

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:
(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]; 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

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 (backward looking):

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

- ▶ Prices (hybrid New Keynesian):

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

- ▶ Wages (backward looking):

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

- 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

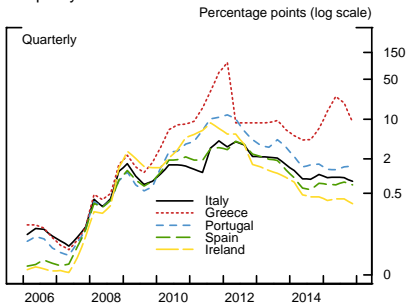
Explanatory Variables	Prices			Wages	
	(1)	(2)	(3)	(4)	(5)
$(u_{it} - \bar{u}_{it})$	-0.273 (0.117)	-0.529 (0.127)	.	-0.559 (0.096)	-0.659 (0.118)
$(y_{it} - \bar{y}_{it})$	.	.	0.134 (0.084)	.	.
$\pi_{i,t-1}$	0.845 (0.046)	0.813 (0.046)	0.561 (0.078)	0.763 (0.057)	0.745 (0.050)
$E_t \pi_{i,t+1}$	.	.	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.

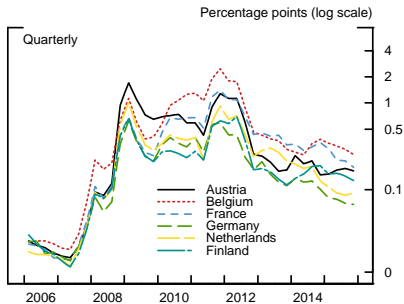
Financial Conditions in the Euro Area

Sovereign (5-year) CDS spreads

Periphery countries



Core countries



SOURCE: Markit.

Financial Conditions and PC Prediction Errors

Without time fixed effects, 2008–2013

PC Prediction Error	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

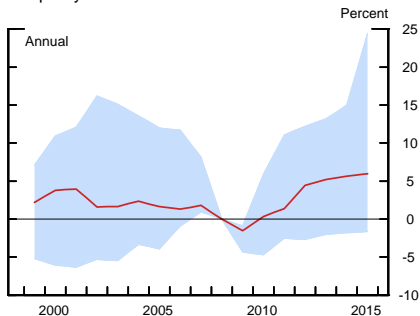
PC Prediction Error	Explanatory Variable		R^2
	$\ln \text{CDS}_{i,t-1}$	$\ln \text{CDS}_{i,t-1} \times \mathbf{1}[i \in P]$	
(1) Prices (homogeneous)	0.044 [-0.239, 0.327]	0.453 [0.092, 0.814]	0.329
(2) Prices (heterogeneous)	0.684 [0.369, 0.999]	0.275 [0.031, 0.519]	0.419
(3) Hybrid NK	0.125 [-0.051, 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.

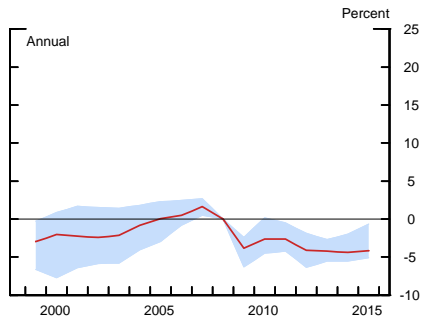
Price Markups

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 markups</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 markups</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, 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: $\begin{cases} \text{home goods } (h): & c_{i,h,t}^j, \quad i \in N_h \equiv [0, 1] \\ \text{foreign goods } (f): & c_{i,f,t}^j, \quad i \in N_f \equiv [1, 2] \end{cases}$
- Preferences of household j in the home country:

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

- ▶ labor (h) is **immobile**
- ▶ ω_t : demand shock

“Deep Habits”

Ravn, Schmitt-Grohe & Uribe [2006]

- Consumption/habit aggregator:

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

- ▶ $\eta > 0$: 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

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:

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

- ▶ A_t : persistent aggregate technology shock
- ▶ a_{it} : i.i.d. idiosyncratic cost shock w/ $\ln a_{it} \sim N(-0.5\sigma^2, \sigma^2)$
- ▶ 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])

