Financial Heterogeneity
and Monetary Union

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Financial Heterogeneity and Monetary Union[1]

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[1]The views herein do not reflect those of the Federal Reserve System.

European Crisis

▶ A balance of payment crisis rather than a fiscal crisis.

▶ Around 2007, the external balance of the peripheral economy becomes clearly unsustainable.
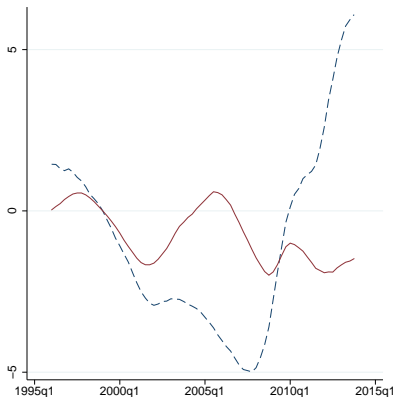
Figure: Eurozone Current Account, % of GDP

Note: Red solid: Core, Blue dashed: Periphery

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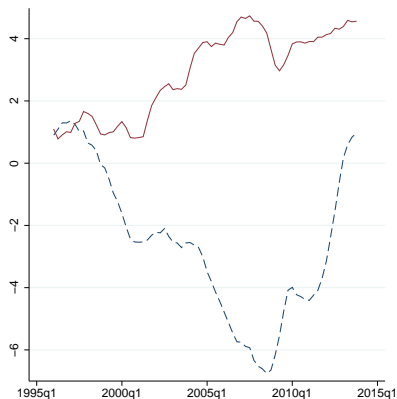
The Origin of the Crisis

- During the expansion, the periphey become overheated.
- The common monetary policy could not deliver a sufficient tightening, a paradoxical outcocme.
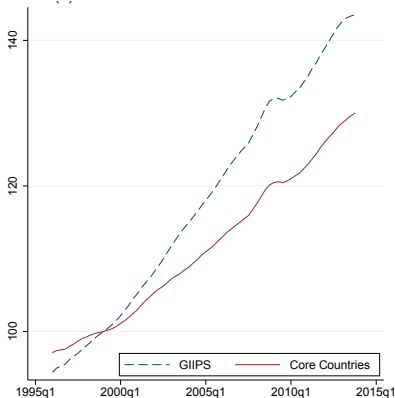
Figure: Eurozone Unemployment Rates

Note: Red solid: Core, Blue dashed: Periphery

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Puzzling Inflation Dynamics

- ▶ The resolution of crisis calls for major realignments of RERs.
- ▶ Only achievable through adjustments in relative prices, but...
- ▶ Inflation rates of crisis countries surprisingly stable until now.

Figure: Eurozone Harmonized CPIs

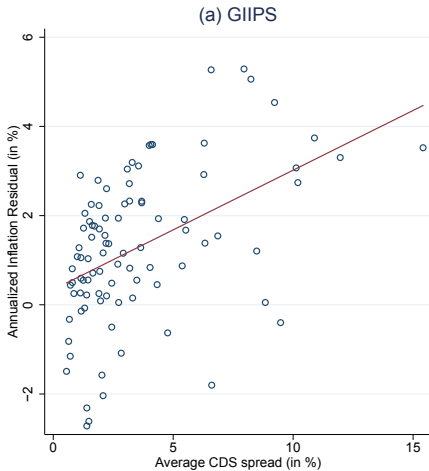Note: Red solid: Core, Blue dashed: Periphery

In This Paper

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- We study the consequences of monetary union among countries with heterogeneous financial conditions.

- We build a two-countries GE model that can
    - shed light on the heterogeneous inflation dynamics.
    - highlight the policy dilemma facing monetary authority.

- In particular, we show a direct link between the liquidity conditions of pricing firms and inflation dynamics, and show
    - Why the periphery faces higher inflation than the core and the RERs appreciate for the periphery under monetary union.
    - How the impact of financial shock is propagated through strategic interaction between countries with heterogeneous financial capacities.

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▶ We study two fiscal options to fight the crisis.

