

# The Costs of Building Walls

## Immigration and the Fiscal Burden of Aging in Europe

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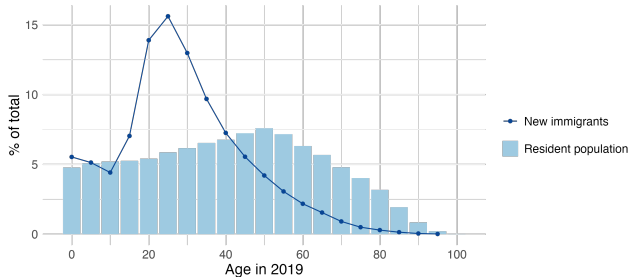
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# Aging, Immigration and Public Finances

Two demographic facts

- ① Low fertility and aging: **2.9** → **2.0** working-age people per older person  
Euro area, 2022–2050; ages 15–64 / 65+ (ECB, 2023)
- ② Migrants arrive mostly at **working age**



How much can immigrants relieve natives' **tax burden of sustaining an aging population?**

# What We Do

## i) Demographic theory

- Characterize immigration in a low-fertility population
- Analyse link between immigration and the fiscal burden of aging

## ii) Generational accounting

- Population projections + fiscal profiles for **17 euro-area countries**
- Compare the tax increase needed to cover future spending and existing debt across migration scenarios

Fixed fiscal profiles, relative prices, behavior and flow composition

# What We Find

## i) A demographic mechanism for fiscal relief

- Migrants enter young; larger inflows reduce dependency
- **Decreasing returns** in reducing the dependency ratio
- Fiscal relief can arise **even when immigrants make a negative full-life-cycle contribution**

## ii) Fiscal relief in the euro area

- Baseline: maintaining 2019 migration flows in size and characteristics
- Tax increase needed for sustainability reduced by **1% of GDP/year** compared to no migration
  - **€845/year** for the average 30-year-old native
  - Despite migrants' lower educational attainment
- **Large differences across countries**

# Related Literature and Contribution

## **Macro: immigration, aging and fiscal sustainability**

Life-cycle accounting, equilibrium models and aggregate evidence

e.g. Auerbach & Oreopoulos (1999); Lee & Miller (2000); Storesletten (2000, 2003); Fehr, Jokisch & Kotlikoff (2004); Hansen et al. (2017); d'Albis et al. (2019); Furlanetto & Robstad (2019); Busch et al. (2020)

## **Micro: immigrants' taxes and benefits**

Fiscal contributions by origin and individual characteristics

e.g. Dustmann & Frattini (2014); Preston (2014); Christl et al. (2022); Fiorio et al. (2023); Colas & Sachs (2024)

## **Our contribution**

- i) Unveil a demographic mechanism showing how even low-skilled immigration can lower the tax burden of aging
- ii) Quantify fiscal relief in the euro area, where immigration is low-skilled

## Immigration in Low-Fertility Populations

## A Three-Generation Model

- Three stages: young  $Y$ , working-age  $W$ , old  $O$
- Two lineages: existing natives  $N$ ; incoming migrants and descendants  $F$
- Common transitions; below-replacement fertility ( $f < \pi_o$ )

$$P_t^{Y,i} = (1 - \pi_w)P_{t-1}^{Y,i} + fP_{t-1}^{W,i}$$

$$P_t^{W,i} = (1 - \pi_o)P_{t-1}^{W,i} + \pi_w P_{t-1}^{Y,i} + M^i$$

$$P_t^{O,i} = (1 - \pi_m)P_{t-1}^{O,i} + \pi_o P_{t-1}^{W,i}$$

$i \in \{N, F\}$ ;  $f$ : fertility;  $\pi_w$ : entry into work;  $\pi_o$ : retirement;  $\pi_m$ : mortality

- Migrants enter at working age:  $M^N = 0$ ,  $M^F = M$
- Dependency ratio:  $D_t = (P_t^Y + P_t^O)/P_t^W$ , with  $P_t^a = \sum_i P_t^{a,i}$

► Assumptions

# Immigration and Dependency Ratios

## Long run: stationary through immigration (SI)

- With no immigration, population tends to zero
- Any constant  $M > 0$  sustains a stationary population
- Its dependency ratio is independent of inflow size:  $D^{SI} = f/\pi_w + \pi_o/\pi_m$

