Sovereign Credit Risk, Macroeconomic Dynamics in Japan, and Contagion from Global Financial Markets

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Overview

1. **Introduction**
2. **Data**
   - Japan’s sovereign CDS spread
   - Covariates
   - Time series property of the CDS data
3. **Single regime analysis**
4. **Regime switching model analysis**
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   - Endogeneity tests
   - Estimation results
5. **Drivers of the regime switching**
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   - News events as drivers
   - European debt crisis as a driver?
6. **Conclusion**
Motivation

- Japan has the highest gross government debt-to-GDP ratio, 237.9%, over the World in 2012.

- The title of a major German newspaper (Spiegel) in January 2013:
  “The Greece of Asia: Japan’s Growing Sovereign Debt Time Bomb”

- According to the 2013 spillover report of the IMF, Japan’s sovereign risk can cause a serious global economic disaster.
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- According to the 2013 spillover report of the IMF, Japan’s sovereign risk can cause a serious global economic disaster.
A chart from IMF(2013)

Impact of sovereign debt stress in Japan

Notes: Based on simulations with the G35-S model. Key assumptions include: an increase in the fiscal balance by 1 percent of GDP; a rise in the short-term bond yield by 100 basis points and in the long-term bond yield by 200 basis points; and a drop in equity prices by 10 percent.
Studies on Japan’s debt sustainability

- Japan’s sovereign debt is unsustainable (Mendoza and Ostry, 2008; Ghosh et al., 2013; Sakuragawa and Hosono, 2011).
- Fincke and Greiner (2011): Japan’s sovereign debt is sustainable if you make the calculating with net government debt.

Limitations
The sustainability condition is a solvency condition, but countries default well before becoming insolvent! (Panizza et al., 2009; Reinhart and Rogoff, 2009)!
The calculation uses low frequency historical data, and therefore, does not provide information for current policy making.
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What we do?

Study how indicators of macroeconomic fundamentals affect Japan’s sovereign CDS spread.

A sovereign CDS spread

- is a market-based indicator of sovereign risk. Its data is available at daily frequency.
- contains information beyond the solvency risk.

The results help reveal what factors are important for the cost-benefit analysis for a government when making decisions regarding repayment.
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Longstaff et al. (2011), Dieckmann and Plank (2011), and Fontana and Scheicher (2010) find international spillover effects are important for a large panel of countries but not Japan.

They share two assumptions
- Effects of all determinants are constant over time.
- All determinants are exogenous.

These assumptions are not innocuous.
- The first one excludes contagion (Forbes and Rigobon, 2002; Dungey et al., 2005).
- The second one excludes the possible feedbacks from Japan’s sovereign risk to macroeconomic variables in and outside Japan.
Previous studies on sovereign CDS determination

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Possibility of contagion and endogeneity

Possible triggers of financial contagion
- The sub-prime crisis in the U.S.
- The European debt crisis

Possible sources of endogeneity
- Japan’s sovereign CDS spread changes cause concerns in global markets
- The output costs of sovereign default (Sandleris, 2008; Bruti, 2011; Mendoza and Yue, 2012)

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Overview of results

- Contagion exists from the U.S. stock market to Japan.
- No *systematic direct* impact of the European debt crisis on Japan’s sovereign CDS market but *temporary indirect* impact does exist.
- No feedback effects from Japan’s sovereign CDS market to global markets, but significant feedback effects on domestic variables.
- The 3.11 earthquake in 2011 had significant impact on the CDS spread.
- Japan’s sovereign credit rating were cut by three rating agencies several times in 2011 and 2012. But only Fitch’s rating cuts in May, 2012 significantly affect Japan’s sovereign CDS spread.
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Structure

- Data
- Single regime analysis
- Regime switching model analysis
- Drivers of regime switching
- Conclusions
Japan’s sovereign CDS spread

A brief introduction to sovereign CDS spread

- A CDS contract can be taken as an insurance contract against the credit event specified in the contract.
- Its spread, expressed in basis points, is the insurance premium that protection buyers have to pay.
- Credit events
  - Obligation acceleration
  - Repudiation
  - Restructuring
  - Failure to pay
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Credit events
- Obligation acceleration
- Repudiation
- Restructuring
- Failure to pay
A brief introduction to sovereign CDS spread

The CDS protection buyer pays the spread in exchange for a compensation from the protection seller when a credit event happens.

