

Sovereign Debt Restructuring:

risk management and financial innovation

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The devil is in the tails

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Outline

***Tactical vs strategic* debt sustainability**

Risk management for debt restructuring

Case study of Greece

Sovereign contingent debt

The issues in sovereign debt crises

Facts on sovereign debt

Reminders of Hyman Minsky (1919—1996):

Debt is fragile

Tactical vs Strategic debt sustainability

Tactical: Short-term

End of an IMF program, under program conditions

Given projections (wishes) does debt decline?

Strategic: Long-term

Past IMF program

Under market uncertainties

Does debt decline with probability 95%?

The issues in sovereign debt crises

Risk management has not been part of analysis

Operational models are missing

“Need for development of criteria for “optimal” debt restructuring process”

(Wright 2012, Harvard Business Law Review)

Risk management for debt restructuring

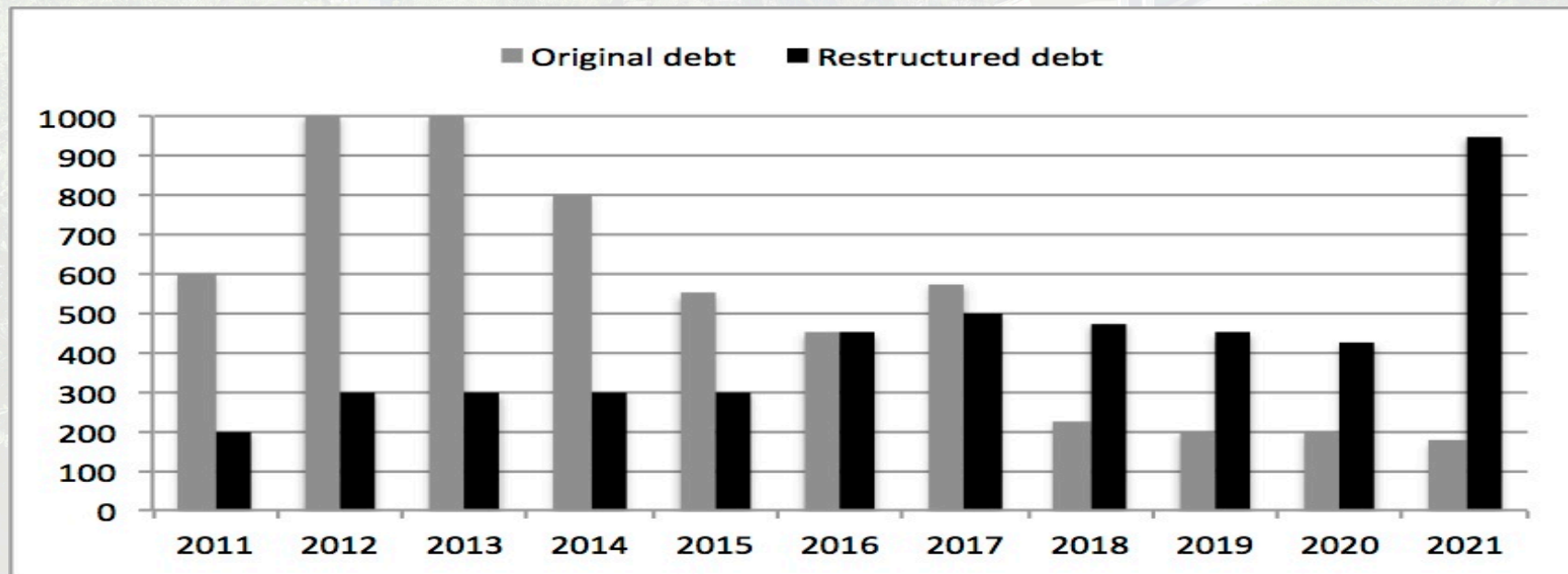
Risk management for debt restructuring

Debt dynamics

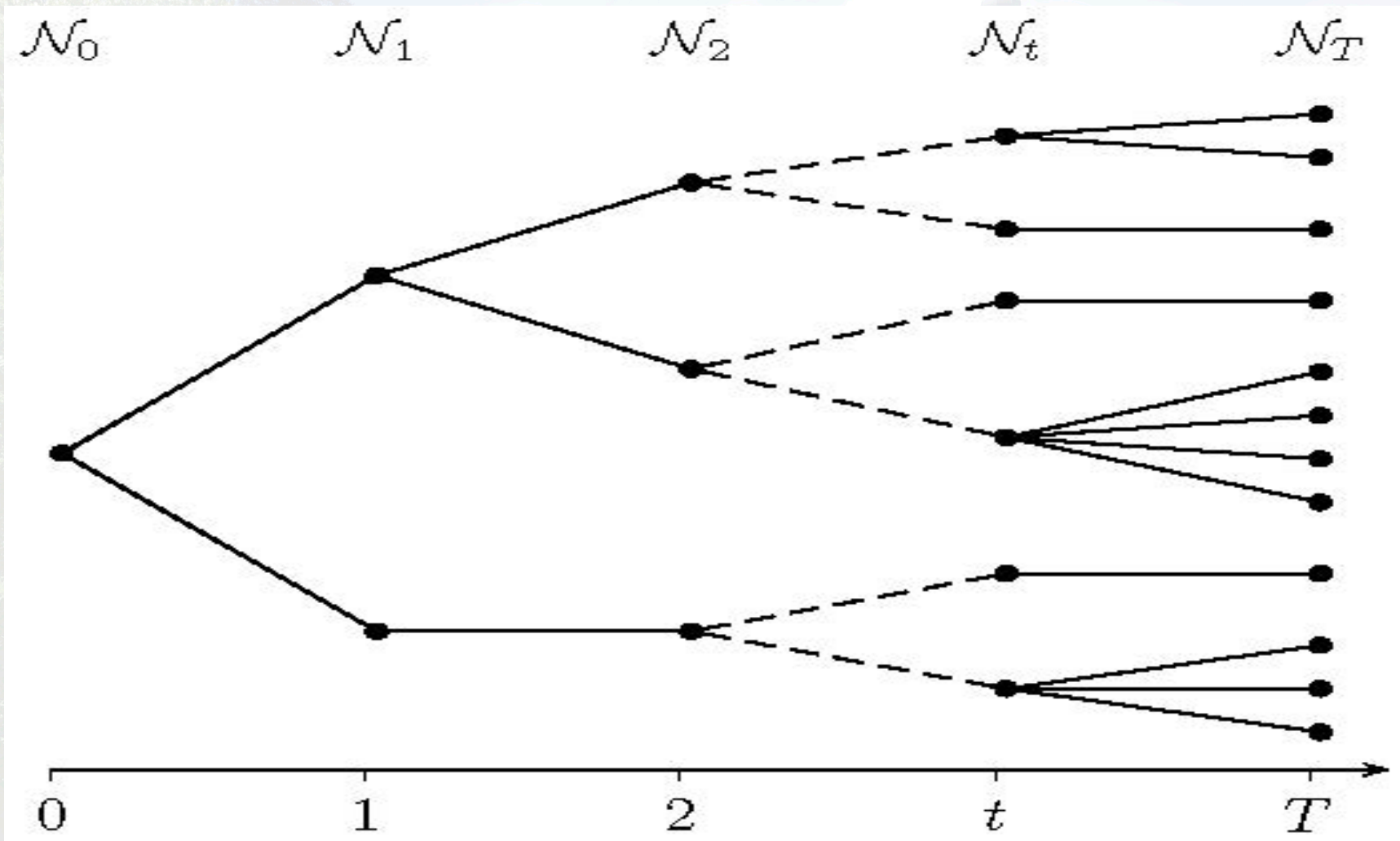
$$D_t = (1 + r_t)D_{t-1} - NB_t + SF_t.$$