▶ Fiscal union:
  ▶ Trading state-contingent bonds among countries.
  ▶ It is shown to be able to bring powerful stabilization.
  ▶ How do we assess the costs of fiscal union?
  ▶ Are these bearable by core countries?

▶ Fiscal Devaluation:
  ▶ Keynes [1931], Adao-Correia-Teles [2009], Farhi-Gopinath-Itskhoki [2014]
  ▶ Under what condition can a uniateral fiscal devaluation by the periphery be beneficial to the core?
  ▶ Depends on the externality created by financial friction.

Evidence on inflation dynamics

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▶ Estimate forward-looking NK Phillips curve a la (Gali et al [2002]) at the country-level over period 1990-2007.

▶ Examine relationship between country-level residuals and country-specific financial conditions as measured by the sovereign CDS spread over period 2008-2012.

Financial Crisis and Inflation: GIIPS

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Figure: CDS Spreads vs Phillips Curve Residuals: GIIPS

(a) GIIPS

Financial Crisis and Inflation: Italy and Spain

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Figure: CDS Spreads vs Phillips Curve Residuals: Italy and Spain

(b) Italy and Spain

Financial Crisis and Inflation: Core

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Figure: CDS Spreads vs Phillips Curve Residuals: Core

(c) Core Countries

Model Setting

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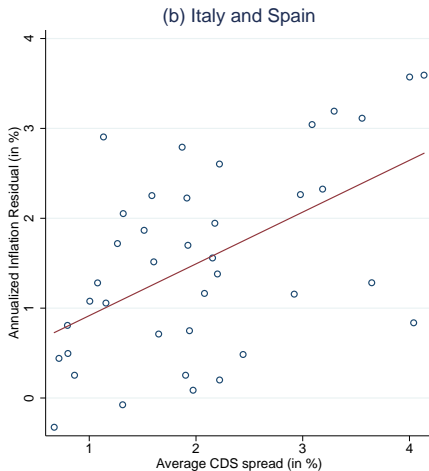
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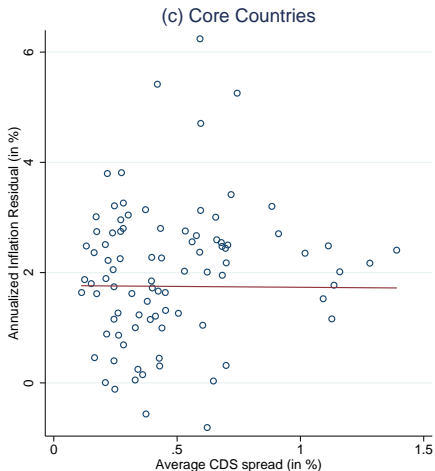
- ▶ Extend Gilchrist-Schoenle-Sim-Zakrajsek [2014] to two-country general equilibrium setting.
  - ▶ Monopolistic competition within and across borders;
  - ▶ Deep habit ("Catching up with Jonesses" at the good-level);
  - ▶ Nominal rigidity in prices/wages;
  - ▶ Financial friction for price-setting firms;
  - ▶ Local currency pricing
  - ▶ Labor immobility

Preferences

- A continuum of households in home $j \in N_c \equiv [0, 1]$
    - Completely symmetric preferences for foreign households.
- Two types of goods:
    - Home goods (h), $c_{i,h,t}^j$, $i \in N_h \equiv [1, 2]$, produced home
    - Foreign goods (f), $c_{i,f,t}^j$, $i \in N_f \equiv [2, 3]$, produced abroad
- Deep habit preferences:
    - CRRA in consumption(c)/habit(s) aggregator x_t^j

    $$\mathbb{E}_t \sum_{s=0}^{\infty} \beta^s U(x_{t+s}^j, h_{t+s}^j) \text{ for } j \in N_c.$$

    - U is concave in h^j, labor hours of household j.

