How the crisis evolved: EMU, Fiscal Policy and Sovereign Debt

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Overview

1. The basics of the euro crisis
2. The role of EMU
3. EU Fiscal sustainability
4. EU Sovereign Debt and credit ratings
5. Conclusions

The basics of the euro crisis

Monetary policy in the eurozone has been dominated by the German economy

EMU set the wrong monetary policy for most countries

Either fiscal policy must be used to correct for this

Or the market must find a solution by pricing in a risk premium

High inflation countries (Greece, Ireland, Italy, Portugal and Spain)

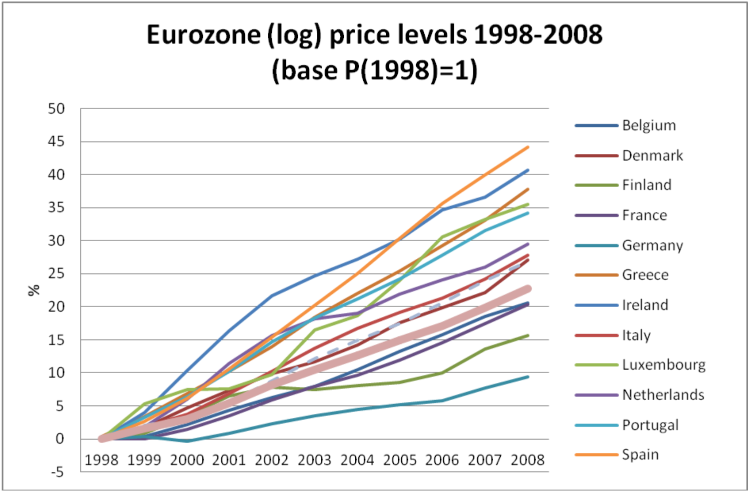
- nominal interest rates were too low
- real rates were frequently negative
- incentive for both the private and public sector to borrow too much
- resulted in rapid growth
- rising price levels caused a loss of competitiveness and C/A deficits
- led to fiscal deterioration, debt crises, credit downgrades and rising borrowing costs

Low inflation countries (especially Germany)

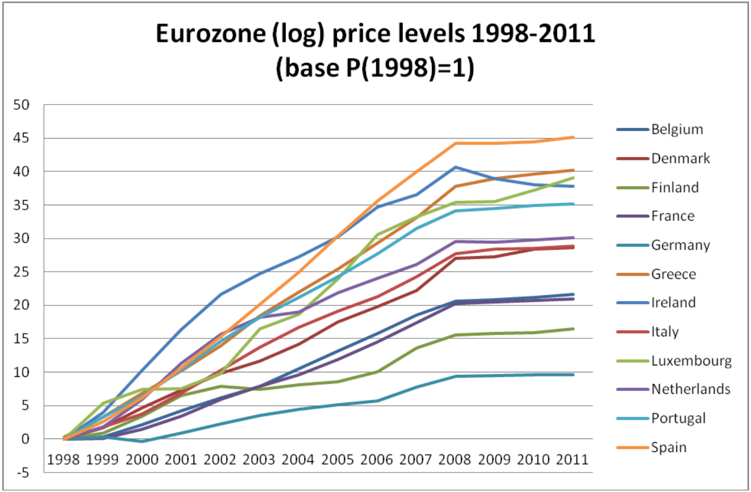
- nominal interest rates were too high
- real rates were positive
- less incentive for the private and public sector to borrow too much
- resulted in low growth
- low price-level growth caused a gain in competitiveness and C/A surpluses
- expected to bail out countries in debt

Some evidence

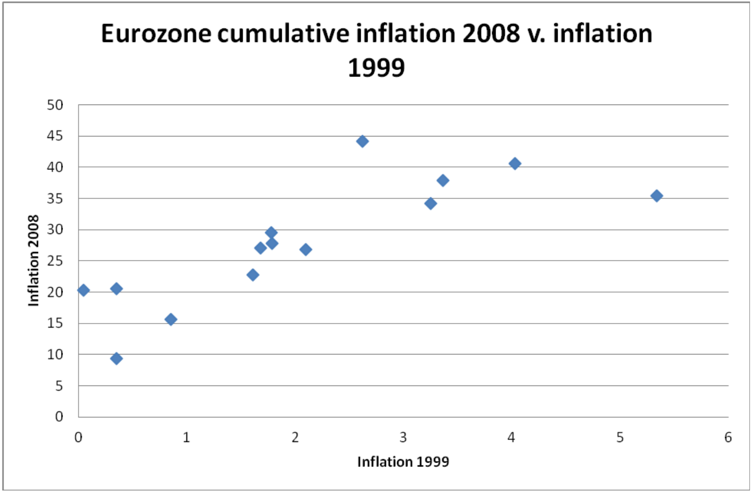
Diverging price levels and hence competitiveness prior to the crisis



