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Taxation and Migration: Evidence and Policy Implications

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Tax rates differ substantially across countries and across locations within countries. An important question is whether people choose locations in response to these tax differentials, thus reducing the ability of local and national governments to redistribute income and provide public goods. Due to globalization and the lowering of mobility costs, it has become increasingly important to pay attention to mobility responses when designing tax policy. In this paper, we review what we know about mobility responses to personal taxation and discuss the policy implications. Our main focus is on the mobility of people, especially high-income people, but we will also discuss the mobility of wealth in response to personal taxes.

It is clear that high-income individuals sometimes move across borders to avoid taxes. The media is filled with examples of famous people who, often by their own admission, engage in such tax avoidance behavior. The Rolling Stones left England for France in the early 1970s in order to avoid the exceptionally high top marginal

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tax rates—well above 90 percent—in the UK at the time.[1] Many other British rock stars moved to lower tax jurisdictions, including David Bowie (Switzerland), Ringo Starr (Monte Carlo), Cat Stevens (Brazil), Rod Stewart (United States), and Sting (Ireland). In more recent years, actor Gérard Depardieu moved to Belgium and eventually Russia in response to the 75 percent millionaire tax in France, while a vast number of sports stars in tennis, golf, and motor racing have taken residence in tax havens such as Monte Carlo, Switzerland, and Dubai.

While these anecdotes are suggestive, two caveats prevent us from drawing any broader conclusion from them. First, all of the examples are from the sports and entertainment industries. These industries may feature particularly high cross-border mobility, both because they involve little location-specific human capital and because workers tend to be less tied to specific firms. Second, some of the examples reflect location responses to extreme top tax rates. The key question—and the one with which we are preoccupied in this paper—is if income tax rates distort the location choices of broader segments of workers? And if they do, how large are the responses and what are the implications for policy? These questions are particularly pertinent due to the recent proposals in the United States and elsewhere to raise the taxation of income or wealth substantially at the top of the distribution.

Mobility of People

The idea that tax policy may affect the location decisions of individuals has a long tradition in economics. In fact, tax-induced mobility is a central mechanism in several strands of economic theory. In the local public finance literature, starting with the seminal contribution of Tiebout (1956), migration responses to local taxes and public goods are the fundamental force that governs the sorting of individuals across jurisdictions. Since the contributions of Rosen (1979) and Roback (1982), the field of economic geography has focused on spatial equilibrium models in which the assumptions placed on migration elasticities are key determinants of the spatial allocation of factors and the geographic variation in prices. The optimal taxation literature has also emphasized that migration responses can have important effects on tax design and may trigger socially inefficient tax competition in uncoordinated tax settings (for example, Mirrlees 1982; Bhagwati and Wilson 1989).

Despite its importance in economic theory and its salience in the policy debate, empirical evidence on the responsiveness of individual location decisions to taxes has been remarkably scant. Table 1 provides a summary of the available literature, focusing on papers that estimate mobility responses to personal income taxes.

[1] Up until 1978, the United Kingdom imposed a top marginal tax rate on labor income equal to 83 percent and a top marginal tax rate on capital income that was even higher, a stunning 98 percent. Very few people had sufficiently high incomes to face these tax rates, but rock stars were among them. The 1966 song "Taxman" by The Beatles was an attack on these high tax rates: "There's one for you, nineteen for me/Cause I'm the taxman, yeah I'm the taxman/Should five percent appear too small/Be thankful I don't take it all/Cause I'm the taxman, yeah I'm the taxman."

Table 1

Summary of Empirical Literature on Migration Responses to Personal Income Taxes

Citation	*Countries*	*Population*	*Tax variation*	*Main result*	*Preferred mobility elasticity*
A: International mobility					
Akcigit, Baslandze, and Stantcheva (2016)	8 OECD countries	Top 1% of inventors	Variation across/ within states over time	Top foreign inventors are strongly mobile internationally	Foreigners = 1 Domestics = 0.03
Kleven, Landais, and Saez (2013)	14 European countries	Top football players	Variation across/ within countries over time	Top foreign footballers are strongly mobile internationally	Foreigners = 1 Domestics = 0.15
Kleven et al. (2014)	Denmark	Immigrants in the top 1%	Variation by earnings within country over time	Top foreign earners are strongly mobile in Denmark	Foreigners = 1.6 Domestics = 0.02
B: Within-country mobility					
Agrawal and Foremny (2019)	Spain	Top 1% of population	Variation across Spanish regions over time	Top taxpayers are strongly mobile within Spain	0.85
Akcigit et al. (2018)	8 US states	All inventors	Variation across/ within states over time	Inventors strongly mobile within the US	Out-of-state = 1.23 In-state = 0.11
Feldstein and Wrobel (1998)	USA	Sample of full-time workers	Variation across US states	Wage changes fully offset tax changes across US states	∞
Liebig, Puhani, and Sousa-Poza (2007)	Switzerland	Population aged 21–64	Variation across Swiss municipalities over time	College graduates and foreigners are mobile within Switzerland	NA
Martinez (2017)	Switzerland	Top 1% in canton of Obwalden	Variation across Swiss cantons over time	Rich taxpayers are strongly mobile within Switzerland	2.0
Moretti and Wilson (2017)	USA	Top 5% of inventors	Variation across US states over time	Top inventors are strongly mobile across US states	1.8
Schmidheiny (2006)	Switzerland	Households in and around Basel	Variation across Swiss municipalities	Rich households more likely to move to low-tax municipalities	NA
Schmidheiny and Slotwinski (2018)	Switzerland	Foreigners below earnings threshold	Variation from duration threshold in tax scheme	Top earners are strongly mobile within Switzerland	NA
Young et al. (2016)	USA	Millionaires	Variation across US states	Millionaires only moderately mobile within the US	0.1

Interestingly, only a dozen papers or so provide direct evidence on such responses and most of these papers are very recent. Two empirical challenges can explain the paucity of empirical research in this area: the lack of suitable data on migration and the lack of credible tax variation for identifying causal effects.

Information on migration patterns combined with precise measures of earnings and tax rates in different locations is hard to come by. Traditional surveys either lack this type of information or are statistically underpowered due to small sample sizes. One way of circumventing this data limitation is to focus on alternative

outcomes, such as wages, and test structural predictions of migration models under different assumptions about mobility. Feldstein and Wrobel (1998) provide an early example of this approach. Their premise is the following. In the absence of heterogeneity in preferences for different locations, a long-run equilibrium equalizes utility across locations for all individuals and therefore fixes the net-of-tax wage rate in each location. In this case, there is perfect mobility: an increase in the tax rate in a given location must be exactly offset by an increase in the wage, because otherwise every individual would move out of that location. Testing if the elasticity of wages with respect to the net-of-tax rate equals minus one is therefore a test of perfect mobility (that is, an infinite mobility elasticity). Using cross-sectional variation in the progressivity of state income taxes in the United States, Feldstein and Wrobel estimate very large wage responses to the net-of-tax rate and cannot reject an elasticity of minus one. However, their large standard errors imply that, in a number of specifications, they also cannot reject the opposite extreme of small or zero elasticities.

The recent literature has taken two different approaches to overcome these data challenges. The first approach is to focus on specific segments of the labor market for which detailed migration information is available from external sources. Examples include football (soccer) players where rich biographical information allows one to reconstruct migration patterns (Kleven, Landais, and Saez 2013), and inventors whose location decisions can be inferred from patent records (Akcigit, Baslandze, and Stantcheva 2016; Akcigit et al. 2018; Moretti and Wilson 2017). The second approach is to find contexts in which administrative data with information on migration is available. For example, researchers have used tax or social security records from countries with a federal structure where the internal migration across tax jurisdictions can be observed (Young et al. 2016; Martinez 2017; Agrawal and Foremny 2019). Another possibility is to study countries, typically Scandinavian countries, that keep migration records of all movements in and out of the country that can be linked to administrative tax records (Kleven et al. 2014).