Re-finance debt of different maturities

Look at alternative debt stock flows



Risk management for debt restructuring



Risk management for debt restructuring

Scenario dependent debt dynamics

$$D^n = (1 + r^n) D^{p(n)} - NB^n + SF^n.$$

Using Debt-to-GDP ratio

$$\frac{D^n}{G^n} = (1 + r^n) \frac{D^{p(n)}}{G^{p(n)}} \frac{G^{p(n)}}{G^n} - \frac{NB^n}{G^n} + \frac{SF^n}{G^n}.$$

GDP growth is given by

$$g^n = \frac{G^n - G^{p(n)}}{G^{p(n)}},$$

and we express the debt dynamics in proportional growth instead of nominal value by:

$$d^n = \frac{1 + r^n}{1 + g^n} d^{p(n)} - nb^n + sf^n.$$

Risk management for debt restructuring

$$D^n = (1 + r^n)D^{p(n)} - NB^n + SF^n.$$

D is the term structure of debt (multiple issues)

r is the term structure of sovereign rates

NB (and GDP) can be state-dependent

SF can be state-contingent

Scenario tree integrates economic and financial risk factors

Objective and risk neutral probabilities

(Consiglio, Carollo, Zenios, Quantitative Finance, in print)

Risk management for debt restructuring

x^{mj} – nominal value of debt instrument j issued at node m

Conservation of flow at each node:

$$O^n = \sum_{m \in \mathcal{P}(n)} \sum_{j=1}^J x^{mj} CF^j(n, m),$$

$$\sum_{j=1}^J x^{nj} = D^n + O^n,$$

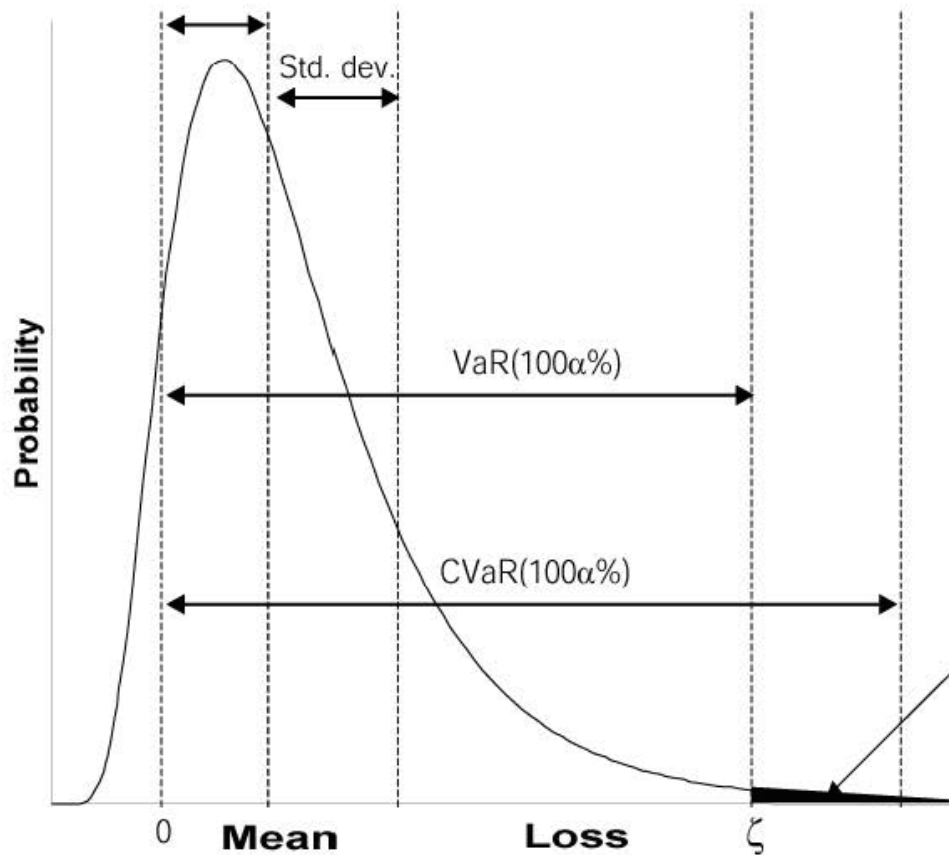
DeaR: Debt-at-Risk

$$\begin{aligned} \mathbf{E}[c] &= \sum_{n \in \mathcal{N}_T} \pi^n c^n, \\ sd^n &= c^n - \mathbf{E}[c], \end{aligned}$$

At each terminal node:

$$C^n = D^n + O^n + \sum_{m \in \mathcal{P}(n)} \sum_{j=1}^J x^{mj} P^j(n, m).$$

Risk management for debt restructuring



Conditional Debt-at-Risk

$$\text{CDeaR} = \zeta + \frac{1}{1-\alpha} \sum_{n \in \mathcal{N}_T} \pi^n y_+^n,$$
$$y_+^n \geq sd^n - \zeta,$$
$$y_+^n \geq 0,$$

(Rockafellar and Uryasev 2000)

Risk management for debt restructuring

Minimize $\mathbb{E}[c]$

s.t.

$$O^n = \sum_{m \in \mathcal{P}(n)} \sum_{j=1}^J x^{mj} \text{CF}^j(n, m)$$

for all $n \in \mathcal{N}_t, t \in \mathcal{T} \setminus 0$,

$$D^n + O^n = \sum_{j=1}^J x^{nj},$$

for all $n \in \mathcal{N}$,

$$C^n = D^n + O^n + \sum_{m \in \mathcal{P}(n)} \sum_{j=1}^J x^{mj} P^j(n, m),$$

for all $n \in \mathcal{N}_T$,

$$c^n = C^n / G^n,$$

for all $n \in \mathcal{N}_T$,

$$sd^n = c^n - \mathbb{E}[c],$$

for all $n \in \mathcal{N}_T$,

$$y_+^n \geq sd^n - \zeta,$$

for all $n \in \mathcal{N}_T$,

$$\zeta + \frac{1}{1-\alpha} \sum_{n \in \mathcal{N}_T} \pi^n y_+^n \leq \rho,$$

$$x^n, O^n, c^n, y_+^n \geq 0,$$

for all $n \in \mathcal{N}$.