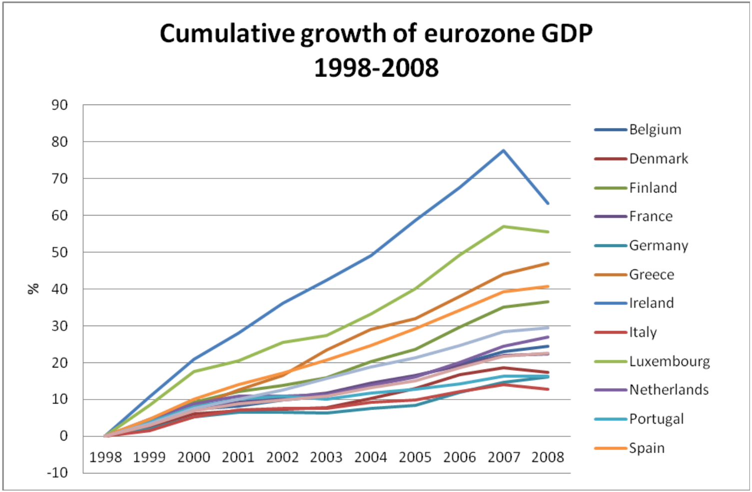
Price levels after the crisis



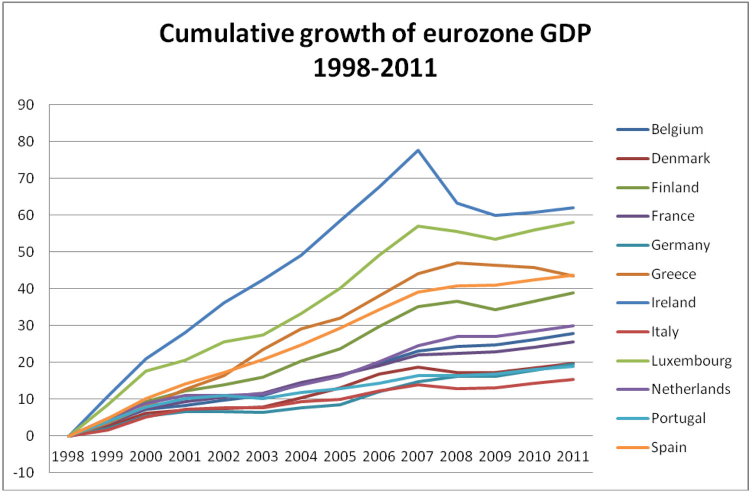
EMU entry conditions matter



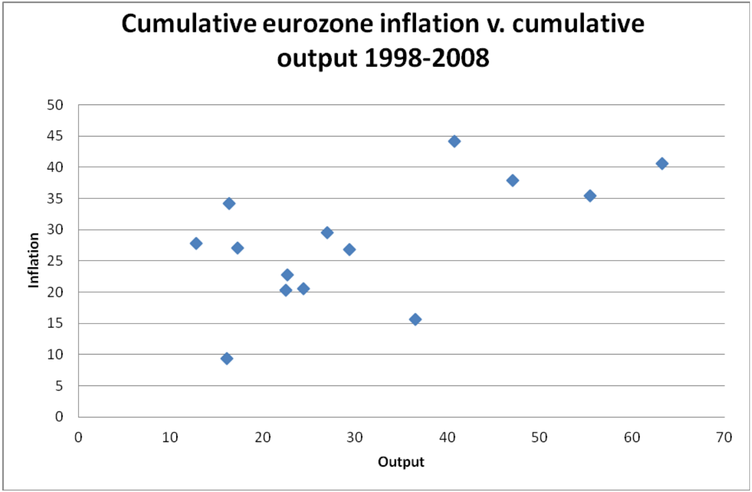
Output growth prior to the crisis



Output after the crisis



Prices and output growth

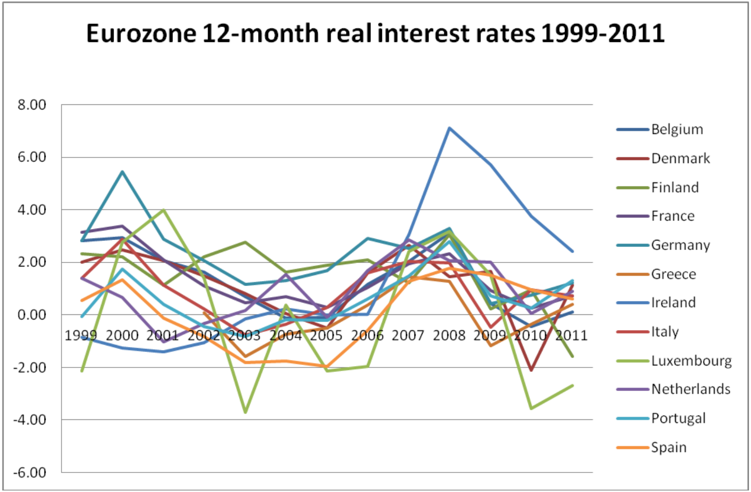


	Bel	Den	Fin	Fr	Ger	Gr	Ir	It	Lux	Neth	Port	Sp
Price	20.6	27.0	15.6	20.3	9.4	37.8	40.6	27.8	35.4	29.5	34.2	44.2
GDP	24.4	17.3	36.5	22.5	16.1	47.0	63.2	12.8	55.4	27.0	16.4	40.8