Where suitable migration data is available, the next challenge relates to the tax variation used to estimate migration responses. This challenge is twofold. First, one needs to measure correctly the tax incentive that governs location decisions. As with other extensive-margin decisions, location decisions depend on the *average* rather than the marginal tax rate, and average tax rates are not always straightforward to calculate.[2] Moreover, for workers at the lower end of the income distribution, the relevant average tax rate depends, not just on the tax system, but also on the potentially complicated system of welfare and social insurance programs.[3] Second, one needs

[2]Estimating the elasticity of migration with respect to the net-of-tax rate relies on correctly measuring the change in the tax incentive (the denominator of the elasticity). Otherwise, the elasticity estimate will be biased, even if the reduced-form effect of the reform on migration (the numerator) is correctly identified.

[3]Despite a long-standing debate about "welfare magnets" (for example, Borjas 1999), there is very little conclusive evidence on mobility responses to welfare benefits by low-income people. Agersnap, Jensen, and Kleven (2019) provide some of the first causal evidence on welfare magnet effects using variation from a special immigrant welfare scheme in Denmark.

Table 2
Summary of Preferential Tax Schemes to Foreigners

Country	*Year of implementation*	*Income eligibility criterion*	*Duration of scheme*	*Preferential tax treatment*
Denmark	1991	Yes	3 years originally, now extended to 7 years	Flat income tax of 30% originally, now 27%
Finland	1999	Yes	2 years	Flat income tax of 35%
France	2004	No	5 years originally, now extended to 8 years	30% of taxable income is tax exempt
Italy	2011	No	5 years	70% of taxable income was exempt originally, now 50%
Netherlands	1985	Yes	5 years originally, now extended to 10 years	35% of taxable income was exempt originally, now 30%
Portugal	2009	No	10 years	Flat income tax of 20%
Spain	2005	Yes since 2010	6 years	Flat income tax of 24%
Sweden	2001	Yes	3 years	25% of taxable income is tax exempt

Note: In the Netherlands, the 35 percent ruling has been officially implemented by law in 1985, but was used in a nonformal way since the 1960s, and was based on a nonpublic internal resolution of the Dutch Revenue Service.

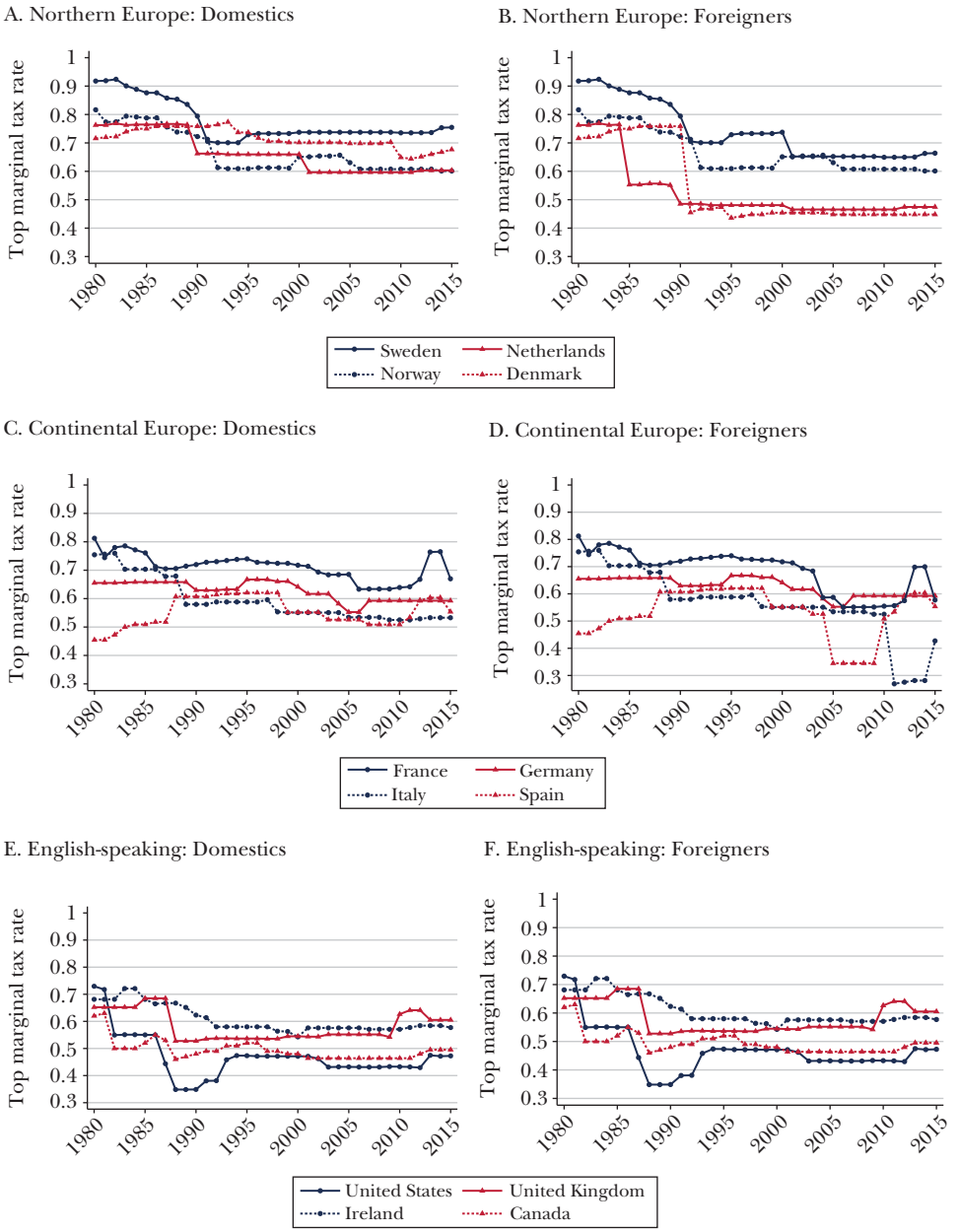
to find tax variation that is plausibly orthogonal to other factors affecting individual location choices—including local labor market conditions, local amenities, and public goods—and sufficiently large to generate effects that can be detected in the data.

Motivated by these challenges, much of the recent literature has focused on people at the top of the earnings distribution. Beyond providing estimates of mobility responses for a segment of the population that may be particularly important for government revenue and economic efficiency, focusing on top earners offers important advantages.

First, for workers with very high earnings, the top marginal tax rate is a reasonable proxy for the average tax rate and is relatively easy to compute across countries and over time (Kleven, Landais, and Saez 2013). Specifically, the top marginal tax rate reflects the combined wedge from the top-bracket personal income tax rate, uncapped social security taxes on workers and firms, and consumption taxes (value-added, sales and excise taxes). Second, because of income tax reforms, top marginal tax rates exhibit substantial variation over time, both within and across countries, offering opportunities to identify the causal effect of taxes on migration. In particular, the introduction of preferential tax schemes to high-income foreigners in a number of countries provides useful sources of quasi-experimental variation for studying mobility responses (Kleven, Landais, and Saez 2013; Kleven et al. 2014). Table 2 provides details of existing preferential tax schemes in different countries, showing that they often introduce very large tax cuts for foreign over domestic workers.

