Migrations and Fiscal Sustainability

Sergii Kiiashko (KSE and NBU), Paweł Kopiec (NBP)

Labor mobility and fiscal policy in the long run

- **Undesirable fiscal consequences of migrations** in sending countries:
  - challenge to social security systems (e.g. Storesletten [2000])
  - increase of public debt per capita (e.g. Brunnermeier et al. [2016])
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- The opposite holds for receiving countries
- **Gap in the literature**: interactions between the global effects of open borders and country-level fiscal policy

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  - Cons: higher debt $\Rightarrow$ future fiscal problems $\Rightarrow$ lower consumption of future old agents $\Rightarrow$ deters migrants

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  - Pros: no debt burden to be repaid $\Rightarrow$ improves fiscal situation $\Rightarrow$ attracts migrants
  - Cons: financial crisis $\Rightarrow$ lower output $\Rightarrow$ less resources to be redistributed $\Rightarrow$ deters migrants

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- **redistribution toward old agents** - due to their voting power - i.e, taxes/pensions
  - Pros: higher consumption of old people
  - Cons: higher taxation of workers $\Rightarrow$ consumption of young agents is lower $\Rightarrow$ lower lifetime utility $\Rightarrow$ outflow of workers
  - Moreover, outflow of workers $\Rightarrow$ lower output $\Rightarrow$ potentially lower consumption of old people

This paper: migrations fosters fiscal prudence

Mechanism:

- Fiscal benefits from immigration:
  - larger tax base
  - space for additional debt issuance
- To attract immigrants government raises:
  - worker's disposable income (by cutting labor tax)
  - raises future provision of public goods (by reducing public debt)
- Fiscal prudence lowers global real interest rate
- Thus: private capital rises in each country $\Longrightarrow$ "a rising tide that lifts all boats"

Framework

- **Starting point** - the model by Song, Storesletten and Zilibotti [2012]:
  - continuum of countries
  - two overlapping generations
  - production factors: capital and labor
  - fiscal rules set by governments
  - time-consistent fiscal policy

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- **Our extensions**:
  - cross-country labor mobility
  - country-level productivity shocks
  - debt renegotiation

Exercises and Findings

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Exercises and Findings

- **Exercises:**
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- **Main findings:**
  - in the presense of endogenous migrations, governments conduct more prudent fiscal policies
  - global effects of migration: lower average Debt-to-GDP ratio (80% vs 72%), lower spreads (1.5% vs 1.2%) and higher output (+1.5%)
  - welfare improvement even for the least productive economies

Related literature

- 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], Kennan [2013], Tombe and Zhu [2019], Walerych [2020]
- Labor mobility in currency unions (short-run analysis): Farhi and Werning [2014], Hauser and Seneca [2019]
- Migrations, trade and labor heterogeneity: Iranzo and Peri [2009], Giovanni et al. [2015]
- Labor mobility and sovereign default: Alessandria et al. [2019]

Model: agents

- Households:
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- Financial intermediaries:
  - trade all types of assets
  - pricing rules of financial contracts

Model: households

- Maximization problem:

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

subject to:

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

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

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- Optimal policy rules:

$$\begin{cases} c^y\left(\tau,\, w\right) = \frac{1}{1+\sigma} \cdot (1-\tau) \cdot w \\ a'\left(\tau,\, w\right) = \frac{\sigma}{1+\sigma} \cdot (1-\tau) \cdot w \\ c^{o'}\left(\tau,\, w\right) = \frac{R^h \cdot \sigma}{1+\sigma} \cdot (1-\tau) \cdot w \end{cases}$$

Model: demography and old agents

- Number of old agents at the beginning of the period: n^o
- Every old agent delivers one young agent
- Survival rate: $\sigma \in (0, 1)$

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  1. Random search: every young agent draws a migration opportunity $\hat{U^y}$ from the distribution with c.d.f. $\Phi \circ F$ (with $\Phi' > 0$, $\Phi'' > 0$)
  2. Decision: as in Alessandria et al. [2019], agent decides to leave if $\hat{U^y} - \xi > U^y$

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  2. Decision: as in Alessandria et al. [2019], agent decides to leave if $\hat{U^y} - \xi > U^y$
- Number of emigrants: E
- Number of immigrants: I
- Number of young agents who live in a given country:

$$n^y\left(n^o, U^y, F\right) = n^o - E\left(n^o, U^y, F\right) + I\left(n^o, U^y, F\right)$$

