Financial Heterogeneity and Monetary Union

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MEFM, NBER SI
Boston
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The views expressed should not be interpreted as reflecting the views of the Federal Reserve System or its staffs.
Eurozone Crisis (2009–?)

- Classic balance-of-payment crisis:
  - The mix of overvalued RERs and cheap credit fueled by economic optimism led to over- and mal-investment.
  - After the Global Financial Crisis came a sudden stop.

- Resolution of the crisis:
  - Realignment of overvalued RERs.
  - The mix of deflation in the “south” and reflation in the “north.”
  - Surprisingly hard to achieve—why?
Inflation and Output Dynamics in the Eurozone

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Panel-version of the NK Phillips curve:

\[
\pi_{it} = 0.449 \frac{E_t \pi_{i,t+1}}{(0.051)} + 0.533 \frac{\pi_{i,t-1}}{(0.049)} + 0.104 (y_{it} - \bar{y}_{it}) + \hat{\eta}_i + \hat{\epsilon}_{it}
\]

- AUT, DEU, BEL, FIN, FRA, NLD, GRC, IRL, ITA, ESP, PRT
- Annual data: 1970–2014 (unbalanced panel, Obs. = 429)

Is lack of deflationary pressures related to financial strains?
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Is lack of deflationary pressures related to financial strains?
Inflation Dynamics and Financial Strains

Sample Period: 2008-2014

Sovereign (5-year) CDS Spreads at t (pps., log scale)
Inflation Residuals at t+1 (pct.)

GIIPS
Core

0.5 1 5 10 20

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Empirics:
- Firms with strong balance sheets slashed prices.
- Firms with weak balance sheets raised prices.

Theory:
- Develops a GE model that can replicate such patterns.
- Emphasizes the interaction between financial market frictions and firms’ pricing decisions in customer markets.

Extend our framework to a two-country GE setting (“North” and “South”).
• Two countries: home \((h = \text{south})\) and foreign \((f = \text{north})\)

• Continuum of households in each country: \(j \in N_c \equiv [0, 1]\)

• Two types of goods: \(\left\{\begin{array}{l}
\text{home goods (} h \text{): } c_{i,h,t}^j, \ i \in N_h \equiv [1, 2] \\
\text{foreign goods (} f \text{): } c_{i,f,t}^j, \ i \in N_f \equiv [2, 3]
\end{array}\right\}

• CRRA in habit-adjusted consumption basket \(x_t^j\):

\[
\mathbb{E}_t \sum_{s=0}^{\infty} \beta^s U(x_{t+s}^j - \delta_{t+s}, h_{t+s}^j); \ j \in [0, 1]
\]

- \(\delta_t = \) persistent aggregate demand shock
- labor \((h)\) is immobile
Armington-Ravn-Schmitt-Grohe-Uribe aggregator:

\[ x_t^j = \left[ \sum_{k=h,f} \omega_k \left[ \int_{N_k} \left( c_{i,k,t}^j s_{i,k,t-1}^\theta \right)^{1-1/\eta} \frac{1}{\eta} \right]^{1/(1-1/\epsilon)} \right]^{1/(1-1/\epsilon)} \]

- \( \eta \) = elasticity of substitution within a type of goods
- \( \epsilon \) = elasticity of substitution between types of goods
- \( \theta > 0 \) governs the strength of deep habits
- \( 0 < \omega_k < 1 \) governs the degree of home bias in consumption

Law of motion for deep habits:

\[ s_{i,k,t} = \rho s_{i,k,t-1} + (1 - \rho) \int_{N_c} c_{i,k,t}^j d\eta; \quad k = h, f \]

- “Keeping up with the Joneses” at the good level.
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- “Keeping up with the Joneses” at the good level.
Continuum of monopolistically competitive firms producing variety of differentiated goods of type $h$ and type $f$.

Production function (labor input, fixed operating costs):

$$y_{it} = c_{i,h,t} + c^*_{i,h,t} = \left( \frac{A_t}{a_{it}} h_{it} \right)^{\alpha} - \phi; \quad i \in N_h \ (0 < \alpha \leq 1)$$

- $A_t = \text{persistent aggregate technology shock}$
- $a_{it} = \text{i.i.d. idiosyncratic shock w/ log } a_{it} \sim N(-0.5\sigma^2, \sigma^2)$
- $\phi = \text{servicing cost of fixed coupon long-term debt}$

Heterogeneity in financial capacity: $\phi > \phi^* = 0$
Financial frictions: costly external equity financing

- New shares sold at a discount because of asymmetric information
  - €1 claim raises only €(1 − φ_t) of funds
- “Lemons premium” φ_t ∼ AR(1) ⇒ financial shock
  - Makes expected shadow value of internal funds, E_t^a[\xi_{it}] > 1

Nominal rigidities: quadratic cost of adjusting nominal prices

Local currency pricing: law of one price does not apply
“Beggar Thy Neighbor” at the Micro Level

- Deep habits make investment in market share profitable:
  - Investment takes the form of low markups, which exposes firms to liquidity risk.
  - Optimal pricing strategy strikes the right balance.

- Price war:
  - Liquidity crisis in the South is a good time for firms in the North to steal market share by undercutting their competitors’ prices.

