Then only Two Wise Men came from the East: a Reduction in the Tax Subsidy for High-skilled Immigrants

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Abstract

Many European countries have tax incentives to attract high-skilled immigrants. In 2019, the Netherlands has reduced the duration of the tax subsidy from eight to five years. This paper analyzes the effect of this reduction on the inflow of high-skilled immigrants in the period 2016-2022. Detailed administrative data on taxable income and the arrival dates of high-skilled immigrants are applied in a difference-in-differences strategy. The main results suggest that the inflow of high-skilled immigrants is reduced by 15.8 percent, implying a migration elasticity of 0.42. The estimates suggest that particularly high-income immigrants are responsive to a reduction of the tax subsidy, with a migration elasticity of approximately 0.6. A stylized back-of-the-envelope calculation suggests that the reduction of the tax subsidy decreases government revenue by 9 percent, mainly driven by high-income immigrants.

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This paper uses confidential microdata from Statistics Netherlands (CBS). The datasets we use can be obtained by filing a request directly to CBS. The above mentioned authors are willing to help others to get access to these datasets.

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1 Introduction

The notion that tax policy influences individuals' location decisions originates from Tiebout (1956). Empirical research supports this hypothesis, suggesting that high earners among immigrants (hereafter refereed to as: high-skilled immigrants) strongly respond to tax subsidies when choosing their place of work. Kleven et al. (2014) show that the introduction of a preferential tax subsidy for high-skilled immigrants has a substantial effect on migration inflow, with a migration elasticity of 1.6. Similar findings are reported in other papers[3], suggesting that preferential tax subsidies strongly affect migration patterns.

In the Netherlands, a preferential tax subsidy is also available for high-skilled immigrants. This subsidy aims to compensate high-skilled immigrant workers for migration-related costs, such as travel expenses and documentation fees. Employers can apply this tax subsidy for high-skilled immigrant workers, allowing them to exempt up to 30% of labor income from taxes and social premiums on an annual basis. In 2022, approximately 110.000 high-skilled workers made use of this tax subsidy (SEO, 2024)).

The analysis in this paper exploits a large scale reform, which reduces the generosity of the tax subsidy in the Netherlands. Before 2019 high-skilled immigrants could use a preferential tax scheme for a period of eight years, conditional on meeting a salary requirement. This salary requirement states that immigrants should earn a minimum amount of labor income to be eligible for a tax reduction of maximum 30%.[4] The reform in 2019 reduces the duration of the tax subsidy from eight to five years for all high-skilled immigrants. This reform is a universal reduction of the tax incentive, thereby affecting all high-skilled immigrants. Using a theoretical model, we infer that a reduction of the tax incentive makes it less likely for high-skilled immigrants to migrate to the Netherlands.

To test this hypothesis, we use rich administrative data from Statistics Netherlands. Our data contains information on the moment of arrival as well as detailed yearly labor income information. In addition, we have background variables on gender, nationality, and sector of employment.

We follow Timm et al. (2022) and employ a difference-in-differences design to determine the effect of a reduction in the tax subsidy on the inflow of high-skilled migration. They use

[3] See for instance, Timm, et al (2022) who find a migration elasticity of around two.
[4] The precise amount of the reduction depends on the income level. The maximum reduction is capped at 30%. So for instance, workers that earn €88,000 could get tax exemption on €88,000 *0.3= €26,400 of their income.

immigrant workers who meet the annual labor income salary requirement as the treatment group and workers who do not as the control group (that is those who earn between 50 and 90 percent of the annual labor income salary requirement). We classify these groups as high- and low-skilled workers and test whether the common trend assumption holds. We find that this is the case.[5]

The estimated coefficients suggest that the decrease in the tax subsidy in 2019 lead to a statistically significant reduction in the inflow high-skilled immigrants (on average 846 per year, compared to a total inflow of 5,342 in 2018). We find that the effect is stronger for high-skilled workers who earn substantially more than the salary requirement (more than 50% above the salary requirement). However, the effect is not statistically significantly different from zero for workers who have labor earnings just above the salary requirement.

Using the estimated coefficients, we calculate the migration elasticity which is defined as the change in migration relative to the change in the net-of-tax rate. We find that the overall migration elasticity equals 0.42. The migration elasticity differs substantially between income groups. For instance, the migration elasticity of the highest income group (top 10% earners) is approximately three times larger than for the income group just above the salary requirement (0.56 vs 0.17).

We compute the effect on government revenue by using these elasticities and the conceptual framework of Fischer et al.(2022). We find that a reduction of the tax subsidy decreases government revenues by 9 percent. This decrease is mainly caused by the response of high-skilled immigrants far above the salary requirement since the migration elasticity of this group is relatively high. In case the abolishment of the tax subsidy would only target high-skilled immigrants just above the salary requirement, government revenue would have been positive as this group has a far lower migration elasticity.

Our contribution to the literature is twofold. First, we show that a reduction of the tax subsidy changes the composition of the pool of high-skilled immigrants. Specifically, high labor income immigrants are more responsive to tax subsidies. A reduction in a tax subsidy foremost reduces the inflow of these very high income immigrants. As a result, we provide evidence that there do not only exist welfare magnets (Borjas (1999)), but also tax magnets at far lower labor income levels than for very specific superstar segments like soccer players (Kleven et al. (2013)) or

[5] For one particular subgroup, we doubt whether this is the case. Therefore, we interpret the result for this subgroup with caution.

particular inventors (Akcigit and Baslandze (2016)).[6] In addition, this paper complements the literature that analyzes the relationship between a reduction of the tax subsidy and the inflow of high-skilled immigrants. This literature is relatively scarce. Apart from Giarola et al. (2023) very few studies[7] focus on this issue (see Kleven et al. (2020) for a survey).

Second, we show that the effect of the tax subsidy on government revenue differs substantially for high-skilled immigrant workers just above the salary requirement and high-skilled immigrant workers far above this threshold. A decrease in the tax subsidy may have negative fiscal effects for the government budget in total, although it still yields positive fiscal revenues for high-skilled immigrant workers just above the salary requirement.

The setup for the rest of the paper is as follows. Section II provides the institutional framework by explaining the tax subsidy in the Netherlands and its reform. Section III describes a theoretical model form which we infer our hypothesis on tax subsidies. Section IV discusses the main summary statistics as well as the common trend assumption. Section V explains the estimation method and the corresponding result. Section VI concludes.

[6] One could also view these results by stating that a tax subsidy for the highest incomes are beggar-thy-neighbor policies resulting in a social inefficient outcome (see Mirrlees (1982) and Bhagwat and Wilson (1989)).

[7] Other examples are Kleven, Landais, Saez, and Schultz (2014). For countries with a federal structure, Liebig, Puhani, and Sousa-Poza (2007), Young, Varner, Ithai, and Prisinzano (2016), Martinez (2017), and Agrawal and Foremny (2019) analyze how tax incentives affects the location decision.

2 Institutional framework

This section explains the institutional setting regarding the tax subsidy for high-skilled immigrants in the Netherlands. We first explain the institutional design of the tax subsidy for which only high-skilled immigrant workers are eligible. Thereafter we describe the 2019 reform.

2.A Institutional design of the tax subsidy

Workers migrating to the Netherlands incur various migration costs, including travel expenses, documentation fees, and housing costs. To offset these extraterritorial expenses, employers are permitted to partially exempt employees from paying taxes and social premiums on a portion of their wages through the so-called "30%-rule." This rule is exclusively available to high-skilled immigrant workers.

