

Financial Heterogeneity and Monetary Union

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Eurozone Crisis (2008–2013)

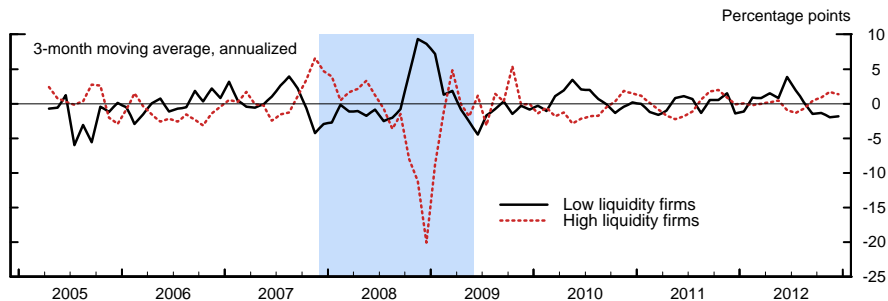
- Classic balance-of-payment crisis:
 - ▶ The mix of overvalued RERs and cheap credit fueled by economic optimism led to over- and mal-investment
 - ▶ With the Global Financial Crisis came a sudden stop
- Resolution of the crisis:
 - ▶ Realignment of overvalued RERs
 - ▶ The mix of deflation in the “periphery” 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:
(Gilchrist & Zakrajšek [2016]; Gilchrist, Schoenle, Sim & Zakrajšek [2017])
 - ▶ 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])
- 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**
(Bils [1989]; Chevalier & Scharfstein [1996])

U.S. PPI Inflation

Liquidity constrained vs. unconstrained firms



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

SOURCE: Gilchrist, Schoenle, Sim & Zakrajšek [2017]

Key Takeaways

- Internal liquidity positions played an important role in shaping U.S. firms' price-setting behavior during the financial crisis.
- Disruption in financial markets in 2008 forced firms with limited financial capacity to significantly increase their prices, whereas their unconstrained counterparts cut prices during the concomitant economic downturn.
- Industry-level data suggests this is a more general phenomenon in response to financial market disruptions.

Euro Area Inflation and Economic Activity

Average (%)	1992–2007		2008–2013	
	Core	GIIPS	Core	GIIPS
Inflation	1.74	4.02	1.49	0.55
Output gap	−0.07	0.81	−0.73	−2.98
Unemployment gap	0.46	−0.60	−0.09	1.27

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: accelerationist

$$\pi_{it} = \alpha_i + \beta\pi_{i,t-1} + \lambda(u_{it} - \bar{u}_{it}) + \phi\Delta\text{VAT}_{it} + \psi\mathbf{1}[i \in \text{€}] + \epsilon_{it};$$

- ▶ Prices: hybrid New Keynesian

$$\pi_{it} = \alpha_i + \beta_f E_t \pi_{i,t+1} + \beta_b \pi_{i,t-1} + \lambda \widehat{mc}_{it} + \phi \Delta \text{VAT}_{it} + \psi \mathbf{1}[i \in \text{€}] + \epsilon_{it},$$

- ▶ Wages: accelerationist

$$\Delta w_{it} = \alpha_i + \beta\pi_{i,t-1} + \lambda(u_{it} - \bar{u}_{it}) + \phi\Delta\check{z}_{it} + \psi\mathbf{1}[i \in \text{€}] + \epsilon_{it};$$

- Data

- ▶ Countries: AUT, DEU, BEL, FIN, FRA, NLD, GRC, IRL, ITA, ESP, PRT
- ▶ Estimation period: 1970–2007

- Are the PC prediction errors during the crisis related to the degree of financial strains across countries?

