Financial Heterogeneity and Monetary Union

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Eurozone Crisis (2008–2013)

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

Resolution of the crisis:
- Realignment of overvalued RERs between the periphery and core
- The mix of deflation in the periphery and reflation in the core
- Surprisingly hard to achieve—why?
“Missing Deflation” in the U.S.

- New empirical evidence on the firms’s price-setting behavior during the 2007–09 crisis:
  - Firms with strong balance sheets cut prices
  - Firms with weak balance sheets raised prices

- Similar patterns documented for the euro area
  - Montero & Urtasun [2014]; Antoun de Almeida [2015]; Montero [2017]; Duca et al. [2017]

- Theory:
  - GSSZ develop a DSGE model that can replicate such price and output patterns in periods of financial distress
  - Emphasizes the interaction between financial market frictions and firms’ pricing decisions in customer markets
    - Gottfries [1991]; Chevalier & Scharfstein [1996]
## Euro Area Inflation and Economic Activity

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Core</td>
<td>GIIPS</td>
<td>Core</td>
<td>GIIPS</td>
</tr>
<tr>
<td>Inflation</td>
<td>1.74</td>
<td>4.02</td>
<td>1.49</td>
<td>0.55</td>
</tr>
<tr>
<td>Output gap</td>
<td>−0.07</td>
<td>0.81</td>
<td>−0.73</td>
<td>−2.98</td>
</tr>
<tr>
<td>Unemployment gap</td>
<td>0.46</td>
<td>−0.60</td>
<td>−0.09</td>
<td>1.27</td>
</tr>
</tbody>
</table>

Core = AUT, DEU, BEL, FIN, FRA, NLD; GIIPS = GRC, IRL, ITA, ESP, PRT

Source: AMECO database.

Is lack of disinflationary pressures in the periphery during the crisis related to financial strains?
Financial Conditions and Inflation Dynamics

- Panel-versions of the price and wage Phillips Curves:
  - Prices (backward looking):
    \[ \pi_{it} = \alpha_i + \beta \pi_{i,t-1} + \lambda (u_{it} - \bar{u}_{it}) + \phi \Delta \text{VAT}_{it} + \psi \mathbb{1}[i \in \mathbb{E}] + \epsilon_{it}; \]
  - Prices (hybrid New Keynesian):
    \[ \pi_{it} = \alpha_i + \beta_f E_t \pi_{i,t+1} + \beta_b \pi_{i,t-1} + \lambda \hat{mc}_{it} + \phi \Delta \text{VAT}_{it} + \psi \mathbb{1}[i \in \mathbb{E}] + \epsilon_{it}, \]
  - Wages (backward looking):
    \[ \pi^w_{it} = \alpha_i + \beta \pi_{i,t-1} + \lambda (u_{it} - \bar{u}_{it}) + \phi \Delta \tilde{z}_{it} + \psi \mathbb{1}[i \in \mathbb{E}] + \epsilon_{it}; \]

- Data
  - Countries: AUT, DEU, BEL, FIN, FRA, NLD, GRC, IRL, ITA, ESP, PRT

Are the PC prediction errors during the crisis related to the degree of financial strains across countries?
## Estimated Euro Area Phillips Curves

<table>
<thead>
<tr>
<th>Explanatory Variables</th>
<th>Prices</th>
<th>Wages</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>(u_{it} - \bar{u}_{it})</td>
<td>-0.273</td>
<td>-0.529</td>
</tr>
<tr>
<td></td>
<td>(0.117)</td>
<td>(0.127)</td>
</tr>
<tr>
<td>(y_{it} - \bar{y}_{it})</td>
<td>.</td>
<td>.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(\pi_{i,t-1})</td>
<td>0.845</td>
<td>0.813</td>
</tr>
<tr>
<td></td>
<td>(0.046)</td>
<td>(0.046)</td>
</tr>
<tr>
<td>(E_t \pi_{i,t+1})</td>
<td>.</td>
<td>.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(\Delta \bar{z}_{it})</td>
<td>.</td>
<td>.</td>
</tr>
<tr>
<td>(\Delta \text{VAT}_{it})</td>
<td>0.091</td>
<td>0.072</td>
</tr>
<tr>
<td></td>
<td>(0.040)</td>
<td>(0.039)</td>
</tr>
<tr>
<td>(1[i \in \mathbb{E}])</td>
<td>-0.631</td>
<td>-0.657</td>
</tr>
<tr>
<td></td>
<td>(0.300)</td>
<td>(0.298)</td>
</tr>
<tr>
<td>Adj. (R^2)</td>
<td>0.839</td>
<td>0.845</td>
</tr>
<tr>
<td>Pr &gt; J</td>
<td>.</td>
<td>.</td>
</tr>
<tr>
<td>Equal coeff. on (u_{it} - \bar{u}_{it})</td>
<td>.</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

