Inequality and Current Account Imbalances in a Monetary Union:
Heterogeneous heterogeneities in the Eurozone

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Outline

Literature Review

- **Micro-level inequality:** use of HA models instead of RA to study inequality as in Bewley (1986), high number of idiosyncratic states is necessary to replicate empirical features as in Den Haan (2001).
- **Current account imbalances:** common origin of changes in exterior position and inequalities, a negative relationship identified in Al-Hussami and Remesal (2012) and its link to aggregate demand in Ranciere et al. (2012).
- **Monetary unions:** disparities between core and periphery countries in low-level savings management, leading to different reactions to shocks as in Gilchrist et al. (2018), European imbalances and inequalities are also studied in a monetary union framework by Marzinotto (2016), who identifies how countries benefit differently from shocks.

Empirical Motivation

	$\mathcal{G}^W$	λ	τ	$\mathcal{R}$	π	R	NFA
France	0.6766	0.35	0.46	1.005	1.0026	1.0024	1.087
Germany	0.7594	0.23	0.41	1.0036	1.0031	1.0005	2.288
Italy	0.6025	0.34	0.47	1.009	1.0031	1.0058	-0.099
Spain	0.5975	0.30	0.36	1.009	1.0028	1.0063	-0.491

$\mathcal{G}^W$ is the after-tax Gini coefficient for wealth, $\{\lambda, \tau\}$ are respectively the capital and labor flat taxes, $\mathcal{R}$ is the nominal interest rate on 10-year treasury bonds, π is the quarterly inflation rate, R is the real interest rate, NFA is the net foreign assets.

Apparent negative correlations between after-tax Gini coefficient $\mathcal{G}^W$ and real interest rate R, and between net foreign assets over GDP NFA and R.
Periphery countries face higher real interest rates and display lower inequalities and exterior positions than the core $\Rightarrow$ the common monetary policy yields disparities in aggregate variables across member states.

Set-Up

- HA model with capital as in Aiyagari (1994) with CRRA preferences
- Idiosyncratic productivity $y_t = \rho y_{t-1} + \varepsilon_t$ with $\varepsilon_t \overset{iid}{\sim} \mathcal{N}(0, \sigma_\varepsilon^2)$
- Discretized set of productivity states $Y = \{y_1, \ldots, y_N\}$ with transition Markov chain $\underset{N \times N}{\Pi}$
- Firms endowed with Cobb-Douglas technology
- Workers supply labor exogenously
- Government levies capital and labor flat taxes $\{\lambda, \tau\}$
- Monetary authority sets a country specific time-invariant R, that can follow one of three scenarios after an aggregate TFP shock hits:
  1. Follow the shock and then gradually return to its steady-state value
  2. Stay invariant for the duration of the shock
  3. Become endogenous (i.e. the country leaves the currency union)

The dynamic problem of the agent is given by the Bellman equation:

$$V(a_t^i, y_t^i) = \max_{\{c_t^i, a_{t+1}^i\}_{t=0}^{\infty}} u(c_t^i) + \beta \sum_{y_{t+1} \in Y} \mathbb{P}(y_{t+1}^i | y_t^i) V(a_{t+1}^i, y_{t+1}^i) \tag{1}$$

which yields the consumption Euler equation:

$$u'(c_t^i) \geq \beta((R_t - 1)(1 - \lambda) + 1) \sum_{y_{t+1} \in Y} \mathbb{P}(y_{t+1}^i | y_t^i) u'(c_{t+1}^i) \tag{2}$$

(2) is slack for credit-constrained households and binds for the others.

Steady-State

The Steady-State is characterized by an open-economy recursive equilibrium that fulfills the following conditions:

1. Policy functions for the state variables must solve the agent's program at all dates for a given set of prices $\{r_t, w_t\}$;
2. Labor market must clear domestically at all dates;
3. Factor prices are the result of the firm's optimization program at all dates;
4. Financial and goods markets do not clear domestically, generating a NFA imbalance, but clear internationally at all dates;
5. Stationary distribution must hold for each possible states at all dates.

Financial and goods market do not clear domestically as savings in the period are not necessarily equal to investment and net foreign assets can be nonzero. When savings are greater (lower) than investment, the current account balance is positive (negative) and the NFA increase (decrease).

Solution Method

The model is solved numerically in Julia using the Endogenous Grid Method.

The algorithm iterates on the policy functions $a_t(A, y_t)$ and $c_t(a_t, y_t)$, where A is a fixed value of a_{t+1}. The program converges on the financial market clearing. In the case of an invariant interest rate, we do not let the algorithm clear the market.

To simulate shocks, the algorithm iterates backwards from the end of the time periods to the beginning, converging on policy functions.