To illustrate the identification opportunities created by the substantial variation in top marginal tax rates, Figure 1 plots their evolution in twelve countries

Figure 1
Top Marginal Tax Rates on Earnings 1980–2015



Note: The figure depicts the evolution of top marginal tax rates on earnings in 12 OECD countries from 1980 to 2015. Our measure of top marginal tax rates includes top income tax rates, uncapped employer and employee payroll taxes, and consumption taxes. Top marginal tax rates on foreigners also account for the provisions of foreigners' tax schemes summarized in Table 2. See online Appendix A for details.

from 1980 to 2015.[4] The rows separate different sets of countries, while the columns distinguish between domestic and foreign residents. Several points are worth highlighting. First, the top marginal tax rate on domestic residents during this time period tends to be largest in northern Europe, intermediate in continental Europe, and smallest in English-speaking countries. For example, the top marginal tax rate equals 75 percent in Sweden and 48 percent in the United States in 2015. Second, this cross-country pattern is less pronounced when focusing on the taxation of foreigners, because preferential foreigner tax schemes are more prevalent in high-tax countries. Third, the introduction of preferential tax schemes to foreigners, due to their generosity and design, creates sharp variation in location incentives.

With this data in hand, a useful preliminary exercise consists in correlating the level of top marginal tax rates with the stock of migrants across countries. Beyond its descriptive purpose, this serves to illustrate the nature of the identification challenges and will also put the overall effect of taxes into perspective. Building on Muñoz (2019), we use survey data from the European Labour Force Survey (EU-LFS) and the Current Population Survey (CPS) to construct yearly measures of the stock of foreigners in 25 European countries and the United States between 2009–2015.[5] Because our focus is on high-income people, we select individuals with labor earnings in the top 5 percent of the distribution in each country and year. We then compute the log share of top 5 percent foreigners in the overall population, where foreigners are defined as citizens of a country different from their country of residence. In Panel A of Figure 2, we plot the average share of top 5 percent foreigners between 2009–15 against the average top marginal net-of-tax rate over the same period (both variables are measured in logs). The figure first confirms the large dispersion in tax rates across countries. On the far right of the diagram, eastern European countries like Bulgaria and the Czech Republic have high net-of-tax rates due to their flat income taxes with

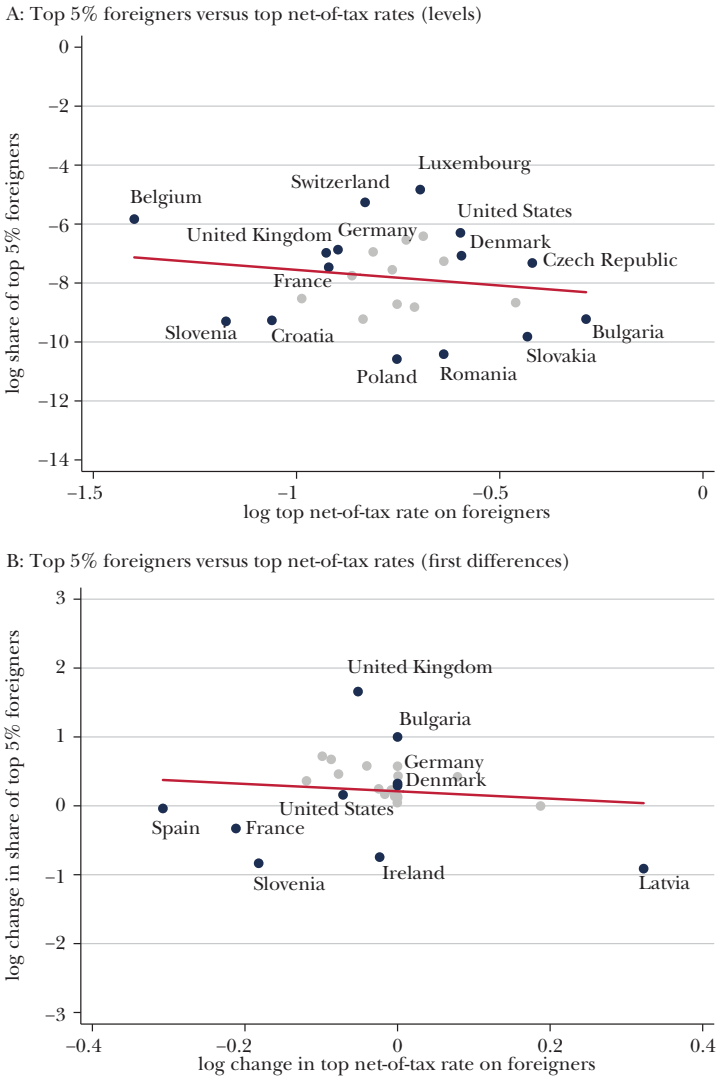
[4]We combine the top personal income tax rate τ_i, the uncapped payroll tax rates on employees (workers) and employers (firms) τ_{pw} and τ_{pf}, and the VAT (or sales tax) rates τ_c in order to obtain our final measure of the top marginal tax rate τ:

$$\left(1-\tau\right) = \frac{\left(1-\tau_i\right)\left(1-\tau_{pw}\right)}{\left(1-\tau_c\right)\left(1-\tau_{pf}\right)}.$$

Note that this formula has been written for the standard case where the employer's and employee's payroll taxes are both based on gross earnings and where the income tax rate applies to earnings net of all payroll taxes. When this is not the case, we have adapted our computations to capture precisely country-specific rules.

[5]The EU Labour Force Survey dataset is the largest European survey of individuals. It is a repeated cross section covering roughly 0.3 percent of the overall European population per year since the 1980s. It includes detailed income information since 2009. The full list of countries in our analysis is the following: Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Switzerland, the United Kingdom, and the United States. For top marginal tax rates, we extend the series created by Kleven, Landais, and Saez (2013) and Piketty, Saez, and Stantcheva (2014) to these 26 countries. We provide a complete description of the data and the construction of our sample in the online Appendix.

Figure 2
Cross-Country Evidence on Mobility Responses at the Top



Note: The figure shows cross-country correlations between log shares of top earning foreigners and log top marginal net-of-tax rate on earnings for 25 European countries plus the United States. Shares of top earning foreigners are computed from the EU-Labor Force Survey and the Current Population Survey for the United States and defined as the number of foreigners who have earnings in the top 5 percent of the distribution divided by the total population of residents. The top marginal net-of-tax rate on earnings accounts for personal income taxes, uncapped payroll contributions, and consumption taxes. Panel A plots the average log share of top foreigners over the period 2009 to 2015 against the average log top marginal net-of-tax rate on earnings for foreign residents over the same period. Panel B plots the same correlation but in first-difference, focusing on variation between 2009 and 2015. Foreigners in the top 5 percent of the wage distribution represent 0.3 percent of the overall population in Belgium, 0.9 percent in Luxembourg, and 0.01 percent in Bulgaria. The corresponding level of top marginal tax rate is 75 percent for Belgium, 50 percent for Luxembourg, and 25 percent for Bulgaria for the same period. See text and online Appendix for details.

low rates. Interestingly, a country such as Denmark is also located on the far right of the diagram because of their preferential tax scheme to foreigners. Second, there is also a large dispersion in the share of foreign workers at the top of the earnings distribution. While countries like Luxembourg and Switzerland have large fractions of foreigners, eastern European countries have small shares. Most importantly, there is no sign of a positive correlation between the stock of foreigners and the net-of-tax rate. If anything, the correlation is negative: countries with large shares of foreigners at the top tend to be those with large tax rates at the top.

This figure lays bare that many country-specific factors affect migration decisions, and such factors must help to explain why countries such as Luxembourg, Belgium, or the United States attract a larger share of high-skill foreigners than Romania or Poland, despite having higher top tax rates on earnings. Furthermore, the factors that make a country attractive evolve significantly over time, as shown in panel B. There we move from a correlation in levels to a correlation in *changes* over time and ask if the share of top foreigners increases more (or falls by less) in countries that have reduced their top tax rate by more between 2009 and 2015. We find no correlation and see very different trends in the stock of top foreigners across countries with no variation in tax incentives. The United Kingdom, for instance, saw a large increase in the stock of top foreigners while Ireland experienced a significant decline—even though top tax rates were roughly constant in both countries.

