

Risk Management Optimization for Sovereign Debt Financing with Debt Sustainability Constraints

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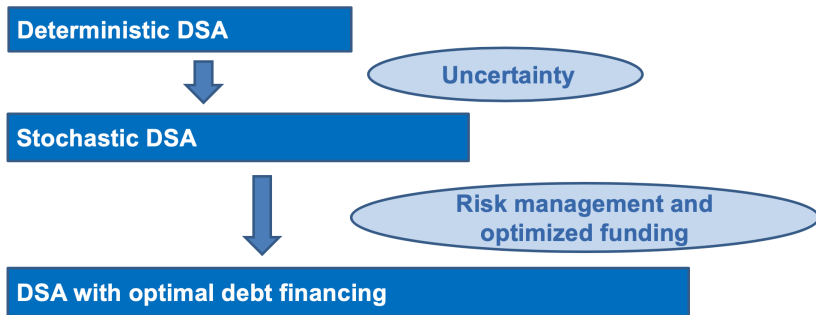
Some history

- Consiglio and Zenios (January 2015)
The devil is in the tails, //Voxeu.org.



- Consiglio and Zenios (2016), Risk management optimization for sovereign debt restructuring, *J. of Globalization & Development*, J. Stiglitz (ed)

Research issues



Contributions

- Q1 Optimize debt financing
- Q2 Sustainability constraints
- Q3 Bound risks with high probability
- Q4 Financing beyond simple rules or consols
- Q5 Optimize adjustments to financing needs

Contributions

- ① Optimize debt financing decisions
- ② Tension between debt stock and debt flow
- ③ Endogenous interest rates

The economic problem

- Sovereign issues debt X to finance its debt
- Uncertain correlated financial, economic, fiscal variables
- Debt sustainability controls
- Feedback loop

$$X \rightarrow D \rightarrow r \rightarrow X$$

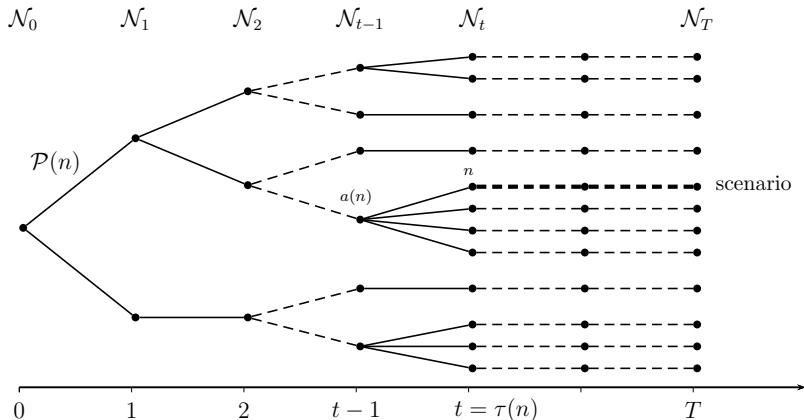
- Tension between debt stock and flow

Q3. (Modeling uncertainty)

- **First innovation: Scenario tree**



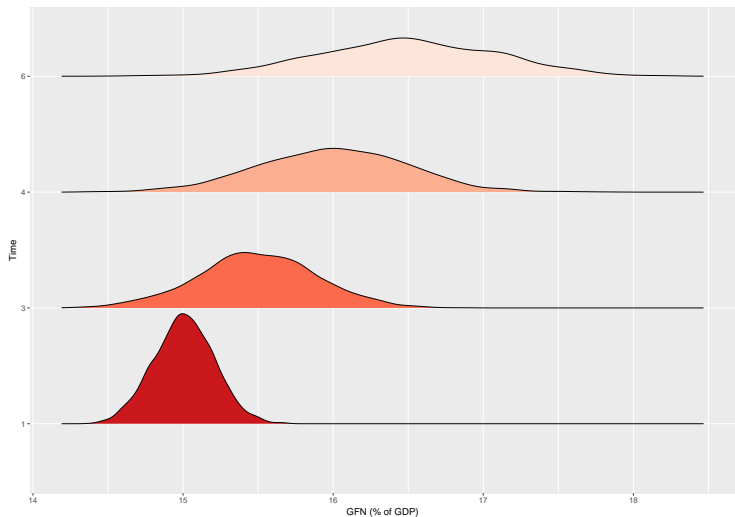
Q3. (Modeling uncertainty)



(Consiglio, Carollo, Zenios, *Quantitative Finance*, 16:201-212, 2016.)

