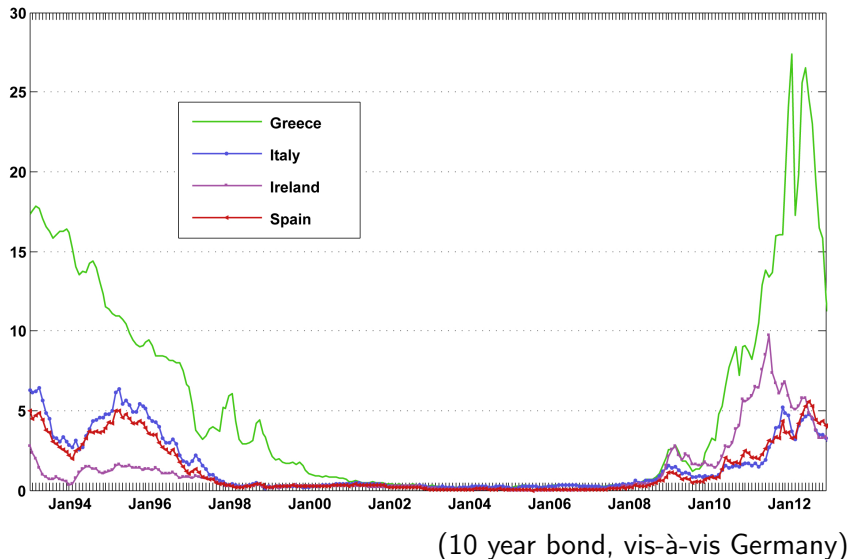


Exit and default premia in currency unions

Alexander Kriwoluzky (U Halle),
Gernot Müller (U Bonn & CEPR), and Martin Wolf (U Bonn)

December 2014

Sovereign yield spreads in the euro area



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- ▶ Nominal anchor for inflation-prone member states: eliminates inflation bias and expectations of depreciated currency

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Mario Draghi (July 26, 2012): “These premia have to do with default, with liquidity, but they also have to do more and more with the risk of convertibility. Now . . . they come into our mandate.”

Question and framework

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New Keynesian model of a small open economy

- ▶ Member of a currency union or independent monetary policy
- ▶ Monetary and fiscal policy (including default) captured by simple rules
- ▶ Policy regime may change and market participants know this: expectations of regime change impact equilibrium outcome

Results

Explosive debt dynamics in member state of currency union

- ▶ Depends on fiscal stance & expectations of exit or default
- ▶ Exit premia and default premia reinforce each other

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Calibration to Greece 2009–2012 (preliminary)

- ▶ Exit premium accounts for small fraction of sovereign yield spreads

Literature

Expected change of exchange rate regime can be destabilizing

- ▶ Krugman (1979), Flood and Garber (1984), Obstfeld (1996)

Stabilizing real value of debt through inflation inside and outside currency unions

- ▶ Woodford (1996), Bergin (2000)

Default due to explosive debt dynamics

- ▶ Uribe (2006), Bi (2012), Daniel and Shiamptanis (2012)

Optimal devaluation and default may happen jointly

- ▶ Na, Schmitt-Grohé, Uribe & Yue (2014)

Literature cont'd

Sovereign risk channel

- ▶ Corsetti, Kuester, Meier & Müller (2013), Bocola (2013)

Equilibrium determination under changing policy regimes

- ▶ Farmer, Waggoner & Zha (2009, 2011)
- ▶ Andolfatto & Gomme (2003), Bianchi & Ilut (2012), Davig & Leeper (2007a,2007b,2011)

Use institutional information to identify redenomination risk

- ▶ De Santis (2014)
- ▶ Krishnamurthy, Nagel & Vissing-Jorgensen (2014)

2. Small open economy model

Households

- ▶ Supply labor, consume bundle of domestically produced and goods imported from the rest of the world/union
- ▶ Hold government debt and trade non-contingent bonds issued under domestic and foreign jurisdiction
- ▶ Sovereign risk channel: private sector yields may rise with expectations of sovereign default (Corsetti et al 2013) [▶ Details](#)