- Formulas for E and I: ▸ details
- Net gross migration rate:

$$\eta \equiv \frac{n^y}{n^o}$$

Model: supply side

- Country-level productivity shocks: y
- Debt renegotiation: $d \in [0, 1]$
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$$\max_{K,\,N} \left(\chi(d) \cdot y \cdot K^{\alpha} \cdot N^{1-\alpha} - w \cdot N - R^{f} \cdot K \right)$$

- Capital: perfect cross-border mobility, depreciates at rate 100% after one period
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- Country-level wage:

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

Model: government

- Government problem:

$$\max_{\tau,\, b',\, d,\, g} \left\{\alpha^y \cdot U^y + \alpha^o \cdot U^o\right\}$$

subject to:

$$U^y = \log c^y\left(\tau, w\left(d, y\right)\right) + \sigma \cdot \log c^{o'}\left(\tau, w\left(d, y\right)\right) + \sigma \cdot \theta^o \cdot \mathbb{E} \log \Gamma\left(b', y'\right)$$

$$U^o = \log c^o\left(\tau_{-1}, w_{-1}\right) + \theta^o \cdot \log\left(g\right)$$

$$\underbrace{\sigma \cdot g}_{\text{public spending}} + \underbrace{(1-d)\cdot(-b)}_{\text{outstanding debt}} = \underbrace{\tau \cdot w\left(d, y\right) \cdot \eta\left(U^y\right)}_{\text{tax revenues}} + \underbrace{q\left(b', y\right) \cdot \left(-b'\right) \cdot \eta\left(U^y\right)}_{\text{issued debt}}$$

- Pareto weights α^y and α^o proportional to population sizes

Model: competitive financial intermediaries

- Maximization problem: details
- Asset pricing:

$$q\left(b_{t+1}, y_t\right) = \frac{1 - \mathbb{E}_{y_{t+1}|y_t} d\left(b'\left(b_t, y_t\right), y_{t+1}\right)}{R}$$

$$\sigma \cdot R^h = R$$

$$R = R^f$$

Model: consistency conditions

- Law of motion of countries across states:

$$\mu'\left(n^{o'}, b', y'\right) = \sum_{n^o, b, y} \Big[\pi\left(y'|y\right) \cdot \mathbb{I}_{\left\{\eta(U^y(b,y),\Omega)\cdot n^o = n^{o'}\right\}}$$

$$\cdot \mathbb{I}_{\left\{b'(b,y)=b'\right\}} \cdot \mu\left(n^o, b, y\right)\Big]$$

- Market clearing for assets: details
- Markov Perfect Equilibrium condition:

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

- Definition of Stationary Markov Perfect Competitive Equilibrium:

details

Mechanism: fiscal prudence

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- Intratemporal optimality condition of government (between private consumption and government spending):

$$\frac{\partial U^y}{\partial c^y} = \frac{\partial U^o}{\partial g} \cdot (1+\sigma) - \underbrace{\frac{\partial U^o}{\partial g} \cdot \frac{\eta'}{\eta} \cdot \frac{\partial U^y}{\partial c^y} \cdot (\tau \cdot w - q \cdot b')}_{\text{fiscal benefits from immigrants}}$$