In order to classify for the 30%-rule, immigrant workers need to satisfy four criteria. First, employees cannot live in the Netherlands or within 150 kilometers of the Dutch border. Second, the employees under consideration must not have lived within 150 kilometers of the Dutch border or in the Netherlands for at least 16 months in the last two years prior to accepting the contract with the current employer in the Netherlands. Third, the employee under consideration cannot have lived or worked in the Netherlands in the past 25 years.[8] Finally, employees need to satisfy the salary requirement. The salary requirement states that employees should earn a taxable income that is indexed every year.[9] Workers below the age of 30 with (the equivalent of) a university degree face a lower salary requirement. If an immigrant satisfies all four criteria, the immigrant is classified as a high-skilled immigrant and is able to make use of the 30%-rule. Especially the salary requirement prevents low skilled immigrants to make use of the 30%-rule.

The 30%-rule does not depend on actual extraterritorial costs but exempts a lump sum of maximal 30 percent of the gross wage. The exact amount exempted depends on the gross labor income wage. Figure 1Figure 1 Overview of 30%-rule in absolute (A) and relative terms (B). The salary requirement is based on the year 2022 and equals € 39.467,-. provides an overview for the amount of tax subsidy and the annual labor income for the year 2022. Immigrants earning a wage below the salary requirement (€ 39.467,- in the year 2022) do not receive any tax subsidy.

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[8] In case the employee did this, the maximum entitlement period is shortened by one-third of the period this person stayed in the Netherlands.

[9] Over the period 2016-2022, the salary requirements for individuals are represented below. Each year the amount is indexed by inflation.

2016:	€ 36.889,-	2019: € 37.743,-	2022: €39.467,-
2017:	€ 37.000,-	2020: € 38.347,-	
2018	€37.296,-	2021: € 38.961,-	

Immigrants that meet the salary requirement (and the other three criteria) are classified as high-skilled immigrants and are eligible for the 30%-rule. The amount of the tax subsidy τ is determined as follows:

$$\tau = \min\{w - \bar{w}, 0{,}3 * w\}$$

Where w denotes the annual labor income and $\bar{w}$ denotes the salary requirement. As an example, a high-skilled immigrant worker who earns a labor income of € 5.000,- euros above the salary requirement will receive a tax subsidy of €5.000,- .[10] In case a high-skilled immigrant worker earns a labor income of € 30.000,- above the salary requirement, the tax subsidy equals € 20.840,-.[11]

The tax subsidy for labor income far above the salary requirement is not only higher in absolute terms but also in relative terms. In this example, a high-skilled immigrant worker who earns € 5.000,- (€30.000,-) above the salary requirement has a tax subsidy of 11% (30%) on their total labor income.

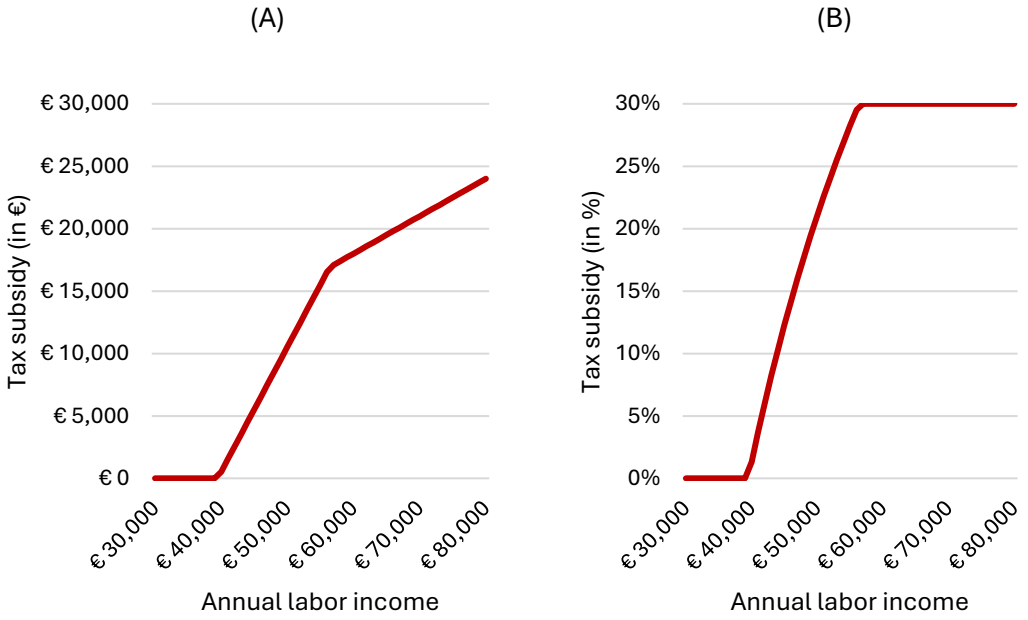

Figure 1 Overview of 30%-rule in absolute (A) and relative terms (B). The salary requirement is based on the year 2022 and equals € 39.467,-.

[10] € 5,000 euros above the salary requirement implies an income of € 44.467,-. The corresponding formula equals $\tau = \min\{€\ 44.467 - €\ 39.467, 0.3 * €\ 44.467\} = \min\{€\ 5.000, €\ 13.340\} = €5000$

[11] € 30.000 euros above the salary requirement implies an income of € 69.467,-. The corresponding formula equals $\tau = \min\{€\ 69467 - €\ 39.467, 0.3 * €\ 69.467\} = \min\{€\ 30.000, €\ 20.840\} = €\ 20.840$,-.

2.B Reform of the tax subsidy

From 2019 onwards, the 30%-rule became less generous. Workers who came to the Netherlands before 2019 could make use of the arrangement for a maximum amount of eight years once they meet all of the abovementioned criteria. Workers who came to the Netherlands after 2018 can only make use of the 30%-rule for five years. Giarola, et al. (2023) show that approximately half of the high-skilled workers stay longer in the Netherlands than five years. As a result, a reduction in the duration of the tax subsidy by three years may substantially shorten the time spent in the Netherlands for high-skilled immigrants.[12]

2.C Limitations

This study only focuses on changes in the Dutch tax scheme and does not take into account to what extent tax subsidies change in other countries during the same period. As a result, the country that high-skilled immigrant workers pick will not only depend on the reduction of the subsidy in the Netherlands, but as well on the increase or decrease of subsidies in other countries (see section IV.A). As an example, Austria allowed as of 2016 a 30% tax subsidy for researchers and professors. Greece and Island introduced similar subsidies (OECD, 2024)). If other countries make their tax subsidies more generous, we likely overestimate the effect of a reduction of tax generosity in the Netherlands.

A second limitation is that this study focuses on the inflow of high-skilled migrants who are eligible for the 30%-rule instead of the inflow of high-skilled migrants who make use of the 30%-rule. In our context it means that some employees meet the salary requirement but the employer refuses to use it in the tax filing (for ethical reasons for instance). Instead the employer may pay a higher wage such that the worker is at least as well of as with the 30%-rule. Therefore our approach can best be interpreted as intention-to-treat. In this example, a reduction in the generosity of the 30%-rule would also still affect high skilled immigrants that do nut use the 30%-rule as employers may lower their wage when the 30%-rule becomes less generous. Since both users and non-users are affected similarly, we believe that focusing on eligibility is a good measure.