Estimated Euro Area Phillips Curves

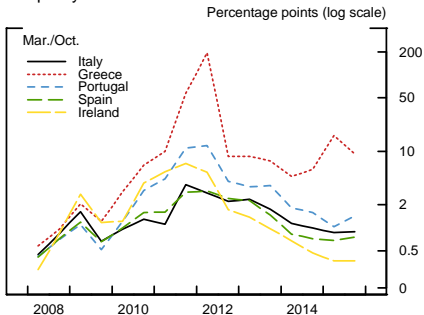
Explanatory Variables	Prices			Wages	
	(1)	(2)	(3)	(4)	(5)
$(u_{it} - \bar{u}_{it})$	-0.273 (0.117)	-0.529 (0.127)	.	-0.559 (0.096)	-0.659 (0.118)
$(y_{it} - \bar{y}_{it})$	.	.	0.134 (0.084)	.	.
$\pi_{i,t-1}$	0.845 (0.046)	0.813 (0.046)	0.561 (0.078)	0.763 (0.057)	0.745 (0.050)
$E_t \pi_{i,t+1}$	.	.	0.407 (0.085)	.	.
$\Delta \bar{z}_{it}$	.	.	.	0.689 (0.127)	0.668 (0.104)
ΔVAT_{it}	0.091 (0.040)	0.072 (0.039)	0.035 (0.057)	.	.
$\mathbf{1}[i \in \text{€}]$	-0.631 (0.300)	-0.657 (0.298)	-0.315 (0.202)	-1.529 (0.358)	-1.230 (0.286)
Adj. R^2	0.839	0.845	.	0.858	0.872
Pr > J	.	.	0.109	.	.
Equal coeff. on $(u_{it} - \bar{u}_{it})$	.	<.001	.	.	<.001

NOTE: Time-clustered standard errors in parentheses.

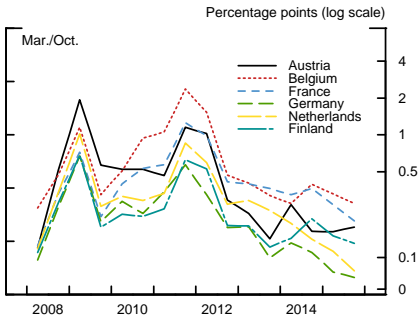
Financial Conditions in the Euro Area

Sovereign (5-year) CDS spreads

Periphery countries



Core countries



SOURCE: Markit.

Sovereign Distress and Business Credit Conditions

Euro area, 2008–2013

Explanatory Variables	(1)	(2)
$\ln \text{CDS}_{i,t-1}$	0.568 [0.406, 0.731]	0.832 [0.493, 1.180]
Adj. R^2	0.200	0.210
Time fixed effects	N	Y

NOTE: Bootstrapped 95% confidence intervals in brackets.

Financial Conditions and PC Prediction Errors

Without time fixed effects, 2008–2013

Specification	Explanatory Variable		R^2
	$\ln \text{CDS}_{i,t-1}$	$\ln \text{CDS}_{i,t-1} \times \mathbf{1}[i \in \text{P}]$	
(1) Prices (homogeneous)	0.043 [-0.139, 0.227]	0.601 [0.218, 0.985]	0.198
(2) Prices (heterogeneous)	0.204 [0.028, 0.372]	0.593 [0.156, 1.030]	0.258
(3) Hybrid NK	0.028 [-0.100, 0.156]	0.299 [0.022, 0.577]	0.110
(4) Wages (homogeneous)	-0.008 [-0.266, 0.251]	-0.776 [-1.425, 0.100]	0.254
(5) Wages (heterogeneous)	0.085 [-0.190, 0.360]	-2.075 [-3.082, -1.069]	0.425

NOTE: Bootstrapped 95% confidence intervals in brackets.

