Exit and default premia in currency unions

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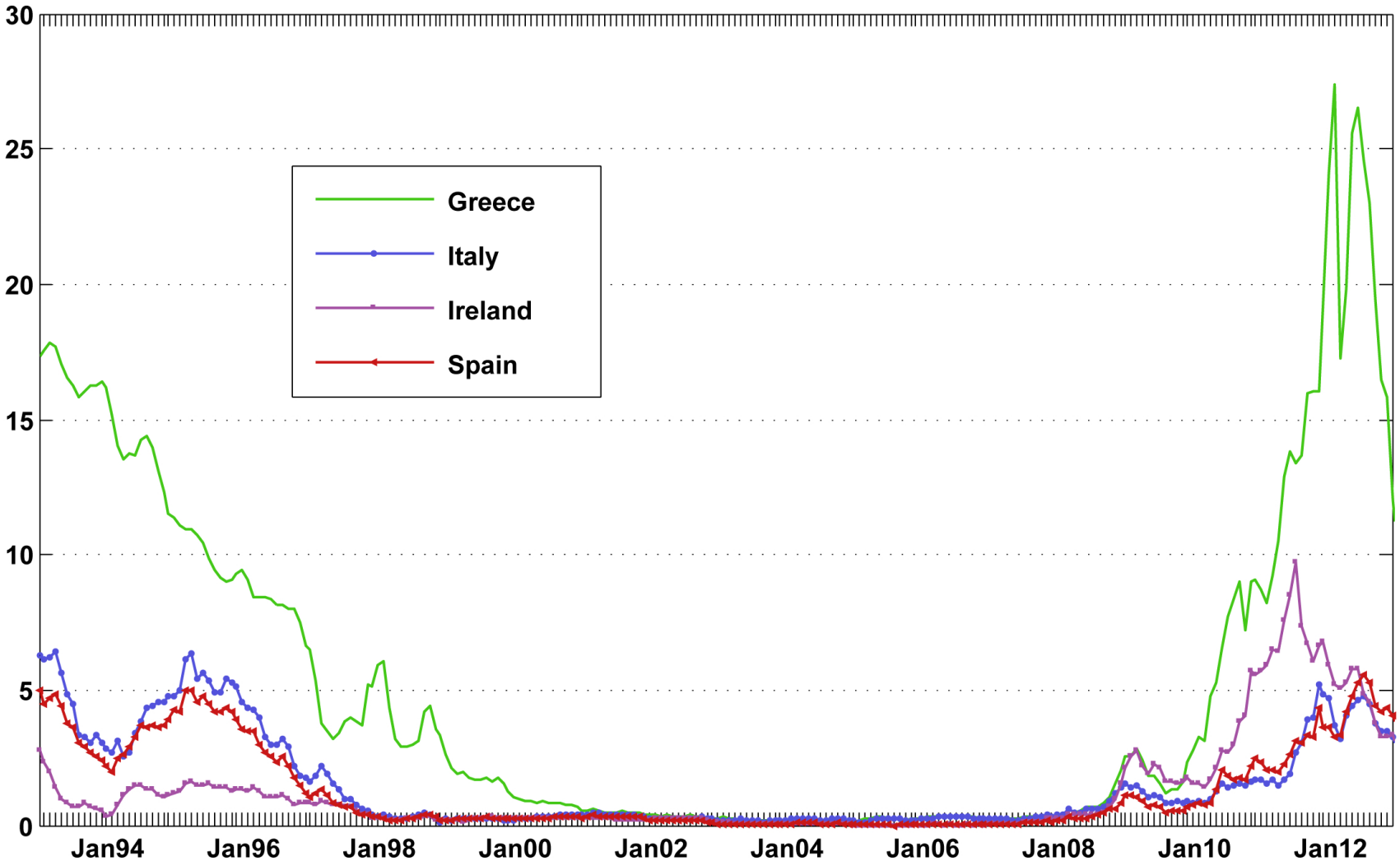
Sovereign yield spreads in the euro area



(10 year bond, vis-à-vis Germany)

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Decline prior to creation of euro area

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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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- Monopolistic competition
- Serve domestic and demand from the rest of the world/union
- Sticky prices and forward-looking price setting ▸ Details

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Linearize optimality conditions of private sector

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- Monetary policy (union membership vs Taylor rule)

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

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

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

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

▸ Details

Sequence of regime transitions

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

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- Upon exit: new currency introduced, securities issued under domestic law redenominated
- Defines transition matrix of Markov chain for policy regimes

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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

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

$$\hat{d}_t = \frac{1-\psi}{\beta\left[\mu + (1-\mu)\lambda(1-\delta)\right]}\left[\hat{d}_{t-1} + (1-\psi)^{-1}\epsilon_t\right]$$