Deep Habit

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- Habit aggregator (x_t^j)

  - Armington-Raven-Schmitt-Grohe-Uribe aggregator:

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

  - η and ε are the elasticity of substitution within a type, and between types.
  - $\theta < 0$ measures the strength of "Catching up with Jonesses"
  - The deep habit does not depend on individual j: external.

  $$s_{ikt} = \rho s_{ikt-1} + (1-\rho) \int_{N_c} c_{ikt}^j dj \text{ for } k = h, f,$$

Technology

▶ Production function (labor input, fixed operating costs):

$$y_{it} = c_{iht} + c_{iht}^* = \left[\frac{A_t}{a_{it}} h_{it}\right]^\alpha - \phi \ \text{ for } i \in N_h; \quad 0 < \alpha \leq 1$$

  ▶ A_t = persistent aggregate technology shock
  ▶ a_{it} = i.i.d. idiosyncratic technology shock with
      $\log a_{it} \sim N(-0.5\sigma^2, \sigma^2)$

▶ Fixed operation cost (ϕ): make possible negative profit.

  ▶ Increasing production scale creates a liquidity problem.
  ▶ ϕ can be thought of as fixed long-term debt payments.

▶ Symmetric technology for foreign firms except $\phi^* = 0$.

▶ $\phi > \phi^* = 0$ captures the heterogenous financial capacities.

Financial Friction

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▶ Financial frictions $\Rightarrow$ costly equity financing
  (Gomes [2001]; Stein [2003]; Myers and Majluf [1984])

  ▶ Dilution cost ($0 < \varphi_t < 1$): \$1 issuance brings in \$1 $- \varphi_t$

$$d_{it} - \varphi_t \min\{d_{it}, 0\} = \left\{ \begin{array}{ll} d_{it} & d_{it} \geq 0 \\ (1 - \varphi_t)d_{it} & d_{it} < 0 \end{array} \right.$$

▶ No cross border ownership of firms.
  French and Poterba [1991]; Tesar and Werner [1995];
  Obstfeld and Rogoff [2000]

Nominal Rigidities

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- Nominal Rigidities (Rotemberg [1982]) with LCP:

$$\frac{\gamma}{2}\left(\pi_t \frac{p_{iht}}{p_{iht-1}} - \bar{\pi}\right)^2 c_t; \ p_{iht} \equiv \frac{P_{iht}}{P_t}$$

$$\frac{\gamma}{2}\left(\pi_t^* \frac{p_{iht}^*}{p_{iht-1}^*} - \bar{\pi}\right)^2 q_t c_t^*; \ p_{iht}^* \equiv \frac{P_{iht}^*}{P_t^*}, \ q_t \equiv \frac{S_t P_t^*}{P_t}$$

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Firm Problem

$$
\begin{aligned}
\mathcal{L} &= \mathbb{E}_0 \sum_{t=0}^{\infty} m_{0,t} \Bigg\{ d_{it} + \kappa_{it} \left[\left(\frac{A_t}{a_{it}} h_{it} \right)^{\alpha} - \phi - (c_{iht} + c_{iht}^*) \right] \\
&+ \xi_{it} \Bigg[(1 - \tau_t^{\nu}) p_{iht} p_{ht} c_{iht} + q_t p_{iht}^* p_{ht}^* c_{iht}^* \\
&- (1 - \varsigma_t^p) w_t h_{it} - d_{it} + \varphi_t \min\{0, d_{it}\} \\
&- \frac{\gamma}{2} \Big(\frac{p_{iht}}{p_{iht-1}} \pi_{ht} - \bar{\pi} \Big)^2 c_t - \frac{\gamma}{2} \Big(\frac{p_{iht}^*}{p_{iht-1}^*} \pi_{ht}^* - \bar{\pi}^* \Big)^2 q_t c_t^* \Bigg] \\
&+ \nu_{iht} \left[(p_{iht})^{-\eta} \tilde{p}_{ht}^{\eta} s_{iht-1}^{\theta(1-\eta)} x_{ht} - c_{iht} \right] \\
&+ \nu_{iht}^* \left[(p_{iht}^*)^{-\eta} \tilde{p}_{ht}^{*\eta} s_{iht-1}^{*\theta(1-\eta)} x_{ht}^* - c_{iht}^* \right] \\
&+ \lambda_{iht} \left[\rho s_{iht-1} + (1-\rho) c_{iht} - s_{iht} \right] \\
&+ \lambda_{iht}^* \left[\rho s_{iht-1}^* + (1-\rho) c_{iht}^* - s_{iht}^* \right] \Bigg\}
\end{aligned}
$$