[12] Workers that migrated to the Netherlands before 2018 also receive a discount in their tax free income thereafter. As a result, we cannot compare the outflow of the group of immigrants that arrived before 2018 to those that arrived after 2018 as both groups are treated by the reform.

3 Theoretical framework

3.A Baseline framework

Following Borjas and Bratsberg (1994), the decision to migrate depends on the income distribution of the source and the sending country. If we assume that earnings in both the sending country (country 0) and the host country (country 1) depend on a perfectly transferable skillset, the income distribution in both countries 0 and 1 can be written as:

$$\log(w_0) = \alpha_0 + r_0 s \qquad (1.1)$$

$$\log(w_1) = \alpha_1 + r_1 s \qquad (1.2)$$

In these equations, w_0 and w_1 denote the mean earnings in the host and sending country, respectively. In addition, s denote the (perfectly) transferable skillset and r_0 and r_1 denote the return to this skillset. Finally, α_0 and α_1 denote a country specific earnings effect.[13] An income maximizing individual will choose to immigrate from country 0 to country 1 whenever:

$$\log(w_1) > \log(w_0) + \pi$$

In other words, an individual will choose to reside in country 1 if the wage in a country 1 exceeds the wage in country 0 and the migration costs π.

3.B Return migration and tax subsidies

The focus of this paper is largely on temporary migration as workers who come to the Netherlands only temporary receive a tax subsidy. As a result, the model is adjusted by adding a subsidy $\tau > 1$ given to high-skilled workers by the host country:

$$\log(w_1) = \alpha_1 + \tau * r_1 s \qquad , \tau > 1 \qquad (1.2a)$$

Following Borjas and Bratsberg (1996), we build a model that takes into account temporary migration. In these type of models, migration serves as a "stepping stone" career path to earn a higher salary upon return to the home country (Rosen (1972)). Wahba (2021) shows that it may be profitable to live abroad for a few years to obtain particular skills (and funds) valuable in the sending country before returning to the home country (this is also known as return migration).

To build on this intuition, we assume rational forward looking workers who view return migration as a human capital investment. Ignoring discounting, we write the wage associated with temporary migration as:

$$\log(w_{10}) = \theta \log(w_1) + (1 - \theta)(\log(w_0 + k) \qquad (1.3)$$

[13] This country specific intercept is largely determined by the welfare state.

In equation (1.3), the variable θ indicates the fixed time the worker spends abroad and κ indicates the constant rate of return to temporary migration. If the fixed cost of migration and return migration are equal to π_{01} and π_{10}, respectively, we can write the decision to permanently migrate as:

$$\log(w_1) - \pi_{01} > \log(w_0) \qquad (1.4)$$

In a similar vein, a worker becomes a return immigrant in case the returns of temporary migration exceed the returns of i) never moving and ii) moving permanently to the host country. This can be written as:

$$\log w_{10} - \pi_{01} - \pi_{10} > \log(w_0) \qquad (1.5)$$

$$\log w_{10} - \pi_{01} - \pi_{10} > \log(w_1) - \pi_{01} \qquad (1.6)$$

Using (1.5) and (1.6), we show that to have any form of return migration, κ needs to be sufficiently large:

$$\kappa > \pi_{01} + \frac{\pi_{10}}{1-\theta} \qquad (1.7)$$

- Proof: see appendix

Intuitively, equation (1.7) shows that the rate of return to temporary migration must exceed the expected costs of migration. In case (1.7) does not hold, no migration occurs as the costs of migration exceeds the benefits. However, if we assume that (1.7) holds, the subset of workers who become migrants are given by

$$(\alpha_1 + \tau * r_1 s) > (\alpha_0 + r_0 s) + \frac{\pi_{01}+\pi_{10}}{\theta} - \kappa\frac{(1-\theta)}{\theta} \qquad (1.8)$$

- Proof: see appendix

Intuitively, equation (1.8) indicates the difference in the rate of return between the host and sending country for a particular skill level. The term on the left hand side equals the earnings in the host country. These earnings should exceed the earnings in the sending country (first term on the right hand side) and the migration costs (second term on the right hand side). The last term on the right hand side equals the value of foreign experience in the sending country. If this is highly valued (i.e. κ is large), then it is less costly to migrate as earnings are higher upon return.

3.C Comparative statistics

Assuming (1.7) holds and using (1.8), we perform comparative statistics to identify what determines the inflow of migrants. A higher subsidy τ increases the inflow of skilled workers from the source country. In addition, the number of immigrants also increase by the amount of time (θ) an immigrant worker tends to or is allowed to stay in the host country. Finally, higher migration costs π_{01} and return migration costs (π_{10}), reduces the inflow of migration into the host country.

From this model, we infer the hypothesis that a reduction in tax subsidies will decrease the inflow of high-skilled immigrants (see Figure 2). In particular, if the tax subsidy is a fixed percentage of labor income, the reduction in the tax subsidy has a stronger negative effect on high-skilled immigrants with the highest incomes since they receive the largest subsidy (both in absolute and relative terms; see also Figure 1). For immigrants with lower wages, the reduction of the subsidy will result in a lower income loss and therefore this group will be less affected. We test these hypotheses in section V of this paper.

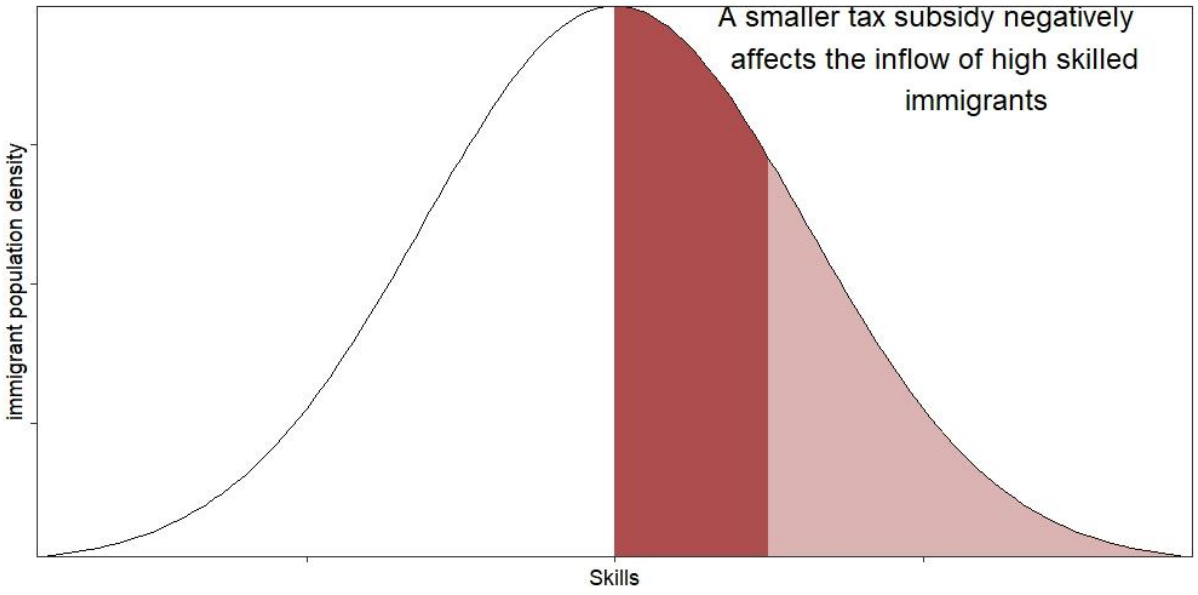

Figure 2: A reduction in tax subsidy has a stronger negative effect on the highest skilled workers (light-red area).