Nominal Rigidities

- Quadratic costs of adjusting nominal prices:

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

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

- ▶ 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 optimize

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

Optimal Financial Policy

- Firm issues new shares if and only if:

$$a_{i,t} > a_t^E \equiv \frac{A_t}{w_t} \left[\frac{p_{h,t}c_{h,t} + q_t p_{h,t}^* c_{h,t}^*}{(\phi + c_{h,t} + c_{h,t}^*)^{\frac{1}{\alpha}}} \right]$$

- First-order conditions for dividends:

$$\zeta_{i,t} = \begin{cases} 1 & \text{if } a_{i,t} \leq a_t^E \\ 1/(1 - \varphi) & \text{if } a_{i,t} > a_t^E \end{cases}$$

- Expected shadow value of internal funds:

$$\mathbb{E}_t^a[\zeta_{i,t}] = 1 + \frac{\varphi}{1 - \varphi} [1 - \Phi(z_t^E)] \geq 1$$

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

Optimal Pricing

Symmetric equilibrium

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

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

economic markup

- Financial frictions \Rightarrow

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

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

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

International Bond Market

Monetary union

- Euler equations:

$$1 = \delta \mathbb{E}_t \left[\frac{U_{x,t+1} / \tilde{p}_{t+1}}{U_{x,t} / \tilde{p}_t} \frac{R_t^U}{\pi_{t+1}} \frac{1}{1 + \tau b_{t+1}} \right]$$

$$1 = \delta \mathbb{E}_t \left[\frac{U_{x,t+1}^* / \tilde{p}_{t+1}^*}{U_{x,t}^* / \tilde{p}_t^*} \frac{q_t}{q_{t+1}} \frac{R_t^U}{\pi_{t+1}^*} \frac{1}{1 + \tau b_{t+1}^*} \right]$$

- Law of motion for bond holdings:

$$b_{t+1} = \frac{R_{t-1}^U}{\pi_t} b_t + \frac{1}{2} (w_t h_t - q_t w_t^* h_t^*) + \frac{1}{2} (\tilde{d}_t - q_t \tilde{d}_t^*) - \frac{1}{2} (\tilde{p}_t x_t - q_t \tilde{p}_t^* x_t^*)$$

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 (φ, φ^*), $\mathbb{E}_t^a[\tilde{\zeta}_{it}] = 1.16$	(0.20,0.02)

Financial Shocks

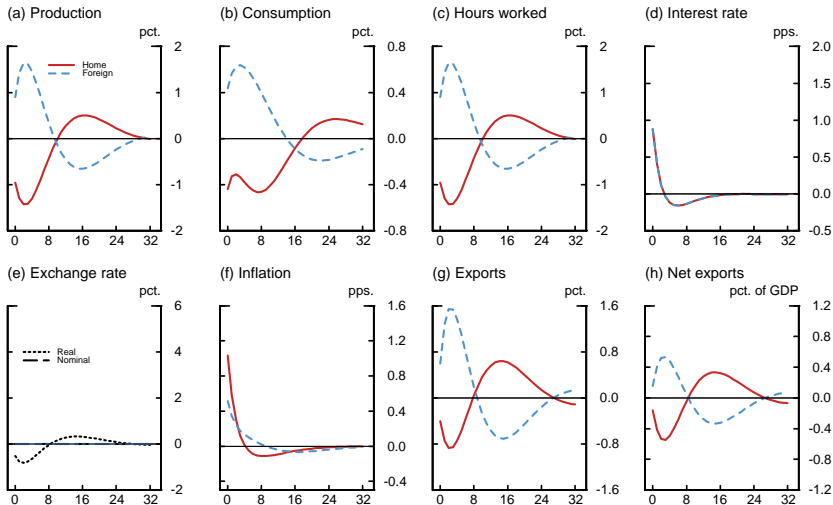
- Temporary but persistent increase in the cost of external finance:

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

- 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 ($\varphi = 0.20$, $\varphi^* = 0.02$)

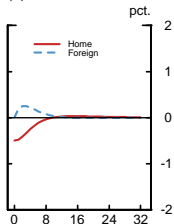


NOTE: Exchange rates are expressed as home currency relative to foreign currency.