Financial Conditions and PC Prediction Errors

With time fixed effects, 2008–2013

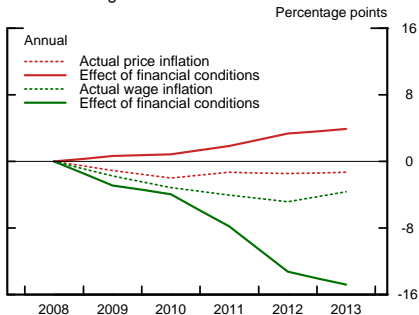
Specification	Explanatory Variable		R^2
	$\ln \text{CDS}_{i,t-1}$	$\ln \text{CDS}_{i,t-1} \times \mathbf{1}[i \in P]$	
(1) Prices (homogeneous)	0.044 [-0.239, 0.327]	0.453 [0.092, 0.814]	0.329
(2) Prices (heterogeneous)	0.684 [0.369, 0.999]	0.275 [0.031, 0.519]	0.419
(3) Hybrid NK	0.125 [-0.051, 0.301]	0.200 [-0.031, 0.410]	0.205
(4) Wages (homogeneous)	-1.364 [-2.221, -0.506]	-0.495 [-1.359, 0.369]	0.352
(5) Wages (heterogeneous)	-2.196 [-2.731, -1.661]	-1.469 [-2.550, -0.389]	0.542

NOTE: Bootstrapped 95% confidence intervals in brackets.

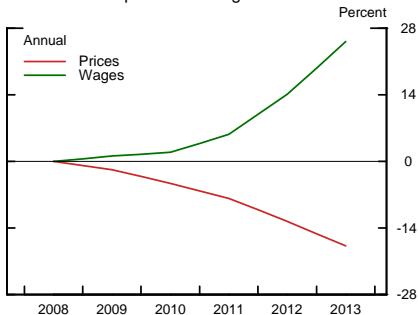
Economic Significance of Financial Factors

Euro area periphery, 2008–2013

Price and wage inflation



Counterfactual prices and wages

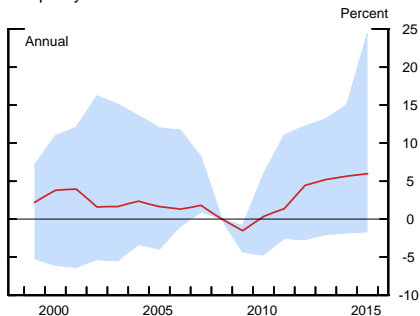


NOTE: In deviations from 2008 levels.

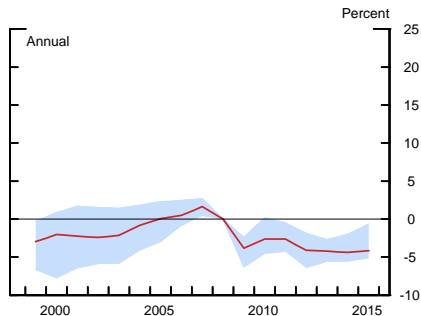
Price Markups

Euro area, 2000–2015

Periphery countries



Core countries



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

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

NOTE: Bootstrapped 95% confidence intervals in brackets.

Financial Heterogeneity as a Propagation Mechanism

- 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, core has an incentive to lower prices to gain market share at home and abroad
 - ▶ Firms in the periphery are forced to raise prices 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 Union:
 - ▶ Trading state-contingent bonds among heterogeneous countries
 - ▶ Highly beneficial to the periphery but requires large transfers from the core
- Fiscal Devaluation:
 - ▶ Certain mixes of fiscal instruments replicate the devaluation
 - ▶ When can a unilateral fiscal devaluation by the periphery be beneficial to 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: $\begin{cases} \text{home goods } (h): & c_{i,h,t}^j, i \in N_h \equiv [0, 1] \\ \text{foreign goods } (f): & c_{i,f,t}^j, i \in N_f \equiv [1, 2] \end{cases}$
- Preferences of household j in the home country:

$$\mathbb{E}_t \sum_{s=0}^{\infty} \delta^s U(x_{t+s}^j, h_{t+s}^j)$$

- ▶ labor (h) is **immobile**

“Deep Habits”

Ravn, Schmitt-Grohe & Uribe [2006]