The issues in sovereign debt crises

Key parameters (Das et al 2012)

Face and market value of bonds or loans

Interest rate and coupon (fixed, flexible, step-up, linked)

Amortization schedule

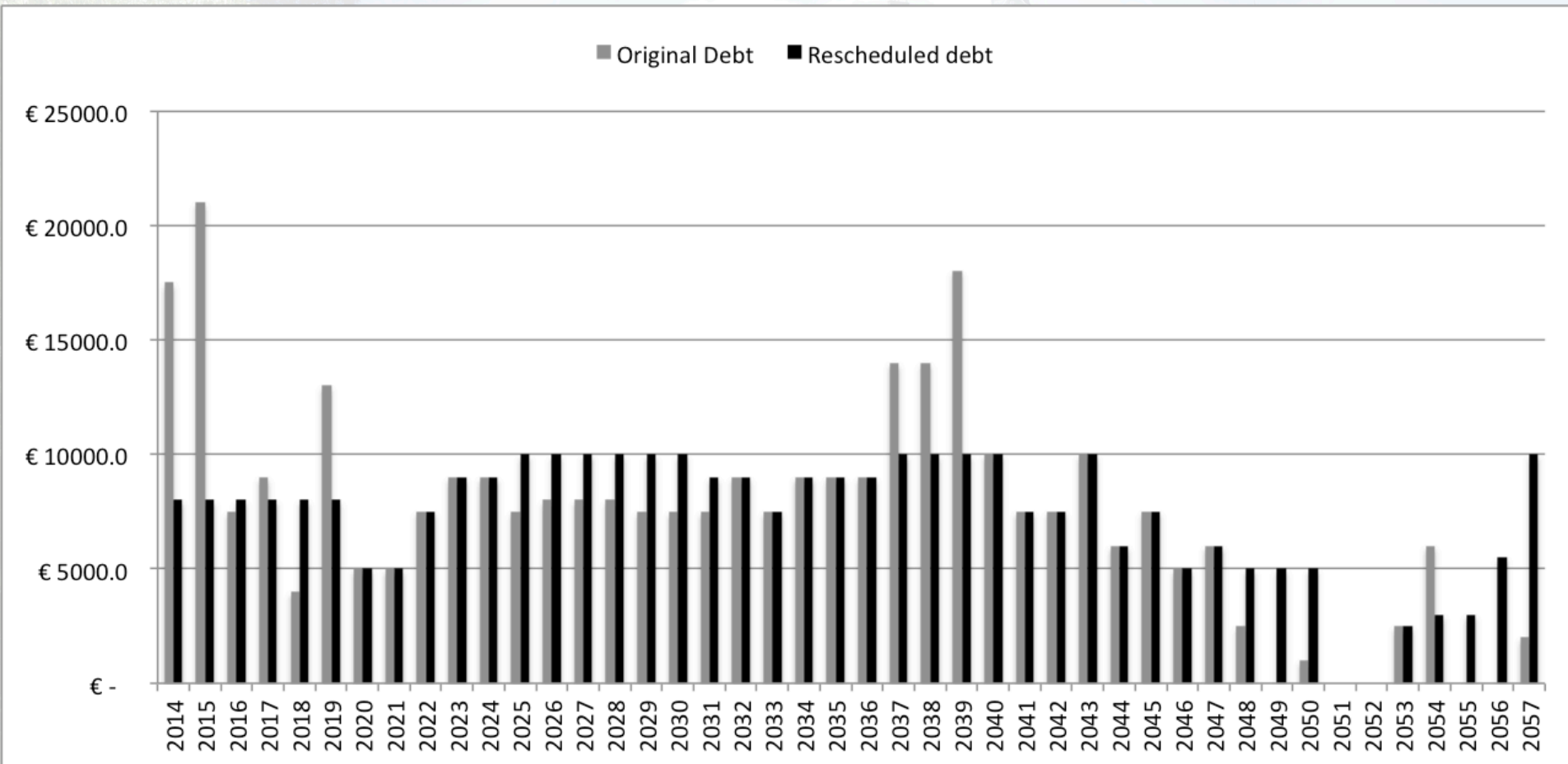
Currency of denomination

Enhancements such as embedded options or collateral

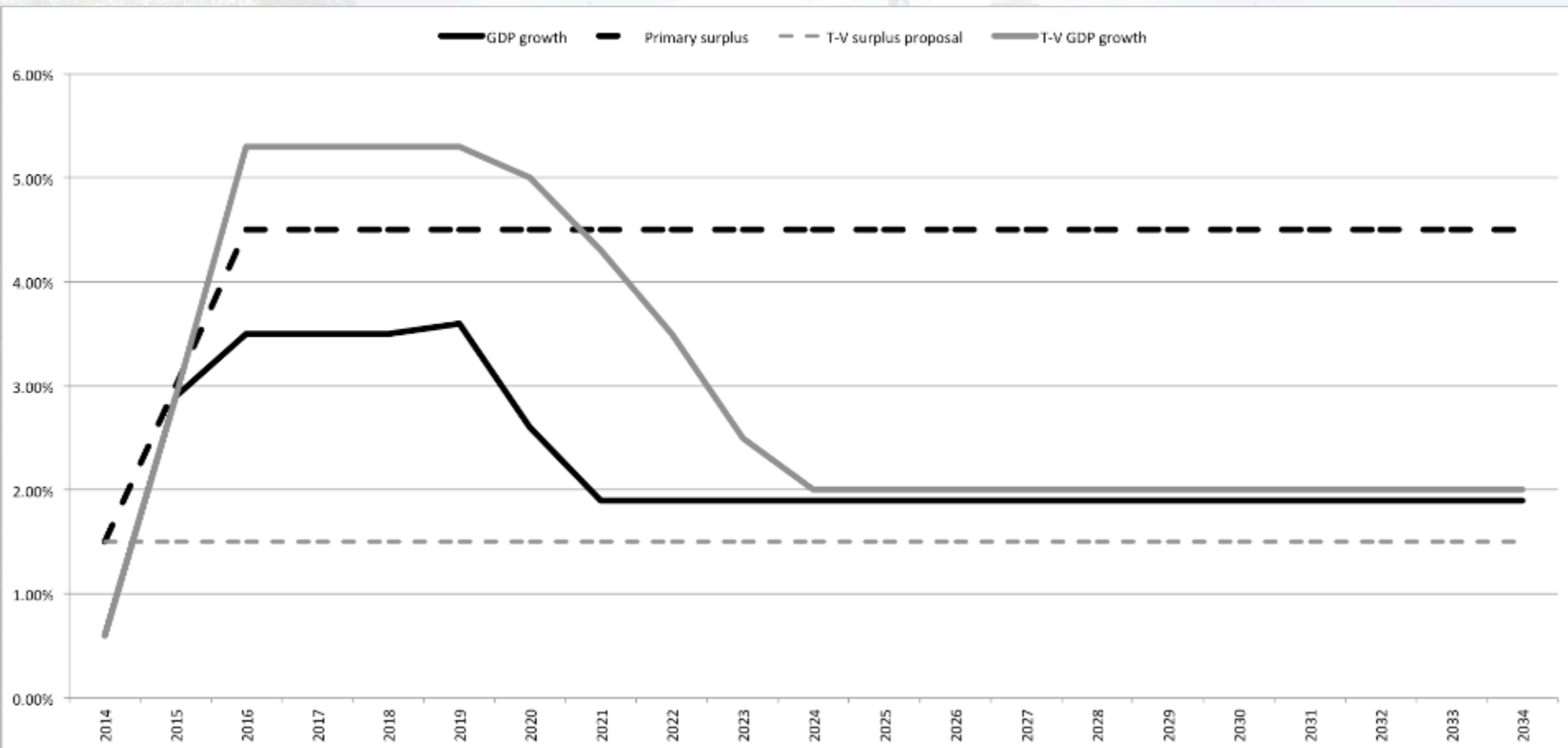
Legal clauses (CAC, exit consents)