4 Summary statistics and graphical evidence

4.A Summary statistics

We use administrative microdata from Statistics Netherlands.[14] These administrative datasets contain information on the wage, gender, sector, and income that employees earn in a particular year. In addition, we observe the year in which workers arrive in the Netherlands as well as their taxable income. These variables determine the annual inflow of workers who are allowed to make use of the tax subsidy.

The first step of the empirical analysis is to determine a credible treatment and a control group for the years 2016-2022. The treatment group consists of high-skilled immigrants who meet the salary requirement and are at least thirty years old (see section III). In addition, we cap the maximum income for the treatment group at 200 percent of the salary requirement.[15] Since high-skilled immigrants from Belgium and Luxembourg do not meet the distance criteria (see section II), they are not eligible for the tax subsidy. Therefore we omit them from our analysis.

We follow Timm, et al. (2022) and select low skilled immigrants who earn between 50-90 percent of the salary requirement and are older than 29 as our control group.[16] As a result, the wage differs substantially between the treatment and control group.

Table 1 shows that the number of migrants in the treatment (control) group prior the reform equals 14,237 (29,722). After the reform, these numbers are equal to 25,539 and 59,111, respectively. The difference between those two numbers shows that the inflow of high-skilled immigrants did not grow as fast as the inflow of low skilled immigrants. Analyzing background characteristics, we observe that the age in the treatment and control group are roughly 39 years old. After the reform, this did not change much.

There are two notable differences between the treatment and control group. First, high-skilled workers more often have a permanent contract. This is both the case prior and after the reform. In addition, we observe that the workers in the treatment group are more often employed in the industry sector. This is also the case both prior and after the reform. Workers in the control group, on the other hand, are more often employed in services. A possible explanation for this is that catering is also included in the service sector.

[14] The datasets we use are gbapersoontab, migratiebus, and polisbus.
[15] We use this cut-off as we do not have a good control group for workers above this salary cap.
[16] We use the group with 90-99% of the salary requirement in our placebo test (see next section and Appendix B).

	Control group		Treatment group	
	Before (2016-2018)	**After (2019-2022)**	**Before (2016-2018)**	**After (2019-2022)**
% male	70.5%	66.5%	76.0%	73.4%
% from Europe	76.1%	76.3%	72.5%	63.9%
age (years)	38.2	39.0	40.6	39.8
% permanent contract	8.2%	7.1%	15.3%	11.9%
gross wage	€ 24,536	€ 25,608	€ 50,572	€ 52,030
% services	69.9%	62.1%	60.2%	52.0%
% industry	22.5%	18.7%	34.4%	27.6%
% agriculture	7.6%	19.2%	5.5%	20.3%
Inflow of immigrants	29,722	59,111	14,237	25,339

Table 1 Summary statistics for workers in the treatment and control group before and after the tax subsidy became less generous.

4.B Graphical evidence and common trend assumption

The key assumption that needs to hold for a difference-in-differences analyses is the common trend assumption. This section analyzes whether the common trend assumption holds.

To do so, we take into account the findings by Donald and Lang (2007), who show that standard asymptotic inference is limited when the treatment and control group differ substantially in size. In our setting, the control group is substantially larger than the treatment group (see Table 1) when we analyze the effect of subgroups. To correct for this, we partition the control group into a set of smaller sub groups such that the size of these control groups equals the size of the treatment group one year prior the reform (2018).[17] In this way we make sure that the number of

[17] To partition the control group into smaller groups, we first order all individuals in the control group based on their year of arrival and their gross salary. Next, we use the year 2018 as the benchmark year to determine the number of control groups. As an example, suppose that in the year 2018 1,000 individuals are in the control group and 100 observations in the treatment group. If that is the case, the number of control groups equals ten (= 1,000/100). In the next step, we select for each control group the individual with the highest income. We divide this number by the salary requirement in 2018. In this way, we define relative income boundaries. For the other years, we use these relative boundaries to determine the inflow of immigrant workers in each control group. We use relative boundaries because the salary requirement changes every year due to an inflation correction. Relative boundaries take this into account (as opposed to absolute boundaries).

control groups depend on the size of the treatment group. For simplicity, we plot the average inflow for the control groups instead of the inflow in each control group separately.[18]

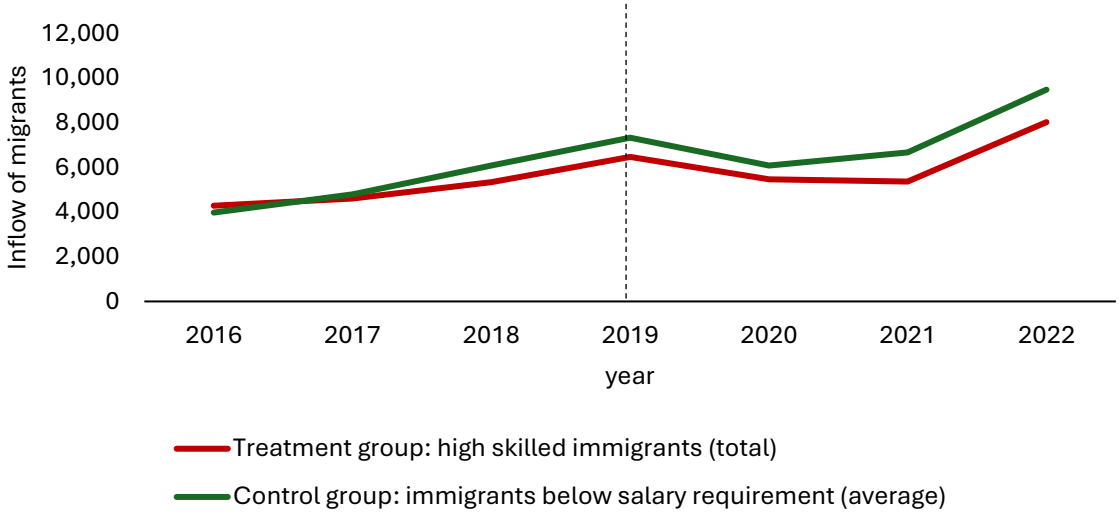

Figure 3 Inflow of high-skilled (red) and low skilled immigrants (grey) in the Netherlands over the period 2016-2022. Dashed line marks the 2019 reform.

Figure 3 shows there is a common trend between the treatment and the average inflow in the control groups pre-2019. We follow Kleven, Landais, Saez, and Schultz (2014) to test for the validity of the control group (see Appenidx B). We run a difference-in-differences regression by using immigrants that earn between 90 and 99 percent of the salary requirement as our treatment group. This groups should not be affected by the reform as they are not eligible for the tax subsidy. We test this hypothesis and find that this is indeed the case, indicating that our control group is valid.

In addition, we plot the inflow in the treatment and control group for particular subgroups. These are visualized Figure 4. We observe here a common trend as well. Interestingly, the group between 10-50 percent above salary requirement does not show a common trend. Therefore, the result for this group should be interpreted with caution as the common trend assumption is not satisfied.

[18] In case we plot the inflow for all control groups, it is sometimes difficult to visualize the common trend due to the large number of groups that is being plotted.