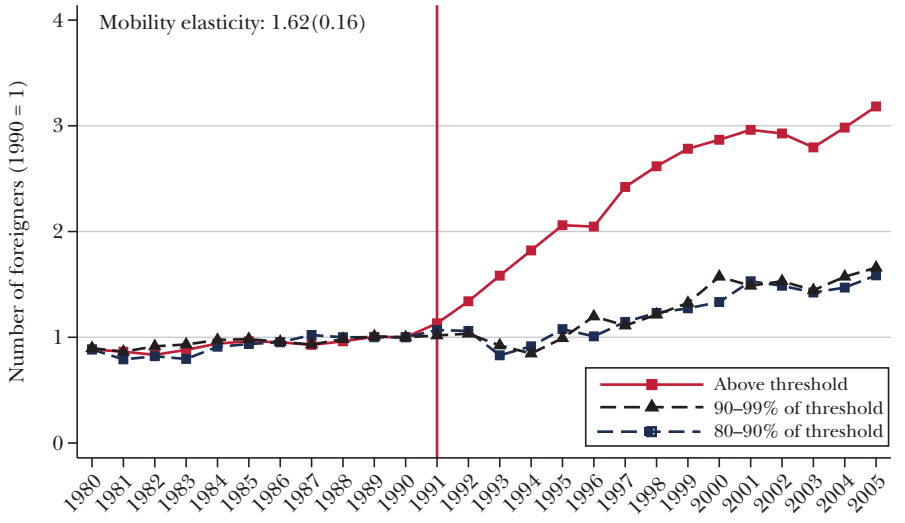
Controlling for all of the nontax determinants of location decisions that vary both across countries and over time is critical: any effect of taxes remains dominated and fully masked by such factors in the cross section.

Quasi-experimental Approaches

Quasi-experimental approaches leveraging variation in tax incentives across individuals within the same country over time can effectively control for any unobserved nontax determinants of location choices. Kleven, Landais, and Saez (2013) and Kleven et al. (2014) argue that the introduction of special tax schemes to foreigners provides such compelling quasi-experimental settings. Consider for instance the Danish tax scheme for foreigners, analyzed in detail by Kleven et al. (2014). This scheme was enacted in 1992 and applied to the earnings of foreign workers from June 1991 onwards. Eligibility for the scheme requires annual earnings above a threshold located around the ninety-ninth percentile of the earnings distribution. Initially, the scheme offered a flat income tax rate of 30 percent in lieu of the regular progressive income tax with a top marginal tax rate of 68 percent. The scheme could be used for a total period of up to three years, after which the taxpayer becomes subject to the ordinary income tax schedule. As shown in Table 2, the scheme parameters—tax rate, duration, and so on—have been revised since its introduction.

The design of the scheme lends itself to a difference-in-differences approach in which we compare the evolution of the number of foreigners above the eligibility threshold (treatments) and below the eligibility threshold (controls). Such an analysis is presented in Figure 3. It shows the stock of foreigners between 1980–2005 in the treated earnings range and in two untreated earnings ranges, between 80–90 percent

Figure 3
Migration Effects of the Danish Tax Scheme



Note: Originally produced by Kleven et al. (2014). The 1992 Danish tax reform, represented by a red vertical line, introduced a preferential tax scheme for foreign workers with earnings above an eligibility threshold, arriving in Denmark in or after 1991. The figure reports the evolution of the number of foreigners with earnings above the eligibility threshold from 1980 to 2005. It also reports the evolution of the number of foreigners in two control groups: individuals with earnings between 80 and 90 percent of the threshold and those with earnings between 90 percent and 99 percent of the threshold. All series are normalized to one in 1990, and numbers are weighted by duration of stay during the year for part-year foreign residents.

of the threshold and between 90–99 percent of the threshold. The two control series are normalized to match the treatment series in the pre-reform year. The graph provides exceptionally compelling evidence of mobility responses. The treatment and control series are perfectly parallel in the ten years leading up to the reform and start diverging immediately after the reform. The gap between the series builds up gradually through the 1990s and then reaches a steady state.[6] The effects are very large: the treatment series more than doubles relative to the control series, producing an elasticity of the stock of foreigners with respect to the average net-of-tax rate equal to about 1.6.

While the Danish evidence is very striking, it is important to highlight that mobility elasticities—as with other extensive-margin elasticities—are not structural

[6]The similarity between the two control series rules out the main potential confounder, namely that foreigners above the threshold are displacing foreigners just below the threshold. In that case, the divergence between treatments and controls would not represent a net mobility effect, but a shift in the earnings level of foreign arrivals. However, such shifting would produce a dip in the number of foreigners just below the threshold relative to the number of foreigners further down. The completely parallel trends of the two different control groups, along with other tests provided in Kleven et al. (2014), are inconsistent with such a story.

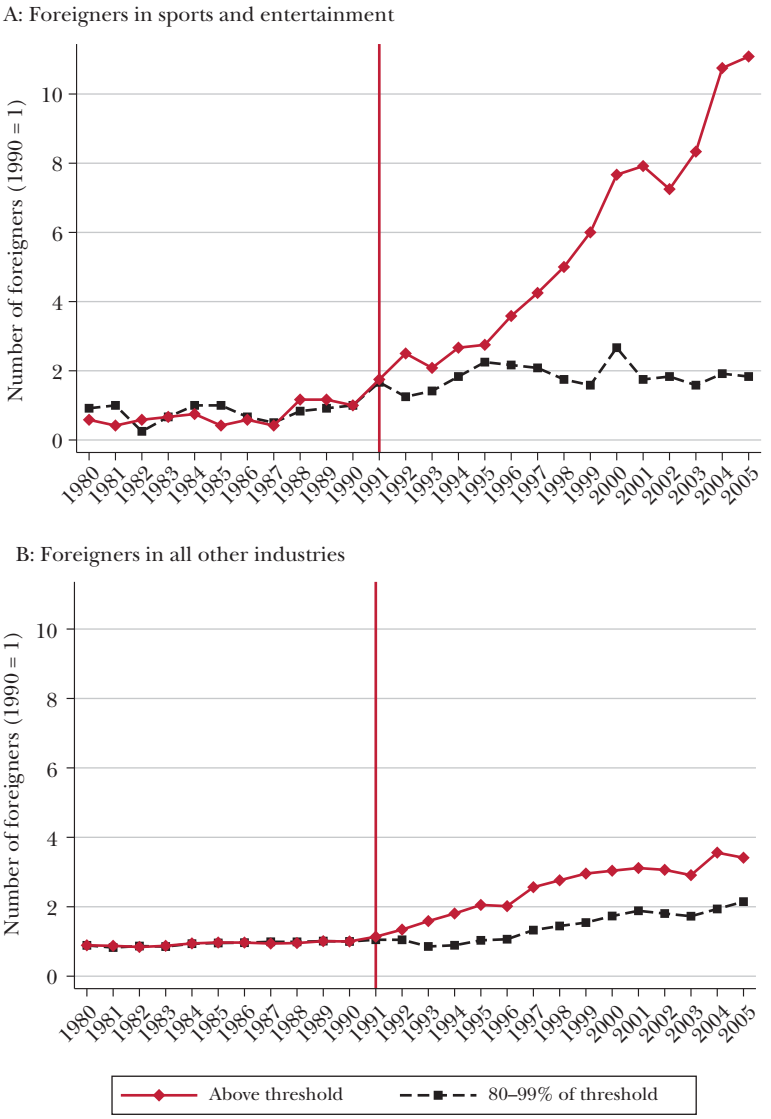
parameters. As a result, the findings in Kleven et al. (2014) are not necessarily transportable to other segments of the labor market or to other countries. To see that mobility elasticities can vary greatly across labor market segments, it is useful to explore heterogeneity across industries in the responses to the Danish tax scheme. Motivated by the many examples of tax-induced mobility in music, film, and sports discussed in the introduction, Figure 4 splits the difference-in-differences analysis into sports and entertainment (panel A) and all other industries (panel B). The effects are starkly different across these sectors. While the number of foreigners increased by a factor of less than two in other industries, it increased by a factor of more than five in sports and entertainment. Much of the dramatic increase in the latter group was driven by sports and, in particular, football (soccer) as analyzed by Kleven, Landais, and Saez (2013).[7]

