Financial Heterogeneity and Monetary Union

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European Central Bank
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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?
Lessons from the Financial Crisis in the U.S.
Gilchrist, Raphael, Sim & Zakrajšek [2015]

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.
Relative Inflation
Financially unconstrained vs constrained firms

Note: Weighted average monthly inflation relative to industry (2-digit NAICS) inflation.
Exhibit 4: Is This a One-Off Event?
· Use detailed industry-level PPIs to examine the sensitivity of inflation to changes in aggregate financial conditions during the 1973 - 2013 period.

- Current and lagged inflation
- Current and lagged growth in industry-level industrial production
- Current commodity price inflation measured by GSCI

Coefficients on EBP and commodity price inflation vary across 4-digit industry groups.

Is variation in industry-specific EBP coefficients related to the likelihood of financial constraints across industries?

Empirical approach
Regress industry-specific year-ahead inflation on
Indicator of current financial conditions - excess bond premium (EBP)
Use industry-specific size-age index to identify the likelihood of financial constraints

Coefficient on EBP (4-digit NAICS)
Median Size-Age Index (4-digit NAICS)

\( p < .10 \)
\( p \geq .10 \)
\( \hat{\beta} = 1.11 \)
\( |t| = 4.88 \)
R-sq = 0.29

Note: Smaller values of the size-age index indicate a smaller likelihood of financial constraints.

12-month PPI inflation and financial conditions
By industry-specific indicator of financial constraints

Coefficient on GSCI (4-digit NAICS)
Median Size-Age Index (4-digit NAICS)

\( p < .10 \)
\( p \geq .10 \)
\( \hat{\beta} = 0.01 \)
\( |t| = 1.39 \)
R-sq = 0.03

Note: Smaller values of the size-age index indicate a smaller likelihood of financial constraints.
Inflation and Output Dynamics in the Eurozone

<table>
<thead>
<tr>
<th></th>
<th>1992-2008</th>
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Panel-version of the NK Phillips curve:

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

- 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?
### Inflation and Output Dynamics in the Eurozone

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#### 1992-2008 vs. 2009-2014

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- **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?**
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
Heterogeneity as Propagation Mechanism

This paper:

- Extend the GSSZ theoretical framework to a two-country GE framework.
- Study the consequences of forming a currency union among countries with heterogeneous financial conditions.

Price War

- During periphery’s liquidity crisis, core has a strong incentive to slash markup to gain market share both home and abroad.
- In contrast, periphery is forced to raise prices to secure cashflow, cannibalizing its own future market share.

Self-Reinforcing Crisis

- Possibility of RERs to appreciate for periphery rather than for core, a feedback loop that reinforces the liquidity crisis of periphery.
Policy Options

- **Fiscal Union:**
  - Trading state-contingent bonds among heterogeneous countries.
  - Highly beneficial to periphery but requires large transfers from core.
  - Are the costs of fiscal union bearable by core countries?

- **Fiscal Devaluation:**
  - Certain mixes of fiscal instruments replicate the devaluation.
  - When can a unilateral fiscal devaluation be beneficial to core?
  - Depends on the strength of externality created by financial friction.
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:

- Home goods \((h)\):
  \[ c_{i,h,t}^j, \quad i \in N_h \equiv [1, 2] \]
- Foreign goods \((f)\):
  \[ c_{i,f,t}^j, \quad i \in N_f \equiv [2, 3] \]

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

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

- Labor \((h)\) is immobile
Armington-Ravn-Schmitt-Grohe-Uribe aggregator:

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

- \( \eta \) = 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:

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

- “Keeping up with the Joneses” at the good level.
Armington-Ravn-Schmitt-Grohe-Uribe aggregator:

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

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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):

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

- $A_t =$ persistent aggregate technology shock
- $a_{it} =$ i.i.d. idiosyncratic shock w/ log $a_{it} \sim N(-0.5\sigma^2, \sigma^2)$
- $\phi =$ 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[ζ_{it}] > 1

Nominal rigidities: quadratic cost of adjusting nominal prices

Local currency pricing: law of one price does not apply
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 competitors’ prices in the south.

“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.”

“Beggar Thy Neighbor” at the Micro Level

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Optimal Pricing without Deep Habits

- Assume flexible prices and no customer markets.