Case study of Greece

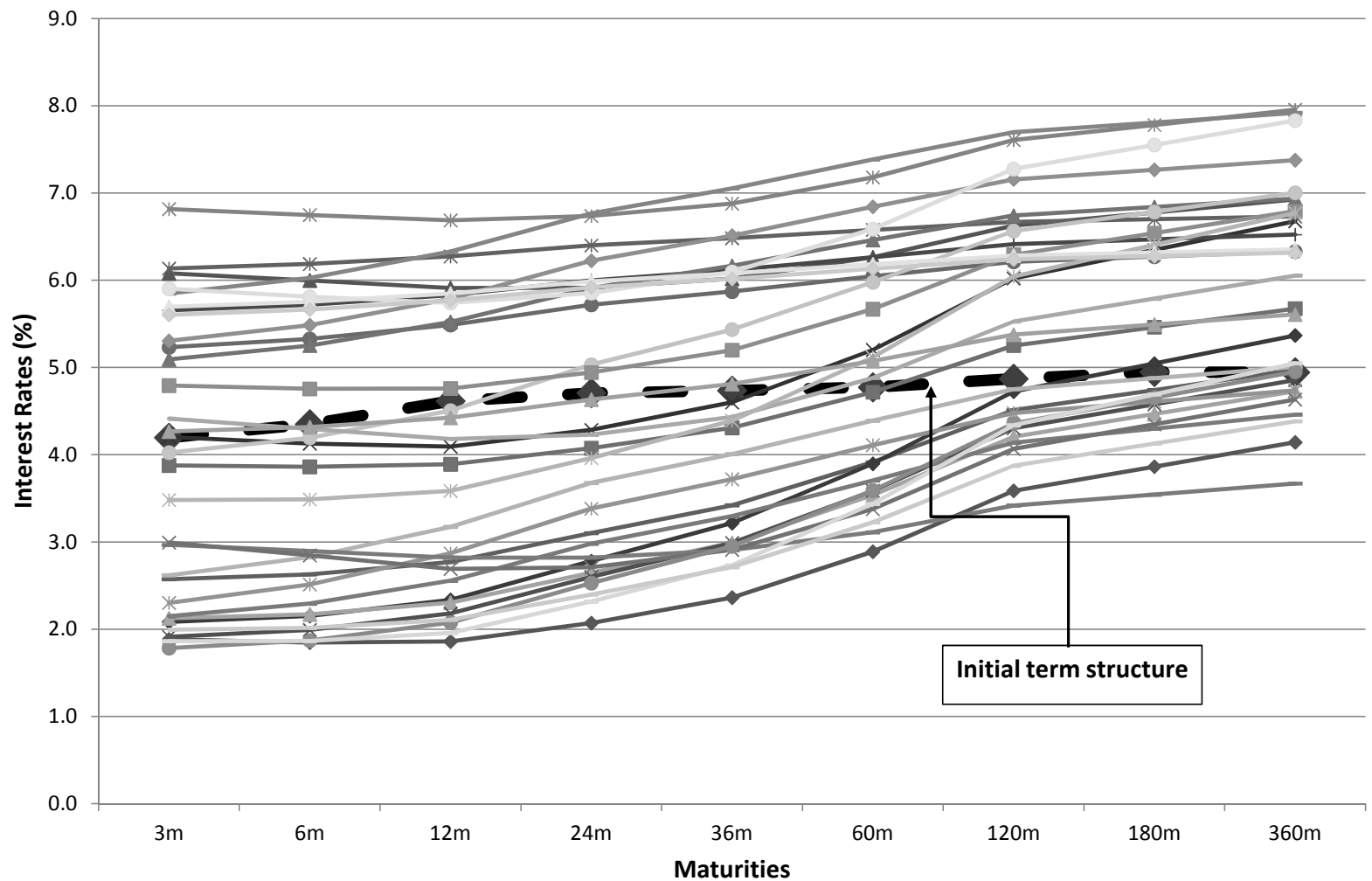
Case study of Greece



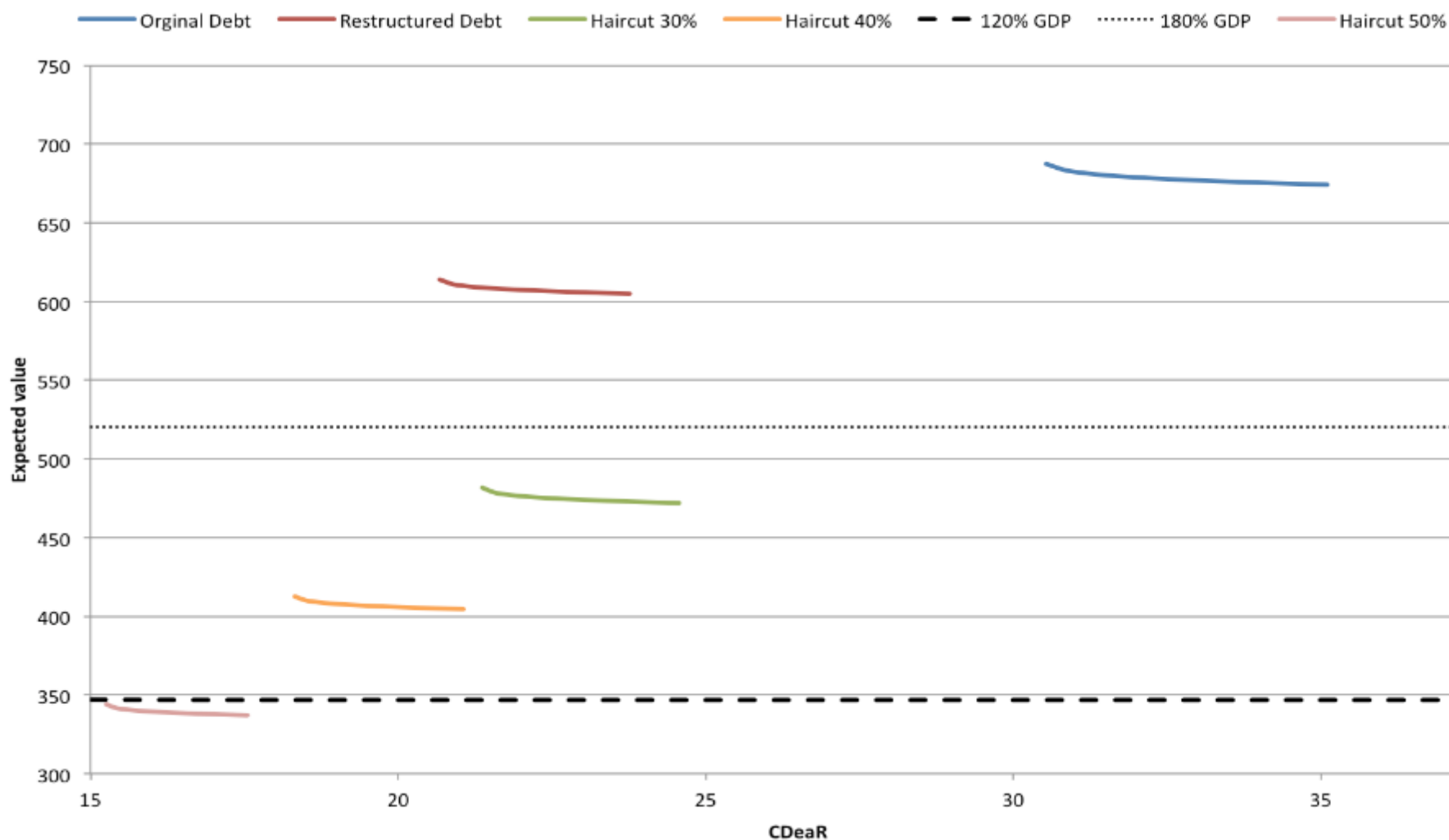
Case study of Greece



