Young Economist's Seminar

Long- and Short-run Determinants of Original Sinners Sovereign Spreads

Marina Tkalec
Miroslav Verbic
Maruska Vizek

Institute of Economics, Zagreb
University of Ljubljana

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Sovereign spread determinants

The usual **sovereign spread** drivers are fundamental macroeconomic conditions (Edwards, 1984) such as:

1. Relative size of the **debt** itself
2. Overall **wealth**
3. **Current account deficit** or surplus
4. International **reserves**

What about the short-run?

It is common that the long-run relationship breaks in the short-run, especially in turbulent times.

1. **Lehman Brothers collapse**
   - Sovereign spreads raised swiftly
   - Macroeconomic indicators stayed unchanged
   - There are factors that are unaccounted for in previous research
2. **Short-run determinants**
   - Balance sheet effects (Berganza et al., 2004)
   - Market volatility
   - Tax revenues

Contributions

Balance sheet effect

- The balance sheet effect is a short-run sovereign spread determinant
- Differentiation between the short- and the long-run
- Short-run deviations from equilibrium, and gradual adjustment in the long-run

Country heterogeneity

Latest financial crisis

- Sovereign spread volatility observed in the last few years

Additional observations

- Croatia, Serbia, and Turkey

Literature

We combine **three different strands** of the existing research to explain sovereign spread dynamics in the countries that suffer from the original sin: an inability to issue debt in local currency (Eichengreen at el., 2003).

1. Base model: small open economy model by Cespedes et al. (2000) and Gertler et al. (2007)

   Suplementary concepts:

2. Collateral value concept from Kiyotaki and Moore (1997)
3. Balance sheet effect empirical findings from Berganza et al. (2004)

Theoretical model

- Sovereign spreads are a function of the **probability of default**, measured by the indicators of liquidity and solvency (Edwards 1984, 1986)
- Macroeconomic variables reflect **liquidity** and **solvency**, and accordingly, the probability of default
- Usually represented by a linear equation:

$$spread_t = \alpha + \sum_{j=1}^{J} \beta_{jt} x_{jt} + \epsilon_t$$

Theoretical model

- Since we explore emerging markets and their sovereign spreads, we will use a small open economy that is externally indebted as our baseline model (Ferrucci, 2003)

$$\text{Max } U_0 = \sum_{t=0}^{\infty} \beta^t u(C_t)$$

s.t.

$$G_t + rD_t \leqslant T_t + D_{t+1} - D_t$$
$$Y_t = C_t + G_t$$
$$T_t = f(Y_t)$$
$$Y_t = (1+g)\,Y_{t-1}$$

- After rearranging:

$$D_{t+1} - D_t \geqslant Y_t - C_t - T_t + rD_t$$

Theoretical model

- The government budget constraint:

  $G_t + rD_t \leqslant T_t + D_{t+1} - D_t$

- The external constraint:

  $D_{t+1} - D_t \geqslant Y_t - C_t - T_t + rD_t$

- Net present values of these two constraints provide us with the fiscal policy and external debt sustainability conditions:

  $$(1+r)D_t \leqslant \sum_{i=0}^{\infty} PS_{t+i}/(1+r)^i$$

$$(1+r)D_t \leqslant \sum_{i=0}^{\infty} (C_{t+i} + T_{t+i} - Y_{t+i})/(1+r)^i$$

Empirical model

- Different solvency indicators can serve as reliable determinants of **external debt sustainability** (Ferrucci, 2003)
- **'Original sin'** (Eichengreen et al., 2003)
- Collateral value concept of Kiyotaki and Moore (1997) suggests that risk premium rises as real net worth falls
- Berganza et al. (2004) explore the relationship between the **balance sheet effect** and sovereign spreads:

  $1+spread_t = \Psi(\omega_t),\ \Psi' < 0$

- Net worth of a country:

  $\omega_t = X_t - D_t R_t$

Empirical model

- Linear approximation around the mean value of net worth:
  $1+spread_t \approx \Psi(\overline{\omega}) + \Psi'(\omega_t - \overline{\omega})$
  $\equiv \alpha - \beta\omega_t$
  $= \alpha - \beta X_t + \beta D_t R_t$
- Empiricallly test the **sign** and the **size** of β

Empirical model

- Taking expectations around the last expression we get:

  $spread_t = E_{t-1} spread_t + \beta \mathrm{D}_t (R_t - E_{t-1} R_t) + \epsilon_t$

- We can estimate this equation in case ϵ_t is not correlated with $D_t(R_t - E_{t-1} R_t)$
- After simplification:

  $spread_t = \beta \mathrm{S}_t + \gamma \mathrm{spread}_{t-1} + \epsilon_t$

- We insert this equation into the theoretical model and obtain our **baseline** model:

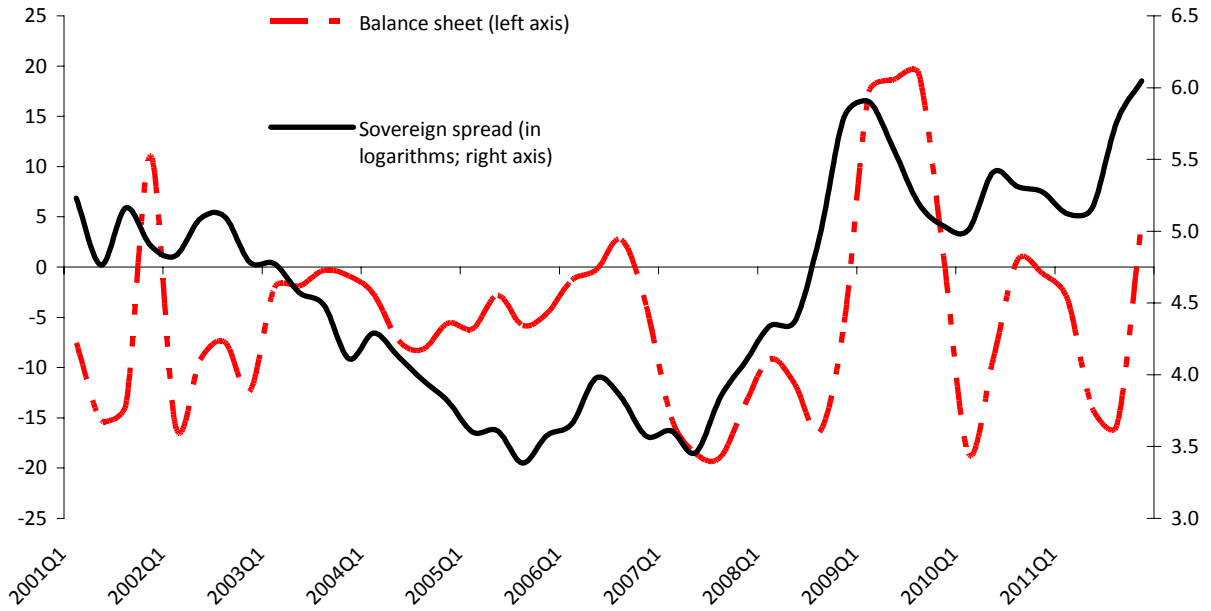
$$spread_t = \alpha + \beta \mathrm{S}_t + \gamma \mathrm{spread}_{t-1} + \sum_{j=1}^{J} \delta_{jt} x_{jt} + \epsilon_t$$

Aims and data

- Empirically test a relationship between the spreads and the financial imperfections that appear in the form of 'original sin'
- Investigate a positive relationship between a country's risk premium and the balance sheet effects
- Nine European emerging economies over the 2001-2011 period