- Consumption/habit aggregator:

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

- ▶ $\eta > 0$ is the elasticity of substitution within a type of goods
 - ▶ $\epsilon > 0$ is the elasticity of substitution between the two types of goods
 - ▶ $0 < \Xi_k < 1$ governs the degree of home bias in consumption
 - ▶ $s_{i,k,t}$ = **good-specific** stock of habit
 - ▶ $\theta < 0$ governs the 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

Technology

- 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:

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

- ▶ A_t = persistent aggregate technology shock
- ▶ a_{it} = i.i.d. idiosyncratic cost shock w/ $\log a_{it} \sim N(-0.5\sigma^2, \sigma^2)$
- ▶ ϕ = 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 $(1 - \varphi)$ € of funds ($0 < \varphi < 1$)
- Heterogeneity in financial capacity: $\varphi^* < \varphi$
- No cross-border ownership of firms.
(Obstfeld & Rogoff [2000])

“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 periphery is a good time for firms from the core 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.”

– *The New York Times*, July 25, 2012

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Nominal Rigidities

- Quadratic costs of adjusting nominal prices:

(Rotemberg [1982]; Erceg, Henderson & Levin [2000])

$$\frac{\gamma_p}{2} \left(\frac{P_{i,h,t}}{P_{i,h,t-1}} - 1 \right)^2 c_t + \frac{\gamma_p^*}{2} \frac{Q_t P_t^*}{P_t} \left(\frac{P_{i,h,t}^*}{P_{i,h,t-1}^*} - 1 \right)^2 c_t^*; \quad (\gamma_p, \gamma_p^* > 0)$$

- ▶ Q_t = nominal exchange rate (home/foreign currency)
- ▶ Consumer price index (CPI) in the home country:

$$P_t \equiv \left[\sum_{k=h,f} \Xi_k P_{k,t}^{1-\varepsilon} \right]^{\frac{1}{1-\varepsilon}}, \text{ where } P_{k,t} \equiv \left[\int_{N_k} P_{i,k,t}^{1-\eta} di \right]^{\frac{1}{1-\eta}}; \quad k = h, f$$

- Pricing to market: law of one price does not apply

(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 maximize

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

Optimal Pricing

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

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

- Financial frictions \Rightarrow

$$\begin{aligned} \mathbb{E}_t^A[\zeta_{it}] &> 1 \\ \frac{\mathbb{E}_t^A[\zeta_{it} a_{it}]}{\mathbb{E}_t^A[\zeta_{it}]} &= 1 + \text{Cov}[\zeta_{it} a_{it}] \geq 1 \end{aligned}$$

Optimal Pricing (cont.)

- 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

$$p_{i,h,t} p_{h,t} = \frac{\eta}{\eta - 1} \frac{\mathbb{E}_t^A[\zeta_{it} a_{it}]}{\mathbb{E}_t^A[\zeta_{it}]} \left[\frac{W_t/P_t}{A_t} \right] \\ - \frac{\chi}{\eta - 1} \mathbb{E}_t \left[\sum_{s=t+1}^{\infty} \tilde{\beta}_{t,s} \frac{\mathbb{E}_s^A[\zeta_{i,s}]}{\mathbb{E}_t^A[\zeta_{i,t}]} \left(p_{h,s} - \frac{W_s/P_s}{A_s} \right) \right]$$