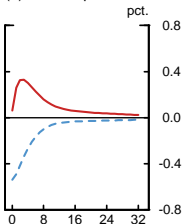
Implications of an Asymmetric Financial Shock

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

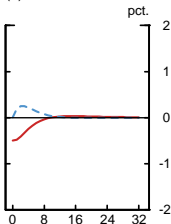
(a) Production



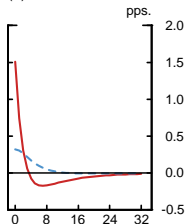
(b) Consumption



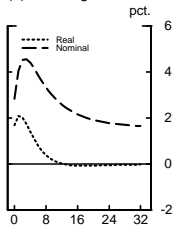
(c) Hours worked



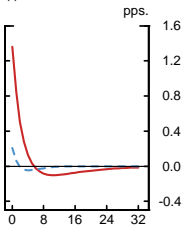
(d) Interest rate



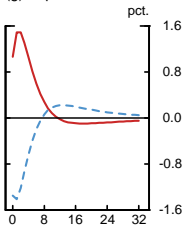
(e) Exchange rate



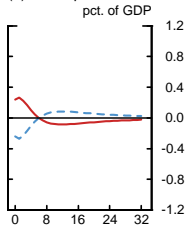
(f) Inflation



(g) Exports



(h) Net exports

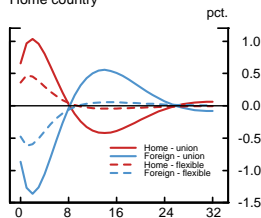


NOTE: Exchange rates are expressed as home currency relative to foreign currency.

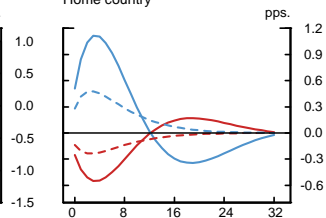
Asymmetric Financial Shock and Price Dynamics

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

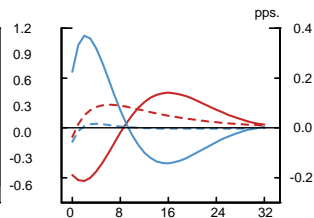
(a) Relative prices
Home country



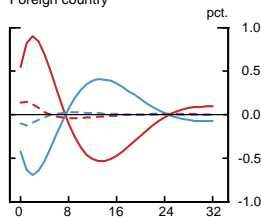
(b) Market share
Home country



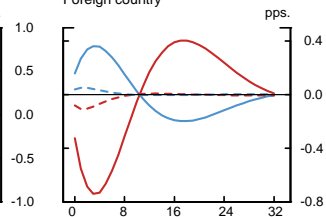
(c) Wage inflation



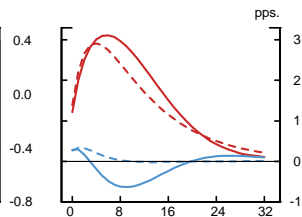
(d) Relative prices
Foreign country



(e) Market share
Foreign country



(f) Markup



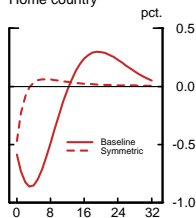
Financial Heterogeneity and the Monetary Union

- 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: $\epsilon_t = \epsilon_t^* > 0$

