What is the risk of sovereign debt default?

Fiscal space, CDS, and market pricing of risk

J. Aizenman, M. Hutchison, Y. Jinjarak

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In a nutshell

We offer empirical linkages:

- Crisis episode of 2008-present
- Investor confidence

[Sovereign R I S K]

- Regional uniqueness
- Space in fiscal dimension

Latest Stats: Reuters
News Events: New York Times
Greece in 2011

- 0.347 €Trillions = sovereign bond outstanding
- 0.055 €Trillions = sovereign CDS outstanding, gross
- 0.004 €Trillions = sovereign CDS outstanding, net

Credit Default Swap (CDS) is an insurance policy.
(a fee/spread for default protection; naked trading is possible)

Outstanding CDS globally is currently around 20 trillion USD.
(negligible in the early 2000; peaked in 2007 at 60 trillion USD)
2008 Crisis, Fiscal Insolvency, and More

- subprime fallout and global recession
- financial sector bailouts
- prospective fiscal expenditures up, revenues down
- harder it in Euro area
- Greece, Ireland, Italy, Portugal, Spain (SWEAP)
- heterogeneity in market responses to fiscal fragility
- uncertainty on rescue packages

- gross asset holdings with the US
- capital flow with emerging markets
- world trade financed by European banks
Questions

- Is market pricing of sovereign default risk systematically linked to fiscal solvency?

- Is Eurozone being treated tougher? ESP, GRC, IRL, ITA, PRT?
Credit Default Swap

A good proxy for market assessment of default risk

- CDS price
  \[ \equiv \quad \text{quarterly payment for a contingent claim in credit event} \]

- 1 basis point = $1000 to insure against $10 million debt
- Credit events: default, restructuring, haircut
- Commercial banks are the main users (CVA desks)
- Mainly OTC derivative markets
- 5-year tenor is the most liquid

more on CDS markets
Sovereign CDS Spreads (basis point)
Related Studies

- Acharya et al. (NBER, 2011)
  Bank bailouts and sovereign credit risk in CDS

- Palladini and Portes (NBER, 2011)
  Sovereign CDS and Bond Pricing Dynamics in the Euro-area

- Pan and Singleton (JF, 2008; AEJ-Macro, 2011)
  How sovereign is sovereign credit risk in CDS
In 1991

[on derivatives and CDS] ‘‘Off-balance sheet activities have a role, but they must be managed and controlled carefully, and they must be understood by top management, as well as by traders and rocket scientists. I hope this sounds like a warning because it is!’’

E.G. Corrigan, Federal Reserve NY President (85-93)
Methodology

Can the sovereign spread be pinned down by some dynamics, cyclical, amenable to macroeconomic and market fluctuation ...

Or is there a far-reaching structural implication due to expected fundamental and investor sentiment ...

- Market assessment of fiscal solvency ⇒ default risk in CDS
- Macro model of sovereign CDS pricing
- Out of sample prediction error (market mispricing)
- Descriptive comparison between countries
Data

- 50 countries, 2005-10, balanced panels
- CDS prices from CMA Datavision
- Macro controls for local and global factors
- Fiscal Space
Fiscal Space

- Fiscal capacity ($\frac{1}{\cdot} = \text{Fiscal burden}$)

- Stock measure: $\text{PublicDebt} \div \text{TaxBase} \Rightarrow [-]

- Flow measure: $\text{FiscalBal} \div \text{TaxBase} \Rightarrow [+]

- $\text{TaxBase} \equiv \text{avg5yr.}(\text{Tax}) \div (\text{GDP})$
Tax Base and Income Inequality in 50 Countries

Figure: correlation = -0.6265
In 1782

“‘We [the American colonists fighting in the War of Independence] have shed our blood in the glorious cause in which we are engaged; we are ready to shed the last drop in its defense. Nothing is above our courage, except only (with shame I speak it) the courage to TAX ourselves.’”

