

Supplementary Materials

Heterogeneous Naturalization Effects of Dual Citizenship Reform in Migrant Destinations:
Quasi-Experimental Evidence from Europe

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American Political Science Review.
(October 2023)

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SM1. Citizenship policies in 18 European countries, 1994 - 2006

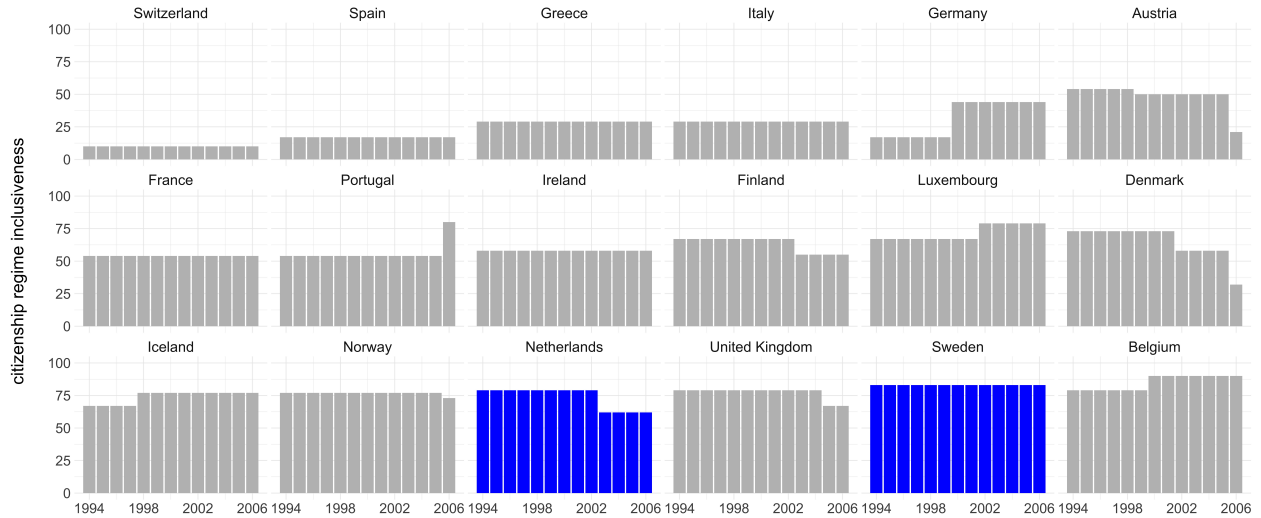


Figure S1: Citizenship regime inclusiveness in 18 West European countries, 1994 - 2006. Plotted are the scores for a measure of the inclusiveness of first-generation immigrant naturalization, excluding dual citizenship acceptance. Measure is based on residence duration, civic integration (language and citizenship test) and economic conditions. Higher scores indicate greater legal inclusiveness to immigrant naturalization. Source: own calculations based on Schmid (2021). Note that the observation periods in our analyses are restricted to 1994 - 2002 for the Netherlands (score of 79) and for Sweden to 1998 - 2006 (score of 83).

SM2. Operationalization

Notes on operationalization of main variables:

- *Observation year*: the administrative data made available to us by Statistics Sweden and Statistics Netherlands (see [Data availability statement]) contain annual observations with one observation per year per individual migrant.

In Sweden, annual observations refer to December 31 of each year. Each year in the Swedish data is thus treated as the same year (e.g. 2000 is based on data from December 31, 2000, and so forth).

In the Netherlands, observations refer to the first of January of each year, hence reflecting the situation in the previous calendar year. In other words, if a migrant is registered as having naturalized on the first of January of a given year, we treat this migrant as having naturalized in the previous calendar year. As a result, in all the tables and figures, each year refers to the measurement of January 1 of the subsequent year (e.g. 1994 is based on data from January 1, 1995, and so forth).

- *Citizen partner*: we distinguish between migrants without (0) and with (1) a registered partner who is a citizen of the destination country. For the purpose of the sub-samples used in our difference-in-differences analysis, this measurement is time-invariant, i.e. we identify migrants without (0) and with (1) a registered partner who is a citizen of the destination country in all relevant observation years.

Note that the ‘total’ sample in Sweden contains no restriction by the citizen status of the partner (nor changes in citizenship status of the partner during the observation years), whereas in the Netherlands -due to the exemption to the re-introduced renunciation requirement in 1997- the ‘total’ sample includes only migrants who are not registered as having a citizen partner in any observation year. The sub-sample of those migrants with a citizen partner in all observations is used in the placebo analysis.

- *EU*: binary variable capturing whether (1) or not (0) a migrant is born in a country that is a member state of the European Union or one of the associated states with which the EU shared a free movement regime between 1994-2006: Belgium, Denmark France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, the United Kingdom (EU) + Austria, Finland, Sweden (1994: EFTA/EEA, from 1995: EU) + Iceland, Norway (1994: EFTA/EEA) + Liechtenstein (1995: EFTA/EEA).

- *Human Development Index (HDI)*, this is a three-dimensional measurement of the socioeconomic conditions in a country, based on indicators for health, knowledge and standards of living. The composite index provides a score from 0 to 1, where a higher score equals greater development (World Bank 2018). For the subgroup analyses, this score is divided into two categories along the boundaries set by the United Nations Development Programme (UNDP 2022). More specifically, the groups are coded as follows: ‘Very high/high’: ≥ 0.7 ; and ‘Medium/Low’: < 0.7 .

- *Treatment group*: information is derived from the MACIMIDE Global Expatriate Dual Citizenship Dataset (Vink, De Groot, and Luk (2015)), which provides detailed information on 200 countries in the world since 1960 regarding the involuntary loss and voluntary renunciation of citizenship after a citizen of a state voluntarily acquires the citizenship of another state. We use the categorical variable “dualcit_grouped” from this Dataset (see Codebook for details) and combine this information with

data on country of birth from the migrant population identified in the administrative micro data from Sweden and the Netherlands.

To identify treatment group we follow the stepwise model illustrated in Figure 1, with the following adjustment due to the specific context of Sweden and the Netherlands. In line with Callaway and Sant'Anna (2021), treatment group allocation is determined in a time-invariant manner, to ensure stable treatment group comparison of naturalisation rates over time.