## Transition: $D_t(M)$ is decreasing and convex

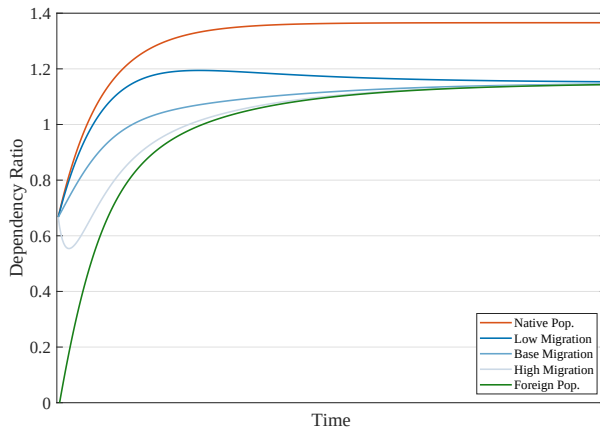
- Two lineages: existing natives; cumulative arrivals and their descendants
- More immigration shifts weight toward the younger migrant lineage

$$D_t(M) = \underbrace{\omega_t(M)}_{\text{declining, convex}} D_t^N + [1 - \omega_t(M)] D_t^F, \quad \omega_t(M) = \frac{W_t^N}{W_t^N + M w_t^F}$$

$w_t^F$ : working-age migrant lineage per unit inflow; result under A1–A4

► Assumptions

# The Mechanism: a Mixture of Two Populations



Larger inflows put more weight on the **younger migrant lineage**

The dependency ratio falls, with **diminishing effects**

# From Population Paths to the Government Budget

- Apply per-person fiscal profiles to each demographic group  $x$ :

$$T_t = \sum_x \tau_{t,x} P_{t,x}, \quad G_t = \sum_x g_{t,x} P_{t,x}$$

$P$ : population;  $\tau$ : revenue per person;  $g$ : spending per person

- Intertemporal balance: initial net debt + future spending = future revenue
  - Generational accounting: Auerbach et al

$$B + \underbrace{\sum_{t \geq 0} q_t G_t}_{\mathcal{G}} = \underbrace{\sum_{t \geq 0} q_t T_t}_{\mathcal{T}}$$

$q_t$ : discount weights; zero discounted terminal debt

- Scale all revenues by  $1 + \theta_\tau$  to restore balance:

$$\boxed{B + \mathcal{G} = (1 + \theta_\tau) \mathcal{T}}$$

## When Does Immigration Lower the Fiscal Adjustment?

- Restate intertemporal budget balance as a function of the migration inflow

$$1 + \theta_{\tau}(M) = \frac{B + \mathcal{G}_0 + \mathcal{G}_1 M}{\mathcal{T}_0 + \mathcal{T}_1 M}$$

$\theta_{\tau}$ : proportional revenue increase;  $M$ : constant migration inflow

$B$ : initial net debt;  $\mathcal{G}$ : present-value spending;  $\mathcal{T}$ : present-value revenue

0: zero-inflow path; 1: added entrants and descendants per unit inflow

**Immigration lowers the adjustment when**

$$\underbrace{\frac{\mathcal{G}_1}{\mathcal{T}_1}}_{\text{Entrants and descendants}} < \underbrace{\frac{B + \mathcal{G}_0}{\mathcal{T}_0}}_{\text{Spending and debt per euro of revenue}}$$

- Simple fiscal profiles:  $\mathcal{G}_1/\mathcal{T}_1$  rises with the migrant lineage's dependency ratio, averaged over time using discounted workers as weights

A negative net contribution can still mean a **lower adjustment**

Fixed profiles; finite present values;  $\mathcal{T}_0, \mathcal{T}_1 > 0$

## Population Projections for Europe

# Population Projections for Europe

**Cohort-component model:** age, gender, education and birthplace

$$P_{t+1,a+1} = (1 - m_{t,a})P_{t,a} + \bar{l}_a$$

## The experiment

- Scale annual **non-EU net migration**
- Baseline: a fixed number, about **0.4% of the 2019 population**
- Keep the inflow's age, gender and education composition fixed
- EU-born net flows unchanged across scenarios

Fertility and mortality paths: EUROPOP2019. Education: stable higher-education share in successive cohorts.