**NOTE:** Time-clustered standard errors in parentheses.
Financial Conditions in the Euro Area

Sovereign (5-year) CDS spreads

Periphery countries

Core countries

SOURCE: Markit.
Financial Conditions and PC Prediction Errors
Without time fixed effects, 2008–2013

<table>
<thead>
<tr>
<th>PC Prediction Error</th>
<th>Explanatory Variable</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Prices (homogeneous)</td>
<td>$\ln CDS_{i,t-1}$</td>
<td>0.198</td>
</tr>
<tr>
<td></td>
<td>$\ln CDS_{i,t-1} \times 1[i \in P]$</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2) Prices (heterogeneous)</td>
<td>0.043</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[−0.139, 0.227]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.601</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.218, 0.985]</td>
<td></td>
</tr>
<tr>
<td>(3) Hybrid NK</td>
<td>0.204</td>
<td>0.258</td>
</tr>
<tr>
<td></td>
<td>[0.028, 0.372]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.593</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.156, 1.030]</td>
<td></td>
</tr>
<tr>
<td>(4) Wages (homogeneous)</td>
<td>−0.008</td>
<td>0.110</td>
</tr>
<tr>
<td></td>
<td>[−0.100, 0.156]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>−0.776</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[−0.776, 1.030]</td>
<td></td>
</tr>
<tr>
<td>(5) Wages (heterogeneous)</td>
<td>0.085</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[−0.266, 0.251]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>−2.075</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[−1.425, 0.100]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>−3.082</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[−3.082, −1.069]</td>
<td></td>
</tr>
</tbody>
</table>

Note: Bootstrapped 95% confidence intervals in brackets.
## Financial Conditions and PC Prediction Errors

With time fixed effects, 2008–2013

<table>
<thead>
<tr>
<th>PC Prediction Error</th>
<th>Explanatory Variable</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\ln CDS_{i,t-1}$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$\ln CDS_{i,t-1} \times 1[i \in P]$</td>
<td></td>
</tr>
<tr>
<td>(1) Prices (homogeneous)</td>
<td>0.044</td>
<td>0.329</td>
</tr>
<tr>
<td></td>
<td>$[-0.239, 0.327]$</td>
<td></td>
</tr>
<tr>
<td>(2) Prices (heterogeneous)</td>
<td>0.684</td>
<td>0.419</td>
</tr>
<tr>
<td></td>
<td>$[0.369, 0.999]$</td>
<td></td>
</tr>
<tr>
<td>(3) Hybrid NK</td>
<td>0.125</td>
<td>0.205</td>
</tr>
<tr>
<td></td>
<td>$[-0.051, 0.301]$</td>
<td></td>
</tr>
<tr>
<td>(4) Wages (homogeneous)</td>
<td>$-1.364$</td>
<td>0.352</td>
</tr>
<tr>
<td></td>
<td>$[-2.221, -0.506]$</td>
<td></td>
</tr>
<tr>
<td>(5) Wages (heterogeneous)</td>
<td>$-2.196$</td>
<td>0.542</td>
</tr>
<tr>
<td></td>
<td>$[-2.731, -1.661]$</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** Bootstrapped 95% confidence intervals in brackets.
Price Markups
Euro area, 2000–2015

NOTE: The markup is equal to minus (100 times) the log or real unit labor costs (2008 = 1).
SOURCE: AMECO database.
## Financial Conditions and Price Markups