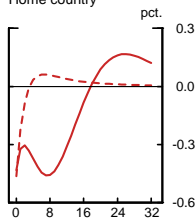
Implications of Financial Heterogeneity

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

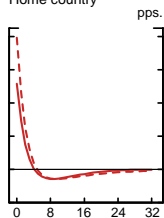
(a) Real GDP
Home country



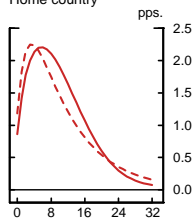
(b) Consumption
Home country



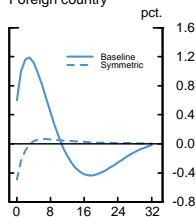
(c) Inflation
Home country



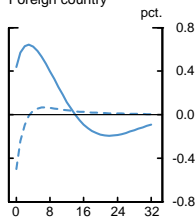
(d) Markup
Home country



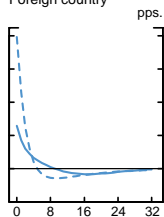
(e) Real GDP
Foreign country



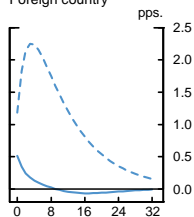
(f) Consumption
Foreign country



(g) Inflation
Foreign country



(h) Markup
Foreign country



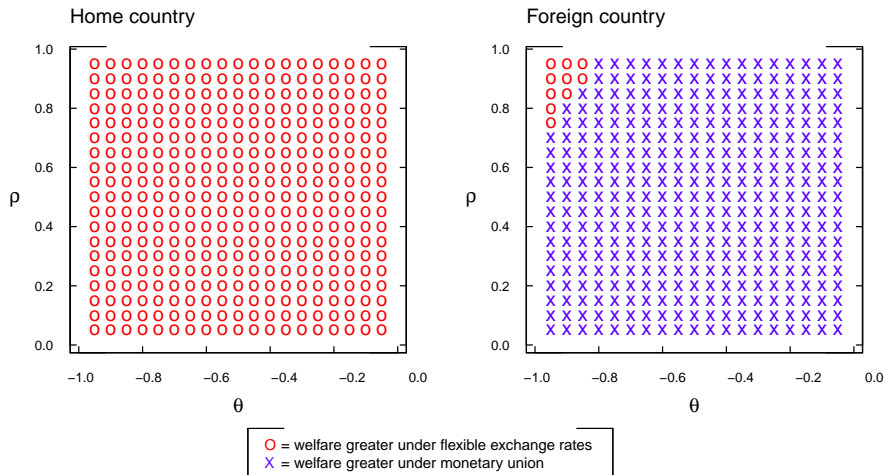
Welfare Consequences of a Monetary Union

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

	$\mu(c^U)/\mu(c^F)$	$\sigma(c^U)/\sigma(c^F)$	$\sigma(h^U)/\sigma(h^F)$	CE (pct.)
Home country	0.99	1.55	2.92	2.53
Foreign country	1.01	1.51	4.31	-0.11

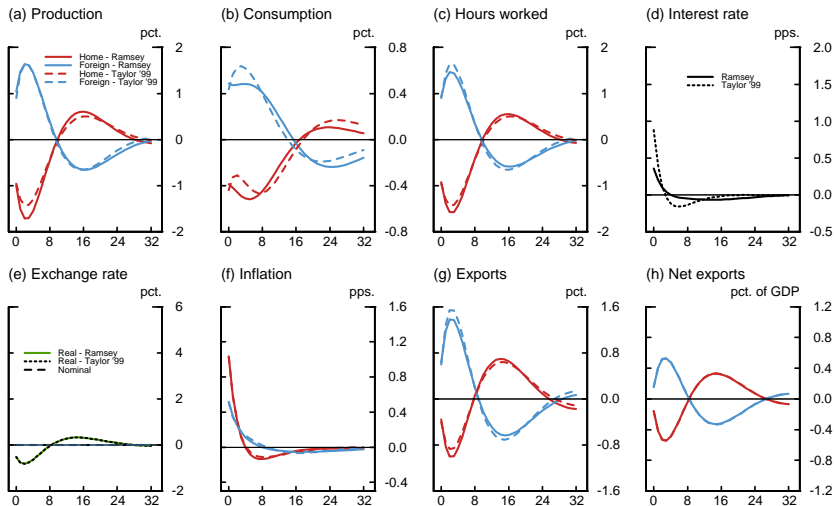
Welfare Gains and Losses

The role of deep habits (θ, ρ)



Optimal Monetary Policy

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



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 (ζ_t^P) financed by VAT (τ_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:

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

Implementable Plan

- Linear and revenue neutral FD rules:

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

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

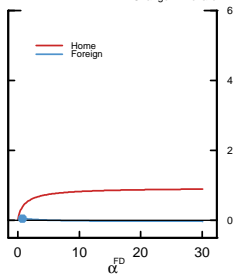
$$\zeta_t^P w_t h_t = \tau_t^V \times (p_{h,t} c_{h,t} + p_{f,t} c_{f,t})$$