Sweden - treatment group identification

Control group: countries with `dualcit_grouped = 1`

Treatment groups

- *2001:* countries with `dualcit_grouped = 2` from 2001
 - Comment: This group includes Chile as the pre-2005 restriction coded as `dualcit_grouped = 1` in the MACIMIDE dataset only applies to those persons who acquired Chilean citizenship by naturalisation.
- *2002:* countries with `dualcit_grouped = 2` only from 2002
 - Comment: This group includes France and Italy as citizens of these countries lost resp. French and Italian citizenship when acquiring Swedish citizenship until 30/06/2002, when Sweden denounced Chapter 1 of the 1963 Strasbourg Convention on Reduction of Cases of Multiple Nationality, Chapter 1 (which implies automatic loss of origin citizenship by national of State Party who acquires citizenship of another State Party).
- *2003:* countries with `dualcit_grouped = 2` only from 2003
- *2004:* countries with `dualcit_grouped = 2` only from 2004
- *2005:* countries with `dualcit_grouped = 2` only from 2005

Placebo group (cannot renounce): `dualcit_grouped = 3`

The Netherlands - treatment group identification

Control group: countries with `dualcit_grouped = 1`

- Comment: This group includes France and Italy as citizens of these countries lost resp. French and Italian citizenship when acquiring Dutch citizenship during the observation period 1994-2000 as a result of Chapter 1 of the 1963 Strasbourg Convention on Reduction of Cases of Multiple Nationality, Chapter 1 (which implies automatic loss of origin citizenship by national of State Party who acquires citizenship of another State Party).

Treatment group: countries with `dualcit_grouped = 2` + no Dutch spouse or registered partner in any observation year.

- Comment: we measure citizen partnership in a time invariant manner, hence excluding migrants from our sample who change citizen partner status over the observation period.
- Comment: This group includes Chile as the pre-2005 restriction coded as `dualcit_grouped = 1` in the MACIMIDE dataset only applies to those persons who acquired Chilean citizenship by naturalisation.

Placebo groups

- (*cannot renounce*): countries with `dualcit_grouped = 3`
- (*citizen partner*): countries with `dualcit_grouped = 2` + Dutch spouse or registered partner in all observation years.

A replication file will be made available upon publication of the paper, linking all origin countries with treatment group in both destination countries.

- *Asylum applicant*: dichotomous indicator for whether a migrant is registered as, or likely to be, an asylum applicant (1) or not (0).

In Sweden, this is based on register data whether a migrant is registered as an asylum applicant, which is available from migrant cohort 1986 onwards. Given that asylum seekers have to formally apply for asylum, we assume that migrants for whom information on the migration motive is missing are not asylum migrants (and therefore coded as 0). In total, 737,639 observations in our sample are coded as asylum migrants. These migrants originate primarily from Bosnia and Herzegovina, Chile, Eritrea, Ethiopia, Lebanon, Iran, Iraq, Romania, Syria, Vietnam and former Yugoslavia.

In the Netherlands, register data on asylum applications is only available from migrant cohorts 1995 onwards. For older migrants, we draw on aggregate statistics on asylum applications in the Netherlands per origin country per cohort, made available by Statistics Netherlands. Aggregate statistics on asylum applications by origin country can only be determined from migration cohort 1987 onwards. Based on the proportion of asylum applications, we exclude a corresponding number of random observations from that country-cohort combination. For instance, according to Statistics Netherlands, 60.86 percent of migrants from Ghana in the year 1989 were asylum seekers. Therefore, of all Ghanaians who arrived in the Netherlands in 1989, 60.86 percent of the observations, selected at random, are excluded from the main analysis. In total, 152,573 observations are thus coded as asylum migrants. These migrants originate primarily from Afghanistan, Algeria, Ethiopia, Ghana, Iran, Iraq, Lebanon, the former Soviet Union, Syria and former Yugoslavia. For migrants from our sample from cohort 1995 and onwards, for which registered asylum application data is available, we observe a moderate to strong positive correlation between the registered and the derived status of being an asylum applicant (Pearson correlation coefficient = 0.632, $p = 0.000$).

SM3. Sample selection

Sweden

The research population consists of all foreign-born residents registered at a municipality between 1998 and 2006 in Sweden. We focus on cohorts who resided less than 40 years in the host country within the observation period, hence those who have migrated to Sweden from 1958 onwards (40 years before the first observation year 1998). We only include foreign-born individuals both of whose parents were born abroad and select only migrants who are 18 years or older at the moment of migration. We only observe migrants once they are eligible for naturalization.

Eligibility criteria

The requirements for naturalization in Sweden are stipulated in the Swedish Nationality Act (Lag om Svenskt medborgarskap). The most important requirements for naturalization are as follows: an applicant needs to

- be at least eighteen years of age;
- in possession of a non-temporary residence permit;
- have been domiciled on the territory of Sweden for a period of five years prior to the request for naturalization;
- has led, and can be expected to lead a respectable life.

While migrants normally become eligible for naturalization after 5 years of residence, there are exceptions for migrants who are the registered partner of a Swedish citizen for three years, and cohabited for the last two years. Moreover, the residence requirement is set to four years for stateless individuals and those who are considered refugees under Chapter 4, Section 1 of the Aliens Act (Utlänningslag), and to two years for Nordic citizens (Denmark, Finland, Iceland or Norway).

The moment of eligibility is determined in a stepwise manner according to the following criteria:

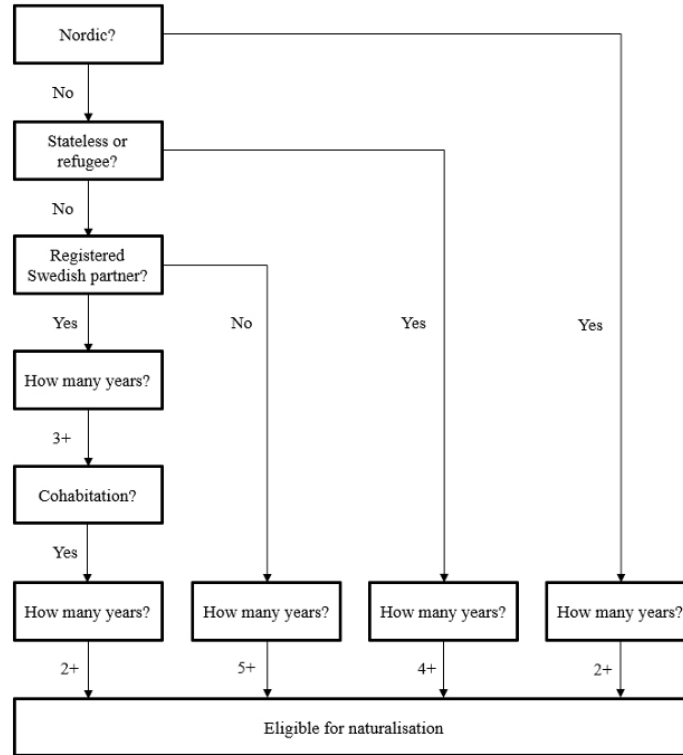


Figure S2: Sweden: main criteria for residence-based naturalization, 1998-2006

Pre-2001 renunciation requirement:

In Sweden, citizenship policy was oriented traditionally to avoiding instances of dual citizenship (Bernitz 2012: 4). The Swedish Citizenship Act of 1950 stipulates that a foreign national who acquires Swedish citizenship by naturalization is expected to renounce their original citizenship, unless she or he already automatically loses that citizenship, or cannot reasonably be expected to do so. Migrants with refugee status or who were entitled to subsidiary protection were exempted from this requirement.

