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Tax-Induced Emigration: Who Flees High Taxes? Evidence from the Netherlands

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Tax-Induced Emigration: Who Flees High Taxes? Evidence from the Netherlands*

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Abstract: We study the impact of a policy change in the Netherlands that reduced preferential tax treatment duration for high-skilled migrants arriving from specific countries in certain years. Utilizing comprehensive tax and population data, we document substantial tax-induced emigration responses, primarily driven by the top 1% of earners. Highly mobile individuals within the top 5% also emigrate sooner, particularly to competing countries offering tax-breaks to attract skilled workers. Crucially, we uncover no change in mobility behavior among lower-earning workers. The increased tax receipts from lower-income individuals who remain offset the loss from fleeing high earners, making the policy fiscally cost-neutral.

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Keywords: Taxation, immigration, labor income, Netherlands.

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1. Introduction

Globalization has reduced the monetary and psychological costs associated with international labor mobility. To benefit from this trend, national governments have increasingly turned to preferential tax schemes to attract specific groups of foreign workers into their labor market. There is now solid evidence of strong elasticities in location decisions when these schemes are available to top earners or scientists and inventors (see Kleven et al. (2020) for a review). [1] Much less is known about how such temporary tax breaks may affect out-migration decisions after their expiration, despite the oft-stated primary aim of these policies being the longer-term integration of the attracted foreign workers. This is an important question as the fiscal burden entailed would be politically tangible if the policies would induce these individuals to stay on to pay the high income tax rates they are usually subject to once the preferential treatment has expired. The difficulty in obtaining credible causal estimates of tax-induced out-migration stems from policies in many other countries and time-specific factors that are difficult to account for affecting individuals' staying decisions. This paper aims to shed light on this issue by using administrative data from the Netherlands to investigate the impact of a policy that radically changed the length of time that migrants were afforded preferential tax rates based on their country of previous residence.

[1] Kleven, Landais, and Saez (2013) made one of the first attempts to try to understand tax-induced international mobility by studying the labor market of professional football players in 14 European countries. Akcigit, Baslandze, and Stantcheva (2016) shift the focus to scientists and inventors and estimate their mobility responses to changes in tax rates of eight OECD countries. Finally, Kleven et al. (2014) focus on only one country to provide evidence on how immigrants that belong to the top 1% of the income distribution react to the introduction of a preferential tax scheme in Denmark. Muñoz (2023), studying changes in top-earner tax rates across Europe, reports migration elasticities of above one for foreigners.

In 2001, the Netherlands introduced a preferential tax scheme aimed at skilled immigrants, in line with many European countries. The four main goals of the "30% ruling" as it is commonly known and which are described in detail in the next section, were to: 1) attract workers from abroad that have a specific skill that is scarce in the Netherlands; 2) make the Dutch settling climate attractive and competitive for companies; 3) decrease the administrative pressure for employers and employees; and 4) create incentives for employees to stay in the Netherlands[2]. As reflected in the policy's name, eligible immigrants would have 30% of their gross income exempted from tax for ten years. The resulting fiscal strain of the scheme on Dutch taxpayers led to a substantial revision of the eligibility criteria and its assessment process, and the maximum duration of the tax exemption in 2012. Controversially, a key new criterion for non-eligibility—having relocated from a place less than 150 km from the Dutch border—was applied retroactively to beneficiaries who arrived after 2007, but it was not applicable to those who had arrived in the country prior to 2007. Individuals who did not meet this distance and arrival threshold would lose their right to the 30% tax break after five years, while all others would keep it for ten years.

To study the effects of this policy change we gained access to administrative data from the Dutch Tax Authority (*Belastingdienst*) about recipients of the scheme and matched it to population-wide administrative data from Statistics Netherlands (CBS) for the years 2002 to 2019. The pool of potential individuals affected by this reform was large, as in 2012 almost 33,000 employees were enrolled in the preferential tax scheme. Their labor market incomes were, as expected given the scarcity skill criteria, higher than the average Dutch population, but they were comparable to the top 50% of the distribution. We can thus look at a much more diverse group of affected migrants than in most previous contexts, which will be highly relevant when we consider policy response

[2]Dialogic (2017)

heterogeneities. Two crucial pieces of information are available in the administrative data: the start date and end date for each individual's eligibility for the preferential tax scheme and each individual's country of residence before migration. These data enable us to identify certain groups as treated individuals. We focus on workers who arrived from Belgium or Luxembourg—the two countries whose emigrants were all excluded from the scheme by the new 150 km criterion—to compare their return rate to those arriving from non-affected countries before or after 2007.

The analysis from our difference-in-differences approach yields very consistent findings: workers from those countries had strong out-migration responses to their loss of eligibility for the tax break, even after they had spent substantial time in the host country. The treated beneficiaries stay, on average, 5.3 fewer months or 8% less time working in the country. Looking at this using a different margin—the probability of treated individuals spending more than five years in the Netherlands (i.e., staying beyond the loss of the tax break)—there is a decrease of 13% for the average tax break recipient. We clearly show that there are no pre-trends in the duration in the pre-policy period, and that our findings are robust to a battery of tests that change the samples used to define control or treatment individuals. Notably, we discover that the policy effect is driven entirely by the behavioral responses of those workers belonging to the top 5%, and especially the top 1% of the income distribution.[3] We do not observe any out-migration timing reactions from all affected workers with earnings between the 50th and 95th percentile. This means that the tax-induced migration responses of top earners, which have been the focus of much of the previous literature (Agrawal and Foremny 2019; Akcigit et al. 2016; Kleven et al. 2014; Martinez 2017), do not appear to be shared by the more typical workers.

[3] Individuals are compared to the Dutch wage distribution of the year that their wage is computed. For more information on the variable construction, please see Appendix B.

We further show that the mobility response is not very sensitive to having created family roots (marrying or having children) while in the Netherlands, but those who have arrived from a third country (not their country of origin/nationality) respond more strongly to the reform. These "highly mobile" individuals explain the drop in duration observed among those just below the top 1% of the income distribution. We consider three potential confounders—working from abroad, changes in wealth taxation, and wage compensation—and demonstrate why they cannot be behind the policy effect we find. Considering policy implications, we estimate the elasticity of out migration responses to the average tax rate for the top 1% of earners of between 1.48 and 1.74 in our context. These are in line with the literature on the elasticity of in-migration decisions, but they are surprisingly large perhaps given that these individuals would have already spent a significant amount of time in the host country. We document how the next location choice of leavers, and in particular that of highly mobile top earners, is influenced by preferential tax treatment in other countries, indicating potential distortionary effects of international tax competition on the policy we study. Finally, we provide a simple cost–benefit analysis of the policy in terms of income tax receipts resulting from this reform and show that it was basically cost neutral.

The rest of the paper is organized as follows. Section 2 describes the institutional background, presenting the eligibility criteria for the Dutch preferential tax scheme and the changes implemented in 2012. It also presents the data and descriptive statistics. Section 3 explains our empirical specification and presents some graphical evidence of the policy effect. Section 4 reviews the results from our empirical analysis and their robustness. Section 5 is devoted to our heterogeneity analysis. Section 6 discusses potential confounders. Section 7 considers the policy implications of our results, and Section 8 concludes.

2. Institutional Background and Data

2.1. Institutional Background

2.1.1 The Dutch 30% ruling preferential tax scheme

It is now common for governments competing for foreign talent to offer temporary but substantial tax breaks to attract high-skill migrants and enjoy the positive externalities they can generate, as shown in the map of Europe reported in **Figure A1**. The design of such policies first aims to incentivize highly productive individuals to choose the country as their immigration destination of choice. A second important objective is to try to retain these high-earning individuals beyond the temporary discount period and, in doing so, collect the (usually) high levels of income taxes these workers would face thereafter. From an individual perspective, potential migrants base their location decisions on maximizing their income given their moving costs. Tax breaks that last for many years make a country relatively more attractive by raising an individual's potential net earnings. Longer duration tax breaks should increase workers' future moving costs: as migrants create deeper roots in the chosen country, they have a better change of settling in the country permanently.

The Netherlands introduced a tax break scheme in the mid-1960s, making it the country with what is probably the oldest and longest running tax break for immigrant workers in the world.[4] Until the 2012 change we study, the 2001 iteration of the law had become

[4] Article 31a, paragraph 2, part e, of the Wage Tax Act 1964 (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties (1964)). Subsequently, the arrangement was further elaborated in 11 articles of the Implementing Decree Wage Tax 1965 (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties (1965)).

widely known as the 30% ruling[5] The stated aim of the policy is to attract individuals with skills considered in short supply in the Dutch labor market by offering a tax break to compensate for the extra expenses the incoming employees might incur as they settle in the Netherlands. Once granted, 30% of the employee's gross labor income is free of tax for up to ten years.[6]

To be eligible for the 30% ruling before 2012, the incoming employee needed to fulfill certain requirements. First, the employee had to be hired from abroad or assigned to work in the Netherlands, meaning that the scheme is a special regime for expatriates.[7] Second, the incoming employee must be employed by a Dutch resident employer or a foreign employer who is a wage tax withholding agent in the Netherlands. Third, the employee must have specific skills not readily available in the Dutch labor market. This scarcity requirement is verified against a specific expertise test. In practice, this last criterion was quite loosely defined, as it only required that an employee's occupation was one of seven broad categories, including one labeled as "other" to accommodate individuals on a case-by-case basis.[8]

If the employee met these requirements, the employee would be granted a tax break for a maximum of ten years. The employee's job would be reevaluated to make sure it still met the scarcity requirement five years after the start of the tax benefit. Thus,

[5] The 30% ruling was actually the result of a merger of two older schemes (the "35% ruling" and Nedeco), which were in place in the Netherlands since the mid-1980s. See Weerepas, M.J.G.A.M. et al. (2013) for more information on the older schemes

[6] There were two adjustments in the duration period. The first one, in 2012, decreased the maximum duration of the benefit to eight years; the second one, in 2019, decreased by another three years to five years.

[7] This definition does not restrict eligibility on nationality, meaning that hired employees did not have to be non-Dutch to be eligible. However, any work period in the Netherlands in the ten years pre-application would be deducted from the potential maximum duration of the tax break.

[8] These seven broad categories were: top managers, scientists product specialists, teachers at international schools, employees of international institutions, and senior and middle management on mandatory company rotation, and an undefined final category where all applicants from other occupations considered high skilled could be accommodated. Author's own translation from the Dutch of the occupational categories described in Algemene Rekenkamer (2016).

in theory, the ten-year duration was divided into two five-year intervals. In practice, meeting the Dutch labor market specific skills requirement criterion was almost never an issue as almost all applicants automatically received the duration extension if they had stayed up to that point.[9]

2.1.2. The 2012 changes in eligibility criteria

In the decade following its introduction, calls for the 30% ruling to be reformed began as it had grown in size and nature beyond its initial scope. The number of yearly applications had grown by 50% (from 8,000 to 12,000) between 2002 and 2009; the government admitted that "the scheme is applied more widely than was intended when it was introduced. In particular, the interpretation of the criterion that the employee must possess a 'specific expertise' is too broad in practice, partly due to jurisprudence on this subject." (Kamerstuk 2011c).

To solve this first issue, the government proposed replacing the expertise criterion with a wage threshold[10] that would arguably more naturally capture areas that had a skills shortage in the Dutch labor market. Another contentious point was the potential application of the tax break to Dutch nationals returning to work in the Netherlands—after deduction of periods within ten years spent working abroad—as it was viewed as unfair that this growing number of individuals would be paid any extraterritorial costs. To avoid almost any Dutch citizen being able to benefit from the 30% ruling, the government proposed extending the deduction period from ten to 25 years.

Finally there were, as the Secretary of State for Finance put it at the time, "signals from the border regions that the 30% ruling can lead to a vacancy at a Dutch employer

[9] This is statistically confirmed in the data as there is no discontinuity in taxable wage levels around the five-year threshold for recipients of the 30% ruling who were not affected by the policy change we study.
[10] This amount was € 35,000 (which is € 50,000 gross) for individuals older than 30 years and € 26,605 (which is € 38,007 gross) for individuals younger than 30 years old

giving preference to foreign employees over Dutch employees, solely because the employee who comes from abroad, can apply the 30% ruling and the Dutch employee cannot." (Kamerstuk 2011a). In response, the secretary proposed the relatively radical solution of imposing a new distance criterion, which made any individual who lived less than 150 km from the border of the Netherlands (as the crow flies) in the period before moving would no longer be eligible for the tax break. All these proposed changes were eventually implemented as amendments to the Wage Tax Act 1964 (Kamerstuk 2011b) and became effective on January 1, 2012.[11]

2.1.3. Transitional rule: eligibility dependent on arrival time

A transitional rule was also implemented along with the changes to the 30% ruling that differentially affected recipients depending on their original application date. Making use of the already existing five-year re-application extension requirement, the government decreed that starting January 1, 2012, if an individual "no longer qualified under the applicable regulations (i.e. does not meet the salary criterion at the time of assessment and/or before entering employment lived in the aforementioned border region), will no longer be entitled to the 30% ruling." (Kamerstuk 2011c).

In practice this meant that all individuals who had started taking advantage of the 30% ruling before December 31, 2006, (i.e., those who had their five-year interim test scheduled *before* 2012) were entitled to ten years of tax breaks regardless of the new criteria. Individuals who arrived between January 1, 2007, and December 31, 2011, (i.e., those who had their five-year interim test scheduled *after* 2012) needed to meet both the new wage and distance criteria to obtain an extension of the tax break beyond five years. Since almost all claimants who reached this stage met the wage criterion—over 94% of

[11] In addition to these changes, the maximum tax break period was limited to eight years instead of ten years, and individuals with doctorates could more easily obtain the benefit.

them[12]—it is the distance threshold that really created an unexpected early loss of the tax break for those who had originally relocated from a place less than 150 km from the Dutch border. More specifically, as **Figure 1** illustrates, workers previously recruited from the whole of Belgium, the whole of Luxembourg, a big part of western Germany, and a small part of northern France were no longer entitled to claim the benefits of the 30% ruling.

To better understand the details of the 2012 law change and its transitional rule, **Figure A2** depicts the duration of the preferential scheme on a time-line diagram and divides the sample of beneficiaries into two different groups: 1) incoming employees who applied for the scheme between 2002 and 2006, and 2) incoming employees who applied for the scheme between 2007 and 2011. We further split these groups into employees who met and those who did not meet the distance threshold criterion introduced in 2012. With this we illustrate the specific group of workers—those who arrived from 2007 to 2011 from specific locations—who were affected by the policy reform. These individuals will constitute the treated group that we use in a difference-in-differences approach to obtain causal estimates of the impact of drastically reducing the duration of the tax break on return migration decisions. All other claimants who were unaffected because they came earlier from the same regions or contemporaneously from other locations, will serve to control for other factors that are unrelated with the policy change that may have influenced worker movement out of the Dutch labor market. Before explaining in more detail our identification strategy, we first present the data used along with essential descriptive statistics of the workers covered by the 30% ruling tax break and its reform.

[12] The value can be seen as the lower bound as we compute the average monthly wage for beneficiaries in their second year in the Netherlands, expressed in the equivalent of 2012 euros, and do not account for sectors that are exempted from the threshold (i.e., Research and Education). Breaking down by treatment status, the values are 94.88% and 94.62% for treated and control individuals, respectively.

Figure 1: New Distance Tax Break Criterion: 150 km to the Dutch Border

Notes. The red line depicts the 150 km distance threshold from the closest point of the Dutch border. To be eligible for the 30% ruling after 2012, workers must be recruited from a place that lies outside the red delimitations. That is, incoming employees from Belgium, Luxembourg, a big part of western Germany, and a small part of northern France are no longer eligible for the Dutch preferential tax scheme. Note that the United Kingdom was not affected by the change, despite a small part of the southeast United Kingdom lying within the 150 km threshold.

2.2. Data and Summary Statistics

2.2.1. Database: 30% ruling tax records and administrative data

We use data from the Dutch tax office (*Belastingdienst Nederland*) on the whole population of beneficiaries of the 30%-ruling from the period of 2002 to 2011. We have specific information on the start and end date of the individuals' tax break, the employer that

made the request, and monthly taxable wage data. Through the analyzed period, 54,386 unique individuals[13] used the preferential tax scheme.

We complement our database with administrative data from the Statistics Netherlands (CBS). The data allow us to identify specific immigration and emigration dates and a full set of background characteristics such as gender, age, municipality of residence, employment information, company sector, citizenship, and other household characteristics. We describe in detail each dataset used, the matching process, and the construction of all variables in **Appendix B**.

One limitation of our data is that we are only able to identify the previous country of residency and not the precise municipality of residence of migrants prior to their arrival in the Netherlands. As noted in **Figure 1**, Germany and France are partially affected by the 150 km distance threshold, but we are unable to precisely ascertain whether individuals fall into the treated category based on their residence. Consequently, as explained in the next section, we will focus on the policy response in terms of out-migration decisions of those who arrived from either Belgium or Luxembourg.

