Immigration and climate change policies

Konstantina Antonopoulou[1] George Liontos[2] Eugenia Vella[3]

[1]AUEB & IOBE
[2]AUEB & IOBE
[3]AUEB

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Climate change and the EGD

- European Green Deal (EGD):
  - **climate neutrality by 2050** with zero net emissions of greenhouse gases,
  - **disconnection** of economic growth **from the use of resources**,
  - distribution of the **transition benefits to everyone.**

- **Policy instruments** for climate change (Airaudo, Pappa, Seoane, 2025):
  - **carbon taxes** on brown energy,
  - **subsidies** on green energy,
  - **public investment** in green capital.

Immigration and Climate Change Policies

- The massive influx of **migrants** to EU borders urges policymakers to consider the **implications** for **climate change policies**.
- **Immigration** contributes to **growth** and expands the **tax base** providing additional resources for climate policy.
- Immigrants **provide labor services** for the production of both ”dirty” and ”clean” goods.
- **Immigration** leads to population growth, resulting in an increase in consumption and overall demand for energy and, thus, in **greenhouse gas emissions**.
- The final outcome is **ambiguous**.

This paper

This paper introduces immigration and energy in a DSGE model with heterogeneous households and labor frictions to study these **research questions**:

- What is the **role of immigration on** the impact of policies for **the transition to green economies**?
- What are the implications of **different tax-spending instruments** used for the reduction of brown energy and the promotion of green energy?
- What **policy recommendations** can be formulated for a smoother green transition?

Macro Literature

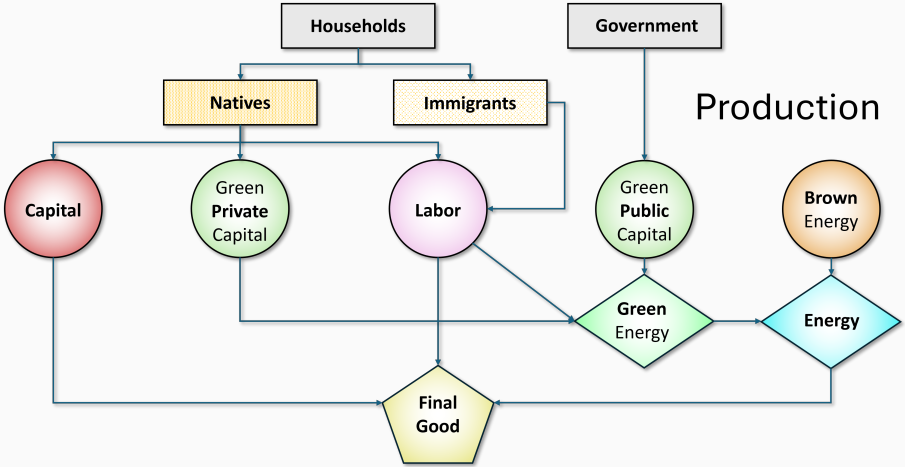
Climate Policy:

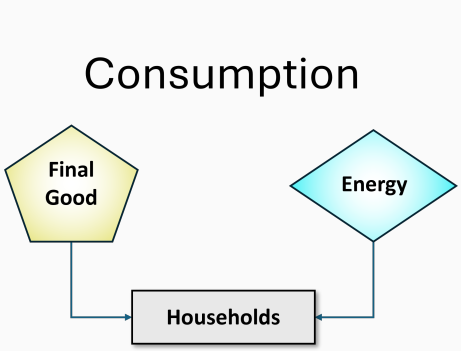
- Airaudo et al. (2025): Green public investment and subsidies can **reduce transition costs** in small open economies.
- Coenen et al. (2024): **Increasing carbon taxes** entails a **transitory rise in inflation** and a **lasting**, albeit moderate **decline in GDP**.
- Economides and Xepapadeas (2025): **Climate change** affects the design of **monetary policy**.

Immigration:

- Bentolila et al. (2008): Immigration **mitigated inflation despite falling unemployment** in Spain.
- Mandelman and Zlate (2012): Remittances **smooth consumption**.
- Maffei-Faccioli and Vella (2021): **Immigration** in Germany has substantial demand effects on top of supply side effects **expanding the economic pie**.
- Bandeira, Caballé and Vella (2022): **Migration** affects the **fiscal base**.

Overview of the Model (1)





On top of increasing the demand for the final good, an **immigration shock** will **increase** the **demand for energy**, which has a direct pass-through on consumer price inflation.

Labor Market and Immigration (a)

- **Household composition** (labor market statuses):

$$1 = n_t^i + u_t^i + l_t^i, \quad i = (H, F) \tag{1}$$

- **Population growth** per household type:

$$g_t^i = \frac{N_t^i}{N_{t-1}^i} \tag{2}$$

- For simplicity the **native population does not grow**.

Labor Market and Immigration (b)

- A **migration AR(1) shock** results in **population growth** and **change** in the **population share of immigrants.**

  Following Chassamboulli and Liu (2024):

- **Matching function**:

$$m_t^i(v_t^i, S_t^i) = \mu_1 (S_t^i)^{\mu_2} (v_t^i)^{1-\mu_2} \tag{3}$$

- Mass of **searching immigrants**:

$$S_t^F = u_{t-1}^F + \rho_n^F n_{t-1}^F + im_t \tag{4}$$

- **Employment** law of motion:

$$n_{t+1}^i = (1 - \rho_n^i) n_t^i + m_t^i \tag{5}$$

Households (a)

- Two types of households.

- **Native households:**
  - access capital and financial markets,
  - own firms,
  - supply labor.