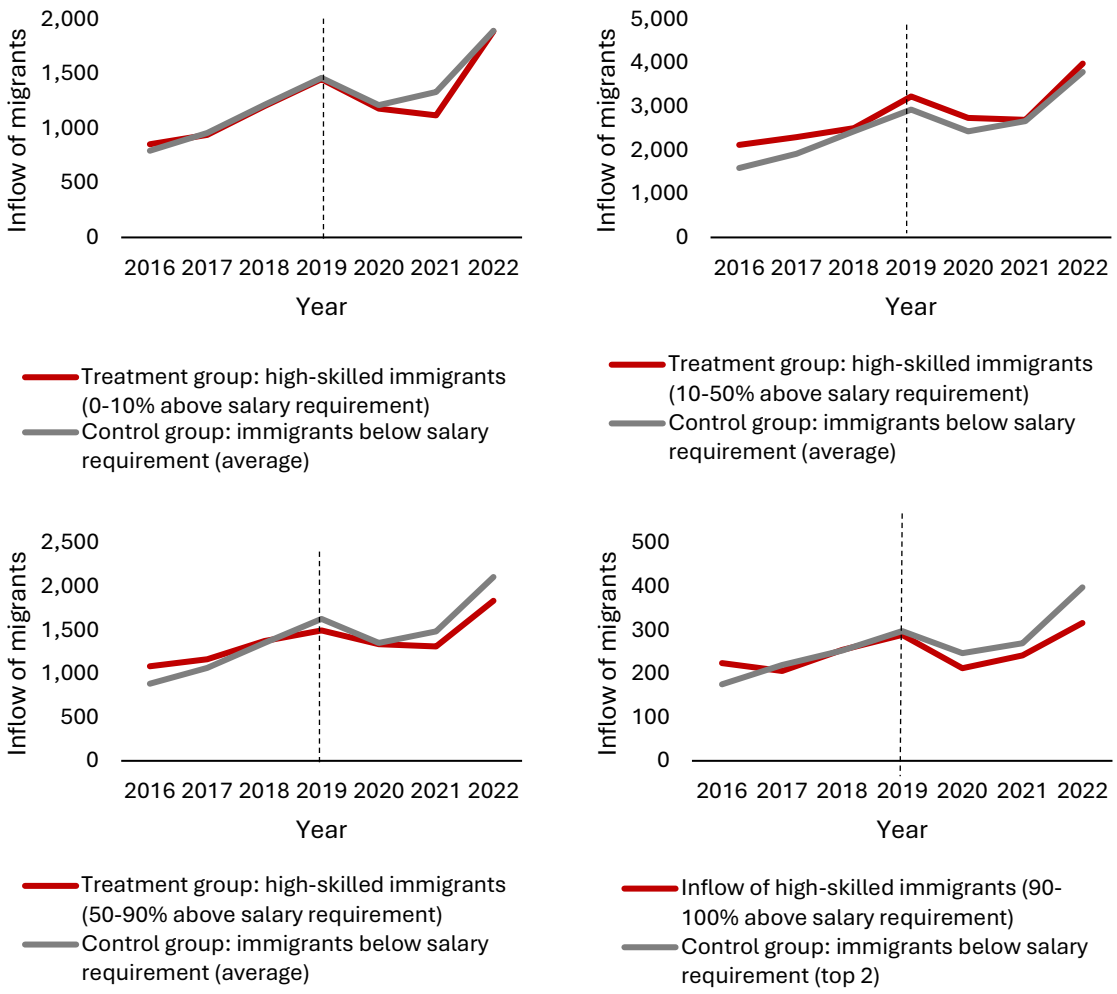

Figure 4 Inflow of high-skilled (red) and the average number of low-skilled immigrants (grey) in the Netherlands over the period 2016-2022. Figure 2 shows the inflow of workers for particular subgroups of the total population. We observe a common trend for all subgroups, except for the subgroup 10-50% (see Appendix B). Dashed line marks the 2019 reform.

5 Regression analysis

5.A Difference-in-differences estimates

We estimate how a reduction in a tax subsidy affects the inflow of high-skilled immigrants. We follow Timm, et al. (2022) and use a difference-in-differences estimation strategy. In this strategy, the control group consist of immigrant workers between 50 and 90 percent of the salary requirement (low-skilled immigrants). The treatment group consists of all immigrants that meet the salary requirement (high-skilled immigrants). Using these two groups, we run the following regression:

$$y_{gp} = \lambda_g + \theta_p + \beta D_{gp} + \delta_{gp} \qquad (2)$$

The dependent variable y measures the inflow of group g in year p. λ and θ denote group and year dummies, respectively. D_{gp} is our difference-in-differences estimator. The variable D_{gp} equals 1 in case an immigrant worker earns at least the salary requirement and came to the Netherlands after 2018. If this is not the case, D_{gp} equals zero. Based on our theoretical framework, we expect the sign of D_{gp} to be negative, meaning that a reduction in the tax subsidy reduces the inflow of high-skilled immigrants. Finally, δ_{gp} denotes the error term. We use robust standard errors since the number of groups (control groups and treatment group) in our estimation is relatively low (see Angrist and Pischke (2009)).

Table 2 shows the estimation results for the entire population (column 1) as well as for smaller subsets of the treatment group (column 2 – column 5). Column (1) shows that the inflow of high-skilled immigrants decreases on average by approximately 846 workers. This effect is significant at the 5% level. Using the inflow of the treatment group in 2018 as a baseline, this equals a reduction in the inflow of high-skilled immigrants by 16%.

Since Timm, et al. (2022) show that an introduction of the tax subsidy resulted in a large inflow of workers just above the salary requirement, we focus our attention on this group (column (2) and (3)). Columns (2) shows there is a negative effect for workers who are maximum 10% above the salary requirement, representing a 6% decrease from a baseline of 1,205 observations in 2018. This effect, however, is not significantly different from zero at the five percent level. Column (3) shows similar results for high-skilled immigrant workers who earn 10-50% above the salary requirement (reduction in inflow of 120 high-skilled immigrants or 5% compared to the baseline). This coefficient is also not statistically different from zero at the five percent level.

In addition, we also analyze the inflow of the top 10% as Giarola et al. (2023) show a strong response to tax subsidies (column (4) and (5)). Column (4) and column (5) show that there is a

negative significant effect for the higher income groups. For high-skilled immigrant workers who earn between 50-90% above the salary requirement, we find a reduction in the inflow of on average 327 workers, indicating a 24% reduction from a baseline of 1,375 observations in 2018. Also for high-skilled immigrants who earn 90-100% above the salary requirement we find similar results (reduction in inflow of on average 53 high-skilled immigrants, or a 21% decline compared to the baseline).

Overall, we observe that a reduction in the generosity of the 30%-rule decreased the inflow of high-skilled immigrants by on average 16% (column 1). Our subgroup analysis (column 2 – column 5) show that this effect is mainly driven by a reduction in the inflow of high-skilled immigrants who earn substantially more than the salary requirement (at least 50% more). For those groups, we find that the percentage wise decrease in inflow is roughly three times as large as for those high-skilled immigrants who are closer to the salary requirement.