2.2.2. Summary statistics on 30% ruling recipients

As **Figure A3.1** illustrates, the country of origin of the tax break recipients is very international; for example, 18.4% come from either China, India, or Japan, and 16.3% from the United Kingdom or Ireland. Germany, France, and Belgium-Luxembourg account for 8.8%, 5.2%, and 2.9% of migrants respectively, meaning that 1,582 individuals are from the two countries that are entirely treated. **Figure A3.2** shows that recipients come to be employed in a wide variety of economic sectors but also that more than half work

[13] There are 46,782 unique individuals if we do not consider individuals from the partially treated countries, Germany and France, which we will drop in our preferred specifications as explained below.

in either business services (28.5%) or trade, transport, and catering (20.6%). The map in **Figure A4** depicts the spatial distribution of recipients in terms of residential location in the Netherlands. There is a very strong concentration, with over a third living in and around Amsterdam and almost 60% when also including The Hague, Rotterdam, and Eindhoven. This is not surprising given that these are the large cities that have companies in need of high-skilled workers, but it does show that there is not an overconcentration of immigrants in the "border regions," which some politicians who called for the policy change were most worried about.

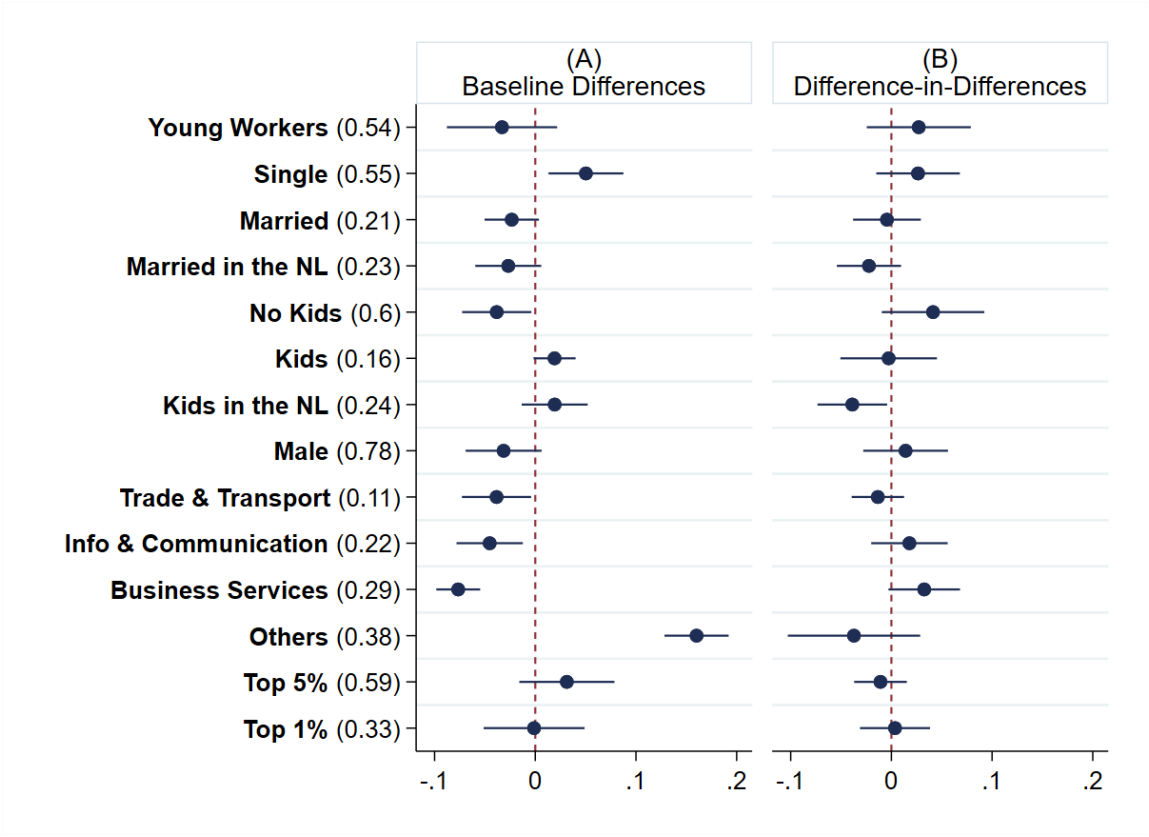
Basic information on the origin, sector, and location of 30% ruling beneficiaries is relevant but our administrative data also enable us to describe them in terms of demographics, family structure, and earnings. Of interest for our identification strategy —the difference-in-differences presented formally in the next section—is how different these characteristics are between individuals from treated and nontreated countries and how this changes before and after the policy was introduced. We present all this information in **Figure 2**, which reports pre-policy averages of all recipients (in brackets), estimated baseline differences relative to those from Belgium-Luxembourg in the left part of the graph, and estimated differences pre and post policy between these two groups in the right part of the graph.

Figure 2 also reveals that tax break beneficiaries are mostly males (78%), are relatively young (54% are younger than age 35), and a majority are single (55%) and without children (60%). As expected, they are high earners, with three-fifth having wages that put them in the top 5% of the Dutch wage distribution and one-third having wages that put them in the top 1%. Recipients from treated countries are less likely to be married and to work in very different sectors,[14] but otherwise, they have similar high earnings

[14] Others refer to Agriculture, forestry, and fishing (0.05%), Construction (0.52%), Industry and energy (13.73%), Financial sectors (8.24%), Renting and trading of real estate (0.2%), Government and care (10.58%) Culture, recreation, and other services (3%) and Unknown (1.2%).

profiles. Finally, when we compare how these differences across origin country change over time, we see that almost none of the differences remain significant, which is reassuring for the validity of our identification strategy.

Figure 2: Descriptive Characteristics of Recipients, by Treatment Status



Notes. Figure 2 Panel A presents the summary statistics for the main characteristics of the beneficiaries. For each variable, we present the baseline average for the treated countries (values in parentheses) as well as the plotted difference in means between the control and treatment countries in the pre-policy period of 2002–2006. Figure 2 Panel B plots the difference-in-differences in means between the control and treatment groups, with no systematic overall differences between the two groups throughout the years.

An interesting feature of the setting we are studying is that the changes introduced in 2012 affected individuals at all levels of the earnings distribution, not only top earners. **Figure 3** depicts this distribution, along with that of all other wage earners in the Netherlands for 2012. As expected from a scheme aimed at attracting high-skilled migrants, the median pre-tax earnings of beneficiaries is high at €8.3k a month (in 2012

€), which was about 2.7 times more than the national median wage in 2012.[15] There are a lot of very high earners among 30% ruling recipients, with nearly 60% of them in the top 5% (monthly wage above €7.2k), and almost a third in the top 1% (monthly wage above €12.3k), of the income distribution of the Netherlands. While almost all tax break beneficiaries are above the national median, many of them re high—but not top—earners, with the mode of the distribution receiving net wages around €4.5k a month, and some even receiving wages below the 50th percentile of the Dutch distribution.[16] This last observation will enable us to uniquely consider the migration response to reducing fiscal advantages for high-skilled migrant workers who have very different earnings profiles, not only for those at the very top of the distribution as in most of the previous literature.

Two final summary statistics we report in Figure A5 relate to the magnitude of the tax break in terms of net earnings, and especially of its loss. We first present, in Figure A5.1, the relationship between taxable and net wages, when the worker benefits or does not benefit from the 30% ruling. The graph also reports the mean tax rate corresponding to each wage level. The relative loss in earnings due to the 30% ruling is large at all wage levels, ranging from 16% for those below the 95th percentile of the distribution, to about 22% and 24% for those between the 95th and 99th percentiles and for the top 1%, respectively. We also show, in Table A5.2, the earnings dynamics around the time when the 30% ruling benefit expires for each recipient in our sample who reaches the end of the tax break. When the tax break ends, we see that the average monthly net wage drops substantially from around €7k to €5k, which is a 28% decrease.[17] The loss in earnings from

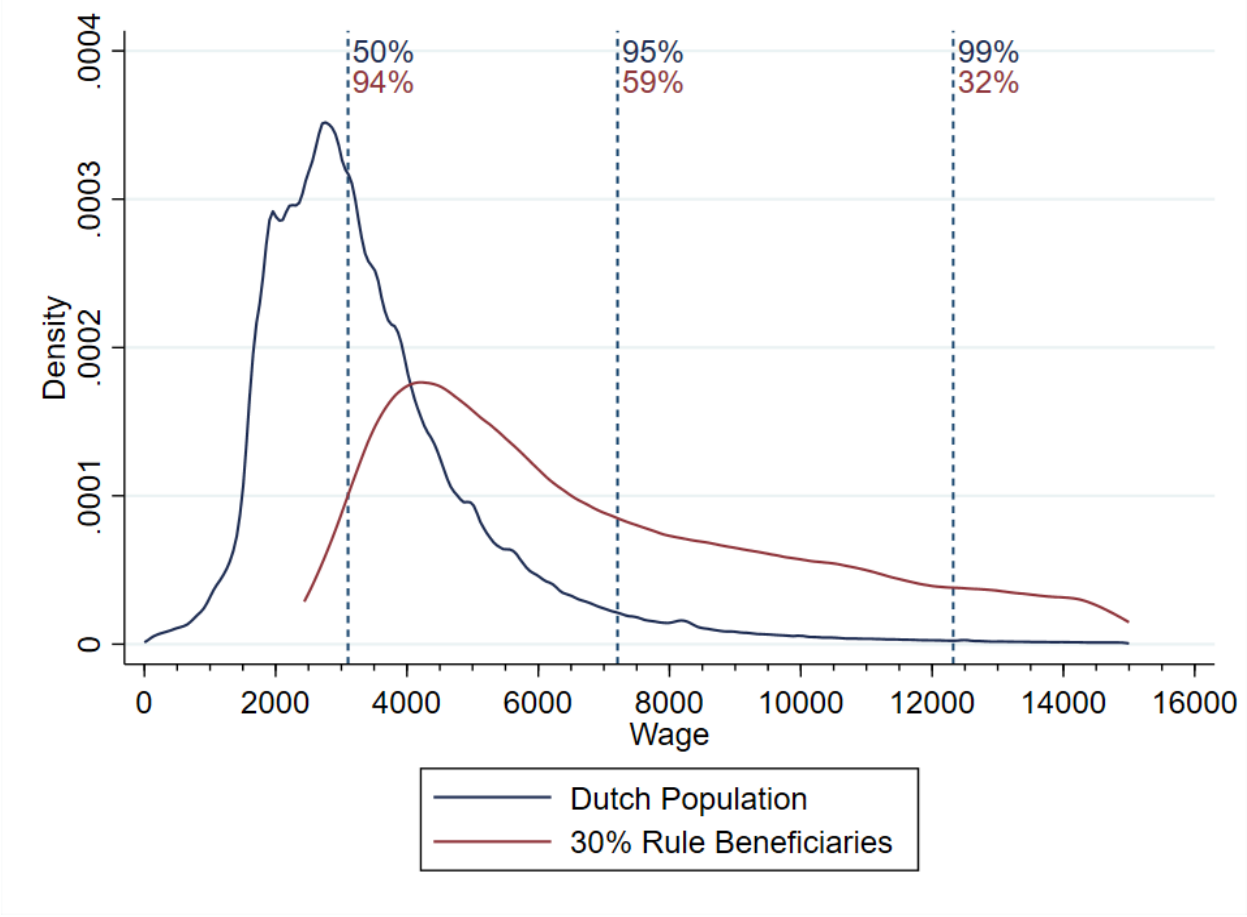
[15] This is about twice the size of the income threshold of €50,000 a year (or €4,166 a month) implemented for eligibility in 2012. Only around 5% of workers had lower earnings when we measured their income, and over 45% of them worked in exempted sectors such as Research and Education, making the new eligibility threshold non-binding for most beneficiaries already in the country (see Timm, Giuliodori, and Muller (2022) for discussion on the arrival of immigrants).

[16] Through the analysis we do not consider any individual with income below 50% of the Dutch distribution.

[17] Note that the average taxable wage follows an inverse path when the 30% ruling expires as it increases from around €6.8k to almost €9k.

losing the benefit of the 30% ruling is thus very large, but slightly less than expected given the change in net wage it entails (Figure A5.1). This could be the result of some wage compensation from employers given to tax-break losers, something we explore later.

Figure 3. Wage Distribution: Dutch Population and 30% Ruling Beneficiaries



Notes. For the Dutch population, we construct their earnings distribution using all Dutch earners in 2012, correcting for the full-time equivalent. For the beneficiaries, we compute their average monthly wage for each year that they were in the Netherlands, and we select the highest average monthly earnings out of their first two years with positive earnings. To construct their earnings distribution, we select all the beneficiaries from the control years (2002–2006) and express their pre-tax monthly wages in the equivalent of 2012 euros.

3. Identification Strategy and Graphical Evidence

3.1. Difference-in-Differences Approach

Our identification strategy exploits the 2012 policy change in the 30% ruling as a quasi-experiment to causally evaluate the impact of losing preferential tax rate status on the out-migration decision of high-skilled migrants. The fact that it unexpectedly increased the tax rate after five years, rather than ten, for a specific group of individuals—depending on arrival time in the Netherlands and on country of previous residence—makes it ideal for a difference-in-differences approach. Estimates obtained will reflect the difference in migrants' decisions to leave the Netherlands pre and post policy (i.e., arrived before or after 2007) between those who originally relocated from a treated or control country (i.e., from a country closer or further than 150 km[18]).

The difference-in-differences specification we estimate in equation (1) is its most basic form, where the main outcome of interest, Y, is either the length of stay in the Netherlands, measured in months, or a dummy variable that indicates whether the incoming employee stayed in the country for more than five years.

$$Y_{it} = \alpha + \beta_1 PPR_i \times Start\ Year_t + \beta_2 PPR_i + \beta_3 Start\ Year_t + \varepsilon_{it}\,. \qquad (1)$$

Subscripts i and t denote beneficiary i and start year t. PPR is a dummy variable equal to 1 if the previous place of residence of individual i, lies within 150 km of the Dutch border,

[18] As previously mentioned, we are only able to identify the previous country of residence and thus cannot properly assign treatment status to individuals coming from Germany and France. All our empirical analyses will either exclude Germany and France from the sample or include Germany and France in the control groups. The next section will show that the results are robust irrespective of which two samples we use.

and 0 otherwise. *StartYear* is a dummy variable equal to 1 if individual *i* started benefiting from the 30% ruling between 2007 and 2011, and 0 if they started benefitting from 2002 to 2006. Therefore, β_1 is our coefficient of interest that reflects the causal policy impact. Finally, α and ε are, respectively, the constant and error term. We will estimate multiple versions of equation (1), most often augmented with country of origin and start year fixed effects that include all available individual controls from our administrative data.

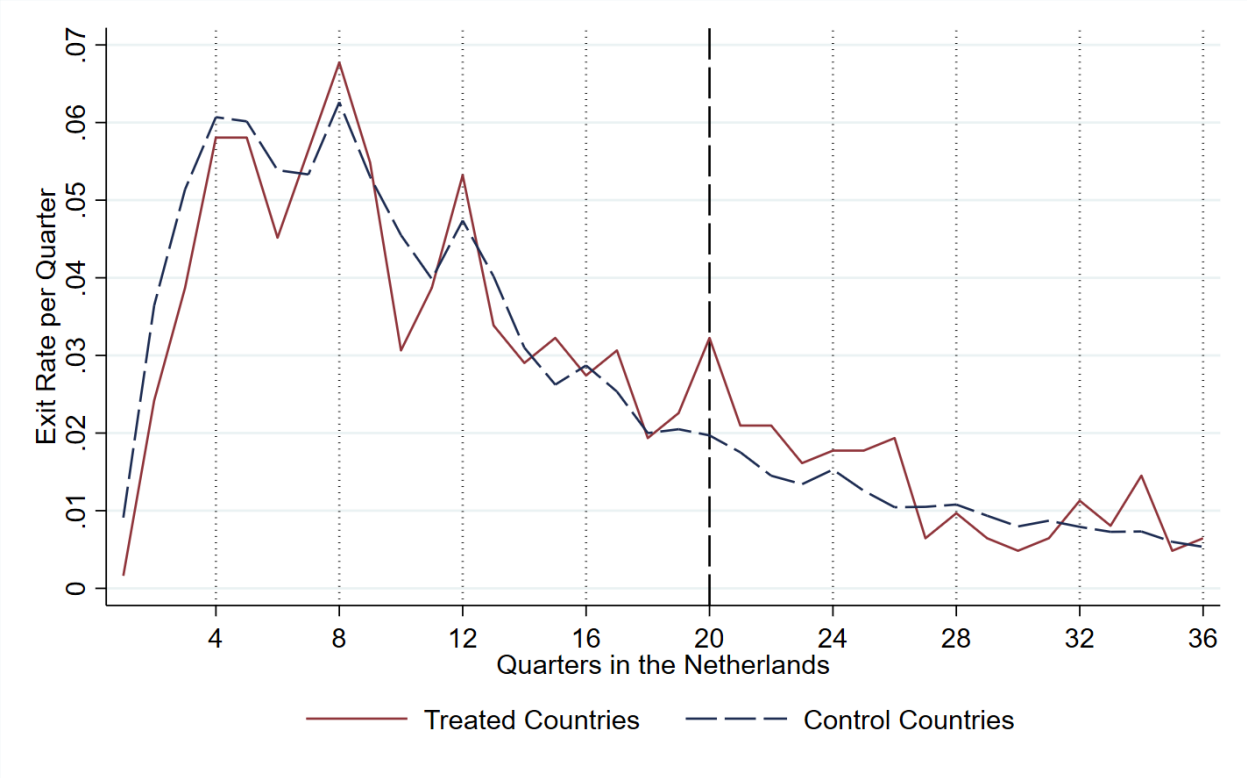
Of paramount importance to the validity of our identifications strategy is that the policy change was credibly orthogonal to any other observed and unobserved factors that may have affected past individual location decisions; given the retroactive nature of the policy implementation, that condition is likely met. This is also statistically confirmed by the exercise we carry out in Panel B of Figure 2, which shows that there were no significant differences in characteristics between treated and control individuals in the pre- and post-policy period (i.e., estimates of equation (1) using characteristics as outcomes). Also crucial to any difference-in-differences approach is that the pre-policy trends between the treatment and control groups are similar. In our case that would mean that the difference in time spent in the Netherlands between individuals from treated countries and control countries was evolving similarly for those arrived up to 2007. We check (and validate) for common pre-trends in Section 3.3., which graphically presents pre- and post-treatment dynamics.