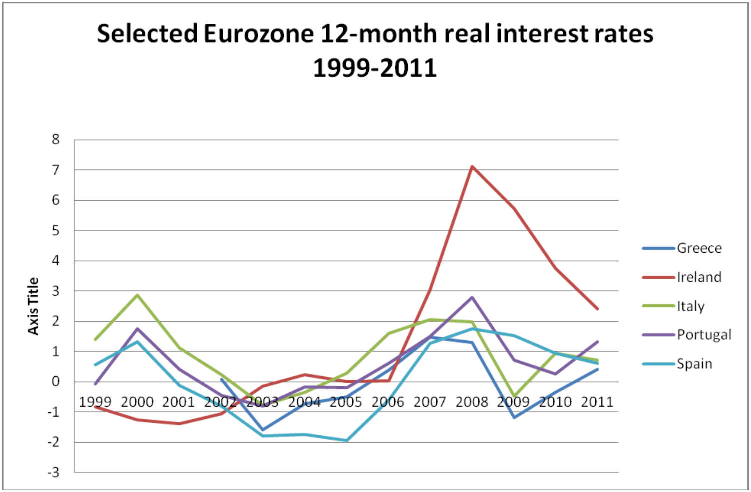
Table 1: Percentage Growth of Price Level and Output 1998-2008

Real interest rates

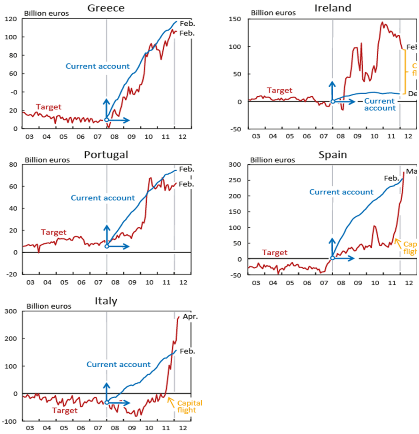
Real interest rates were negative for the crisis countries



The crisis countries



The current account and Target balances for crisis countries



Source: Sinn and Wollmershershauser (2012)

C/A deficits - deteriorated badly just prior to the crisis
Target balances - previously reflected C/A; afterwards they deviated

Fiscal Sustainability Basics

1. The nominal GBC

$$P_t g_t + (1 + R_t) B_{t-1} = B_t + \Delta M_t + P_t T_t$$

2. The real GBC as a proportion of GDP

$$\frac{g_t}{y_t} + \frac{1 + R_t}{(1 + \pi_t)(1 + \gamma_t)} \frac{b_{t-1}}{y_{t-1}} = \frac{T_t}{y_t} + \frac{b_t}{y_t} + \frac{m_t}{y_t} - \frac{1}{(1 + \pi_t)(1 + \gamma_t)} \frac{m_{t-1}}{y_{t-1}}$$

3. Fundamental fiscal dynamic

$$\begin{aligned}
\frac{b_t}{y_t} &= (1+\rho_t)\frac{b_{t-1}}{y_{t-1}} + \frac{d_t}{y_t} \\
\frac{d_t}{y_t} &= \frac{g_t}{y_t} - \frac{T_t}{y_t} - \frac{m_t}{y_t} + \frac{1}{(1+\pi_t)(1+\gamma_t)}\frac{m_{t-1}}{y_{t-1}}
\end{aligned}$$

where ρ_t is real interest rate adjusted for economic growth

$$\begin{aligned}
1+\rho_t &= \frac{1+R_t}{(1+\pi_t)(1+\gamma_t)} \\
\rho_t &\simeq R_t - \pi_t - \gamma_t = r_t - \gamma_t
\end{aligned}$$

4. Testing fiscal sustainability

Traditional econometric tests: look at the stationarity of $\frac{b_t}{y_t}$ and $\frac{d_t}{y_t}$

- backward-looking
- not time-varying

More relevant question: can $\frac{b_t}{y_t}$ be paid-off in the future?

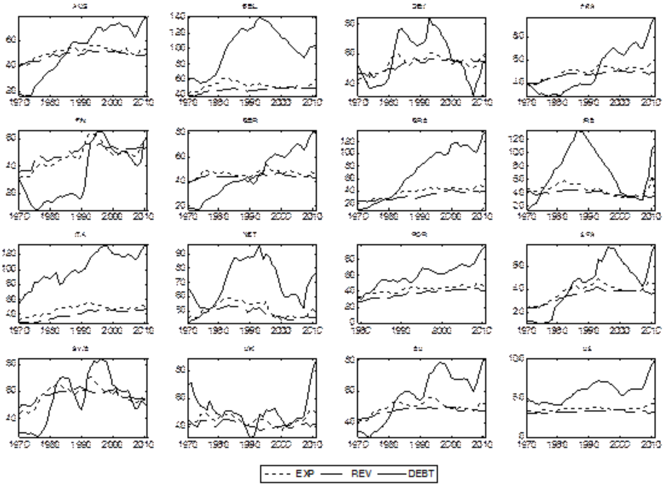
$$\frac{b_t}{y_t} = E_t[(\Pi_{s=1}^{n}\frac{1}{1+\rho_{t+s}})\frac{b_{t+n}}{y_{t+n}}] - E_t[\sum_{s=1}^{n}(\Pi_{i=1}^{s}\frac{1}{1+\rho_{t+i}})\frac{d_{t+s}}{y_{t+s}}]$$