It is important to note that the mobility responses discussed above pertain to the immigration decisions of *foreign* citizens as opposed to the emigration or return-migration decisions of *domestic* citizens. The Danish scheme allows for studying the return-migration channel, because the scheme is available to any worker—independently of citizenship—who has been a tax resident abroad for at least three years (under the initial rules) prior to claiming the scheme treatment. As shown in Table 1, Kleven et al. (2014) find that the mobility elasticity of Danish expatriates is extremely small. Other papers that were able to identify the mobility elasticities of foreigners and domestics separately (Kleven, Landais, and Saez 2013; Akcigit, Baslandze, and Stantcheva 2016) also find much smaller elasticities for domestic workers. This difference can be explained, at least in part, by the fact that extensive-margin elasticities depend on the initial base. In any country, the vast majority of workers are domestic citizens rather than foreign citizens. As a result, the elasticity of foreign immigration represents a percentage change in an initially small stock of foreigners, whereas the elasticity of domestic emigration or return-migration represents a percentage change in an initially large stock of domestics. This mechanical difference in elasticities is very important for tax policy implications, as we discuss later.

Mobility elasticities are likely to vary not only by occupation or citizenship status, but also across countries within the same segment of the labor force. Indeed, an important question to ask is whether mobility elasticities are large only in small countries, for the same mechanical reasons that drive the differences in elasticities between foreigners and domestic residents. Can elasticities be sizable even for large countries that start with a large base of foreigners? Akcigit, Baslandze, and Stantcheva (2016) shed light on this question. They study the effects of top tax rates on the international mobility of "superstar" inventors—those with the most and best patents. Leveraging panel data from the US and European Patent Offices, they are able to track inventors over time and across countries and to exploit the differential impact

[7] The fact that immigration in the sports and entertainment industry starts accelerating after four years can be explained partly by regulation in the football sector until 1995. In addition, some sluggishness in the ability of firms (such as football clubs) to take full advantage of the scheme is natural due to information and hiring/firing frictions.

Figure 4
Migration Effects of the Danish Tax Scheme by Industry



Note: Originally produced by Kleven, Landais, and Saez (2013). The 1992 Danish tax reform, represented by a red vertical line, introduced a preferential tax scheme for foreign workers with earnings above an eligibility threshold, arriving in Denmark in or after 1991. The figure reports the evolution of the number of foreigners with earnings above the eligibility threshold separately for the sports and entertainment sector (panel A) and all other industries (panel B). In each panel, we also report the evolution of the number of foreigners in a control group of individuals with earnings between 80 and 99 percent of the threshold. All series are normalized to one in 1990, and numbers are weighted by duration of stay during the year for part-year foreign residents.

of top tax rates on inventors at different productivity and therefore income levels. They provide several country case studies, two of which are reproduced in Figure 5. Panel A considers once again the introduction of the Danish preferential tax scheme to foreigners, while panel B considers the US Tax Reform Act of 1986 which sharply reduced the top marginal income tax rate. Both panels rely on a synthetic control method, where a synthetic country is constructed as a weighted average of the other countries in the sample, in order to best fit the pre-reform time series of the treated country. The Danish reform shows a significant effect on the share of foreign inventors in Denmark, although the mobility elasticity is smaller than that estimated by Kleven et al. (2014) for the full population of high-income workers.[8] Importantly, the bottom panel suggests that the US Tax Reform Act of 1986 had a strong effect on the growth of foreign superstar inventors. In fact, the estimated mobility elasticity of top 1 percent superstar inventors for the US economy is extremely large, above 3.

In a complementary paper, Moretti and Wilson (2017) consider the mobility responses of star scientists across US states—rather than across countries—over the period 1977–2010. They estimate large long-run elasticities of mobility with respect to both personal and corporate income taxes. The elasticity of mobility with respect to personal income taxes is equal to 1.8.

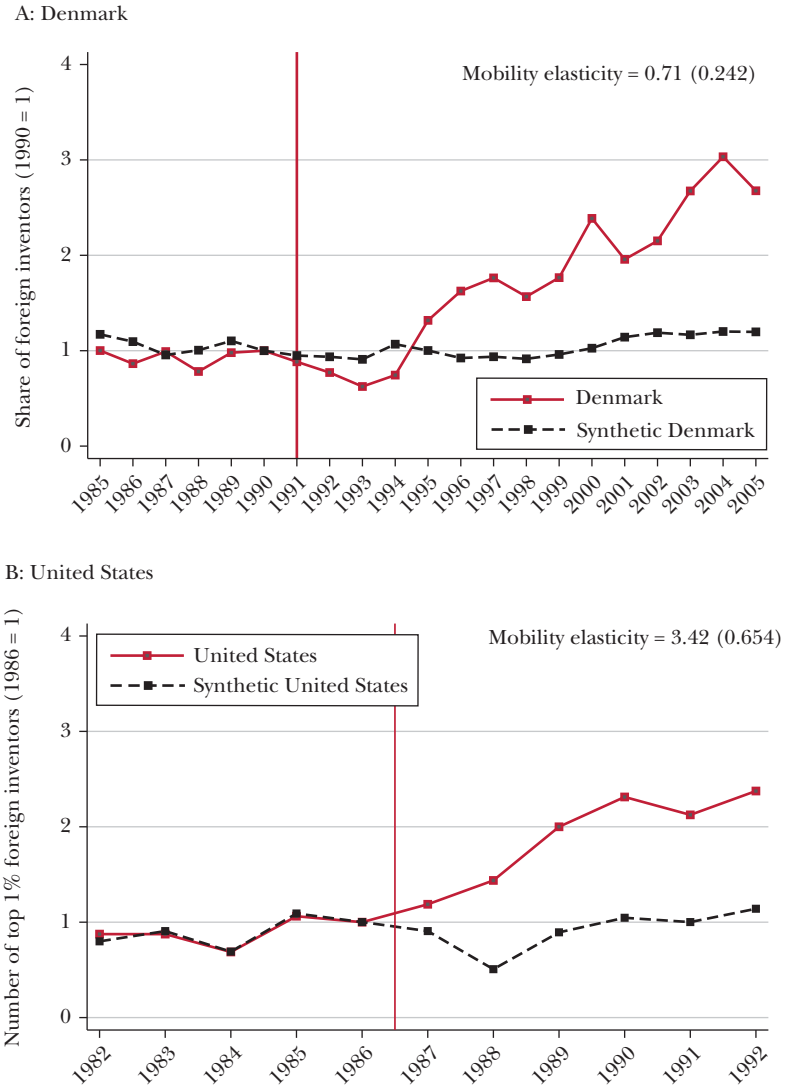
Are these tax-induced mobility effects only relevant for modern day economies? New historical evidence from Akcigit et al. (2018) shows significant effects of taxes on mobility across US states. They study the effects of personal and corporate taxes over the twentieth century in the United States, using a new panel of the universe of inventors who patented since 1920; a dataset of the employment, location, and patents of firms active in research and development since 1921; and a historical state-level corporate and personal tax database since 1900. They estimate that, over the twentieth century, the elasticity of the number of inventors residing in a state equals 0.11 for inventors from that state and 1.23 for inventors not from that state. These findings are consistent with the distinction made above, in the contest of international migration, between the mobility elasticities of foreigners and domestics.