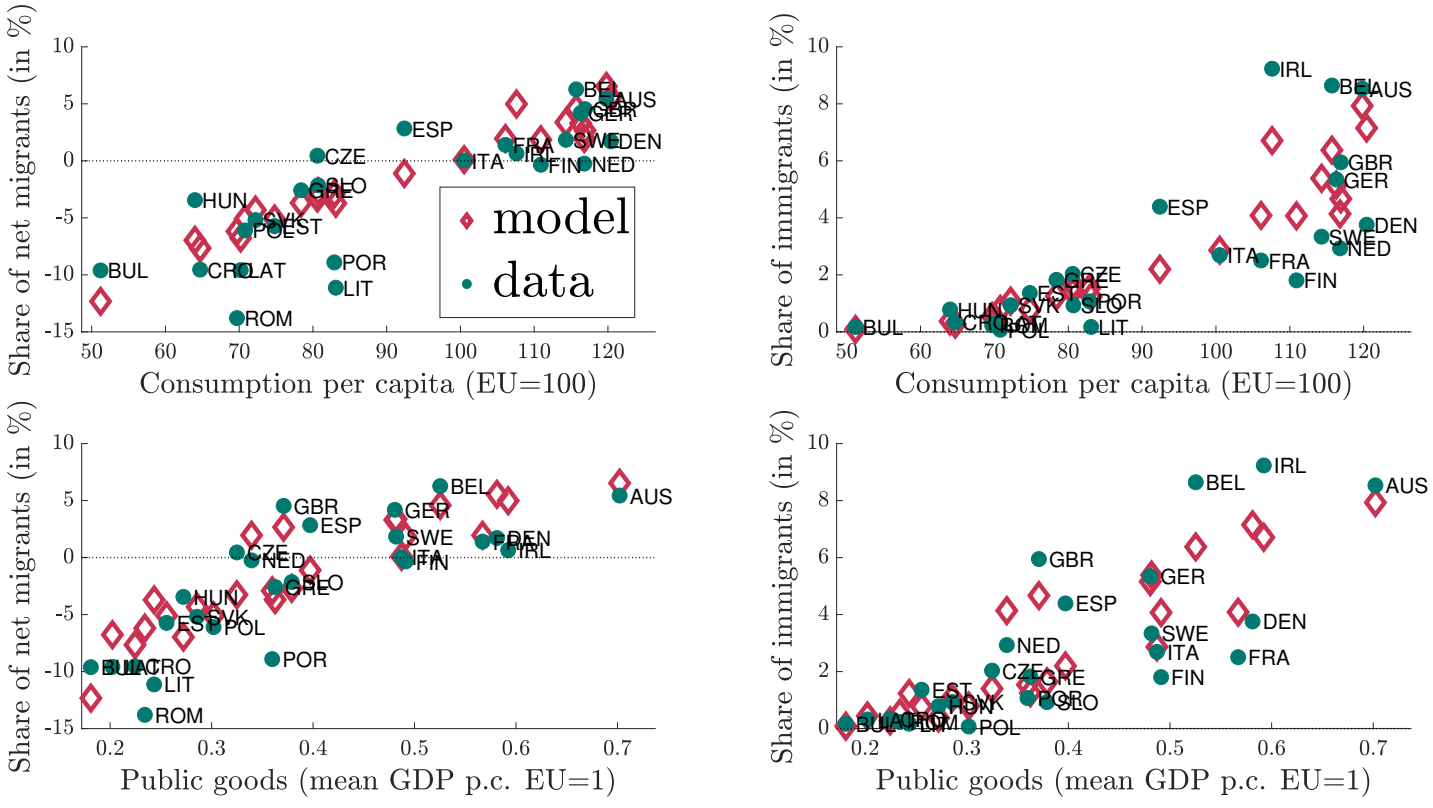
- Intertemporal optimality condition of government (between today and tomorrow):

$$\frac{\partial U^y}{\partial b'} = \frac{\partial U^o}{\partial g} \cdot \left(\frac{\partial q}{\partial b'} \cdot b' + q \right) - \underbrace{\frac{\partial U^o}{\partial g} \cdot \frac{\eta'}{\eta} \cdot \frac{\partial U^y}{\partial b'} \cdot (\tau \cdot w - q \cdot b')}_{\text{fiscal benefits from immigrants}}$$