- compare $\frac{b_t}{y_t}$ with the present-value of future discounted primary surpluses

$$FSI(t,n) = \frac{PV_{t,n}}{b_t/y_t}$$

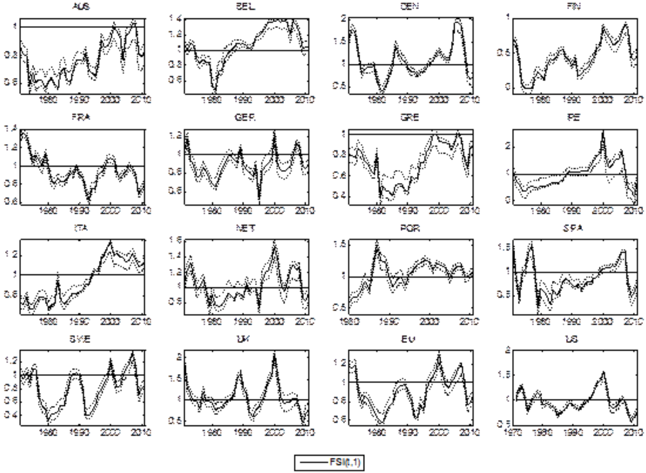
- equivalent to comparing $\frac{b_t}{y_t}$ with its forecast value at some point in the future
- eg will it increase?
- forward-looking measure
- time-varying

EU Expenditures, Revenues and Debt



AUS	BEL	DEN	FIN
FRA	GER	GRE	IRE
IT	NTH	POR	SP
SWE	UK	EU	US

Fiscal Sustainability Index: <1 unsustainable



- Index varies over time as fiscal stance changes

- General worsening following the crisis

- Greece never sustainable

\- suggests excessive government borrowing

- Ireland, Portugal and Spain have sustainable stance until the crisis
  \- suggests that government borrowing was not the problem

Alternative approaches

- Two problems:

- how to choose the target debt-GDP ratio for the fiscal sustainability index?
- for a market solution in which a risk premium is added to the policy rate, how to determine the risk premium?

- Solutions

1. External financial premium due to financial frictions
2. Use sovereign credit ratings

- in the crisis achieving a good credit rating has replaced stabilization as the object fiscal policy
- aim is to use credit ratings to determine the sustainability of the fiscal stance
- doubts over official credit ratings
- propose a new way to estimate the probability of default and map this onto a credit rating

External Finance Premium

- Given the possibility of default, banks adjust their loan rates to break even
- Simple example of EFP

R^L = loan rate, R = opportunity cost of bank funds, π = probability of default
Equating expected returns gives

$$(1-\pi)R^L = R.$$

and the credit spread (EFP)

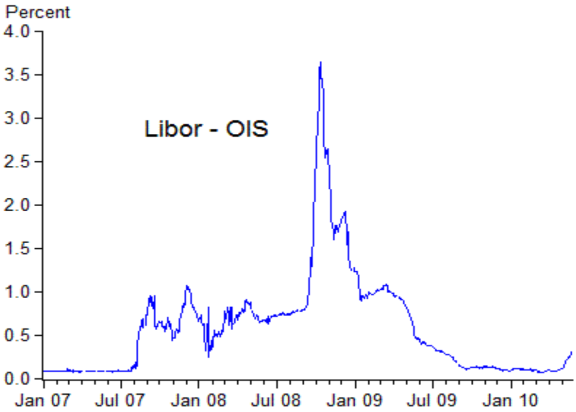
$$R^L - R = \frac{\pi}{1-\pi}R \geq 0$$

Hence, the higher the probability of default, the larger the credit spread

- Problems

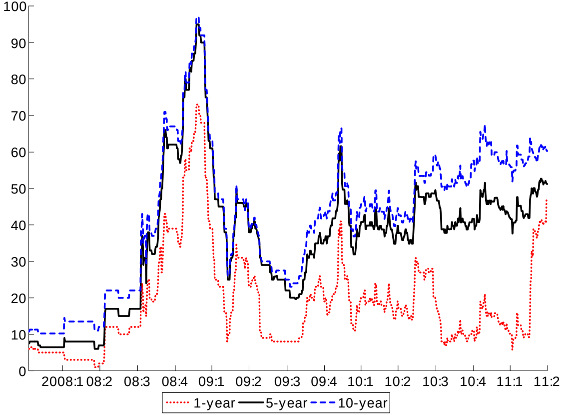
- this is not a risk premium as banks are risk neutral
- an appropriate EFP wasn't charged prior to the crisis and didn't prevent a crisis

Evidence of a market solution but were credit ratings correct?



The spread between LIBOR and UK OIS

The UK was triple-A until 2012



U.S. sovereign CDS 2008-2011.

Sept 2009 US CDS's traded at 100bps and by June 2011 51bps (Japan 52, Germany 26) yet still the US received the highest rating by all CRAs

EU Credit Ratings: a new methodology

- Determine the maximum debt-GDP ratio that a country can sustain
- Forecast the debt-GDP ratio over a given time period
- Then assess the probability this will exceed the debt-GDP limit before the end of the horizon
- Map this probability into a credit rating using Moody's tables
- The theoretical basis of the analysis is the inter-temporal government budget constraint

- The forecasts are made using a rolling-window VAR model that reflects the IGBC and picks up structural change
- The debt-GDP limit may be derived in two ways:

(i) using ad hoc values
(ii) maximize tax revenues using an RBC model with distortionary taxation

- We use an adaptation to government debt of Merton's (1974)'s measure of distance-to-default and default probability.
- Problem not dissimilar to pricing an American option