3.2. Distribution of Out-Migration Timing

We begin our analysis of the policy effect by documenting the probability of out-migration by duration, depending on treatment status. Our administrative data allow us to precisely identify immigration and emigration dates, which we use to construct exit rates by quarters spent in the Netherlands for those previously located in a treated or

control country. **Figure 4** shows this distribution for the post-policy period (i.e., for those who arrived in the Netherlands between 2007 and 2011).

Figure 4. Exit Rate Dynamics: Post-Policy Period



Notes. The figure depicts the quarterly exit rate by treatment status. Treatment and control refer to the country of previous residence, meaning that the treatment group contains the individuals who left the Netherlands after immigrating from Belgium or Luxembourg while the control group contains individuals who immigrated from elsewhere. The series is constructed considering only individuals who arrived between 2007 and 2011. The series is delimited by quarter 36 because not all individuals who arrived between 2007 and 2011 would have reached more than 36 quarters in the Netherlands by the end of 2019. Moreover, all individuals from our control sample would lose the benefit after ten years in the country.

The figure first reveals that there are peaks of exits at 4, 8, and 12 quarters which are most likely linked due to full year contract durations that are negotiated by migrant workers. This bunching in the density of the distribution is very similar between 30% ruling beneficiaries from both treated and control countries. What is clearly different however is the much higher exit rate for treated expats (50% higher than for the control group), which coincides with the fifth year of stay in the Netherlands—hen they lose their

tax break. **Figure A6** shows the same figures for the pre-policy period and, if somewhat noisier in terms of its distribution, crucially does not reveal any difference in exit probability around the twentieth quarter between treatment and control country arrivals from 2002 to 2006.

3.3. Pre- and Post-Treatment Dynamics

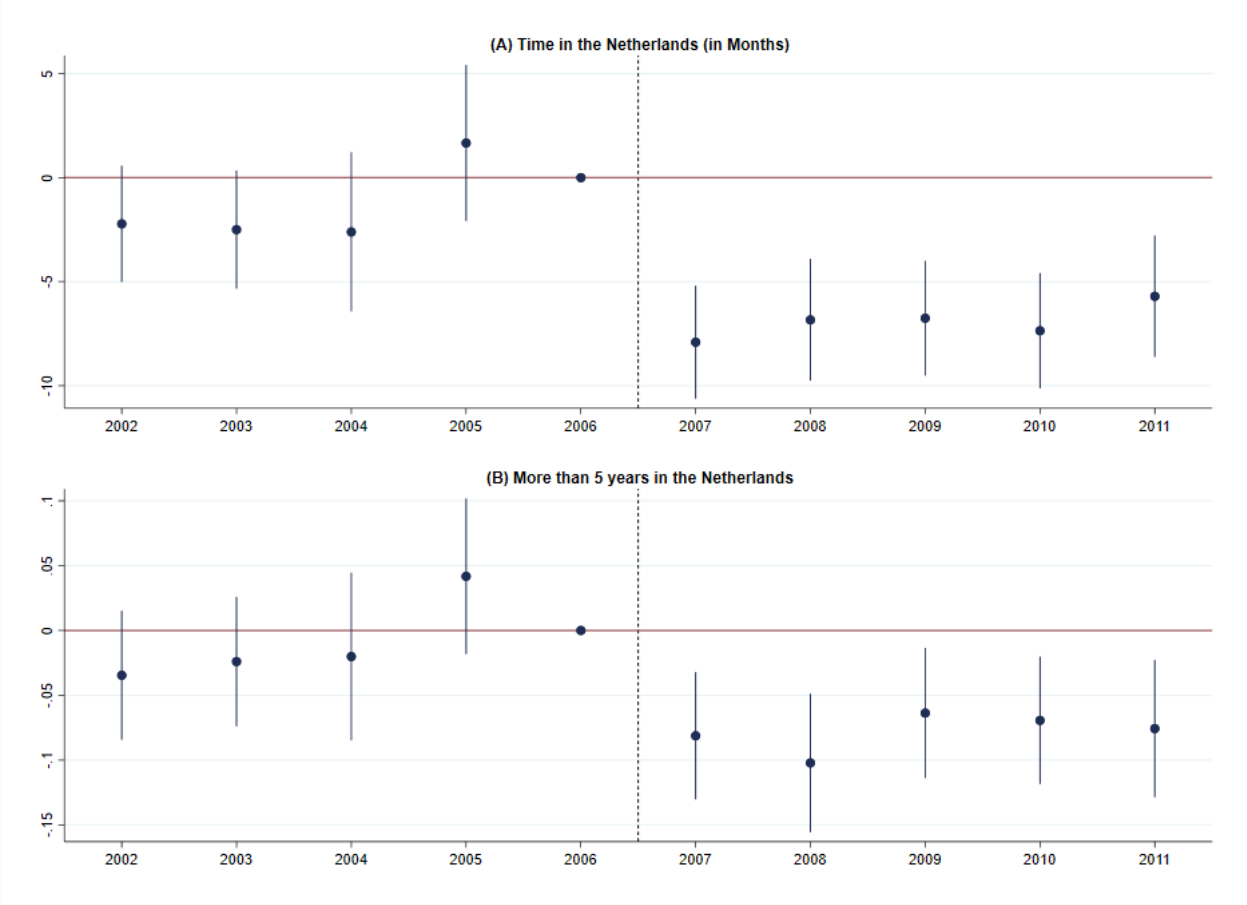
The main regression estimates we will rely on to evaluate the policy impact in this paper will stem from the difference-in-differences specification defined by equation (1). Before turning to these average effects, we inspect the dynamics of the treatment effect pre and post treatment. We do this by estimating separate coefficients $\hat{\gamma}$ for each year of arrival t using equation (2), which is a dynamic version of equation (1) anchored around 2006, the year prior to the treatment start (i.e., akin to an event study difference-in-differences specification).

$$Y_{it} = \alpha + PPR_i \times \sum_{\substack{t=2002 \\ t\neq 2006}}^{2011} \gamma_t \mathbb{I}(Start\ Year = t) + \beta_1 PPR_i + \beta_2 Start\ Year_t + \varepsilon_{it}\,. \quad (2)$$

Figure 5 displays the coefficients produced from equation (2) and their 95% confidence intervals with the outcome Y being either months in the Netherlands in Panel A or staying longer than five years in Panel B and the horizontal red line representing no difference in duration. What stands out is the visually striking contrast with all estimates pre policy being small and statistically nondifferentiable from zero and all post-policy estimates being strongly negative, relatively constant, and statistically significant. The first finding of a non-effect pre-policy is reassuring for the validity of our difference-in-differences approach as it confirms that the common pre-trend assumption is not violated. The second finding of a negative and stable post-policy treatment effect suggests that the policy had a homogenous effect of significantly reducing time spent in the

Netherlands, independent of time already spent in the country. This implies that the average effect generated by standard difference-in-differences specifications presented in the next section does not hide large heterogeneities of the out-migration response by the remaining tax break duration, which is a highly relevant policy finding.

Figure 5. Effect of the 30% Ruling Loss on Time Spent in the Netherlands



Notes. Depicts the event study based on equation 2. Panel A considers the first outcome of interest, time in the country measured in months, while Panel B considers the second outcome of interest, the probability of staying in the Netherlands for more than five years. The vertical dashed line between 2006 and 2007 split the sample between the cohorts that were affected by the 2012 change in the 30% ruling from the sample that was not affected.

4. Average Policy Impact Estimates and Robustness Checks

4.1. Average Policy Impact Estimates

Table 1 reports estimates of how the policy change affected the mobility behavior of highly skilled immigrants. Panels A and B show our outcomes of interest, the length of stay in the Netherlands measured in months and the probability of staying more than five years in the country, respectively.

Column (1) presents the most basic specification stemming from equation (1); then we successively add control variables up to our full and preferred, specification in column (6). All regressions include country of previous residence and start year fixed effects. The coefficients of interest, the interaction between *PPR* and *StartYear*, are always negative, statistically significant, and hardly vary across specifications. These results clearly show that individuals affected by the shortening of the preferential tax scheme from ten to five years spent less time working in the Netherlands. Our results from Panel A (months spent in the country) show that treated beneficiaries out-migrated on average 5.3 months earlier, representing an 8.1% decrease from a baseline of 65.5 months. Looking at our extensive margin measure in Panel B (the probability that individuals stayed beyond the end of the five-year preferential tax treatment), we reach the same conclusion. We estimate that the mean beneficiary affected by the policy change was 13% less likely to spend at least five years working in the Netherlands, a duration that is almost half the time that all high-skilled migrant workers spent before the duration of the tax break was shortened.

Table 1: Baseline Results: Time Spent in the Netherlands

Dependent Variable:	**Time in Country** in Months (Panel A) and Over 5 Years (Panel B)					
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Months in Country						
Previous Place of Residence (PPR) *Start Year	-5.78*** (0.88)	-5.38*** (0.87)	-5.38*** (0.87)	-5.36*** (0.91)	-5.34*** (0.91)	-5.34*** (0.93)
Mean of dependent variable	65.79	65.79	65.79	65.79	65.79	65.79
Impact at mean	-8.8%	-8.2%	-8.2%	-8.1%	-8.1%	-8.1%
Panel B: Probability > 5 Years						
Previous Place of Residence (PPR) *Start Year	-.071*** (.015)	-.067*** (.014)	-.067*** (.014)	-.067*** (.015)	-.067*** (.015)	-.067*** (.015)
Mean of dependent variable	.510	.510	.510	.510	.510	.510
Impact at mean	-13.9%	-13.1%	-13.1%	-13.1%	-13.1%	-13.1%
Country of Origin FE	Yes	Yes	Yes	Yes	Yes	Yes
Start Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Sector	No	Yes	Yes	Yes	Yes	Yes
Age	No	No	Yes	Yes	Yes	Yes
Gender	No	No	No	Yes	Yes	Yes
Married	No	No	No	No	Yes	Yes
Child	No	No	No	No	No	Yes
Observations	**46,763**	**46,763**	**46,763**	**46,763**	**46,763**	**46,763**

Notes. Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. All regressions include country of origin and start year fixed effects. Panel A considers the first outcome of interest, time in country, while Panel B considers the second outcome of interest, the probability of staying in the Netherlands for more than five years.

4.2. Robustness Checks

We carefully check the robustness of our main findings by changing how we define the treatment and control group and graphically plot the resulting coefficients and

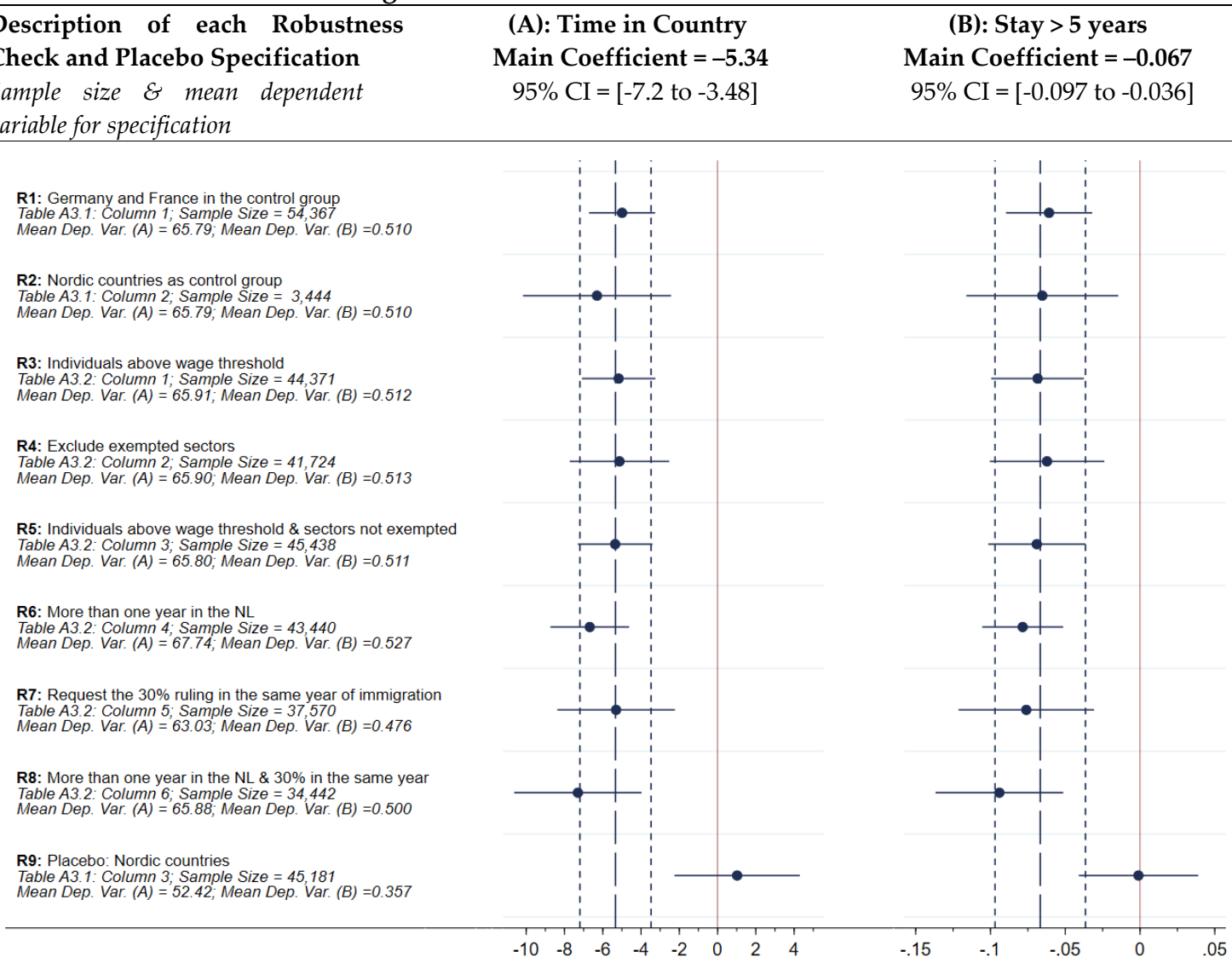
95% confidence intervals in **Figure 6** (R1 to R8)**; Tables A3.1 and A3.2** present the detailed estimates presented. The left graph (A) shows the length of stay in the Netherlands measured in months, and the right graph (B) shows the probability of staying in the Netherlands beyond five years. All coefficients in **Figure 6** are put in perspective with our preferred estimates from **Table 1**, column (6): a vertical blue line shows the coefficient, and dashed lines show the 95% confidence interval. Hence, when the estimated robustness check's coefficient overlaps with these lines, we can reject the hypothesis that it is significantly different from our main policy estimate.

Including French and German migrants, whose countries are partially treated, in the control group (R1) does not change the results. Using only individuals from Nordic countries as controls (R2)[19] – (the rich and nearby counties, so they are most similar to Belgium and Luxembourg) makes the estimates somewhat larger, but more imprecise. Excluding individuals who have wages below the threshold introduced in 2012 (R3), workers from exempted sectors after the reform (R4), or both (R5), do not affect the findings. Finally, if we use only individuals who stayed at least 12 months in the Netherlands (R6), those who applied for the 30% ruling the same year as they immigrated to the Netherlands (R7), or both (R8), the estimates are again statistically equivalent to those in the main specification. These checks confirm that our findings do not depend on any specificities of the sample used to evaluate the policy.

In the last row of Figure 6 (R9), we report results from running a placebo specification in which individuals arriving from Nordic countries are taken as the treated group and those from Belgium and Luxembourg are dropped from the sample. The estimates on both outcomes are very close and statistically indistinguishable from zero (the vertical red line).

[19] The Nordic countries are Sweden (40.1%), Denmark (25.9%), Finland (19.4%), Norway (12.5%), and Iceland (2.1%).