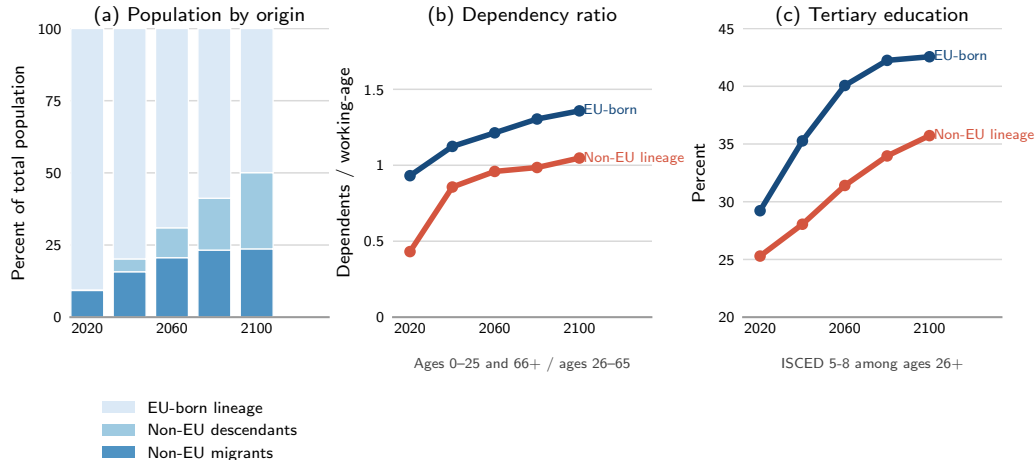
# The Starting Population

Euro area, 2019

## Non-EU-born residents are younger and less educated

|                                   | EU-born | Non-EU-born |
|-----------------------------------|---------|-------------|
| <b>Age composition</b>            |         |             |
| 0–25                              | 27.7%   | 17.5%       |
| 26–65                             | 52.0%   | 71.1%       |
| > 65                              | 20.3%   | 11.5%       |
| <b>Education, adults aged 26+</b> |         |             |
| Primary (ISCED 0–2)               | 28.8%   | 41.1%       |
| Secondary (ISCED 3–4)             | 42.3%   | 33.8%       |
| Tertiary (ISCED 5–8)              | 28.9%   | 25.1%       |

# Projected Population Composition



Non-EU immigrants and descendants reach **about half the population** by 2100

Constant 2019 net flows and composition. Lines compare origin lineages, including descendants.

Dependency: ages 0–25 and 66+ / 26–65. Tertiary share: adults 26+.

## Measuring the Fiscal Burden of Aging in Europe

# Measuring the Fiscal Burden of Aging in Europe

Rebalancing tax increase: the same proportional rise in all revenues needed to cover existing debt and future spending

$$\underbrace{B + \mathcal{G}}_{\text{Debt} + \text{future spending}} = \underbrace{(1 + \theta_{\tau})\mathcal{T}}_{\text{Adjusted future revenues}}$$

- **Estimated from data:** taxes and spending for natives and migrants separately, by age, gender and education
- **Held fixed in projections:** these per-person profiles, apart from trends in productivity growth
- Future migrants have current migrants' fiscal profiles

Present values; fiscal projections through 2125, then a geometric tail

► Details

# Estimating the Fiscal Profiles

## By age, gender, education and birthplace

|                       |                                                     |
|-----------------------|-----------------------------------------------------|
| <b>EU-SILC 2019</b>   | Income taxes, contributions, transfers and pensions |
| <b>HBS 2015</b>       | Consumption taxes                                   |
| <b>HFCS, wave 3</b>   | Corporate taxes, allocated using business wealth    |
| <b>AWG / Eurostat</b> | Health and education spending                       |