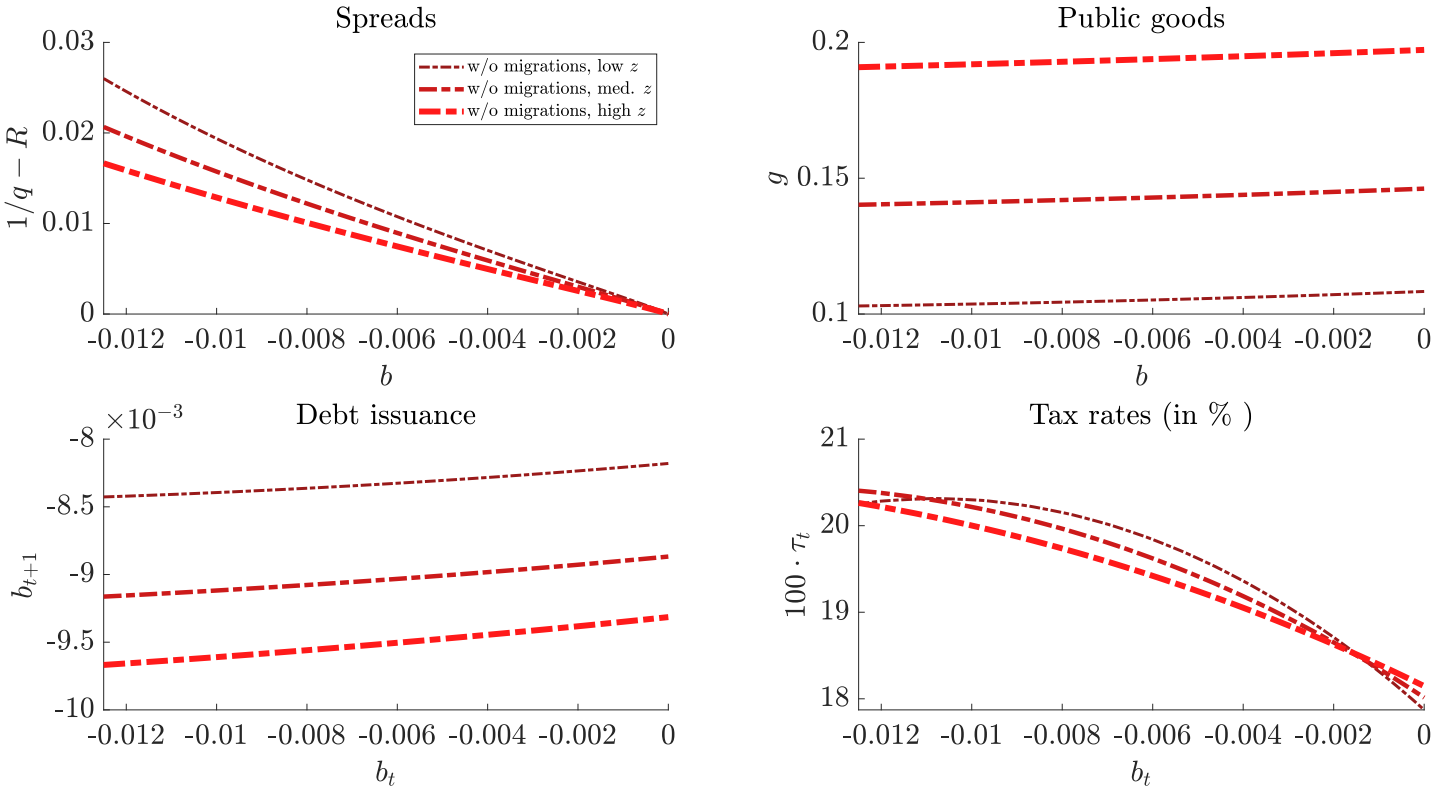
Calibration (for $T = 30$ years)

Parameter	Description	Value	Calibration target
σ	Survival rate	0.30	Old age dependency ratio
α	Output elasticity of capital	0.33	Standard value in the literature
ρ_T	Persistence of the AR(1) process	0.61	Country-level productivity process
$\sigma_{\epsilon,\,T}$	Std. error of the AR(1) process	0.08	Country-level productivity process
χ_0	Parameter of defult penalty	0.04	Mean debt to GDP ratio of 72%
χ_1	Parameter of defult penalty	2.10	Mean spread over riskless rate of 1.2%
θ^o	Preferences for public goods	1.00	Public goods for the elderly to GDP of 12%
ψ_1	Parameter of matching technology	2.95	Intra-EU migrations
ψ_2	Parameter of matching technology	1.50	Intra-EU migrations
ϕ	Parameter of matching technology	1.40	Intra-EU migrations

