Financial Heterogeneity and Monetary Union

S. Gilchrist[1] R. Schoenle[2] J. Sim[3] E. Zakrajšek[3]

Boston University[1]
Brandeis University[2]
Federal Reserve Board[3]

European Central Bank

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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?

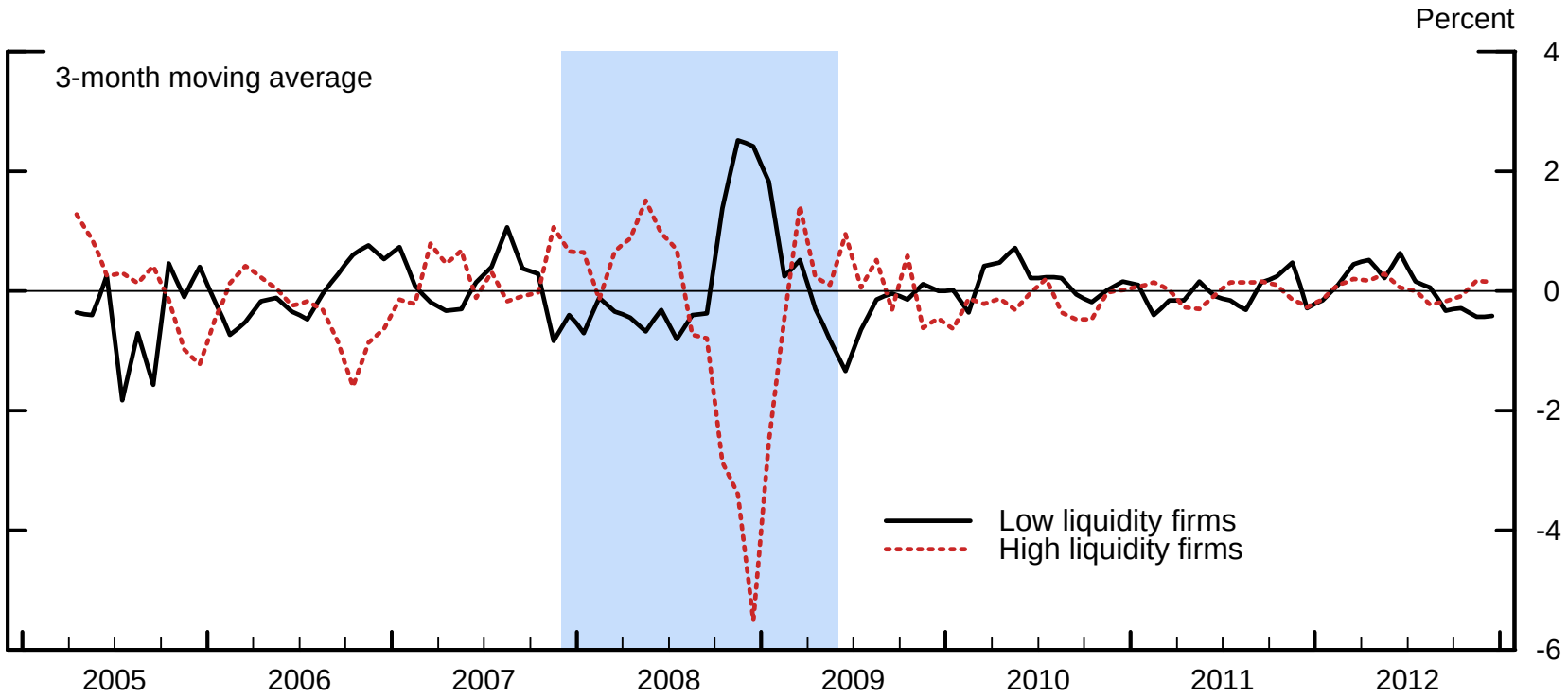
Lessons from the Financial Crisis in the U.S.

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.