This meant that the renunciation requirement applied only to those applicants for Swedish citizenship who did not have refugee or subsidiary protection and did not already lose their origin country citizenship according to the origin country citizenship law: “[i]f an applicant who has foreign citizenship does not lose such citizenship through his naturalization but consent for this must be obtained from the government or some other authority in the foreign state, the acquisition of Swedish citizenship may be conditional upon the applicant submitting proof to the Swedish Immigration Board, within a specified period, that such consent has been granted.” (Swedish Citizenship Act 1950, Section 6). In practice, this meant that successful applicants for naturalization who did not lose their citizenship as a result of the origin country legislation were granted so-called “conditional naturalization”, i.e. acquired Swedish citizenship on the condition “that the applicant must demonstrate within a certain time, normally two years, that he or she has been granted release from her second citizenship.” (SOU 1999, Svenskt medborgarskap: Slutbetänkande av 1997 års medborgarskapskommitté, p. 140).

Discussions on gender equality in citizenship legislation, political representation of minorities and

cultural pluralism in integration policy resulted in increasingly positive views towards liberalizing dual citizenship legislation, particularly among the Social Democrats. Throughout the 1980s exemptions to the renunciation requirement were instituted for those cases where renunciation would be very costly (Statens offentliga utredningar 1984, 11, 131ff. See also Departementsserien 1986, 6, 55: Dubbelt medborgarskap). Following several years of preceding discussion on full dual citizenship liberalization (see Szabo 1997: 54-79 and Bernitz 2012: 5 for an overview and discussion), under pressure from Swedish nationals living abroad who were also subject to dual citizenship restrictions (Spang 2007: 112), in July 2001 the renunciation requirement was abolished, allowing naturalizing migrants to retain their original citizenship if the host country would allow it (Sveriges Rikstag Parliament records 2000/01, 70).

Migrants who presumably have refugee status or are asylum migrants who are entitled to subsidiary protection are excluded from the main analysis (SM1. Operationalization). Note that Dutch migrants with a Swedish partner, who would normally automatically lose their original citizenship when voluntarily acquiring another, could hold dual citizenship from 2001 onwards due to reciprocation of the partner exception in the Dutch citizenship law.

The Netherlands

The research population consists of all foreign-born residents registered at a municipality between 1994 and 2002 in the Netherlands. We focus on cohorts who resided less than 40 years in the host country within the observation period, hence those who have migrated to the Netherlands from 1954 onwards (40 years before the first observation year 1994). We only include foreign-born individuals both of whose parents were born abroad and select only migrants who are 18 years or older at the moment of migration. We only observe migrants once they are eligible for naturalization.

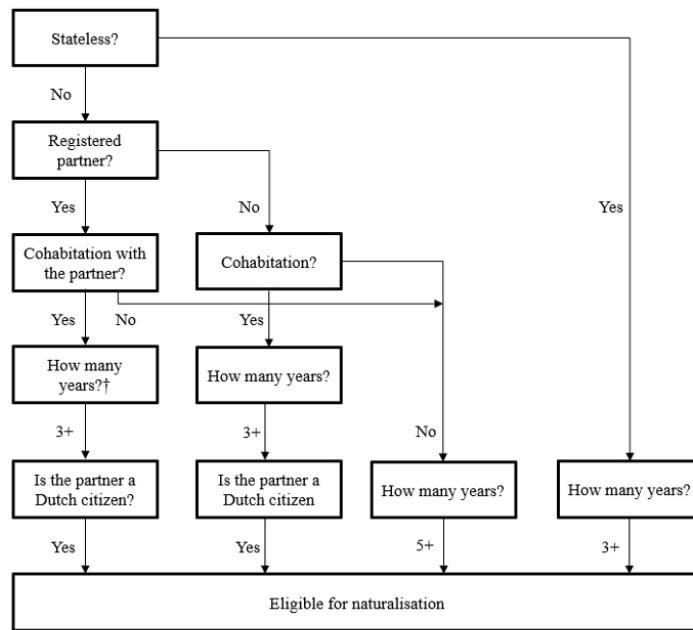
Eligibility criteria

The requirements for naturalization in the Netherlands are stipulated in the Dutch Nationality Act (Rijkswet op het Nederlanderschap). The most important requirements for naturalization are as follows: an applicant needs to

- be at least eighteen years of age;
- in possession of a non-temporary residence permit;
- have primary residence on the territory of the Netherlands for a period of five years prior to the request for naturalization;
- pose no danger to public order, good morals or security in the Netherlands;
- be considered sufficiently integrated into Dutch society based on his or her mastery of the Dutch language or – if residing in the Dutch Antilles or Aruba – the language commonly spoken on the island besides Dutch.

While migrants normally become eligible for naturalization after 5 years of residence, there are exceptions for migrants who are the registered partner of and cohabit with a Dutch citizen, or those who cohabit in the Netherlands with a Dutch citizen, for three years. Moreover, the residence requirement is set to three years for stateless individuals.

The moment of eligibility is determined in a stepwise manner according to the following criteria:



†Include years of cohabitation prior to the registered partnership.

Figure S3: The Netherlands: main criteria for residence-based naturalization, 1994-2002

Under current Dutch law, a foreign national who acquires Dutch citizenship by option declaration or naturalization in principle is expected to renounce her or his other citizenship(s), unless she or he already automatically loses that citizenship, or cannot reasonably be expected to do so¹; on the other hand, a Dutch citizen who voluntarily acquires another citizenship automatically loses Dutch citizenship, unless one of the exceptions indicated by the law applies. One of these exceptions is having a Dutch partner, which allows migrants to naturalize while keeping their original citizenship.

We exclude migrants born in Indonesia or in Suriname before 1975 from the Dutch sample, as almost all these migrants are Dutch citizens by birth or where able to acquire Dutch citizenship on special facilitated grounds.

While migrants who are in a registered partnership with a Dutch citizen prior to migration to the Netherlands can be eligible earlier than three years after migration, Dutch register data does not include information to identify such instances.