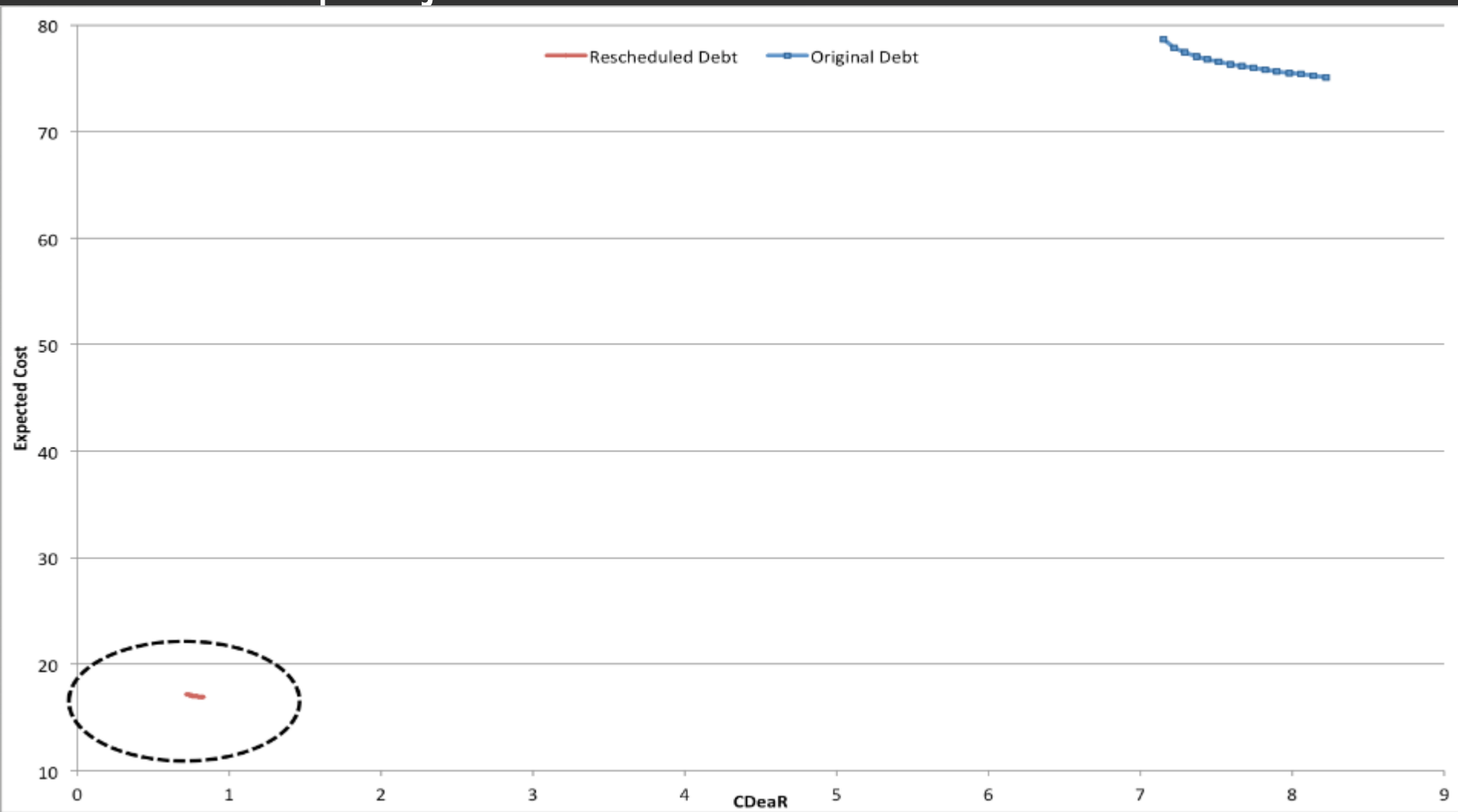
Case study of Greece



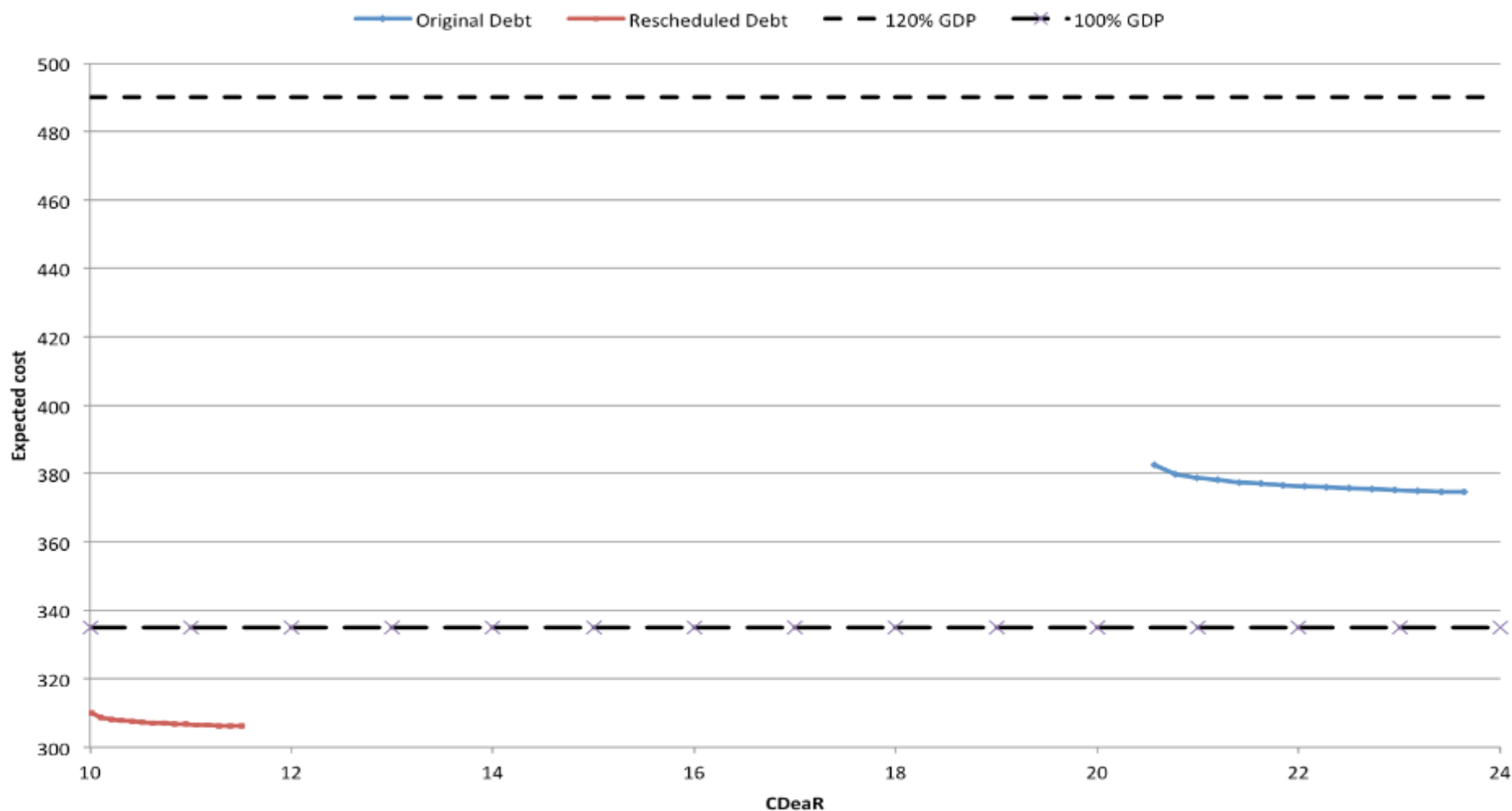
Case study of Greece: current debt situation