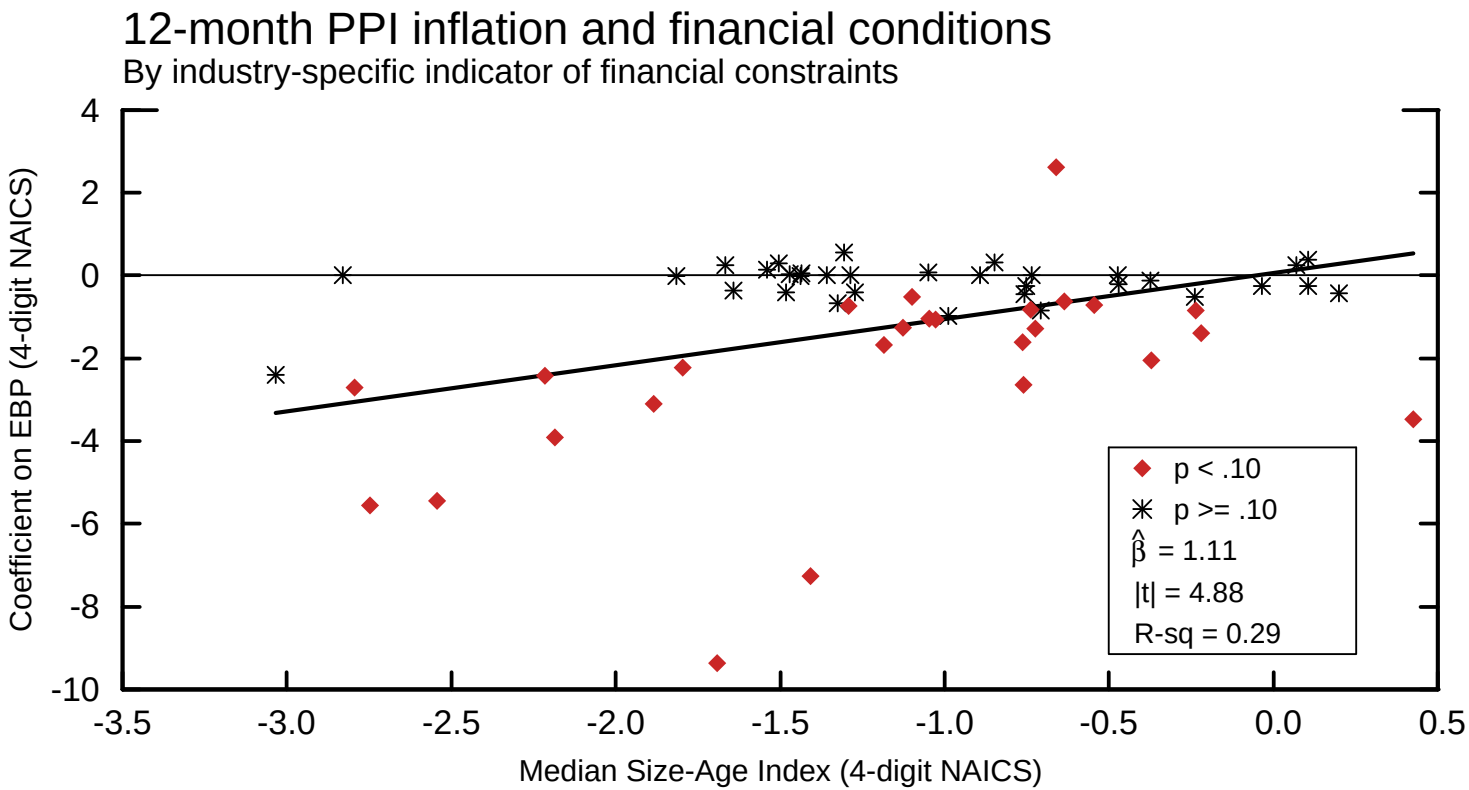
Relative Inflation

Financially unconstrained vs constrained firms



Note: Weighted average monthly inflation relative to industry (2-digit NAICS) inflation.

Inflation Response to EBP



Inflation and Output Dynamics in the Eurozone

	1992-2008		2009-2014	
	Core	GIIPS	Core	GIIPS
Avg. inflation (%)	1.58	3.34	1.22	0.66
Avg. output gap (%)	0.32	0.81	-1.38	-4.88

- Panel-version of the NK Phillips curve:

$$\pi_{it} = \underset{(0.051)}{0.449}\, E_t \pi_{i,t+1} + \underset{(0.049)}{0.533}\, \pi_{i,t-1} + \underset{(0.048)}{0.104}\, (y_{it} - \bar{y}_{it}) + \hat{\eta}_i + \hat{\epsilon}_{it}$$