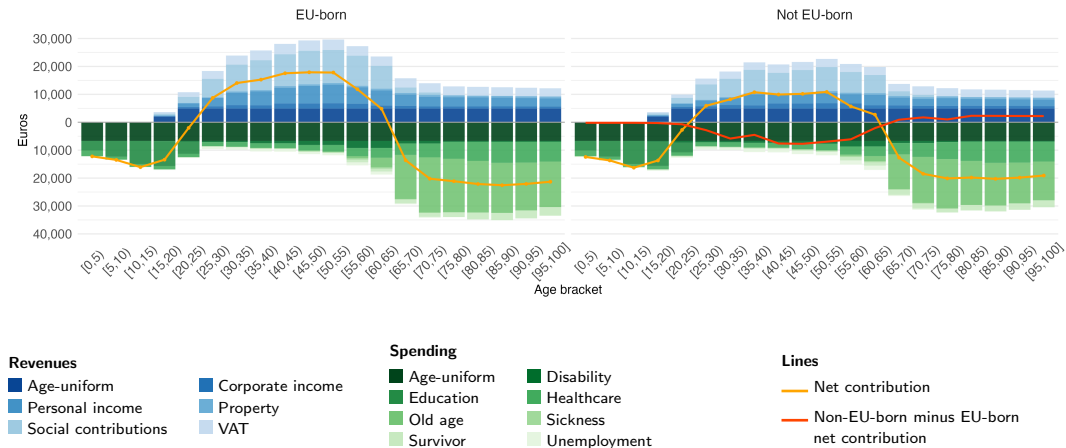
## Scale to national accounts in each country

Cross-sectional estimates, projected over the life cycle

► Estimation

# Fiscal Contributions over the Life Cycle

Euro area, 2019; GDP-weighted profiles



Working-age migrants contribute less per person; older migrants receive less in pensions

# Remaining Lifetime Net Contributions

Annualized euros per year, at current tax rates

- Combine the microdata fiscal profiles with demographic projections to sum expected taxes minus benefits over the remaining lifetime
- Express the discounted total as an equivalent annual amount

|             | From age 0 | From age 30 |
|-------------|------------|-------------|
| EU-born     | −5,051     | 2,160       |
| Non-EU-born | −9,757     | −2,697      |

**Later entry avoids childhood spending:** a migrant at 30 has a less negative remaining contribution than a newborn native

► From individual contributions to fiscal adjustment

# Immigration Lowers the Euro-Area Fiscal Adjustment

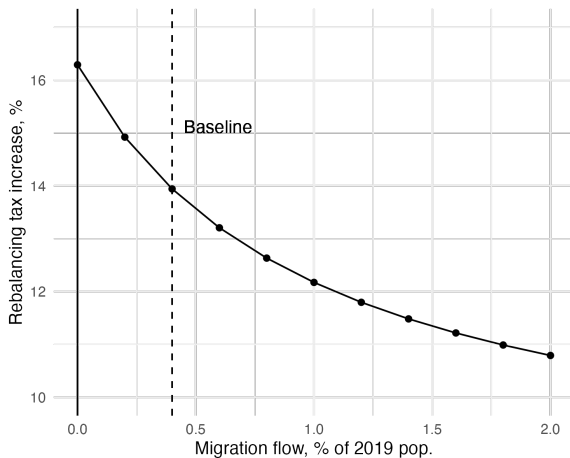
**Zero non-EU net flow: 16.3%**

**2019 flow: 14.0%**

**Difference: 2.3 p.p.**

≈ 1% of base-year potential GDP in revenue

≈ €845/year for the average EU-born 30-year-old



GDP-weighted projection; €845 is an annualized tax-payment difference

► Macro

► Fertility

► Second generation

## Fertility: an Alternative to Immigration?

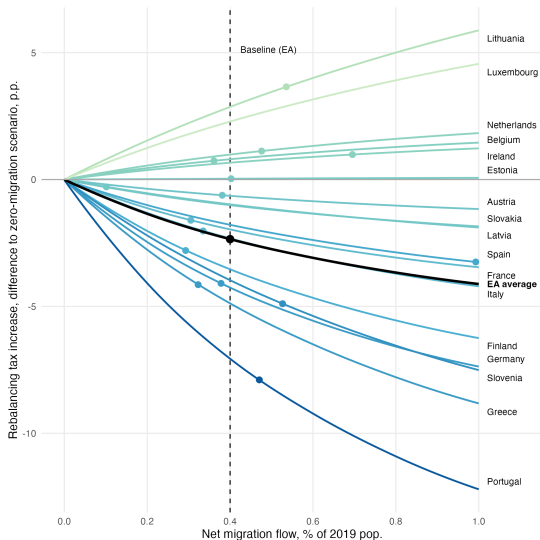
| Non-EU net migration | Native fertility | Tax increase |
|----------------------|------------------|--------------|
| Zero                 | Baseline path    | 16.3%        |
| Zero                 | 2.1              | 15.2%        |
| 2019 flow            | Baseline path    | 14.0%        |

