Modeling Banking, Soverign, and MacroRisk in a CCA Global VAR

Discussion by
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• **VARs**
  
  o Work-horse of economists

  o An issue: Nonlinear dependence among variables like level of national and corporate debt, bank capital, GDP, credit, etc., due to embedded option like features.

  o Solution, CCA VAR: Use transformed variables (expected loss on debt) to restore linearity

  - Use contingent claims valuation model and use information in financial statements to net out the effect of government guarantees that mask the information in the variables
CCA Global-VAR: An application

• CCA Global-VAR
  o Expected loss for banking sector, corporate sector, and sovereign debt using CCA
  o Real economy: GDP and Credit
  o Joint dynamics

• Scenario Analysis
  o Effect of shocks to banking sector / sovereigns in Italy and Spain
Framework

- Assumption:
  - Asset value evolves as a geometric Brownian motion with constant volatility (can be relaxed). Use Merton’s risky bond valuation model

- Inputs
  - Face value of debt and maturity date (observed)
  - Time series of market values of equity (observed)
  - Risk free rate (observed)
  - Volatility of assets (implied by the model)
  - Market value of assets (implied by the model)

- We can compute the expected loss (based on probability of default and expected loss given default)
The Merton Model helps link the credit spread, $s$, and the expected loss, $EL$.

1. $1 - \exp(-sT) = EL$
2. The CDS spreads, $s$, is the Moody’s CreditEdge Fair Value CDS for each bank – with a horizon of 5 years (not affected by government guarantees etc!).
• Framework
  o Compute the expected loss for each firm (bank)
  o Aggregate across all banks – gives expected banking sector loss
  o Do the same at corporate firms and aggregate to get expected loss from the corporate sector
  o Do the same for Sovereign debt of a country using CDS on Sovereign debt
  o This gives a monthly time series of observations on the three expected losses – banking sector, corporate sector and the country sovereign debt from the market
CCA Global-VAR: An application ...

• Framework
  o Take observations on macro variables
    ▪ GDP, country level Credit
  o There are 16 countries, 5 variables for each country
  o For each country take 5 variables from the country (y)
  o And 5 variables (y*) obtained by taking a weighted sum of the y’s for the other 15 countries.
  o Weights are computed by solving the Global VAR

\[ y_{it} = a_{i0} + a_{i1}t + \sum_{p=1}^{P} \Phi_{ip}y_{i,t-p} + \sum_{q=0}^{Q} \Lambda_{iq}y_{i,t-q}^* + \Psi d_t + \varepsilon_{it} \]
CCA Global-VAR: An application ....

- **Framework**
  - Use the estimated GVAR to examine what will be the response to say a shock to the banking sector or the sovereign sector in Italy and Spain.
Choosing the shocks

- Take the residuals from the GVAR
- Consider the empirical distribution of the two variables
- Pick the months with the two Adverse and Positive residuals at 5% level (for each, marginal) – i.e., 4 months
  - Spanish (ES) and Italian (IT) Sovereign
  - Spanish (ES) and Italian (IT) Banking Systems
- Take the vector of $5 \times 16 = 80$ shocks
- Use these shocks to do impulse response and see the effect over 2 years – pick the max/min cumulative deviations
- Reference point is set to Dec 2012
Shock Scenario Analysis.

- Equation for scenario analysis

\[
y_{it} = a_{i0} + a_{i1}t + \sum_{p=1}^{P} \Phi_{ip}y_{i,t-p} + \sum_{q=0}^{Q} \Lambda_{iq}y_{i,t-q} + \Psi d_t + \varepsilon_{it}
\]

Table 1. Shock Scenarios

<table>
<thead>
<tr>
<th>Scenario / Shock origins</th>
<th>Marginal shock probabilities</th>
<th>Joint shock probability</th>
<th>Implied shock sizes at T=1 (EL relative)</th>
<th>Implied shock sizes at T=1 (EL absolute in basis points)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adverse shock to Spanish (ES) and Italian (IT) sovereigns</td>
<td>5%</td>
<td>0.7%</td>
<td>18.4%</td>
<td>19.6%</td>
</tr>
<tr>
<td>Adverse shock to Spanish (ES) and Italian (IT) banking systems</td>
<td>5%</td>
<td>0.8%</td>
<td>15.0%</td>
<td>24.3%</td>
</tr>
<tr>
<td>Positive shock to Spanish (ES) and Italian (IT) sovereigns</td>
<td>5%</td>
<td>1.6%</td>
<td>-23.7%</td>
<td>-21.8%</td>
</tr>
<tr>
<td>Positive shock to Spanish (ES) and Italian (IT) banking systems</td>
<td>5%</td>
<td>0.8%</td>
<td>-31.5%</td>
<td>-64.9%</td>
</tr>
</tbody>
</table>
Shock Scenario Analysis

- Fig 5, Effect of Adverse Shock to Sovereign

Source: Author estimates.
Fig 5, Effect of Adverse Shock to IT & ES Sovereign
Shock Scenario Analysis …

• Fig 6, Effect of Adverse Shock to Banks
Shock Scenario Analysis

Fig 6, Effect of Adverse Shock to Banks of IT & ES
Shock Scenario Analysis

- Fig 7, Effect of Positive Shock to Sovereign
Shock Scenario Analysis .......

• Fig 8, Effect of Positive Shock to Banks

Source: Author estimates.
Comments

- Vast amount of data
- GVAR provides a way of identifying a few key variables that policy makers and analysts should watch.
- Interesting “Leading” information in “expected losses” to
  - Corporate and banking sector debts, sovereign debts
  - Not just own country but other countries as well
- Novel use information in “expected cash flow” on financial instruments for Macro Policy
  - Similar to the analysts watching “corporate cash flows”
  - Litton Industries
    - Started in 1953, became a large conglomerate by 1965 producing over 5000 different items (pre communication revolution era)
    - Roy Ash: Co-founder: Controlled such a large corporation with many divisions by watching changes in corporate “cash position” – mid 60’s HBS case.
• Shocks to expected losses on corporate debt, bank debt etc., are leading indicators of impending adverse economic conditions

• How should this observation be used by policy makers?
  o Ignore Lucas Critique

• Suppose there is a large shock to IT and ES Sovereign.
  o The model says GR and IE were affected with a lag, looking back in the historical data

• What should GR and IE do?
  o Assume they can!

• What causes the GVAR relation in the data?
  o Absent a satisfactory answer, unlikely to affect policy
• One driver of linkages the authors mention
  o Budget constraints of households and governments
### Table 2. Risk Mitigation Policies

<table>
<thead>
<tr>
<th>On-Balance Sheet Adjustment Policies to Mitigate Risk to:</th>
<th>Risk Transfer-Type Instruments and Policies to Mitigate Risk to:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Banks</strong></td>
<td><strong>Sovereign</strong></td>
</tr>
<tr>
<td>Increase market capital</td>
<td>Increase regulatory capital; Increase solvency ratio</td>
</tr>
<tr>
<td>Increase assets, change asset composition and lower asset volatility</td>
<td>Pillar 2 measures Macro-prudential policies, including ones that affect credit growth</td>
</tr>
<tr>
<td>Debt equity conversion/Bail-in</td>
<td>Extending debt maturity or restructuring</td>
</tr>
</tbody>
</table>
An astonishing record – of complete failure

By Tim Harford

‘In 2008, the consensus from forecasters was that not a single economy would fall into recession in 2009’

Predictions from multinational organisations such as the IMF and the Organisation for Economic Co-operation and Development have remained very similar to the private sector consensus – similarly bad, that is.