  - 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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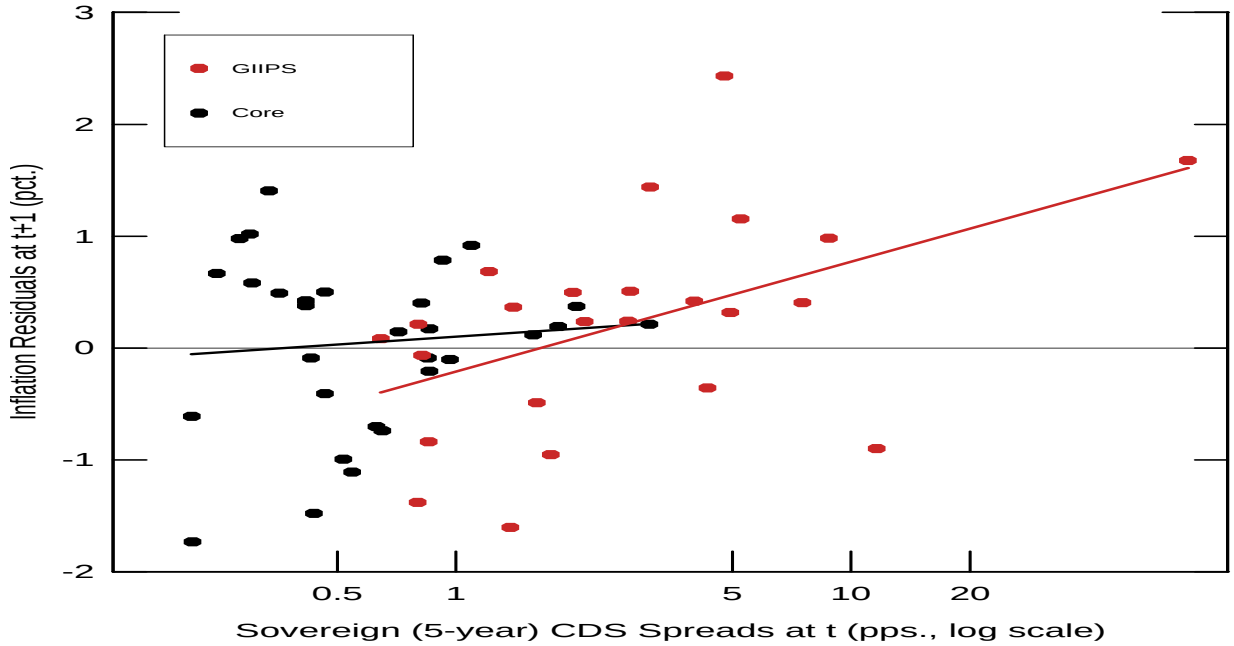
Inflation Dynamics and Financial Strains

Sample Period: 2008-2014



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.

Preferences

- Two countries: home (h = south) and foreign (f = north)
- Continuum of households in each country: $j \in N_c \equiv [0,1]$
- Two types of goods: $\begin{cases} \text{home goods } (h): & c^j_{i,h,t},\ i \in N_h \equiv [1,2] \\ \text{foreign goods } (f): & c^j_{i,f,t},\ i \in N_f \equiv [2,3] \end{cases}$
- CRRA in habit-adjusted consumption basket x^j_t:

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

  - labor (h) is immobile

Deep Habits

Ravn, Schmitt-Grohe & Uribe [2006]

- Armington-Ravn-Schmitt-Grohe-Uribe aggregator:

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

  - $\eta =$ 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.

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Technology

- 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/ $\log a_{it} \sim N(-0.5\sigma^2, \sigma^2)$
  - ϕ = servicing cost of fixed coupon long-term debt
- Heterogeneity in financial capacity: $\phi > \phi^* = 0$

Frictions

- Financial frictions: costly external equity financing
  - New shares sold at a discount because of asymmetric information

    €1 claim raises only $€(1-\varphi_t)$ of funds
  - "Lemons premium" $\varphi_t \sim$ AR(1) $\Rightarrow$ financial shock
  - Makes expected shadow value of internal funds, $\mathbb{E}_t^a[\tilde{\varsigma}_{it}] > 1$
- 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 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."

– *The New York Times*, July 25, 2012

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Optimal Pricing without Deep Habits

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

$$p_{i,h,t} = \underbrace{\underbrace{\frac{\eta}{\eta - 1}}_{\text{accounting markup}} \times \frac{\mathbb{E}_t^a[\xi_{it} a_{it}]}{\mathbb{E}_t^a[\xi_{it}]}}_{\text{economic markup}} \times \underbrace{\left[\frac{w_t / p_{h,t}}{A_t}\right]}_{\text{real marginal cost}}$$