Mapping to credit ratings

	Rating		Cumulative default probability			
Category	Long-term	Short-term	1-year	5-year	10-year	average
Investment	Aaa	Prime - 1	0.000	0.000	0.000	0.000
grade	Aa1	Prime - 1	0.026	0.245	0.317	0.208
	Aa2	Prime - 1	0.053	0.490	0.634	0.415
	Aa3	Prime - 1	0.079	0.736	0.952	0.623
	A1	Prime - 1	0.106	0.981	1.269	0.830
	A2	Prime - 1/2	0.132	1.226	1.586	1.038
	A3	Prime - 1/2	0.159	1.471	1.903	1.245
	Baa1	Prime - 2	0.185	1.717	2.221	1.453
	Baa2	Prime- 2 or 3	0.212	1.962	2.538	1.660
	Baa3	Prime-3	0.238	2.207	2.855	1.868
Speculative	Ba1	Not Prime	0.415	3.950	8.197	3.942
grade	Ba2	Not Prime	0.592	5.692	13.540	6.017
	Ba3	Not Prime	0.769	7.435	18.882	8.092
	B1	Not Prime	1.643	9.989	20.785	10.196
	B2	Not Prime	2.517	12.542	22.687	12.299

Measuring the probability of sovereign default

Based on the h-period ahead forward solution

$$\frac{b_{t+h}}{y_{t+h}} = -E_t \sum_{j=1}^{h} \left[\Pi_{s=1}^{j} \left(1+\rho_{t+s}\right) \frac{d_{t+j}}{y_{t+j}} \right] + \Pi_{s=1}^{h} \left(1+\rho_{t+s}\right) \frac{b_t}{y_t},$$

p_{t+h} = the probability of defaulting in period $t+h$ given information up to period t

$$p_{t+h} = \Pr\left(\frac{b_{t+h}}{y_{t+h}} \geq \overline{\frac{b_{t+h}}{y_{t+h}}} \Big| \frac{b_t}{y_t} = \frac{b}{y} \right),$$

where $\overline{\frac{b_{t+h}}{y_{t+h}}}$ is the default threshold of the debt-GDP ratio and $\Pr(.)$ is assumed to be the normal probability density function

$p_{t,t+h}$= the probability of sovereign default by period $t+h$ (hazard rate) is the probability of not defaulting prior to year $t+h$ but defaulting in year $t+h$

$$p_{t,t+h} = p_{t+h}\left(1-p_{t+h-1}\right)\left(1-p_{t+h-2}\right)\dots\left(1-p_{t+1}\right)$$

The probability of default in any period between t and $t+h$ is therefore

$$p^{c}_{t,t+h} = \Sigma_{j=1}^{h} p_{t,t+j}$$

The debt-GDP ratio at time $t+1$ may be decomposed into

$$\begin{aligned}
\frac{b_{t+1}}{y_{t+1}} &= E_t \frac{b_{t+1}}{y_{t+1}} + \xi_{t+1} \\
\xi_t &= \sigma_t \varepsilon_t \\
\varepsilon_t &\sim i.i.d.\,(0,1)
\end{aligned}$$

Hence

$$\begin{aligned}
\frac{b_{t+h}}{y_{t+h}} &= E_t \frac{b_{t+h}}{y_{t+h}} + \eta_{t+h} \\
\eta_{t+h} &= \Sigma_{s=1}^{h} \xi_{t+s} \\
V_t(\eta_{t+h}) &= \sigma^2_{\eta,t+h} = \Sigma_{s=1}^{h} \sigma^2_{t+s}
\end{aligned}$$

The probability of sovereign default in period $t+h$ given information in period t is therefore

$$p_{t+h} = \Pr\left(-DD_{t+h} \leq \zeta_{t+h}\right),$$

where the distance-to-default is

$$\begin{aligned} DD_{t+h} &= \frac{E_t \frac{b_{t+h}}{y_{t+h}} - \overline{\frac{b_{t+h}}{y_{t+h}}}}{\sigma_{\eta,t+h}} \\ \zeta_{t+h} &= \frac{\eta_{t+h}}{\sigma_{\eta,t+h}} \end{aligned}$$

The (cumulative) probability of default in any period between t and $t+h$ is

$$p^c_{t,t+h} = \sum_{j=1}^{h} p_{t,t+j}$$

Forecasting sovereign debt and volatility

- Use a rolling-window VAR
- Has two lags and a moving-data window of 40 quarters
- VAR is estimated using data from $t-40$ until date t and forecasts are for $h-$period ahead

Theory-based debt limits

The debt-GDP limit

- We now specify a DSGE model - an open-economy RBC model with distortionary taxation
- And use this to derive the government's maximum borrowing capacity
- This is the maximum sustainable steady-state debt-GDP limit with respect to the income tax rate - the Laffer hill
- There is no interior maximum wrt consumption taxes
- We ignore seigniorage taxation and regard inflation as partial default
- "Default" is assumed to occur whenever the expected present value of net revenues is lower than the existing debt-GDP ratio

Four measures of the debt-GDP limit

In general, the debt-GDP limit $\frac{b_t}{y_t}^{IGBCL}$ is

$$\frac{b_t}{y_t}^{IGBCL} = -E_t \sum_{j=1}^{\infty} \frac{\frac{g_{t+j}}{y_{t+j}} + \frac{z_{t+j}}{y_{t+j}} - \frac{v_{t+j}}{y_{t+j}},}{\prod_{s=1}^{j} \left(1 + \rho_{t+s}\right)},$$

g_t = government expenditures on goods and services
z_t = transfers
v_t = government revenues
IGBCL identifies a government's borrowing capacity based on the market's anticipation of the future evolution of fiscal and monetary policy

Natural debt limit (NDL) - Aiyagari (1994)