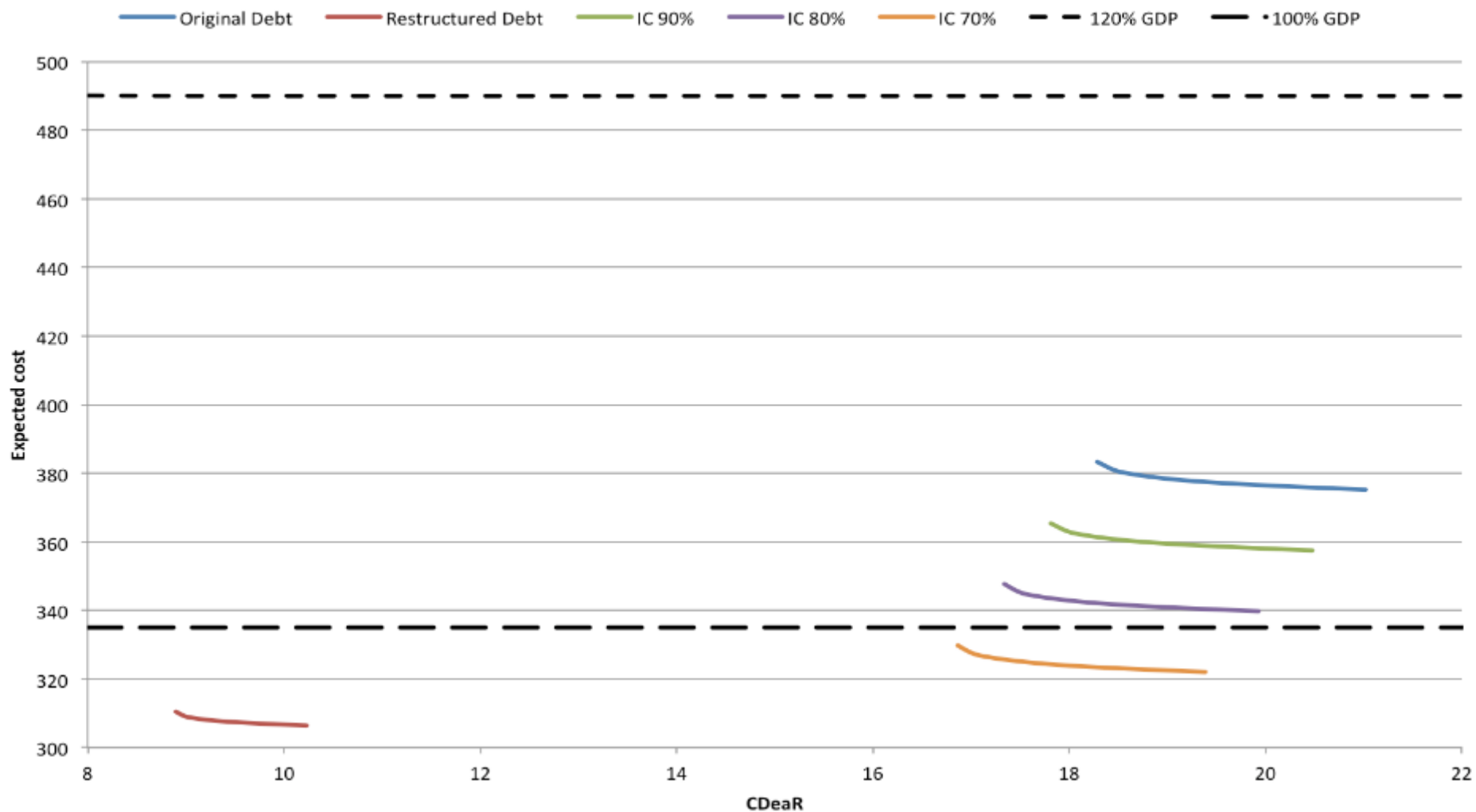
Case study of Greece: IMF projections



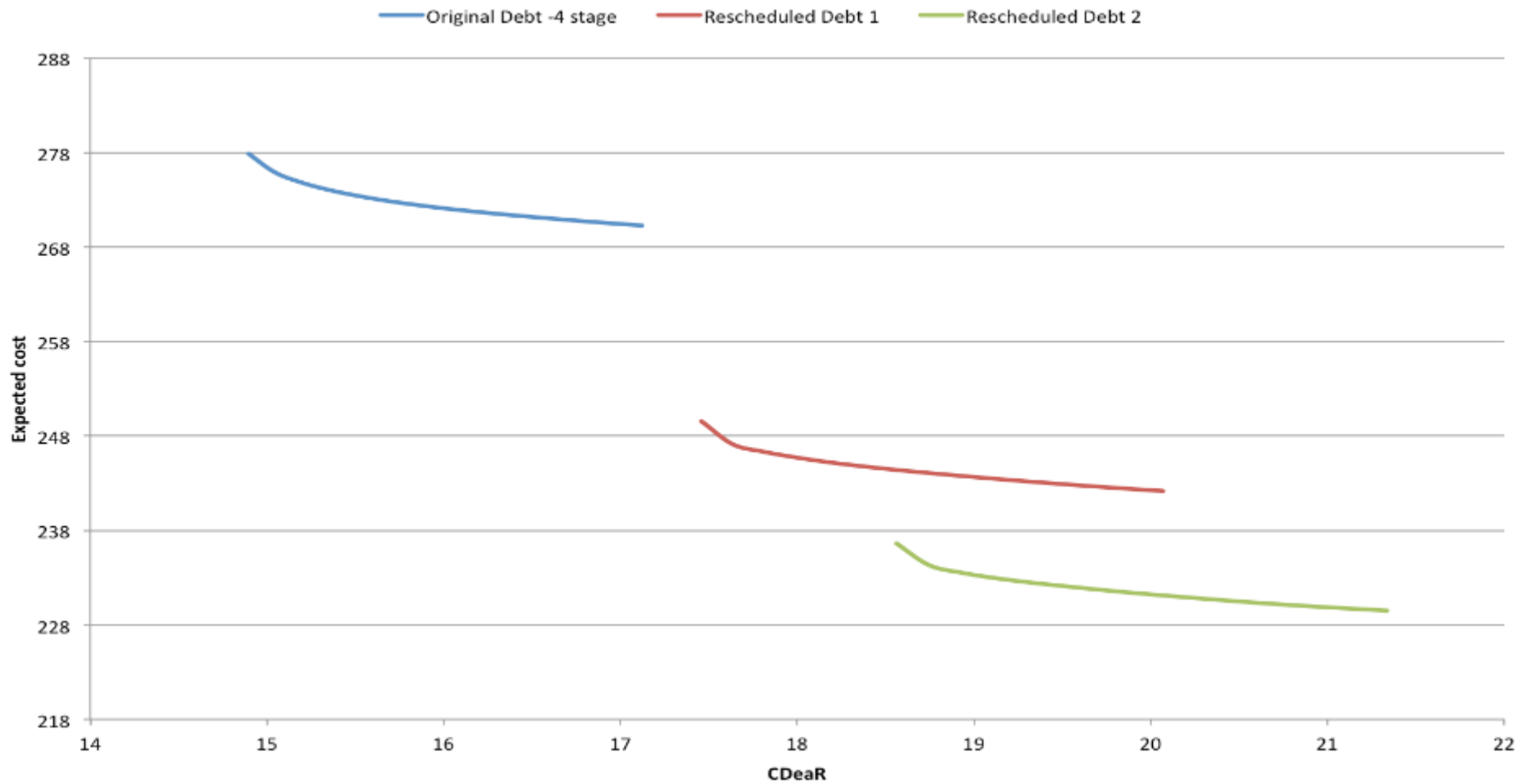
Primary surplus 1.5% and improved country growth assuming fiscal multiplier 0.8