James Madison, US President (1809-17)
BEI DER 1. KLASSE DABEI?
## Debt, Deficit, Tax Base

### Panel A

<table>
<thead>
<tr>
<th>Year</th>
<th>PublicDebt GDP</th>
<th>Tax GDP</th>
<th>PublicDebt Tax</th>
<th>FiscalBal GDP</th>
<th>FiscalBal Tax</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>.63</td>
<td>.10</td>
<td>6.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Panama</td>
<td>.63</td>
<td>.10</td>
<td>6.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Austria</td>
<td>.64</td>
<td>.44</td>
<td>1.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Panel B

<table>
<thead>
<tr>
<th>Year</th>
<th>PublicDebt GDP</th>
<th>Tax GDP</th>
<th>PublicDebt Tax</th>
<th>FiscalBal GDP</th>
<th>FiscalBal Tax</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>.33</td>
<td>-2.9</td>
<td>-.09</td>
<td>-.09</td>
<td>-.21</td>
</tr>
<tr>
<td>Poland</td>
<td>.33</td>
<td>-2.9</td>
<td>-.09</td>
<td>-.09</td>
<td>-.21</td>
</tr>
<tr>
<td>Philippines</td>
<td>.13</td>
<td>-2.7</td>
<td>-.21</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
In 2012

‘‘I am concerned about fiscal stability in future because our fiscal deficit has worsened in the past three years.’’

‘‘We have run out of fiscal space and must once again begin the process of fiscal consolidation.’’

In his New Year address, Prime Minister Manmohan Singh told the nation it could not take India’s high economic growth rate for granted and warned of the need to pare back subsidies and implement tax reform. (FT, Jan.02)
FiscalSpace as Measured by \[\frac{\text{Public Debt}}{\text{Tax Base}}\]

Figure: 1/Emerging...... 2/High-Inc........... 3/SWEAP........... 4/OECD........ 5/Euro.........................
### Sovereign CDS Price in a Macro Fundamental Model

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CDS spread</td>
<td>coefficient</td>
<td>(s.e.)</td>
<td>coefficient</td>
</tr>
<tr>
<td>TEDSpread</td>
<td>3.2 (27.3)</td>
<td>7.3 (27.8)</td>
<td></td>
</tr>
<tr>
<td>$CDS_{t-1}$</td>
<td>.1 (00.1)***</td>
<td>.3 (00.1)***</td>
<td></td>
</tr>
<tr>
<td>Trade/GDP</td>
<td>-86.1 (151)</td>
<td>-118.0 (129)</td>
<td></td>
</tr>
<tr>
<td>Inflation</td>
<td>24.5 (11.9)**</td>
<td>19.8 (10.3)*</td>
<td></td>
</tr>
<tr>
<td>ExternalDebt/GDP</td>
<td>-36.6 (30.1)</td>
<td>-1.9 (17.9)</td>
<td></td>
</tr>
<tr>
<td>FiscalBal/TaxBase</td>
<td>-829.4 (302)***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PublicDebt/TaxBase</td>
<td></td>
<td>81.0 (29.9)***</td>
<td></td>
</tr>
</tbody>
</table>

| $R^2$            | .52             | .46             |       |
| Observations     | 300 , balanced  | 300 , balanced  |       |
| Countries        | 50 w/ f.e.      | 50 w/ f.e.      |       |
Macro-Fundamental Error: \( \frac{Actual\ CDS}{Forecasted\ CDS} \): Market Misprice

<table>
<thead>
<tr>
<th>Country</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greece</td>
<td>2.7</td>
<td>2.2</td>
<td>3.3</td>
</tr>
<tr>
<td>Portugal</td>
<td>2.8</td>
<td>2.9</td>
<td>6.9</td>
</tr>
<tr>
<td>Emerging Markets</td>
<td>3.9</td>
<td>1.0</td>
<td>1.8</td>
</tr>
<tr>
<td>EURO excl. SWEAP</td>
<td>5.0</td>
<td>5.8</td>
<td>13.7</td>
</tr>
</tbody>
</table>
Matching Countries in Fiscal Space

- Match SWEAP with similar emerging markets in terms of fiscal space to study their sovereign CDS price.

- See if the pricing of risk in SWEAP was different from corresponding matches.

- ESP — GRC — IRL — ITA — PRT .......SWEAP

- ZAF — PAN — MYS — MEX — COL ...Emerging Markets

- EM have the option to inflate/devalue away the imbalance.
FiscalSpace and Market Mispricing of Sovereign CDS Price

correlation = −.6217
Taking Stock

- A large component of market risk assessment in CDS cannot be accounted for by fundamentals ($R^2 = .5$)

- Market valuing CDS spread in Eurozone and SWEAP more than twice of what fundamentals have forecasted

- Pre-crisis excessive optimism?
  ...fundamental under-forecasting

- Crisis excessive pessimism?
  ...market over-pricing
What Have We Learned

- Fiscal space \(\left(\frac{debt}{tax}; \frac{deficit}{tax}\right)\) \(\rightsquigarrow\) a potent predictor of fiscal solvency reflected in CDS spreads

- Systematically large market over-pricing on sovereign CDS especially in and after crisis

- Euro area being priced much higher given its fundamentals locally and globally
In 2010/11

‘‘Credit default swaps are traded without any transparency and are threatening to bring down entire countries and entire societies ... They are betting on our bankruptcy and the breakup of the Euro. But their effort is in vain.’’

