703***	0.0000***	0.0001***	0.0001***	0.0001***	0.0001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Finland FE	No	Yes	No	No	No	No
Country FE	No	No	Yes	Yes	Yes	No
Country*Year FE	No	No	No	No	No	Yes
Country-trends	No	No	No	No	Yes	No
GDP	No	No	No	Yes	Yes	No
Unemployment rate	No	No	No	Yes	Yes	No
Domestic elasticity	-0.5551	-0.0002	0.0004	0.0005	0.0004	0.0004
Foreign elasticity	-162.6159	-0.0622	0.1263	0.1369	0.1271	0.1222
N	5158095	5158095	5158095	5158095	5158095	5158095
R-squared	0.040	0.998	0.998	0.998	0.998	0.998

Notes: The table reports individual-level linear probability model regressions where the outcome is whether the person moves to a particular country. All models include person-year fixed effects. Model (2) adds a home country fixed effect whereas models (3) to (5) add country fixed effects. Model (4) contains, in addition, time-varying macro controls and model (5) country-year linear trends. In column (6), the covariates in (1) to (5) are replaced with country-year fixed-effects. Individual-year-clustered standard errors are in parenthesis. The analysis uses a 5% random sample of non-migrants and corresponding inverse-probability weights for non-migrants. * p<0.10, ** p<0.05, *** p<0.010.

Table A1: Individual-level estimates using LIS for EU-SILC-countries : whole sample

	(1) decision b/se	(2) decision b/se	(3) decision b/se	(4) decision b/se	(5) decision b/se	(6) decision b/se
Log net-of-tax rate	-0.4760***	-0.0003***	0.0004***	0.0004***	0.0004***	0.0003**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Log earnings	-0.0693***	0.0000***	-0.0001**	-0.0000*	-0.0001**	-0.0001**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Finland FE	No	Yes	No	No	No	No
Country FE	No	No	Yes	Yes	Yes	No
Country*Year FE	No	No	No	No	No	Yes
Country-trends	No	No	No	No	Yes	No
GDP	No	No	No	Yes	Yes	No
Unemployment rate	No	No	No	Yes	Yes	No
Domestic elasticity	-0.5052	-0.0003	0.0004	0.0004	0.0004	0.0003
Foreign elasticity	-179.0159	-0.1074	0.1356	0.1573	0.1465	0.1111
N	21519150	21519150	21519150	21519150	21519150	21519150
R-squared	0.043	0.996	0.996	0.996	0.996	0.996

Notes: The table reports individual-level linear probability model regressions where the outcome is whether the person moves to a particular country. All models include person-year fixed effects. Model (2) adds a home country fixed effect whereas models (3) to (5) add country fixed effects. Model (4) contains, in addition, time-varying macro controls and model (5) country-year linear trends. In column (6), the covariates in (1) to (5) are replaced with country-year fixed-effects. Individual-year-clustered standard errors are in parenthesis. * p<0.10, ** p<0.05, *** p<0.010.

Table A2: Individual-level estimates using LIS for EU-SILC-countries: annual earnings in the top decile

	(1) decision b/se	(2) decision b/se	(3) decision b/se	(4) decision b/se	(5) decision b/se	(6) decision b/se
Log net-of-tax rate	-0.5287***	-0.0002***	0.0003***	0.0004***	0.0003***	0.0003***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Log earnings	-0.0702***	0.0000***	0.0001***	0.0001***	0.0001***	0.0001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Finland FE	No	Yes	No	No	No	No
Country FE	No	No	Yes	Yes	Yes	No
Country*Year FE	No	No	No	No	No	Yes
Country-trends	No	No	No	No	Yes	No
GDP	No	No	No	Yes	Yes	No
Unemployment rate	No	No	No	Yes	Yes	No
Domestic elasticity	-0.5611	-0.0002	0.0003	0.0004	0.0003	0.0003
Foreign elasticity	-155.2620	-0.0577	0.0964	0.1049	0.0900	0.0834
N	4620270	4620270	4620270	4620270	4620270	4620270
R-squared	0.040	0.998	0.998	0.998	0.998	0.998

Notes: The table reports individual-level linear probability model regressions where the outcome is whether the person moves to a particular country. All models include person-year fixed effects. Model (2) adds a home country fixed effect whereas models (3) to (5) add country fixed effects. Model (4) contains, in addition, time-varying macro controls and model (5) country-year linear trends. In column (6), the covariates in (1) to (5) are replaced with country-year fixed-effects. Individual-year-clustered standard errors are in parenthesis. The analysis uses a 5% random sample of non-migrants and corresponding inverse-probability weights for non-migrants. * p<0.10, ** p<0.05, *** p<0.010.