- Baseline native fertility follows country-specific EUROPOP2019 paths, below replacement  
Higher-fertility scenario: 2.1 children per woman from 2020; descendants adopt native fertility
- Children require spending now; their tax payments arrive later

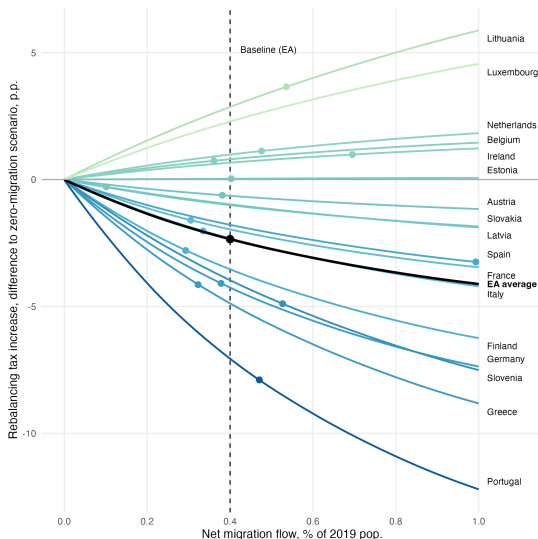
**1.1 p.p.** relief from higher fertility, versus **2.3 p.p.** from baseline immigration

## Rebalancing Tax Increase at the Country Level

# Country Effects Differ in Size and Sign



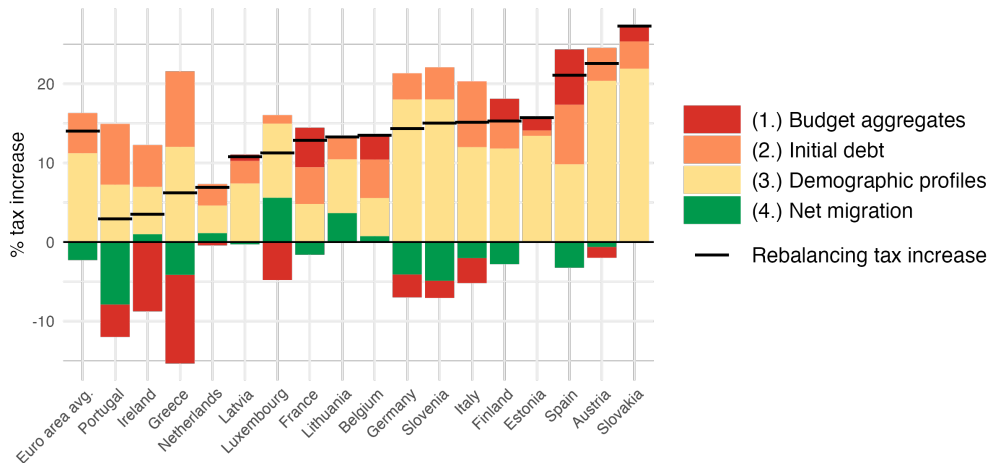
# Country Effects Differ in Size and Sign



## What differs across countries?

- **Age gap:** younger migrants have more working years ahead
- **Aging:** fewer native workers to finance dependents
- **Fiscal contributions:** lower migrant earnings and taxes can offset the age advantage
  - Differences reflect both wages and tax policy

# Sources of the Baseline Rebalancing Tax Increase



Variation in baseline  $\theta_\tau$  reflects both explicit debt and implicit liabilities accumulated by current generations through unbalanced tax and spending policies

## Conclusion

# Conclusion

- **A demographic mechanism for fiscal relief**
  - Lower dependency from working-age immigration, with diminishing returns
  - Fiscal relief possible even with low-skilled immigrants
- **In Europe, immigrants relieve the fiscal burden of aging despite their lower skills**
  - Evidence from generational accounting and population projections
- **Stark differences across countries**
  - Unequal fiscal gains complicating agreement on a common EU migration policy