Financial Shocks

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

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

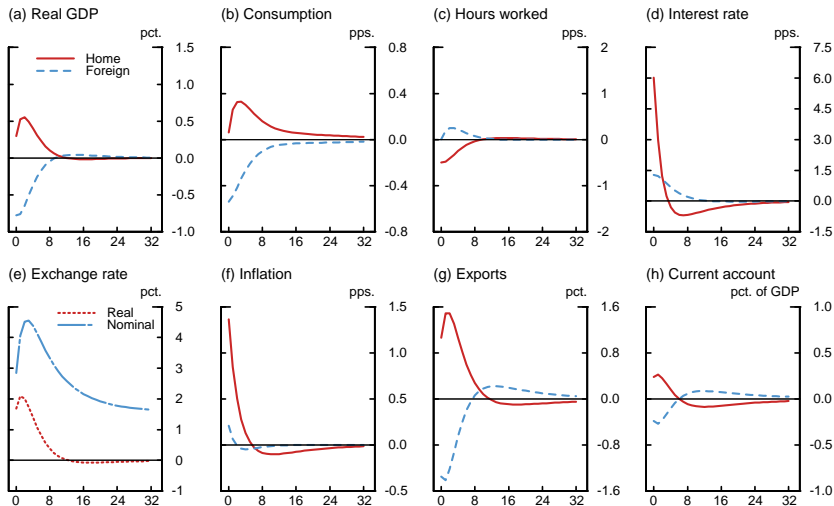
- Asymmetric shock \Rightarrow affects the home country only.
- Size of the shock: $\varphi_t \rightarrow 2\bar{\varphi}$ upon impact

Calibration Summary

Key Model Parameters	Value
<i>Preferences & Technology</i>	
strength of deep habits (θ)	-0.86
persistence of deep habits (ρ)	0.85
elasticity of substitution b/w and w/i goods (η, ϵ)	(2.00,1.50)
fixed operating costs (ϕ, ϕ^*)	(0.10,0.10)
idiosyncratic volatility (σ)	0.15
<i>Nominal Rigidities</i>	
price adjustment costs (γ_p)	10.0
wage adjustment costs (γ_w)	30.0
<i>Financial Frictions</i>	
equity dilution costs ($\bar{\varphi}, \bar{\varphi}^*$), $\mathbb{E}_t^A[\xi_{it}] = 1.16$	(0.20,0.02)

Implications of an Asymmetric Financial Shock

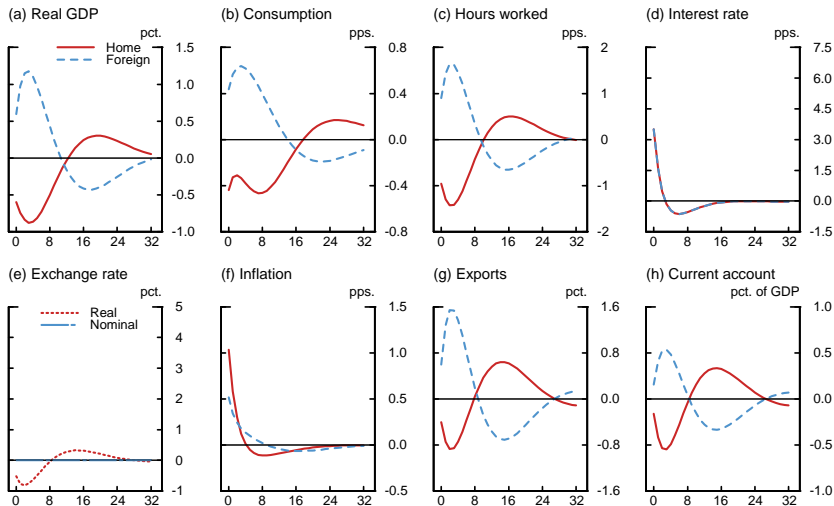
Under floating exchange rates ($\varphi = 0.20$, $\varphi^* = 0.02$)



NOTE: Exchange rates are expressed as home currency relative to foreign currency.