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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
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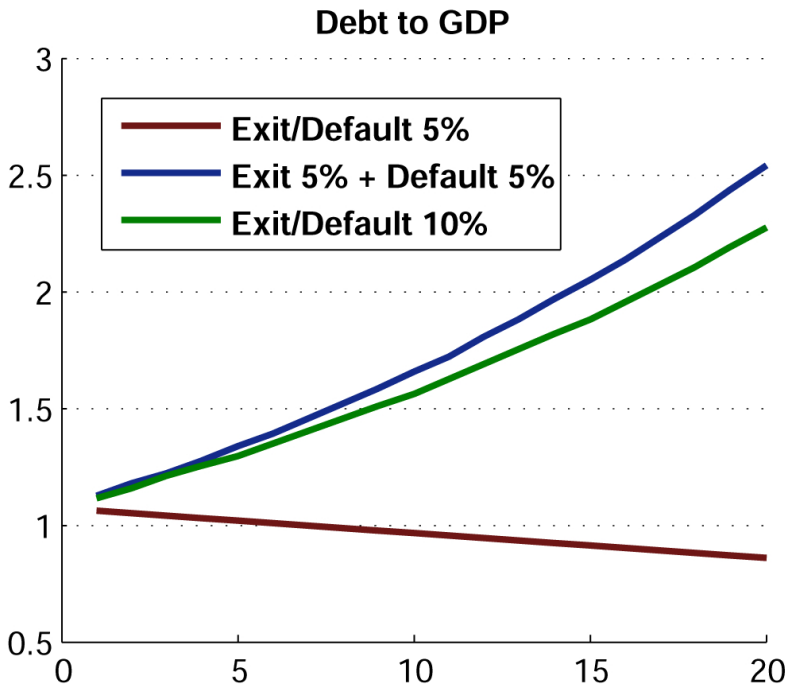
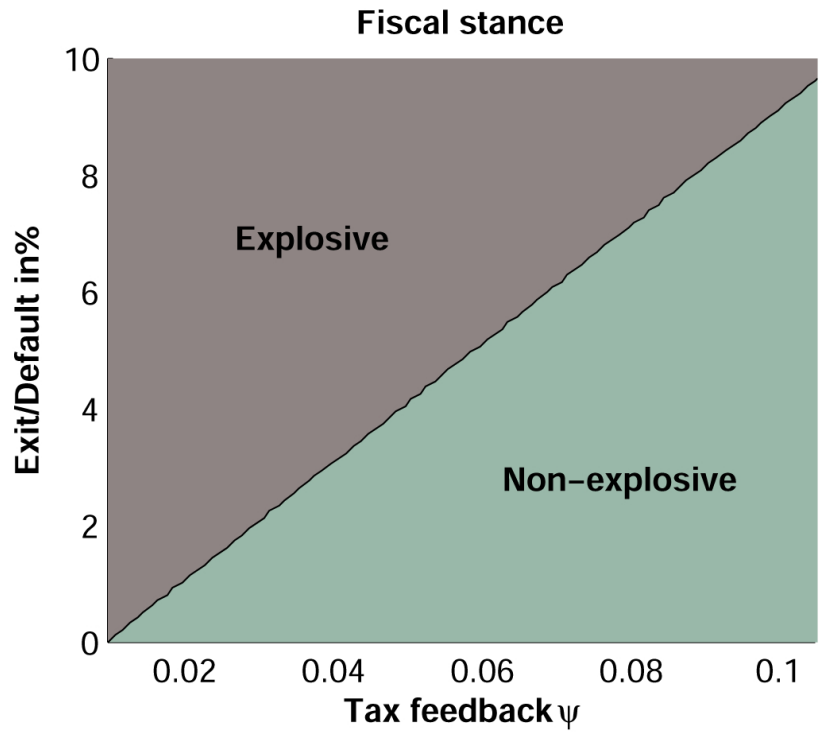
Prior to exit

- Expected depreciation raises nominal yields
- Higher debt service raises debt stock further
- Expected losses and exit premia rise $\rightarrow$ 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)

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Sovereign yield spread reflects default premium in addition