**Thank you**

Comments very welcome: [teles@rsm.nl](mailto:teles@rsm.nl), [luisteleasm.github.io](https://github.com/luisteleasm)

# Demographic Profiles

**Four dimensions:** age, gender, education and birthplace

$$T_t = \sum_i \sum_{x \in X} \tau_{t,x}^i P_{t,x}, \quad G_t = \sum_i \sum_{x \in X} g_{t,x}^i P_{t,x}$$

- $\tau_{t,x}^i$  and  $g_{t,x}^i$ : per-capita revenue and spending on item  $i$
- $P_{t,x}$ : population of demographic group  $x$

Government flow budget constraint:

$$B_t = G_t - T_t + (1 + i_t)B_{t-1}$$

# Estimation and Projection of Fiscal Profiles

- 1 **Estimate** the profile of each budget item from microdata
- 2 **Scale** the predicted amounts to the national-account total
- 3 **Project** per-capita profiles with common nominal growth

$$\tilde{\tau}_{t,x}^i = \tilde{\tau}_{2019,x}^i \prod_{j=2020}^t (1 + \gamma_j), \quad t > 2019$$

Spending profiles follow the same rule

Here  $\gamma_j$  is nominal per-capita growth

# Fiscal Sustainability

Under the paper's present-value convention, fiscal balance requires

$$B + \sum_{s=0}^{\infty} \mathcal{D}^s G_{t+s}^{\text{fixed}} = \sum_{s=0}^{\infty} \mathcal{D}^s T_{t+s}^{\text{fixed}}.$$

- $B$ : initial net debt, with zero discounted terminal debt
- $T^{\text{fixed}}, G^{\text{fixed}}$ : totals from fixed base-year profiles and projected populations
- Common growth/discount factor:  $\mathcal{D} = (1 + \gamma)(1 + \pi)/(1 + i)$

A proportional adjustment to all revenue items gives

$$B + \mathcal{G} = (1 + \theta_{\tau})\mathcal{T}, \quad \theta_{\tau} = \frac{B + \mathcal{G} - \mathcal{T}}{\mathcal{T}}.$$

## Rebalancing Tax Increase

The same proportional adjustment to every revenue item and demographic group:

$$B + \sum_{s=0}^{\infty} \sum_i \sum_{x \in X} \mathcal{D}^s [g_{2019,x}^i - (1 + \theta_{\tau}) \tau_{2019,x}^i] P_{2019+s,x} = 0$$

Solve for the adjustment:

$$1 + \theta_{\tau} = \frac{B + \sum_{s=0}^{\infty} \sum_i \sum_{x \in X} \mathcal{D}^s g_{2019,x}^i P_{2019+s,x}}{\sum_{s=0}^{\infty} \sum_i \sum_{x \in X} \mathcal{D}^s \tau_{2019,x}^i P_{2019+s,x}}$$

**Initial debt + discounted spending**, divided by **discounted revenue**

► Back

# Cyclical Adjustment

Remove the base year's cyclical component before projecting fiscal profiles

**Revenues:** output-gap adjustment

$$\frac{(T_{2019}^i)^*}{T_{2019}^i} = \left( \frac{Y_{2019}^*}{Y_{2019}} \right)^{\varepsilon_{i,Y}}$$

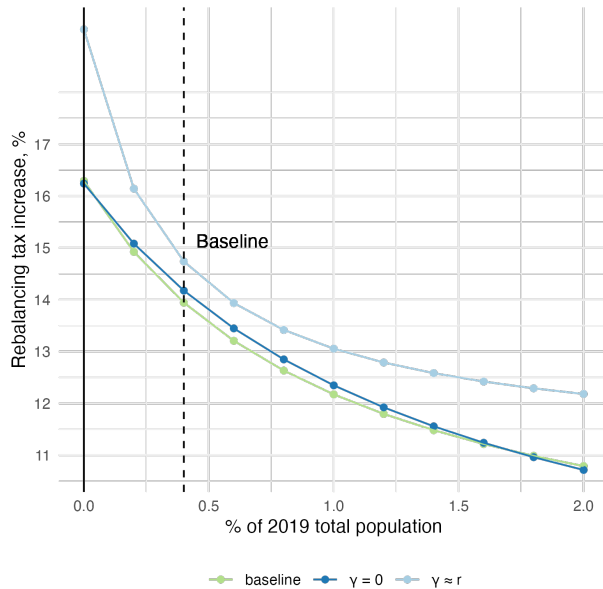
**Spending:** unemployment-gap adjustment, where applicable

$$\frac{(G_{2019}^i)^*}{G_{2019}^i} = \left( \frac{U_{2019}^*}{U_{2019}} \right)^{\varepsilon_{i,U}}$$