- state contingent debt in every possible state by eliminating all government expenditures

$$\frac{b_t}{y_t}^{NDL} = E_t \sum_{j=1}^{\infty} \frac{\frac{v_{t+j}}{y_{t+j}}}{\prod_{s=1}^{j} \left(1+\rho_{t+s}\right)}.$$

NDL cuts government expenditures to the minimum as $\frac{g}{y} = \frac{z}{y} = 0$

Fiscal limit (FL) - Davig, Leeper and Walker (2010, 2011)

- the expected present value of future primary deficits under the assumption that tax revenue is maximized in each period and there will be no unanticipated changes in the conduct of government expenditure policy

$$\frac{b_t}{y_t}^{FL} = E_t \sum_{j=1}^{\infty} \frac{\frac{d_{t+j}}{y_{t+j}}^{FL}}{\prod_{s=1}^{j} \left(1+\rho_{t+s}\right)}$$

$$\left\{ \frac{d_{t+j}}{y_{t+j}}^{FL} = \frac{g_{t+j}}{y_{t+j}} + \frac{z_{t+j}}{y_{t+j}} - \frac{v_{t+j}^{\max}}{y_{t+j}} \right\}_{j=0}^{\infty}$$

FL maximises borrowing for given expenditures by maximising τ^n and τ^k with $\tau^{n,\max}$ and $\tau^{k,\max}$

Maximum debt limit (MDL)

- maximizes tax revenues whilst setting government expenditure and transfers to zero in FL
- government can no longer use unanticipated fiscal policy to finance more debt and would need to resort to monetary policy

$$\frac{b_t}{y_t}^{MDL} = E_t \sum_{j=1}^{\infty} \frac{\frac{v_{t+j}^{\max}}{y_{t+j}}}{\prod_{s=1}^{j} \left(1 + \rho_{t+s}\right)}.$$

When MDL is satisfied a government can no longer use unanticipated changes in fiscal policy to finance additional debt and so would then need to resort to monetary policy.

Model

Households maximize

$$E_0 \sum_{t=0}^{\infty} \beta^t \left[\log c_t + \psi \log(1-n_t)\right]$$

subject to

$$\begin{aligned}(1+\tau_t^c)c_t + k_t + b_t^D + s_t f_t &= (1-\tau_t^n)w_t n_t + \left(r_t^k - \delta\right)\left(1-\tau_t^k\right)k_{t-1} \\ &\quad + (1+r_t)\, b_{t-1}^D + z_t + (1+r_t^*)\, s_t f_{t-1}\end{aligned}$$

Total consumption is assumed to satisfy the CES function

$$c_t = \left[\phi\left(c_t^H\right)^{1-\frac{1}{\eta}} + (1-\phi)\left(c_t^F\right)^{1-\frac{1}{\eta}}\right]^{\frac{1}{1-\frac{1}{\eta}}},$$

Firms

$$y_t = k_t^{\alpha} \left(A_t n_t\right)^{1-\alpha}$$

Government budget constraint

$$\begin{aligned} g_t + (1 + r_t)\, b_{t-1}^D + (1 + r_t)\, b_{t-1}^F + z_t &= \tau_t^c c_t + \tau_t^n w_t n_t \\ &\quad + \tau_t^k \left(r_t^k - \delta\right) k_{t-1} + b_t^D + b_t^F \end{aligned}$$

Balance of payments and the national income identities

$$\begin{aligned} s_t f_t - b_t^F &= x_t + (1 + r_t^*)\, s_t f_{t-1} - (1 + r_t)\, b_{t-1}^F \\ y_t &= c_t + g_t + k_t - (1 - \delta)\, k_{t-1} + x_t \end{aligned}$$

Comments

- The existence of an equilibrium solution implies that the intertemporal GBC is satisfied and that a government cannot roll over its liabilities forever
- and governments can borrow at a rate that allows an equilibrium to exist.
- No default risk premium in r_t^b - like Davig, Leeper and Walker (2010, 2011) and Bi (2011)
- In practice this can be ignored for the UK due to a low probability of default
- No seigniorage tax as it has been negligible for the UK
- Inflating away real debt is a form of default

Steady-state solution

Maximise $\frac{v}{y}$ wrt to τ^n and τ^k taking τ^c, $\frac{g}{y}$ and $\frac{z}{y}$ given

$$\frac{b^D + b^F}{y} = \frac{b}{y} = \frac{1}{r^*}\left\{ \begin{array}{c} \tau^c \chi \left(\frac{1}{\varphi k} - 1 \right) + \tau^n \left(1-\alpha\right) \\ +\tau^k \alpha \left[1 - \delta \left(\frac{\beta^{-1}-1}{1-\tau^k} + \delta \right)^{-1} \right] - \frac{g}{y} - \frac{z}{y} \end{array} \right\}$$

$$\begin{aligned} \chi &= \frac{(1-\tau^N)}{\psi(1+\tau^C)}\left(1-\alpha\right), \quad \varphi = \left[\frac{\beta^{-1} - 1 + \delta\left(1-\tau^k\right)}{\alpha A^{1-\alpha}\left(1-\tau^k\right)} \right]^{\frac{1}{1-\alpha}} \\ k &= \frac{\mu + \left(1+\tau^c\right)\left(g+x\right)}{\left[(1+\tau^c)\Omega + \mu\varphi\right]}, \quad \mu = \frac{1}{\psi}\left(1-\tau^n\right)\left(1-\alpha\right) A^{1-\alpha}\varphi^{-\alpha} \\ \Omega &= \left(A\varphi\right)^{1-\alpha} - \delta \end{aligned}$$