Mobility of Wealth

So far, we have considered mobility responses to the taxation of labor income. However, mobility responses may depend on the tax treatment of both labor income and capital income, or on wealth. In general, it is easier to measure tax rates on labor income than on capital income and wealth. For the latter, detailed information on the income and wealth composition of individuals and their spouses is often

[8] Contrary to the effects on other occupations considered above, there is a lag in the effects of the reform on inventors. This can be explained by the fact that an inventor not only has to move to Denmark but also patent there, in order to be recorded as having moved to Denmark. Note also that the elasticity here can be diluted, because the analysis lumps together inventors across all income levels, some of which are not eligible for the foreign tax scheme (income is not observable in the patent data).

Figure 5
Migration Responses by Inventors



Note: Originally produced by Akcigit, Baslandze, and Stantcheva (2016). The figure shows inventors' migration response to two major tax reforms in Denmark and the United States. Panel A focuses on the 1992 Danish reform, which introduced a preferential tax scheme for foreign workers with earnings above an eligibility threshold, arriving in Denmark in or after 1991. The panel depicts the evolution of the share of foreign inventors, normalized to one in 1990, in Denmark and in a synthetic control country, constructed as a weighted average of all other countries in the sample, in order to best match the pre-reform series for Denmark. Panel B focuses on the 1986 Tax Reform Act, which lowered top marginal income tax rates in the United States. The panel shows the number of foreign inventors belonging to the top 1 percent of the distribution of citation-weighted patents in the United States and in a synthetic control country. Both series are normalized to one in 1986.

necessary. Absent such data, focusing on the top marginal tax rate on labor earnings can introduce measurement error in the true tax incentive, especially because some countries actively rely on specific provisions of capital taxation to attract foreign residents. Belgium is a case in point. Although its top marginal tax rate on earnings is relatively high, the fact that capital gains are exempt from taxation and inter vivos gifts are taxed at very low rates are often cited as reasons why a large number of wealthy French people have moved their tax residence to Uccle or Ixelles in the suburbs of Brussels.

Unfortunately, we still know little about the effects of capital income and wealth tax provisions on mobility. The data and identification challenges outlined above are, if anything, even stronger when studying the effects of wealth or estate taxation on migration. The literature is therefore limited to just a few papers. Most of them focus on within-country mobility responses to the taxation of bequests. In the United States, Bakija and Slemrod (2004) and Conway and Rork (2006) find that high inheritance and estate taxes have statistically significant, but modest, negative impacts on the number of federal estate tax returns filed in a state. This finding is echoed by Brülhart and Parchet (2014), who find that variation in bequest taxes across Swiss cantons have little impact on the location decisions of retirees. But the recent work by Moretti and Wilson (2019), focusing on individuals from the Forbes 400 in the United States, suggests that mobility responses to estate tax incentives might be larger at the very top of the wealth distribution.

An emerging literature also estimates taxable wealth elasticities, which in effect provides an upper bound on the size of the household mobility elasticity. Using a large wealth tax reform in Denmark, Jakobsen et al. (forthcoming) estimate long-run elasticities of taxable wealth with respect to the net-of-tax return at the top of the wealth distribution. They find sizable elasticities, between 0.7 and 1. Using variation in wealth taxation across Swiss cantons, Brülhart et al. (2019) also find large taxable wealth responses. They argue that these responses are not driven by the geographic mobility of people across cantons.

However, mobility responses to wealth and capital taxes are not limited to the mobility of people, because taxpayers may be able to relocate wealth and capital income without changing personal residence. In a perfectly enforced residence-based tax system, unless the individual owner changes fiscal residence, the geographic location of capital has no impact on tax liability. However, since residence-based taxation of capital income and wealth is difficult to enforce internationally, there is in practice considerable scope for tax avoidance through geographic mobility of capital income and wealth (for example, see Griffith, Hines, and Sørensen 2010). In general, we would expect capital to be more mobile than people, because it is less affected by the possibly strong and idiosyncratic preferences for specific locations.

The early empirical literature on international capital and wealth mobility relied predominantly on cross-country correlations. This body of work has been summarized by Gordon and Hines (2002) and Griffith et al. (2010). They argue that international tax provisions have significant effects on capital allocation, that

tax avoidance through foreign investments and wealth holdings is a key threat to revenue collection and income redistribution, and that these forces have important implications for tax design.[9]

The most direct evidence on tax-related wealth mobility comes from recent work that uses creative data sources to quantify the amount of unreported wealth held in tax havens. Alstadsæter, Johannesen, and Zucman (2019) use leaked data from HSBC Switzerland and Mossack Fonseca (the so-called "Panama Papers") linked to administrative wealth records in Scandinavian countries. They show that the probability of hiding assets offshore rises sharply at the extreme tail of the wealth distribution: the top 0.01 percent of the wealth distribution owns about half of the leaked offshore wealth. Combining the micro data from specific leaks with estimates of the aggregate amount of offshore wealth from macroeconomic statistics (Zucman 2013), they argue that the top 0.01 percent evades about 25 percent of its tax liability by moving assets and investment income abroad. They do not estimate the response of such offshoring behavior to tax changes, but their evidence is certainly consistent with the presence of substantial tax-induced mobility of wealth by the very wealthy.

Policy Implications

The policy implications of mobility responses to taxes will depend on the extent to which tax policy is uncoordinated across countries—that is, a situation in which each country sets its tax rate without any international constraints or cooperation—and situations in which there is an element of coordination. We first consider uncoordinated tax policy and then turn to the implications of policy coordination.

Uncoordinated Tax Policy

When tax policy is not coordinated across countries, a key issue is whether there is targeted taxation of foreigners, as with the many preferential tax schemes discussed above, or a population-wide tax scheme applying to both foreign and domestic individuals. We start by discussing tax policy targeted to foreigners.

If the social welfare objective of a given country depends only on its domestic residents, the optimal influx of foreigners is governed solely by the externalities they generate on the domestic residents. As a result, the optimal taxation of foreigners trades off the revenue losses from cutting taxes on immigrants against the externality gains of attracting additional immigrants. These externalities include fiscal externalities—the additional tax revenue collected due to immigration—and non-fiscal externalities such as productivity spillovers (positive) and congestion (negative). In the absence of any non-fiscal externalities, the policy prescription is particularly

[9] Saez and Stantcheva (2018) derive the optimal tax rates on capital in different settings, including when capital income can be shifted abroad and there are different types of capital assets with potentially different elasticities.

simple: the optimal tax rate on foreigners is equal to the Laffer rate—that is, the tax rate that brings in the most revenue. In other words, if the government does not care about the welfare of the foreigners themselves and if the only externalities they create operate through the government budget, then it is optimal to maximize the revenue collected from them (Kleven, Landais, and Saez 2013).

These ideas can be formalized in a relatively straightforward manner. The theory of optimal taxation with migration responses was first analyzed by Mirrlees (1982) and reviewed by Piketty and Saez (2013) for the case without non-fiscal externalities, while the theory of welfare analysis with non-fiscal externalities was recently laid out in Kleven (2018). To simplify the analysis, let us make two assumptions. First, suppose the only behavioral response by foreigners is the migration response; labor supply conditional on moving is fixed. Second, suppose that the marginal non-fiscal externality from foreign immigration is zero. These assumptions are quite strong, but they provide a useful benchmark for developing intuition. Under these assumptions, we can show that the optimal tax rate on foreigners, τ^F, is given by

$$\tau^F \equiv \frac{1}{1+\eta^F},$$

where η^F is the elasticity of the stock of foreigners with respect to the net-of-tax rate.[10] The elasticity parameter η^F corresponds to the estimates reported in Table 1. This tax formula corresponds to the well-known inverse elasticity formula for the Laffer rate.

As mentioned, it is possible that foreign immigrants generate other externalities than those operating through the government budget. In particular, the foreigners targeted by the special tax schemes described above—high-income workers, researchers, and scientists—are often considered to have especially high positive spillovers. If such positive spillovers are taken into account, the optimal tax rate on foreigners would be correspondingly lower.

