

# Labor Market Integration and the Fiscal Competition for Workers

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The views presented in this paper are those of the authors, and should not be attributed neither to Narodowy Bank Polski nor to the National Bank of Ukraine.

# Motivation: common EU market and the OCA

- Treaty of Rome (1957) - four fundamental freedoms of the common EU market:
  - free movement of goods
  - free movement of services
  - free movement of capital
  - **free movement of workers**
- Mundell [1961] and the theory of OCA:
  - no independent monetary policy
  - migration mitigates asymmetric country-level shocks

# Motivation: labor mobility and long-run concerns

- **Eastern enlargement** of the EU 2004, 2007 and 2013:
  - the outflow of working-age citizens toward richer locations
  - acceleration of the aging process in CEE [▶ details](#)
  - Batog et al. [2019]: annual GDP per capita growth between 2020 and 2050 drops by 0.5 percentage points in CEE
  - adverse feedback loop: outflow of workers  $\Rightarrow$  aging  $\Rightarrow$  share of age-related spending  $\uparrow \Rightarrow$  taxes and public debt  $\uparrow \Rightarrow$  outflow of workers

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- **European Sovereign Debt Crisis** in peripheral countries:
  - inflows of workers dried up [▶ details](#)
  - Brunnermeier et al. [2016]: *“When productive and innovative people abandon their country, the debt has to be paid off by a smaller, less productive, aging population...”*
  - Alessandria et al. [2020]: emigration accounts for almost all of the lack of recovery in output during the recent Spanish debt crisis
  - adverse feedback loop: outflow of workers  $\Rightarrow$  debt to GDP  $\uparrow \Rightarrow$  taxes and economic instability  $\uparrow \Rightarrow$  outflow of workers

## Endogenous response by governments?

- The abovementioned view might miss **the endogenous government response** to the exposure to migration flows...
- Recent examples: tax exemptions for the young in Poland and Croatia (2019, 2020)
- Incentives may affect the entire lifetime of a worker

# Our paper

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  - How fiscal competition for workers shapes the effects of labor mobility?
- Tool: the model by Song, Storesletten and Zilibotti (ECTA 2012) calibrated to match the patterns in the EU
  - multi-country OLG model
  - optimal time-consistent fiscal policy at the country level
  - intergenerational conflict over fiscal policy
  - **extension 1:** endogenous labor flows dependent on welfare differentials
  - **extension 2:** country level productivity differentials
  - **extension 3:** debt renegotiation

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  - **extension 1:** endogenous labor flows dependent on welfare differentials
  - **extension 2:** country level productivity differentials
  - **extension 3:** debt renegotiation
- Three versions of the model analyzed:
  - model with migrations and fiscal competition for workers
  - model without migrations
  - model with migrations and without fiscal competition for workers



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  - larger tax base
  - lower debt per capita
- **Fiscal tools** to increase welfare of workers to attract them:
  - worker's disposable income (by cutting labor tax)
  - future provision of public goods (by reducing public debt)

# Results

- Labor market integration effects in the EU (3.5% of migrants in the total population):
  - the union-wide GDP rises by 2.1%
  - the union-wide capital rises by 3.9%
  - average debt-to-GDP ratio drops by 15.8 p.p.
  - average labor income tax rate drops by 0.8 p.p.
  - average welfare (measured with a consumption equivalent) increases by 2.5%
- Fiscal competition for workers explains:
  - 38% of a rise in GDP
  - 59% of a rise in capital
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- **Fiscal policy and inter-generational conflict:** Song et al. [2012]
- **Labor mobility and sovereign default:** Alessandria et al. [2020]
- **Heterogeneous labor markets in currency unions:** Dolls et al. [2018], Abraham et al. [2019], Moyen et al. [2019]
- **Social security, fiscal policy and migrations:** Storesletten [2000], Bandeira et al. [2018]
- **Migrations and allocation of resources:** Klein and Ventura [2009], Tombe and Zhu [2019], Walerych [2020]
- **Labor mobility in currency unions (short-run analysis):** Farhi and Werning [2014], Hauser and Seneca [2019]