Calibration

All countries share a common set of calibrations:

β	α	δ	γ	$\bar{l}$	ϕ	a_{max}	na	ns
0.99	0.36	0.025	1.5	1	10^{-9}	1000	200	5

All countries empirically differ for these parameters:

	R	ρ	σ_ε	λ	τ
France	1.0024	0.991	0.174	0.35	0.46
Germany	1.0005	0.996	0.168	0.23	0.41
Italy	1.0058	0.985	0.159	0.34	0.47
Spain	1.0063	0.983	0.139	0.30	0.36

ρ and σ_ε are identified using a Nelder-Mead algorithm to match NFA and after-tax Gini coefficients for wealth for each country.

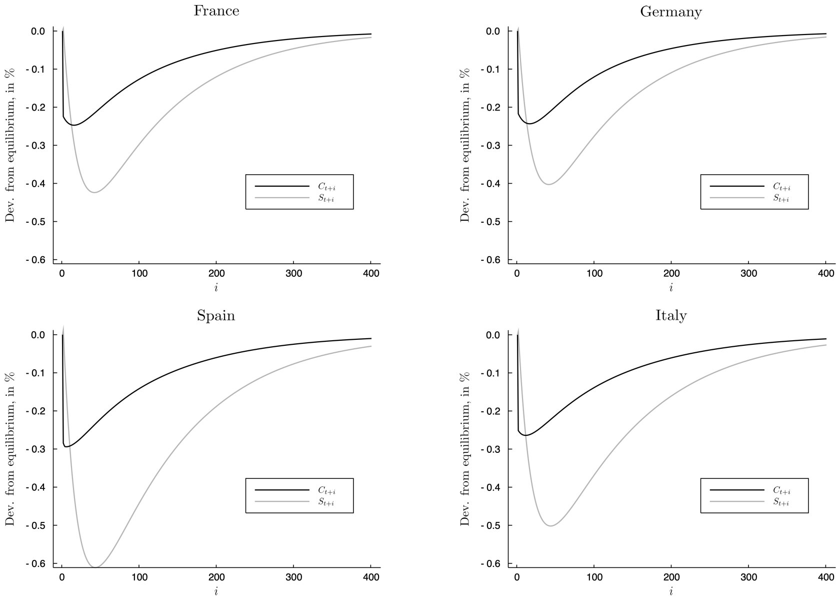
Technological Shock

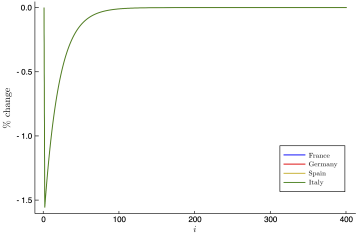
The law of motion for the technological shock is symmetric for all Eurozone countries and follows:

$$Z_{t+i} = Z_t + \mu^{i-1}\zeta, \quad \forall i \geq 1 \tag{3}$$

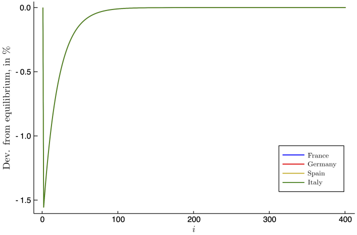
with $\mu = 0.95$ and $\zeta = -1\%$.

The shocks are unanticipated and once they happen, agents expect them to happen again with probability 0.

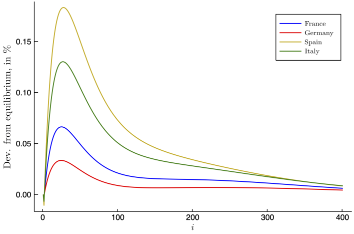

France
Germany
Spain
Italy
Dev. from equilibrium, in %
0.0
- 0.1
- 0.2
- 0.3
- 0.4
- 0.5
- 0.6
0
100
200
300
400
i
C_{t+i}
S_{t+i}