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

Full model

Result 3. Exit expectations make debt/deficit stagflationary

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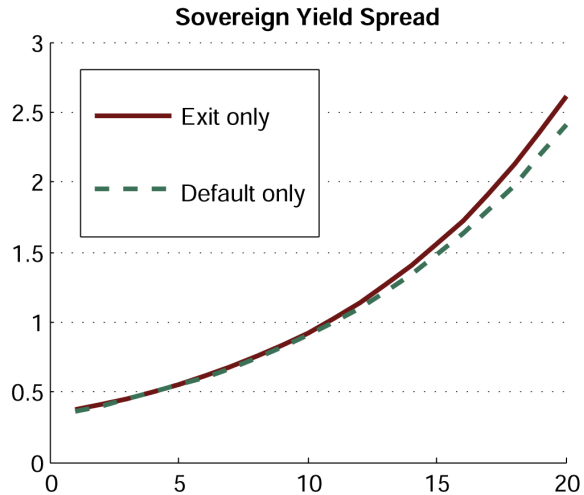
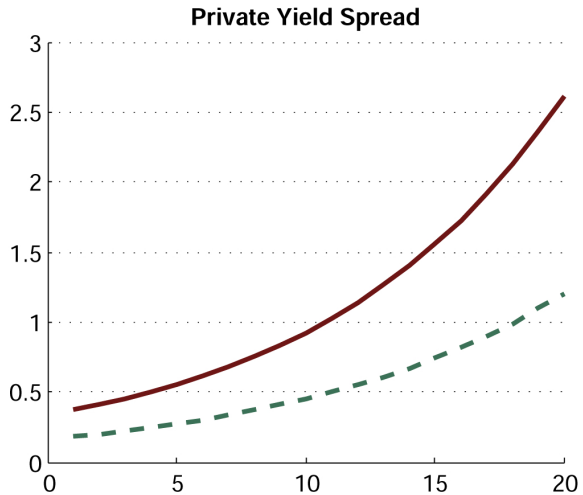
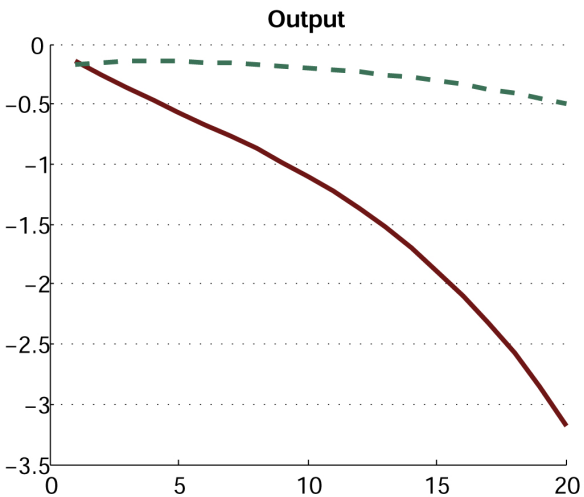
Result 4. Default expectations make debt/deficit deflationary

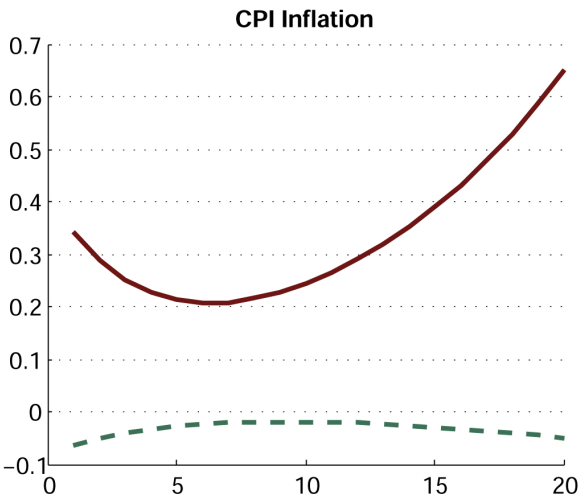
- Sovereign risk channel raises borrowing costs and depresses demand

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
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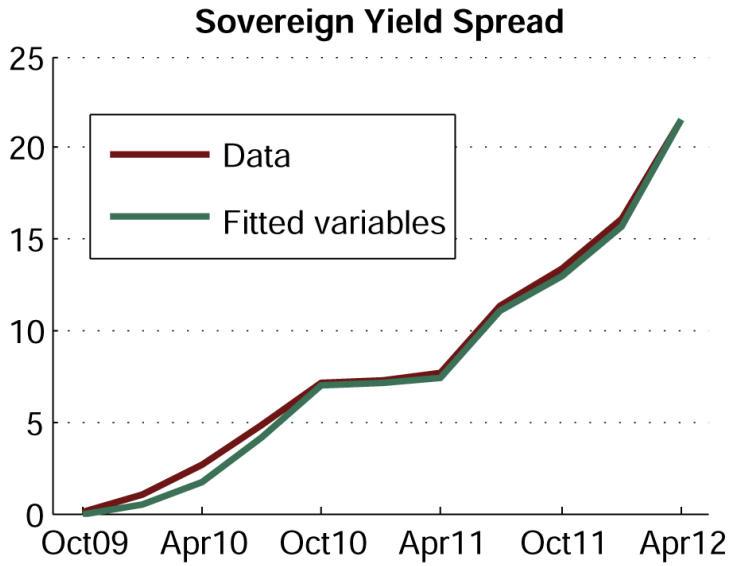
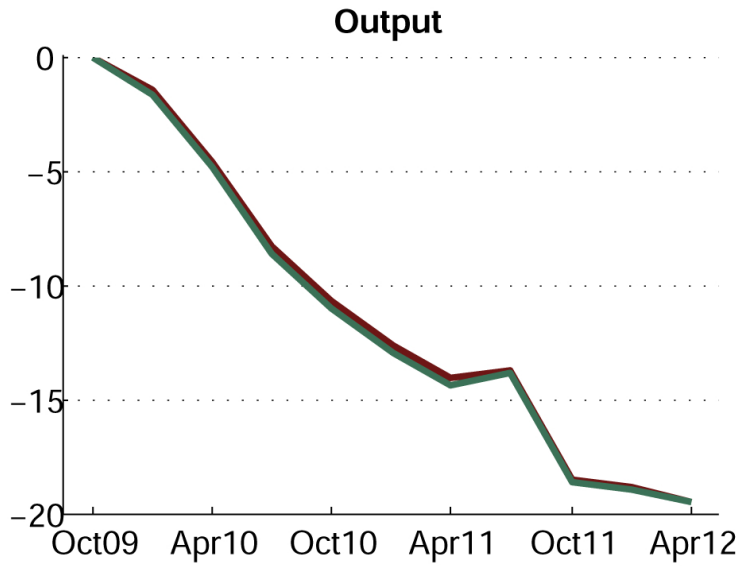
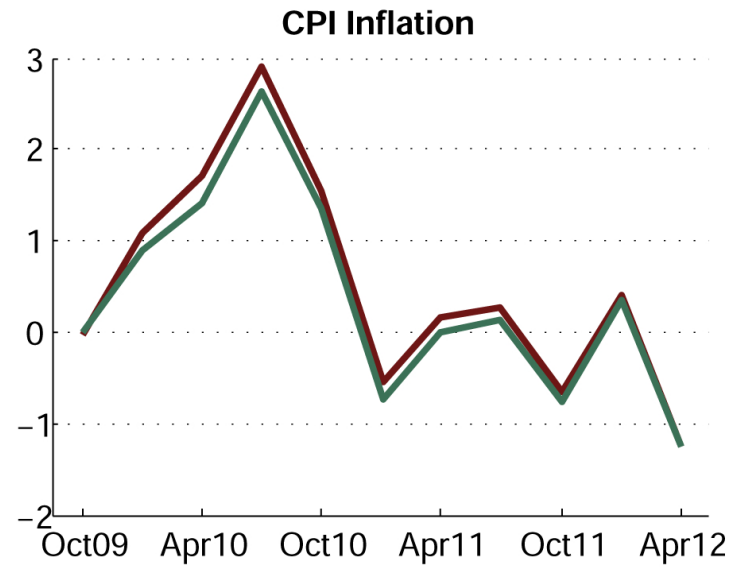
Empirical strategy