- **Time:** discrete and infinite
- **Structure:** a union formed by a continuum of small open economies of mass one
- **Heterogeneity of countries:** population size, productivity, public debt
- **Goods:** consumption and public good
- **Production factors:** capital and labor
- **Agents:**
  - households
  - firms
  - governments
  - financial intermediaries

# Households: consumption and savings choice

- After the migration decision, young household chooses  $c^y$ ,  $c^{o'}$  and  $a'$  to maximize:

$$U^y = \log c^y + \sigma \cdot \left[ \log c^{o'} + \theta \cdot \mathbb{E}_{y'|y} (\log g') \right]$$

- Budget constraints:

$$c^y + a' = (1 - \tau) \cdot w$$

$$c^{o'} = R^h \cdot a'$$

- Earn wage  $w$ , pay labor income tax  $\tau$
- Save  $a'$  at interest rate  $R^h$
- Household enjoys the provision  $g'$  of public goods when old

# Households: demography and migration decision

- Demography:
  - one old agent delivers one young agent
  - share  $1 - \sigma$  of the elderly die
  - young households make migration decision
- Each household draws a migration opportunity  $\hat{U}^y$  from the endogenous distribution with density  $\Phi$
- As in Alessandria et al. [2020]: each worker features an individual value of the disutility cost of emigration  $\xi$
- The household decides to leave if:

$$\hat{U}^y - \xi > U^y$$

- We assume that  $\xi$  is distributed normally with mean  $\mu_\xi$ , standard deviation  $\sigma_\xi$  and the cumulative distribution function  $\Psi$

# Households: migration flows

- Let  $n$  be the measure of old households in a country (before the realization of the survival/death shock)
- Measure of emigrants:

$$E(n, U^y) = n \cdot \int \Psi(\hat{U}^y - U^y) \cdot \Phi(\hat{U}^y) \cdot d\hat{U}^y$$

- Measure of immigrants:

$$I(n, U^y) = n \cdot \int \Phi(\hat{U}^y) \cdot \Psi(U^y - \hat{U}^y) d\hat{U}^y$$

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- Total measure of young agents in a given country:

$$n'(n, U^y) = n + I(n, U^y) - E(n, U^y)$$

- Immigration rate:

$$\eta(U^y) \equiv \frac{n'(n, U^y)}{n}$$

- Given the optimal rules of households benevolent government maximizes:

$$\lambda^y \cdot U^y + \lambda^o \cdot U^o$$

- $\lambda^y$  and  $\lambda^o$  are proportional to populations of the young and the elderly
- Utilities:

$$U^y = \log c^y + \sigma \cdot \left[ \log c^{o'} + \theta \cdot \mathbb{E}_{y'|y} (\log g') \right]$$

$$U^o = \log c^o + \theta \cdot \log g$$

## Government 2

- Government policies:
  - labor income tax  $\tau$
  - public assets or debt  $B'$
  - public spending per old agent  $g$
  - default on a fraction  $d \in [0, 1]$  of outstanding debt
  - cost of default - lower productivity:

$$z = \chi(d) \cdot y \quad (1)$$

- Time consistency:  $g'$  is determined by the optimal policy  $\Gamma$  of the future government
- Government budget constraint in per capita terms

$$q(b', y) \cdot \eta(U^y) \cdot b' + \sigma \cdot g = (1 - d) \cdot b + \tau \cdot w \cdot \eta(U^y)$$

- Where  $b \equiv B/n$  and  $b' \cdot \eta(U^y) = B'/n$



- A representative firm in each country hires capital and labor to maximize

$$z \cdot K^{\alpha} \cdot L^{1-\alpha} - w \cdot L - R^f \cdot K$$

where  $R^f$  is rental cost of capital. Capital is perfectly mobile, labor is inelastic.