Calibration: matching process



Results: optimal policies at the country level



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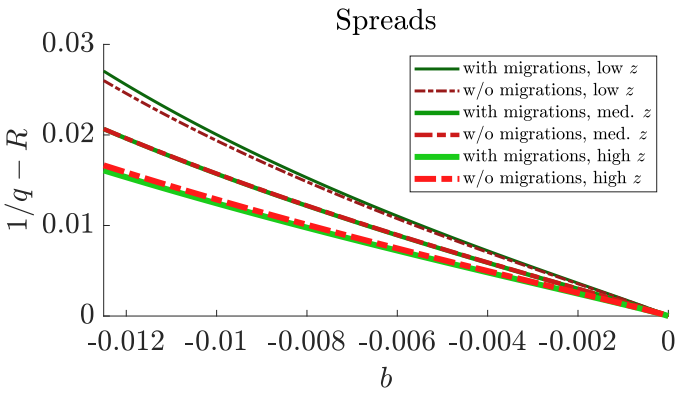
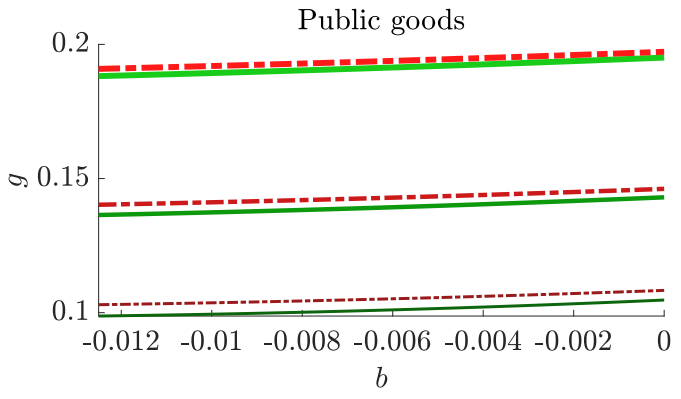
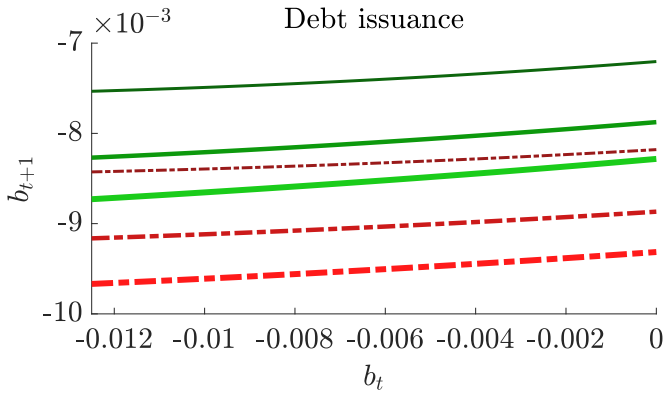
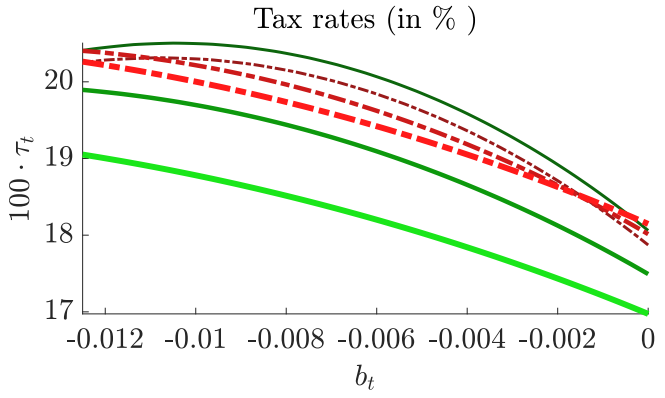




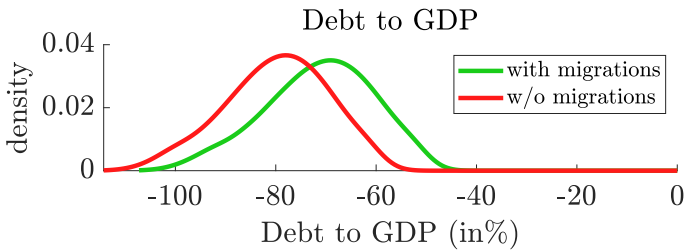


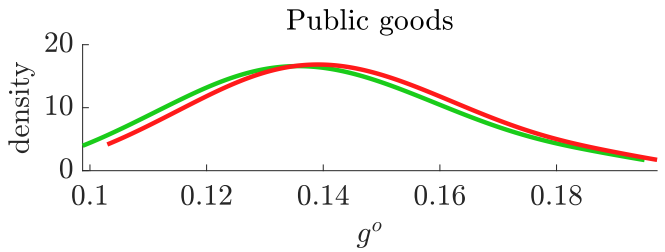


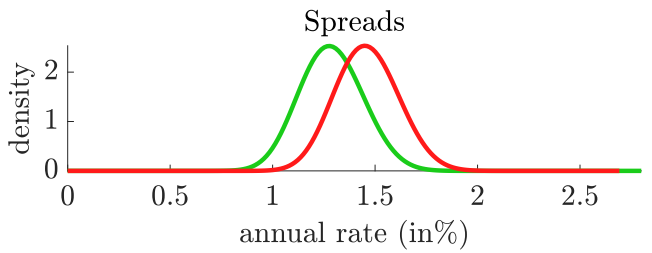
Results: global aggregates in two regimes

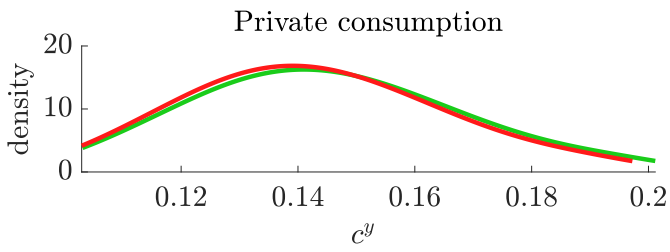
	w/o migrations	with migrations
Mean debt-to-GDP ratio	80%	72%
Average annual spread	1.5%	1.2%
Aggregate capital	1.00	1.03
Global GDP	0.347	0.352 (+1.5%)