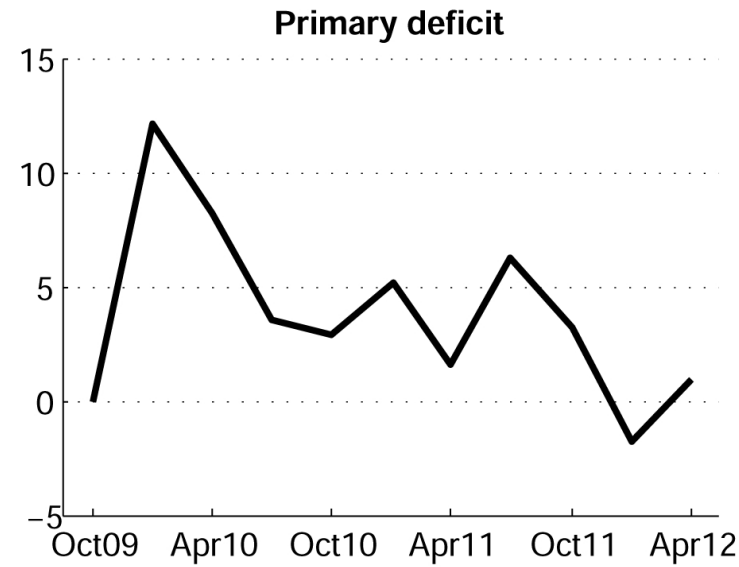
- Data on sovereign yield spreads, primary deficits, output, inflation
- Calibration based on conventional parameter values ▸ Table
- Estimate μ, λ, χ: implied prob of exit is 3%, default 24%
- Estimate realized deficit shocks, external demand shocks, cost-push shock, liquidity premium shock