Closing the Model

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- ▶ Fiscal Policy: No tax/subsidy structure in the baseline.
- ▶ Later, tax/subsidy instruments to study fiscal devaluation.
    - ▸ Value added tax: τ_t^v
    - ▸ Payroll subsidy: ς_t^p
- ▶ Budget balance by imposing revenue neutral tax structure.
- ▶ Monetary policy: Innertial Taylor rule with ave. fundamental.

Beggar Thy Neighbor at the Micro-Level

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- Deep habit makes investment in market share profitable.
- Investment takes the form of low markups, which exposes firms to liquidity risk. Optimal pricing strikes a balance.

- Price war: the liquidity crisis of competitors is a good chance to steal market share by undercutting their 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*

Calibration

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Table: Baseline Calibration

Description	Value
Preferences and technology	
time discounting factor, β	0.99
constant relative risk aversion, γ_x	2.00
deep habit, θ	-0.90
persistence of deep habit, ρ	0.90
elasticity of labor supply, $1/\gamma_h$	5.00
elasticity of subs b/w goods and type, η, ε	2.00, 1.50
home bias, ω_h^ε	0.60
returns to scale, α	1.00
fixed operation cost, ϕ, ϕ^*	0.08, 0.00
Nominal rigidity and monetary policy	
price adjustment cost, γ_p	10.0
wage adjustment cost, γ_w	30.0
monetary policy, ρ^R, ρ^y, ρ^π	0.85, $[0.25, 1.50] * 0.15$
Financial Frictions	
equity issuance cost, φ	0.30
idiosyncratic volatility (a.r.), σ	0.10

Shocks

- ▶ We consider financial shock (f) and technology shock (z).

  - ▸ f−shock: $\varphi_t = \bar{\varphi} f_t$ and $\varphi_t^* = \bar{\varphi} f_t^*$ with $\bar{\varphi} = 0.3$.

  $$\begin{bmatrix} \log f_t \\ \log f_t^* \end{bmatrix} = \rho_f \begin{bmatrix} \log f_{t-1} \\ \log f_{t-1}^* \end{bmatrix} + \begin{bmatrix} \varepsilon_{ft} \\ \varepsilon_{ft}^* \end{bmatrix}, \begin{bmatrix} \varepsilon_{ft} \\ \varepsilon_{ft}^* \end{bmatrix} \sim N\left(-0.5\sigma_f^2, \begin{bmatrix} \sigma_f^2 & 0 \\ 0 & \sigma_f^2 \end{bmatrix} \right)$$

  - ▸ z−shock:

  $$\begin{bmatrix} \log z_t \\ \log z_t^* \end{bmatrix} = \rho_z \begin{bmatrix} \log z_{t-1} \\ \log z_{t-1}^* \end{bmatrix} + \begin{bmatrix} \varepsilon_{zt} \\ \varepsilon_{zt}^* \end{bmatrix}, \begin{bmatrix} \varepsilon_{zt} \\ \varepsilon_{zt}^* \end{bmatrix} \sim N\left(-0.5\sigma_z^2, \begin{bmatrix} \sigma_z^2 & 0 \\ 0 & \sigma_z^2 \end{bmatrix} \right)$$

- ▶ We set $\rho_z = \rho_z = 0.9$. We set $\sigma_z = 0.01$ and choose σ_f such that the variance decomposition of output has 50:50 shares.