Descriptive

Balance sheet and sovereign spread movements in the period 2001-2011



Estimation

- Test stationarity of panel variables using five different **panel unit root tests**
- A **dynamic panel** can be estimated using different procedures
- We use both **pooling** and **averaging** so that we allow intercepts, short-run coefficients and error variance to differ, but we restrict the long-run coefficients to be equal across groups
- **Pooled mean group** (PMG) by Pesaran et al. (1999)
- Pesaran et al. (1999) start with an autoreggressive distributed lag dynamic panel specification:

$$spread_{it} = \sum_{j=1}^{p} \lambda_{ij} spread_{i,t-j} + \sum_{j=0}^{q} \delta'_{ij} X_{i,t-j} + \mu_i + \epsilon_{it}$$

- This approach provides **more flexibility**, but also estimation advantages, such as **improved efficiency** and **better performance** of the model

Estimation

Error-correction model:

$$\Delta \text{spread}_{it} = \phi_i(spread_{i,t-1} - \theta_i' externaldebt_{it} - \theta_i' currentaccount_{it} - \theta_i' reserves_{it})$$
$$+ \sum_{j=1}^{p-1} \lambda_{ij}^* \Delta \text{spread}_{i,t-1} + \sum_{j=0}^{q-1} \delta_{ij}'^* \begin{pmatrix} \Delta \text{balancesheet}_{i,t-j} \\ \Delta \text{volatilityindex}_{i,t-j} \\ \Delta \text{taxrevenues}_{i,t-j} \end{pmatrix} + \mu_i + \epsilon_{it}$$

where

$$\phi_i = -1 + \sum_{j=1}^{p} \lambda_{ij} \ , \quad \theta_i = \sum_{j=0}^{q} \delta_{ij} / \ (1 - \sum_{k} \lambda_{ik}),$$

$$\lambda_{ij}^* = - \sum_{m=j+1}^{p} \lambda_{im} \ , \quad j = 1,2,\ldots,p-1, \text{ and } \delta_{ij}^* = - \sum_{m=j+1}^{q} \delta_{im}$$

Results

Panel unit root tests results

			p-values			
Test	Null hypothesis	Alternative hypothesis	Spread	External debt	Current account	International reserves
Im-Pesaran-Shin	All panels contain unit roots	Some panels are stationary	0.994	0.993	0.364	0.998
Fisher	All panels contain unit roots	At least one panel is stationary	0.860	0.847	0.153	0.987
Levin-Lin-Chu	All panels contain unit roots	All panels are stationary	1.000	0.108	0.156	0.843
Breitung	All panels contain unit roots	All panels are stationary	1.000	0.933	0.002	0.671
Hadri	All panels are stationary	Some panels contain unit roots	0.000	0.001	0.000	0.000

Results

Baseline estimates

	Model (1)	Model (2)	Model (3)	Model (4)
Speed of adjustment				
	-0.139***	-0.169***	-0.120***	-0.170***
	[0.000]	[0.000]	[0.000]	[0.000]
Long-run coefficients				
External debt	0.019***	0.020***	0.022***	0.019***
	[0.000]	[0.000]	[0.000]	[0.000]
Current account	-0.105**	-0.084**	-0.078**	-0.054*
	[0.013]	[0.013]	[0.043]	[0.058]
International reserves	-0.033***	-0.040***	-0.046***	-0.037***
	[0.000]	[0.000]	[0.000]	[0.000]
Short-run coefficients				
Δ balance sheet		0.084***	0.052**	0.065*
		[0.009]	[0.019]	[0.087]
Δ volatility index			0.754***	0.755***
			[0.000]	[0.000]
Δ tax revenues				-0.040***
				[0.006]
Number of observations	338	326	326	295
Number of countries	9	9	9	9
Log likelihood	-85.1381	-62.5343	23.0836	42.7068
Within R-squared[a]	0.6777	0.7253	0.833	0.8468
Between R-squared	0.1560	0.0147	0.1974	0.5277
Overall R-squared	0.4215	0.4777	0.6637	0.6709
Hausman test	1.67	3.81	1.83	5.49
	[0.645]	[0.283]	[0.969]	[0.704]