Implications of an Asymmetric Financial Shock

In a monetary union ($\varphi = 0.20$, $\varphi^* = 0.02$)

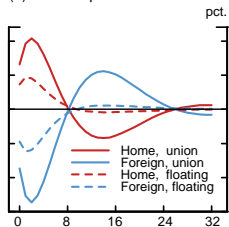


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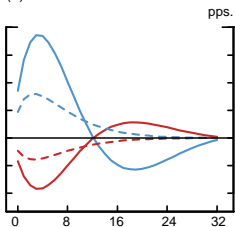
Asymmetric Financial Shock and Price War

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

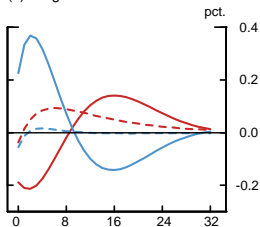
(a) Relative prices - home



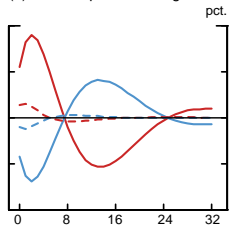
(b) Market share - home



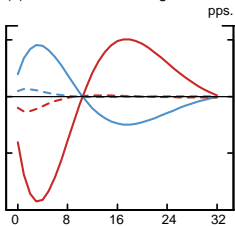
(c) Wage inflation



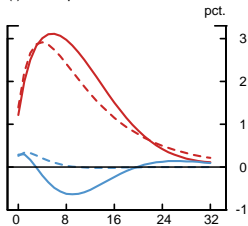
(d) Relative prices - foreign



(e) Market share - foreign

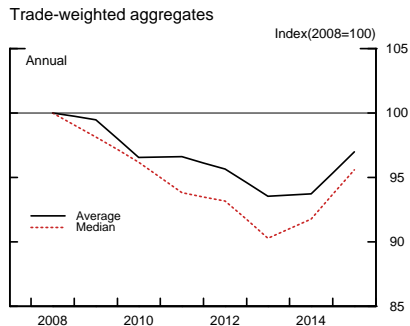
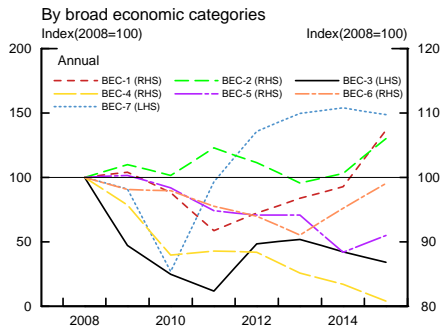


(f) Markup



Relative Import Shares

Euro area periphery and core, 2008–2015

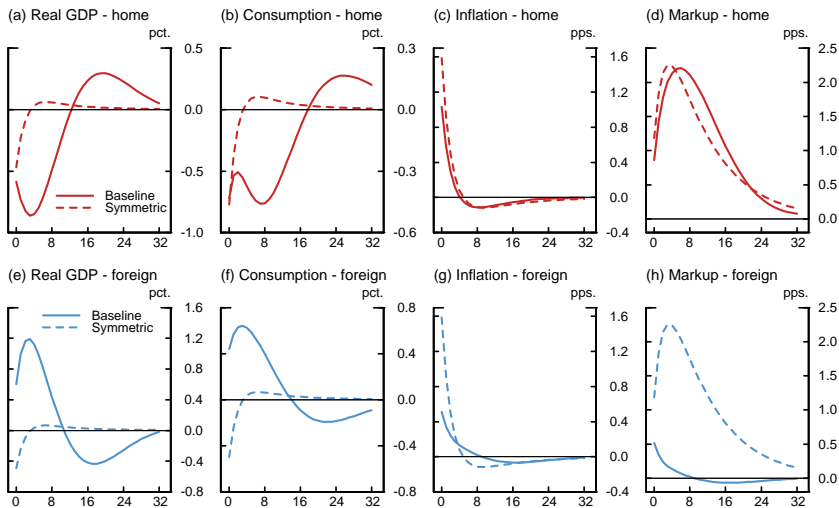


Financial Heterogeneity and Monetary Union

- Alternative calibration: $\varphi = \varphi^* = 0.20$
- All other parameters are kept at their baseline values.
- Financial shocks in both core and periphery.