Model vs Greek data

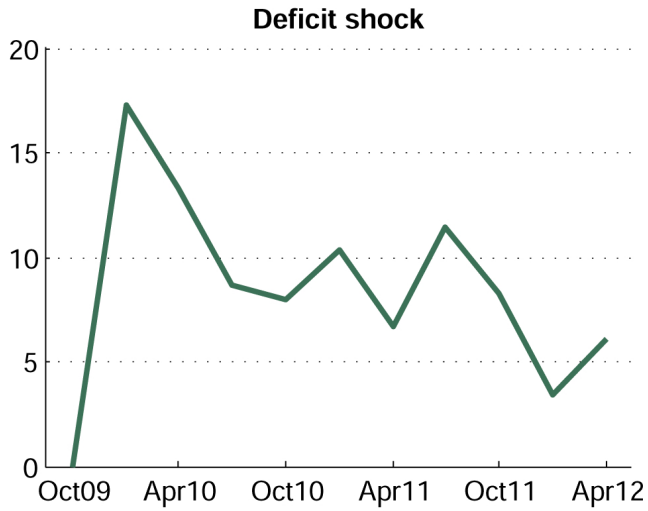


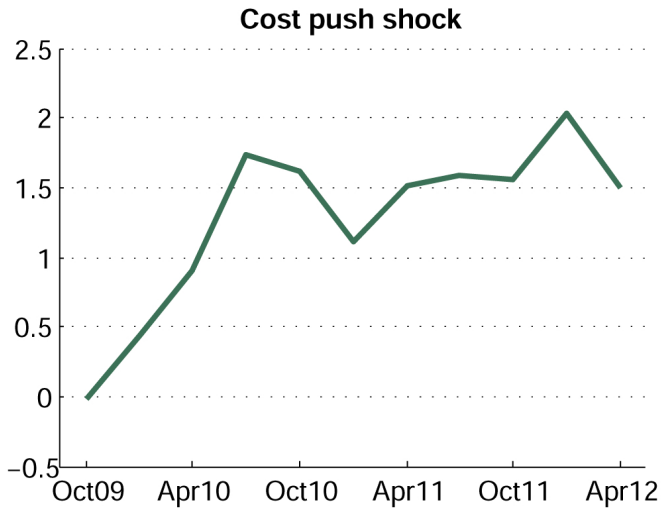


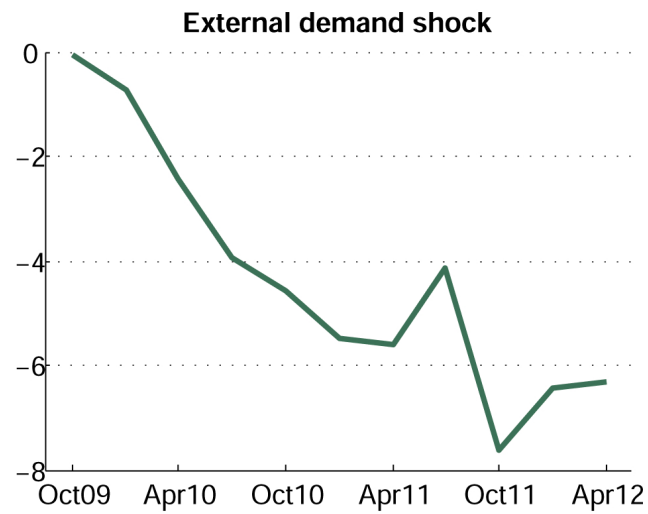


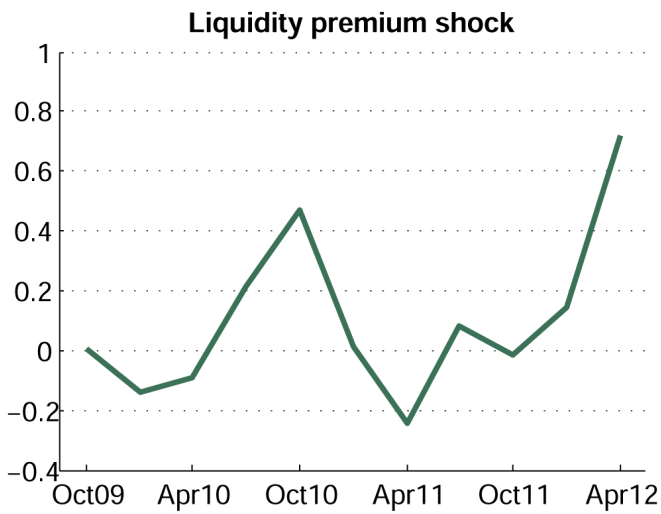


Estimated shocks

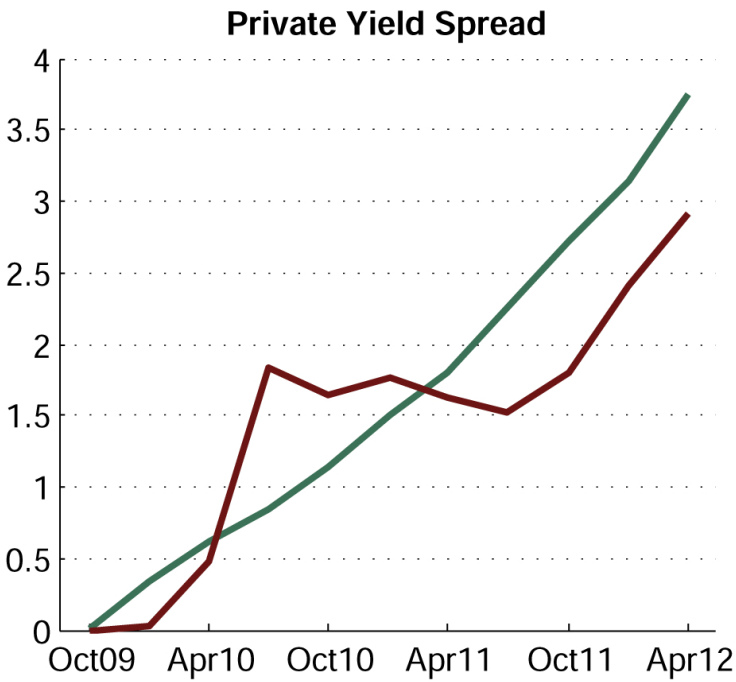


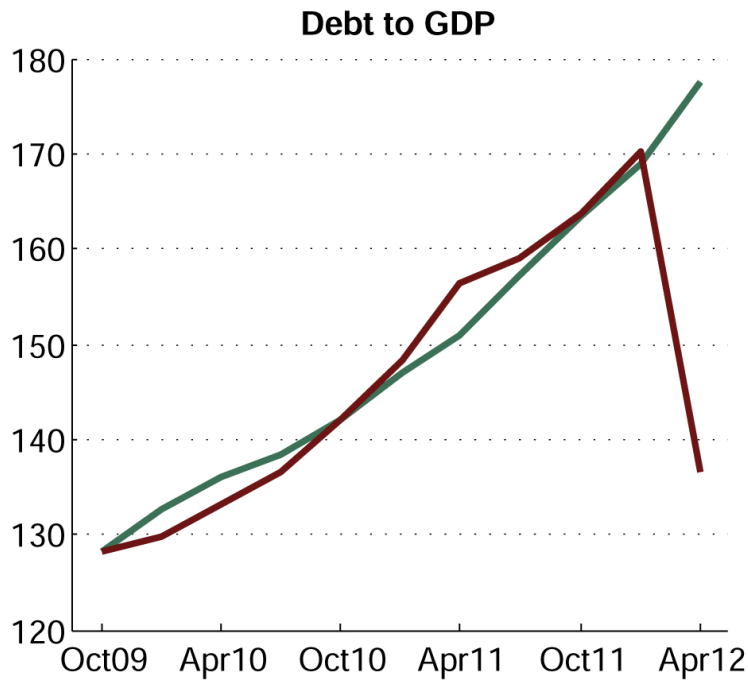




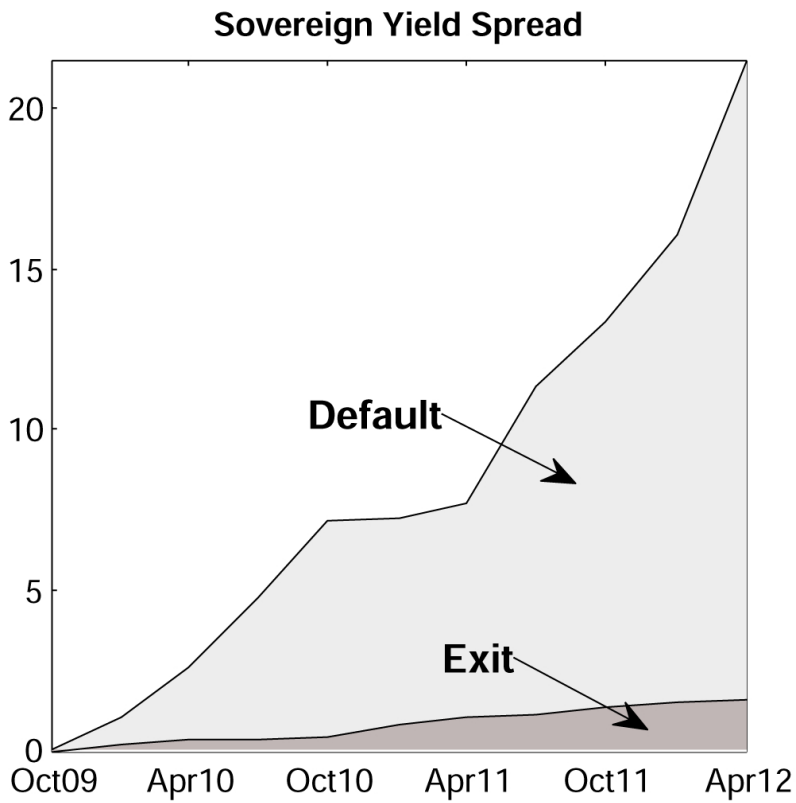


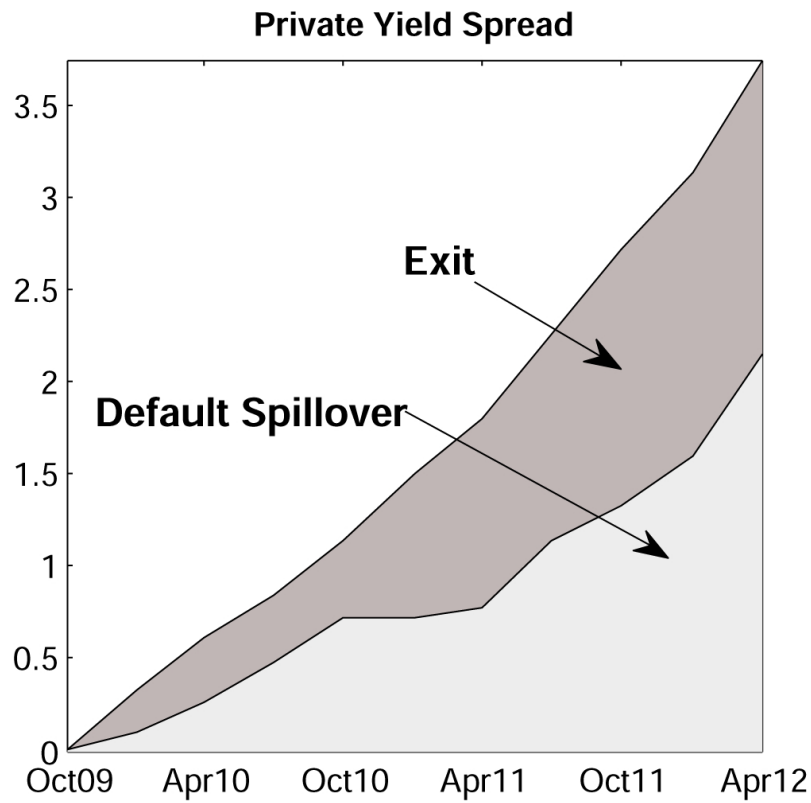
Non-targeted variables: model vs data





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

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

Price indices

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

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

Real exchange rate

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

Budget constraint

$$Y_t + (1-\delta_t)D_{t-1} + B_{t-1} + B^*_{t-1}\mathcal{E}_t$$
$$= Q_{D,t}D_t + P_tC_t + Q_{B,t}B_t + Q_{B^*,t}B^*_t\mathcal{E}_t$$