Results

Speed of adjustment coefficients

	Baseline model	Estimated half-life
Bulgaria	-0.064** [0.014]	2y
Croatia	-0.128 [0.184]	-
Czech Republic	-0.258* [0.083]	6m
Hungary	-0.046* [0.062]	2y 8m
Poland	-0.095*** [0.023]	1y 4m
Romania	-0.131*** [0.005]	1y
Serbia	-0.213** [0.028]	7m
Slovak Republic	-0.201*** [0.000]	7m
Turkey	-0.397*** [0.004]	4m

Results

Tests on the homogeneity restriction

	Pooled mean group (PMG)	Mean group (MG)	Hausman test	Dynamic fixed effects (DFE)	Hausman test
Speed of adjustment					
	-0.170***	-0.279***		-0.656***	
	[0.000]	[0.002]		[0.000]	
Long-run coefficients					
External debt	0.019***	0.016***		0.010***	
	[0.000]	[0.002]		[0.000]	
Current account	-0.054*	-0.032	5.49	0.038***	0.04
	[0.058]	[0.511]	[0.704]	[0.000]	[0.998]
International reserves	-0.037***	-0.030		-0.018*	
	[0.000]	[0.256]		[0.070]	
Short-run coefficients					
Δ balance sheet	0.065*	0.094		0.002**	
	[0.087]	[0.155]		[0.014]	
Δ volatility index	0.755***	0.759***		0.884***	
	[0.000]	[0.000]		[0.000]	
Δ tax revenues	-0.040***	-0.038*		-0.023***	
	[0.006]	[0.063]		[0.006]	
Number of observations	295	295		295	
Number of countries	9	9		9	
Log likelihood	42.7068	64.5318		-184.0232	

Robustness

Robustness checks for the baseline model

	Model (1)	Model (2)	Model (3)	Model (4)
Speed of adjustment				
	-0.170***	-0.152***	-0.207***	-0.164***
	[0.000]	[0.000]	[0.002]	[0.000]
Long-run coefficients				
External debt	0.019***	0.020***	0.018***	0.019***
	[0.000]	[0.000]	[0.000]	[0.000]
Current account	-0.054*	-0.067**	-0.007	-0.059*
	[0.058]	[0.040]	[0.694]	[0.053]
International reserves	-0.037***	-0.039***	-0.038***	-0.038***
	[0.000]	[0.000]	[0.000]	[0.000]
Short-run coefficients				
Δ balance sheet	0.065*	0.083*	0.103*	
	[0.087]	[0.087]	[0.074]	
Δ volatility index	0.755***	0.750***	0.748***	0.749***
	[0.000]	[0.000]	[0.000]	[0.000]
Δ tax revenues	-0.040***	-0.040***	-0.037**	-0.040***
	[0.006]	[0.006]	[0.025]	[0.007]
Δ export		-0.000		
		[0.864]		
Δ external debt			0.001	
			[0.707]	
Δ external debt*inflation				-0.002
				[0.148]
Number of observations	295	295	295	295
Number of countries	9	9	9	9
Log likelihood	42.7068	50.9645	50.7357	42.0037
Within R-squared[b]	0.8468	0.8665	0.8731	0.8462
Between R-squared	0.5277	0.0304	0.1514	0.0008
Overall R-squared	0.6709	0.6732	0.7768	0.6468
Hausman test	5.49	1.42	7.70	3.29
	[0.704]	[0.700]	[0.565]	[0.915]

Conclusion

- There exists a **strong positive relationship** between the spreads and the balance sheet effects in the short-run
- **Market volatility** and **tax revenues** also affect the sovereign spreads in the short run
- On average, half of this deviation from long-run equilibrium is **corrected in eight months**
- **External factors**, either market related (such as market volatility) or created by the financial imperfections manifested as the inability to issue debt in local currency (balance sheet effects), can be responsible for severe short-run changes in sovereign spreads

- Further research should focus on building a **theoretical model** of the relation between countries risk premiums and its respective total debt euroization