Table A3: Individual-level estimates using LIS for EU-SILC-countries: annual earnings below the top decile

	(1) decision b/se	(2) decision b/se	(3) decision b/se	(4) decision b/se	(5) decision b/se	(6) decision b/se
Log net-of-tax rate	-0.5556***	-0.0002***	0.0004***	0.0004***	0.0004***	0.0004***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Log earnings	-0.0336***	-0.0000	0.0000***	0.0000***	0.0001***	0.0001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Finland FE	No	Yes	No	No	No	No
Country FE	No	No	Yes	Yes	Yes	No
Country*Year FE	No	No	No	No	No	Yes
Country-trends	No	No	No	No	Yes	No
GDP	No	No	No	Yes	Yes	No
Unemployment rate	No	No	No	Yes	Yes	No
Domestic elasticity	-0.5897	-0.0002	0.0004	0.0005	0.0004	0.0004
Foreign elasticity	-172.7634	-0.0548	0.1315	0.1390	0.1279	0.1213
N	5158095	5158095	5158095	5158095	5158095	5158095
R-squared	0.048	0.998	0.998	0.998	0.998	0.998

Notes: The table reports individual-level linear probability model regressions where the outcome is whether the person moves to a particular country. All models include person-year fixed effects. Model (2) adds a home country fixed effect whereas models (3) to (5) add country fixed effects. Model (4) contains, in addition, time-varying macro controls and model (5) country-year linear trends. In column (6), the covariates in (1) to (5) are replaced with country-year fixed-effects. Individual-year-clustered standard errors are in parenthesis. The analysis uses a 5% random sample of non-migrants and corresponding inverse-probability weights for non-migrants. * p<0.10, ** p<0.05, *** p<0.010.

Table A4: Individual-level estimates using EU-SILC: whole sample

	(1) decision b/se	(2) decision b/se	(3) decision b/se	(4) decision b/se	(5) decision b/se	(6) decision b/se
Log net-of-tax rate	-0.5027***	-0.0002***	0.0008***	0.0009***	0.0012***	0.0014***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Log earnings	-0.0846***	0.0000***	0.0004***	0.0004***	0.0007***	0.0011***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Finland FE	No	Yes	No	No	No	No
Country FE	No	No	Yes	Yes	Yes	No
Country*Year FE	No	No	No	No	No	Yes
Country-trends	No	No	No	No	Yes	No
GDP	No	No	No	Yes	Yes	No
Unemployment rate	No	No	No	Yes	Yes	No
Domestic elasticity	-0.5335	-0.0002	0.0008	0.0009	0.0012	0.0015
Foreign elasticity	-189.0605	-0.0677	0.2999	0.3352	0.4404	0.5226
N	21519150	21519150	21519150	21519150	21519150	21519150
R-squared	0.060	0.996	0.996	0.996	0.996	0.996

Notes: The table reports individual-level linear probability model regressions where the outcome is whether the person moves to a particular country. All models include person-year fixed effects. Model (2) adds a home country fixed effect whereas models (3) to (5) add country fixed effects. Model (4) contains, in addition, time-varying macro controls and model (5) country-year linear trends. In column (6), the covariates in (1) to (5) are replaced with country-year fixed-effects. Individual-year-clustered standard errors are in parenthesis. * p<0.10, ** p<0.05, *** p<0.010.

Table A5: Individual-level estimates using EU-SILC: annual earnings in the top decile

	(1) decision b/se	(2) decision b/se	(3) decision b/se	(4) decision b/se	(5) decision b/se	(6) decision b/se
Log net-of-tax rate	-0.5640***	-0.0002***	0.0002***	0.0003***	0.0002***	0.0001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Log earnings	-0.0294***	-0.0000***	-0.0000***	-0.0000***	-0.0000**	-0.0000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Finland FE	No	Yes	No	No	No	No
Country FE	No	No	Yes	Yes	Yes	No
Country*Year FE	No	No	No	No	No	Yes
Country-trends	No	No	No	No	Yes	No
GDP	No	No	No	Yes	Yes	No
Unemployment rate	No	No	No	Yes	Yes	No
Domestic elasticity	-0.5986	-0.0002	0.0003	0.0003	0.0002	0.0001
Foreign elasticity	-165.6232	-0.0585	0.0696	0.0739	0.0528	0.0385
N	4620270	4620270	4620270	4620270	4620270	4620270
R-squared	0.047	0.998	0.998	0.998	0.998	0.998

Notes: The table reports individual-level linear probability model regressions where the outcome is whether the person moves to a particular country. All models include person-year fixed effects. Model (2) adds a home country fixed effect whereas models (3) to (5) add country fixed effects. Model (4) contains, in addition, time-varying macro controls and model (5) country-year linear trends. In column (6), the covariates in (1) to (5) are replaced with country-year fixed-effects. Individual-year-clustered standard errors are in parenthesis. The analysis uses a 5% random sample of non-migrants and corresponding inverse-probability weights for non-migrants. * p<0.10, ** p<0.05, *** p<0.010.