	Inflow of high-skilled immigrants				
	(1)	(2)	(3)	(4)	(5)
Variable/ group specification	Total (0-100% above salary requirement)	0-10% above salary requirement	10-50% above salary requirement	50-90% above salary requirement	90-100% above salary requirement
D_{gp}	-846.13** (306,05)	-75.38 (51.72)	-120.00 (177.28)	-326.58*** (92.81)	-53.04** (20.83)
Year dummies	YES	YES	YES	YES	YES
Group dummies	YES	YES	YES	YES	YES
Number of bins	3	11	6	10	9
Number of observations (bins)	21	77	42	70	63
Total number of observations within groups	128,409	95,591	108,417	98,433	16,549
Inflow in treatment group in 2018	5,342	1,205	2,508	1,375	254
R^2	99.8%	99.8%	98.5%	99.6%	99.3%
Migration Elasticity	0.42	0.17	0.13	0.63	0.56

Table 2 The effect of a reduction in tax subsidy on the average inflow of high-skilled workers. Column (1) shows the effect on total inflow of high-skilled workers, while columns (2)-(5) show the effect on particular subgroups. In column (5), we only use two control groups (between 75 and 90 percent of the salary requirement) as workers further away from the salary requirement

*are not a good control group. Since the control group is substantially larger than the treatment group, the control group is defined in smaller subgroups (bins) for the difference-in-differences analyses. The number of bins depends on the size of the treatment group and therefore differs per subset. For instance, in column (1) we have, given the size of the treatment group, two control groups such that the number of observations between treatment and control group are (almost) equal. Therefore the total number bins equals three (two control groups and one treatment group). The number of observations (bins) is in this case seven years of data for three groups, so twenty-one. The total number of observations is the sum of all immigrants over the entire period (2016-2022). ** denotes significance at the 5% level and *** denotes significance at 1% level. Robust standard errors between parentheses.*

5.B Implied migration elasticity

Using the regression results in Table 2, we calculate the elasticity of inflow with respect to the tax subsidy. In the previous section we already determined the percentual change in inflow for different income groups. In addition, we calculate the percentual change in the size of the tax subsidy in the second step. This equals the difference between the net present value (NPV) of an eight-year subsidy and the NPV of a five-year subsidy. If we assume a constant wage growth over the entire period and we simulate 441 combinations of wage growth rate and discount rates[19], we find that the average percentual change in the tax subsidy is 37.6 percent (approximating 3/8).[20]

Using both a) the percentage change in inflow and b) the percentage change in the tax subsidy, we find the elasticity of the inflow of high-skilled immigrants with respect to the size of the tax subsidy (see last row of Table 2). These elasticities are equal to 0.42 (total), 0.17 (0-10% above salary requirement), 0.13 (10-50% above salary requirement), 0.63 (50-90% above salary requirement), and 0.56 (90-100% above salary requirement). The results show that the elasticity with respect to the tax subsidy is substantially larger for the higher income groups than for the group with an income just above the salary requirement.

These elasticities are somewhat lower than found in the literature. This could be explained by the different groups under consideration. The literature mainly studied the extremely high

[19] We simulated a wage growth rate and discount rate of 0 to 10%, with an interval of 0.5%.

[20] $NPV_{t\ years} = tax\ rate \times 0.3 \times wage \times \frac{1-\left(\frac{1+g}{1+r}\right)^{t}}{r-g}$, where g is the wage growth rate and r the discount rate. The percentual reduction in the NPV equals $\frac{1-\left(\frac{1+g}{1+r}\right)^{5}}{r-g} \Big/ \frac{1-\left(\frac{1+g}{1+r}\right)^{8}}{r-g} - 1$.

income groups such as professional athletes and inventors (e.g. Kleven et al., 2013 and Moretti & Wilson, 2017). They have incomes far higher above the salary requirement, which may result in stronger responses to tax incentives. For those super high incomes, the marginal tax rate is very close to their average tax rate. This differs from the group in this study, which may explain why we find somewhat lower elasticities. [21]

5.C Effect on government revenue

We use the results in Table 2 to calculate the effect of a reduction in the tax subsidy on government tax revenue. The decrease in the tax subsidy causes two opposite effects. First, a lower tax subsidy increases the revenue for high-skilled immigrant workers who come to the Netherlands. Second, tax revenues are reduced since less high-skilled workers will come to the Netherlands. To determine which effect dominates, we calculate the effect of the 30%-rule on government revenue in three scenarios:

1. No reduction in the duration of the 30%-rule from 8 to 5 years in 2019.
2. A reduction in the duration of the 30%-rule from 8 to 5 years in 2019. In this scenario, we compare i) higher government revenue for a period of five years is to ii) a lower inflow of high-skilled immigrants and iii) a share of the high-skilled immigrants who leaves the Netherlands after 5 years as they no longer receive the tax subsidy.
3. Abolishment of 30%-rule in 2019 in total.

The first scenario describes the government revenue for the 2019 cohort in absence of the reform. The second scenario describes the effect of the current reform on government revenue, taking into account that tax subsidies affect both the composition and the exit rate of high-skilled immigrants. The third scenario describes the effect of an abolishment of the 30%-rule. By describing all three scenarios, we map the potential outcomes.

We follow Fischer, Heckemeyer, Spengel, and Steinbrenner (2022) to determine the wage and tax parameters (Table 3). The average wage per group is estimated at the midpoint of the range multiplied by the salary requirement in 2019 (€ 37,743). The average tax rate in the Netherlands is approximately 40 percent and we apply this to all migrants. The tax subsidy thus equals 12 percent of the total wage sum (40% of 30%).

[21] For those super high incomes, the marginal tax rate is very close to their average tax rate. In our population this is different. This may also explain why we find lower elasticities.

Parameter	Value
Salary requirement (2019)	€ 37,743
Tax rate	40%
Average wage subgroups	(1+Midpoint of salary range) * salary requirement
Average wage total	Weighted average of subgroups

Table 3 Parameters scenario analysis government revenue. The midpoint of salary range refers to the average labor income in each subgroup. So for instance, the midpoint of salary range for the 0-10% subgroup equals 5%, so the average wage in the subgroup equals 1.05€ 37,743 = € 39,630.-*.

Table 4 shows how differences in the tax subsidy affect high skilled migration inflow. We use the regression estimates from Table 2 to calculate inflow in these scenarios. For scenario 2, we assume that all migrants stay in the Netherlands for the first 5 years. After five years, some leave as they no longer receive a subsidy. The total inflow in this scenario is the sum of columns (4) and (5). The inflow of migrants in the various scenarios are the main factor in explaining differences in the effect on government revenue results.

We use the results from Table 3 and Table 4 to calculate the effect on government revenue for all three scenarios. We do this by calculating the product of the tax rate, the taxable income (both from Table 3), and the high-skilled migration inflow (Table 4). As an example, for the group 0-10% above the salary requirement, tax revenues are equal to (100% -30%) * 40% * (12,400 * 1.05 * € 37,743) = € 137,595,881, or approximately 137.6 million. We do this as well for all other income categories and all three scenarios. The results are shown in Table 5.

Over a period of 8 years, the net tax revenues for the 2019 cohort are highest in scenario 1 (8 year – 30% rule). This result is driven by high-skilled immigrant workers far above the salary requirement (50-90% and 90-100%). This group is more responsive to tax subsidies since they have the largest migration elasticity. For high-skilled immigrants just above the salary requirement this is not the case. A less generous tax subsidy (scenario 2) or an abolition of the tax subsidy (scenario 3) of the 30%-rule would yield higher tax revenues for those groups. A limitation to the third scenario is that we assume linearity in our calculations, meaning that a calculation at the intensive margin (a reduction in years) can be calculated the same way as the effect on the extensive margin (an abolition of the tax subsidy). It is debatable whether this assumption holds, although it may serve as an intuitive reference point.