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Linearize optimality conditions of private sector

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- ▶ Monetary policy (union membership vs Taylor rule)

$$\gamma_{\zeta_t} e_t + (1 - \gamma_{\zeta_t})(r_t - \phi_{\pi} \pi_{H,t}) = 0$$

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$$\hat{t}_t = \psi_{\zeta_t} \hat{d}_{t-1} - \epsilon_t$$

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$$\hat{t}_t = \psi_{\zeta_t} \hat{d}_{t-1} - \epsilon_t$$

- ▶ Default rule prescribes haircut on public debt in some states of the world

$$\delta_t = \zeta_D^{-1} \delta_{\zeta_t} \hat{d}_{t-1}$$

▶ Details

Sequence of regime transitions

$$\begin{array}{l} \text{Union}_{\circlearrowleft\mu} \\ \psi > 1 - \beta, \delta = 0 \end{array} \longrightarrow_{1-\mu} \begin{cases} \lambda \\ 1 - \lambda \end{cases} \begin{array}{l} \text{Default} \longrightarrow_1 \text{Union}_{\circlearrowleft 1} \\ \text{Exit } (\phi_\pi < 1, \psi = 0)_{\circlearrowleft 1} \end{array}$$

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- ▶ Upon exit: new currency introduced, securities issued under domestic law redenominated
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Focus on dynamics while economy operates in first regime

- ▶ Emergence of exit and default premia and their consequences

3. Results

Result 1. Explosive debt dynamics within currency union if

- a) Fiscal policy sufficiently unresponsive and
- b) Expectations of exit or default sufficiently large

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Solution for public debt in initial regime (assuming flexible prices, no sovereign risk channel, unitary trade elasticity, $\beta \in (0, 1)$)

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- ▶ Locally explosive debt dynamics sustainable in equilibrium (within currency union)

Intuition

Consider exit

- ▶ Outstanding debt converted into new currency
- ▶ Fiscal policy “active” after exit (Leeper 1991): real value of debt stabilized through inflation
- ▶ Depreciation

Intuition

Consider exit

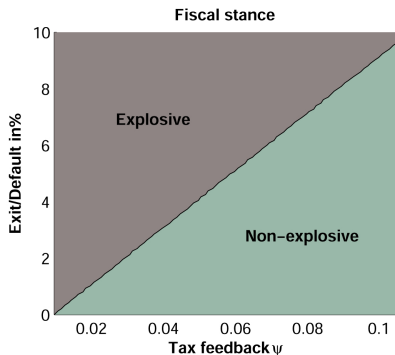
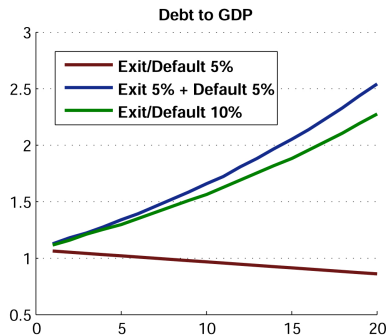
- ▶ Outstanding debt converted into new currency
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Prior to exit

- ▶ Expected depreciation raises nominal yields
- ▶ Higher debt service raises debt stock further
- ▶ Expected losses and exit premia rise → vicious circle

Analogous logic applies to case of default

Dynamics after purely transitory deficit shock: Expectations matter, but current policies too...