Figure 6: Robustness Checks and Placebo



Note. The main coefficient is from our preferred specifications estimating the impact of losing the tax break on the time length in the Netherlands measured in months and on the dummy indicator of staying more than five years in the Netherlands as in column (6) of Table 1, Panels A and B, respectively. The long-dashed line is the coefficient estimate, dotted lines are lower and upper bounds of the confidence interval, and the solid line marks the zero effect. The coefficients for each regression are displayed as a blue circle with a line representing +/– 2 standard errors. R1 includes Germany and France as control countries; R2 only takes Nordic countries as controls; R3 excludes individuals with wages below the threshold introduced in 2012 (5.1% of the sample); R4 excludes individuals who work in sectors exempted from the wage threshold (e.g., Research and Education, 10.8% of the sample); R5 restricts the sample on both R3 and R4 (97.16% of the sample); R6 uses only individuals who stayed more than one year in the Netherlands (92.9% of the sample); R7 uses only individuals who requested the 30% ruling in the same year as they immigrated to the Netherlands (80% of the sample); R8 restricts on both R6 and R7 (73.7% of the sample), R9 is a placebo test in the country, considering the Nordic countries as our treated sample and dropping individuals who immigrated from Belgium and Luxembourg.

5. Heterogeneity in Policy Response

Our baseline results quite clearly show that beneficiaries who had their tax break revoked after five years shortened their stay in the Netherlands. To get a more comprehensive picture of the policy effect, we analyze the heterogeneity in the out-migration response of subgroups of the population. We first focus on individuals with different earnings levels to check whether our results are driven by those belonging to the top of the distribution, which is the most studied group in the literature (see Kleven et al. (2020) for a review). We also explore whether behavioral responses are different for individuals who might be more mobile as they arrived in the Netherlands from a third country (i.e., a country where they are not a citizen of or were not born in). Lastly, we look to see whether creating family roots by marrying or having children while benefiting from the scheme influences the timing of the out-migration after the shortening of the tax break duration.

5.1. Top Earners versus Other Beneficiaries

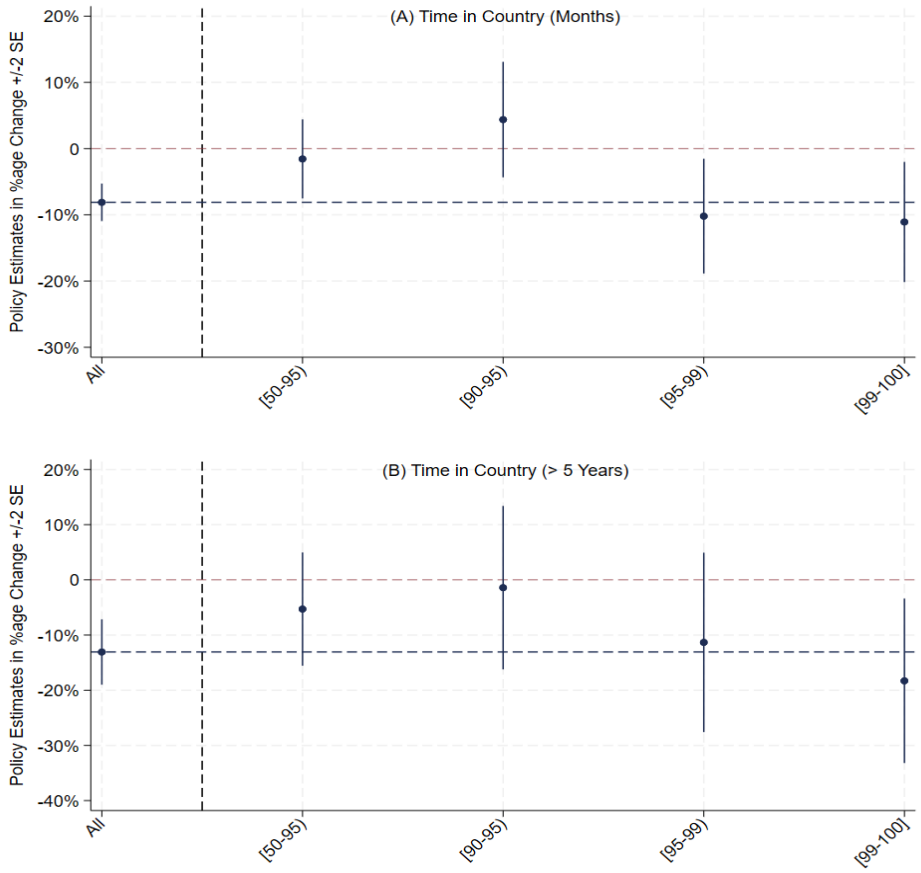
The literature on taxation and migration has mainly focused on the behavioral responses of top earners primarily because those individuals are the ones targeted by preferential schemes, thereby allowing researchers to study the causal effect of taxes on migration. Our setting provides a unique opportunity of studying the mobility response of a much broader population as the policy change applied to all levels of the distribution, with beneficiaries quite well represented at most level of earnings above the median (see

Figure 3). We thus estimate the policy response in out-migration behavior separately for four subgroups of the earnings distribution: 50–95, 90–95, 95–99, and 99–100.[20]

Figure 7 graphically presents the resulting coefficients in terms of policy effects (i.e., estimated impact relative to baseline) with details about each specification reported in **Table A4**. For comparison, our baseline mean policy impact estimates are shown and extended by the horizontal blue dashed line: at –8% for time in months in Panel (A) and at –13% for staying longer than five years in Panel (B). What this exercise reveals is that top earners are the most responsive individuals following a loss in their preferential tax status and that, surprisingly, there is no detectable change in the duration of stay for those below the 95th percentile of the distribution. Even more strikingly, in terms of staying longer than five years, only the estimate for the top 1% of earners is statistically significant. These individuals are, post reform, 18% less likely to still be in the Netherlands after 30% tax break expires for them; this means they do not start paying the high tax rates they would pay if they stayed in the country. These are large effects that are very much in line with the rest of the literature on tax-induced migration responses of the very rich. What is a very new and policy-relevant finding is that, below these high earnings thresholds, there seems to be very little mobility reaction among highly skilled migrants to the radical change in the preferential tax status. Given its importance, we will further explore the reasons, and consequences of this large difference in out-migration response of top earners.

[20] We have also estimated coefficients for these subgroups using interactions of the difference-in-differences effects with dummy indicators of our earning percentile groups. Adding the main policy coefficient to the extra subgroup effect estimated gave us statistically similar estimates as when using this split-sample approach. Since we have enough statistical power in these split regressions, we decided to report these results instead of the triple interaction variant as they are much easier to interpret.

Figure 7. Policy Response by Position in Earnings Distribution



Notes. The figure reports the policy impact evaluated at the mean +/- 2 standard errors based on equation (1), by position in the earnings distribution: 50–95, 90–95, 95–99, and 99–100 percentile. Panel A shows time in country in months and Panel B shows the probability of staying more than five years. The first coefficient and the horizontal blue dashed line relate to the baseline results from **Table 1**. The horizontal dashed red line indicates zero effect. Table A4 presents detailed results.

5.2. Mobility Potential of Migrants

Migrant workers originally attracted by tax incentives to a country are not a random sample of the population. They are all, by definition, mobile, but some may be especially so and react more strongly to the loss of preferential tax treatment. In addition to the individuals' earnings level, which we just saw changes response behavior, we explore the

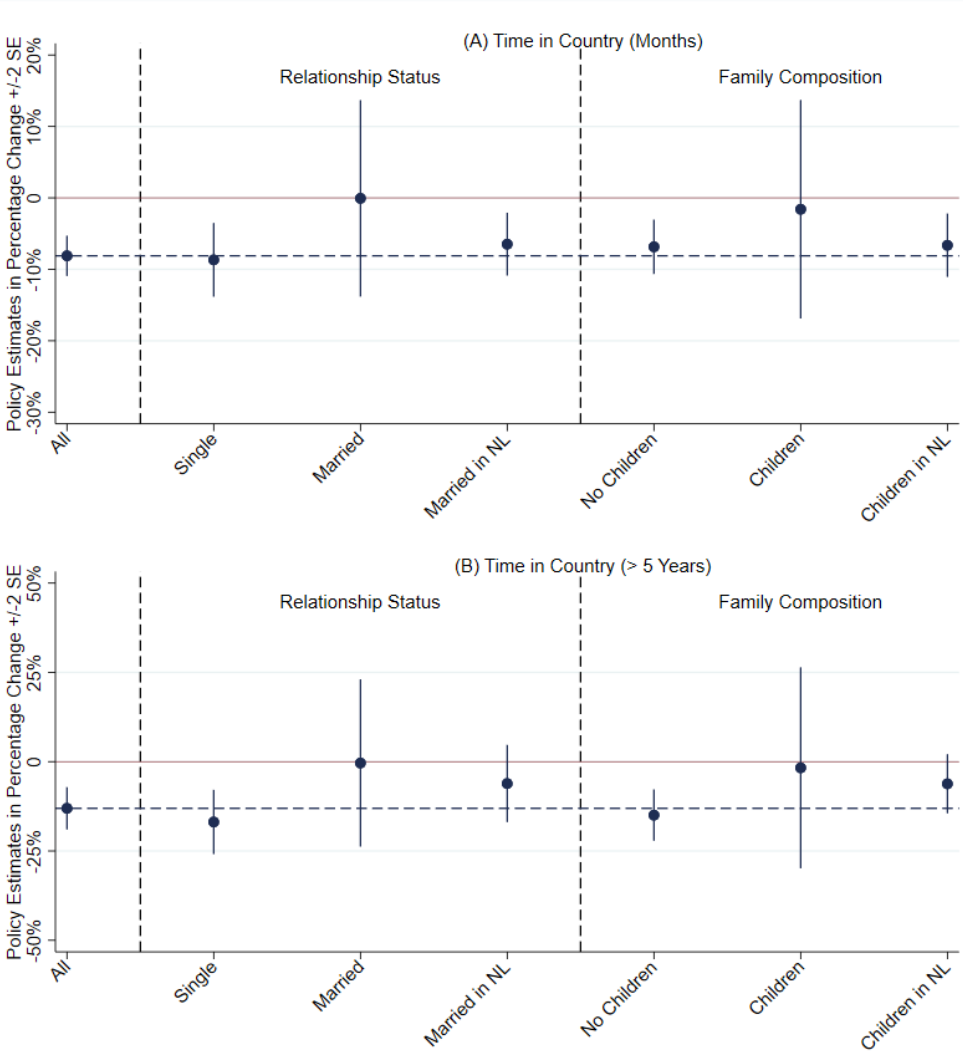
potential impact of other migrant characteristics that make someone more or less likely to leave the Netherlands after the unexpected shortening by five years of the 30% ruling. First, we consider the effect of having established stronger family roots, specifically, marrying or having a child in the Netherlands before the loss of the tax break. Either of these events should increase the cost of migration and could in turn reduce the response to treatment. Second, we consider how migrants who arrived in the Netherlands from a third country (i.e., a country where they are not a citizen or were not born in) may react differently from others. These individuals are probably "highly mobile," as living in the Netherlands is not their first migration experience, and they may be especially sensitive to tax rates when choosing a location.

5.2.1 Family roots: marriage and children

To explore the importance of having created family roots while in the Netherlands on the response to the new policy, we split the individuals in our sample depending on their marital status—single, married, or married in the Netherlands—and on the presence of a child in the household—no children, with children, and children born in the Netherlands. We graphically present the coefficients in **Figure 8** in terms of percentage change**;** details are reported in **Table A5**. Despite very different baseline durations, single individuals (average stay 58.5 months) and those married in the Netherlands (average stay 85.9 months) react proportionally as strongly to losing the benefit, at about the mean level (**Figure 8**, Panel A). Those already married when they migrated do no change the timing of their out-migration at all. A very similar picture emerges when looking at heterogeneity depending on the presence or non-presence of children in the household. Turning to stays longer than five years in Panel B, the only statistically significant estimate is for single individuals without children who reduce their probability of staying beyond their qualification for the 30% ruling by almost 15%. Those who married or who had children in the Netherlands are not affected; this may stem from the fact that almost

three-quarters of them already passed the threshold pre policy. Family roots thus do seem to matter for mobility behavior, but perhaps not as much as one would have expected.

Figure 8. Policy Response by Family Roots Status



Notes. The figure reports the policy impact evaluated at the mean +/– 2 standard errors based on equation (1) by roots status, specifically, their marriage status and family composition. Panel A shows time in country in months and Panel B shows the probability of staying more than five years. The first coefficient and the horizontal blue dashed line relate to the baseline results from **Table 1**. The horizontal dashed red line indicates zero effect. **Table A5** presents detailed results.

5.2.2 Highly mobile: third-country migrants

Third-country migrants may have low mobility costs and thus be especially reactive to changes in tax status when choosing their living location. We are uniquely able to study

their policy response in our setting as a very large share of individuals—41.6%—relocated from treated countries (Belgium and Luxembourg) to the Netherlands.[21] **Table 2** presents the result from a specification that adds an interaction of our difference-in-differences estimator with a dummy indicating that the individual is a third-country national. This triple interaction will reveal any additional effects that being a potentially highly mobile individual may have on out-migration behavior post policy. We do this for the whole sample and then depending on level of earnings relative to the Dutch distribution.

The main sample regression results reported in column (1) show that being highly mobile does not seem to be a source of sensitivity in either of our outcomes of interest. Running the same specification on distinct samples of the income distribution (i.e. 50–95, 95–99, 99–100) reveals that this average result hides strong response heterogeneities. While being a highly mobile individual has no additional effect on the out-migration decision for the bottom 95% (no response) or top 1% (strong response), it is important for top earners between these two groups. These high-income, highly mobile migrants react much more strongly in terms of both intensive and extensive duration margins. They stay on average 13.6 fewer months, and 16.5% of them stay less than five years after the policy implementation which, when evaluated at the mean, translates into decreases of 18.1% and 27.4% respectively. Two important takeaways from these results are that highly mobile individuals react at lower thresholds of earnings than other workers to tax incentives, but that this only occurs at very high incomes; all those below the 95th percentile do not change their migration behavior after losing the 30% ruling.

[21] Third-country nationals represent 28% of individuals who migrated from control countries.

Table 2: Highly Mobile Individuals

Dependent Variable	**Time in Country** in Months (Panel A) and Over 5 Years (Panel B)			
	(1)	(2)	(3)	(4)
Panel A: Months in Country				
	All	**[50-95)**	**[95-99)**	**[99-100]**
Previous Place of Residence (PPR) *Start Year	-5.38***	-3.77	-1.53	-7.96**
	(1.60)	(3.58)	(4.05)	(3.51)
Previous Place of Residence (PPR) *Start Year *Highly Mobile	0.25	7.49	-13.64**	1.82
	(4.10)	(7.47)	(5.30)	(4.66)
Mean of Dependent Variable	63.00	59.84	75.26	56.59
Impact at Mean	0.4%	12.5%	-18.1%	3.2%
Panel B: Probability > 5 Years				
Previous Place of Residence (PPR) *Arrival Year	-0.071***	-0.074	0.003	-0.087**
	(0.017)	(0.049)	(0.050)	(0.035)
Previous Place of Residence (PPR) *Start Year *Highly Mobile	0.010	0.125	-0.165***	-0.006
	(0.051)	(0.107)	(0.061)	(0.062)
Mean of Dependent Variable	0.475	0.435	0.603	0.415
Impact at Mean	2.1%	28.7%	-27.4%	-1.4%
Controls	YES	YES	YES	YES
Country of Origin FE	YES	YES	YES	YES
Start Year FE	YES	YES	YES	YES
Observations	**46,763**	**24,629**	**10,659**	**11,422**

Notes: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. All regressions include country of origin and start year fixed effects. Highly mobile individuals are defined as the individuals who are not nationals of or were not born in the previous country of residence. Panel A considers the first outcome of interest, time in country measured in months, while Panel B considers the second outcome of interest, the probability of staying in the Netherlands for more than five years.

6. Potential Confounders

Our results so far clearly point to a strong policy effect on the migration behavior of certain individuals but before making definite causal claims, we must first consider three potential cofounders that may bias our results. First, the 30% ruling never required claimants to physically move to the Netherlands, and thus our out-migration measure may not be the appropriate outcome of interest. Second, the preferential tax scheme studied also extends to wealth accumulated in the Netherlands, which potentially threatens the interpretation of our findings, particularly the earnings heterogeneity interpretation. Finally, certain migrants may be better at negotiating wage compensation than others after the loss of the tax break, which could also affect our interpretation of heterogeneity in the responses.

6.1 Commuting, Not Migrating?

We have so far measured migration duration response in terms of time between a physical move in and out of the Netherlands for work. Commuting, or even working from abroad, does not preclude an individual from benefitting from the 30% ruling as long as she was recruited while living in another country.[22] Since job and physical tax-induced mobility do not have to be aligned, something demonstrated by Agrawal and Hoyt (2018) for the United States, one might worry that our results so far may not reflect the true policy response in terms of employment (and tax payment) duration.