The renunciation requirement before and after 1997

In the Netherlands, the restrictive approach towards dual citizenship (Van Oers et al. 2013) already met with sustained criticism since the 1980s from immigrant groups and (centre-)left political parties, who argued that dual citizenship policies should be liberalized (van den Bedem 1993: 31-35). The Scientific Council for Government Policy advised late 1980s to allow migrants to retain their original citizenship upon naturalization to reinforce the legal position of immigrants

¹According to information from the Ministry of Justice, Immigration and Naturalization Service (“Trendrapportage Naturalisatie: Trends En Ontwikkelingen in Naturalisatieverzoeken in de Periode Januari 1998 – December 2002”, 2003, Table 9) about the application of the renunciation requirement in the period 1998 - 2002, in none of these 5 years do the number of applicants who are exempted from the renunciation requirement due to individual circumstances (“eg financial disadvantages”) reach one percent of the total applications (reported as “0%” for all five years).

through naturalization, thereby facilitating their participation and integration (Heijs 1995). The subsequent centre-left coalition thus decided, after considerable parliamentary debate, no longer to require naturalizing foreigners to renounce their original citizenship (Staatscourant 1992, no. 25; see also Kamerstuk 21 132, nr. 8, vergaderjaar 1989-1990, p. 43). However, the amendment of the Dutch Nationality Act to abolish the renunciation requirement, which was introduced in 1993 (Wetsvoorstel 23 029 (R1461), encountered increasing opposition and failed to be approved by the Senate in 1996, resulting in its withdrawal. The renunciation requirement was thus reinstated in June 1997, albeit with a new provision that foreigners who were married to a Dutch citizen were not required to renounce their other citizenship (Staatscourant 1997, no. 128). This exception reflected the Second Protocol to the 1963 Strasbourg Convention, which was adopted in 1993 and had been signed by the Netherlands and ratified in 1996.

Hence, since 18 June 1997, foreign nationals who acquire Dutch citizenship by option declaration or naturalization are expected to renounce their other citizenship(s), unless they automatically lose that citizenship due to origin country legislation, or cannot reasonably be expected to do so (Staatssecretaris van Justitie, Wijziging beleid inzake afstand doen van oorspronkelijke nationaliteit bij naturalisatie tot Nederlander, Staatscourant 1997, nr 128, p. 7). Should a successful applicant, who agreed to renounce her or his other citizenship, fail to ‘do everything possible’ to renounce her or his citizenship, then the naturalization can be annulled (Dutch Nationality Act, art. 15(1)(d)).

In addition, there are a number of exceptions to this requirement, including those relevant for our sample population of foreign-born person who arrive in the Netherlands as adult:

- migrants who have refugee status or are asylum migrants who are entitled to subsidiary protection.
- migrants with a Dutch partner

Migrants who presumably have refugee status or are asylum migrants who are entitled to subsidiary protection are excluded from the main analysis ([SM1. Operationalization](#)).

SM4. Summary statistics

Sweden

variable	category	percent
naturalised	yes	59.01
	no	40.99
treatment	control	21.98
	treatment2001	41.02
	treatment2002	1.89
	treatment2003	27.42
	treatment2004	0.30
	treatment2005	1.70
	placebo	2.55
	post-treatment eligible	3.14
gender	male	45.55
	female	54.45
age at migration	18-30	65.42
	31-40	20.86
	41-50	7.66
	50+	6.06
minor children in the household	yes	34.22
	no	65.78
highest level of education	low	53.81
	middle	22.77
	high	15.43
	unknown	7.99
country of birth (grouped)	EU	46.98
	non-EU high HDI	28.01
	non-EU low/medium HDI	25.01

Table S1: Sweden: summary statistics (sample: total) | N(ind) = 484.008 | N(obs) = 3.191.258

Table S2: Sweden: top 10 origin countries, control group and treatment groups

country	obs	group	country	obs	group
Norway	156537	control	fmr Yugoslavia	238556	treat_2001
Denmark	133167	control	Poland	205571	treat_2001
Germany	101595	control	Turkey	129488	treat_2001
Thailand	37444	control	Iran	102695	treat_2001
Bosnia and Her	30369	control	Chile	70807	treat_2001
China	29851	control	Greece	61222	treat_2001
Spain	24785	control	UK	61119	treat_2001
India	23630	control	Hungary	52113	treat_2001
Ethiopia	11231	control	Lebanon	42647	treat_2001
China	10841	control	Syria	39442	treat_2001
Italy	25250	treat_2002	Finland	840530	treat_2003
France	17187	treat_2002	Philippines	24749	treat_2003
Netherlands	8423	treat_2002	Iceland	17133	treat_2003
Australia	5417	treat_2002	Rwanda	53	treat_2003
Belarus	469	treat_2002	Sao Tome & Prin	12	treat_2003
Congo	224	treat_2002	Bolivia	7827	treat_2004
			Mozambique	823	treat_2004
			Djibouti	120	treat_2004
			Iraq	53333	treat_2005
			Uganda	522	treat_2005
			Nauru	8	treat_2005

Table S3: Sweden: top 10 origin countries, placebo group (no loss of citizenship, cannot renounce)

country	obs	group
Morocco	25588	placebo (cannot renounce)
Tunisia	16380	placebo (cannot renounce)
Uruguay	11133	placebo (cannot renounce)
Argentina	9433	placebo (cannot renounce)
Eritrea	2929	placebo (cannot renounce)
Mexico	2854	placebo (cannot renounce)
Ecuador	1962	placebo (cannot renounce)
Guatemala	852	placebo (cannot renounce)
Dom Repuglic	686	placebo (cannot renounce)
Panama	619	placebo (cannot renounce)

Netherlands

variable	category	percent
naturalised	yes	29.89
	no	70.11
treatment	control	21.46
	treatment1997	39.21
	placebo (cannot renounce)	29.02
	post-treatment eligible	10.31
gender	male	48.22
	female	51.78
age at migration	18-30	66.03
	31-40	25.11
	41-50	7.21
	50+	1.65
minor children in the household	yes	54.88
	no	45.12
highest level of education	low	33.86
	middle	7.91
	high	5.56
	unknown	52.67
country of birth (grouped)	EU	22.41
	non-EU high HDI	6.33
	non-EU low/medium HDI	71.26

Table S4: Netherlands: summary statistics I (sample: no citizen partner)

N(ind) = 136.521 | N(obs) = 912.031

variable	category	percent
naturalised	yes	63.41
	no	36.59
treatment	control	40.33
	placebo (citizen partner)	37.83
	placebo (cannot renounce)	9.93
	post-treatment eligible	7.91
gender	male	41.58
	female	58.42
age at migration	18-30	78.22
	31-40	17.61
	41-50	3.35
	50+	0.82
minor children in the household	yes	62.91
	no	37.09
highest level of education	low	23.28
	middle	13.40
	high	9.23
	unknown	54.09
country of birth (grouped)	EU	38.51
	non-EU high HDI	12.90
	non-EU low/medium HDI	48.59

Table S5: Netherlands: summary statistics II (sample: citizen partner)
N(ind) = 148.511 | N(obs) = 931.413

Table S6: The Netherlands: top 10 origin countries, control group and 1997 treatment group (immigrants without citizen partner)

country	obs	group	country	obs	group
Germany	64308	control	Turkey	219992	treat_1997
Belgium	25215	control	UK	26152	treat_1997
Spain	19251	control	fmr Yugoslavia	21470	treat_1997
Italy	17464	control	Portugal	14346	treat_1997
China	11663	control	Cape Verde	13640	treat_1997
France	7634	control	Greece	7519	treat_1997
Pakistan	7174	control	Vietnam	6607	treat_1997
India	5433	control	Egypt	5956	treat_1997
Ethiopia	4597	control	Poland	5416	treat_1997
Philippines	3695	control	US	4829	treat_1997