All securities issued under domestic law carry exit premium

Result 2. Yields on domestic-law bonds (simplified model)

$$r_t = \frac{(1 - \mu)(1 - \lambda)}{\zeta_D \beta [\mu + (1 - \mu)\lambda(1 - \delta)]} [(1 - \psi)\hat{d}_{t-1} + \epsilon_t]$$

- ▶ No premium if exit ruled out ($\lambda = 1$)

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Sovereign yield spread reflects default premium in addition

$$i_t = r_t + \underbrace{\frac{(1 - \mu)\delta\lambda}{\zeta_D \beta [\mu + (1 - \mu)\lambda(1 - \delta)]}}_{E_t \delta_{t+1}} [(1 - \psi)\hat{d}_{t-1} + \epsilon_t]$$

Full model

Result 3. Exit expectations make debt/deficit stagflationary

- ▶ Output declines, as real interest rates rise with expected real depreciation upon exit: uncovered (real) interest rate parity

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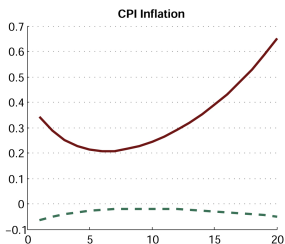
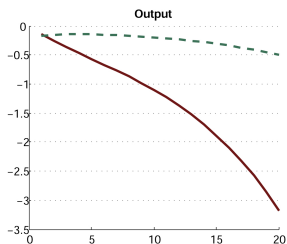
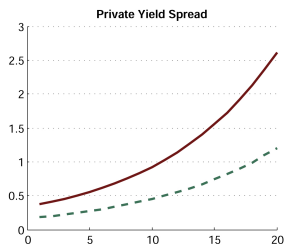
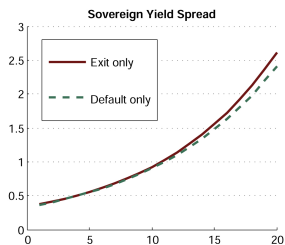
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Result 4. Default expectations make debt/deficit deflationary

- ▶ Sovereign risk channel raises borrowing costs and depresses demand

Transitory deficit shock: exit and default expectations impact transmission, each in its own way



4. The case of Greece 2009Q4–2012Q1

Calibrate the model to capture key features of Greek data

- ▶ October 2009: newly elected government revises 2009 budget deficit from 6 to 12.7 percent of GDP
- ▶ March 2012: Greek debt restructured

4. The case of Greece 2009Q4–2012Q1

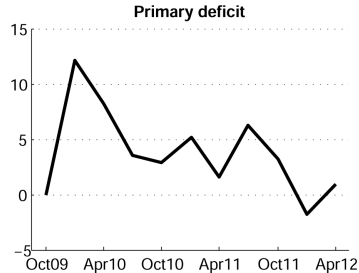
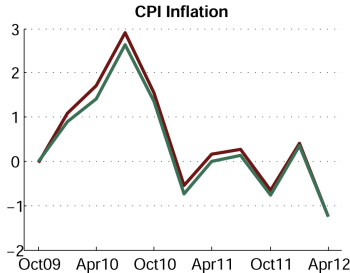
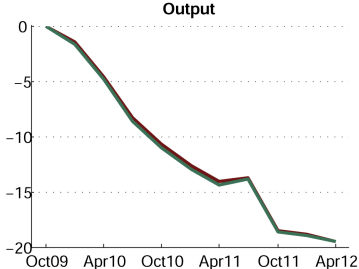
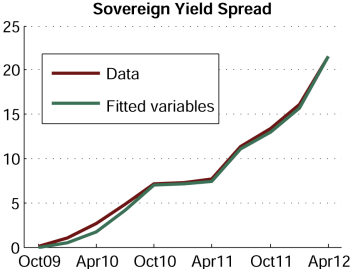
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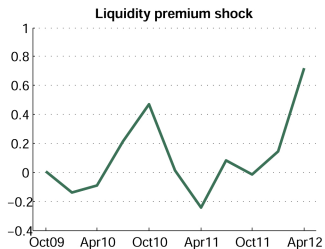
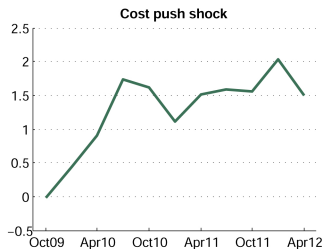
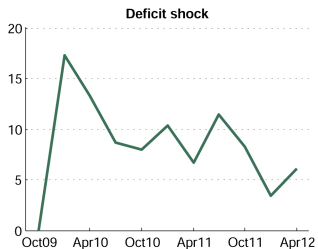
Empirical strategy