To check this, we first document, in **Figure A7**, changes in the number of beneficiaries who worked from abroad over our whole sample period, for treated and

[22] About one in four individuals from treated countries commuted at some point pre-policy, and they do so for about four out of the average 18 quarters they spent working in the Netherlands (see baselines in Tables A7 and A8).

control countries. Apart from a downward trend for both groups, there is no clear difference throughout between the two groups, suggesting no differential policy response in the probability of working from abroad. These results are confirmed by the nonsignificant estimates presented in Table A6, Panel A, which runs our difference-in-differences specification using a dummy indicating whether an individual has ever commuted as an outcome. Panel B considers commuting duration and again returns small and nonsignificant estimates. There is also no heterogeneity on these two margins by income level, as indicated by the results presented in columns (2) to (4). Finally, we also show, in **Tables A7–A8**, that our main and heterogeneity policy response results are unaffected by considering employment time instead of residence time in the Netherlands as the outcome of interest.[23]

6.2. A Wealth Tax Migration Response?

In addition to 30% of their wage being free of tax, beneficiaries of the Dutch high-skill migrant scheme are also exempt from taxes on their income from assets, savings, and investments. The effective tax rate on such wealth in the Netherlands is relatively low—1.2% at the time of the policy change. Still, one might worry that the out-migration responses we have so far uncovered are not because of the change in the tax rate on labor income but because of the loss of the wealth tax exemption. This is especially relevant for heterogeneity by earnings level, which may be linked to levels of taxable wealth.

To investigate this issue, we obtained administrative wealth data from Statistics Netherlands and matched it to our sample of beneficiaries.[24] We use this information to

[23] Employment time is defined as the duration for which an individual spent working for a Dutch employer, in the Netherlands or abroad, something we can precisely estimate in the tax receipt data.

[24] One limitation of these data is that they are only available from 2006 to 2019, meaning that individuals who out-migrated from the Netherlands before this period are not covered, nor are individuals who stayed less than one year in the Netherlands. Detailed information on the wealth data construction can be found in Appendix B

generate new estimates that account for relative wealth level to check whether this affects the nature of our findings. We do so by including in our specification an indicator as to which quintile of the wealth distribution beneficiaries belong to and interacting this indicator with our main difference-in-differences estimator. The resulting triple interaction should capture the additional impact on timing of out-migration by wealth level (and the taxes it implies). Of particular interest is how this breaks down across individuals of different earnings levels as it is possible that our finding of a strong policy response only at the top of the wage distribution is driven by underlying wealth differences between these groups.

Table A9 presents the results from this analysis and first reports, in column (1), estimates of the baseline difference-in-differences coefficient for the subsample of beneficiaries on the availability of the wealth data. These are, in comparison to our main findings from **Table 1**, still negative and significant if somewhat larger for both the intensive and extensive duration margins. Adding a control indicating the wealth quintile, column (2), slightly reduces the size of the main coefficient but also reveals a positive and significant coefficient for our wealth measure. This positive correlation between duration and wealth is probably endogenous—length of stay increases wealth accumulation—so it should not be causally interpreted. The triple interactions reported in column (3) are the estimates that will indicate whether wealth level matters differently pre and post policy across individuals from treated and control countries. These estimates are positive but small and insignificant, helping us reject that wealth (tax) differences are what is behind our result of earlier out-migration for those who lost the benefit of the 30% ruling. We also show, in the final three columns of **Table A9**, that this finding is driven by the change in the behavior of the top 1% of earners, independently of their wealth

level. We thus conclude that in our context, the effect we estimate is an earnings tax response, not a wealth tax response.[25]

6.3. Wage Compensation?

A final potential confounder relates to a possible difference in bargaining power: the more rent an individual can extract from her employer when losing her preferential tax status, the longer she is likely to stay. If this variation is large between individuals with higher or lower wages, this could explain the striking difference in out-migration responses we have found at various levels of the earnings distribution. To investigate this potential threat, we perform a simple exercise that compares the growth in taxable wages for individuals from treated and control countries, depending on their earnings level, around the time when their tax exemption status ended (four quarters after compared to four quarters before).[26] That is, after five years for treated individuals and ten years for all nontreated ones.[27]

Table A10 presents the estimates of the change in log-wage by position in the earnings distribution—50–95, 95–99, and 99–100. The coefficient of the dummy for quarters after the expiration of the tax break is almost exactly equivalent to the increase in taxable wages expected by the loss of the 30% ruling benefit for all groups. However, the difference in wage growth by treatment status is small and non-significant, especially for those in the top 5% and top 1% of the earnings distribution. This suggests that the

[25] This is in line with the modest emigration responses with respect to the net of wealth taxation that Advani, Burgherr, and Summers (2023) find for the very rich in the United Kingdom.

[26] Since we have already shown that the policy has a strong effect on out-migration duration beyond the expiration of the tax break, there are obviously important selection issues as to which individuals we can observe post-period wages for. However, we think that comparing across earnings groups can still be informative about underlying differences in bargaining power potential.

[27] Because our data end in 2019, we use the subsample of recipients who arrived up to 2008 in the Netherlands for this analysis to have at least one year of wage data for those who stayed beyond the expiration of the 30% ruling.

strong out-migration response we uncovered for the very top earners is not driven by large differences in the bargaining power of these workers.

7. Policy Implications

7.1 Elasticity Estimates

The quasi-experimental institutional setting used in this paper allows us to uncover the individuals' intensive and extensive margin duration responses to a sudden and unexpected increase in tax rates. However, a key parameter to the design of optimal tax policy is the elasticity of mobility responses with respect to the net tax rate.

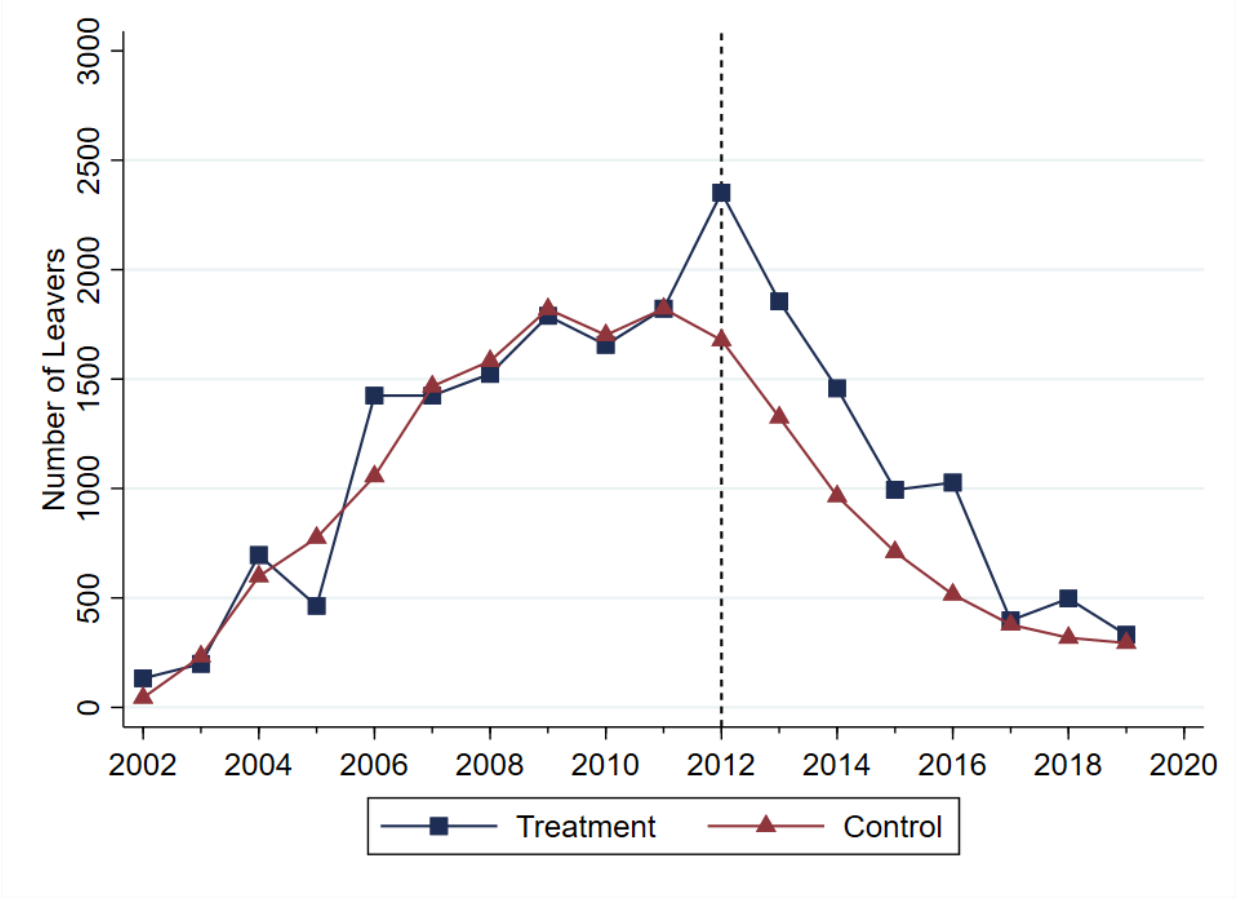
We turn to estimating these in our context and start by graphically documenting, in **Figure 9**, the evolution of the number of 30% ruling recipients belonging to the top 5% of the earnings distribution in our sample who left the Netherlands between 2002 and 2019. The series is labeled as treatment and control, in reference to the country of previous residence and normalized in 2011, the pre-policy year. Up to that point, both series followed very similar paths, but after there is a clear increase in the number of leavers among treated recipients but not those in the control group. The difference persists until 2016, the year by which the tax exemption was over for all treated individuals in our sample.

Next, to obtain elasticity of mobility estimates with respect to the net tax rate, we follow the literature and run the following two-stage least squares (2SLS) equation:

$$Ln(Leavers_{it}) = \alpha_0 + \beta_1 PPR_i + \beta_2 Treat\ Year_t + e \ln(1 - \tau_{it}) + \varepsilon_{it} . \qquad (3)$$

The units of analysis i={1,0} indicate that individuals belong to either treatment or control group , based on *PPR*, place of previous residence. $Leavers_{it}$ is the number of leavers in each t={2001,2019}, and τ_{it} is the average tax rate, both for each group i in year t. We instrument the net of tax rate $\ln(1-\tau_{it})$ by interacting $PPR \times Treat\,Year$, where $Treat\,Year = \mathbb{I}(t \geq 2012)$.

Figure 9. Out-Migration of 30% Recipients, Treated vs. Control Countries



Notes. **Figure 9** reports the number of leavers by treatment status. Treatment and control refer solely to the country of previous residence, meaning that treatment group contains individuals who left the Netherlands after immigrating from Belgium or Luxembourg, while the control group contains individuals who immigrated from elsewhere. The treatment series is normalized to match the control series in 2011, and the vertical dashed line marks the year in which the change in the 30% ruling became effective. To construct these series we only considered individuals from the top 5% and excluded all individuals whose previous country of resident was Germany or France.

Table 3: Elasticity Estimates

Dependent Variable	$Ln(Leavers)$			
	(1)	(2)	(3)	(4)
Panel A: Long Run				
	All	50-95	95-99	Top 1
$Ln(1-\tau)$	-1.05**	-0.78	-1.26**	-1.74***
	(0.47)	(1.06)	(0.58)	(0.51)
Observations	34	34	34	34
Panel B: Short Run				
$Ln(1-\tau)$	-0.86	-0.53	-1.28	-1.48**
	(1.07)	(1.85)	(1.21)	(0.65)
Treat Country FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Observations	30	30	30	30

Note.: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. All regressions include country of origin and year fixed effects. The long-run elasticities consider all individuals from treated versus control countries who emigrated between the years 2003 and 2019. Short-run elasticities consider all individuals who stayed five years or less in the Netherlands who emigrated between the years of 2002 and 2016, the period when the preferential tax treatment has expired for all treated recipients in our sample.

Table 3, column (1) presents the elasticity of mobility with respect to the net tax rate for the whole sample; columns (2) to (4) show the elasticity of mobility by subsamples with respect to the net tax rate based on individual's position in the earnings distribution. Long-term elasticities in Panel A are from a specification that includes 2012–2019 as the post-policy period, while the short-term elasticities in Panel B include only 2012–2016. The short-term estimates include only individuals who stayed less than five years in the Netherlands, the period when the preferential tax treatment expired for all treated recipients in our sample. The mean long-run elasticity is –1.05 and significant, but, as in our duration results, it is mostly driven by the out-migration reaction of those at the top of the earnings distribution. The elasticity of mobility with respect to the net the tax rate

is not significant for the bottom 95% of the income distribution, while for the 95–99 category and the top 1%, they are large and precisely estimated between –1.26 and –1.74, respectively The gradient in elasticity is even more marked when looking at short-run estimates, as only the coefficient of those above the 99th percentile of earnings is precisely estimated at –1.48. These results first serve to confirm our novel finding that tax-induced migration seems to only be an important issue for very top earners.[28] The results are large but in line with what has been found for migration inflows of this population in other contexts, such as Denmark, for which Kleven et al (2014) estimate elasticities with respect to tax rates of between 1.5 and 2.

7.2. Leaving for Tax Friendly Countries?

Many of the migrants leaving the Netherlands because of the reform were probably originally attracted to the country because of the tax break it offered. A relevant policy question concerns the next location of those who left early: are they more likely to move to (other) countries who also offer preferential tax schemes to high-skilled migrants? This would speak to the problem of international tax competition, which can reduce the effectiveness of a global impact of tax reforms enacted in isolation by one country. Using information on the exact destination reported by all 30% ruling recipients who left the country and our quasi-experimental setting, we investigate this issue.

We use the list produced in **Table 2** of Kleven et al. (2020) to identify countries that offer tax breaks to high-skilled migrants and in which year these were introduced to create a "tax break destination" dummy that takes a value 1 if a departing migrant moves

[28] As already highlighted in Section 2.2.2, the net tax rate for the 50–95, 95–99, and top 1% income groups decreases respectively by 16%, 22%, and 24% with the loss of the tax break. The very small difference between the last two groups suggests that differences in the intensity of the treatment received cannot fully explain why the top 1% behave differently in terms of their migration responses.

to one of those countries, and 0 otherwise.[29] We then estimate our standard difference-in-differences specification, using this dummy as the outcome of interest. **Table A11** presents the results for all beneficiaries, for the split by income group, and for "mobility" for the top 1%. The reform does not, on average, affect the likelihood of an individual moving to a tax break country. However, it appears to increase the probability that the highest earners leave for places with preferential migrant tax schemes, although this is not precisely estimated. This effect is driven by the location choice of the 1% who are highly mobile—defined in Section 5.2.2 as those arriving in the Netherlands from a third country—who are post policy more than twice as likely to leave for other tax break countries. These results do point to a distortionary effect on national policies from international tax competition, especially among the most mobile high earners.

7.3 Cost–Benefit Analysis

To get an overall view of the policy we study, we provide a very basic tax revenue cost–benefit analysis of reducing tax breaks for all high-skilled migrants from ten to five years. We use the out-migration response estimates reported for the various earnings groups in **Table A4**. That is, we assign a decrease in the length of stay in the Netherlands of 0 months for the bottom 95%, 7.2 months for the 95–99 group, and 6.9 months for the top 1%. **Table A12** reports some key values needed for our cost-benefit estimations: the average monthly wage, the length of stay in the Netherlands, and the average tax rate with and without the 30% ruling. The table does so for each income group and separately for those who stay more or less than five years.

[29] This includes all departures to the individual's previous country of residence—the destination of most leavers—and those who decided to stay in the Netherlands.

All individuals who stay beyond the new tax exemption threshold pay higher taxes, even if they react by leaving early, which is beneficial for the country's coffers. However, there is a loss to the public purse from those who react to the reform by out-migrating before reaching five years in the Netherlands. That is what happens following the early flight of those at the top of the income distribution, which is costly given the tax receipt potential they represent. These two effects together, through the years, yield lower tax returns to the Dutch tax office. That is, collecting higher taxes from individuals after their initial five-year stay would turn into €497.3 million in extra revenue. However, given the decrease in the length of stay for all individuals, revenues would decrease by €516.9 million, translating into a net loss in tax revenue of €1.63 million per year. Given that the income tax receipts were almost €67 billion in the Netherlands for 2019,[30] we can conclude that, at least in terms of a change in taxable receipts from labor, this radical policy was in the end cost neutral.

8. Conclusions

In this paper, we investigate the mobility response of migrants to a loss in preferential tax treatment using a radical change in the duration of the 30% ruling in the Netherlands, which provide certain migrants with a tax break of 30%. Only workers who arrived from certain countries during a certain period were affected by this reform, which enables us to produce a credible causal estimate of tax-induced out-migration resulting from this reform. We find strong mobility responses: the durations of stay in the Netherlands shorten significantly, especially for those at the top of the income distribution, who were post policy 18% less likely to stay beyond the expiration of their tax break. The result also

[30] This is according to latest public finance overview report for the country from Statistics Netherlands (CBS).

reveals that for most typical workers treated—those below the 95th percentile of earnings—there is no change in migration behavior. This is an important finding as most previous evidence of large international mobility elasticities to tax rates has been based on the reaction of top earners, which we show to be unique.