Table S7: The Netherlands: top 10 origin countries, control group and placebo treatment group (immigrants with citizen partner)

country	obs	group	country	obs	group
Germany	157480	control	Turkey	116412	placebo (citizen partner)
Belgium	62514	control	UK	49579	placebo (citizen partner)
China	31605	control	fmr Yugoslavia	31099	placebo (citizen partner)
Spain	23658	control	Cape Verde	18585	placebo (citizen partner)
Philippines	16545	control	Vietnam	17118	placebo (citizen partner)
Pakistan	11875	control	Poland	16772	placebo (citizen partner)
Austria	11059	control	US	10451	placebo (citizen partner)
Thailand	8682	control	Portugal	8600	placebo (citizen partner)
India	6994	control	Egypt	8496	placebo (citizen partner)
Denmark	4949	control	Greece	7860	placebo (citizen partner)

SM5. Descriptive trend

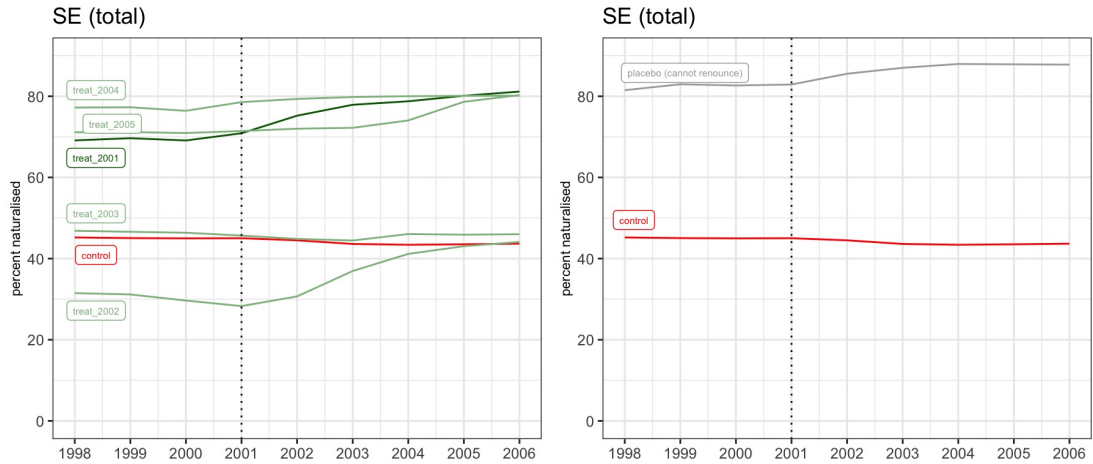


Figure S4: Unadjusted naturalization rates in the staggered treatment groups and control group of never treated (left panel) and the placebo group and control group (right panel), among foreign-born immigrants (excl asylum applicants) in Sweden. Placebo group consists of migrants from origin countries where citizenship is not lost upon naturalization abroad and cannot be renounced. Vertical line refers to the removal of the renunciation requirement in 2001.

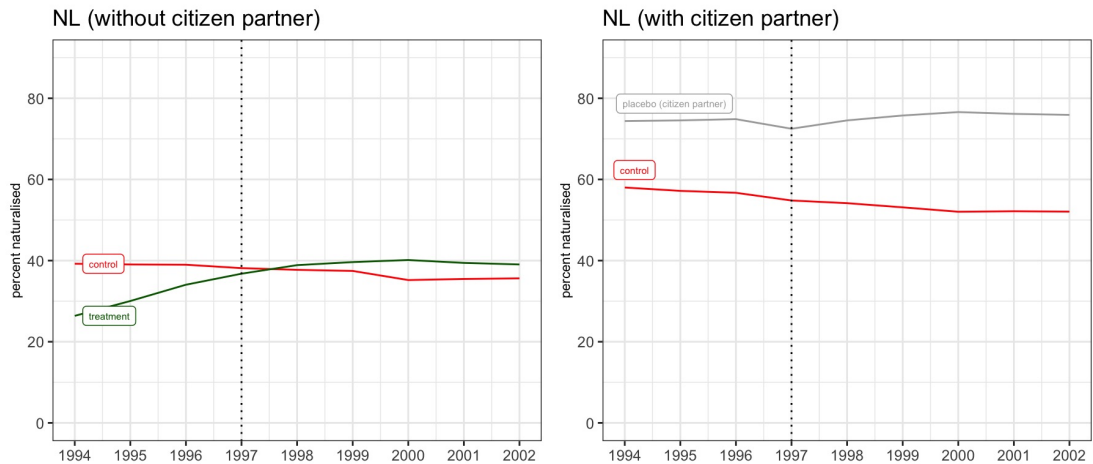


Figure S5: Unadjusted naturalization rates in the treatment group and control group of never treated (left panel) and the placebo group and control group (right panel), among foreign-born immigrants (excl asylum applicants) in the Netherlands. In the left panel both the treatment and control group consist of immigrants who do not have a Dutch citizen partner in any observation year. In the right panel both the placebo and control group consist of immigrants who have a Dutch citizen partner in each observation year, and the placebo group consists of migrants from origin countries where citizenship is not lost upon naturalization abroad but can be renounced. Vertical line refers to the reintroduction of the renunciation requirement in 1997.

SM6. Notes on method

We use migrant-level ('ID_number'), unbalanced panel data with annual observations to analyze the effect of a policy change ('treatment') on the outcome *naturalized* ('Y') using difference-in-differences (DiD) among those migrants from the treatment group. Due to exogenous variation (changes in origin country characteristics) some units are not treated immediately in the year the policy change goes into effect, but only in one of the subsequent years. Staggered treatment is problematic for a number of reasons (Callaway and Sant'Anna (2021)). Ordinary least squares regression would over-weight units with more variance in treatment status (in this case, being subject to a policy condition) when estimating the treatment effect, introducing selection bias if being treated early or late is non-random, or if treatment effects depend on treatment duration. Moreover, in the context of DiD models, the assessment of the parallel trend assumption is complicated when some individuals in the treatment group are not yet treated in the post-treatment period. To account for differences in treatment timings ('treat_group'), or staggered treatment, we use the "did" package by Callaway and Sant'Anna in R, applying the following settings:

```
library(did)

att_gt(yname = "Y", tname = "t", idname = "ID_number", gname = "treat_group",
data = dataset, panel = TRUE, allow_unbalanced_panel = TRUE)
```

In this approach, we start with the identification of causal parameters associated with the policy change disaggregated by group and time. These 'group-time average treatment effects' can be thought of as the average treatment effect for group g at time t . In this paper, group g corresponds to the year in which immigrants first receive treatment. In Sweden for example, migrants from Poland receive treatment in 2001, because Polish citizens do not automatically lose their original citizenship upon naturalization and Sweden no longer requires renunciation from this year onwards. Migrants from Finland however only receive treatment in 2003 because they automatically lost their original citizenship upon naturalization before then, regardless of the Swedish policy. Migrants from Poland and Finland are thus in the 2001 and 2003 group respectively. Time t corresponds to the observation year.

