Discussion:Sovereign CDS Spreads with Credit Rating (Li, Li & Yang)

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Motivation

- What drives variation in the term structure of sovereign credit default swap (CDS) spreads
- Good to have a model which explain this variation for many countries over a long period of time, with a small number of factors
- Nice to relate small set of factors to economically meaningful factors, e.g. GDP growth, etc

What the paper does

- Basic starting point: reduced form model of default – risk-neutral default intensity is constant
- Existing progress: Pan & Singleton (2008) – fit CDS spreads for 3 countries with one factor risk-neutral default intensity. Augustin (2013) – fit CDS spreads for 44 countries with macrofinance model (long-run risk SDF) – slope matters for relative importance of global and local factors.
- This paper – fit CDS spreads for 34 countries (in-sample) with good out-of-sample performance for another 34 countries – use 3 factor model for risk-neutral default intensity
- Important points
  - Ambition – large number of countries, out-of-sample performance
  - Small number of factors driving risk-neutral default intensity

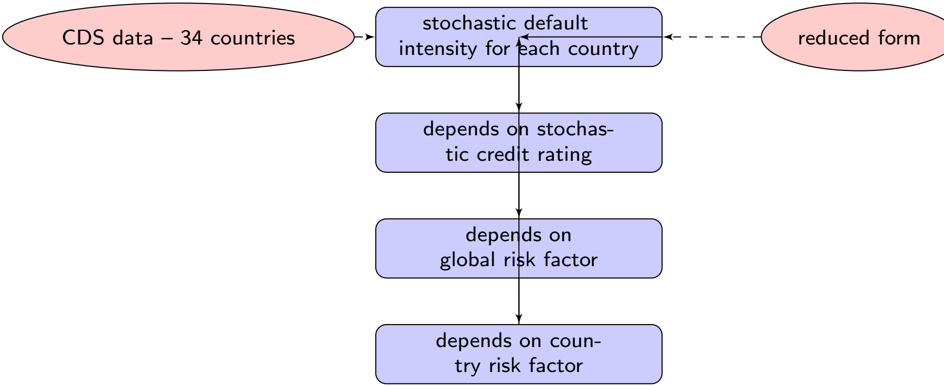
How the paper does it

- Make default intensity for Country i stochastic via dependence on 3 factors
  - credit rating (paper silent any economic factors driving credit ratings – hard)
  - global risk factor z (drives price of risk – easy)
  - country specific risk factor y_i (what drives this? Monetary policy, fiscal policy, local political risk? – hard)
- Credit rating can change stochastically according to Markov chain
- Country i's default intensity higher when
  - global risk factor is higher
  - country specific risk factor is higher
  - credit rating is lower

Preliminary Comments

- Not much economic intuition behind the model
- What do the 3 factors mean? If we know what they mean, we can check whether the implied levels make sense.

Summary



Fit model to data via MLE. Test model out of sample on 34 new countries.

SDF and Risk Price

- global **SDF**

$$\frac{d\Lambda_t}{\Lambda_t} = -rdt - \underbrace{\left(-\lambda_z \sqrt{z_t}\right)}_{\textbf{risk price}} \cdot \overbrace{dW_t^P}^{\textbf{global shock}}$$

- Easy to see z drives the price of risk
- risk price is **stochastic**

$$\mathbb{P} : dz_t = \kappa_z^P(\theta_z^P - z_t)dt + \sigma_z\sqrt{z_t}dW_t^P$$
$$\mathbb{Q} : dz_t = \kappa_z(\theta_z - z_t)dt + \sigma_z\sqrt{z_t}dW_t$$

- global state summarized by (z_t, W_t^P) under $\mathbb{P}$

3-factor risk-neutral default intensity

- Country k's risk-neutral default intensity, $h_{k,i,t}$ depends on country k, credit rating category i (different for each country) and price of risk z (global)

$$h_{k,i,t} = (\alpha + z_t)\tilde{h}_i + y_{k,t}$$

  - risk factor for Country k

$$dy_{k,t} = -\kappa_y y_{k,t} dt + \sigma_y dW^y_{k,t},\ dW^y_{k,t} dW^P_t = 0$$

- Country k's risk-neutral default intensity higher when
  - global risk price is higher
  - country specific risk factor is higher
  - country's credit rating is lower – a downgrade creates an upward jump in the default intensity
- Credit ratings transitions only occur between adjacent ratings categories – reduce parameter space

Question: $y_{k,t}$ can take any negative value, so what stops negative default intensities?