- When $\alpha = 1$, optimal pricing (home market) $\Rightarrow$

$$p_{i,h,t} = \frac{\eta}{\eta - 1} \times \frac{\mathbb{E}_t^a[\zeta_{it} a_{it}]}{\mathbb{E}_t^a[\zeta_{it}]} \times \left[ \frac{w_t}{\rho_{h,t}} \right] \frac{A_t}{\mathbb{E}_t[\zeta_{it}]}$$

  - accounting markup
  - economic markup
  - real marginal cost

- Financial frictions $\Rightarrow$

$$\frac{\mathbb{E}_t^a[\zeta_{it} a_{it}]}{\mathbb{E}_t^a[\zeta_{it}]} = 1 + \text{Cov}[\zeta_{it} a_{it}] \geq 1$$
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 ⇒

\[ p_{i,h,t} = \frac{\eta}{\eta - 1} \frac{\mathbb{E}^a_t[\xi_{it}a_{it}]}{\mathbb{E}^a_t[\xi_{it}]} \left[ \frac{w_t/p_{h,t}}{A_t} \right] - \frac{\chi}{\eta - 1} \mathbb{E}_t \left[ \sum_{s=t+1}^{\infty} \tilde{\beta}_{t,s} \frac{\mathbb{E}_s^a[\xi_{i,s}]}{\mathbb{E}^a_t[\xi_{i,t}]} \left( p_{h,s} - \frac{w_s/p_{h,s}}{A_s} \right) \right] \]
Bring back customer markets (still flexible prices!)

Growth-adjusted, compounded discount rate:

\[ \tilde{\beta}_{t,s} \equiv m_{s,s+1} \frac{s_{h,s+1}/s_h,s - \rho}{1 - \rho} \]
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Optimal pricing \( \Rightarrow \)

\[ p_{i,h,t} = \frac{\eta}{\eta - 1} \frac{\mathbb{E}_t^a[\xi_i a_{it}]}{\mathbb{E}_t^a[\xi_i]} \left[ \frac{w_t / p_{h,t}}{A_t} \right] \]
\[ - \frac{\chi}{\eta - 1} \mathbb{E}_t \left[ \sum_{s=t+1}^{\infty} \tilde{\beta}_{t,s} \frac{\mathbb{E}_s[\xi_{i,s}]}{\mathbb{E}_t^a[\xi_i]} \left( p_{h,s} - \frac{w_s / p_{h,s}}{A_s} \right) \right] \]
<table>
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<th>Key Model Parameters</th>
<th>Value</th>
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<tr>
<td>Preferences &amp; Technology</td>
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<tr>
<td>deep habit ($\theta$)</td>
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<td>persistence of deep habit ($\rho$)</td>
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<tr>
<td>elasticity of substitution b/w and w/in goods ($\eta, \epsilon$)</td>
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<td>fixed operating costs ($\phi, \phi^*$)</td>
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<td>Nominal Rigidities</td>
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<td>price adjustment cost ($\gamma_p$)</td>
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<td>wage adjustment cost ($\gamma_w$)</td>
<td>30.0</td>
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<td>Financial Frictions</td>
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<td>equity dilution cost ($\varphi$), $\mathbb{E}[\xi_i] = 1.12,$</td>
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Implications of a Financial Shock in the South

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

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

NER (\cdot\cdot\cdot) and RER (\cdot\cdot) are Home/Foreign
Implications of a Financial Shock in the South
Under floating exchange rates ($\phi = 0.08$, $\phi^* = 0.00$)

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

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

NER (−−) and RER (−) are Home/Foreign
Alternative calibration: $\phi = \phi^* = 0.08$

- Financial shocks in both North and South.

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

$$\text{VAT}(\tau_t^V) + \text{payroll subsidy}(\zeta_t^P)$$

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

$$\tau_t^V = \alpha^{FD} \times \log \left( \frac{y_t}{\bar{y}} \right)$$

Is there a parameter region that is mutually beneficial to both home and foreign countries?
Fiscal Devaluation vs Flexible Exchange Rates

\[ \alpha^{FD^*} = \arg \max_{\alpha^{FD}} \left\{ U(x_t - \delta_t, h_t) + \beta \mathbb{E}_t[V(s_{t+1})] \right\} \]

Figure: Monetary Union w/ and w/o optimal FD vs Floating
Welfare

Difference in welfare from the baseline w/o FD

\[ \Delta W \]

\[ \Delta W^* \]
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.
**Prices and Market Shares**

**Figure:** Financial Shock, Relative Prices and Market Shares

(a) relative price, home markets, pct

(b) relative price, foreign markets, pct

(c) market share, home markets, pct

(d) market share, foreign markets, pct

(e) wage inflation, pp

(f) markup, pct

- **Home, floating**
- **Foreign, floating**
- **Home, union**
- **Foreign, union**
Some Evidence: Market Share Dynamics During the Crisis

2010Q1=1.0

Figure 8: Euro-zone Market Share Dynamics

Portugal Export to Germany GDP
Germany Export to Portugal GDP

Italy Export to Germany GDP
Germany Export to Italy GDP

Greece Export to Germany GDP
Germany Export to Greece GDP

Spanish Export to German GDP
Germany Export to Spanish GDP

Note: Blue lines show the ratios of nominal values of export from Portugal, Italy, Greece, and Spain to Germany relative to Germany’s nominal GDP. Red lines show the ratios of nominal values of German exports to these countries relative to these countries’ nominal GDPs. Export excludes energy, commodities, and agricultural products. The ratios are normalized to one in 2010Q1.