**Euro area, 2008–2013**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Explanatory Variable</th>
<th>In CDS$_{i,t-1}$</th>
<th>In CDS$_{i,t-1} \times 1[i \in P]$</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Aggregate markups</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1) Without time fixed effects</td>
<td></td>
<td>$-0.205$</td>
<td>$1.378$</td>
<td>$0.256$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$[-0.944, 0.534]$</td>
<td>$[0.557, 2.220]$</td>
<td></td>
</tr>
<tr>
<td>(2) With time fixed effects</td>
<td></td>
<td>$-0.312$</td>
<td>$1.148$</td>
<td>$0.681$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$[-0.528, -0.095]$</td>
<td>$[0.926, 1.372]$</td>
<td></td>
</tr>
<tr>
<td><strong>B. Sectoral markups</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(3) Without time fixed effects</td>
<td></td>
<td>$-0.442$</td>
<td>$2.556$</td>
<td>$0.057$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$[-2.135, 1.252]$</td>
<td>$[0.913, 4.198]$</td>
<td></td>
</tr>
<tr>
<td>(4) With time fixed effects</td>
<td></td>
<td>$-0.331$</td>
<td>$1.974$</td>
<td>$0.152$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$[-1.915, 1.254]$</td>
<td>$[1.244, 2.704]$</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** Bootstrapped 95% confidence intervals in brackets.
This paper:
- Extend GSSZ [2015] to a two-country setting (“core” and “periphery”)
- Study the consequences of forming a monetary union among countries with heterogeneous financial capacities

Implications:
- During a financial crisis in the periphery, firms from the core have an incentive to lower markups to gain market share
- Firms in the periphery are forced to raise markups to maintain current cashflows, thereby sacrificing future market shares
- RER appreciating for periphery rather than for core creates a feedback loop that reinforces liquidity crisis in the periphery
Policy Options

**Fiscal Devaluation:**
- Certain mixes of fiscal instruments replicate the devaluation
- When can a unilateral fiscal devaluation by the periphery be beneficial to the core?

**Fiscal Union:**
- Trading state-contingent bonds among heterogeneous countries
- Highly beneficial to the periphery but requires large transfers from the core
Preferences

- Two countries: home \((h = \text{periphery})\) and foreign \((f = \text{core})\)

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

- Two types of goods:
  \[
  \begin{aligned}
  \text{home goods (}h\text{)}: & \quad c^j_{i,h,t}, \ i \in N_h \equiv [0, 1] \\
  \text{foreign goods (}f\text{)}: & \quad c^j_{i,f,t}, \ i \in N_f \equiv [1, 2]
  \end{aligned}
  \]

- Preferences of household \(j\) in the home country:
  \[
  \mathbb{E}_t \sum_{s=0}^{\infty} \delta^s U(x^j_{t+s} - \omega_{t+s}, h^j_{t+s})
  \]
  - labor \((h)\) is \textbf{immobile}
  - \(\omega_t\): demand shock
“Deep Habits”
Ravn, Schmitt-Grohe & Uribe [2006]

Consumption/habit aggregator:

\[
X_t^j = \left[ \sum_{k=h,f} \Xi_k \left[ \int_{N_k} \left( \frac{C_{i,k,t}^j}{S_{i,k,t-1}^\theta} \right)^{1-1/\eta} \frac{1}{1-1/\eta} \frac{1}{1-1/\epsilon} \right]^{1/(1-1/\epsilon)} \right]^{1/(1-1/\epsilon)}
\]

- \( \eta > 0 \): elasticity of substitution within a type of goods
- \( \epsilon > 0 \): elasticity of substitution between the two types of goods
- \( 0 < \Xi_k < 1 \): degree of home bias in consumption
- \( s_{i,k,t} \): good-specific stock of habit
- \( \theta < 0 \): strength of “deep” habits

Law of motion for (external) deep habits:

\[
s_{i,k,t} = \rho s_{i,k,t-1} + (1 - \rho) \int_0^1 c_{i,k,t}^j dj; \quad k = h, f
\]

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

- Labor is the only input

Production function of home country firms:

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

- $A_t$: persistent aggregate technology shock
- $a_{it}$: i.i.d. idiosyncratic cost shock w/ $\ln a_{it} \sim N(-0.5\sigma^2, \sigma^2)$
- $\phi$: fixed costs $\Rightarrow$ firms can incur operating losses
- Homogeneous operating costs: $\phi = \phi^*$
Liquidity Risk

- **First half of period** $t$:
  - Collect information about the aggregate state of the economy
  - Post prices, take orders from customers, and plan production based on *expected* marginal cost