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Monetary Union and Financial Shock

- ▶ Impact of the shock to the periphery (Home)

Figure: Financial Shock under Monetary Union

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Floating and Financial Shock
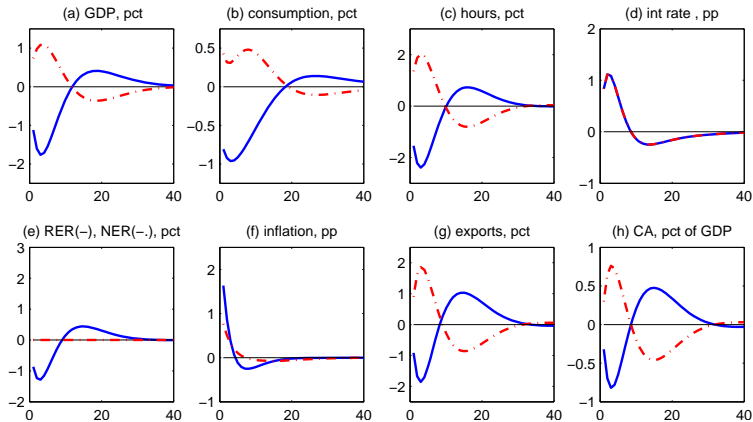
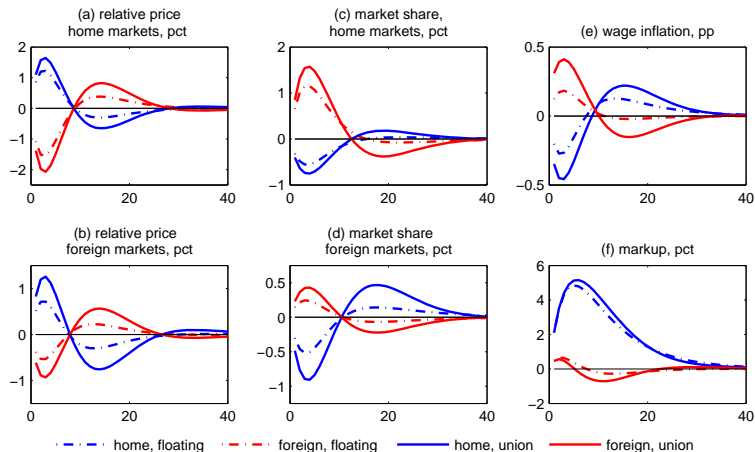▶ Impact of the shock to the periphery (Home)

Figure: Financial Shock under Floating
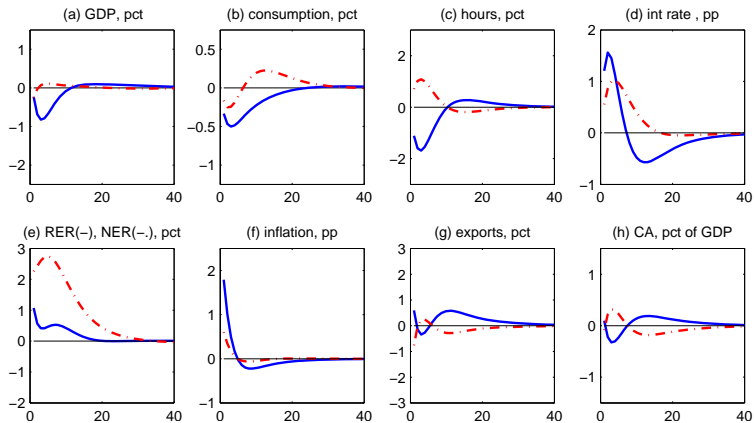
Price War and Market Shares
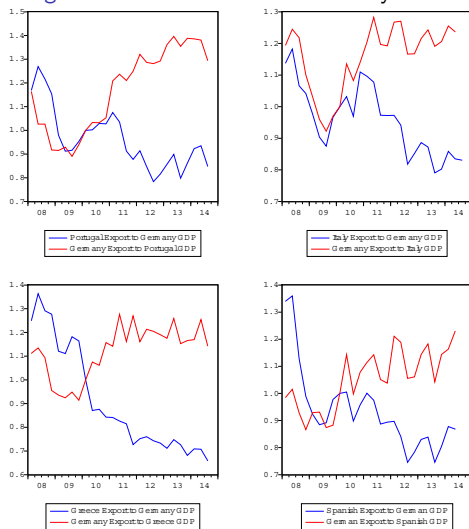
▶ Impact of the shock to the periphery (Home)

Figure: Financial Shock, Relative Prices and Market Shares

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Some Evidence

▶ Measure macro market share as the ratio of country A's export to B relative to B's market size, i.e., GDP.