George Papandreou, Greece Prime Minister (2009 - 11)

‘‘The markets don’t believe that Italy is capable or has the intention of approving these reforms,’’ ... ‘‘Things like who leads or who doesn’t lead the government are less important than doing what is best for the country.’’

Silvio Berlusconi, Italy Prime Minister (1994-96; 2001-06; 2008-11)
Interesting Patterns, Many Interpretations

- **Eurozone uniqueness**
  which currency to issue debt? to devalue? €

- **Panic premium**
  (un)warranted pessimism to future deterioration

- **Multiple equilibria**
  high debt, a high required rate of return, low prospective tax

- **Potential contagion**
  haircuts; bank recapitalization; no €; how bad are twins?

- **Fiscal consolidation?**
  disciplinary? debt, tax, spending, growth? [+ golden rule, automatic sanction, bailout facility, financial regulation]

- **Public finance in the presence of financial innovation?**
  CDS? Euro bond? [sharing tax resource (i.e. VAT); but relative power of member governments to the center?]
The Functioning of CDS Markets

- Risk pooling, asynchronicities, counter-party risk
- Decentralised trading, multilateral netting
- Naked trading of CDS: not owning the underlying bond
- No credit event: worth buying sovereign CDS? i.e. a rollover of Greek debt
- 10 commercial banks and 5 investment funds = ISDA committee deciding on credit event
### Market Overpricing and Outstanding CDS Positions

<table>
<thead>
<tr>
<th>CDS Positions</th>
<th>Gross b(s.e.)</th>
<th>Gross b(s.e.)</th>
<th>Turnover b(s.e.)</th>
<th>Net b(s.e.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Debt</td>
<td>.51(.08)***</td>
<td>.55(.07)***</td>
<td>.75(.09)***</td>
<td>.57(.06)***</td>
</tr>
<tr>
<td>CDSprice</td>
<td></td>
<td>.32(.15)**</td>
<td>.38(.18)**</td>
<td>.06(.11)</td>
</tr>
<tr>
<td>Market &gt; [*]</td>
<td>.20(.07)***</td>
<td>.21(.09)**</td>
<td>.12(.06)**</td>
<td></td>
</tr>
<tr>
<td>Market &lt; [*]</td>
<td>.13(.09)</td>
<td>.09(.11)</td>
<td>.08(.07)</td>
<td></td>
</tr>
<tr>
<td>$R^2$</td>
<td>.48</td>
<td>.63</td>
<td>.67</td>
<td>.76</td>
</tr>
</tbody>
</table>
CDS, FiscalSpace and Default Risk in Multiple Equilibria

After all, probabilities have to add up to 1.0
Ang and Longstaff (NBER, 2011)

- Euro countries and US states
- weekly data: May 08 - Jan 11
- multi-factor affine framework
- systemic risk vs sovereign-specific shock
- systemic risk represents a smaller fraction of total risk among the U.S. states than among the Euro countries

∽ systemic risk has roots in global financial markets, not sovereign-specific macro fundamentals?
Using Fiscal Space to Summarize Fiscal Capacity?

- This time is different
  (Reinhart and Rogoff, Princeton Press, 2010)
  Public debt/GDP > .9, then median GDP growth falls by 1pct

- Fiscal fatigue and debt sustainability
  (Ghosh, Kim, Mendoza, Ostry, Qureshi, NBER WP, 2011)
  Debt limit: primary balances to keep pace with rising debt

- Debt and the effects of fiscal policy
  (Favero, Giavazzi, Perego, IMF, 2011)
  \[ PublicDebt_t = \text{Sum}_{t \to T} \left( \frac{1 + r}{1 + g} \right) [\text{Tax} - \text{Spending}] \]
  Debt feedback can affect the dynamic effects of fiscal shocks