- Wage

$$w(z) = (1 - \alpha) \cdot \left( \frac{\alpha}{R^f} \right)^{\frac{\alpha}{1-\alpha}} \cdot z^{\frac{1}{1-\alpha}}$$

- Financial intermediaries are risk-neutral and price all the assets in the model so that the asset market clears:

$$q(b', y) = \frac{1 - \mathbb{E}_{y'|y} d(b'(b, y), y')}{R}$$

$$R^h = \frac{R}{\sigma}$$

$$R^f = R$$

# Consistency and market clearing conditions

- Consistency and market clearing conditions (details: [▶ details](#))
  - union-wide capital market clearing
  - time evolution of distribution  $\mu$  of countries over  $n$ ,  $b$  and  $y$
  - consistency between  $\Phi$ ,  $\mu$  and  $U^y$
- Definition of the stationary equilibrium (details: [▶ details](#))

## First order conditions: No-migration

Intratemporal condition:

$$\frac{\partial U^y}{\partial c^y} = \frac{\partial U^o}{\partial g} \cdot (1 + \sigma)$$

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Intertemporal condition:

$$\frac{\partial U^y}{\partial b'} = \frac{\partial U^o}{\partial g} \cdot \left( \frac{\partial q}{\partial b'} (b', y) \cdot b' + q(b', y) \right)$$

# First order conditions: Benchmark model

Intratemporal condition:

$$\frac{\partial U^y}{\partial c^y} = \frac{\partial U^o}{\partial g} \cdot (1 + \sigma) - \underbrace{\frac{\partial U^o}{\partial g} \cdot \frac{1}{\eta} \cdot \frac{\partial \eta}{\partial U^y} \cdot \frac{\partial U^y}{\partial c^y} \cdot (\tau \cdot w - q \cdot b')}_{\text{The impact of fiscal competition on the intratemporal choice}}$$

Intertemporal condition:

$$\frac{\partial U^y}{\partial b'} = \frac{\partial U^o}{\partial g} \cdot \left( \frac{\partial q}{\partial b'} \cdot b' + q \right) - \underbrace{\frac{\partial U^o}{\partial g} \cdot \frac{1}{\eta} \cdot \frac{\partial \eta}{\partial U^y} \cdot \frac{\partial U^y}{\partial b'} \cdot (\tau \cdot w - q \cdot b')}_{\text{The impact of fiscal competition on the intertemporal choice}}$$

We numerically solve:

- Benchmark model
- No-migration model
- No-competition model - with endogenous migration but governments do not internalize the impact of fiscal policy on migration flows

**Aggregate impact of migration:** the difference between benchmark model and no-migration model

**Impact of fiscal competition:** the difference between benchmark model and no-competition model

- Productivity  $y$  follows an AR(1) process:

$$\log y_t = \rho \cdot \log y_{t-1} + \epsilon_t$$

where  $\epsilon_t \sim N(0, \sigma_\epsilon)$

- The functional form for the productivity loss associated with debt renegotiation is given by:

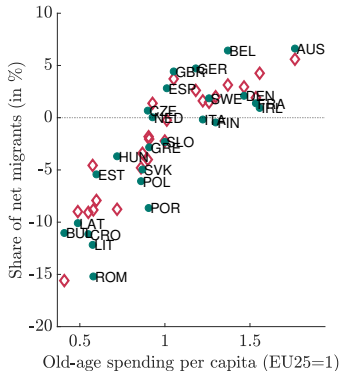
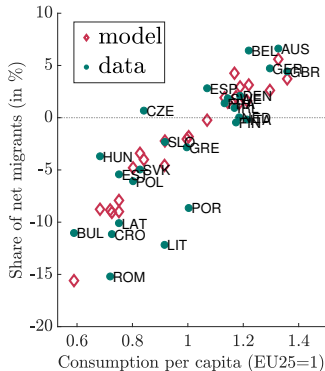
$$1 - \chi(d) = \chi_0 \cdot d^{\chi_1}$$