- Physical settlement: swap the face value of the bond for the defaulted bond.
- Cash settlement: face value—recovery value.
Japan’s sovereign CDS spread

**Japan’s CDS spread that we use**

- 5-year.
- Against the credit event complete restructuring.
- Denominated in USD.
- Source: Datastream.
### Table: Variable definitions

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>forex</td>
<td>Nominal Yen to US Dollar exchange rate</td>
</tr>
<tr>
<td>sdri</td>
<td>DJTM Japan stock market return</td>
</tr>
<tr>
<td>svol</td>
<td>GARCH(1,1) Japan stock market volatility</td>
</tr>
<tr>
<td>gstock</td>
<td>MSCI US stock market total return</td>
</tr>
<tr>
<td>gbond</td>
<td>5-year constant maturity US treasury rate</td>
</tr>
<tr>
<td>ivbond</td>
<td>Investment grade corporate bond spread</td>
</tr>
<tr>
<td>hybond</td>
<td>High yield corporate bond spread</td>
</tr>
<tr>
<td>pe</td>
<td>S&amp;P 100 price-earning ratio</td>
</tr>
<tr>
<td>vp</td>
<td>VIX minus Garman-Class volatility</td>
</tr>
<tr>
<td>tp</td>
<td>Excess return on five-year treasury bond</td>
</tr>
</tbody>
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**Notes:**  
Raw data are from Datastream.
Time series property of the CDS data
Time series property of the CDS data

**Unit root tests**

Table: Unit root tests of Japan’s sovereign CDS spread

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<th>ERS</th>
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<td>Test statistics</td>
<td>-2.879</td>
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<td>1% critical value</td>
<td>-3.967</td>
<td>-3.967</td>
<td>-3.480</td>
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<tr>
<td>5% critical value</td>
<td>-3.414</td>
<td>-3.414</td>
<td>-2.890</td>
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<td>10% critical value</td>
<td>-3.239</td>
<td>-3.129</td>
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<td><strong>First-differenced series</strong></td>
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<tr>
<td>Test statistics</td>
<td>-20.906</td>
<td>-32.734</td>
<td>-20.906</td>
</tr>
<tr>
<td>1% critical value</td>
<td>-3.436</td>
<td>-3.436</td>
<td>-2.567</td>
</tr>
<tr>
<td>5% critical value</td>
<td>-2.864</td>
<td>-2.864</td>
<td>-1.941</td>
</tr>
<tr>
<td>10% critical value</td>
<td>-2.568</td>
<td>-2.568</td>
<td>-1.616</td>
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### Table: Single regime model results