Heterogeneity as a Propagation Mechanism

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



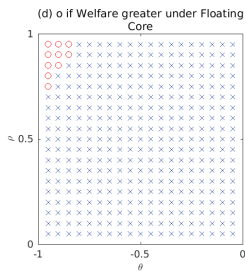
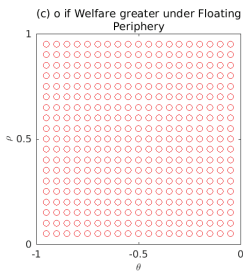
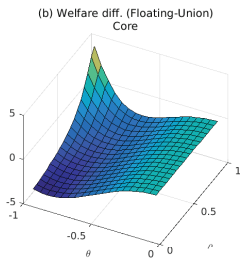
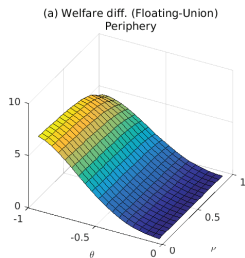
Welfare Consequences of a Monetary Union

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

	Welfare		
	Monetary Union	Flexible FX	CE (%)
Home country	-259.23	-254.16	2.53
Foreign country	-254.05	-254.26	-0.11
Joint	-513.28	-508.42	.

Welfare Consequences of a Monetary Union

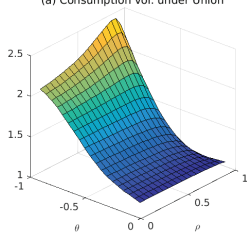
Importance of customer markets relationships



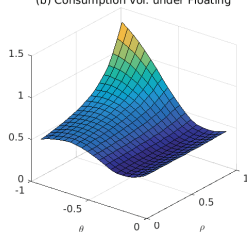
Macroeconomic Volatilities

Monetary union vs. flexible exchange rates

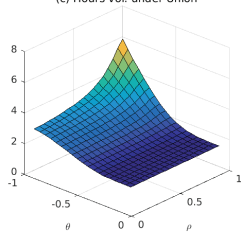
(a) Consumption vol. under Union



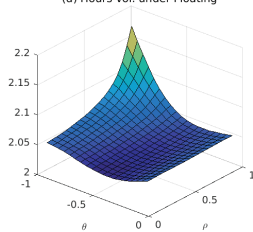
(b) Consumption vol. under Floating



(c) Hours vol. under Union



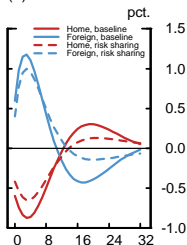
(d) Hours vol. under Floating



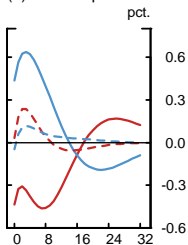
Monetary Union with Complete Risk Sharing

Asymmetric financial shock ($\varphi = 0.20$, $\varphi^* = 0.02$)

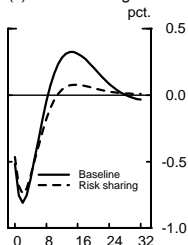
(a) Real GDP



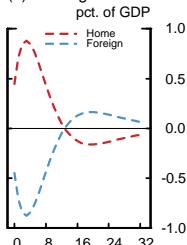
(b) Consumption



(c) Real exchange rate



(d) Contingent transfer



NOTE: Exchange rates are expressed as home currency relative to foreign currency.

Welfare Consequences of a Fiscal Union

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

	Welfare in a Monetary Union		CE (%)
	w/o Risk Sharing	w/ Risk Sharing	
<i>A. Calibration: $\theta = -0.86$, $\rho = 0.85$, $\phi^* = 1.0 \times \phi$</i>			
Home country	-259.23	-257.61	0.79
Foreign country	-254.05	-253.15	0.45
Joint	-513.28	-510.76	.
<i>B. Calibration: $\theta = -0.95$, $\rho = 0.95$, $\phi^* = 1.0 \times \phi$</i>			
Home country	-283.64	-279.86	1.71
Foreign country	-278.47	-274.84	1.66
Joint	-562.11	-554.80	.
<i>C. Calibration: $\theta = -0.86$, $\rho = 0.85$, $\phi^* = 0.9 \times \phi$</i>			
Home country	-261.00	-254.69	3.13
Foreign country	-248.73	-249.81	-0.56
Joint	-509.73	-504.50	.