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

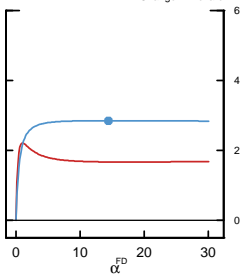
Welfare Implications of Fiscal Devaluations

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

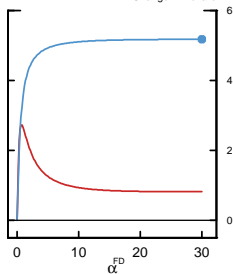
(a) Deep habits: $\theta = -0.3$; $\rho = 0.3$
Change in welfare



(b) Deep habits: $\theta = -0.86$; $\rho = 0.85$
Change in welfare



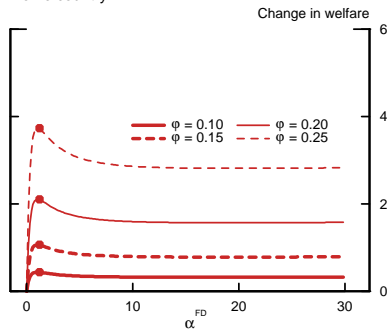
(c) Deep habits: $\theta = -0.95$; $\rho = 0.95$
Change in welfare



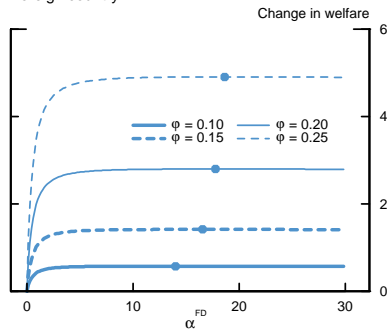
Welfare Implications of Fiscal Devaluations

The role of financial frictions

Home country



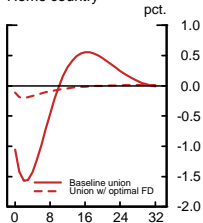
Foreign country



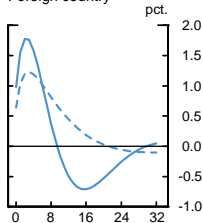
Optimal Fiscal Devaluation

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

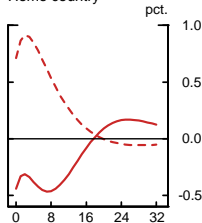
(a) Production
Home country



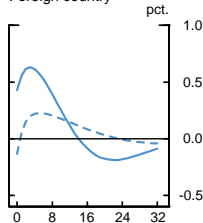
(b) Production
Foreign country



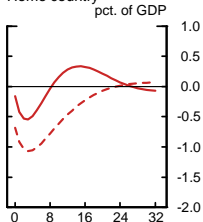
(c) Consumption
Home country



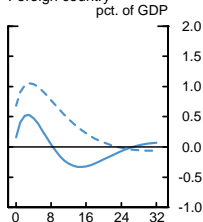
(d) Consumption
Foreign country



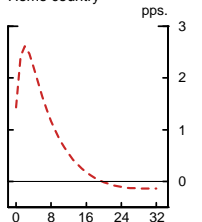
(e) Net exports
Home country



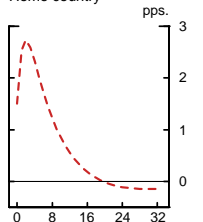
(f) Net exports
Foreign country



(g) Value-added tax
Home country



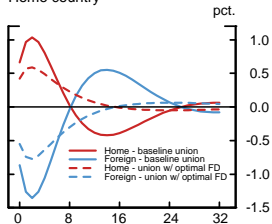
(h) Payroll subsidy
Home country



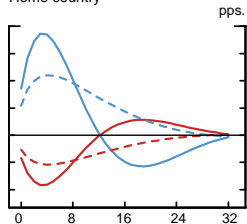
Price Dynamics and Optimal Fiscal Devaluation