The fact that top earners are almost as sensitive to changes in the tax rate when making out-migration decisions as they are when making initial location choices in other contexts is striking given that most have already spent a significant amount of time in the country before leaving. The reactions are, perhaps, particularly large given the relatively small size of the Netherlands and the potential for high-skilled migrants to benefit from preferential treatment in other (nearby) countries. We speak to this important problem of international tax competition by showing that the most mobile tax earners become much more likely to leave for a tax-friendly country post reform. This reinforces the idea that, to be really efficient, any major tax changes should be implemented at the level of large entities (e.g. the EU, the OECD), rather than unilaterally by individual countries.

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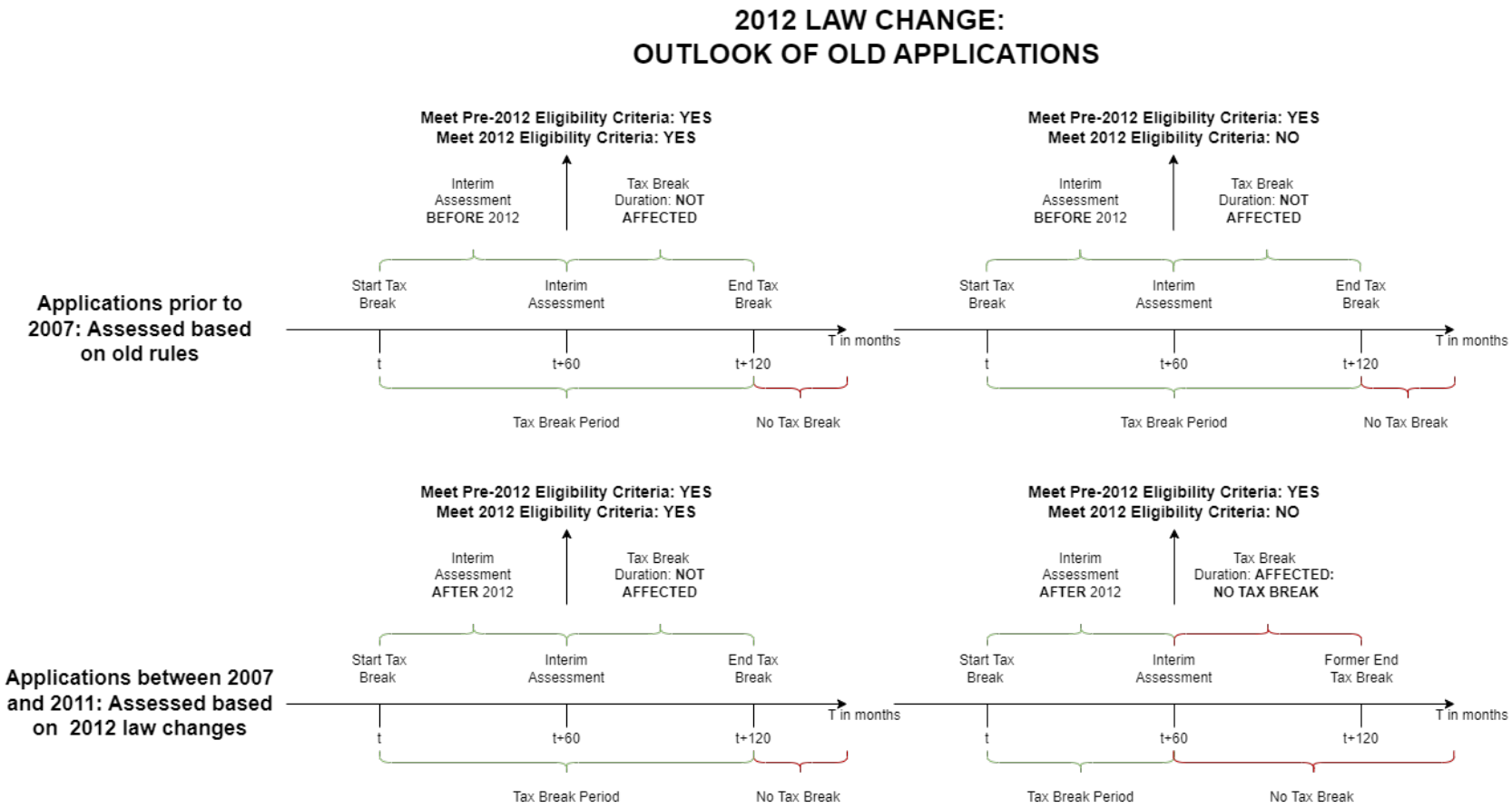
Appendix A: Additional Figures and Tables

Figure A1: Preferential Tax Scheme Countries for High-Skilled Migrants

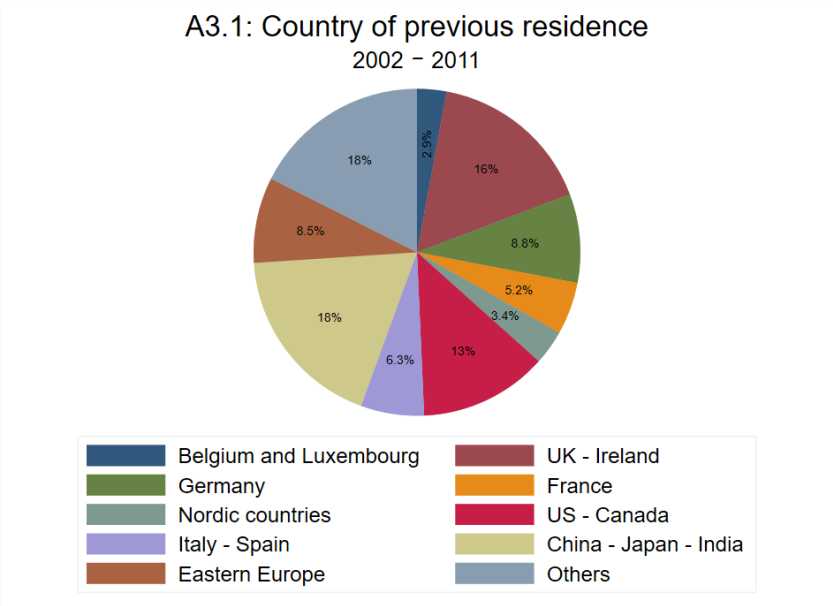
Notes. Figure based on tax break countries identified in Table 2 of Kleven et al (2020).

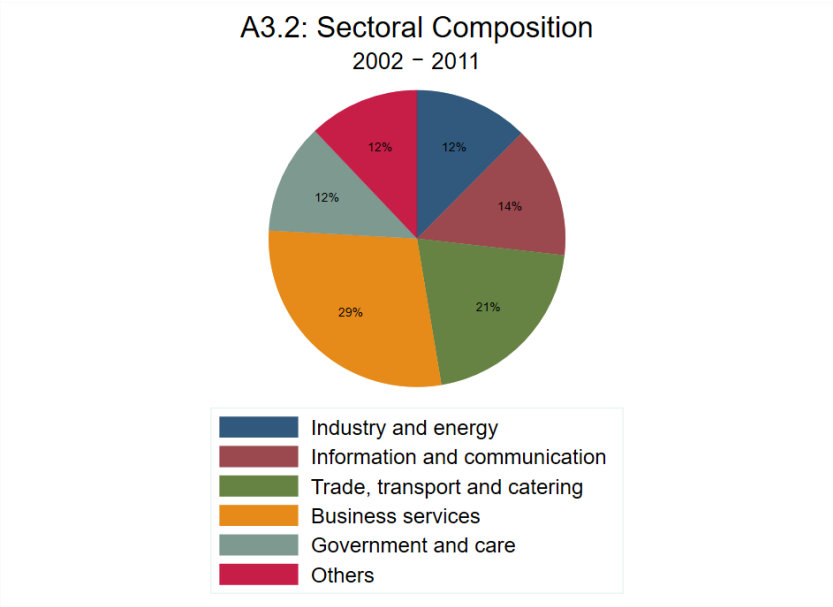
Figure A2: Preferential Tax Scheme Time Diagram



Notes. The time diagram divides the sample of beneficiaries into three different groups presented in two different rows: incoming employees who applied to the scheme in the period prior to 2007 and therefore were assessed by the five-year interim check before January 1, 2012; incoming employees who applied to the scheme between 2007 and the end of 2011 and therefore were susceptible to the 2012 law change due the format of the transitional rule; and, incoming employees who applied from 2012 onward. We further divide the groups into two other subgroups, those who meet and those who do not meet the 2012 eligibility criteria (diagrams in the left and right, respectively).

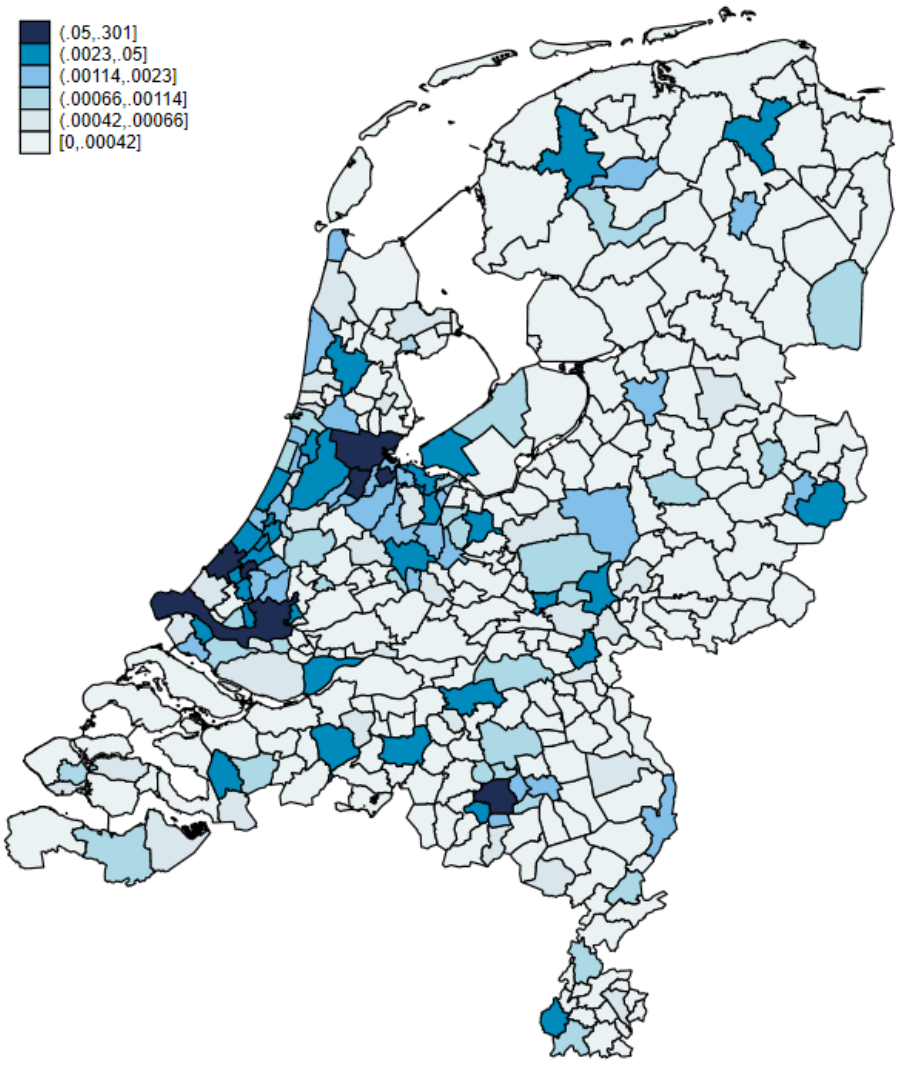
Figure A3: Origin Country of Beneficiaries and Sectoral Composition of Employers





Notes. Figure A3.1 reports the country of previous residence of beneficiaries as a percentage of the total sample (2002–2011). Figure A3.2 reports the sectors in which beneficiaries work as a percentage of the total sample (2002–2011). Others are composed of Agriculture, forestry, and fishing (0.1%), Construction (0.63%), Financial sectors (7.39%), Renting and trading of real estate (0.21%), Culture, recreation, and other services (3.16%) and unknown (0.59%).

Figure A4: Residential Location of Beneficiaries



Notes. Author's own calculations: 27% of the workers live in Amsterdam. The Hague, Amstelveen, Rotterdam, and Eindhoven complete the top five municipalities in the Netherlands, which account for the place of residence of more than 50% of all incoming employees.

Figure A5. Static and Dynamic Impact on Earnings of Losing the 30% Ruling

Figure A5.1 Tax rate and net wage, with and without 30% ruling

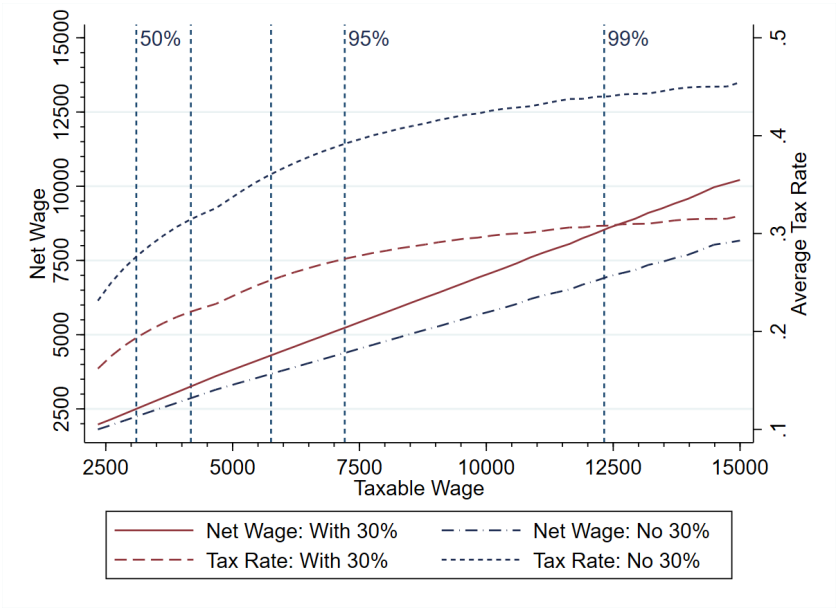
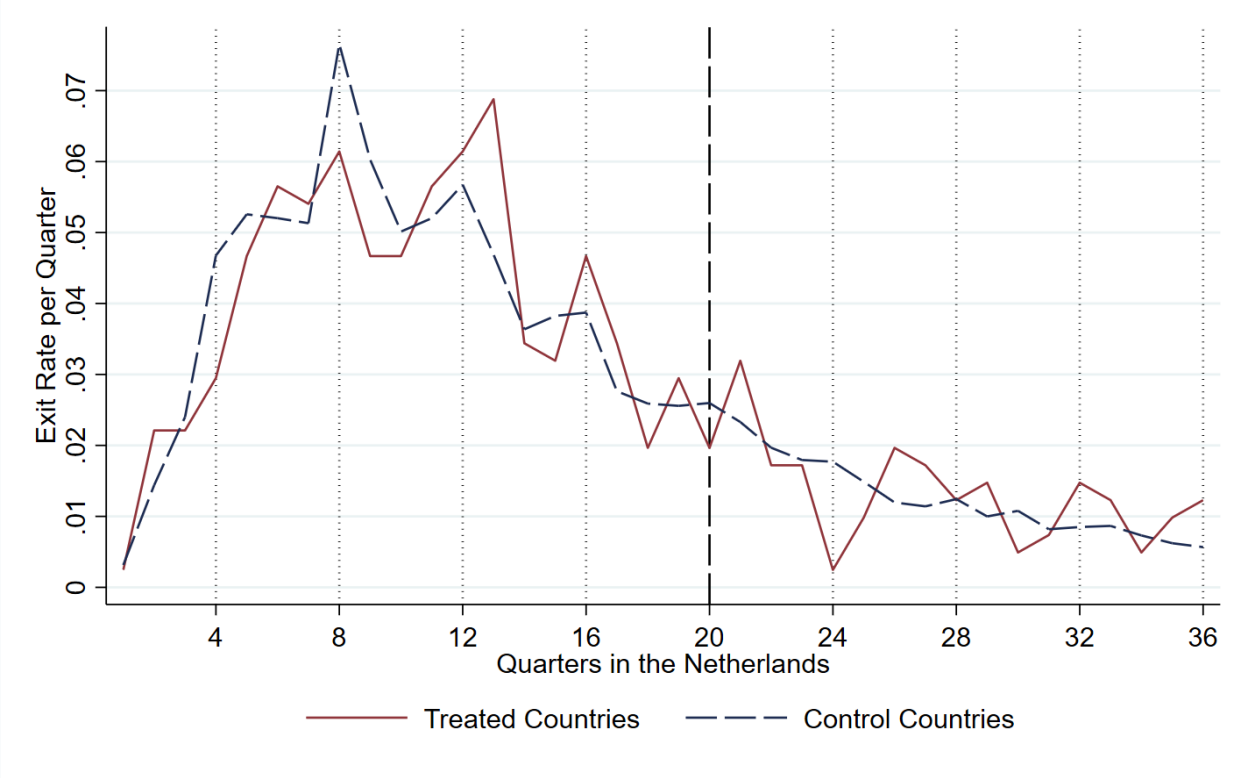