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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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

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

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

back

Union membership vs autonomy/float

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

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: $\varsigma_t \in \{\text{Union, Default, Union, Float}\}$

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 $P = [p_{ij}] = [Prob(\varsigma_t = j; \varsigma_{t-1} = i)]$

back

MSS

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

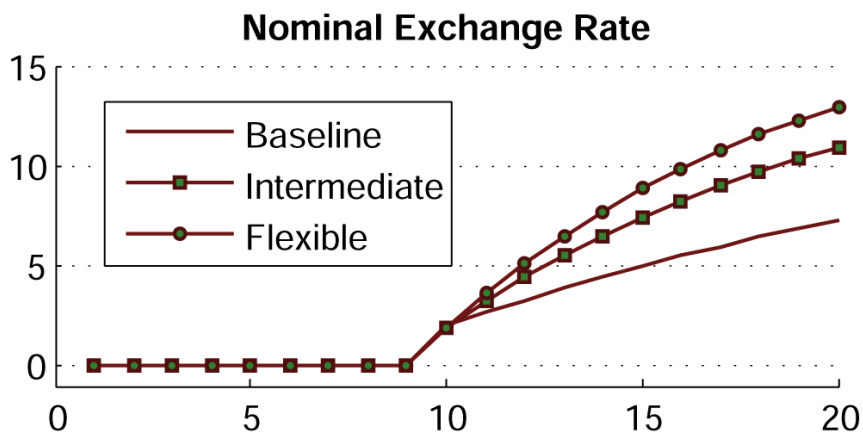
- $\lim_{n\to\infty} E_t[x_{t+n}] = x_\infty$
- $\lim_{n\to\infty} E_t[x_{t+n}\ x_{t+n}'] = \Sigma_\infty$

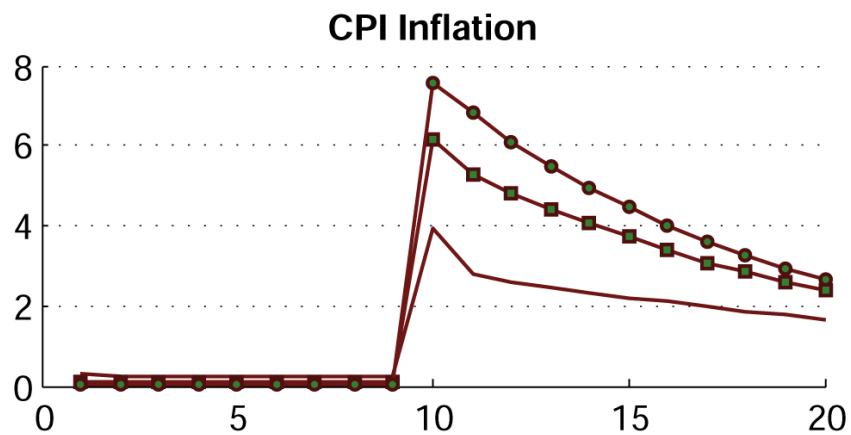
back

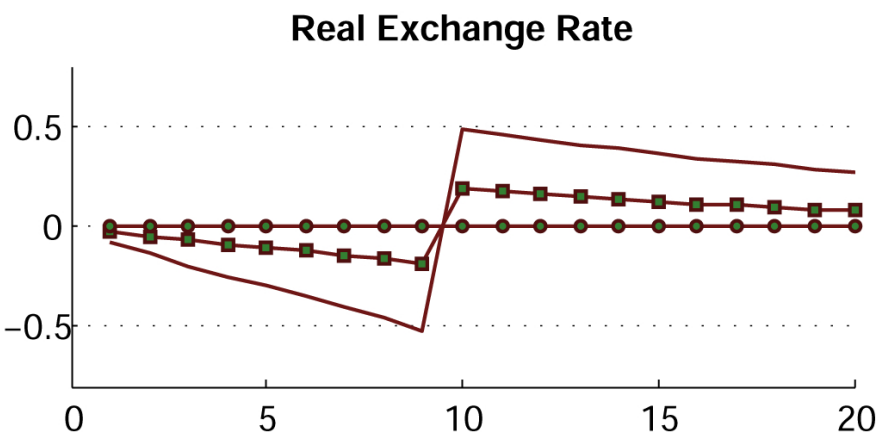
Exit under different degrees of price rigidities