Table A6: Individual-level estimates using EU-SILC: annual earnings below the top decile

	(1) decision b/se	(2) decision b/se	(3) decision b/se	(4) decision b/se	(5) decision b/se	(6) decision b/se
Log net-of-tax rate	-0.3900***	-0.0001***	0.0002***	0.0002***	0.0003***	0.0005***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Log earnings	0.0264***	0.0000***	0.0000***	0.0000***	0.0000***	0.0001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Finland FE	No	Yes	No	No	No	No
Country FE	No	No	Yes	Yes	Yes	No
Country*Year FE	No	No	No	No	No	Yes
Country-trends	No	No	No	No	Yes	No
GDP	No	No	No	Yes	Yes	No
Unemployment rate	No	No	No	Yes	Yes	No
Domestic elasticity	-0.4139	-0.0001	0.0002	0.0002	0.0003	0.0005
Foreign elasticity	-129.7555	-0.0428	0.0723	0.0769	0.0939	0.1657
KP stat	322552	320981	230588	226213	218527	159439
KP p-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Weak id test	1445215	1361815	120997	119471	93064	87786
N	6693221	6693221	6693221	6693221	6693221	6693221
R-squared	0.065	0.998	0.998	0.998	0.998	0.998

Notes: The table reports individual-level IV regressions where the outcome is whether the person moves to a particular country. Log retention rate is instrumented with 1 - marginal tax rate. All models include person-year fixed effects. Model (2) adds a home country fixed effect whereas models (3) to (5) add country fixed effects. Model (4) contains, in addition, time-varying macro controls and model (5) country-year linear trends. In column (6), the covariates in (1) to (5) are replaced with country-year fixed-effects. Individual-year-clustered standard errors are in parenthesis. The analysis uses a 5% random sample of non-migrants and corresponding inverse-probability weights for non-migrants. Kleibergen-Paap test statistic and the associated p value, with the null of the 1st stage being underidentified, are presented at the bottom of the table. The weak identification test is the Kleibergen-Paap first stage F test. * p<0.10, ** p<0.05, *** p<0.010.

Table A8: Instrumental variable results for the entire sample

	(1) decision b/se	(2) decision b/se	(3) decision b/se	(4) decision b/se	(5) decision b/se	(6) decision b/se
Log net-of-tax rate	-0.3915***	-0.0002***	0.0005***	0.0005**	0.0010***	0.0015***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Log earnings	0.0249***	0.0000***	0.0000**	0.0000*	0.0001**	0.0002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Finland FE	No	Yes	No	No	No	No
Country FE	No	No	Yes	Yes	Yes	No
Country*Year FE	No	No	No	No	No	Yes
Country-trends	No	No	No	No	Yes	No
GDP	No	No	No	Yes	Yes	No
Unemployment rate	No	No	No	Yes	Yes	No
Domestic elasticity	-0.4155	-0.0002	0.0005	0.0005	0.0010	0.0016
Foreign elasticity	-130.2478	-0.0603	0.1624	0.1722	0.3211	0.4989
KP stat	34374	34353	18557	17197	9241	4345
KP p-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Weak id test	854703	783167	25874	24322	12214	5226
N	698716	698716	698716	698716	698716	698716
R-squared	0.064	0.996	0.996	0.996	0.996	0.996

Notes: The table reports individual-level IV regressions where the outcome is whether the person moves to a particular country. Log retention rate is instrumented with 1 - marginal tax rate. All models include person-year fixed effects. Model (2) adds a home country fixed effect whereas models (3) to (5) add country fixed effects. Model (4) contains, in addition, time-varying macro controls and model (5) country-year linear trends. In column (6), the covariates in (1) to (5) are replaced with country-year fixed-effects. Individual-year-clustered standard errors are in parenthesis. The analysis uses a 5% random sample of non-migrants and corresponding inverse-probability weights for non-migrants. Kleibergen-Paap test statistic and the associated p value, with the null of the 1st stage being underidentified, are presented at the bottom of the table. The weak identification test is the Kleibergen-Paap first stage F test. * p<0.10, ** p<0.05, *** p<0.010.

Table A10: Instrumental variable results for the top 10 group