Self-Fulfilling Debt Crises: A Quantitative Analysis
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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: expect 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 \( \{\text{Pr}_t\{S_{t+1} \in S^{\text{default}}\}\} \), the gray area \( \{\text{Pr}_t\{S_{t+1} \in S^{\text{crisis}}\}\} \), and the blue area \( \{\text{Cov}_t\left( \frac{M_{t+1}}{E_t[M_{t+1}]} \right)\} \).
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 ΔBund rates
The red shaded area represents the conditional probability of falling into the default region next period, the gray shaded area reports the conditional probability of a rollover crisis, and the blue shaded area denotes risk premia. From the figure, we can see that the risk premium component explains, on average, roughly 10% of the variation in interest rate spreads over our sample. The bulk of the variation in interest rate spreads arise because of fluctuations in the conditional probability of a fundamental default. Finally, rollover risk accounts for up to 38% of the observed movements in spreads, although its role is negligible at the end of the sample.

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6.2 The information content of maturity choices

We now repeat the filtering experiment, this time excluding the debt duration series from the set of observables. Table 4 reports several statistics for this specification. Specifically, the point estimates for the average of the three components of the interest rate spreads over the sample, along with the 5th and 95th percentile. We also report, as a comparison, the same statistics for the experiment of Section 6.1.

Absent data on debt duration, the model does not have clear identifying restrictions.

- 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 (and 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

![Chart showing GDP and CDS-Bond Basis for various countries from 2008 to 2012. The chart illustrates the movement of GDP and CDS-Bond basis for Greece, Portugal, Ireland, Spain, France, and Italy.](chart.png)

Note: This plot uses seasonally-adjusted and log-detrended GDP from OECD data. The basis is calculated with 5-year bond and CDS data from Datastream. For Greece, Spain, Ireland, Portugal, and Italy, as GDP goes below the mean (1.0), the basis becomes negative. Low output shocks are usually an indicator of a debt-crisis. In contrast, France also had a small GDP contraction but given it did not have a debt sustainability crisis during this period the basis remains close to zero.
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
  - 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