- **Second half of period** $t$:
  - Idiosyncratic uncertainty is resolved, and firms realize *actual* marginal cost
  - Hire labor to fulfill agreed-upon orders and produce output

- **End of period** $t$:
  - Pay out all operating profits as dividends
  - In the case of operating losses, the firm must issue new shares
Financial Frictions

- Costly external equity financing: (Myers & Majluf [1984]; Gomes [2001]; Stein [2003])
  - New shares sold at a discount because of asymmetric information
  - 1 € claim raises only $(1 − \phi) €$ of funds $(0 < \phi < 1)$

- Heterogeneity in financial capacity: $\phi^* < \phi$

- No cross-border ownership of firms. (Obstfeld & Rogoff [2000])
Nominal Rigidities

- Quadratic costs of adjusting nominal prices:
  \[ \frac{\gamma_p}{2} \left( \frac{P_{i,h,t}}{P_{i,h,t-1}} - 1 \right)^2 c_t + \frac{\gamma_p}{2} \frac{Q_t P_t^*}{P_t} \left( \frac{P_{i,h,t}^*}{P_{i,h,t-1}^*} - 1 \right)^2 c_t^* \]

  - \( Q_t \): nominal exchange rate (home/foreign currency)
  - Consumer price index (CPI) in the home country:
    \[ P_t \equiv \left[ \sum_{k=h,f} \Xi_k P_{k,t}^{1-\epsilon} \right]^{\frac{1}{1-\epsilon}} \]
    where \( P_{k,t} = \left[ \int_{N_k} P_{i,k,t}^{1-\eta} \, di \right]^{\frac{1}{1-\eta}} \) ; \( k = h, f \)

- Pricing to market: law of one price does not apply
  \( \text{(Fabiani, Loupias, Martins & Sabbatini [2007])} \)
The Firm’s Problem

Choose \( \{d_{i,t}, h_{i,t}, c_{i,h,t}, c_{i,h,t}^*, s_{i,h,t}, s_{i,h,t}^*, p_{i,h,t}, p_{i,h,t}^*\}_{t=0}^{\infty} \) to optimize

\[
\mathcal{L} = \mathbb{E}_0 \sum_{t=0}^{\infty} m_{0,t} \left\{ d_{i,t} + \kappa_{i,t} \left[ \left( \frac{A_t}{a_{i,t}} \right)^{\alpha} - \phi - (c_{i,h,t} + c_{i,h,t}^*) \right] + \tilde{\xi}_{i,t} \left[ p_{i,h,t} p_{h,t} c_{i,h,t} + q_t p_{i,h,t}^* p_{h,t}^* c_{i,h,t}^* - w_t h_{i,t} - d_{i,t} + \phi \min \{0, d_{i,t}\} \right] - \frac{\gamma_p}{2} \left( \frac{p_{i,h,t}}{p_{i,h,t-1}} \pi_{h,t} - 1 \right)^2 c_t - \frac{\gamma_p}{2} q_t \left( \frac{p_{i,h,t}^*}{p_{i,h,t-1}^*} \pi_{h,t}^* - 1 \right)^2 c_t^* \right. \\
+ \left. \nu_{i,h,t} \left[ (p_{i,h,t})^{-\eta} \tilde{p}_{h,t}^{\eta} s_{i,h,t-1}^{\theta(1-\eta)} x_{h,t} - c_{i,h,t} \right] + \nu_{i,h,t}^* \left[ (p_{i,h,t}^*)^{-\eta} \tilde{p}_{h,t}^{*\eta} s_{i,h,t-1}^{*\theta(1-\eta)} x_{h,t}^* - c_{i,h,t}^* \right] + \lambda_{i,h,t} [\rho s_{i,h,t-1} + (1-\rho)c_{i,h,t} - s_{i,h,t}] + \lambda_{i,h,t}^* [\rho s_{i,h,t-1}^* + (1-\rho)c_{i,h,t}^* - s_{i,h,t}^*] \right\}
\]
Optimal Financial Policy

- Firm issues new shares if and only if:

\[ a_{i,t} > a^E_t \equiv \frac{A_t}{w_t} \left[ \frac{p_{h,t}c_{h,t} + q_tp_{h, t}^*c_{h, t}^*}{(\phi + c_{h, t} + c_{h, t}^*)^{1/\alpha}} \right] \]