- Financial frictions $\Rightarrow$

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

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 $\Rightarrow$

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

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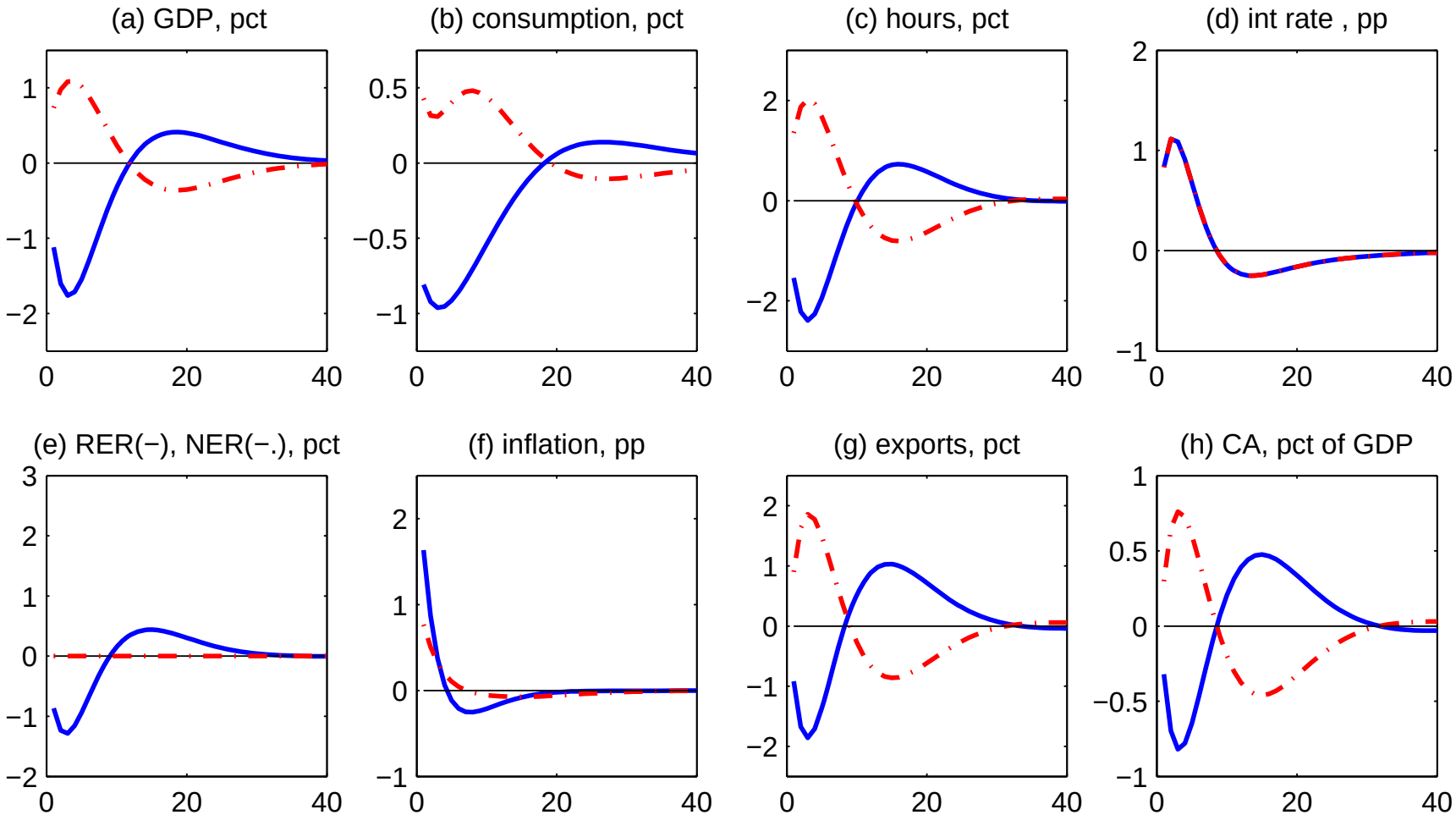
Calibration

Key Model Parameters	Value
Preferences & Technology	
deep habit (θ)	0.90
persistence of deep habit (ρ)	0.90
elasticity of substitution b/w and w/in goods (η, ϵ)	2.00, 1.50
fixed operating costs (ϕ, ϕ^*)	0.08, 0.00
Nominal Rigidities	
price adjustment cost (γ_p)	10.0
wage adjustment cost (γ_w)	30.0
Financial Frictions	
equity dilution cost (φ), $\mathbb{E}^a[\xi_i] = 1.12$,	0.30
idiosyncratic volatility, a.r. (σ)	0.10
persistence financial shock (ρ_φ)	0.90