Figure: Euro-zone Market Share Dynamics

Endogenous Volatilities of Monetary Union

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Table: Endogenous Volatility Under Alternative Environments

	Output (GDP) volatility			Consumption volatility		
	MU (A)	Float (B)	B/A	MU (A)	Float (B)	B/A
Home	.015	.011	72	.022	.010	45
Foreign	.015	.009	58	.020	.009	46

Note: The consumption equivalent is the required minimum increase in average consumption per period holding labor hours constant to make the representative agent living in the economy under the floating exchange rate regime no worse off by transitioning to the currency union.

Welfare Consequences of Monetary Union

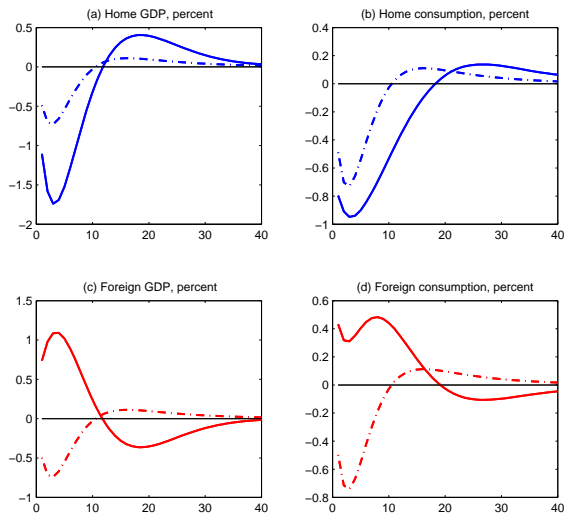Table: Welfare Consequence of Currency Union

	Welfare		Con Equiv
	MU (A)	Float (B)	Percent
Home country	-274.86	-274.37	0.22
Foreign country	-217.86	-217.37	0.38
Joint welfare	-492.82	-491.48	$-$

Note: The consumption equivalent is the required minimum increase in average consumption per period holding labor hours constant to make the representative agent living in the economy under the floating exchange rate regime no worse off by transitioning to the currency union.

Heterogeneity in Financial Conditions

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- An alternative experiment to illustrate the role of heterogeneity.

  - Baseline: Heterogeneity with $\phi = 0.08$, $\phi^* = 0.00$ and financial shock only to Home
  - Alternative: Homogeneity with $\phi = 0.08$, $\phi^* = 0.08$ and financial shock both to Home and to Foreign

Price War and Business Cycle

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Figure: Heterogeneity as a Propagation Channel

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Monetary Union under Complete Risk Sharing (Fiscal Union)

- ▶ Dramatic reduction in consumption volatility
- ▶ Requires large wealth transfers from the north to the south.

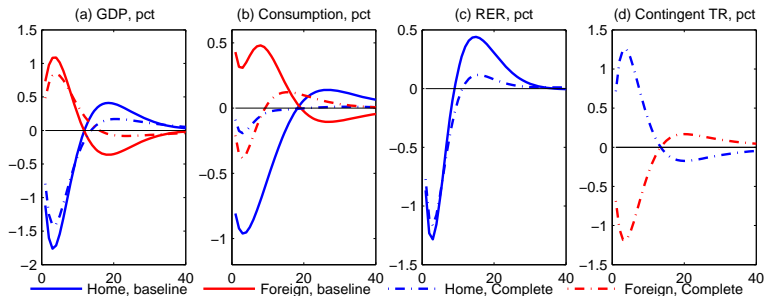Figure: Financial Shock, Monetary Union and Complete Risk Sharing

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Gains vs Losses of Fiscal Union

Table: Costs and Benefits of Complete Risk Sharing

	Welfare		Con Equiv
	MU (A)	Risk Sharing (B)	Percent
Home country	−274.86	−253.21	10.28
Foreign country	−217.86	−236.96	−9.13
Joint welfare	−492.82	−490.17	−

Note: The consumption equivalent is the required minimum increase in average consumption per period holding labor hours constant to make the representative agent living in the economy under the floating exchange rate regime no worse off by transitioning to the currency union.