Q3. (Risk measure)

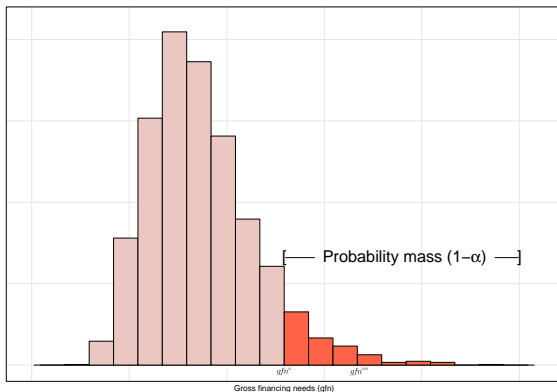
- Scenario dynamics of debt



Q3. (Risk measure)

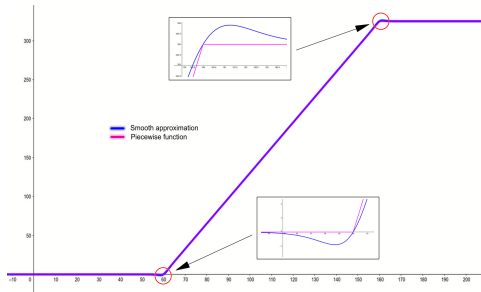
Second innovation: Conditional Flow at Risk (CFaR)

$$\Psi(gfn) \doteq \mathbb{E}(gfn \mid gfn \geq gfn^{\diamond})$$



Q3. (Endogenous interest rates)

Third innovation: Endogeneity of interest rates



Q1+Q2. Risk optimization of debt financing with sustainability controls

$$\text{Minimize}_x \quad \sum_{n \in \mathcal{N}} p^n NIP_t^n$$

s.t.

$$\begin{aligned} \Psi(gfn) &\leq \omega \\ \frac{\partial d^n}{\partial t} &\leq \delta \end{aligned}$$

Q1+Q2. Risk optimization of debt financing with sustainability controls

Sovereign issues debt $X^n(j)$ to finance its debt

Fixed-mix (rules)

Adaptive fixed-mix

Dynamic

Q4. Beyond simple rules, with high probability

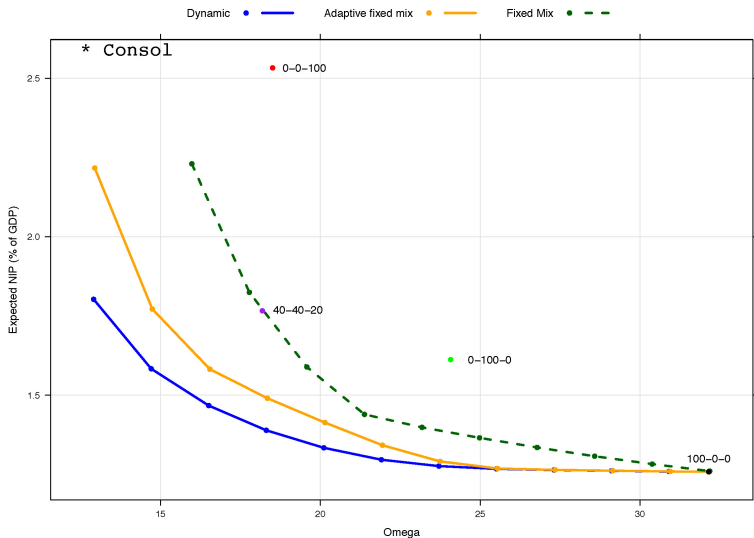
Typical eurozone crisis country

Netherlands

Italy

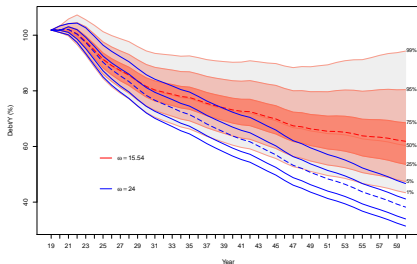
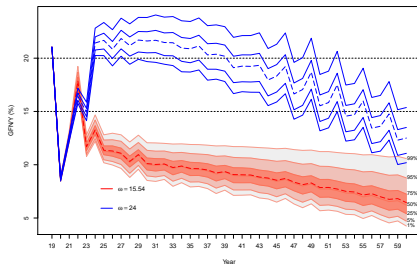
Q4. Beyond simple rules, with high probability