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<td>(CDS_L1)</td>
<td>0.064***</td>
<td>0.061*</td>
<td>0.163***</td>
<td>0.153***</td>
<td>0.146***</td>
<td>0.141***</td>
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<td>(0.032)</td>
<td>(0.038)</td>
<td>(0.038)</td>
<td>(0.041)</td>
<td>(0.041)</td>
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<td>(forex)</td>
<td>-0.423***</td>
<td>-0.374**</td>
<td>-0.020</td>
<td>-0.001</td>
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<td></td>
<td>(0.171)</td>
<td>(0.054)</td>
<td>(0.115)</td>
<td>(0.116)</td>
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<td>(0.118)</td>
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<td>(sdri)</td>
<td>-0.275***</td>
<td>-0.249***</td>
<td>-0.273***</td>
<td>-0.244***</td>
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<td>-0.195***</td>
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<td></td>
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<td>(0.041)</td>
<td>(0.043)</td>
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<td>(svol)</td>
<td>0.300***</td>
<td>0.278***</td>
<td>0.417***</td>
<td>0.310***</td>
<td>0.445***</td>
<td>0.340***</td>
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<td></td>
<td>(0.102)</td>
<td>(0.100)</td>
<td>(0.102)</td>
<td>(0.122)</td>
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<tr>
<td>(gstock)</td>
<td>-0.070</td>
<td>-0.077</td>
<td>-0.027</td>
<td>-0.045</td>
<td>0.036</td>
<td>0.016</td>
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<tr>
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<td>(0.071)</td>
<td>(0.070)</td>
<td>(0.059)</td>
<td>(0.059)</td>
<td>(0.062)</td>
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<td>(gbond)</td>
<td>-3.850**</td>
<td>-3.057*</td>
<td>-2.467*</td>
<td>-1.766*</td>
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<td>(1.580)</td>
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<td>(ivbond)</td>
<td>0.424</td>
<td>0.458</td>
<td>0.834**</td>
<td>0.879**</td>
<td>0.778**</td>
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<td>(0.641)</td>
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<td>(pe)</td>
<td>-0.275</td>
<td>-0.265</td>
<td>-0.111</td>
<td>-0.107</td>
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<td>(0.170)</td>
<td>(0.169)</td>
<td>(0.176)</td>
<td>(0.172)</td>
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<td>(tp)</td>
<td>-0.824</td>
<td>-0.869</td>
<td>-0.719**</td>
<td>-0.683**</td>
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<tr>
<td></td>
<td>(0.549)</td>
<td>(0.548)</td>
<td>(0.346)</td>
<td>(0.335)</td>
<td>(0.338)</td>
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<td>(vp)</td>
<td>0.000</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
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<td></td>
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<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.001)</td>
</tr>
<tr>
<td>(vix)</td>
<td>0.116**</td>
<td>0.116***</td>
<td>0.105***</td>
<td>0.105***</td>
<td>0.105***</td>
<td>0.105***</td>
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<tr>
<td></td>
<td>(0.049)</td>
<td>(0.029)</td>
<td>(0.030)</td>
<td>(0.030)</td>
<td>(0.030)</td>
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Standard errors in parentheses. ***, **, * denotes significance at one, five, and ten percent level, respectively.
Methodology Kim(2009)

- We use a regime switching (RS) model to capture contagion effect.

- RS model v.s. sample division
  - no pretesting problems (Danilov and Magnus, 2004)

- We instrument potential endogenous variables by lags.

- The model is estimated in two steps.
  - In the first step, endogenous variables are regressed on their lags, like a RS-VAR. RS is allowed for the first step model for the sake of the Lucas (1976) critique.
  - In the second step, the first step residuals are used as control variables to eliminate the endogeneity bias.
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Tests for endogeneity