Implications of a Financial Shock in the South

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

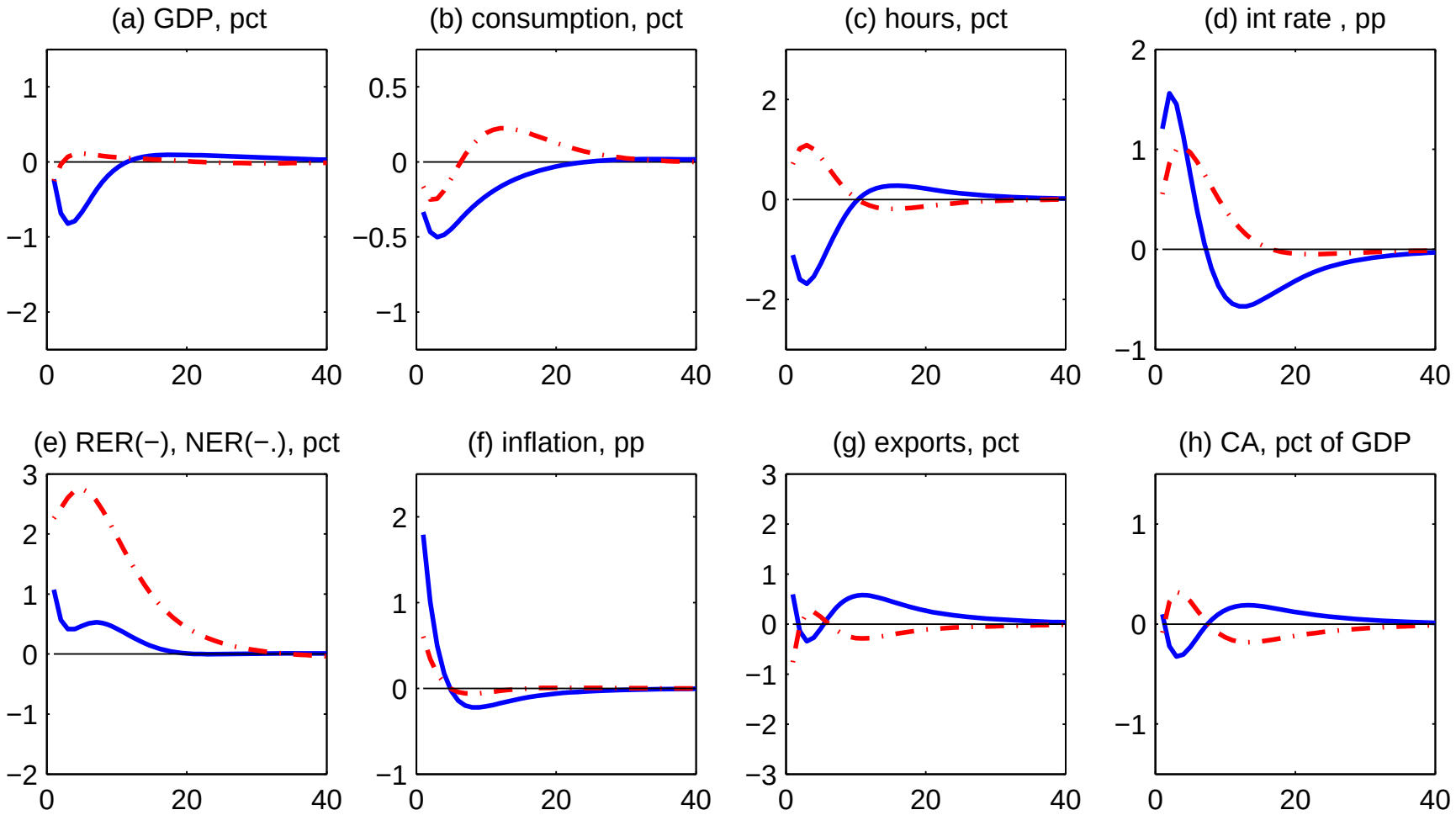


Red = Foreign (North) , Blue = Home (South)