Figure A5.2 Change in taxable and net wage around timing of 30% ruling loss

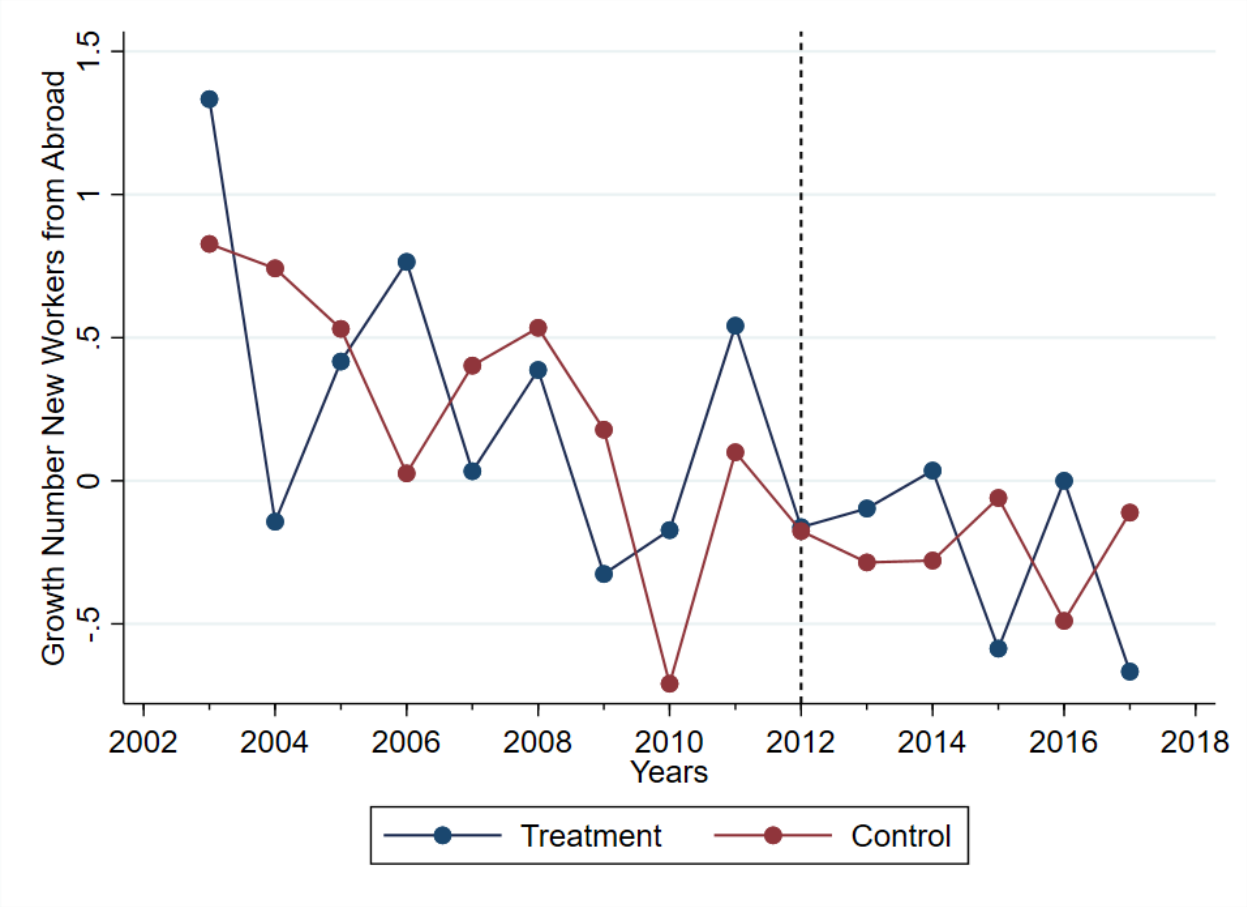
Notes. In Figure A5.1 the net wage and tax rate are constructed based on the Dutch sample of earners in 2012. In Figure A5.2 the wage dynamics are constructed by performing a kernel-weighted local polynomial regression of the taxable and net wage in the months around the end of the tax break for the whole sample of beneficiaries that stayed at least ten years in the Netherlands. Note that the net wage is higher than the taxable wage before the end of the tax break: for example, if the average individual earns €100,000.00 per year and faces an average tax of 40%, her taxable wage is €70,000.00 while the net wage is €30,000.00 + €70,000.00*60% = €72,000.00.

Figure A6. Exit Rate Dynamics: Pre-policy Period



Notes. Figure A6 depicts the quarterly exit rate by treatment status in control years. Treatment and control refer to the country of previous residence, meaning that the treatment group comprises the individuals who left the Netherlands after immigrating from Belgium or Luxembourg, while the control group comprises individuals who immigrated from elsewhere. The series is constructed only considering individuals who arrived between 2002 and 2006.

Figure A7. Growth Rates on the Number of New Workers Commuting



Notes. Figure A7 shows the growth rates in the number of workers who do not reside in the Netherlands but continue to work for a Dutch employer. The series is divided by treatment status. Treatment and control refer solely to the country of previous residence, meaning that treatment group comprises the individuals who left the Netherlands after immigrating from Belgium or Luxembourg, while the control group comprises individuals who immigrated from elsewhere. The vertical dashed line marks the year in which the change in the 30% ruling became effective.

Table A1 Descriptive Statistics of Tax Break Recipients by Timing of Arrival

	Treat Country				Control Country			
	2002–2006		2007–2011		2002–2006		2007–2011	
	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D
Panel A: Migration								
Time in Job (Months)	72.58	37.19	68.35	37.57	60.08	37.11	59.80	39.03
Fraction ≥ 5 years	0.51	0.50	0.47	0.50	0.41	0.49	0.43	0.50
Fraction ≥ 10 years	0.41	0.49	0.23	0.42	0.27	0.44	0.20	0.40
Panel B: Employment								
Top 5%	0.63	0.48	0.49	0.50	0.59	0.49	0.41	0.49
Top 1%	0.34	0.47	0.25	0.43	0.32	0.47	0.20	0.40
Number of Jobs	1.65	1.00	1.90	1.09	1.52	0.97	1.82	1.04
Industry & Energy	0.13	0.33	0.11	0.32	0.14	0.35	0.11	0.32
Trade & Transport	0.07	0.26	0.07	0.26	0.11	0.31	0.17	0.37
Information & Communication	0.18	0.38	0.20	0.40	0.22	0.41	0.20	0.40
Business Services	0.21	0.41	0.25	0.43	0.28	0.45	0.28	0.45
Government & Care	0.23	0.42	0.17	0.38	0.11	0.32	0.12	0.32
Others	0.19	0.39	0.19	0.39	0.13	0.34	0.12	0.33
Panel C: Background								
Age	36.13	7.97	35.82	8.56	35.69	8.15	34.45	8.16
Gender	0.75	0.43	0.74	0.44	0.78	0.42	0.76	0.43
With Children	0.18	0.38	0.14	0.35	0.16	0.36	0.12	0.32
Without Children	0.57	0.50	0.63	0.48	0.61	0.49	0.62	0.49
Children in NL	0.25	0.44	0.23	0.42	0.24	0.42	0.26	0.44
Single	0.60	0.49	0.65	0.48	0.56	0.50	0.58	0.49
Married	0.20	0.40	0.14	0.35	0.21	0.41	0.16	0.37
Married in NL	0.21	0.40	0.21	0.41	0.23	0.42	0.26	0.44
Observations	629		964		19,072		34157	

Notes. Appendix B contains the descriptions of the variables.

Table A2: Pre- and Post-Treatment Dynamics Estimates

Dependent Variable	Time in Country (Months) (1)	Time in Country (> 5 years) (2)
Cohort 2002	-2.22	-0.035
	(1.42)	(0.025)
Cohort 2003	-2.50*	-0.024
	(1.45)	(0.025)
Cohort 2004	-2.61	-0.020
	(1.95)	(0.033)
Cohort 2005	1.66	0.042
	(1.91)	(0.031)
Cohort 2006, omitted	-	-
	(-)	(-)
Cohort 2007	-7.91***	-0.081***
	(1.38)	(0.025)
Cohort 2008	-6.83***	-0.102***
	(1.49)	(0.027)
Cohort 2009	-6.76***	-0.064**
	(1.41)	(0.026)
Cohort 2010	-7.36***	-0.069***
	(1.41)	(0.025)
Cohort 2011	-5.71***	-0.076***
	(1.49)	(0.027)
Constant	58.49***	0.430***
	(0.20)	(0.003)
Country of Origin FE	YES	YES
Start Year FE	YES	YES
Observations	**46,763**	**46,763**

Notes. Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. All regressions include country of origin and start year fixed effects. The event study results are based on equation 2. Column (1) considers the first outcome of interest, time in country measured in months, while column (2) considers the second outcome of interest, the probability of staying in the Netherlands for more than five years. We omit the year 2006 as it was the last year in which the 30% ruling change did not affect individuals.

Table A3.1: Robustness Checks: Alternative Control Groups & Placebo Tests

Dependent Variable	**Time in Country** in Months (Panel A) and Over 5 Years (Panel B)		
	(1)	(2)	(3)
Panel A: Months in Country			
	DE & FR	**Nordic Countries**	**Placebo**
Previous Place of Residence (PPR) *Start Year	-4.99***	-6.30***	1.02
	(0.86)	(1.93)	(1.64)
Mean of Dependent Variable	65.79	65.79	52.42
Impact at Mean	-7.6%	-9.6%	1.9%
Panel B: Probability > 5 Years			
Previous Place of Residence (PPR) *Start Year	-0.061***	-0.07**	-0.001
	(0.014)	(0.03)	(0.020)
Mean of Dependent Variable	0.510	0.510	0.357
Impact at Mean	-12.0%	-13.7%	-0.3%
Controls	YES	YES	YES
Country of Origin FE	YES	YES	YES
Start Year FE	YES	YES	YES
Observations	**54,367**	**3,444**	**45,181**

Notes. Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. All regressions include country of origin and start year fixed effects. Panel A considers the first outcome of interest, time in country measured in months, while Panel B considers the second outcome of interest, the probability of staying in the Netherlands for more than five years. Column (1) consider Germany and France as control countries along with all other countries. Column (2) considers an alternative control group comprising the Nordic Countries. Column (3) presents a placebo test in the country, considering the Nordic countries as our treated sample and dropping individuals who immigrated from Belgium and Luxembourg.

Table A3.2: Robustness Checks: Wage, Sectors, Migration Time & Rule Request

Dependent Variable	Time in Country in Months (Panel A) and Over 5 Years (Panel B)					
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Months in Country						
	Above Wage	**Exempted Sectors**	**Wage & Exempted**	**> 1 Year**	**Same Year**	**> 1 year & Same Year**
Previous Place of Residence (PPR) *Start Year	-5.17***	-5.13***	-5.35***	-6.68***	-5.30***	-7.30***
	(0.96)	(1.30)	(0.97)	(1.03)	(1.54)	(1.66)
Mean of Dependent Variable	65.91	65.90	65.80	67.74	63.03	65.88
Impact at Mean	-7.8%	-7.8%	-8.1%	-9.9%	-8.4%	-11.1%
Panel B: Probability > 5 Years						
Previous Place of Residence (PPR) *Start Year	-0.068***	-0.062***	-0.069***	-0.078***	-0.076***	-0.094***
	(0.016)	(0.019)	(0.016)	(0.014)	(0.023)	(0.021)
Mean of Dependent Variable	0.512	0.513	0.511	0.527	0.476	0.500
Impact at Mean	-13.3%	-12.1%	-13.5%	-14.8%	-16.0%	-18.8%
Controls	YES	YES	YES	YES	YES	YES
Country of Origin FE	YES	YES	YES	YES	YES	YES
Start Year FE	YES	YES	YES	YES	YES	YES
Observations	**44,371**	**41,724**	**45,438**	**43,440**	**37,570**	**34,442**

Notes. Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1 All regressions include country of origin and start year fixed effects. Panel A considers the first outcome of interest, time in country measured in months, while Panel B considers the second outcome of interest, the probability of staying in the Netherlands for more than five years. The robustness tests are divided into six groups: 1) excluding individuals who in the base year have a wage (in 2012 euros) below the threshold introduced in 2012 (5.1% of the sample); 2) excluding individuals who work in sectors that are exempted from the wage threshold (e.g., Research and education) (10.8% of the sample); 3) considering only individuals with wages above the threshold or who work in exempted sectors (97.16% of the sample); 4) considering only individuals who stayed more than one year in the Netherlands (92.9% of the sample); 5) considering only individuals who the firm requested application of the 30% ruling for in the same year that they immigrated to the Netherlands (80% of the sample); 6) considering individuals who stayed more than one year in the Netherlands and the firm requested application of the 30% ruling for in the same year of the immigration (73.7% of the sample).

Table A4: Time in NL: Income Heterogeneity

Dependent Variable	**Time in Country** in Months (Panel A) and Over 5 Years (Panel B)			
	(1)	(2)	(3)	(4)
Panel A: Months in Country				
	[50–95)	**[90–95)**	**[95–99)**	**[99–100]**
Previous Place of Residence (PPR) *Start Year	-1.01	2.77	-7.21**	-6.93**
	(1.93)	(2.75)	(3.06)	(2.84)
Mean of Dependent Variable	64.79	63.14	70.68	62.53
Impact at Mean	-1.6%	4.4%	-10.2%	-11.1%
Panel B: Probability > 5 Years				
Previous Place of Residence (PPR) *Start Year	-0.027	-0.007	-0.063	-0.087**
	(0.026)	(0.035)	(0.045)	(0.035)
Mean of Dependent Variable	0.504	0.477	0.557	0.476
Impact at Mean	-5.4%	-1.5%	-11.3%	-18.3%
Controls	YES	YES	YES	YES
Country of Origin FE	YES	YES	YES	YES
Start Year FE	YES	YES	YES	YES
Observations	**24,629**	**6,638**	**10,659**	**11,422**

Notes. Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. All regressions include country of origin and start year fixed effects. Panel A considers the first outcome of interest, time in country measured in months, while Panel B considers the second outcome of interest, the probability of staying in the Netherlands for more than five years. All regressions are conditional on being part of a certain income distribution group: 50–95, 90–95, 95–99, and 99–100.

Table A5: Time in NL: Family Root Heterogeneity

Dependent Variable	Time in Country in Months (Panel A) and Over 5 Years (Panel B)					
	(1)	(3)	(3)	(4)	(5)	(6)
Panel A: Months in Country						
	Single	Married	Married NL	No Kids	Kids	Kids NL
Previous Place of Residence (PPR) *Start Year	-5.09***	-0.04	-5.56***	-3.78***	-1.12	-5.67***
	(1.52)	(4.55)	(1.89)	(1.05)	(5.42)	(1.90)
Mean of Dependent Variable	58.46	65.89	85.87	55.08	70.26	85.56
Impact at Mean	-8.7%	-0.1%	-6.5%	-6.9%	-1.6%	-6.6%
Panel B: Probability > 5 Years						
Previous Place of Residence (PPR) *Start Year	-0.073***	-0.002	-0.045	-0.058***	-0.009	-0.046
	(0.019)	(0.060)	(0.040)	(0.014)	(0.078)	(0.031)
Mean of Dependent Variable	0.433	0.508	0.736	0.388	0.555	0.750
Impact at Mean	-16.9%	-0.4%	-6.1%	-14.9%	-1.6%	-6.1%
Controls	YES	YES	YES	YES	YES	YES
Country of Origin FE	YES	YES	YES	YES	YES	YES
Start Year FE	YES	YES	YES	YES	YES	YES
Observations	26,223	8,597	11,887	28,623	6,190	11,886

Notes. Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. All regressions include country of origin and start year fixed effects. Panel A considers the first outcome of interest, time in country measured in months, while Panel B considers the second outcome of interest, the probability of staying in the Netherlands for more than five years.

Table A6: Working from Abroad

Dependent Variable	Commuting			
	(1)	(2)	(3)	(4)
Panel A: Ever Commute				
	All	**[50-95)**	**[95-99)**	**[99-100]**
Previous Place of Residence (PPR) * Start Year	0.031	0.039	0.011	0.041
	(0.022)	(0.024)	(0.041)	(0.047)
Mean of Dependent Variable	0.265	0.233	0.238	0.325
Impact at Mean	11.7%	16.7%	4.6%	12.6%
Panel B: Months Commuting				
Previous Place of Residence (PPR) * Start Year	-0.119	0.820	-0.466	-1.051
	(1.240)	(2.268)	(3.360)	(1.515)
Mean of Dependent Variable	11.43	9.82	11.48	13.21
Impact at Mean	-1.0%	8.4%	-4.1%	-8.0%
Controls	YES	YES	YES	YES
Country of Origin FE	YES	YES	YES	YES
Start Year FE	YES	YES	YES	YES
Observations	46,763	24,629	10,659	11,422

Notes. Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. All regressions include country of origin and start year fixed effects. The two outcomes of interest are employment abroad (measured in months) and whether the individual has ever worked abroad. Employment abroad is measured by the number of months an individual spent working abroad for a Dutch company and who continues to pay taxes in the Netherlands on an average monthly wage of at least €1,000.00. Work from abroad is a dummy variable that equals 1 if employment abroad is higher than zero.