This discussion, along with evidence reviewed above, highlights the temptation of introducing preferential tax schemes for foreigners. For example, based on the tax scheme to foreigners in Denmark, Kleven et al. (2014) estimates a mobility elasticity of 1.6, which under the assumptions above implies a tax rate on foreigners of only 38 percent. While this is higher than the scheme's income tax rate, it is lower than the total top marginal tax rate when accounting for social security taxes

[10] This optimal tax rule in the equation can be derived as follows. Given the assumption of separability between the externalities from foreigners and the behavior of domestics, we define the external welfare effect of foreigners as $E^F(y^F N^F)$, where y^F denotes the average earnings of foreigners and N^F denotes the number of foreigners. The fact that we write the externality as a function of the aggregate earnings of foreigners, $Y^F \equiv y^F N^F$, as opposed to the number of foreigners is not crucial. Given foreigners are taxed separately at a flat tax rate of τ^F, the revenue collected from foreigners equals $\tau^F y^F N^F$. Denoting by μ the marginal value of government revenue, the government objective is to maximize $E^F(y^F N^F) + \mu \cdot \tau^F y^F N^F$. Absent intensive-margin responses (y^F is fixed), this yields the first-order condition for τ^F equal to $(\partial E^F / \partial Y^F) dN^F + \mu(d\tau^F N^F + \tau^F dN^F) = 0$. Defining the mobility elasticity as $\eta^F \equiv (dN^F/N^F)/(d(1-\tau^F)/(1-\tau^F))$ and the marginal externality effect in terms of the marginal value of government revenue as $e^F \equiv (\partial E^F/\partial Y^F)/\mu$, we would obtain the optimal tax rule shown here.

and value-added taxes (shown in Figure 1). Therefore, despite its apparent generosity, the Danish tax rate for foreigners may actually be higher than optimal. If we believe that top-earning foreigners coming to Denmark generate other positive externalities, then the optimal tax rate is even lower. In fact, the Danish tax scheme was originally motivated, not primarily by fiscal externalities and the Laffer logic, but by concerns about "brain drain" and the importance of high-skilled labor for economic growth and competitiveness. Our estimates imply that the fiscal externalities alone could justify Denmark's current preferential tax rate for foreigners.

While these arguments would seem to justify the use of preferential tax schemes to foreigners, a number of important qualifications should be emphasized. First, because mobility elasticities are not structural parameters, they may vary widely across countries and time periods. In particular, mobility elasticities depend mechanically on the size of the tax jurisdiction: a smaller jurisdiction is easier to exit. Indeed, as the size of a jurisdiction becomes infinitesimal, the mobility elasticity goes to infinity. Conversely, as the size of the jurisdiction approaches the global economy, the mobility elasticity goes to zero. Consistent with these conceptual ideas, the recent evidence showing large mobility responses is based predominantly on small tax jurisdictions: Denmark, Spanish regions, Swiss cantons, and US states. But the incentive to offer low taxes to foreigners is stronger in small countries such as Denmark than in large countries such as the United States.[11] By the same logic, the incentive to offer low taxes is stronger in subnational tax jurisdictions (a municipality or a state) than in a nation as a whole. The mechanical relationship between mobility elasticities and jurisdictional size can explain why tax havens tend to be small countries (Kanbur and Keen 1993).

Second, we have characterized the optimal tax policy of a given country not accounting for the welfare impact on other countries. Indeed, this formulation of the issues involves beggar-thy-neighbor policies done at the expense of other countries (although the externalities do not have to be symmetric, so the game is not exactly zero-sum). Moreover, in the case of special tax schemes targeted to foreign residents—unlike broader setting looking at taxes and provision of public goods—there is no clear Tiebout-sorting argument to justify the policy.

Third, the tax policy characterized above takes the policies of other countries as given. As analyzed in the literature on tax competition (for example, see Keen and Konrad 2013), when one country lowers its tax rate, other countries have an incentive to lower their tax rate too. But considering the tax rate series in Figure 1, there is no clear indication of a race to the bottom. Following an international trend of reducing top marginal tax rates around the 1980s, tax rates have remained relatively flat for the last two or three decades. Some countries have introduced special tax schemes to foreigners, but there is no evidence of any broad-scaled retaliation or race to the bottom. This might be because these preferential tax rates for foreigners

[11] A potentially offsetting effect is that negative congestion externalities—in the terms used above, the nonmonetary externalities from additional foreigners are negative rather than positive—are likely to be stronger in small countries.

have been introduced mostly in high-tax countries and are therefore perceived as leveling the playing field, rather than creating an unfair tax advantage. Still, it is interesting that almost all of the northern European countries have now introduced some version of a special tax scheme to foreigners, which suggests the possibility of tax competition between similar countries located in close proximity.

Finally, the policy implications change drastically if, instead of targeted taxation of foreigners, we consider uniform taxation of foreigners and domestic residents. Again, under the simplifying assumption that migration is the only behavioral response, the Laffer rate in an undifferentiated tax system equals $1/(1+\eta)$, where η is the average mobility elasticity on all residents. Because domestic residents constitute the vast majority of the population in most countries, η is approximately equal to the mobility elasticity of domestic residents. As shown in Table 1, this elasticity is very close to zero, and therefore, the Laffer rate is very close to one. Of course, there might be intensive-margin responses like reduced labor effort that lower the Laffer rate, but the key point here is that mobility responses across countries are not important for tax policy design unless the tax system targets foreign citizenship. This is not necessarily true of mobility responses across tax jurisdictions within countries like US states or Swiss cantons, where the relevant mobility elasticity may be considerably larger.

Coordinated Tax Policy

In the case of uncoordinated tax policy, each fiscal authority ignores any externalities that it imposes on other fiscal authorities (for example, Gordon 1983). A broadly coordinated tax policy is unlikely to materialize in the near future, even in otherwise integrated areas such as the European Union, both because fiscal policy is considered a matter of national sovereignty and because the potential gains from international tax coordination may be unevenly spread (Griffith, Hines, and Sørensen 2010). However, we can contemplate what such a policy would look like.

The issue of coordinated tax policy encompasses two main aspects. The first aspect concerns the level at which such coordination can happen. This leads to the question of the optimal size of jurisdiction over which tax policy is coordinated: for example, should it include a collection of countries (such as the European Union) or a collection of states within a country (such as the United States). The second aspect concerns what parts of fiscal policy are coordinated and to what degree.

On the first issue, a literature on fiscal federalism has studied the efficiency trade-offs associated with jurisdictional size (Oates 1972, 1999). Smaller jurisdictions (as mentioned above) will face larger migration elasticities and thus be more constrained in their choice of fiscal policy. They will have an incentive to lower tax rates, as in the earlier example of the special foreigner tax schemes. On the other hand, larger jurisdictions will be less able to cater to the diverse preferences for public goods and services among their residents. Diversity of policies, which may be valuable, could be lost. As a result, there is a trade-off between the inefficiencies from tax competition and the inefficiencies from public goods provision. Another challenge for large jurisdictions is an aversion to redistributing to immigrants in the

European Union and the United States, which can limit the ability to set progressive tax policy in a large and ethnically diverse jurisdiction (Alesina, Miano, and Stantcheva 2018). There may also be political economy frictions and transactions costs from administering large jurisdictions, which limit the ability of many countries to coordinate their tax policies.[12]

Regarding the type and degree of coordination, a conceptual distinction arises between situations where jurisdictions are constrained to set uniform policies and situations where they can—in a coordinated fashion—target taxes, transfers, and public goods to the local preferences of each jurisdiction. In the United States, for example, the federal government shoulders the bulk of progressive taxation, but states and municipalities have additional taxes, transfers, and public goods available to cater to their residents.

