

Self-Fulfilling Debt Crises: A Quantitative  
Analysis  
by Luigi Bocola & Alessandro Dovis

Discussion by Juliane Begenau

Harvard Business School

MIT Sloan Junior Finance Faculty Conference 2015

## Question & Exercise

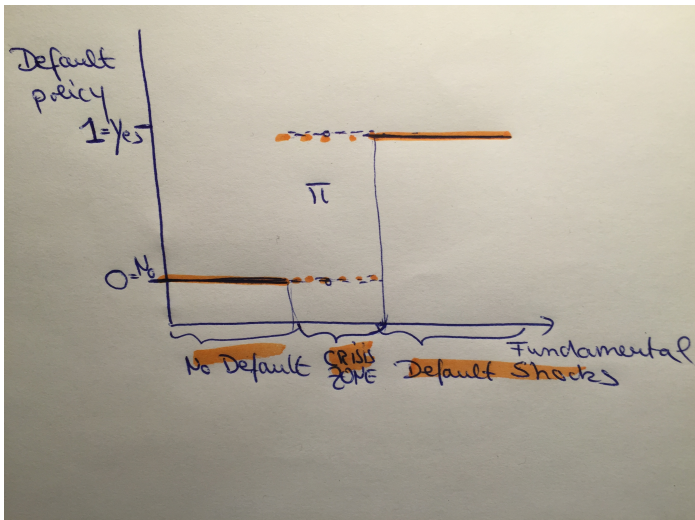
- ▶ How to identify non-fundamental movements in sovereign spreads?
  - ▶ Did the Draghi put eliminate “non-fundamental risk” or raise bailout expectations?
- ▶ This paper does a ton of work
  - ▶ Combines canonical sovereign default models with Cole and Kehoe (2001), self-fulfilling debt crises
  - ▶ Quantified with Italian data, German ZCB
  - ▶ Decomposition

$$\text{Spread}_{I-G} = \text{Output Risk} + \text{Rollover Risk} + \text{Risk Premia}$$

- ▶ Identify Draghi put by constructing counter-factual “fundamental” spreads

# Model

- ▶ Gov picks default, debt maturity, debt, consumption
- ▶ Fundamental shocks to output and lenders' SDF
- ▶ Random rollover shocks to solve indeterminacy



# Identification of Rollover Risk

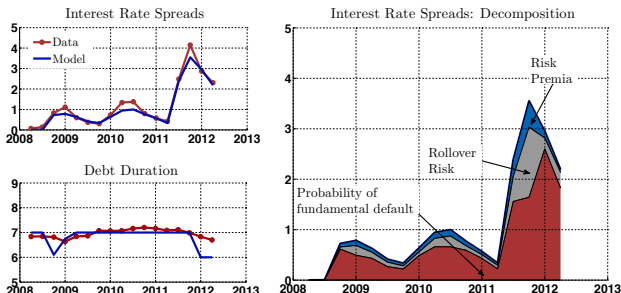
$$\text{Spread}_{I-G} = \underbrace{\text{Output Risk}}_{\text{Fund. Def. Risk}} + \underbrace{\text{Rollover Risk}}_{\text{Non-Fund. Def. Risk}} + \underbrace{\text{Risk Premia}}_{\text{Fund. Risk}}$$

- ▶ Risk-averse lenders: exp. affine TS (Ang & Piazzesi 03)
  - ▶ use SDF to isolate risk-premia
- ▶ Use model to identify rollover risk
  - ▶ Model implication for debt maturity choice
    - ▶ Incentive channel: prefer shorter maturity
    - ▶ Insurance channel: prefer longer maturity
  - ▶ Fundamental default risk: shorten maturity
    - ▶ incentive problem stronger
    - ▶ insurance channel weaker
  - ▶ Rollover risk: lengthen maturity

# Quantitative Analysis

- ▶ Endowment (IT GDP, G ZCB) & rollover risk process (picked to be consistent w/ IT CDS spread)
- ▶ Success
  - ▶ targeted: Debt/GDP, spread distribution (6 month CDS)
  - ▶ untargeted: default rate,  $\text{corr}(\Delta b', y)$ ,  $\sigma(b/y)$