Table A7: Employment Time in NL: Heterogeneities — Income

Dependent Variable	Time in Employment in Months (Panel A) and Over 5 Years (Panel B)			
	(2)	(3)	(4)	(5)
Panel A: Months in Employment				
	All	**[50-95)**	**[95-99)**	**[99-100]**
Previous Place of Residence (PPR) *Start Year	-4.57***	-0.67	-4.54	-7.16**
	(1.32)	(2.18)	(3.13)	(3.39)
Mean of Dependent Variable	72.91	71.43	76.69	71.17
Impact at Mean	-6.3%	-0.9%	-5.9%	-10.1%
Panel B: Probability > 5 Years				
Previous Place of Residence (PPR) *Start Year	-0.054**	-0.014	-0.028	-0.093**
	(0.021)	(0.023)	(0.039)	(0.040)
Mean of Dependent Variable	0.600	0.582	0.632	0.592
Impact at Mean	-9.0%	-2.4%	-4.4%	-15.7%
Controls	YES	YES	YES	YES
Country of Origin FE	YES	YES	YES	YES
Start Year FE	YES	YES	YES	YES
Observations	46,763	24,629	10,659	11,422

Notes: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. All regressions include country of origin and start year fixed effects. Panel A considers the first outcome of interest, time in employment measured in months, while Panel B considers the second outcome of interest, the probability of being employed by a Dutch firm for more than five years.

Table A8: Employment Time in NL: Family Root Heterogeneity

Dependent Variable	Time in Employment in Months (Panel A) and Over 5 Years (Panel B)					
	(1)	(3)	(3)	(4)	(5)	(6)
Panel A: Months in Employment						
	Single	Married	Married NL	No Kids	Kids	Kids NL
Previous Place of Residence (PPR) *Start Year	-5.30**	1.24	-3.21	-4.08***	3.60	-5.42***
	(2.14)	(5.44)	(2.13)	(1.56)	(4.98)	(1.85)
Mean of Dependent Variable	68.05	71.97	87.85	64.33	76.78	89.16
Impact at Mean	-7.8%	1.7%	-3.7%	-6.3%	4.7%	-6.1%
Panel B: Probability > 5 Years						
Previous Place of Residence (PPR) *Start Year	-0.076***	0.012	0.000	-0.062***	0.069	-0.042
	(0.028)	(0.061)	(0.039)	(0.023)	(0.065)	(0.026)
Mean of Dependent Variable	0.551	0.592	0.752	0.504	0.627	0.794
Impact at Mean	-13.8%	2.0%	0.0%	-12.3%	11.0%	-5.3%
Controls	YES	YES	YES	YES	YES	YES
Country of Origin FE	YES	YES	YES	YES	YES	YES
Start Year FE	YES	YES	YES	YES	YES	YES
Observations	26,223	8,597	11,887	28,623	6,190	11,886

Notes. Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. All regressions include country of origin and start year fixed effects. Panel A considers the first outcome of interest, time in employment measured in months, while Panel B considers the second outcome of interest, the probability of being employed by a Dutch firm for more than five years.

Table A9: Time in Country: Wealth Heterogeneity

Dependent Variable	Time in Country (1)	Time in Country (2)	Time in Country (3)	Time in Country (4)	Time in Country (4)	Time in Country (5)
Panel A: Time in Country (in Months)						
	All			**[50-95)**	**[95-99)**	**[99-100]**
Previous Place of Residence (PPR) *Start Year	-6.95***	-5.89***	-12.90**	-9.33	-1.96	-21.48**
	(1.39)	(1.72)	(6.03)	(11.01)	(5.52)	(9.67)
Wealth Quintile		3.54***	3.74***	5.19***	3.60***	2.79***
		(0.24)	(0.44)	(0.75)	(0.72)	(0.53)
Previous Place of Residence (PPR) *Start Year *Wealth Quintile			2.16	1.45	-0.12	3.58*
			(1.48)	(3.00)	(1.98)	(1.92)
Mean of Dependent Variable	66.87	66.87	66.87	69.76	66.73	64.36
Impact at Mean	-10.4%	-8.8%	-16.1%	-11.3%	-3.1%	-27.8%
Panel B: Time in Country (> 5 years)						
Previous Place of Residence (PPR) * Start Year	-0.101***	-0.090***	-0.140	-0.110	0.011	-0.245**
	(0.023)	(0.027)	(0.106)	(0.144)	(0.150)	(0.118)
Wealth Quintile		0.037***	0.040***	0.060***	0.043***	0.024***
		(0.003)	(0.006)	(0.009)	(0.010)	(0.008)
Previous Place of Residence (PPR) *Start Year *Wealth Quartile			0.016	0.009	-0.009	0.026
			(0.027)	(0.041)	(0.047)	(0.025)
Mean of Dependent Variable	0.528	0.528	0.528	0.571	0.511	0.500
Impact at Mean	-19.1%	-17.0%	-23.5%	-17.7%	0.4%	-43.8%
Controls	YES	YES	YES	YES	YES	YES
Country of Origin FE	YES	YES	YES	YES	YES	YES
Start Year FE	YES	YES	YES	YES	YES	YES
Observations	30,529	30,529	30,529	16,529	6,718	7,218

Notes. Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. All regressions include country of origin and start year fixed effects. Panel A considers the first outcome of interest, time in country, while Panel B considers the probability of staying in the Netherlands for more than five years. Wealth Quintiles are constructed with respect to the wealth of other beneficiaries to avoid a distribution that is skewed to the left and low variation. Appendix B presents more information about the wealth data.

Table A10: Wage Compensation

Dependent Variable	Ln(Wage) (1)	Ln(Wage) (2)	Ln(Wage) (3)
	[50-95)	**[95-99)**	**Top 1**
Treat Quarters	0.283***	0.254***	0.281***
	(0.014)	(0.025)	(0.044)
Previous Place of Residence (PPR) *Treat Quarters	-0.102*	-0.088	-0.029
	(0.055)	(0.068)	(0.091)
Quarter in NL FE	YES	YES	YES
Country of Origin FE	YES	YES	YES
Observations	26,824	10,543	6,456

Notes. Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. The logarithm of the taxable wage is our outcome of interest; it is regressed on treated quarters and the interaction between treated quarters and treated countries. The sample is restricted to individuals who arrived between 2002 and 2008 to account for the fact that individuals from control countries who arrived in treated years had completed their ten years before 2019. Treated quarters are defined in two different ways: 1) for the treated country from treated years, treated quarters are defined from the 20th quarter onward; 2) for the rest of the sample, the treated quarters are defined from the 40th quarter onward. The analysis is done locally around the end of the tax break, minus four quarters before, and four quarters after. All regressions include years in the Netherlands and country of origin fixed effects.

Table A11: Tax Break Countries

Dependent Variable	**Time in Country** in Months (Panel A) and Over 5 Years (Panel B)					
	(1)	(2)	(3)	(4)	(5)	(6)
	All	**50-95**	**95-99**	**Top1**	**Top 1 Low Mobile**	**Top 1 High Mobile**
Previous Place of Residence (PPR) *Start Year	0.014	-0.002	0.014	0.035*	-0.002	0.081**
	(0.014)	(0.026)	(0.016)	(0.021)	(0.013)	(0.041)
Mean of Det Variable	0.045	0.056	0.038	0.039	0.018	0.064
Impact at Mean	31.1%	-3.6%	36.8%	89.7%	-11.1%	126.6%
Controls	YES	YES	YES	YES	YES	YES
Country of Origin FE	YES	YES	YES	YES	YES	YES
Start Year FE	YES	YES	YES	YES	YES	YES
Observations	**46,763**	**24,629**	**10,659**	**11,422**	**7,841**	**3,559**

Notes. Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. All regressions include country of origin and year fixed effects. The outcome of interest takes a value of 1 if the destination country offers a tax break, and 0 otherwise, including if an individual decided to stay in the Netherlands. If an individual is returning to their country of previous residence, then we assign 0 to the dependent variable.

Table A12: Cost–Benefit Analysis

	[50–95)		[95–99)		Top 1%	
	< 5 years	> 5 years	< 5 years	> 5 years	< 5 years	> 5 years
Monthly Wage (€ of 2012)	€3,548.53	€3,667.90	€6,682.96	€6,687.97	€18,921.72	€17,785.02
Time in Country (Months)	26.71	100.91	27.62	99.04	29.74	95.68
Δ Time in Country (Months)	0	0	7.21	7.21	6.93	6.93
Tax Burden - With 30%	24.3%		29.1%		36.4%	
Tax Burden - Without 30%	37%		44%		52%	
Observations	14,686	13,533	7,306	5,263	8,868	4,202
Millions of €						
10 Years Tax Break	€334.98	€1,216.76	€385.43	€1,013.67	€1,786.38	€2,599.64
5 Years Tax Break	€ 334.98	€1,474.57	€ 284.81	€1,106.68	€1,370.12	€2,746.12
Δ Tax Revenue	€ 0	€ 257.82	€ -100.62	€ 93.01	€ -416.26	€ 146.48
Δ Total Tax Revenue			**€-19.57**			
Δ Total Tax Revenue/Year			**€-1.63**			

Notes. **Table A12** presents the cost–benefit analysis based on estimated numbers obtained from **Table A4**. The Table displays the average monthly wage, length of stay in the Netherlands, average tax rate with and without the 30% ruling by each group of income, and separating individuals who stayed less than five years and more than five years. We assume that the decrease in the length of stay in the Netherlands is equal for individuals who stayed less or more than five years in the country.

Appendix B: Dataset, Sample, and Variables Descriptions

Construction of sample

We use administrative data from the Dutch Tax Office (Belastingdienst) and from Statistics Netherlands (CBS). The Dutch Tax Office provides specific and unique data on all the beneficiaries of the 30% ruling, 200,885 individuals, for 2001–2019. The information details the specific starting and end date of the tax break for each individual as well as their respective employer.

We start our sample construction by merging these individuals with their specific migration information from the CBS files GBAMIGRATIEBUS and VRLGBAADRESBUITENLANDBUS. GBAMIGRATIEBUS contains information from the Municipal Personal Records Database – Registration of Residents – (GBA), and VRLGBAADRESBUITENLANDBUS contains the Registration of Non-Residents (RNI).

The GBAMIGRATIEBUS provides information on immigration, emigration, and country of previous residence of all individuals who once lived in the Netherlands. The VRLGBAADRESBUITENLANDBUS mainly provides information on the start and end dates of a foreign address, when individuals emigrated from the Netherlands. For some countries, mainly neighboring countries, the following information is also available: 1) the place where the person officially lives; and 2) the distance to the Dutch border in kilometers. It is noteworthy that an individual who has never lived in the Netherlands but has any relationship with any Dutch authority will appear in the VRLGBAADRESBUITENLANDBUS but not in the GBAMIGRATIEBUS.[31]

Information on monthly wage comes from the CBS files SECMWERKNDGAMNDBEDRAGBUS (2001–2019) and is complemented with the file

[31] Statistics Netherlands acknowledges that individuals are not obliged to report a move to the RNI (unlike the GBA), so the information quality may not be as good as that in the GBA.

POLISBUS/SPOLISBUS (2006–2019). When the monthly wage is not available in either of these CBS files, we fill the gaps with unique data from the Dutch Tax Office on annual earnings that we transform to a monthly basis.

Information on background characteristics such as age, gender, and birth country come from the file GBAPERSOONTAB, while information on household characteristics such as marital status and number of children comes from GBAHUISHOUDENSBUS. Both files are available for 2001–2019.

Our analysis mainly focuses on the individuals who arrived in the Netherlands from 2002–2011 and participated in a valid 30% ruling during this period; they are observed from 2002–2019 (73,400 individuals). There are 48,334 individuals in both the VRLGBAADRESBUITENLANDBUS and the GBAMIGRATIEBUS files. There are 11,612 individuals who immigrated to the Netherlands and never left and are only in GBAMIGRATIEBUS; 13,454 individuals have never lived in the Netherlands and thus, they are only in VRLGBAADRESBUITENLANDBUS.

Construction of variables

Using GBAMIGRATIEBUS and VRLGBAADRESBUITENLANDBUS we construct a longitudinal panel with the individuals' start and end dates (immigration and emigration) in the Netherlands as well as the start and end dates at a foreign address. We defined cross-border workers as workers who have at least €1,000.00 of average monthly income in a certain period covered by the VRLGBAADRESBUITENLANDBUS.

We divide our variables of interest in two groups: 1) time in country, which is the number of months an individual stayed in the Netherlands, taking into account the first immigration date and the last emigration date from GBAMIGRATIEBUS; and 2) time in contact, which is the number of months an individual stayed in contact with the Netherlands, which takes into account the first contact date and the last contact date from

the GBAMIGRATIEBUS and the VRLGBAADRESBUITENLANDBUS. That is, time in contact also considers the period an individual spent commuting, before and/or after they immigrated/emigrated to the Netherlands. From these two groups we extract two other variables of interest namely two dummy variables indicating whether the individual stayed in the country for more than 60 months (five years) and whether the individual stayed in contact with the Netherlands for more than 60 months (five years).

Our difference-in-differences strategy is constructed by interacting a year dummy variable with a country of previous residence dummy. The year dummy equals 1 if the start year of the tax break is between 2007 and 2011, and 0 if the start year of the tax break is between 2002 and 2006. The country dummy equals 1 if the country of previous residence was Belgium or Luxembourg, and 0 otherwise. Information on country of previous residence is extracted from GBAMIGRATIEBUS. Some individuals immigrated and emigrated more than once to the Netherlands in the observed period.[32] As one of the eligibility criteria to be eligible for the 30% ruling before 2012 was that the individual had not lived in the Netherlands in the past ten years, then only the country of previous residence when they first immigrated to the Netherlands is sufficient for our purposes.

We have monthly wage information from SECMWERKNDGAMNDBEDRAGBUS and POLISBUS/SPOLISBUS that we deflated to 2012 euros. SECMWERKNDGAMNDBEDRAGBUS is the average wage, and POLISBUS/SPOLISBUS is the monthly wage. We use POLISBUS/SPOLISBUS to develop the wage dynamic graph around the end date of the tax break. To construct the wage percentiles we select we use both SECMWERKNDGAMNDBEDRAGBUS and POLISBUS/SPOLISBUS. We compute the average monthly wage for each year, and we select the highest average monthly wage out of an individual's first two years with positive earnings. Then, we compare it to the Dutch wage distribution of that specific

[32] Around 86% of the 61,450 individuals either immigrated permanently or emigrated permanently.

year, excluding all the beneficiaries. As we are using the average monthly wage of beneficiaries, we rely on the SECMWERKNDGAMNDBEDRAGBUS to define the Dutch distribution.

We use the GBAHUISHOUDENSBUS for our family composition heterogeneity analysis. We look at each beneficiary household characteristic when they arrived in the Netherlands and the last household characteristic observed in the data. The data allow us to split individuals into two different groups with three subgroups of interest. The first group relates to the marital status and the subgroups are always single, always married, and married in the Netherlands. We could also add a fourth group for the individuals who divorced in the NL, but the sample size would be too small, so we decided to include them in the always single group. The second group relates to the kids in the household; the subgroups are with children, no children, and, children in the Netherlands.

VRLGBAADRESBUITENLANDBUS contains information on the foreign country in which individuals live after they left the Netherlands.[33] Using this file we construct the variable country of destination, which we use for our German analysis.

The last variable of interest that we use is a dummy variable that equals 1 if an individual's country of birth is different than the country of previous residence, and 0 otherwise. We use the GBAPERSOONTAB files to define the country of birth and the GBAMIGRATIEBUS to define the country of previous residence.

Wealth Data

We use administrative data from Statistics Netherlands (CBS) on household wealth (VEHTAB), which is available from 2006 to 2020, and which contains asset and debt

[33] Some case also contains the period and country where the individual lived before moving for the first time to the Netherlands. This is the case if and only if this individual has any relationship with the Netherlands (e.g. work relation).

information from January 1 of the reporting year, recorded at the end of the previous year (e.g., 2006 data reports 2005 household assets and debts). We define wealth as the net assets of a household as in the variable VEHW1000VERH.

The wealth of an individual is defined as the household level in the same year as their income level was calculated (see section above). If an individual's household did not report its assets and debts in the same year as the recorded income data, then we consider the wealth recorded one year after the base year as the individual's wealth. Wealth quintiles are constructed with respect to the wealth distribution of other beneficiaries given that the distribution of wealth of beneficiaries is not comparable to the wealth distribution of the Dutch population.

Only individuals living in the Netherlands by January 1, 2006, have data on household wealth. The sample of individuals who benefit from the 30% ruling from 2005 to 2011 is 37,868, while the sample of individuals who have wealth data recorded over the same period is 30,529, which is the sample we use to run our analysis.