The relevance of optimizing

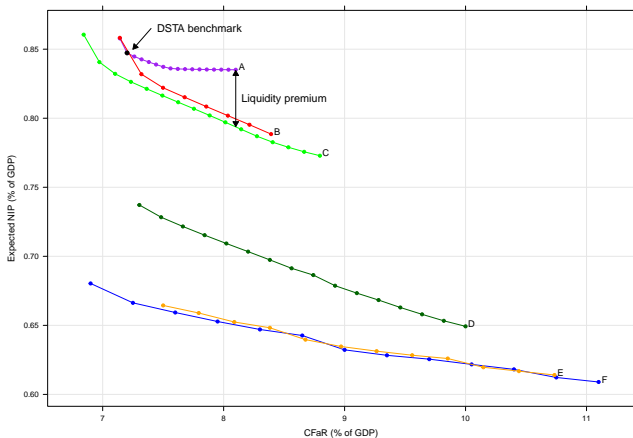


Q4. Beyond simple rules, with high probability

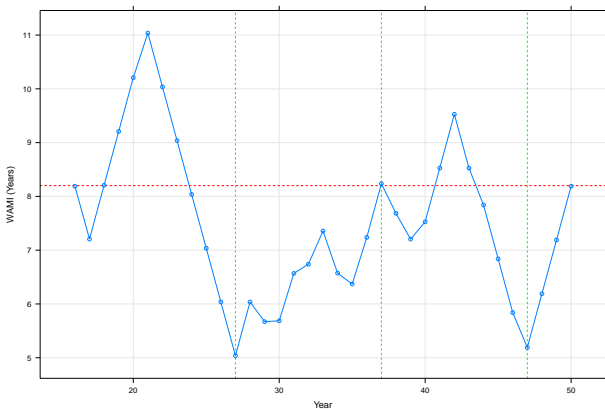
Tradeoff debt stock and flow



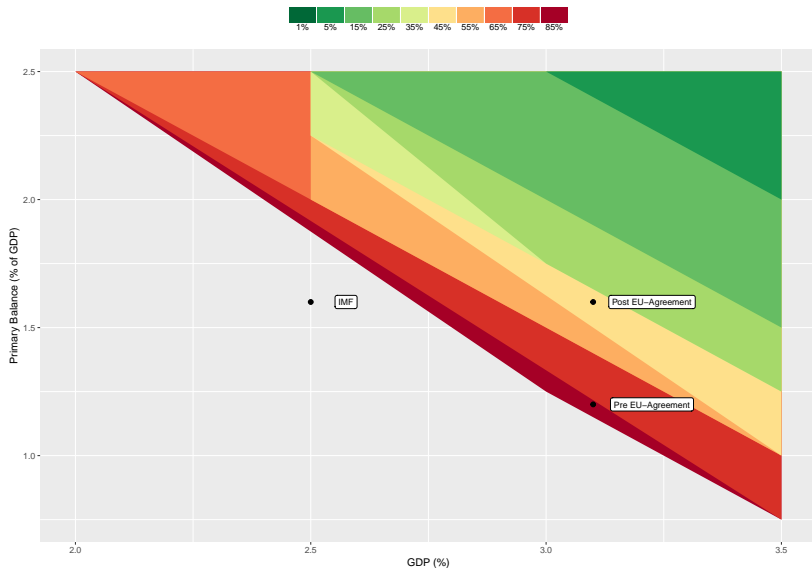
Q4. Netherlands: evaluate DSTA rules



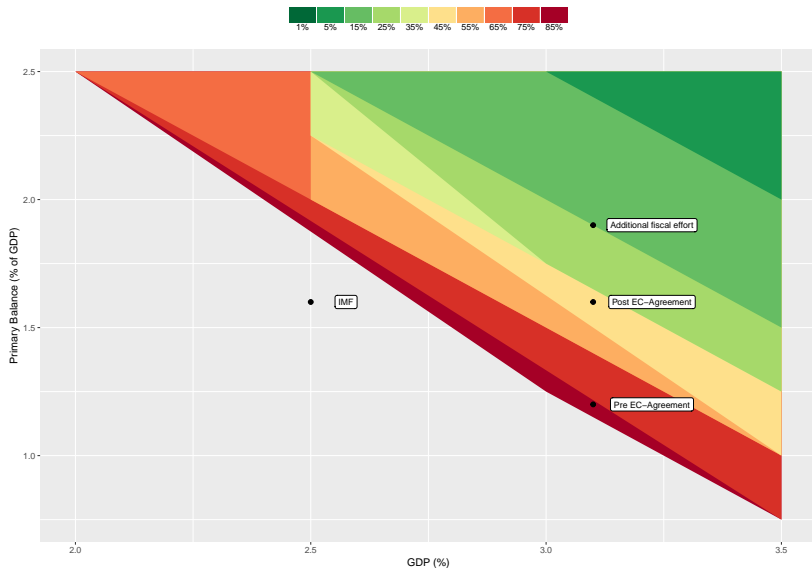
Q4. Netherlands: forward guidance



Q4. Italy: A big question-mark!



Q5. Italy: Optimize adjustments to financing needs



Conclusions

Rich management is a rich framework for debt sustainability

- Debt financing with sustainability controls
- Stochastic financial, economic, and fiscal variables
- Coherent risk measure
- Endogenous interest rates

Publications

Zenios et al., *Risk management for sovereign financing with debt sustainability conditions*, European Stability Mechanism, Working Paper Series 31, Luxembourg, July 2018.