Formally, the estimation draws on weighted average of all possible 2x2 traditional DiD comparisons (i.e. DiD designs involving two discrete time periods – pre- and post-treatment – and two treatment groups – units receiving treatment or not). This number increases exponentially with the number of treatment groups, so to simplify, consider the scenario in which there are only two treatment groups besides the never-treated (u) [note: the Swedish case has five]: the early-treated e who receive treatment at time (t_e^*), and the late-treated l who receive treatment at time (t_l^*).

In this set-up, there are three time-periods: the early period which takes place prior to treatment reception for group e and group l (specified as T1 or $[0, t_e^* - 1]$; the intermediate period in which group e has received treatment but group l has not (specified as T2 or $[0, t_l^* - 1]$; the late period in which both group e and group l have received treatment (specified as T3 or $[t_l^*, T]$). This culminates in four possible 2x2 DiD comparisons which together make up the ATT.

The first two combinations are based on a comparison of group e or l respectively with the untreated (group u) in the periods where the relevant treatment group has received treatment (T2 + T3 for group e (equation 2) and T3 for group l (equation 3)).

$$Y_{eu}^{2x2} = (\bar{Y}_e^{T2+T3} - \bar{Y}_e^{T1}) - (\bar{Y}_u^{T2+T3} - \bar{Y}_u^{T1}) \quad (2)$$

$$Y_{lu}^{2x2} = (\bar{Y}_l^{T3} - \bar{Y}_l^{T1+T2}) - (\bar{Y}_u^{T3} - \bar{Y}_u^{T1+T2}) \quad (3)$$

The other two combinations are based on a comparison between groups that receive treatment at different timings. In the first case, we compare units in group e to units in group l before T3. In this scenario, group l serves as the control group to the treatment group e , whose treatment status varies (over T1 and T2), in contrast to the stable status over this period of time for group l .

$$Y_{el}^{2x2,e} = (\bar{Y}_e^{T2} - \bar{Y}_e^{T1}) - (\bar{Y}_l^{T2} - \bar{Y}_l^{T1}) \quad (4)$$

In the second case, we compare units in group l to units in group e after T1. In this scenario, group e serves as the control group to the treatment group l , whose treatment status varies (over T2 and T3), in contrast to the stable status over this period of time for group e .

$$Y_{el}^{2x2,l} = (\bar{Y}_l^{T3} - \bar{Y}_l^{T2}) - (\bar{Y}_e^{T3} - \bar{Y}_e^{T2}) \quad (5)$$

If the number of treatment groups is denoted as G , then the possible 2x2 DiD combinations equals $G^2 - G$ (comparing treated groups at various times) + G (comparing treatment groups with the never-treated), or G^2 . The ATT constitutes the weighted average of the outcomes of these 2x2 DiD equations, where the relevant weights depend on (1) the absolute size of the subsample in question, (2) the relative size of the treatment and control group, (3) the duration of treatment (based on timing of treatment), and (4) the magnitude of the treatment variance in each subsample.

This approach has a number of advantages. First, it avoids bias by accommodating variation in treatment timing. If we used a traditional two group, two periods DiD setup in this context, the parallel trend assumption is unlikely to hold given that some migrants are not yet treated in parts of the post-treatment period. Second, given that the overall ATT is weighted as a function of the time that each unit spends in the pre- and post-treatment period, failing to account for unequal treatment timing could result in an over- or underestimation of the treatment effect. Third, this approach is transparent about potential impact heterogeneity by group and/or time, whereas such information would be hidden in the traditional DiD setup where all treatment groups and post-treatment periods are aggregated in one ATT.

By specifying separate treatment groups for each period in which individuals first receive treatment, this provides average treatment effects across all group-time combinations. To acquire average effects across different lengths of exposure (but irrespective of treatment timing) or across different groups (but irrespective of duration since treatment), we apply the following settings (where 'att_gt_output' is an att_gt object):

```
aggte(att_gt_output, type = "dynamic")
```

```
aggte(att_gt_output, type = "group")
```

Due to exogenous treatment allocation, a comparison of the control and treatment group should not be biased by compositional confounders. To assess whether that is the case, we perform the main analysis whilst controlling for either gender, highest level of education and age at migration, using these settings (where ‘control’ is the control variable):

```
att_gt(yname = "Y", tname = "t", idname = "ID_number", gname = "treat_group",
data = dataset, panel = TRUE, allow_unbalanced_panel = TRUE, xformula =
\~control)
```

If s denotes time since treatment, group compositions can differ across s when using an unbalanced panel (as is the case in our study). The price one pays for balancing the panel is reduced external validity and potential selection bias due to non-random right- and left-censoring; hence we do not balance the panel but have to consider the implications of these censored units. In our design, right-censoring arises due to outmigration and left-censoring due to eligibility for naturalization. The institutional conditions migrants face upon eligibility (in this case, a renunciation requirement or not) are difficult to anticipate and thus exogenous. However, the decision to leave the destination country is endogenous and likely associated with the propensity to naturalize. To explore potential selection bias associated with non-random right-censoring, we perform a robustness analysis in which we only analyze migrants who remain in the data for the entire observation window by applying the following settings (where ‘dataset_no_right_censoring’ is a sample including only migrants who, from their first observation onwards, remain in the dataset for the duration of the observation window):

```
att_gt(yname = "Y", tname = "t", idname = "ID_number", gname = "treat_group",
data = dataset_no_right_censoring, panel = TRUE, allow_unbalanced_panel
= TRUE)
```

Migrants may anticipate policy changes, which could affect their untreated outcomes (and by extension the ATT). To assess the extent to which this is the case, we perform a separate analysis where potential anticipatory behavior is explicitly modeled (by relaxing the default “no anticipation” assumption ([Callaway and Sant’Anna 2021: 204](#))). In this approach, the path of outcomes assessed for the parallel trend assumption is based on a comparison of individuals in the treatment group two years prior to treatment ($g - 2$) with untreated individuals, rather than the default ‘base period’ of one year prior to treatment ($g - 1$).

```
att_gt(yname = "Y", tname = "t", idname = "ID_number", gname = "treat_group",
data = dataset, panel = TRUE, allow_unbalanced_panel = TRUE, anticipation
= 1)
```