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

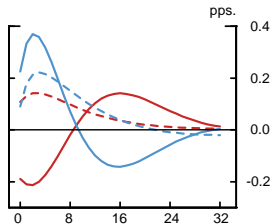
(a) Relative prices
Home country



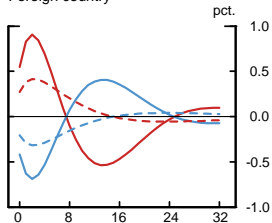
(b) Market share
Home country



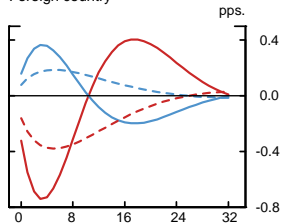
(c) Wage inflation



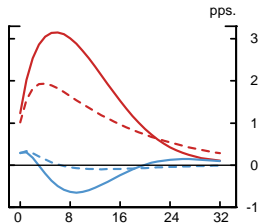
(d) Relative prices
Foreign country



(e) Market share
Foreign country



(f) Markup



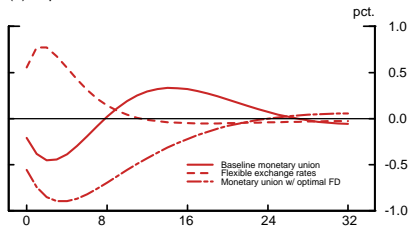
Summary

- 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.

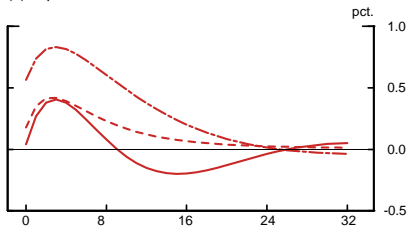
Optimal Fiscal Devaluation

Home country – external position

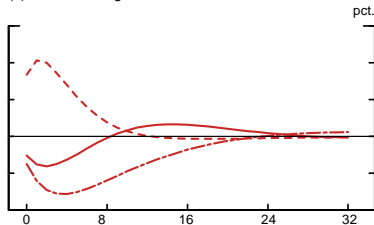
(a) Exports



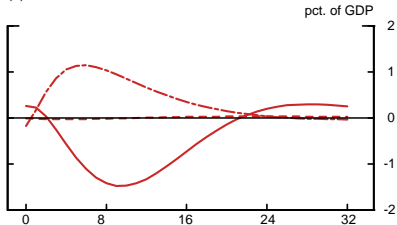
(b) Imports



(c) Real exchange rate



(c) Current account

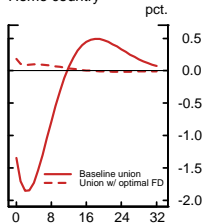


NOTE: Exchange rates are expressed as home currency relative to foreign currency.

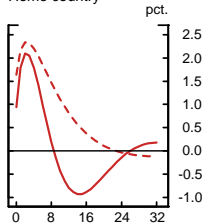
Optimal Fiscal Devaluation

Consumption and relative prices

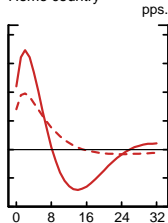
(a) Cons. of h-type goods
Home country



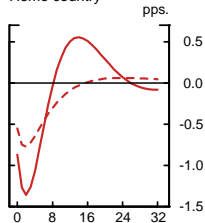
(b) Cons. of f-type goods
Home country



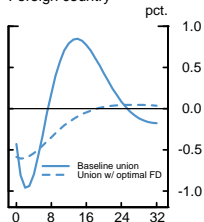
(c) Rel. price of h-type goods
Home country



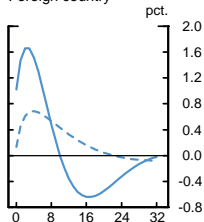
(d) Rel. price of f-type goods
Home country



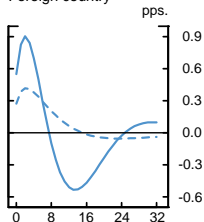
(e) Cons. of h-type goods
Foreign country



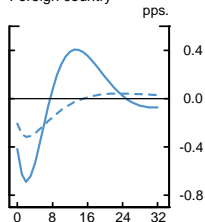
(f) Cons. of f-type goods
Foreign country



(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