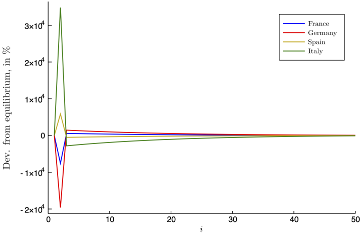
(a) Demand for capital



(b) GDP



(c) Wealth Gini



(d) CA/GDP

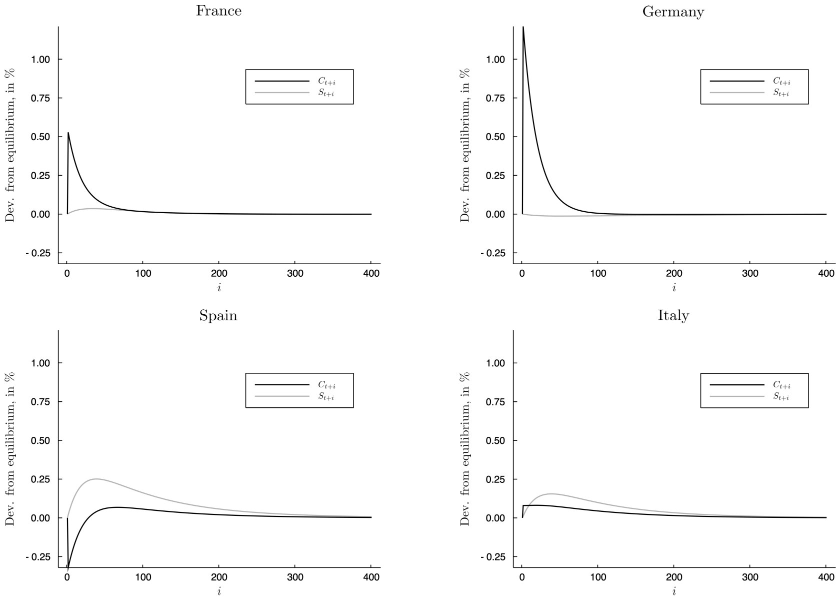
Monetary Shock

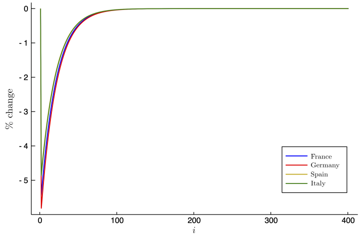
The law of motion for the monetary shock is symmetric for all Eurozone countries and follows:

$$R_{t+i} = R_t + \Gamma^{i-1}\xi, \quad \forall i \geq 1 \tag{4}$$

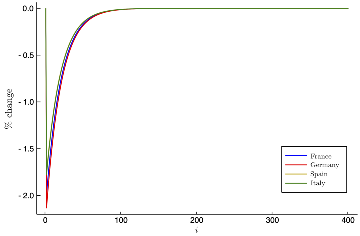
with $\Gamma = 0.95$ and $\xi = 0.1\%$.

The shocks are, again, unanticipated and once they happen, agents expect them to happen again with probability 0.

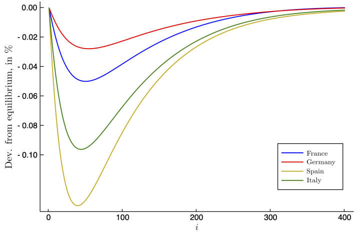

France
Germany
Spain
Italy
Dev. from equilibrium, in %
1.00
0.75
0.50
0.25
0.00
- 0.25
0
100
200
300
400
i
C_{t+i}
S_{t+i}



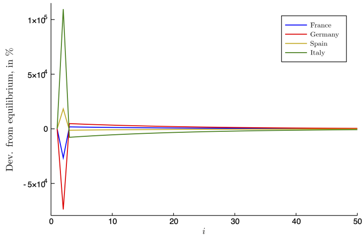
(a) Demand for capital



(b) GDP



(c) Wealth Gini



(d) CA/GDP

Currency Union v. Independence

The technological shock is the same as before, unanticipated, with $\zeta = -1\%$ and autocorrelation $\mu = 0.95$.

Once the shock happens, the monetary authority follows one of the three scenarios described here:

$$R^I_{t+i} = R_t, \quad \forall i \tag{5}$$

$$R^E_{t+i} = 1 + F_K(K_{t+i}, \bar{L}) - \delta, \quad \forall i \geq 1 \tag{6}$$

$$R^C_{t+i} = R_t + \psi^{i-1}(R^E_{t+1} - R_t), \quad \forall i \geq 1 \tag{7}$$

The endogenous interest rate is derived from the marginal productivity of capital and the correlated rate takes the value of the endogenous interest rate at time $i = 1$ and then returns to its steady state value with an autocorrelation $\psi = 0.95$.