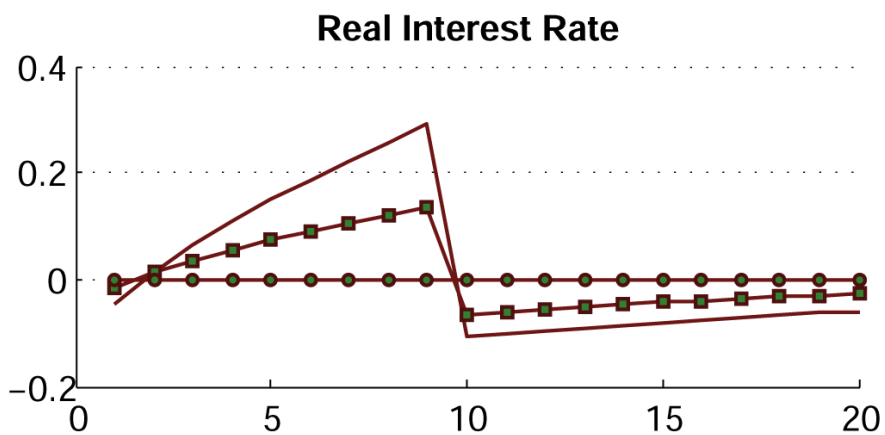
back

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

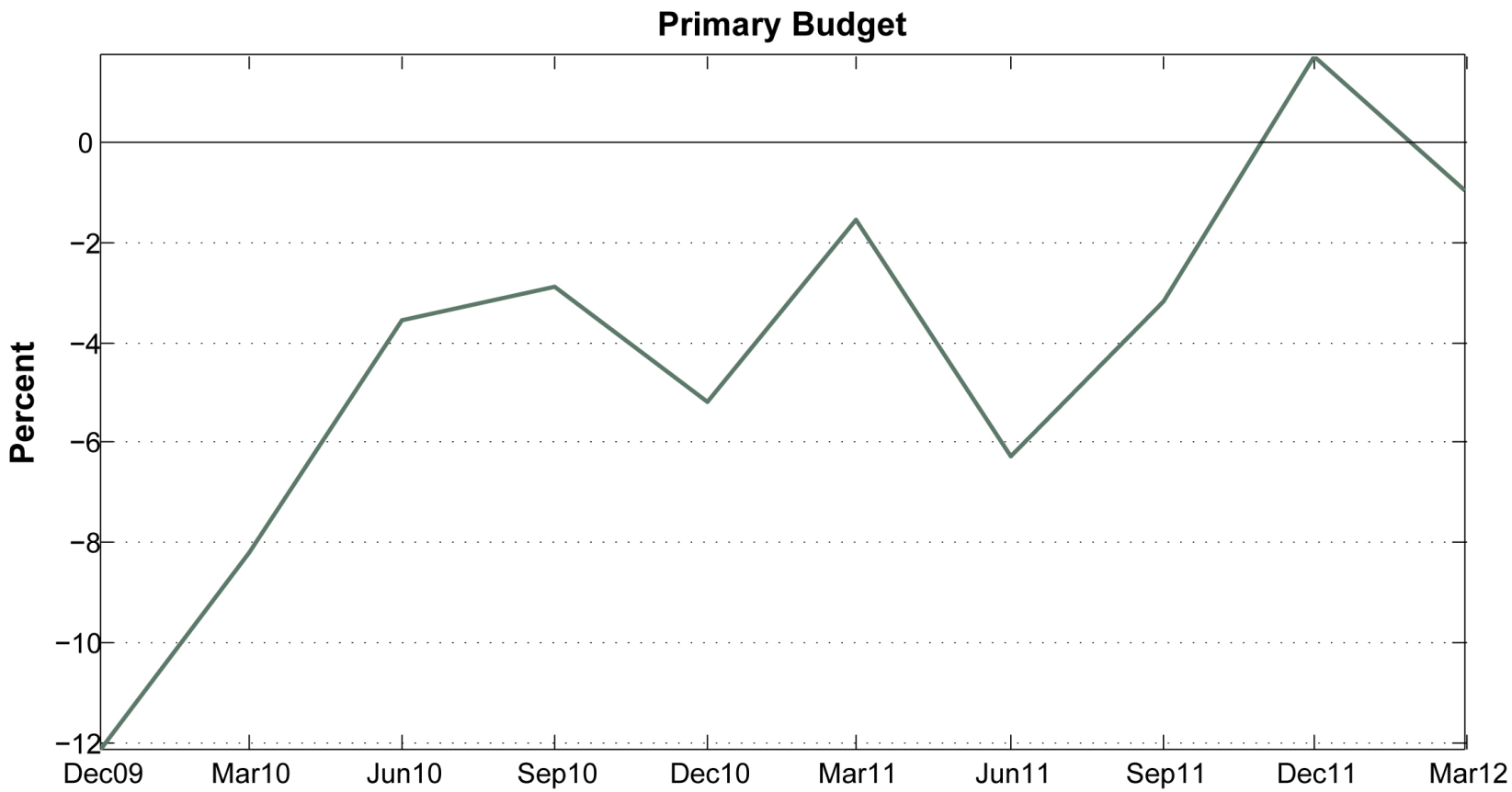








Primary government budget (% of GDP, annualized)



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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

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