- ▶ Data on sovereign yield spreads, primary deficits, output, inflation
- ▶ Calibration based on conventional parameter values [▶ Table](#)
- ▶ Estimate μ, λ, χ : implied prob of exit is 3%, default 24%
- ▶ Estimate realized deficit shocks, external demand shocks, cost-push shock, liquidity premium shock

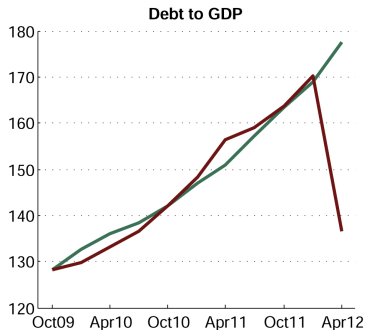
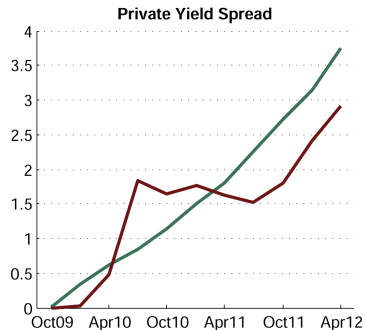
Model vs Greek data



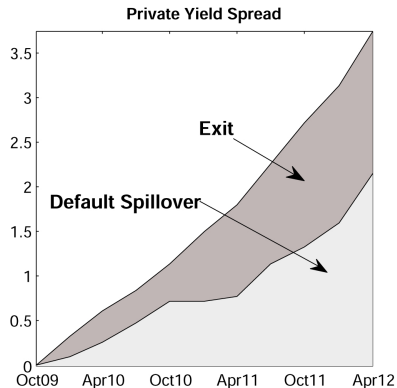
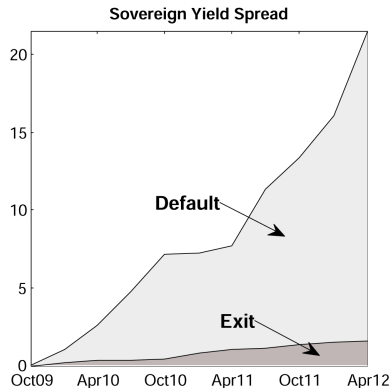
Estimated shocks



Non-targeted variables: model vs data



Decomposing yield spreads



5. Conclusion

Sovereign yield spreads may reflect exit and default premia

- ▶ Achieve identification through structural model
- ▶ Markov-switching rational expectations framework permits explosive debt dynamics within currency union
- ▶ Important role for expectations of regime change and current fiscal stance

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Exit premia in Greece 2009Q4–2012Q1

- ▶ Account for a small fraction sovereign yield spreads ($\approx 1/10$)
- ▶ and for up to $1/3$ of private yield spread

Appendix

$H_t(j)$ is labor supplied to Calvo firm $j \in [0, 1]$, objective of representative household

$$\max_{\{C_t, H_t\}_{t=0}^{\infty}} E_0 \sum_{t=0}^{\infty} \beta_t \left[\log C_t - \eta_t \int_0^1 \frac{H_t(j)^{1+\varphi}}{1+\varphi} dj \right]$$

with

$$\beta_0 = 1, \quad \beta_{t+1} = (1 + \eta C_t)^{-1} \beta_t$$

Consumption C_t : bundle of differentiated goods, produced at home as well as abroad

$$C_t = \left[(1 - \omega)^{\frac{1}{\sigma}} \left(\left[\int_0^1 Y_{H,t}(j)^{\frac{\epsilon-1}{\epsilon}} dj \right]^{\frac{\epsilon}{\epsilon-1}} \right)^{\frac{\sigma-1}{\sigma}} + \omega^{\frac{1}{\sigma}} \left(\left[\int_0^1 Y_{F,t}(j)^{\frac{\epsilon-1}{\epsilon}} dj \right]^{\frac{\epsilon}{\epsilon-1}} \right)^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}}$$