- Test for endogeneity is equivalent to a test whether the first-step residuals are significant in the second step.
- The usual t test is valid in a given regime.
- The test for joint significance of all residuals across all regimes is a Wald test. The test statistic follows a $\chi^2$ distribution.
- Endogeneity of domestic variables? The Wald test for endogeneity gives $W = 123.9$ with $p$-value 0.000
- Endogeneity of global variables? If we instrument both domestic variables and the global stock market return, the $p$-value of $W$ statistic is 0.084.
  t-tests also suggests that the global stock market return is exogenous in both regimes.
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<thead>
<tr>
<th></th>
<th>Turbulent</th>
<th>Tranquil</th>
</tr>
</thead>
<tbody>
<tr>
<td>constant</td>
<td>−0.001</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
<td>(0.001)</td>
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<tr>
<td>$CDS_L1$</td>
<td>0.087***</td>
<td>0.055</td>
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<tr>
<td></td>
<td>(0.041)</td>
<td>(0.059)</td>
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<tr>
<td>$sdri$</td>
<td>−0.041</td>
<td>−0.432***</td>
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<td></td>
<td>(0.118)</td>
<td>(0.096)</td>
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<td>svol</td>
<td>0.010</td>
<td>4.110***</td>
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<tr>
<td></td>
<td>(0.159)</td>
<td>(0.347)</td>
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<td>gstock</td>
<td>−0.209**</td>
<td>0.007</td>
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<td></td>
<td>(0.101)</td>
<td>(0.081)</td>
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<td>ivbond</td>
<td>0.725</td>
<td>0.314</td>
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<td></td>
<td>(1.173)</td>
<td>(0.866)</td>
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<tr>
<td>vix</td>
<td>0.135*</td>
<td>0.101*</td>
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<td></td>
<td>(0.074)</td>
<td>(0.057)</td>
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<tr>
<td>$p_{ii}$</td>
<td>0.889</td>
<td>0.867</td>
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<tr>
<td>$\sigma_\omega$</td>
<td>0.039</td>
<td>0.009</td>
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Standard errors in parentheses. ***, **, * denotes significance at one, five, and ten percent level respectively.
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<table>
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<td>0.011***</td>
<td>0.013***</td>
<td>0.013***</td>
<td>0.007***</td>
</tr>
<tr>
<td></td>
<td>(0.004)</td>
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<td>0.094</td>
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<tr>
<td></td>
<td>(0.118)</td>
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<tr>
<td>$sdri$</td>
<td>$-0.073^*$</td>
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<tr>
<td></td>
<td>(0.039)</td>
<td>(0.033)</td>
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<td>$svol$</td>
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<td>$-0.767^{***}$</td>
<td>$-0.996^{***}$</td>
<td>$-1.074^{***}$</td>
<td>$-0.413^{***}$</td>
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<tr>
<td></td>
<td>(0.189)</td>
<td>(0.220)</td>
<td>(0.232)</td>
<td>(0.133)</td>
<td>(0.096)</td>
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<tr>
<td>$gstock$</td>
<td>$-0.102^*$</td>
<td>$-0.039$</td>
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<tr>
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<td>(0.054)</td>
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<tr>
<td>$gbond$</td>
<td>1.310</td>
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<tr>
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<td>(1.099)</td>
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<tr>
<td>$ivbond$</td>
<td>$-0.565^*$</td>
<td>$-0.754^{**}$</td>
<td>$-0.773^{**}$</td>
<td>$-0.793^{**}$</td>
<td>$-0.574^{**}$</td>
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<tr>
<td></td>
<td>(0.340)</td>
<td>(0.377)</td>
<td>(0.392)</td>
<td>(0.345)</td>
<td>(0.325)</td>
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<td>0.015*</td>
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<tr>
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<td>(0.007)</td>
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<tr>
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<td>(0.394)</td>
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<tr>
<td>$JR$</td>
<td>$0.234^{***}$</td>
<td>$0.227^{***}$</td>
<td>$0.227^{***}$</td>
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<td>2.914***</td>
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<td>(0.486)</td>
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Heteroscedasticity-Autoregression Consistent Standard errors in parentheses. ***, **, * denote significance at one, five, and ten percent level, respectively.
News events as drivers

**Event drivers**

- Sept. 19th, 2008: Right after Lehman Bros. collapse
- Dec. 8th, 2009: Japanese government announced a 7.2 trillion Yen stimulus package
- Mar. 11th, 2011: Earthquake
- May. 10th, 2010: 1 trillion Euro area rescue package
- May. 22nd, 2012: Fitch's rating cut
European debt crisis as a driver?

- From the last figure, we see that the news about the Euro rescue package had a short impact.
- To check whether there is a systematic impact, we do two things
  - Control iTraxx SovX WE index (Euro zone, Denmark, Norway, Sweden, UK) in the RS model, but find no significance.
  - Regress the filtered probability of being in the turbulent regime on iTraxx SovX WE, but find no significance.
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- The 3.11 earthquake in 2011 had significant impact on the CDS spread.
- Rating agencies’ sovereign ratings do not always add new information to the market, but they are also not always useless.
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