To formalize the conceptual ideas, consider a central tax authority such as a federal government or a supernational authority who sets tax policy in two regions, which we denote by A and B. To begin with, suppose the tax authority can set different tax rates in the two regions, τ^A and τ^B. We define two migration elasticities: η^A is the (positive) elasticity of migration in region A with respect to the net-of-tax rate in that region, while η^B is the (negative) elasticity of migration in region B to the net-of-tax rate in region A. Let's also assume that g^A is the average, income-weighted value to the social planner of transferring one unit of income to people in region A, while y^A and y^B denote aggregate incomes in the two regions. For simplification, assume that migration responses are the only behavioral responses to taxation, as we did in the previous section, and that any non-fiscal externalities are zero-sum across the two regions. Finally, assume that the aggregate tax revenue is rebated in a lump-sum fashion to all residents in the two regions, although this assumption can easily be relaxed. With this structure, it is possible to derive an optimal tax rate in region A:

$$\tau^A = \frac{1 - g^A - \tau^B \eta^B_A \cdot y^B / y^A}{1 - g^A + \eta^A}.$$

The formula for τ^B is symmetric.[13]

[12] There is also a small literature on the optimal size of countries more generally (Alesina and Spolaore 1997), which highlights the trade-offs between the efficiencies and inefficiencies from size. The trade-offs determining the optimal country size are between economies of scale from size (of which a reduced migration elasticity is a special case) and the gains from a diversity of policies adapted to residents' heterogeneous preferences.

[13] This formula is derived as follows. Conditional on moving to region A or B, person i has heterogeneous, but exogenously given income y_i^A or y_i^B. The total income in each region is then $y^A \equiv \sum_{i \in A} y_i^A$ and $y^B \equiv \sum_{i \in B} y_i^B$. As people can freely migrate, the income in each region is a function of both net-of-tax rates, i.e., $y^A = y^A\left(1 - \tau^A, 1 - \tau^B\right)$ and $y^B = y^B\left(1 - \tau^A, 1 - \tau^B\right)$. The central authority rebates the total tax revenues in a lump-sum fashion to all residents of the jurisdiction (this assumption can easily be relaxed). Thus, the consumption of agent i in region A under this tax system is $c_i^A = y_i^A(1 - \tau^A) + \tau^A y^A + \tau^B y^B$. People can have idiosyncratic preferences over the regions. Note, g_i is the marginal social welfare weight on agent i to be interpreted as a generalized social welfare weight as in Saez and Stantcheva (2016). Let

This formulation clarifies three main distinctions of coordinated policy relative to the uncoordinated policy setting considered in the preceding section. First, any non-fiscal externalities are internalized by the central tax authority, which no longer tries to implement beggar-thy-neighbor policies to benefit one region at the expense of the other. If these externalities are zero-sum, as assumed here, they drop out of the optimal tax formula entirely. Second, the central tax authority also internalizes the fiscal externalities that occur when people move between the two regions. This fiscal externality appears in the last term of the numerator and depends on the (negative) cross-elasticity of migration between the two regions and on the level of taxes in the other region. This term makes optimal taxes higher in both regions, all else being equal. Finally, the formula illustrates why it is valuable to differentiate policies across regions. Regions with more inequality or with more strongly redistributive preferences, as captured by a lower social welfare weight g^A, will prefer more progressive tax and transfer systems. However, the degree of progressivity and tax diversity is limited by the mobility of people across regions within the fiscal union (as captured by η_A^B) as well as by the mobility out of the fiscal union as a whole (as captured by η^A).

The elasticity of mobility with respect to taxes for region A would be smaller if (1) the region is larger (as discussed above), (2) if there is more tax coordination with jurisdictions that do not operate under the same fiscal authority, and (3) if mobility is lower due to nontax factors such as preferences and other policies. As for the latter, regulatory policies such as visa requirements and work permits, or transfer policies such as eligibility for welfare benefits and social insurance, may be important. Several countries, including France, Spain, and the United States, also impose exit or expatriation taxes for residents who decide to leave, which can be viewed as another way of trying to reduce the migration elasticity of domestic residents. Mobility responses to taxes will depend crucially on the local amenities of a region, on the public goods and services provided, and on agglomeration effects. All these forces also shape the within-jurisdiction cross-elasticity η_A^B and are plausibly even stronger within jurisdictions. Regions which are more similar in terms of amenities and thus more closely substitutable will face higher cross-elasticities and will have to set more similar tax rates than in a world without people and income mobility.

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us consider the effects of a small change in the tax rate τ^A, $d\tau^A$. First, this reduces each agent's income by $y_i^A\, d\tau^A$, which costs $-g_i y_i^A\, d\tau^A$ in terms of social welfare. Aggregating across all agents, the total effect is $-\sum_i g_i y_i^A\, d\tau^A$. In addition, the mechanical effect on revenues (without agents moving regions) equals $-\sum_i g_i y^A\, d\tau^A$. Since people also move regions following the tax change, there is an additional revenue effect, equal to $-\sum_i g_i \left(\frac{\tau^A dy^A}{d(1-\tau^A)} + \frac{\tau^B dy^B}{d(1-\tau^A)}\right) d\tau^A$. Let $\eta^A \equiv \frac{dy^A}{y^A}\frac{(1-\tau^A)}{d(1-\tau^A)} > 0$ be the elasticity of income in region A to the net-of-tax rate $1-\tau^A$ in the region and $\eta_A^B \equiv \frac{dy^B}{y^B}\frac{(1-\tau^A)}{d(1-\tau^A)} < 0$ be the cross-elasticity of income in region B to the net-of-tax rate $1-\tau^A$ in region A. The term $g^A \equiv \frac{\sum_{i\in A} g_i y_i^A}{\sum_i g_i y^A}$ is the average, income-weighted welfare weight in region A. Setting the three effects to zero, rearranging, and using the definitions in the text yields the formula in the text.

If policies are instead constrained to be uniform across the two regions within the jurisdiction, then the ability to differentiate policies and adapt them to local conditions is thus lost.

As discussed above, when considering tax policy setting across independent jurisdictions (states or countries), we do not immediately see evidence of a race to the bottom. This suggests that some implicit coordination is taking place, perhaps because of a fear of retaliation along the tax policy or other margins. On the other hand, the preferential tax schemes to foreigners implemented in several countries may hint at a slippery slope towards beggar-thy-neighbor policies. Getting rid of such schemes would be a limited form of policy coordination that seems welfare-increasing in our framework and potentially feasible. Partial coordination which internalizes some, even if not all, of the welfare gains from full coordination is an intermediate solution and already exists between state and local jurisdictions in the United States and subnational jurisdictions in other countries. Examples include revenue sharing and matching or categorical grants, partially centralized provision of public goods, central tax deductibility of local government taxes, or regulations concerning what sort of taxes and tax bases may be used by local governments.

Conclusion

There is growing evidence that taxes can affect the geographic location of people both within and across countries. This migration channel creates another efficiency cost of taxation with which policymakers need to contend when setting tax policy. At the same time, we have cautioned against overusing these empirical findings to argue in favor of an ineluctable reduction in the level of taxation or progressivity. Let us reiterate two key caveats.

First, while the mobility responses documented in some of the recent literature are striking and perhaps surprisingly large, they pertain to specific groups of people and to specific countries. Although we are far from having to rely on the celebrity anecdotes presented in the introduction, data limitations and identification challenges have forced researchers to study the migration flows in specific countries (like Denmark) or to focus on a specific population internationally (like superstar football players or inventors). We are still lacking systematic evidence on the mobility elasticities of the broader population and across different types of countries.

Second, the strength of the mobility response to taxes is not an exogenous, structural entity. It depends critically on the size of the tax jurisdiction, the extent of international or subnational tax coordination, and the prevalence of other forces that foster or limit the movement of people, all of which can also be affected by policies. These forces include local or national amenities, agglomeration effects, and the provision of public goods and services. Rather than compromising redistribution or restraining free mobility in an inefficient way, these can, in a productive way, be fostered to make the country or state attractive to people.

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