“Mr. Marchionne and other auto executives accuse Volkswagen of exploiting the crisis to gain market share by offering aggressive discounts. “It’s a bloodbath of pricing and it’s a bloodbath on margins,” he said.”

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- Assume flexible prices and no customer markets.
- When $\alpha = 1$, optimal pricing (home market) \( \Rightarrow \)

\[
p_{i,h,t} = \frac{\eta}{\eta - 1} \times \frac{E_t^a[\zeta_{it}a_{it}]}{E_t^a[\zeta_{it}]} \times \left[ \frac{w_t/p_{h,t}}{A_t} \right]
\]

- Financial frictions \( \Rightarrow \)

\[
\frac{E_t^a[\zeta_{it}a_{it}]}{E_t^a[\zeta_{it}]} = 1 + \text{Cov}[\zeta_{it}a_{it}] \geq 1
\]
Optimal Pricing with Deep Habits

- Bring back customer markets (still flexible prices!)

- Growth-adjusted, compounded discount rate:

  \[ \tilde{\beta}_{t,s} \equiv m_{s,s+1} \frac{s_{h,s+1} / s_{h,s} - \rho}{1 - \rho} \]

  \[ \times \prod_{j=1}^{s-t} \left[ \rho + \chi \frac{s_{h,t+j} / s_{h,t+j-1} - \rho}{1 - \rho} \right] m_{t+j-1,t+j} \]

- Optimal pricing \( \Rightarrow \)

  \[ p_{i,h,t} = \frac{\eta}{\eta - 1} \frac{E_t[a_{it} \xi_{it}]}{E_t[\xi_{it}]} \left[ \frac{w_t / p_{h,t}}{A_t} \right] \]

  \[ - \frac{\chi}{\eta - 1} E_t \left[ \sum_{s=t+1}^{\infty} \tilde{\beta}_{t,s} \frac{E_s[\xi_{i,s}]}{E_t[\xi_{i,t}]} \left( p_{h,s} - \frac{w_s / p_{h,s}}{A_s} \right) \right] \]
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## Calibration

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<th>Value</th>
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<td><strong>Preferences &amp; Technology</strong></td>
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<td>deep habit ($\theta$)</td>
<td>0.90</td>
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<td>persistence of deep habit ($\rho$)</td>
<td>0.90</td>
</tr>
<tr>
<td>elasticity of substitution b/w and w/in goods ($\eta, \epsilon$)</td>
<td>2.00, 1.50</td>
</tr>
<tr>
<td>fixed operating costs ($\phi, \phi^*$)</td>
<td>0.08, 0.00</td>
</tr>
<tr>
<td><strong>Nominal Rigidities</strong></td>
<td></td>
</tr>
<tr>
<td>price adjustment cost ($\gamma_p$)</td>
<td>10.0</td>
</tr>
<tr>
<td>wage adjustment cost ($\gamma_w$)</td>
<td>30.0</td>
</tr>
<tr>
<td><strong>Financial Frictions</strong></td>
<td></td>
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<tr>
<td>equity dilution cost ($\varphi$), $\mathbb{E}^a[\xi_i] = 1.12$,</td>
<td>0.30</td>
</tr>
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<td>idiosyncratic volatility, a.r. ($\sigma$)</td>
<td>0.10</td>
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<td>persistence financial shock ($\rho_\varphi$)</td>
<td>0.90</td>
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Implications of a Financial Shock in the South

In a monetary union \((\phi = 0.08, \phi^* = 0.00)\)

\[
\begin{align*}
\text{(a) GDP, pct} & \quad \text{(b) consumption, pct} & \quad \text{(c) hours, pct} & \quad \text{(d) int rate, pp} \\
\text{(e) RER(−), NER(−.), pct} & \quad \text{(f) inflation, pp} & \quad \text{(g) exports, pct} & \quad \text{(h) CA, pct of GDP}
\end{align*}
\]

Red = Foreign (North), Blue = Home (South)

NER (−−−) and RER (−−) are Home/Foreign
Implications of a Financial Shock in the South

Under floating exchange rates ($\phi = 0.08, \phi^* = 0.00$)

![Graphs showing economic indicators](image)

Red = Foreign (North), Blue = Home (South)

NER (⋅⋅⋅) and RER (−) are Home/Foreign
Heterogeneity As a Propagation Mechanism

- Alternative calibration: $\phi = \phi^* = 0.08$
- Financial shocks in both North and South.

Alternative = (---) and Baseline = (—)
We consider a simple VAT-payroll subsidy swap rule:

\[ \text{VAT}(\tau^V_t) + \text{payroll subsidy}(\zeta^P_t) \]

FD rules that are linear in the resource gap of the home country:

\[ \tau^V_t = \alpha^{FD} \times \log \left( \frac{y_t}{\bar{y}} \right) \]

Is there a parameter region that is mutually beneficial to both home and foreign countries?
Difference in welfare from the baseline w/o FD
When firms engage in market share competitions, differences in financial capacity across countries imply strong amplification mechanism: “beggar-thy-neighbor” at the micro-level.

Monetary union impedes adjustment of RERs and exacerbates the downturn in response to an adverse financial shock.

Unilateral fiscal devaluation by periphery may be welfare improving for both periphery and core.