SM7. Model summaries

Sweden

country	model	estimate	std.error	units	obs	p.val.par.trends
SE	total	0.067	0.003	471689	3107869	0.998
SE	EU	0.075	0.002	225670	1511187	0.982
SE	non-EU (high HDI)	0.075	0.003	131798	880990	0.924
SE	non-EU (low-medium HDI)	0.046	0.003	114221	715692	0.980
SE	placebo (cannot renounce)	0.014	0.009	13298	83400	0.998
SE	total w ctrl gender	0.069	0.005	471689	3107869	0.995
SE	total w ctrl education	0.069	0.005	471689	3107869	0.992
SE	total w ctrl age at migration	0.066	0.005	471689	3107869	0.994
SE	wh right-censoring	0.066	0.003	403826	2804011	0.997
SE	balanced panel	0.069	0.003	266779	2401009	0.999
SE	wh citizen partner	0.068	0.004	228561	1484337	0.990
SE	w citizen partner	0.065	0.002	199838	1296174	0.993
SE	total w anticipation, 1 yr	0.068	0.003	471689	3107869	0.999
SE	recently eligible	0.070	0.007	257071	1737299	0.999

Table S8: ATT of the abolishment of the renunciation requirement in Sweden in 2001 on naturalization rates among foreign-born immigrants (excl asylum applicants), sub-samples by origin region of country of birth and by citizen status of partner. Placebo analysis based on total sample, with placebo treatment group those immigrants from origin countries that do not allow voluntary renunciation of citizenship. Robustness checks: models with time-invariant controls for gender, education, age at migration; models without right-censoring and with balanced panel; model with 1 year anticipation of treatment effect; model with sample consisting only of recently eligible migrants (since 1997). Estimates based on difference-in-differences specification for staggered treatment, using did package by Callaway and Sant’Anna (2022). All models with control group = never treated, estimation method = doubly robust, no anticipation, no covariates. Final column includes p-values for test of violation parallel trends assumption.

The Netherlands

country	model	estimate	std.error	units	obs	p.val.par.trends
NL	total	-0.064	0.002	92129	604362	0.844
NL	EU	-0.092	0.003	30617	200845	0.761
NL	non-EU (high HDI)	-0.080	0.009	8770	57529	0.994
NL	non-EU (low-medium HDI)	-0.046	0.004	52742	345988	0.957
NL	placebo (citizen partner)	0.009	0.002	122801	805488	0.840
NL	placebo (cannot renounce)	0.058	0.002	76666	502922	0.008
NL	total w ctrl gender	-0.066	0.002	92129	604362	0.895
NL	total w ctrl education	-0.067	0.003	92129	604362	0.889
NL	total w ctrl age at migration	-0.064	0.003	92129	604362	0.864
NL	wh right-censoring	-0.069	0.003	91172	598085	0.897
NL	balanced panel	-0.059	0.002	54821	493383	0.766
NL	total w anticipation, 1 yr	-0.064	0.003	92129	604362	0.820
NL	recently eligible	-0.068	0.006	50222	338007	0.863

Table S9: ATT of the reintroduction of the renunciation requirement in the Netherlands in 1997 on naturalization rates among foreign-born immigrants (excl asylum applicants) who do not have a Dutch citizen partner in any observation year, sub-samples by origin region of country of birth. Placebo (citizen partner) based on sample of immigrants who have a Dutch citizen partner in each observation year, with placebo treatment group those immigrants who do not lose, but can renounce citizenship of origin country; Placebo (cannot renounce) based on sample of immigrants who do not have a Dutch citizen partner in any observation year, with placebo treatment group those immigrants from origin countries that do not allow voluntary renunciation of citizenship. Robustness checks: models with time-invariant controls for gender, education, age at migration; models without right-censoring and with balanced panel; model with 1 year anticipation of treatment effect; model with sample consisting only of recently eligible migrants (since 1993). Estimates based on difference-in-differences specification for staggered treatment, using did package by Callaway and Sant’Anna (2022). All models with control group = never treated, estimation method = doubly robust, no anticipation, no covariates. Final column includes p-values for test of violation parallel trends assumption.

SM8. Group-time effects

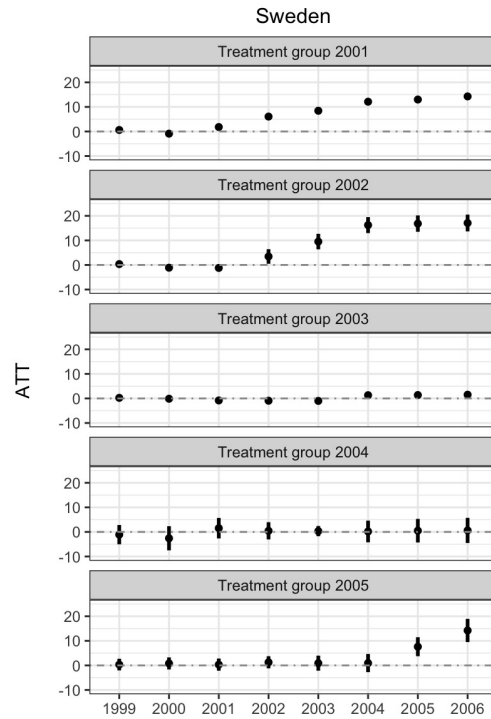


Figure S6: The average treatment effect on the treated (ATT) of the abolishment of the renunciation requirement in Sweden in 2001 in percentage point change of naturalization rates among foreign-born immigrants (excl asylum applicants), by staggered treatment group. Detailed output in Dataverse replication file 'Peters_Vink_APSR_dualcit_SE_NL_csDiD_final.xlsx', tab 'SE_g_t'.

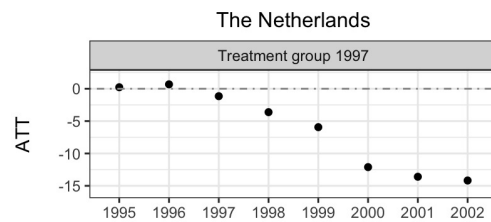


Figure S7: The average treatment effect on the treated (ATT) of the reintroduction of the renunciation requirement in the Netherlands in 1997 in percentage point change of naturalization rates among foreign-born immigrants (excl asylum applicants) without a citizen partner, by treatment group. Detailed output in Dataverse replication file 'Peters_Vink_APSR_dualcit_SE_NL_csDiD_final.xlsx', tab 'NL_g_t'.