# Calibration parameters

| Parameter           | Description                          | Value | Calibration target                 |
|---------------------|--------------------------------------|-------|------------------------------------|
| $\rho$              | Persistence of the AR(1) process     | 0.61  | Country-level productivity process |
| $\sigma_{\epsilon}$ | Std. deviation of the AR(1) process  | 0.08  | Country-level productivity process |
| $\mu_{\xi}$         | Mean of migration cost               | 2.41  | Intra-EU migration                 |
| $\sigma_{\xi}$      | Std. error of migration cost         | 1.28  | Intra-EU migration                 |
| $\chi_0$            | Parameter of default penalty         | 0.045 | Mean debt-to-GDP ratio             |
| $\chi_1$            | Parameter of default penalty         | 2.76  | Mean spread over riskless rate     |
| $\theta$            | Preference for public goods          | 1.1   | Public goods for old to GDP        |
| $\sigma$            | Survival rate                        | 0.273 | Old age dependency ratio           |
| $\alpha$            | Parameter of the production function | 0.33  | Literature                         |

# Calibration of migration process



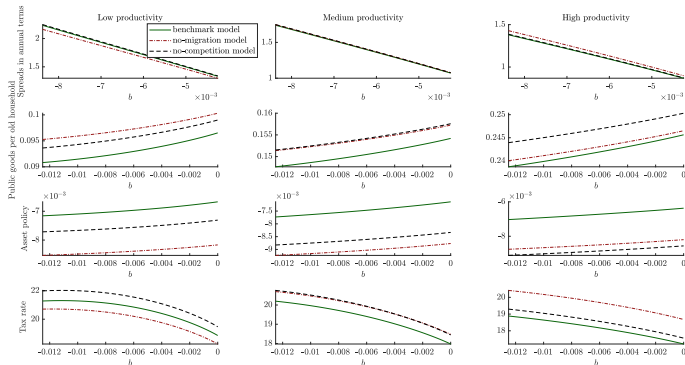
## Non-targetted moments

| Moment                                     | Model   | Data    |
|--|---------|---------|
| Share of the intra-EU emigrants            | 3.53%   | 3.51%   |
| Gini index: country-level consumption p.c. | 0.09    | 0.10    |
| Gini index: age-related spending p.c.      | 0.09    | 0.13    |
| Std. error of debt-to-GDP                  | 17 p.p. | 36 p.p. |

# Union-wide implications of migration

|                                 | no-migration<br>model | no-competition<br>model | benchmark model |
|---------------------------------|-----------------------|-------------------------|-----------------|
| Average debt-to-GDP ratio       | 84.1%                 | 80.1%                   | <b>68.3%</b>    |
| Average tax rate                | 20.4%                 | 20.4%                   | <b>19.6%</b>    |
| Average annual spread           | 1.94%                 | 1.87%                   | <b>1.66%</b>    |
| Annual riskless rate            | 3.76%                 | 3.75%                   | 3.70%           |
| Share of emigrants              | 0%                    | 3.53%                   | 3.53%           |
| Aggregate capital               | 100%                  | +1.6%                   | +3.9%           |
| Average GDP pc                  | 100%                  | +1.3%                   | <b>+2.1%</b>    |
| Average wage                    | 100%                  | +0.2%                   | +1.0%           |
| Average consumption of young pc | 100%                  | +0.3%                   | <b>+2.0%</b>    |
| Average public spending pc      | 100%                  | +0.3%                   | <b>-1.9%</b>    |