- First-order conditions for dividends:

\[ \xi_{i,t} = \begin{cases} 1 & \text{if } a_{i,t} \leq a^E_t \\ 1/(1 - \varphi) & \text{if } a_{i,t} > a^E_t \end{cases} \]

- Expected shadow value of internal funds:

\[ E_t^a[\xi_{i,t}] = 1 + \frac{\varphi}{1 - \varphi} \left[ 1 - \Phi(z_t^E) \right] \geq 1 \]

- \( z_t^E = (\ln a_t^E + 0.5\sigma^2)/\sigma \)
- \( \Phi(\cdot) = \) standard normal CDF
Optimal Pricing

Symmetric equilibrium

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

$$p_{h,t} = \frac{\eta}{\eta - 1} \times \frac{\mathbb{E}^a_t[\zeta_{it}a_{it}]}{\mathbb{E}^a_t[\zeta_{it}]} \times \left[ \frac{W_t}{P_t} \right]$$

- Financial frictions $\Rightarrow$

$$\mathbb{E}^a_t[\zeta_{it}] > 1$$
$$\frac{\mathbb{E}^a_t[\zeta_{it}a_{it}]}{\mathbb{E}^a_t[\zeta_{it}]} = 1 + \text{Cov}[\zeta_{it}a_{it}] \geq 1$$
Optimal Pricing (cont.)

Symmetric equilibrium

- Bring back customer markets (still flexible prices!)
- Growth-adjusted, compounded discount rate:

\[ \beta_{h,t,s} = \begin{cases} 
  m_{s-1,s}g_{h,s} & \text{if } s = t + 1; \\
  m_{s-1,s}g_{h,s} \times \prod_{j=1}^{s-(t+1)} (\rho + \chi g_{h,t+j}) m_{t+j-1,t+j} & \text{if } s > t + 1;
\end{cases} \]

where \( g_{h,t} = \frac{s_{h,t}/s_{h,t-1}-\rho}{1-\rho} \) and \( \chi = (1 - \rho)\theta(1 - \eta) > 0 \)

- Optimal pricing \(\Rightarrow\)

\[
\rho_{h,t} = \frac{\eta}{\eta - 1} \frac{\mathbb{E}_t^{a}[\xi_{it}a_{it}]}{\mathbb{E}_t^{a}[\xi_{it}]} \left[ \frac{W_t}{P_t} \right] \]
\[
+ (1 - \rho)\theta \eta \mathbb{E}_t \sum_{s=t+1}^{\infty} \beta_{h,t,s} \frac{\mathbb{E}_s^{a}[\xi_{is}]}{\mathbb{E}_t^{a}[\xi_{i,t}]} \left( \rho_{h,s} - \frac{\mathbb{E}_s^{a}[\xi_{is}a_{is}]}{\mathbb{E}_t^{a}[\xi_{is}]} \left[ \frac{W_s}{P_s} \right] \right)
\]
International Bond Market

Monetary union

Euler equations:

\[
1 = \delta E_t \left[ \frac{U_{x,t+1}/\tilde{p}_{t+1}}{U_{x,t}/\tilde{p}_t} \frac{R^U_t}{\pi_{t+1}} \frac{1}{1 + \tau b_{t+1}} \right]
\]

\[
1 = \delta E_t \left[ \frac{U^*_{x,t+1}/\tilde{p}^*_{t+1}}{U^*_{x,t}/\tilde{p}^*_t} \frac{q_t}{q_{t+1}} \frac{R^U_t}{\pi^*_{t+1}} \frac{1}{1 + \tau b^*_{t+1}} \right]
\]

Law of motion for bond holdings:

\[
b_{t+1} = \frac{R^U_{t-1}}{\pi_t} b_t + \frac{1}{2} (w_t h_t - q_t w^*_t h^*_t) + \frac{1}{2} (\tilde{a}_t - q_t \tilde{a}^*_t) - \frac{1}{2} (\tilde{p}_t x_t - q_t \tilde{p}^*_t x^*_t)
\]
### Calibration Summary