SM9. Heterogeneous effects

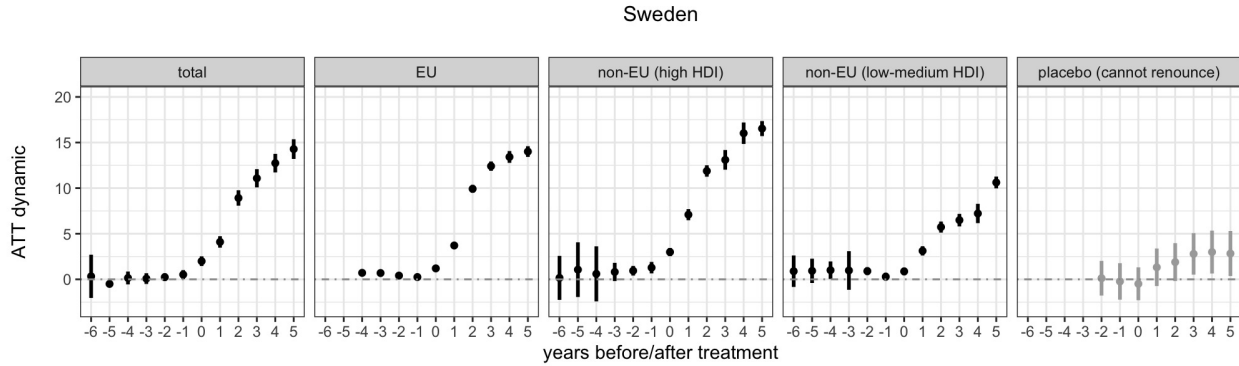


Figure S8: The average treatment effect on the treated (ATT) of the abolishment of the renunciation requirement in Sweden in 2001 in percentage point change of naturalization rates among foreign-born immigrants (excl asylum applicants). Dynamic (pseudo-) ATT estimated with varying base period (changes from period $t-1$ to t), for total sample. Placebo analysis based on total sample, with placebo treatment group those immigrants from origin countries that do not allow voluntary renunciation of citizenship. Detailed output in Dataverse replication file ‘Peters_Vink_APSR_dualcit_SE_NL_csDiD_final.xlsx’, tab ‘SE_t’.

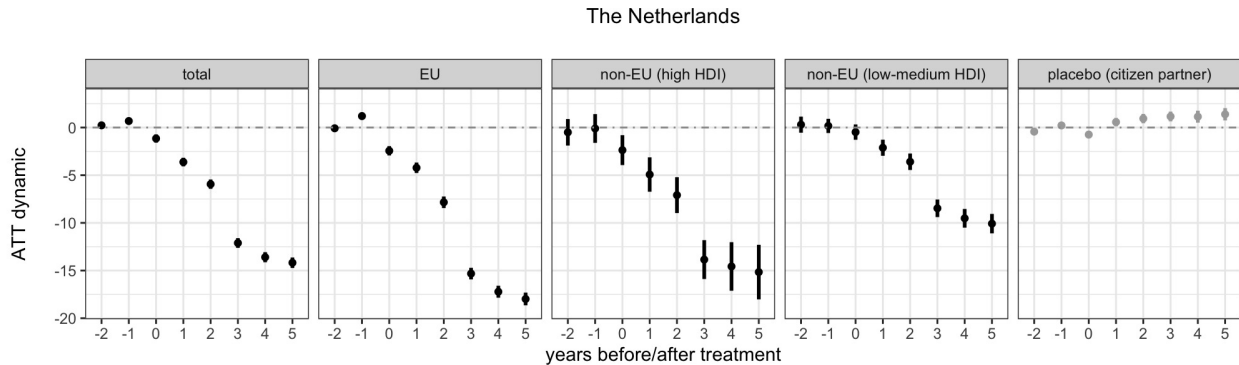


Figure S9: The average treatment effect on the treated (ATT) of the reintroduction of the renunciation requirement in the Netherlands in 1997 in percentage point change of naturalization rates among foreign-born immigrants (excl asylum applicants) who do not have a Dutch citizen partner in any observation year. Dynamic (pseudo-) ATT estimated with varying base period (changes from period $t-1$ to t), for total sample. Placebo analysis based on immigrants who have a Dutch citizen partner in each observation year, with placebo treatment group those immigrants who do not lose, but can renounce citizenship of origin country. Detailed output in Dataverse replication file ‘Peters_Vink_APSR_dualcit_SE_NL_csDiD_final.xlsx’, tab ‘NL_t’.

SM10. Robustness checks

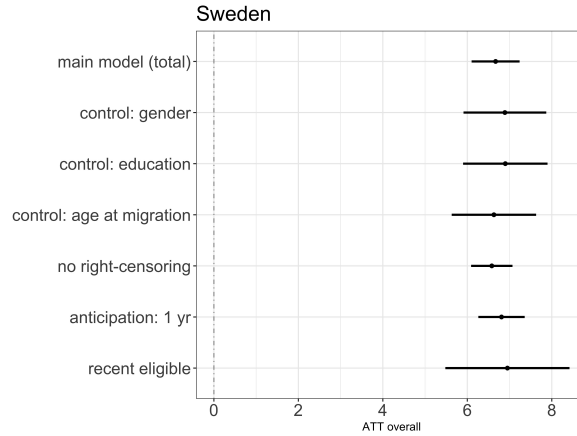


Figure S10: The average treatment effect on the treated (ATT) of the abolishment of the renunciation requirement in Sweden in 2001 in percentage point change of naturalization rates among foreign-born immigrants (excl asylum applicants). First model reports overall ATT from main model; models 2-4 include selected time-invariant controls; model 5 based on sample excluding migrants who emigrate from Sweden before the end of the observation period; model 6 sets anticipation at 1 year before first treatment year; model 7 includes only migrants who are eligible to naturalize from 1997. Detailed output in SM7, Table S8.

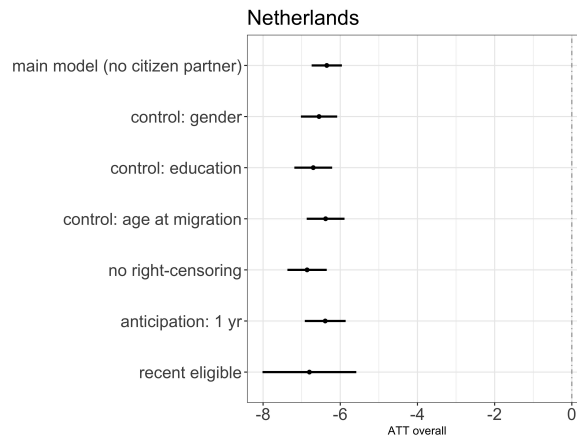


Figure S11: The average treatment effect on the treated (ATT) of the re-introduction of the renunciation requirement in the Netherlands in 1997 in percentage point change of naturalization rates among foreign-born immigrants (excl asylum applicants) who do not have a Dutch citizen partner in any observation year. First model reports overall ATT from main model; models 2-4 include selected time-invariant controls; model 5 based on sample excluding migrants who emigrate from the Netherlands before the end of the observation period; model 6 sets anticipation at 1 year before first treatment year; model 7 includes only migrants who are eligible to naturalize from 1993. Detailed output in SM7, Table S9.

References

- Callaway, Brantly, and Pedro H. C. Sant'Anna. 2021. "Difference-in-Differences with Multiple Time Periods." *Journal of Econometrics* 225 (2): 200–230. <https://doi.org/10.1016/j.jeconom.2020.12.001>.
- Schmid, Samuel. 2021. "Stagnated Liberalization, Long-Term Convergence, and Index Methodology: Three Lessons from the CITRIX Citizenship Policy Dataset." *Global Policy* 12 (3): 338–49. <https://onlinelibrary.wiley.com/doi/10.1111/1758-5899.12903>.
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