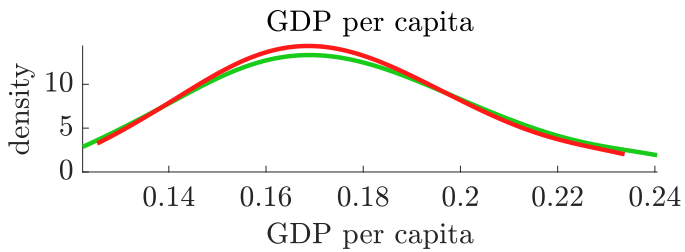
Results: distributions of countries over variables and policies



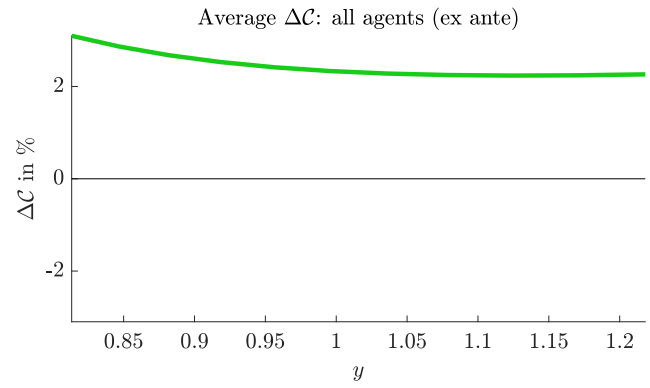


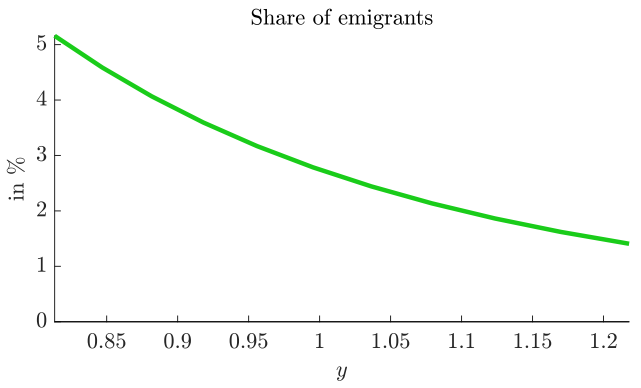


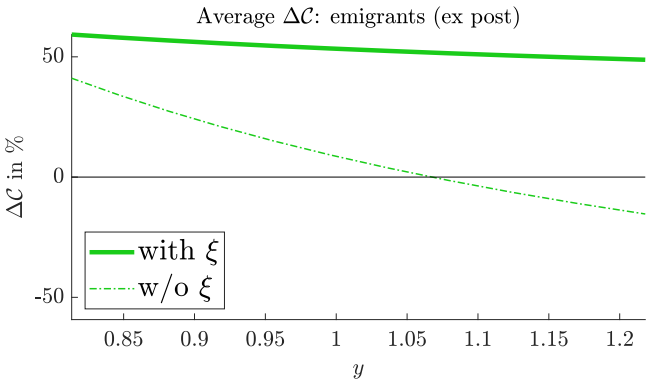


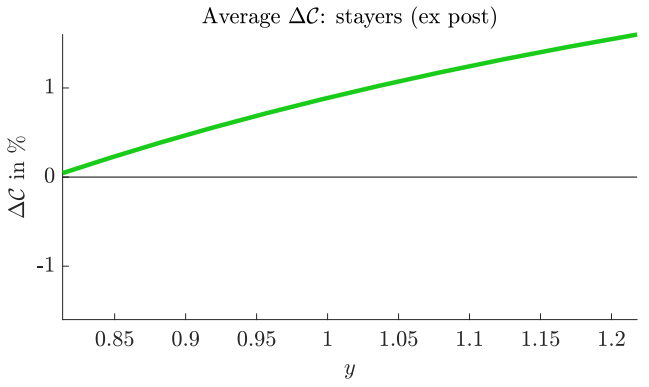


Results: welfare





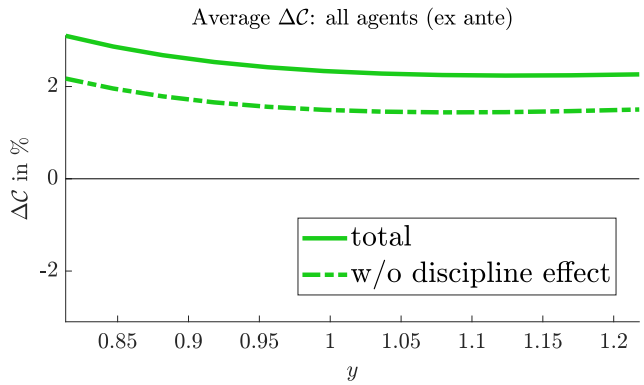


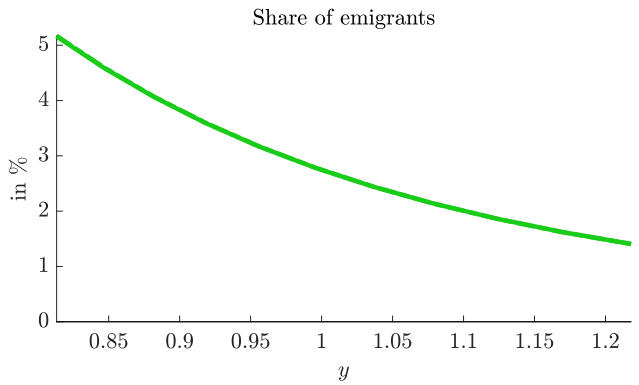


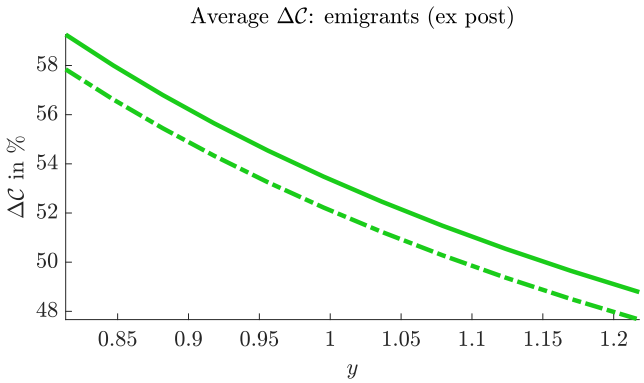
Results: quantitative role of fiscal prudence 1

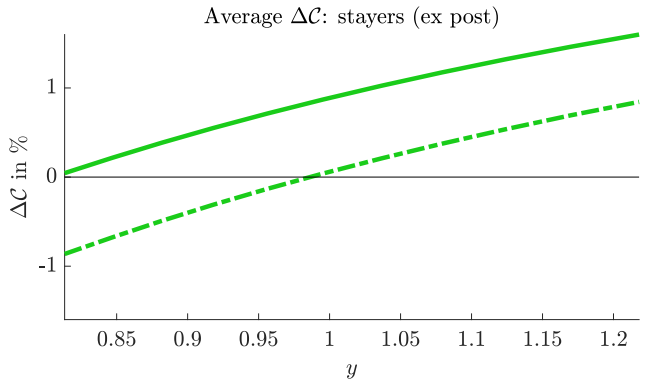
	w/o migrations	Counterfactual: with Migrations but w/o FP	w/o migrations and with FP
Mean debt-to-GDP ratio	80%	78%	72%
Average annual spread	1.5%	1.4%	1.2%
Aggregate capital	1.00	1.01	1.03
Global GDP	0.347	0.350 (+0.9%)	0.352 (+1.5%)

Results: quantitative role of fiscal prudence 2









The end

Thank you for your attention!

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Formulas for E and I i

Country-level number of emigrants:

$$E\left(n^o, U^y, F\right) = n^o \cdot \left[\sum_{\hat{B},\hat{y},\hat{n^o}} \mathbb{P}_\Phi \left(U^y \left(\hat{n^o}, \hat{B}, \hat{y} \right), F \right) \right.$$

$$\times \frac{\mu\left(\hat{n^o}, \hat{B}, \hat{y}\right) \cdot \hat{n^o}}{\sum_{\tilde{B},\tilde{y},\tilde{n^o}} \mathbb{I}_{\left\{U^y\left(\tilde{n^o},\tilde{B},\tilde{y}\right)=U^y\left(\hat{n^o},\hat{B},\hat{y}\right)\right\}} \cdot \mu\left(\tilde{n^o}, \tilde{B}, \tilde{y}\right) \cdot \tilde{n^o}}$$

$$\left. \times \Psi\left(U^y \left(\hat{n^o}, \hat{B}, \hat{y} \right) - U^y \left(n^o, B, y \right) \right) \right].$$