Interest rate concessions



Debt extension



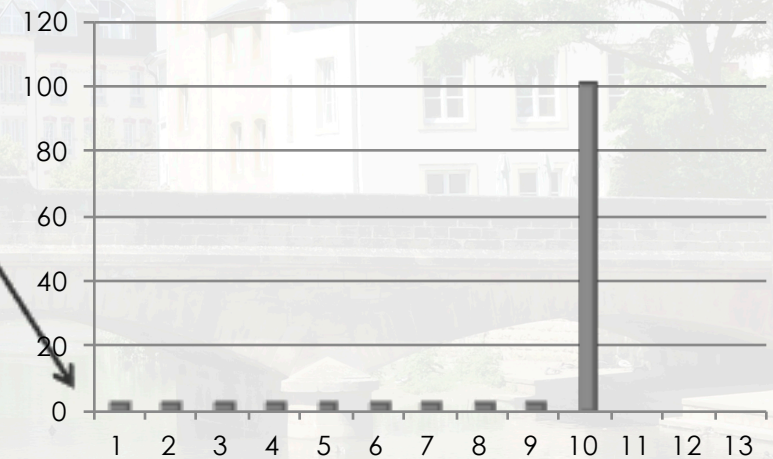
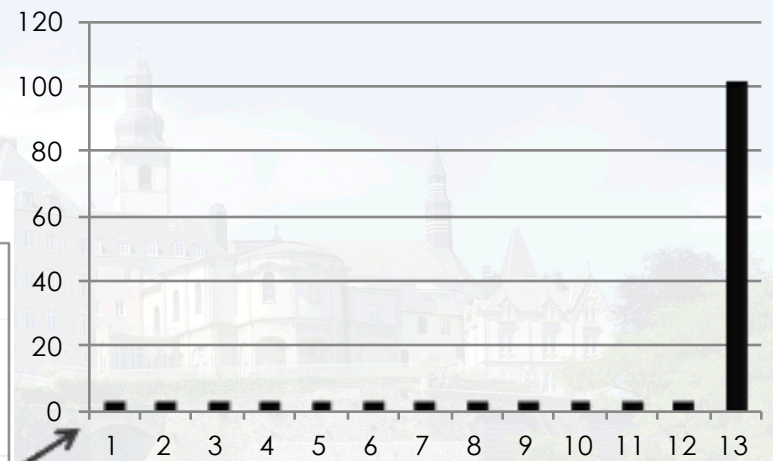
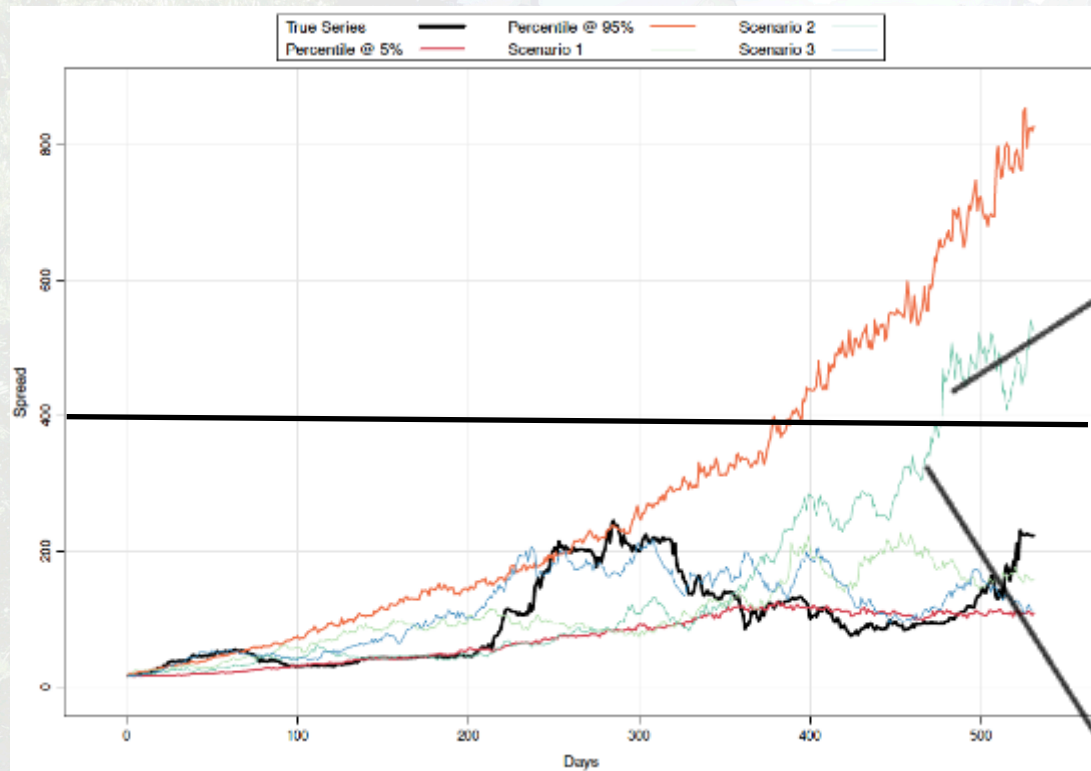
Sovereign CoCo: contingent convertible debt