Credit Ratings Transitions I

- Important points
  - Changes in a country's credit rating i matter, because they change its risk-neutral default intensity $h_{k,i,t}$
  - 7 ratings categories, $i \in \{1, \ldots, 7\}$ – 7 states in Markov chain
  - higher risk price increases risk-neutral intensity of a ratings transitions
  - only allow transitions between adjacent categories – reduces parameter space

Credit Ratings Transitions II

- Define **ratings transition intensities** $\mathbb{Q}$– 7 states in Markov chain, $i \in \{1, \ldots, 7\}$
  - $Q_{ij,t}dt$, $i \neq j$, risk-neutral prob of moving from i to j within an instant dt (risk-neutral transition intensity)
  - over an instant, dt, **only allow transitions between adjacent categories**, e.g. AAA $\rightarrow$ AA can occur, but not AAA $\rightarrow$ B – reduces parameter space
  - Only need to define the adjacent transition intensities (others are zero). E.g. need to define $Q_{12,t}$ and $Q_{21,t}$, but $Q_{13,t} = Q_{14,t} = Q_{15,t} = Q_{16,t} = 0$

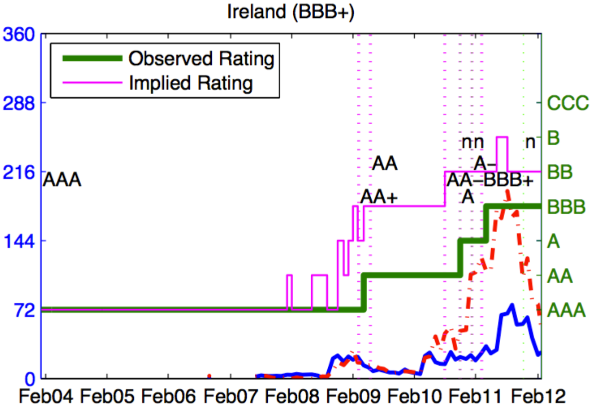
$$Q_{i,i\pm1,t} = (\alpha + z_t)\tilde{Q}_{i,i\pm1}$$

  - Risk-neutral transition intensity linear in risk price
  - Where is the country dependence? The ratings category, i, differs across countries.

How well does the model do?

Generally model does well. Impressive.

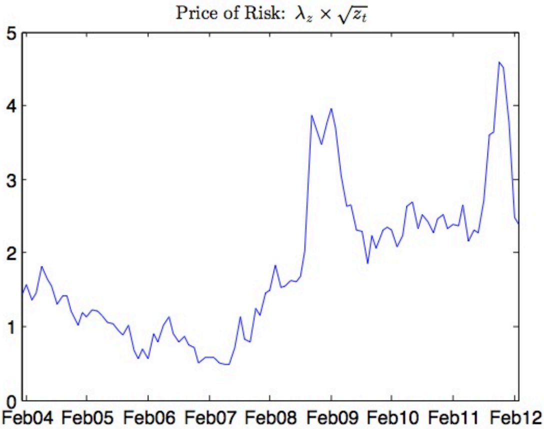
- Focus on Ireland (because its credit rating changed substantially), time series of in-sample absolute pricing errors in basis points (dashed-dotted line)



Pricing errors small until Eurozone debt crisis

Comment and Suggestion 1

- Instead of plotting global risk factor z_t, just plot $-\lambda_z\sqrt{z_t}$, which is the price of risk.
- Check the time-series of the estimated price of risk from model



- Risk prices look too high. Is this unrealistically high risk price what underlies the model's ability to fit the data? Try constrained MLE

Suggestion 2

- The paper does not mention the macro factors driving credit ratings transitions.
- We do know [Afonso, Gomes & Rothe (2007)] that credit ratings are related to
  - GDP per capita
  - real GDP growth
  - government debt
  - government effectiveness
  - external debt
  - external reserves,
- Check relationship between model implied credit ratings and above factors for each country

Suggestion 3

- Find out something about what drives the country-specific factor, $y_{k,t}$?
- Is it related to political risk, country-level volatility, fiscal policy?

Suggestion 4

- Perhaps setting bar too low.
- Low pricing errors are great, but how does it compare with Pan & Singleton, Ang & Longstaff, and Augustin.

Conclusions

- Ambitious empirical paper
- Price of risk needed to fit data seems too high