NER $(\cdot - \cdot)$ and RER $(-)$ are Home/Foreign

Implications of a Financial Shock in the South

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



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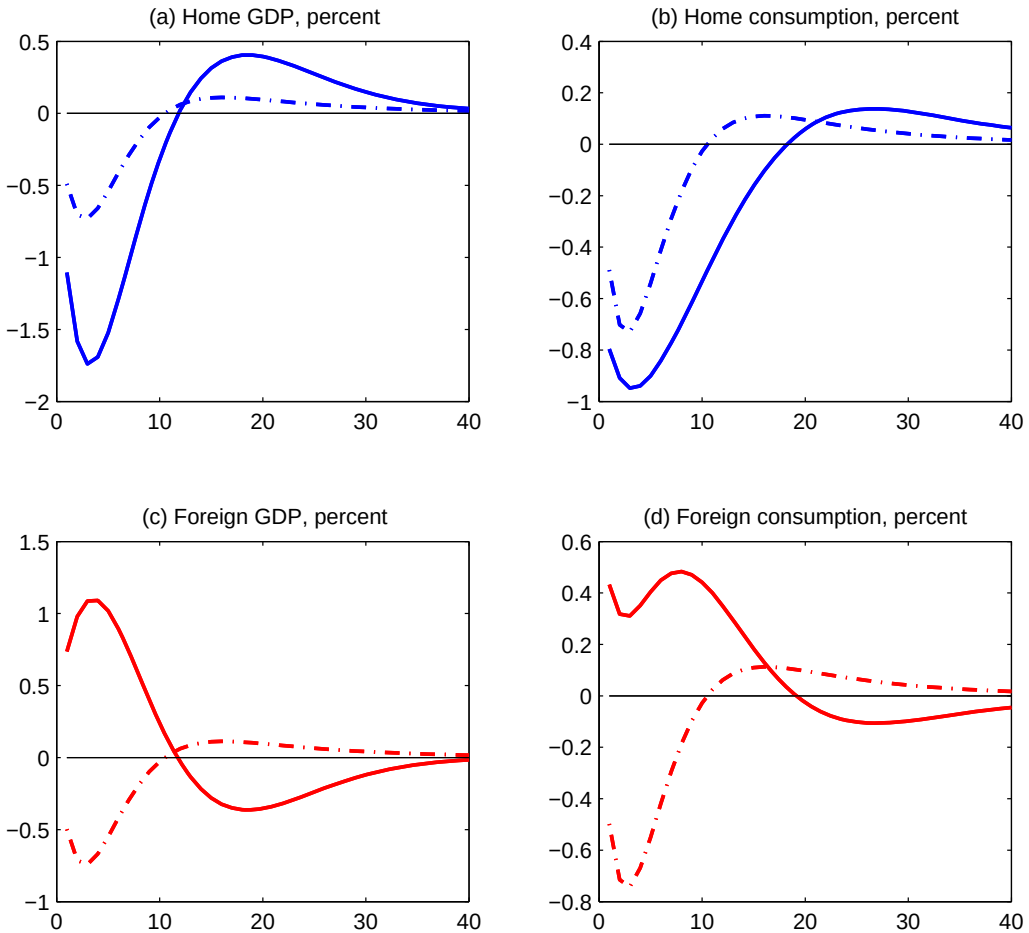
The effect of Heterogeneity

In a monetary union

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



Alternative $= (\cdot - \cdot)$ and Baseline $= (-)$

Fiscal Devaluation

- We consider a simple VAT-payroll subsidy swap rule:

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

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

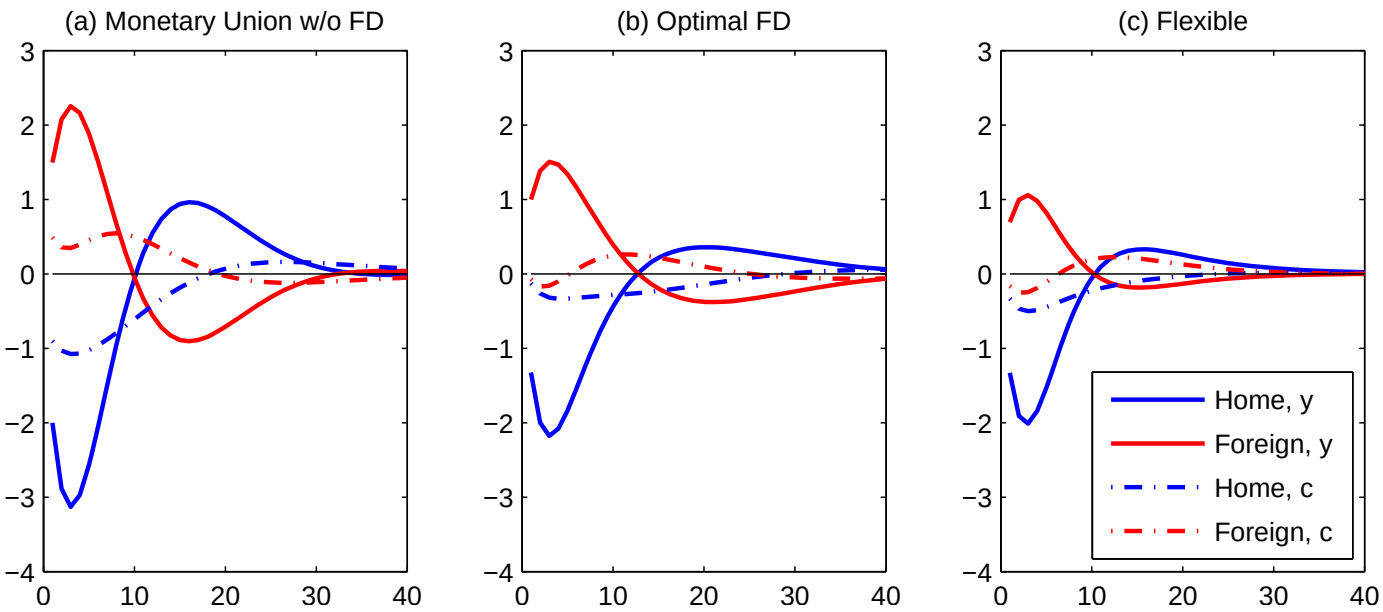
$$\tau_t^V = \alpha^{FD} \times \log\left(\frac{y_t}{\bar{y}}\right)$$