Price indices

$$P_t = [(1 - \omega)P_{H,t}^{1-\sigma} + \omega P_{F,t}^{1-\sigma}]^{\frac{1}{1-\sigma}}$$

$$P_{H,t} = \left(\int_0^1 P_{H,t}(j)^{1-\epsilon} dj \right)^{\frac{1}{1-\epsilon}} \quad P_{F,t} = \left(\int_0^1 P_{F,t}(j)^{1-\epsilon} dj \right)^{\frac{1}{1-\epsilon}}$$

Real exchange rate

$$Q_t = \frac{P_t \mathcal{E}_t}{P_t^*}$$

Budget constraint

$$\begin{aligned} Y_t + (1 - \delta_t)D_{t-1} + B_{t-1} + B_{t-1}^* \mathcal{E}_t \\ = Q_{D,t}D_t + P_t C_t + Q_{B,t}B_t + Q_{B^*,t}B_t^* \mathcal{E}_t \end{aligned}$$

with

- ▶ Labor and dividend income Y_t
- ▶ Public debt D_{t-1} coming due net of haircut δ_t
- ▶ Private bonds coming due: B_{t-1}, B_{t-1}^* issued under domestic and foreign jurisdiction, respectively
- ▶ Price of foreign currency in terms of domestic currency \mathcal{E}_t
- ▶ Price of privately issued bonds possibly declines as sovereign default risk rises (sovereign risk channel)

$$Q_{B,t} = R_t^{-1} E_t(1 - \delta_{t+1})^\chi, \quad Q_{B^*,t} = R_t^{*-1} E_t(1 - \delta_{t+1})^\chi$$

▶ back

Firms operate under monopolistic competition

Generic firm $j \in [0, 1]$ runs linear technology

$$Y_{j,t} = H_{j,t}$$

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Generic firm $j \in [0, 1]$ runs linear technology

$$Y_{j,t} = H_{j,t}$$

Price setting in producer currency and restricted à la Calvo

- ▶ Opportunity to reset price arrives with probability ξ
- ▶ Given demand $Y_{j,t|0}$, objective is to

$$\max_{P_{j,0}} E_t \sum_{t=0}^{\infty} \xi^t \Xi_{0,t} [(1 - \tau_t) P_{j,0} Y_{j,t|0} - W_t H_{j,t}]$$

- ▶ With stochastic discount factor $\Xi_{0,t+k}$ and wage W_t

▶ back

Union membership vs autonomy/float

$$\mathcal{E}_t = 1 \quad \text{or} \quad \ln(R_t/R) = \phi \ln(\Pi_{H,t})$$

Evolution of government debt (issued under domestic law)

$$Q_{D,t}D_t = (1 - \delta_t)D_{t-1} - T_t$$

T_t lump-sum, debt-financed transfer to households

Tax rule

$$\frac{T_t}{P_{H,t}Y} = \frac{T}{PY} + \psi \left(\frac{D_{t-1}}{P_{H,t-1}Y} - \zeta_D \right) - \epsilon_t, \quad \psi \geq 0$$

▶ back

Markov chain

States: $\zeta_t \in \{\text{Union, Default, Union, Float}\}$

Transition matrix

$$P = \begin{pmatrix} \mu & (1-\mu)\lambda & 0 & (1-\mu)(1-\lambda) \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}.$$

where $P = [p_{ij}] = [\text{Prob}(\zeta_t = j; \zeta_{t-1} = i)]$

▶ back

An n -dimensional process $\{x_t\}$ is MSS if there exists a vector x_∞
 $n \times 1$
and a matrix Σ_∞
 $n \times n$ such that