These main results are robust to various robustness checks (see Table 7 - Table 9 in appendix B). In particular, changing the tax rate or the average wage per group does not affect the main

outcome of the results: the high migration elasticity for high skilled immigrants far above the salary requirements results in lower total government revenue when the 30%-rule becomes less generous. This negative effect outweighs the effect of positive revenue for high-skilled immigrants just above the salary requirement.

Results from regression table		0-10% above salary requirement	10-50% above salary requirement	50-90% above salary requirement	90-100% above salary requirement	Total
Actual inflow 2019 (i_{2019})		1,453	3,233	1,494	289	6,469
%-change inflow (p)		-6.30%	-4.80%	-23.80%	-20.90%	-15.80%
Migration Elasticity (ϵ)		0.17	0.13	0.63	0.56	0.42
Scenario analysis	Formula					
Inflow scenario 1 (year 1-8)	$8 * \frac{i_{2019}}{1+p}$	12,400	27,164	15,675	2,922	61,492
Inflow scenario 2 (year (1-5)+ year (6-8))	$5 * i_{2019} + 3 * i_{2019} * (1 - \epsilon_5)$	11,141 (7,265+3,876)	25,055 (16,165+8,890)	9,635 (7,470+2,165)	1,932 (1,445+4,87)	45,691 (32,345+13,346)
Inflow scenario 3 (year 1-8)	$8 * i_{2019} * (1 - \epsilon)$	10,337	23,707	5,773	1,299	35,588

Table 4 Calculation of the migration inflow under in case of no change in the 30% rule (scenario 1), a shortage of the duration of the 30% scenarios by three years (scenario 2), and an abolition of the 30%-rule (scenario 3). The grey shaded area displays the results from the regression table (Table 2). We use these results to calculate the migration inflow for scenarios 1-3. For the third scenario elasticity for scenario 2 and scenario 3. The migration elasticity for the 5-year tax subsidy equals $\epsilon_5 = ((1 - \epsilon) - (1 + p))/(1 + p)/(-1)$. For the total group: ((1 – 0.42) – (1 – 0.158)) / (1 – 0.158) / (-1) = 0.31. In this calculation, (1-0.42) is the share of migrants that comes to the Netherlands when the 8-year 30%-rule is abolished. (1-0.158) equals the share of migrants that comes to the Netherlands under the 5-year policy. Lastly, -1 refers to the 100% abolishment of the 5-year 30%-rule.

Group / Scenario	(1) 8-year 30%-rule	(2) 5-year 30%-rule	(3) No 30%-rule
Total tax revenues	€ 852.6	€ 772.5	€ 815.6
Tax revenues per subgroup			
0-10% above salary requirement	€ 137.6	€ 142.1	€ 163.9
10-50% above salary requirement	€ 373.2	€ 396.6	€ 465.3
50-90% above salary requirement	€ 281.6	€ 189.8	€ 148.2
90-100% above salary requirement	€ 60.2	€ 44.1	€ 38.3

Table 5 Effect of policy scenarios on cumulative tax revenues (in millions of euros) over an eight year period.

6 Discussion and Conclusion

In this paper we analyze the effect of a reduction in tax subsidies on the inflow of high-skilled immigrants. After 2019, high-skilled immigrants face a reduction in tax subsidies as their tax exemption period is reduced from eight to five years. Using a difference-in-differences strategy, we find that the inflow of high-skilled immigrants decreases on average by 16 percent. This effect is stronger among high-skilled immigrants who earn substantially more than the salary requirement. A stylized back-of-the-envelope calculation shows that a reduction in the duration of the tax subsidy from eight to five years decreases government revenue by 9 percent, relative to an 8-year subsidy. However, the results differ per income group. The effect on government revenue is negative for workers who have labor earnings far above the salary requirement whereas for workers around the salary requirement the fiscal revenue is positive. From a policy perspective this implies that an increase of the salary requirement may increase government revenue. This policy change may result in higher government revenue from high-skilled immigrant workers just above the salary requirement. In addition, while still remaining an attractive host country for high-skilled immigrant workers far above the salary requirement (and henceforth no negative effect on government revenue from this group).

When calculating the fiscal revenue we rely on a number of assumptions. Although we relax those assumptions in a robustness analysis, it is difficult to predict how long high-skilled immigrants will stay in the host countries. Unexpected events like political turmoil in the country of origin, host country, or a global pandemic may unexpectedly increase or decrease the stay in the host country. These events could have a large impact (both positive and negative) on how profitable a reduction in the tax subsidy will be.

An important limitation of this study is that we did not take into account knowledge spillover effects. If high-skilled labor is complementary to other forms of labor, the productivity of the Dutch workforce will increase and, as a result, tax revenues will also increase. These second order effects could affect government revenues, making a reduction (or abolishment) of the tax subsidy less positive (or even negative) in terms of government revenue. Determining the magnitude of this knowledge spillover effect on government revenue is a question open for further research.

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Appendix A: mathematical derivation

Proof of 1.7

To prove of (1.7) we rewrite 1.6 and 1.7 as break even conditions:

$$\log(w_{10}) - \pi_{01} - \pi_{10} = \log(w_0)$$

$$\log w_{10} - \pi_{01} - \pi_{10} = \log(w_1) - \pi_{01}$$

Use (1.3) and rearrange:

$$\theta \log(w_1) + (1-\theta)\log(w_o) + (1-\theta)\kappa - \pi_{01} - \pi_{10} = \log(w_0)$$

$$\theta \log(w_1) + (1-\theta)\log(w_o) + (1-\theta)\kappa - \pi_{01} - \pi_{10} = \log(w_0) - \pi_{01}$$

Which can be written as:

$$\theta[\log(w_1) - \log(w_0)] + (1-\theta)\kappa - \pi_{01} - \pi_{10} = 0 \qquad (*)$$

$$\log(w_1) - \log(w_0) = -\frac{\pi_{10}}{1-\theta} + \kappa \qquad (**)$$

Plug (**) into (*) to find:

$$\theta\left[-\frac{\pi_{10}}{1-\theta} + \kappa\right] + (1-\theta)\kappa - \pi_{01} - \pi_{10} = 0$$

Rearranging yields the break-even condition:

$$\kappa = \pi_{01} + \frac{\pi_{10}}{1-\theta}$$

So, in order to make sure the rate of return to temporary migration (left-hand side) exceeds the expected cost of migration (right hand side), we obtain equation (1.7).