- Is there a parameter region that is mutually beneficial to both home and foreign countries?

Fiscal Devaluation vs Flexible Exchange Rates

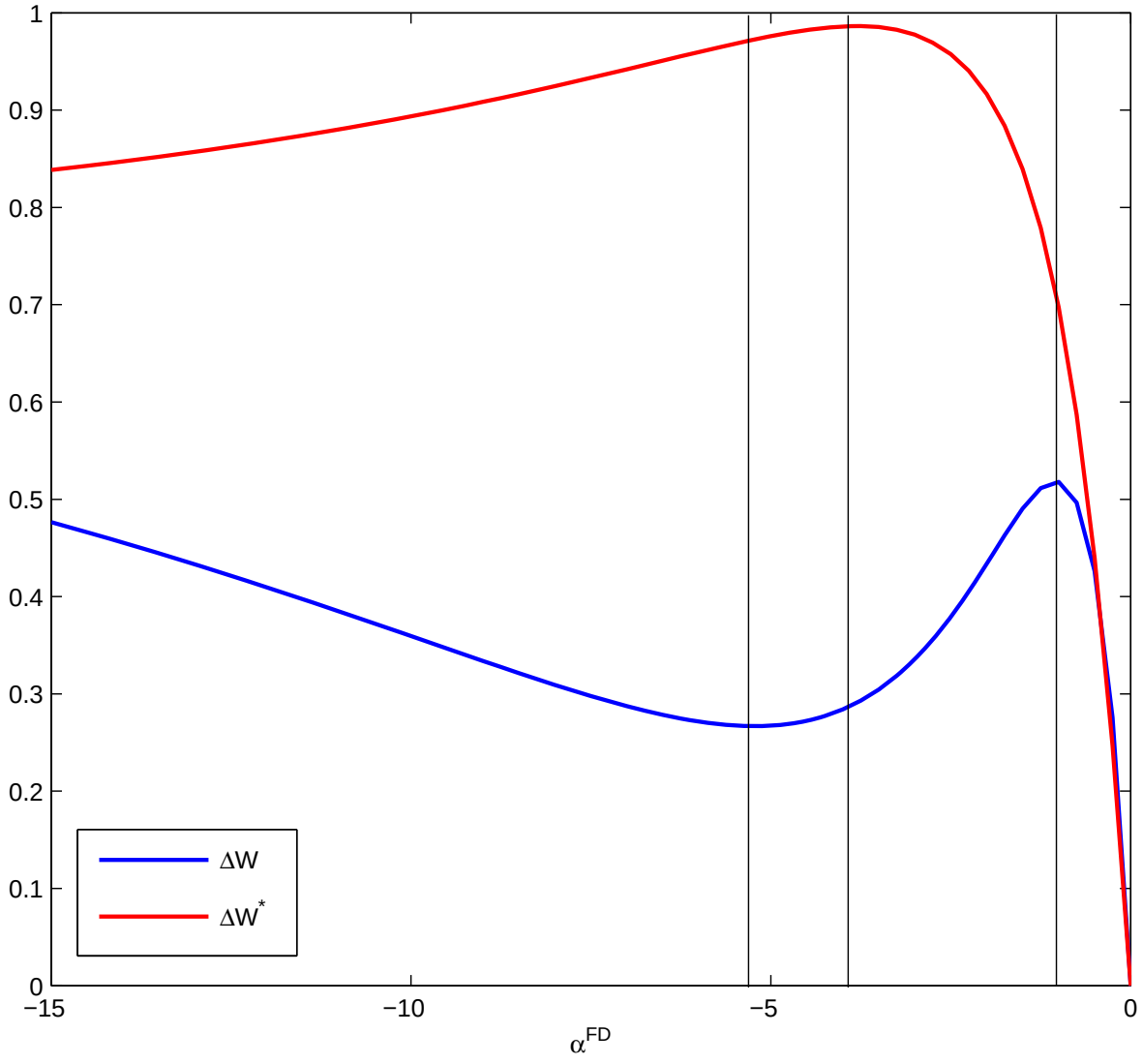
- $\alpha^{FD*} = \arg\max_{\alpha^{FD}} \{U(x_t - \delta_t, h_t) + \beta \mathbb{E}_t[V(\mathbf{s}_{t+1})]\}$