# The cross-country differences



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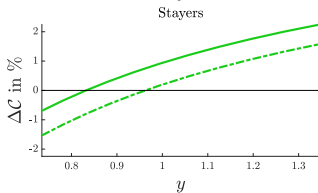
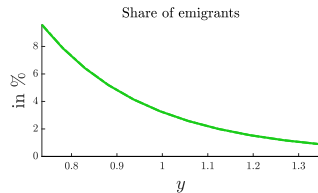
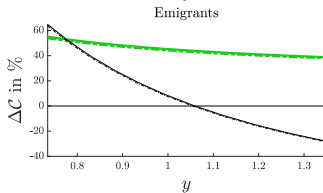
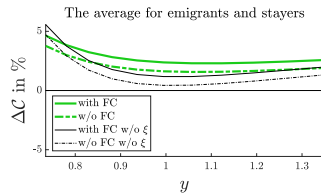
| Indicator            | no-migration model |           |           | no-competition model |              |              | benchmark model |              |              |
|----------------------|--------------------|-----------|-----------|----------------------|--------------|--------------|-----------------|--------------|--------------|
|                      | $y_{min}$          | $y_{med}$ | $y_{max}$ | $y_{min}$            | $y_{med}$    | $y_{max}$    | $y_{min}$       | $y_{med}$    | $y_{max}$    |
| GDP per capita       | 0.1619             | 0.2606    | 0.4101    | <b>-1.6%</b>         | +0.2%        | +1.7%        | <b>-0.7%</b>    | +1.0%        | +2.5%        |
| Net immigration rate | 0%                 | 0%        | 0%        | -7.6%                | -0.1%        | +7.2%        | -7.5%           | -0.1%        | +7.2%        |
| Debt to GDP (%)      | 121.1              | 82.8      | 49.6      | -3.1                 | -4.0         | -1.6         | -13.4           | -15.1        | -13.6        |
| Annual spread (%)    | 2.24               | 1.86      | 1.50      | -0.07                | -0.06        | -0.04        | -0.25           | -0.26        | -0.26        |
| Public spending pc   | 0.0963             | 0.1526    | 0.2416    | <b>-1.4%</b>         | <b>+0.2%</b> | <b>+1.6%</b> | <b>-4.0%</b>    | <b>-1.9%</b> | <b>-0.1%</b> |
| Consumption pc       | 0.0875             | 0.1388    | 0.2196    | <b>-1.4%</b>         | <b>+0.2%</b> | <b>+1.6%</b> | <b>+0.5%</b>    | <b>+1.9%</b> | <b>+3.2%</b> |
| Tax rate (%)         | 20.6               | 20.4      | 20        | +1.3                 | -0.0         | -1.1         | +0.5            | -0.7         | -1.7         |
| Wage                 | 0.1403             | 0.2218    | 0.3497    | +0.2%                | +0.2%        | +0.2%        | +1.1%           | +1.0%        | +1.0%        |

- Definition of consumption equivalent  $\mathcal{C}$ :

$$\log \mathcal{C} + \sigma \cdot [\log \mathcal{C} + \theta \cdot \log \mathcal{C}] = U^y$$

- Welfare changes reported for:
  - stayers
  - emigrants (weighed over all destinations chosen)
  - stayers + emigrants = aggregate welfare
- Isolating the welfare changes that ignore  $\xi$
- To compare different models: aggregation over countries with the same level of  $y$

# Welfare analysis





- This paper: interactions between fiscal policy and labor mobility
- A novel model with endogenous flows of workers
- Quantitative assessment of labor market integration
- Fiscal competition for workers and labor mobility:
  - theoretical analysis
  - quantitative assessment

Thank you for your  
attention!

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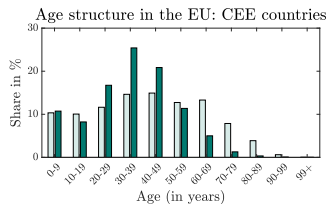
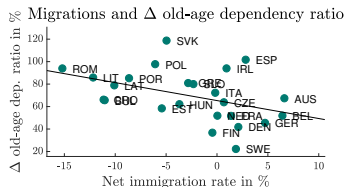
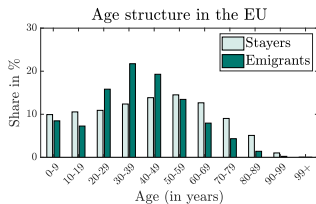
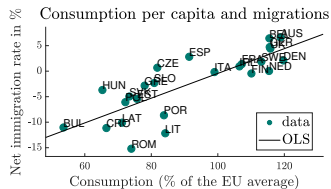
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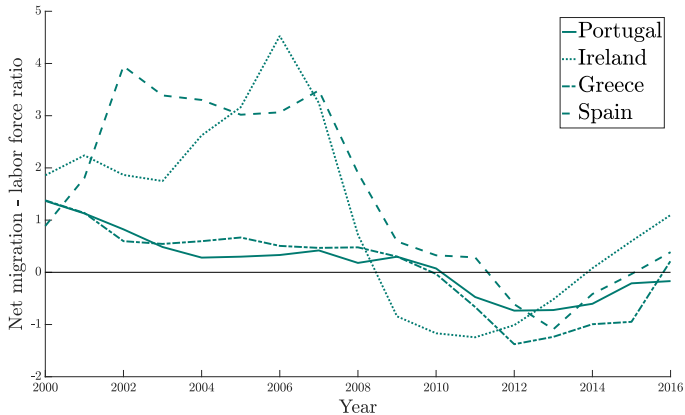