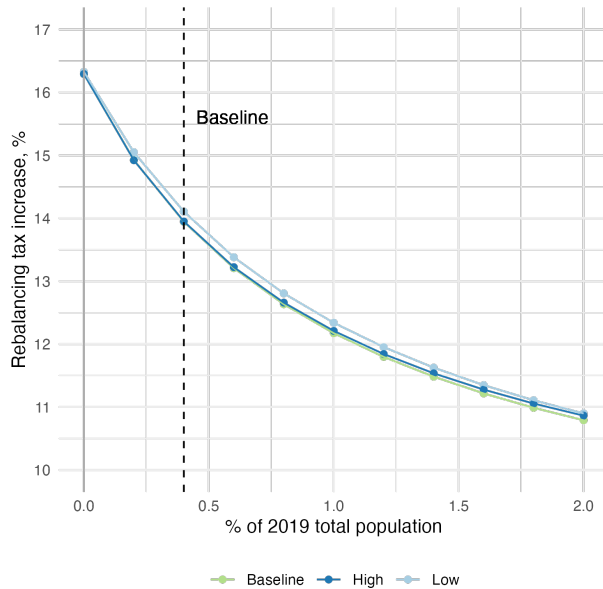
$Y^*$ : potential output;  $U^*$ : natural unemployment;  $\varepsilon$ : item elasticity

Girouard & André (2006); Price, Dang & Botev (2015); AMECO and Eurostat

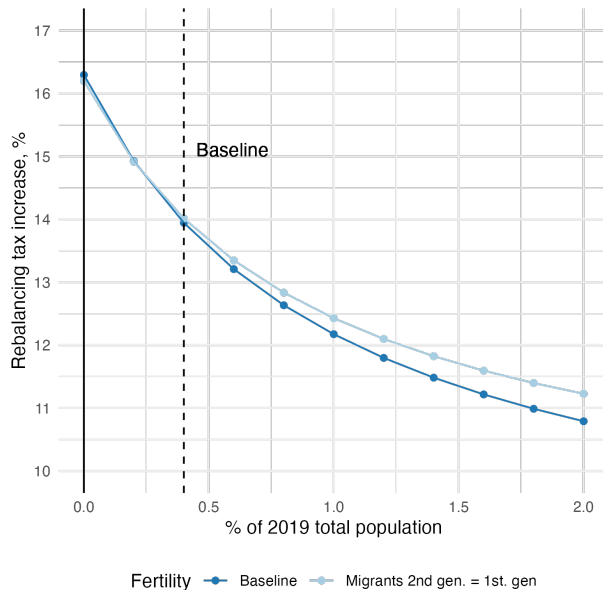
# Robustness: Macro Assumptions [▶ Back](#)



## Robustness: Migrants' Fertility [▶ Back](#)



# Robustness: Descendants' Fertility

[▶ Back](#)

# Assumptions Behind the Demographic Result

- **A1:**  $f < \pi_o$ . Below-replacement fertility
- **A2:**  $\pi_w + \pi_o < 1$ . Multiple periods in each life stage
- **A3:**  $\rho(A_{YW}) > 1 - \pi_m$ . Young-worker persistence exceeds old-age survival
- **A4:**  $\pi_m \leq \pi_w$ . Old-age mortality is no greater than the youth transition rate

$$A = \begin{pmatrix} 1 - \pi_w & f & 0 \\ \pi_w & 1 - \pi_o & 0 \\ 0 & \pi_o & 1 - \pi_m \end{pmatrix}, \quad v = (0, 1, 0)'.$$

$A_{YW}$  is the upper-left  $2 \times 2$  block. Parameters are common to origin groups and fixed over time. Entrants arrive at working age. Descendants retain their origin group's fiscal profile in the simple fiscal block.

► Fiscal condition