Immigrants arriving to the analyzed economy:

$$I\left(n^o, U^y, F\right) = \sum_{\hat{B},\hat{y},\hat{n^o}} \left[\mu\left(\hat{n^o}, \hat{B}, \hat{y}\right) \cdot \hat{n^o} \cdot \mathbb{P}_\Phi \left(U^y, F\right) \right.$$

Formulas for E and I ii

$$\times \frac{1 \cdot n^o}{\sum_{\tilde{B},\tilde{y},\tilde{n^o}} \mathbb{I}_{\left\{U^y\left(\tilde{n^o},\tilde{B},\tilde{y}\right)=U^y\right\}} \cdot \mu\left(\tilde{n^o},\tilde{B},\tilde{y}\right) \cdot \tilde{n^o}} \times \Psi\left(U^y - U^y\left(\hat{n^o},\hat{B},\hat{y}\right)\right)\Big].$$

where probability $\mathbb{P}_\Phi\left(\hat{U^y},F\right)$ of drawing opportunity $\hat{U^y}$ from distribution characterized with c.d.f. $\Phi \circ F$ is:

$$\mathbb{P}_\Phi\left(\hat{U^y},F\right) = \lim_{\epsilon \to 0}\left\{\Phi \circ F\left(\hat{U^y}+\epsilon\right) - \Phi \circ F\left(\hat{U^y}-\epsilon\right)\right\}$$

and the c.d.f. of disutility shock ξ is Ψ.

back

Intermediary: maximization problem i

Similar to Chatterjee et al. [2007] (financial intermediaries sell the amount $\bar{K}_{t+1}$ of capital, choose the number A of type (b', y) sovereign loan/deposit contracts at price q and A^P of private loan/deposit contracts signed with households populating a country indexed with (b, y) traded at price q^P, to maximize the discounted sum of profits):

$$\sum_{t=0}^{+\infty} R^{-t} \cdot \Pi_t$$

where:

$$\Pi_t = \left(1 - \delta + R^f\right) \cdot \bar{K}_t - \bar{K}_{t+1}$$

$$+ \sum_{b_{t+1}, y_t} q\left(b_{t+1}, y_t\right) \cdot A\left(b_{t+1}, y_t\right) \cdot b_{t+1} - \sum_{b_t, y_{t-1}} \left(1 - d\left(b_t, y_{t-1}\right)\right) \cdot A\left(b_t, y_{t-1}\right) \cdot b_t$$

Intermediary: maximization problem ii

$$+\sum_{b_t,y_t} A^P\left(b_t,y_t\right)\cdot a_{t+1}\left(b_t,y_t\right)-\sum_{b_{t-1},y_{t-1}} \sigma\cdot R^h\cdot A^P\left(b_{t-1},y_{t-1}\right)\cdot a_t\left(b_{t-1},y_{t-1}\right).$$

back

Market clearing condition: asset market i

Consistency condition for private contracts:

$$A^P(b,y) = \sum_{b,y,n^o} \eta\left(U^y(b,y)\right) \cdot n^o \cdot \mu\left(n^o,b,y\right)$$

Consistency for sovereign debt contracts:

$$A(b',y) = \sum_{b,y,n^o} \mathbb{I}_{\{b'(b,y)=b'\}} \cdot \eta\left(U^y(b,y)\right) \cdot n^o \cdot \mu\left(n^o,b,y\right)$$

Market clearing condition for assets:

$$\bar{K}_{t+1} - \sum_{b_{t+1},y_t} q\left(b_{t+1},y_t\right) \cdot A\left(b_{t+1},y_t\right) \cdot b_{t+1} - \sum_{b_t,y_t} A^P\left(b_t,y_t\right) \cdot a_{t+1}\left(b_t,y_t\right) = 0$$

◂ back

Markov Perfect Equilibrium i

Definition: A Stationary Markov Perfect Competitive Equilibrium (SMPCE) consists of prices R, R^f, R^h, *debt contracts* $q\left(b', y\right)$, *wages* w, *household policies* c^y, $c^{o'}$, a', *government policies* τ, d, b', g, *choices of financial intermediaries* A, A^P, $\bar{K}'$, *distribution* μ^* *and function* η, *such that:*

1. *Policies* c^y, $c^{o'}$, a' *solve household problem given* τ, g', R^h *and* w,
2. *Policies* τ, d, b', g *solve government's problem given* Γ, w, q, η,
3. *First order conditions associated with financial intermediaries problem hold*
4. *Markov Perfect Equilibrium condition holds*
5. *Consistency conditions hold*
6. *Pareto weights satisfy* $\alpha^y = \eta$ *and* $\alpha^o = \sigma$

back