# Migrations and CEE countries i



◀ back

# Migrations and PIGS countries i



◀ back



- Measure of countries with population  $n$ , asset position  $b$  and productivity  $y$ :  $\mu(n, b, y)$
- Union-wide capital market clearing:

$$\int K(n, b, y) \cdot d\mu(n, b, y) - \int a'(b, y) \cdot n'(n, b, y) \cdot d\mu(n, b, y) \\ - \int q(b'(b, y), y) \cdot b'(b, y) \cdot n'(n, b, y) \cdot d\mu(n, b, y) = 0.$$

- Time evolution of the distribution of countries  $\mu$ :

$$\mu'(\mathcal{N}', \mathcal{B}', \mathcal{Y}') = \int \mathbb{I}_{\{n'(n, b, y) \in \mathcal{N}'\}} \times \mathbb{I}_{\{b'(b, y) \in \mathcal{B}'\}} \cdot \mathbb{P}(y' \in \mathcal{Y}' | y) \cdot d\mu(n, b, y)$$

where  $\mathcal{B}'$ ,  $\mathcal{N}'$  and  $\mathcal{Y}'$  are Borel sets

- The union-wide distribution of lifetime utilities  $\Phi$ :

$$\Phi(x) = \int \mathbb{I}_{\{U^y(b, y) = x\}} \cdot n \cdot d\mu(n, b, y)$$

# Markov Perfect Equilibrium i

*Definition: A Stationary Markov Perfect Competitive Equilibrium (SMPCE) consists of interest rates  $R^f$ ,  $R^h$ ,  $R$ , prices  $q$ , wages  $w$ , household policies  $c^y$ ,  $c^{o'}$ ,  $a'$ , demand functions for production factors  $L$  and  $K$ , effective productivity  $z$ , government policies  $b'$ ,  $\tau$ ,  $g$ ,  $d$ , distributions  $\mu$ ,  $\Phi$ , Pareto weights  $\lambda^y$ ,  $\lambda^o$  and functions  $E$ ,  $I$ ,  $n'$ ,  $\eta$ ,  $U^y$  such that:*

- 1. Policies  $c^y$ ,  $c^{o'}$ ,  $a'$  solve the household problem given  $\tau$ ,  $R^h$  and  $w$ ,*
- 2. Wage  $w$  satisfies local labor market clearing,  $L$ ,  $K$  satisfy firm's capital optimality given  $R^f$ ,  $z$  and  $n'$  and  $z$  solves (1) given policy  $d$ ,*
- 3. Policies  $\tau$ ,  $d$ ,  $b'$ ,  $g$  solve the government problem given  $\Gamma$ ,  $w$ ,  $q$ ,  $\eta$  and given the households' policies  $c^y$ ,  $c^{o'}$ ,  $a'$  and  $U^y$  is the associated lifetime policy of young households,*
- 4. Prices  $q$ ,  $R$ ,  $R^f$ ,  $R^h$  satisfy the asset pricing equations*
- 5. Given measure  $\mu$  and function  $U^y$ , distribution  $\Phi$ ,  $E$ ,  $I$ ,  $n'$ ,  $\eta$  satisfy consistency equations*

6. Policy  $\Gamma$  is consistent with  $g$  (i.e., the Markov Perfect Equilibrium condition holds):

$$\forall_{b,y} g(b,y) = \Gamma(b,y),$$

7. Union-wide market clearing condition for assets holds

8. Measure  $\mu$  satisfies the law of motion and is ergodic:  $\mu = \mu'$

9. Pareto weights satisfy  $\lambda^y = \eta$  and  $\lambda^o = \sigma$

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