Solution for four debt limits

$$\frac{b}{y}^{IGBCL} = \frac{1}{r^*}\left\{\begin{array}{c} \tau^c \chi\left(\frac{1}{\varphi k} - 1\right) + \tau^n(1-\alpha) \\ +\tau^k \alpha\left[1 - \delta\left(\frac{\beta^{-1}-1}{1-\tau^k} + \delta\right)^{-1}\right] - \frac{g}{y} - \frac{z}{y} \end{array}\right\}$$

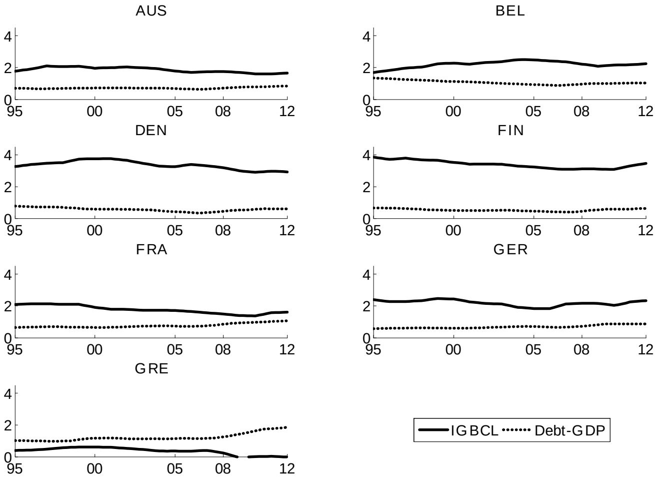
$$\frac{b}{y}^{NDL} = \frac{1}{r^*}\left\{\begin{array}{c} \tau^c \chi\left(\frac{1}{\varphi k} - 1\right) + \tau^n(1-\alpha) \\ +\tau^k \alpha\left[1 - \delta\left(\frac{\beta^{-1}-1}{1-\tau^k} + \delta\right)^{-1}\right] \end{array}\right\}.$$

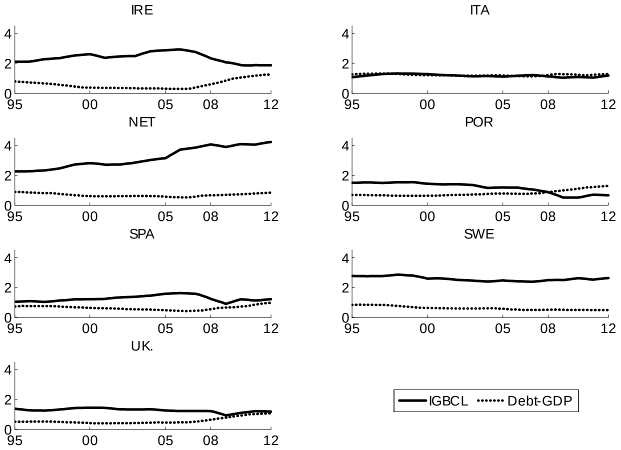
$$\frac{b}{y}^{FL} = \frac{1}{r^*}\left\{\begin{array}{c} \tau^c \chi\left(\frac{1}{\varphi k} - 1\right) + \tau^{n,\max}(1-\alpha) \\ +\tau^{k,\max} \alpha\left[1 - \delta\left(\frac{\beta^{-1}-1}{1-\tau^k} + \delta\right)^{-1}\right] - \frac{g}{y} - \frac{z}{y} \end{array}\right\}$$

$$\frac{b}{y}^{MDL} = \frac{1}{r^*}\left\{\begin{array}{c} \tau^c \chi\left(\frac{1}{\varphi k} - 1\right) + \tau^{n,\max}(1-\alpha) \\ +\tau^{k,\max} \alpha\left[1 - \delta\left(\frac{\beta^{-1}-1}{1-\tau^k} + \delta\right)^{-1}\right] \end{array}\right\}$$

Actual and sustainable debt with unchanged policies

Greece's debt is always unsustainable, Ireland and Portugal worsen with crisis

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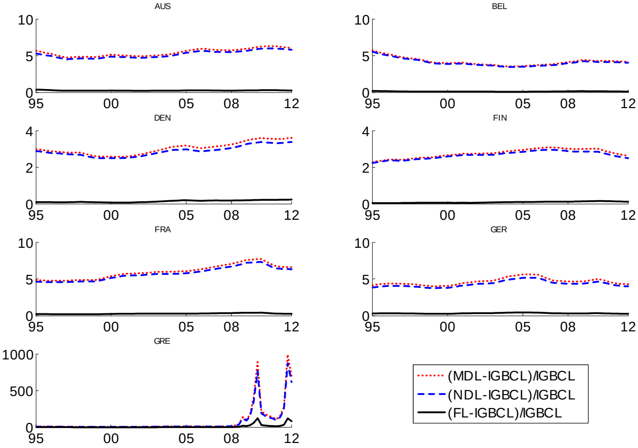
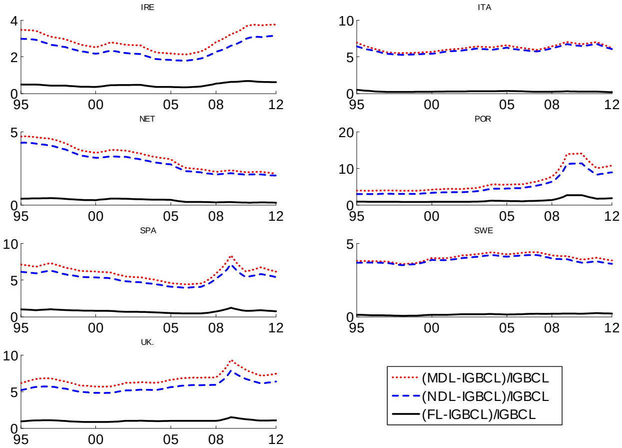
IGBCL
Debt-GDP