Figure 5: Contribution of rollover risk to interest rate spreads



Notes: The top left panel reports CDS spreads on 6 months Italian government bonds along with the point estimates for interest rate spreads on a one period ZCB implied by the model. The bottom left panel reports the same information for the weighted-average life of outstanding government debt. The right panel reports the decomposition of the filtered interest rate spreads given by equation (17). The red area represents  $\{Pr_t\{S_{t+1} \in S^{default}\}\}$ , the gray area  $\{Pr_t\{S_{t+1} \in S^{crisis}\}\}$ , and the blue area  $\left\{Cov_t\left(\frac{M_{t,t+1}}{E_t[M_{t,t+1}]}\right)\right\}$ .

# Discussion

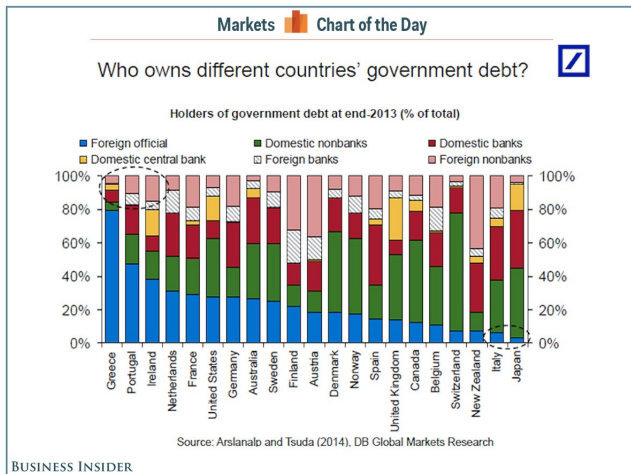
- ▶ Trust numbers?
  - ▶ SDF
  - ▶ Modeling rollover risk
  - ▶ Quantifying rollover risk
- ▶ Minor comments

# Stochastic Discount Factor

- ▶ Strategy
  - ▶ SDF estimated using German zero-coupon bonds
  - Assumptions:
    - ▶ Same mg investor prices G & I bonds
    - ▶ G-ZCB contain information about investors' attitudes towards Italian default risk
    - ▶ No-arbitrage condition holds
- ▶ Comment:
  - ▶ Seems SDF set up to underestimate risk premium
  - ▶ Simple test would be to use SDF on Italian bonds

# Who owns Italy's Debt?

- ▶ Investors are Italian → SDF should price systematic risk of Italian investors





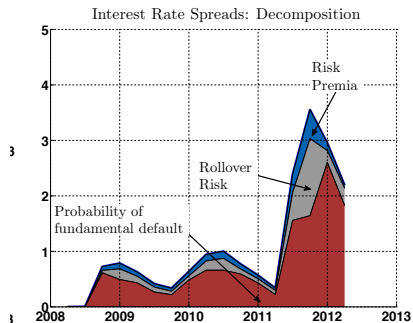
# Issues with German ZCB

- ▶ I-G spread falling also due to flight to safety



- ▶ Factor moves changes in riskless bonds prices: interest rate risk
  - ▶ Esti. risk premia: investor attitudes to  $\Delta$ Bund rates

# Estimated risk premium too small



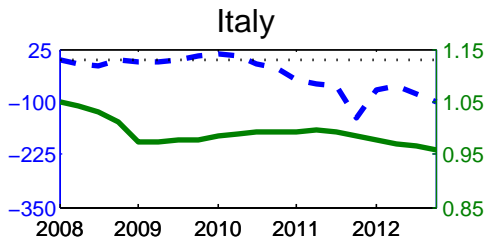
- ▶ Could estimate SDF based on TS of defaultable bonds (see Duffie & Singleton 1999) with I & G yields
- ▶ Problem: affine TS imposes no-arbitrage conditions across time and maturity
  - ▶ During crisis: doesn't even work well for U.S. data