Proof of 1.8

Use (1.5) and plug in (1.3) and (1.1) and (1.2a), respectively to find:

$$\log w_{10} - \pi_{01} - \pi_{10} > \log(w_0)$$

$$\theta \log(w_1) + (1-\theta)\log(w_o) + (1-\theta)\kappa - \pi_{01} - \pi_{10} > \log(w_0)$$

$$\theta[\log(w_1) - \log(w_o)] + (1-\theta)\kappa - \pi_{01} - \pi_{10} > 0$$

$$\theta[\alpha_1 + \tau * r_1 s - \alpha_0 - r_0 s] > \pi_{01} + \pi_{10} - (1-\theta)\kappa$$

Finally, rearranging yields:

$$(\tau * r_1 - r_0)s > (\alpha_0 - \alpha_1) + \kappa + \frac{\pi_{01} + \pi_{10} - \kappa}{\theta}$$

$$(\alpha_1 + \tau * r_1 s) > (\alpha_0 + r_0 s) + \frac{\pi_{01} + \pi_{10}}{\theta} - \kappa\frac{(1-\theta)}{\theta}$$

Appendix B: Additional results

We test for the validity of the control group by using immigrants that earn between 90 and 99 percent of the salary requirement as our treatment group (see Kleven, Landais, Saez, and Schultz (2014)). Both groups should not be affected by the reform as they are not eligible for the tax subsidy. To test this hypothesis, we run the following difference-in-differences regression

$$y_{gp} = \lambda_g + \theta_p + \beta D_{gp} + \epsilon_{gp} \qquad (2)$$

In the above regression, the dependent variable y measures the inflow of group g in year p. λ and θ denote group dummies and year dummies, respectively. D_{gp} is our difference-in-differences estimator. The variable D_{gp} equals unity in case an immigrant worker earns between 90 and 99 percent of the salary requirement after 2018. Otherwise the variable equals zero. In case the treatment group is not affected by the reform, the coefficient for the variable D_{gp} should be insignificant. If this is the case, our control group is valid. Table 2 show the results of our regression outcome. We indeed find an insignificant coefficient. This indicates that our control group is valid. Figure 3 shows graphically the validity of our control group.

Variable/ group	Test for validity
D_{gp}	-102.135 (61.721)
Year dummies	YES
Group dummies	YES
Number of bins	9
Number of observation	16
Total number of observations within groups	99850
R^2	99.8%

Table 6 Placebo test common trend.

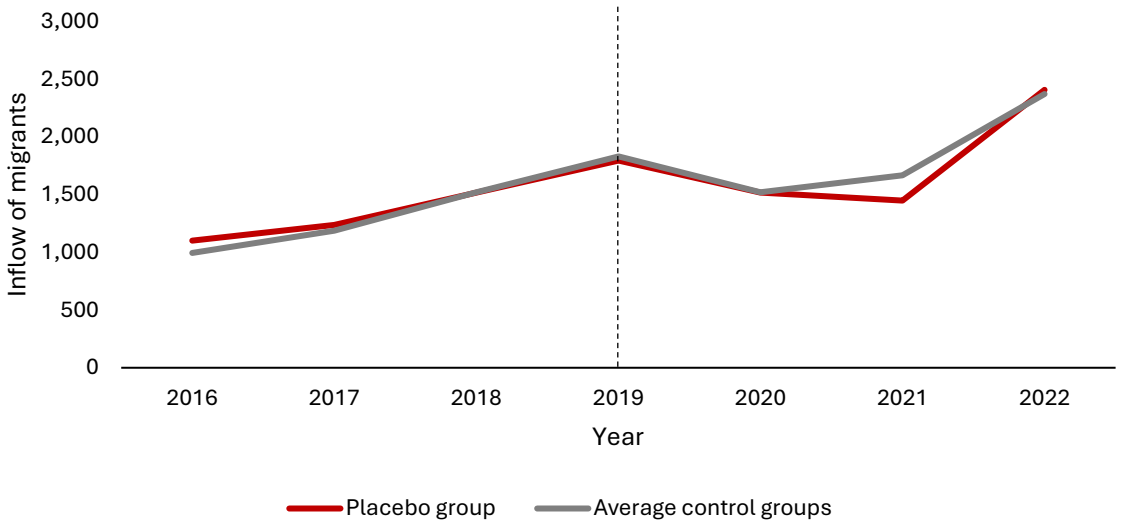

Figure 5 Placebo test common trend. The placebo group consists of immigrant workers earning between 90-9 99 percent of the salary requirement. The control groups consist of workers earning between 50-90% of the salary requirement.

Group / Scenario	(1) 8-year 30%-rule	(2) 5-year 30%-rule	(3) No 30%-rule
	Cumulative tax revenues 2019-2026 (mln.)		
	Tax rate = 35%		
Total	€ 746.0	€ 676.0	€ 713.6
0-10% above salary requirement	€ 120.4	€ 124.3	€ 143.4
10-50% above salary requirement	€ 326.5	€ 347.0	€ 407.1
50-90% above salary requirement	€ 246.4	€ 166.0	€ 129.7
90-100% above salary requirement	€ 52.7	€ 38.6	€ 33.5
	Tax rate = 45%		
Total	€ 959.2	€ 869.1	€ 917.5
0-10% above salary requirement	€ 154.8	€ 159.8	€ 184.3
10-50% above salary requirement	€ 419.8	€ 446.1	€ 523.4
50-90% above salary requirement	€ 316.8	€ 213.5	€ 166.7
90-100% above salary requirement	€ 67.7	€ 49.6	€ 43.0

Table 7 Robustness check effect of policy scenarios on cumulative tax revenues over 8 years for the 2019 cohort – tax rate.

Group / Scenario	(1) 8-year 30%-rule	(2) 5-year 30%-rule	(3) No 30%-rule
	Cumulative tax revenues 2019-2026 (mln.)		
	Average wage = (midpoint – 5 percentage points) x average wage		
Total	€ 821.9	€ 743.8	€ 815.6
0-10% above salary requirement	€ 131.0	€ 135.3	€ 163.9
10-50% above salary requirement	€ 358.8	€ 381.3	€ 465.3
50-90% above salary requirement	€ 273.3	€ 184.2	€ 148.2
90-100% above salary requirement	€ 58.7	€ 43.0	€ 38.3
	Average wage = (midpoint + 5 percentage points) x average wage		
Total	€ 883.3	€ 801.2	€ 846.6
0-10% above salary requirement	€ 144.1	€ 148.8	€ 171.7
10-50% above salary requirement	€ 387.5	€ 411.8	€ 483.2
50-90% above salary requirement	€ 289.9	€ 195.4	€ 152.5
90-100% above salary requirement	€ 61.8	€ 45.3	€ 39.2

Table 8 Robustness check effect of policy scenarios on cumulative tax revenues over 8 years for the 2019 cohort – average wage.

Group / Scenario	(1) 8-year 30%-rule	(2) 5-year 30%-rule	(3) No 30%-rule
	Cumulative tax revenues 2019-2026 (mln.)		
	Upper bound elasticity, treatment effect – 1 standard error		
Total	€ 923.5	€ 709.5	€ 647.6
0-10% above salary requirement	€ 144.2	€ 136.2	€ 148.2
10-50% above salary requirement	€ 403.1	€ 370.0	€ 394.3
50-90% above salary requirement	€ 309.0	€ 165.5	€ 83.3
90-100% above salary requirement	€ 67.2	€ 37.9	€ 21.7
	Lower bound elasticity, treatment effect + 1 standard error		
Total	€ 792.2	€ 826.2	€ 958.7
0-10% above salary requirement	€ 131.6	€ 147.4	€ 178.1
10-50% above salary requirement	€ 347.4	€ 419.5	€ 526.4
50-90% above salary requirement	€ 258.7	€ 210.1	€ 202.5
90-100% above salary requirement	€ 54.6	€ 49.2	€ 51.7

Table 9 Robustness check effect of policy scenarios on cumulative tax revenues over 8 years for the 2019 cohort – implied elasticities.