<table>
<thead>
<tr>
<th>Key Model Parameters</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Preferences &amp; Technology</strong></td>
<td></td>
</tr>
<tr>
<td>strength of deep habits ((\theta))</td>
<td>(-0.86)</td>
</tr>
<tr>
<td>persistence of deep habits ((\rho))</td>
<td>0.85</td>
</tr>
<tr>
<td>elasticity of substitution b/w and w/i goods ((\eta, \epsilon))</td>
<td>((2.00, 1.50))</td>
</tr>
<tr>
<td>fixed operating costs ((\phi, \phi^*))</td>
<td>((0.10, 0.10))</td>
</tr>
<tr>
<td>idiosyncratic volatility ((\sigma))</td>
<td>0.15</td>
</tr>
<tr>
<td><strong>Nominal Rigidities</strong></td>
<td></td>
</tr>
<tr>
<td>price adjustment costs ((\gamma_p))</td>
<td>10.0</td>
</tr>
<tr>
<td>wage adjustment costs ((\gamma_w))</td>
<td>30.0</td>
</tr>
<tr>
<td><strong>Financial Frictions</strong></td>
<td></td>
</tr>
<tr>
<td>equity dilution costs ((\phi, \phi^*)), (E_t^a[\xi_{it}] = 1.16)</td>
<td>((0.20, 0.02))</td>
</tr>
</tbody>
</table>
Financial Shocks

- Temporary but persistent increase in the cost of external finance:

\[ \varphi_t = \varphi \times f_t, \quad \ln f_t = 0.90 \times \ln f_{t-1} + \epsilon_{f,t}, \quad \epsilon_{f,t} \sim N(-0.5\sigma_f^2, \sigma_f^2) \]

- Asymmetric shock \( \Rightarrow \) affects the home country only.

- Size of the shock: \( \varphi_t \rightarrow 1.5\varphi \) upon impact
Implications of an Asymmetric Financial Shock

Monetary union ($\varphi = 0.20$, $\varphi^* = 0.02$)

(a) Production

(b) Consumption

(c) Hours worked

(d) Interest rate

(e) Exchange rate

(f) Inflation

(g) Exports

(h) Net exports

NOTE: Exchange rates are expressed as home currency relative to foreign currency.
Implications of an Asymmetric Financial Shock
Flexible exchange rates ($\varphi = 0.20$, $\varphi^* = 0.02$)

(a) Production
(b) Consumption
(c) Hours worked
(d) Interest rate
(e) Exchange rate
(f) Inflation
(g) Exports
(h) Net exports

**NOTE:** Exchange rates are expressed as home currency relative to foreign currency.
Asymmetric Financial Shock and Price Dynamics

Monetary union vs. flexible exchange rates ($\varphi = 0.20$, $\varphi^* = 0.02$)

(a) Relative prices
   Home country

(b) Market share
   Home country

(c) Wage inflation

(d) Relative prices
   Foreign country

(e) Market share
   Foreign country

(f) Markup
How does the periphery fare in a situation where the core has equally distorted financial markets and the whole union experiences financial distress?

**Symmetric calibration:**
- Same degree of financial market frictions: $\varphi = \varphi^* = 0.2$
- Same financial shock: $\epsilon_t = \epsilon^*_t > 0$
Implications of Financial Heterogeneity

Monetary union ($\varphi = \varphi^* = 0.20$, $\epsilon_t = \epsilon_t^* > 0$)

(a) Real GDP
Home country

(b) Consumption
Home country

(c) Inflation
Home country

(d) Markup
Home country

(e) Real GDP
Foreign country

(f) Consumption
Foreign country

(g) Inflation
Foreign country

(h) Markup
Foreign country
# Welfare Consequences of a Monetary Union

Heterogeneous financial capacity ($\varphi = 0.20$, $\varphi^* = 0.02$)

<table>
<thead>
<tr>
<th></th>
<th>$\mu(c_U)/\mu(c_F)$</th>
<th>$\sigma(c_U)/\sigma(c_F)$</th>
<th>$\sigma(h_U)/\sigma(h_F)$</th>
<th>CE (pct.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home country</td>
<td>0.99</td>
<td>1.55</td>
<td>2.92</td>
<td>2.53</td>
</tr>
<tr>
<td>Foreign country</td>
<td>1.01</td>
<td>1.51</td>
<td>4.31</td>
<td>-0.11</td>
</tr>
</tbody>
</table>
Welfare Gains and Losses
The role of deep habits ($\theta, \rho$)