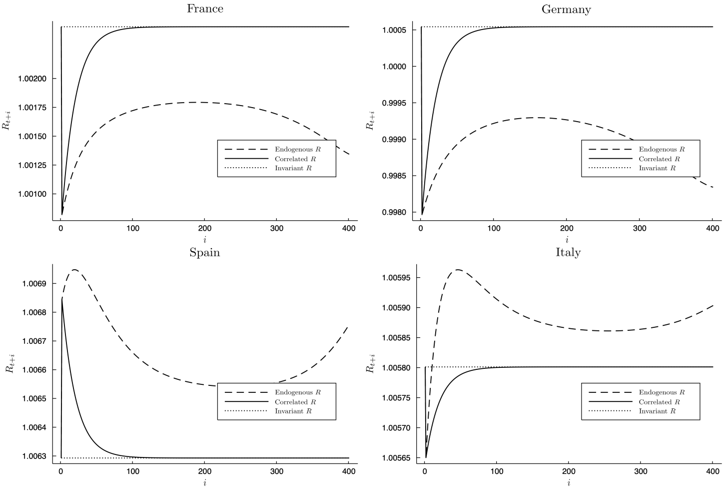


Figure: Interest Rates

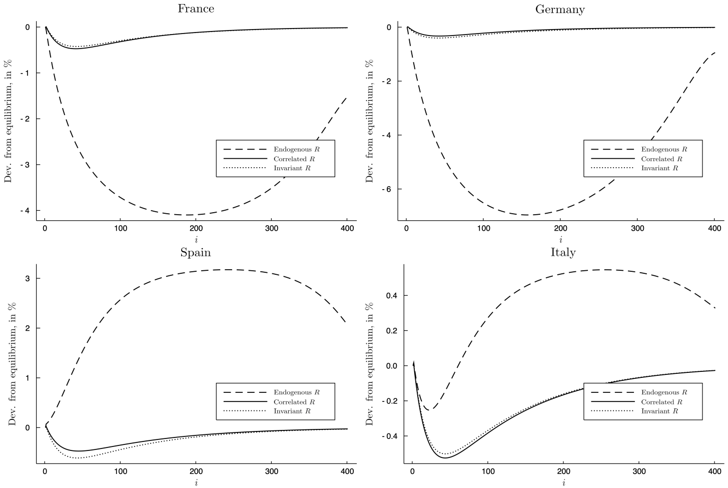


Figure: Savings

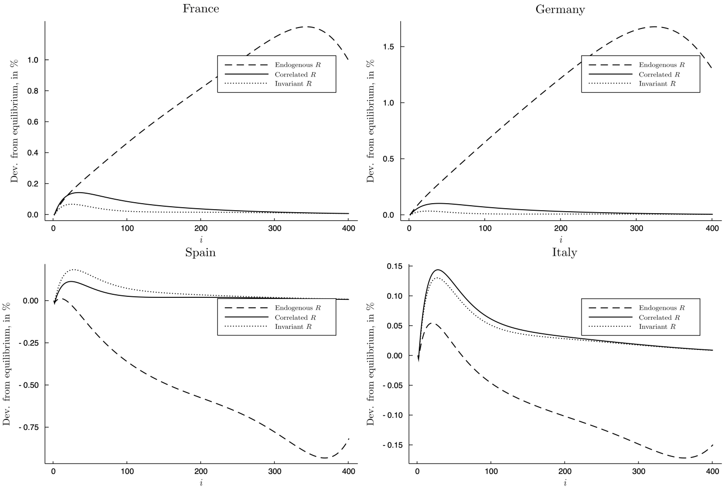

France
Germany
Spain
Italy
Endogenous R
Correlated R
Invariant R
Dev. from equilibrium, in %
i
0
100
200
300
400
0.0
0.2
0.4
0.6
0.8
1.0
0.5
1.5
0.00
- 0.25
- 0.50
- 0.75
0.05
0.10
0.15
- 0.05
- 0.10
- 0.15

Figure: Gini

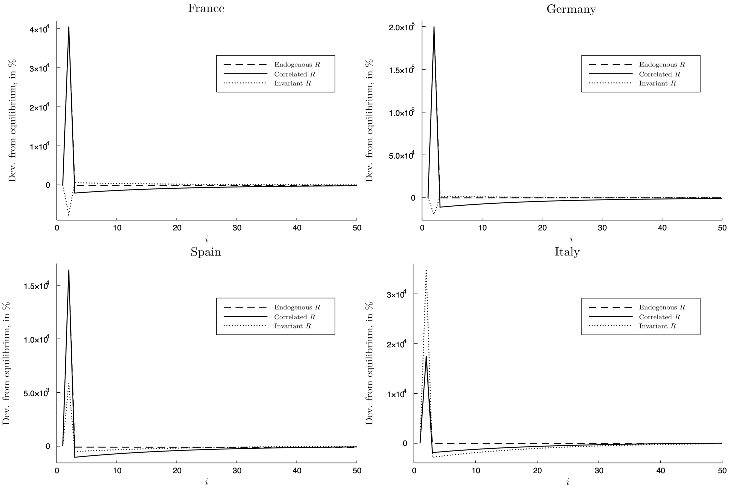


Figure: CA/GDP

Results & Discussion

Results:

- CA balances and inequalities originate from individual savings
- Countries with higher social mobility and lower dispersion of idiosyncratic productivities tend to be less unequal
- Core countries are more stable than the periphery when facing an aggregate shock
- A monetary union constrains the volatility of aggregate variables when a shock hits

Caveats:

- Flat taxes
- No redistribution
- No dynamic interactions between member states
- No comovements between aggregate and idiosyncratic shocks

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