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



Welfare

Difference in welfare from the baseline w/o FD

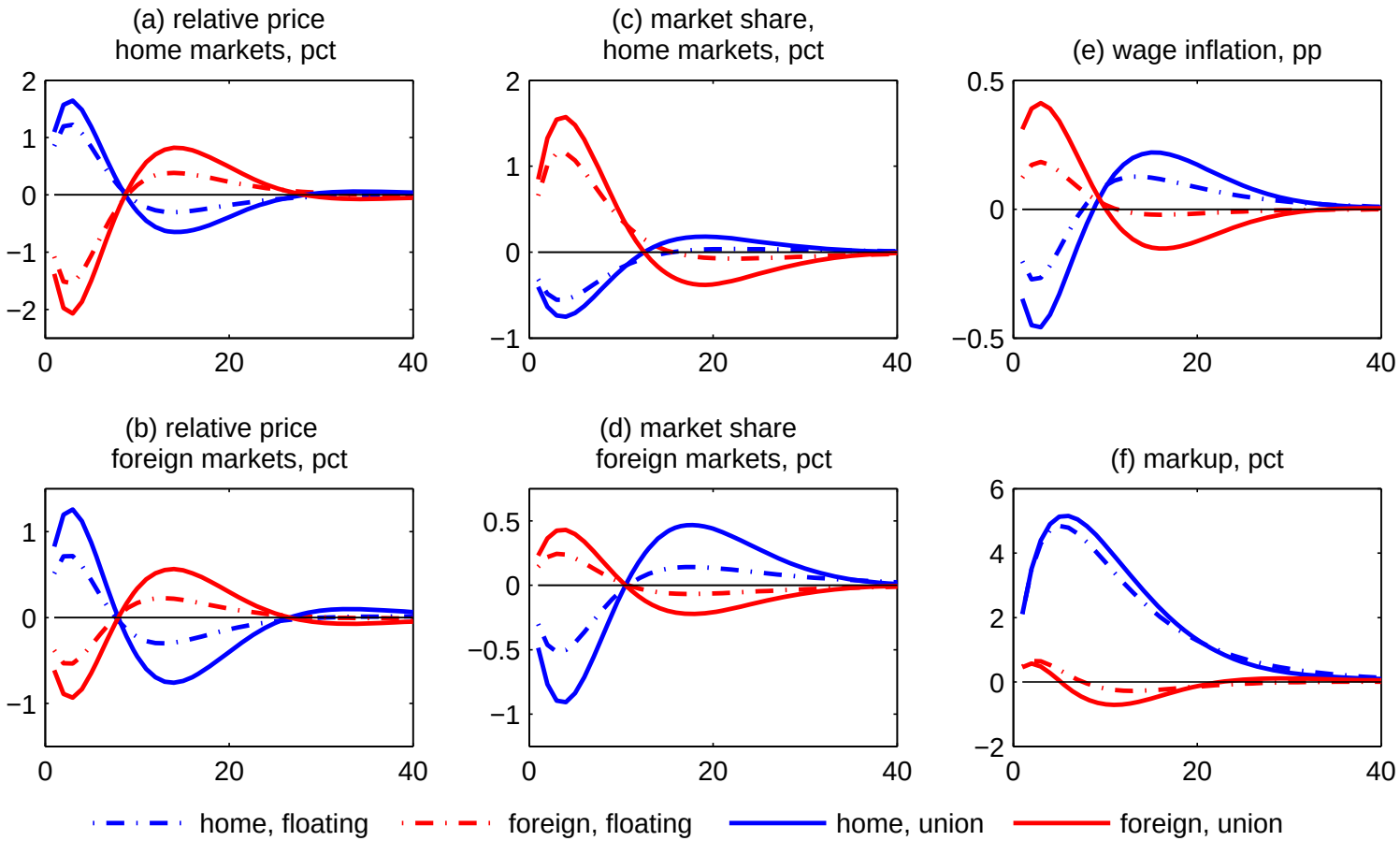


Concluding Remarks

- 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



Some Evidence: Market Share Dynamics During the Crisis

2010Q1=1.0