- $O$ = welfare greater under flexible exchange rates
- $X$ = welfare greater under monetary union
Optimal Monetary Policy
Monetary union ($\varphi = 0.20, \varphi^* = 0.02$)

(a) Production
(b) Consumption
(c) Hours worked
(d) Interest rate
(e) Exchange rate
(f) Inflation
(g) Exports
(h) Net exports

NOTE: Exchange rates are expressed as home currency relative to foreign currency.
Theory of Fiscal Devaluation
Adao, Correia & Teles [2009]; Farhi, Gopinath & Itskhoki [2014]

- EU countries have considered swapping VAT and payroll subsidies:
  - VAT is a discriminatory tax on imported goods.
  - For revenue-neutrality, payroll subsidy to domestic firms.

- Consider payroll subsidy ($\zeta_t^P$) financed by VAT ($\tau_t^V$):
  - Marginal revenue (home country firm): $(1 - \tau_t^V)p_{h,t}$
  - Marginal labor cost (home country firm): $(1 - \zeta_t^P)w_{h,t}$
  - Marginal revenue (foreign country firm): $(1 - \tau_t^V)p_{f,t}/q_t$

- Modified equity issuance threshold:

$$a_t^E = \frac{A_t}{(1 - \zeta_t^P)w_t} \left[ \frac{p_{h,t}(1 - \tau_t^V)c_{h,t} + qt^*p_{h,t}c_{h,t}^*}{(\phi + c_{h,t} + c_{h,t}^*)^{1/\alpha}} \right]$$
Implementable Plan

- Linear and revenue neutral FD rules:
  \[
  \tau_t^v = \frac{\Delta_t}{1 + \Delta_t} \\
  \Delta_t = -\alpha^{FD} \times \ln \left( \frac{y_t}{\bar{y}} \right) \quad (\alpha^{FD} > 0) \\
  \zeta_t^P w_t h_t = \tau_t^v \times (p_{h,t} c_{h,t} + p_{f,t} c_{f,t})
  \]

- Foreign country does not retaliate
- Home country firms are not subject to VAT in the foreign country

- Is there a region for $\alpha^{FD}$ that is mutually beneficial to both home and foreign countries?
Welfare Implications of Fiscal Devaluations

Monetary union ($\varphi = 0.20$, $\varphi^* = 0.02$)

(a) Deep habits: $\theta = -0.3$; $\rho = 0.3$
(b) Deep habits: $\theta = -0.86$; $\rho = 0.85$
(c) Deep habits: $\theta = -0.95$; $\rho = 0.95$
Welfare Implications of Fiscal Devaluations

The role of financial frictions
Optimal Fiscal Devaluation

Monetary union ($\varphi = 0.20$, $\varphi^* = 0.02$)

(a) Production
Home country

(b) Production
Foreign country

(c) Consumption
Home country

(d) Consumption
Foreign country

(e) Net exports
Home country

(f) Net exports
Foreign country

(g) Value-added tax
Home country

(h) Payroll subsidy
Home country
Price Dynamics and Optimal Fiscal Devaluation

Monetary union ($\varphi = 0.20, \varphi^* = 0.02$)

(a) Relative prices
Home country

(b) Market share
Home country

(c) Wage inflation

(d) Relative prices
Foreign country

(e) Market share
Foreign country

(f) Markup
Summary

- With customer markets, differences in financial capacity across countries imply a strong amplification mechanism.

- 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.
**Optimal Fiscal Devaluation**

**Home country – external position**

(a) Exports

(b) Imports

(c) Real exchange rate

(c) Current account

**Note:** Exchange rates are expressed as home currency relative to foreign currency.
Optimal Fiscal Devaluation
Consumption and relative prices

(a) Cons. of h-type goods
Home country

(b) Cons. of f-type goods
Home country

(c) Rel. price of h-type goods
Home country

(d) Rel. price of f-type goods
Home country

(e) Cons. of h-type goods
Foreign country

(f) Cons. of f-type goods
Foreign country

(g) Rel. price of h-type goods
Foreign country

(h) Rel. price of f-type goods
Foreign country
Relative Import Shares
Euro area periphery and core, 2008–2015

By broad economic categories
Index(2008=100)

Trade-weighted aggregates
Index(2008=100)

Average
Median