EU Credit Ratings: comparison of debt-GDP limits

In general FL is close to IGBCL, implying not much room for additional taxes

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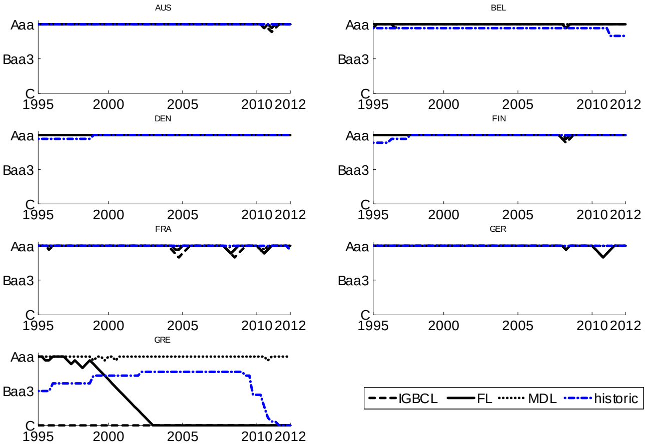
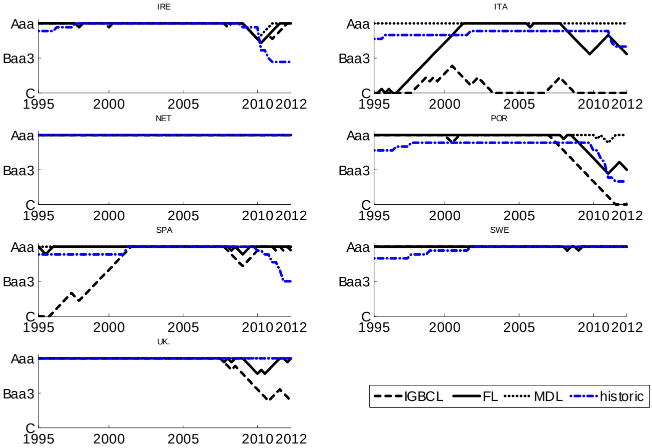
EU credit ratings for 5-year time horizon



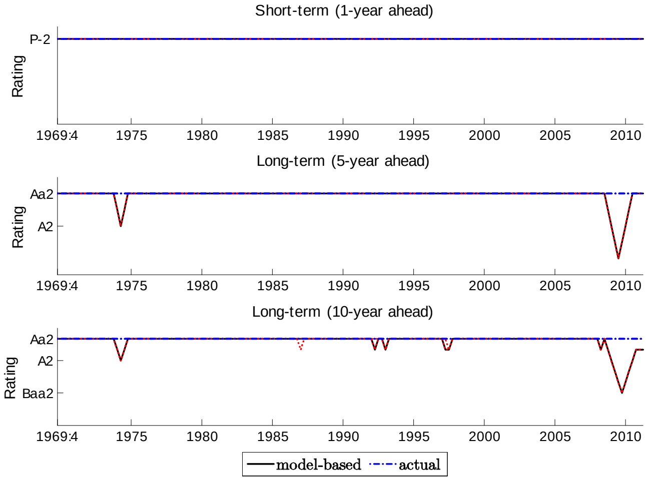
Greece's rating started to decline before entering the euro



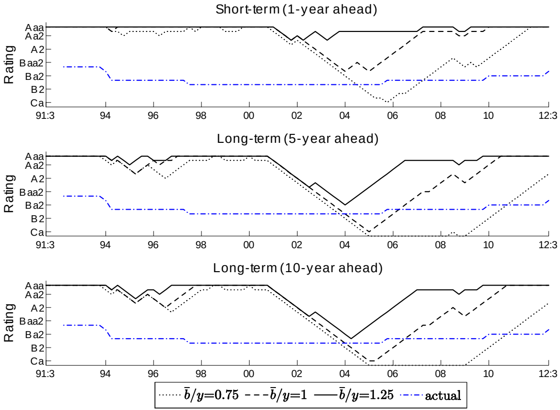
Ireland, Italy, Portugal, Spain and UK all decline with the crisis

Are official ratings too low for Ireland and Spain?

US credit rating



Turkey: credit rating based on ad hoc limits



Official Turkish rating has only just gone up

Conclusions

- Official euro interest rate is dominated by low German inflation
- This resulted in negative real interest rates and excessive borrowing in the crisis countries

- Excessive private borrowing in Ireland, Portugal and Spain
- Excessive government borrowing in Greece

- A common fiscal rule is not appropriate as a tighter than average fiscal policy is required for countries with negative real interest rates
- Using sovereign credit rating might be a better way to judge fiscal sustainability
- A market solution would become more feasible through more timely sovereign credit ratings