Sovereign CoCo

A sovereign debt instrument with

- (i) a built-in trigger to allow, but not require, a standstill of payments for a fixed period of time
- (ii) that is activated when an indicator breaches a threshold
- (iii) becomes effective after the sovereign enters a program with IMF
- (iv) makes the triggered bond senior to subsequently issued debt

Our suggestion: 30-day average CDS spreads exceed 400bp.



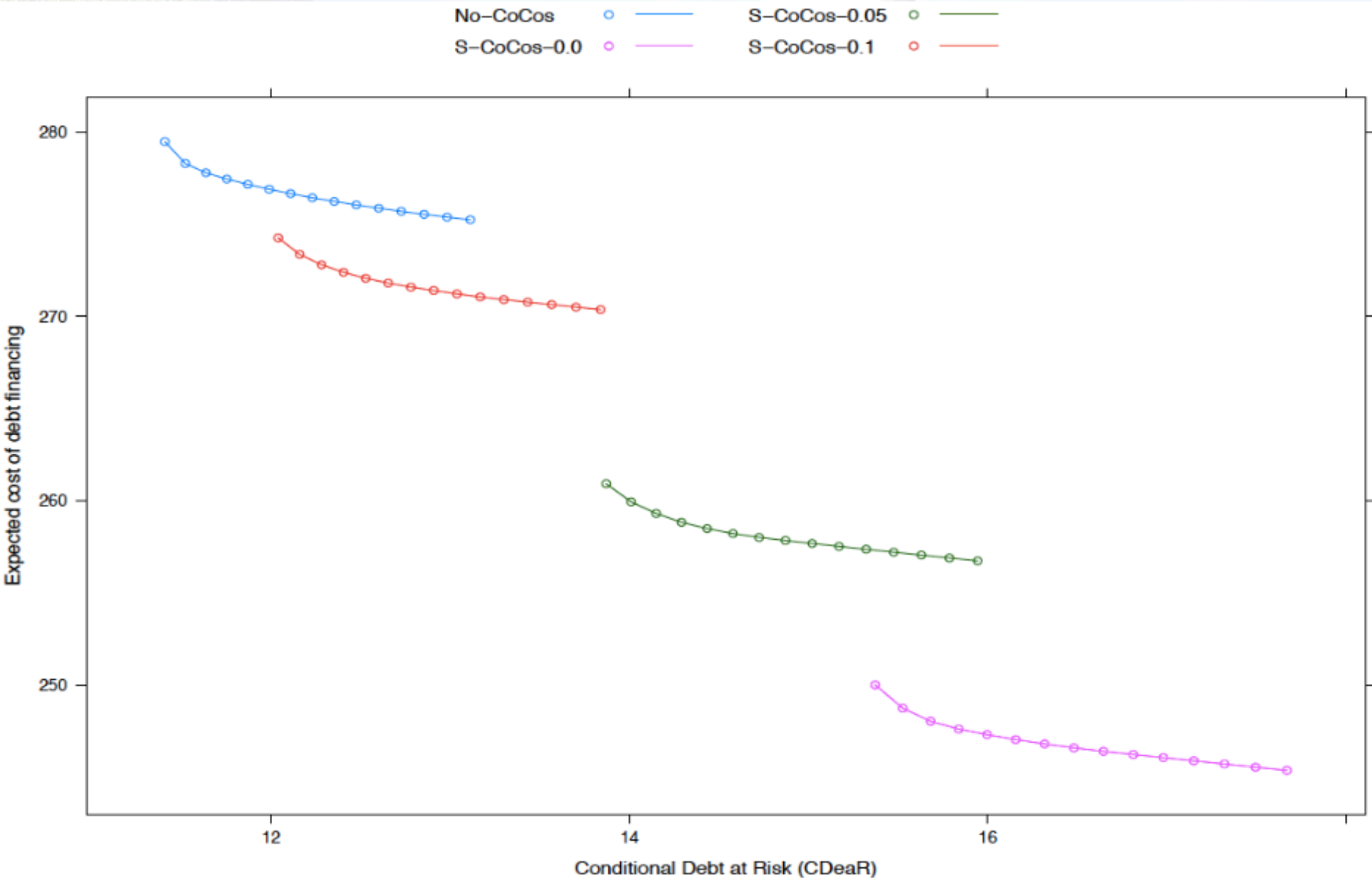
Ex ante treatment of sovereign risk

Address creditor moral hazard

Deal with “neglected risks”

Contingent contracts

Risk management for debt restructuring with CoCo



Conclusions

The devil is in the tails

Ex post, risk management for sovereign debt

Ex ante, uncertainty part of contingent contract

Conclusions

No matter how misguided the negotiating tactics of the Greek government might have been, debt was unsustainable before they came to power.

References

Consiglio, A. and Zenios, S.A.

Risk management optimization for sovereign debt restructuring

http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2478380

Greek debt sustainability: the devils is in the tails

<http://www.voxeu.org/article/greek-debt-sustainability-devil-tails>

Consiglio, A. and Mody, A. and Zenios, S.A. (in preparation)

Contingent convertible bonds for sovereign debt risk management

Consiglio, Carollo and Zenios,

A parsimonious model for generating arbitrage free scenario trees

http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2362014