Theory of Fiscal Devaluation

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- ▶ Recently, individual countries of EU consider the idea of swapping VAT and payroll subsidy.
    - ▶ VAT is a discriminatory tax on imported goods.
    - ▶ For revenue-neutrality, payroll subsidy on domestic firms.
    - ▶ Germany: raised VAT16% to 19% Jan 2007, lowered corporate income tax rate from 38.7% to 29.8% Jul 2007 (effective Jan 2008).
- ▶ We consider a simple experiment: VAT + payroll subsidy of a size δ_t: $\tau_t^v = \varsigma_t^p = \dfrac{\delta_t}{1 + \delta_t}$

Implementable Plan

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▶ FD rules that are linear in the resource gap of the periphery.

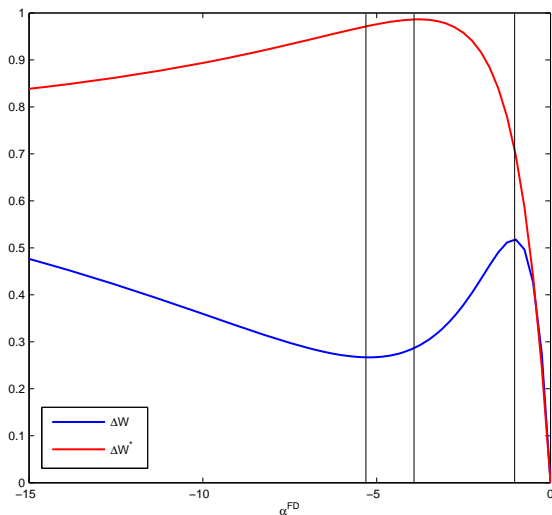▶ In particular, we consider a simple VAT-payroll subsidy swap rule,

$$\tau_t^v = \varsigma_t^p = \frac{\delta_t}{1+\delta_t}$$

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

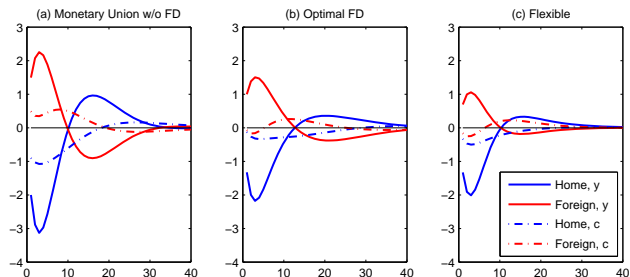▶ Is there a parameter region that is mutually beneficial both to the core and to the periphery?

Welfare (2nd order)

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Figure: Welfare Difference from Baseline w/o FD

Optimal Rule vs Flexible Allocations

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

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Financial Friction, Externality and Fiscal Devaluation

Figure: Financial Friction and Benefit of Fiscal Devaluation to Core

Conclusion

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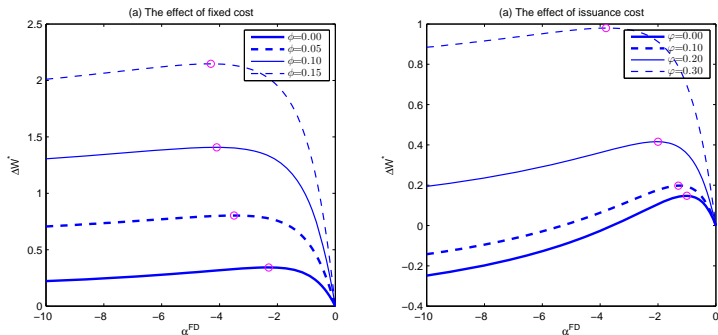
▶ Heterogeneous financial frictions in cust omer markets model
  implies strong amplification mechanism through "price war"
  in export markets.

▶ Monetary union distorts adjustment of real exchange rates
  and exacerbates the downturn.

▶ Unilateral fiscal devaluation by periphery may be welfare
  improving for both periphery and core.