- Fiscal stimulus of 2009-10
  (Aizenman and Jinjarak, NBER ISoM, 2011)
  Greater Tax/Debt, lower trade openness \(\leadsto\) higher stimulus
## Income Inequality and Tax Base in 2005

<table>
<thead>
<tr>
<th>variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\text{tax~GDP}) (t=5yr)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>(\text{laggedGini})</td>
</tr>
<tr>
<td>(\text{laggedGini}^2)</td>
</tr>
<tr>
<td>(R^2)</td>
</tr>
</tbody>
</table>

| \(\text{public~debt~GDP}\) | 2005 | 2010 |
|--------------------------|
| Countries | 50 | 50 |

### Notes

- **\(*\)**: Significant at the 10% level.
- **\(***\)**: Significant at the 1% level.
<table>
<thead>
<tr>
<th>Y-variable</th>
<th>FiscalBal coefficient</th>
<th>PublicDebt coefficient</th>
<th>(s.e.)</th>
<th>(s.e.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDS spread</td>
<td></td>
<td></td>
<td>t = 2008</td>
<td>328.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>t = 2009</td>
<td>-36.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>t = 2010</td>
<td>2.5</td>
</tr>
<tr>
<td>t = 2008</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i_{Euro}</td>
<td>-225.3</td>
<td>-209.5</td>
<td>(82.3)***</td>
<td>(80.7)***</td>
</tr>
<tr>
<td>t = 2009</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i_{Euro}</td>
<td>14.6</td>
<td>-15.0</td>
<td>(30.1)</td>
<td>(30.8)</td>
</tr>
<tr>
<td>t = 2010</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i_{Euro}</td>
<td>5.2</td>
<td>-29.1</td>
<td>(26.6)</td>
<td>(28.0)</td>
</tr>
<tr>
<td>t = 2008</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i_{sweep}</td>
<td>-249.5</td>
<td>-159.3</td>
<td>(98.2)**</td>
<td>(82.7)*</td>
</tr>
<tr>
<td>t = 2009</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i_{sweep}</td>
<td>18.7</td>
<td>73.4</td>
<td>(58.6)</td>
<td>(36.1)**</td>
</tr>
<tr>
<td>t = 2010</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i_{sweep}</td>
<td>174.4</td>
<td>261.9</td>
<td>(108)</td>
<td>(63.7)***</td>
</tr>
</tbody>
</table>

(continuing next)
Robustness

- 3-year, 5-year, 10-year tenors
- Debt/Tax v. Debt/GDP horserace
- Arellano-Bond type estimation
- Structural change
### Selected Robustness Checks

*(w/ full set of fixed effects and macro controls)*

<table>
<thead>
<tr>
<th>Test</th>
<th>variable</th>
<th>coefficient</th>
<th>(s.d.)</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP?</td>
<td>$\frac{PublicDebt}{GDP}$</td>
<td>1.5</td>
<td>(0.4)***</td>
<td>.48</td>
</tr>
<tr>
<td>Arellano-Bond</td>
<td>$\frac{PublicDebt}{Tax}$</td>
<td>240.3</td>
<td>(14.8)***</td>
<td>.44</td>
</tr>
<tr>
<td>2005 – 07</td>
<td>$\frac{FiscalBal}{Tax}$</td>
<td>-291.7</td>
<td>(86.5)***</td>
<td>.89</td>
</tr>
<tr>
<td>2008 – 10</td>
<td>$\frac{FiscalBal}{Tax}$</td>
<td>-567.4</td>
<td>(606)</td>
<td>.61</td>
</tr>
</tbody>
</table>
Economic Significance of 1s.d. on CDS (basis points)

Real GDP Growth  TaxBase  Reserves/Ext. Debt  Trade Openness  Volatility of GDP  Lagged dependent  Public Debt  GDP/capita  Inflation

-90.9  -86.0  0.0  8.9  17.6  35.7  44.8  67.6

Real GDP Growth  TaxBase  Reserves/Ext. Debt  Trade Openness  Volatility of GDP  Lagged dependent  Public Debt  GDP/capita  Inflation

-90.9  -86.0  0.0  8.9  17.6  35.7  44.8  67.6

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FiscalSpace and Under-Forecasting

Estimated Prediction Error 2008−10

Euro / corr = −.7296

Non−Euro / corr = −.3897

Public Debt/Tax Base 2005−07

Non−Euro / corr = .5232

Fiscal Balance/Tax Base 2005−07

Euro / corr = .5893