- **Immigrants:**
  - hand-to-mouth consumers,
  - supply labor,
  - earn a lower wage than natives,
  - send remittances back home.

Households (b)

- Natives **maximize** lifetime **utility**:

$$\mathbb{E}_t \sum_{t=0}^{\infty} \beta^t \left\{ \frac{{c_t^H}^{1-\sigma}}{1-\sigma} + \Phi^H \frac{{l_t^H}^{1-\phi}}{1-\phi} \right\} \tag{6}$$

s.t. $c_t^H + i_t + {i_t^G} + FX_t r_t^d d_t = (1-\tau_t^{n,H}) w_t^H n_t^H + (1-\tau_t^k) r_t^k k_t + FX_t d_{t+1} + \pi_{d,t} - \tau_t + \bar{\omega} u_t^H$ (7)

- **Physical** capital:

$$i_t = k_{t+1} - (1-\delta_k) k_t + \frac{\Xi_k}{2} \left(\frac{k_{t+1}}{k_t} - 1 \right)^2 k_t \tag{8}$$

- **Green** capital:

$${i_t}^G = s_{t+1}^G - (1-\delta_s) s_t^G + \frac{\Xi_s}{2} \left(\frac{s_{t+1}^G}{s_t^G} - 1 \right)^2 s_t^G \tag{9}$$

Households (c)

- Immigrants **maximize** lifetime **utility**:

$$\mathbb{E}_t \sum_{t=0}^{\infty} \beta^t \left\{ \frac{c_t^{F^{1-\sigma}}}{1-\sigma} + \Phi^F \frac{l_t^{F^{1-\phi}}}{1-\phi} \right\} \tag{10}$$

$$\text{s.t.} \quad c_t^F = (1 - \tau_t^{n,F} - rem_t) FX_t w_t^F n_t^F - \tau_t + \bar{\omega} u_t^F \tag{11}$$

- **Total consumption** is a composite good:

$$c_t^i = \left[(1-\alpha_1)^{\frac{1}{\nu_2}} (c_{f,t}^i)^{\frac{\nu_2-1}{\nu_2}} + (\alpha_1)^{\frac{1}{\nu_2}} (c_{e,t}\}^i)^{\frac{\nu_2-1}{\nu_2}} \right]^{\frac{\nu_2}{\nu_2-1}} \tag{12}$$

where c_f is the consumption of the final good and c_e **is the consumption of the energy good.**

Final goods

- The representative firm aggregates **domestic intermediate goods** Y_t^H and **imported aggregate goods** Y_t^F using a CES technology:

$$Y_t = \left[\omega^{\frac{1}{\gamma}} \left(Y_t^H \right)^{\frac{\gamma-1}{\gamma}} + (1-\omega)^{\frac{1}{\gamma}} \left(Y_t^F \right)^{\frac{\gamma-1}{\gamma}} \right]^{\frac{\gamma}{\gamma-1}} \tag{13}$$

- The firm **maximizes profits**:

$$\Pi_t = P_t Y_t - p_t^H Y_t^H - p_t^F Y_t^F \tag{14}$$

- **Prices** are **sticky** (New-Keynesian model).

Intermediate goods

- Each firm here requires **physical capital** k_t^f, **native workers** n_t^H, **immigrant workers** n_t^F, and **energy** $e_{i,t}$ to produce the domestic intermediate good $y_{i,t}^f$ using a CES production technology:

$$y_{i,t}^f = A_t[(1-\lambda)(x_{i,t})^{\varepsilon} + \lambda(e_{i,t})^{\varepsilon}]^{1/\varepsilon} \tag{15}$$

$$x_{i,t}^f = [(1-\lambda_1)(k_t^f)^{\varepsilon_1} + \lambda_1(n_t^{HF})^{\varepsilon_1}]^{1/\varepsilon_1} \tag{16}$$

- Native and immigrant labor is combined via a CES function:

$$n_t^{HF} = [(1-\lambda_2)(n_t^H)^{\varepsilon_2} + \lambda_2(n_t^F)^{\varepsilon_2}]^{1/\varepsilon_2} \tag{17}$$

In our parameterization, we assume perfect substitutability.

Energy

- Energy is an aggregate of **exogenous brown** ($e^B_{i,t}$) and **clean energy** ($e^G_{i,t}$):

$$e_{i,t} = \left[(1-\zeta)(e^G_t)^{\xi} + \zeta(e^B_t)^{\xi}\right]^{1/\xi} \tag{18}$$

- **Green energy** is produced with **private green capital** s^G_t, **public green capital** $s^{G,P}_t$, and the composite of **native and immigrant labor** n^{HF}_t:

$$e^G_t = \left[(1-\zeta_1)(s^{GP}_t)^{\xi_1} + \zeta_1(n^{HF}_t)^{\xi_1}\right]^{1/\xi_1} \tag{19}$$

$$s^{GP}_t = \left[(1-\zeta_2)(s^G_t)^{\xi_2} + \zeta_2(s^{G,P}_t)^{\xi_2}\right]^{1/\xi_2} \tag{20}$$

- The economy receives an **endowment of brown energy** $e^{B,d}_t$, **traded internationally** and exported or imported at price $P^{B,*}_t$.
- **Imports** of brown energy, $e^{B,*}_t$:

$$e^{B,*}_t = e^B_t - e^{B,d}_t \tag{21}$$

Next Steps

- **Data collection** for climate policies and labor inflows to Europe.
- **Calibration and solution** of the DSGE model.
- Analysis of model's results and formulation of **policy recommendations**.

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