# Modeling Rollover Risk

- ▶ This (& other) papers: rollover risk iid events
- ▶ He & Milbradt (2014) corporate bonds
  - ▶ positive feedback loop b/w default & liquidity
  - ▶ model delivers default driven illiquidity & illiquidity driven default
  - ▶ spreads decomposition into default, liquidity, and interaction default x liquidity

# Quantifying rollover risk

- ▶ Rollover risk identification
  - ▶ data: small variation in duration (6 month) - \*footnote 29: stock vs new issuance
  - ▶ model: overshoots reduction in duration (authors: grid)
  - ▶ limits role for rollover risk
- ▶ Salomao 2014: CDS spreads (blue dashed is 5Y CDS-Bond basis (bps)) move aside from “default-risk” as measured by the bond spread



# Conclusion

- ▶ Ambitious quantitative paper with interesting question
  - ▶ Builds cutting-edge sovereign-default model (maturity choice, risk-averse investors, rollover crisis)
  - ▶ Quantified with Italian data (this is very difficult! Chapeau!)
  - ▶ Restrictions of model used to disentangle movements in spreads due to “fundamental risk” from “non-fundamental” risk
- ▶ A few suggestions
  - ▶ SDF (not yet pricing credit risk)
  - ▶ Open possibility for feedback loop between default and rollover risk
  - ▶ Identification & quantification (more of that in the minor comments)

## Minor comments

- ▶ Bank run analogue tricky
  - ▶ Diamond (1984) optimal to insure deposits to prevent inefficient bank run. Here rollover risk also inefficient. Draghi put welfare would therefore be welfare improving. One has to believe your estimation to interpret the counter-factual spread calculation as proof .
- ▶ Sensitivity of results to recuperation value. Lenders do not lose everything - equation (6)
- ▶ Other related work
  - ▶ Working paper by Cohen and Villemot (2008)
  - ▶ Pelizzon, Subrahmanyam, Tomio, and Uno (2013):  
Microstructure of the European Sovereign Bond Market:  
A Study of the Euro-zone Crisis
  - ▶ He and Xiong (2012). Rollover and Credit risk:
  - ▶ He and Milbradt (2014). Endogenous Liquidity and Defaultable Bonds

## Minor comments ctd

- ▶ Insurance channel gets weaker - requires better explanation
  - ▶ Ex-post argument of sensitive pricing functions close to default state true, but this is a policy argument not an equilibrium outcome.
  - ▶ If default risk rises, precautionary motives should rise
  - ▶ Lower ex-ante likelihood of roll-over risk, by raising long-term debt
  - ▶ In fact surprising that the model doesn't want to raise only long-term debt / could immediately eliminate rollover risk
- ▶ Calibration
  - ▶ 3 Parameters  $\beta, d_0, d_1$  match 5 moments?
  - ▶ I think you wanna say that  $\beta, d_0, d_1$  and  $\pi^*$  and  $\sigma_\pi$  match those 5 moments?
  - ▶ Very high probability of crisis zone (87.26%) seems not plausible

## Minor comments ctd

- ▶ Why you have to keep track of  $\pi'$  if it's simply the realization of an iid process with some constant mean?
- ▶ Italian GDP process: estimate shows that shocks to German forward rates enter tiny and negative
  - ▶ what does matching correlation means? match is scale-free, risk premia care about covariance, scaled correlation
- ▶ Fact that Italian banks important holders of sovereign bond also tricky:
  - ▶ Note: banks have incentives (zero risk-weight) to hold sovereign bonds, like to hold long term asset (term premium), may also affect sovereign's maturity choice
  - ▶ Perhaps even other stories possible why sovereign chooses maturity, unrelated to rollover and default risk
- ▶ Don't use 6 month CDS spread to compare model to data if average duration is 6-7 years. Suggest use CDS spread that fits average maturity/duration of portfolio
- ▶ How about other maturities?
- ▶ Current SDF estimation  $R^2$  are rather small
- ▶ Arguments in Appendix D seems weak given that data variation in duration small + model biases against finding roll-over risk