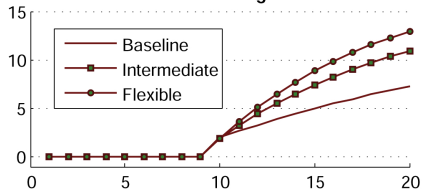
- ▶ $\lim_{n \rightarrow \infty} E_t[x_{t+n}] = x_\infty$
- ▶ $\lim_{n \rightarrow \infty} E_t[x_{t+n} x_{t+n}'] = \Sigma_\infty$

[▶ back](#)

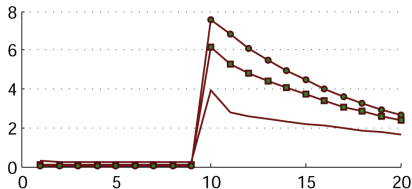
Exit under different degrees of price rigidities [▶ back](#)

$$r_t - E_t \pi_{t+1} = r^* + \underbrace{E_t \Delta e_{t+1} - E_t \pi_{t+1}}_{\text{expected real depreciation}}$$

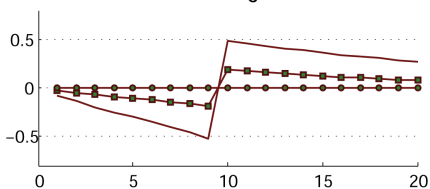
Nominal Exchange Rate



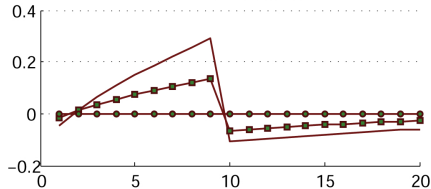
CPI Inflation



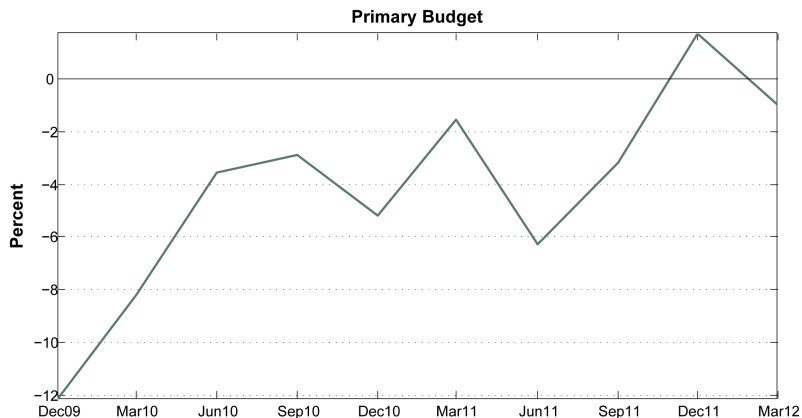
Real Exchange Rate



Real Interest Rate



Primary government budget (% of GDP, annualized)



▶ back

Calibration

	Parameter description	Value	Target / Source
β	Discount factor (steady state)	0.99	Annual interest rate 4.1%
γ	risk aversion	1	Balanced growth
φ	Inverse Frisch elasticity	3	Domeij and Flodén (2006)
σ	Trade-price elasticity	1.5	Bennett et al. (2008)
ω	Home Bias	0.2	Export-to-GDP ratio 2009
ξ	Fraction of unchanged prices	0.925	Flat Phillips curve
ϵ	Elasticity of substitution	11	Mark-up 10%
ϕ_π	Taylor-rule coefficient	0.9	PM
ψ	Tax-rule coefficient	0.009	AF
ζ	Steady-state debt-to-GDP ratio	5.13	128.3% Debt 2009Q3
δ	Haircut	0.519	51.9% Haircut 2012Q1
μ	Probability of staying in initial regime	0.78	Spread 2009Q4–2012Q1
λ	Default vs exit	0.945	CPI 2009Q4–2012Q1

▶ back