Theory of Fiscal Devaluation

Adao, Correia & Teles [2009]; Farhi, Gopinath & Itskhoki [2014]

- Some EU countries have considered the idea of swapping VAT and payroll subsidies:
 - ▶ VAT is a discriminatory tax on imported goods.
 - ▶ For revenue-neutrality, payroll subsidy to domestic firms.
- Germany:
 - ▶ Raised VAT (from 16% to 19%) on January 2007
 - ▶ Lowered corporate income tax rate (from 38.7% to 29.8%) on July 2007 (effective January 2008).

Implementable Plan

- We consider a simple VAT-payroll subsidy swap rule (VAT (τ_t^V) + payroll subsidy (ζ_t^P))
- FD rules that are linear in the resource gap of the **home** country and revenue neutral:

$$\tau_t^V = \frac{\Delta_t}{1 + \Delta_t}$$

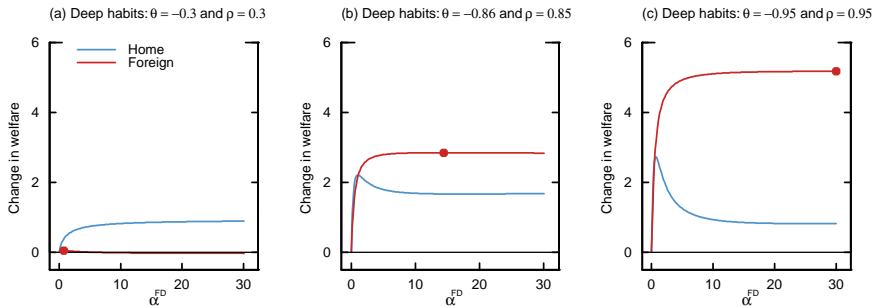
$$\Delta_t = -\alpha^{FD} \times \log\left(\frac{y_t}{\bar{y}}\right) \quad (\alpha^{FD} > 0)$$

$$\zeta_t^P = \tau_t^V \times (p_{h,t}c_{h,t} + p_{f,t}c_{f,t})$$

- ▶ Foreign country does not retaliate
 - ▶ Home firms are not subject to the VAT in the foreign country
- Is there a region for α^{FD} that is mutually beneficial to both home and foreign countries?

Welfare Implications of Fiscal Devaluations

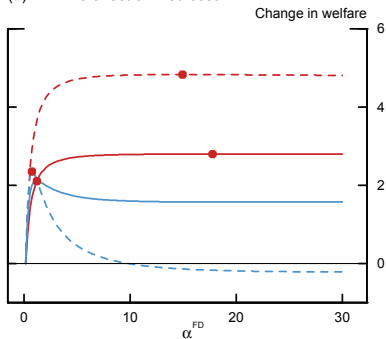
Monetary union ($\varphi = 0.20$, $\varphi^* = 0.02$)



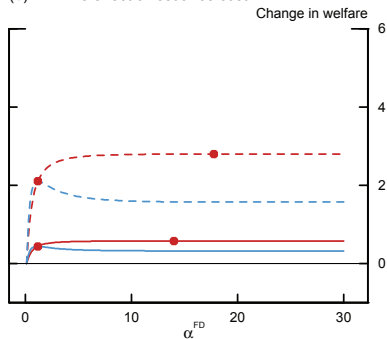
Welfare Implications of Fiscal Devaluations

The role of financial frictions

(a) FD: The effect of fixed cost



(b) FD: The effect of issuance cost



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.