Spillovers in the Credit Default Swap Market

Mauricio Calani

Central Bank of Chile
University of Pennsylvania

Prepared for the BIS CCA Research Conference - Santiago, Chile

April 25, 2013

Contents of this presentation

Motivation & Background

The CDS Contract

- The credit default swap spread is the cost per annum for a kind of protection to a "credit event", namely a loan default
- It is tempting to praise the following argument: If an investor buys an asset which bears extra risk and simultaneously buys CDS protection this should be equivalent to purchasing a risk-free asset, hence the name CDS **spread**.
- Arbitrage tested mostly for corporate sector: Blanco et. al. (2005), Hull et. al. (2004) and may not hold

The CDS Contract

Perfect arbitrage assumes

- Participants can *quickly* short bonds or are prepared to sell these bonds, buy riskless bonds, and sell default protection (or viceversa).
- Ignores the "cheapest-to-deliver bond" option in a credit default swap. Typically a protection seller can choose to deliver any of a number of different bonds in the event of a default to meet her obligation.
- There is counterparty risk.
- The argument assumes perfectly elastic supply of CDS contracts, whereas it is more likely that this is not the case.
- What happens in the absence of a less-risky bond alternative?

Stylized fact # 1: Increased synchronization of CDS spread across countries

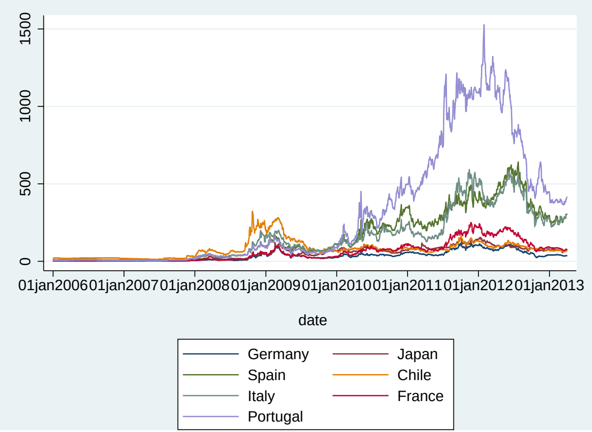


Figure : CDS by country (daily data)

Stylized fact # 2: Bond yields do not co-move accordingly

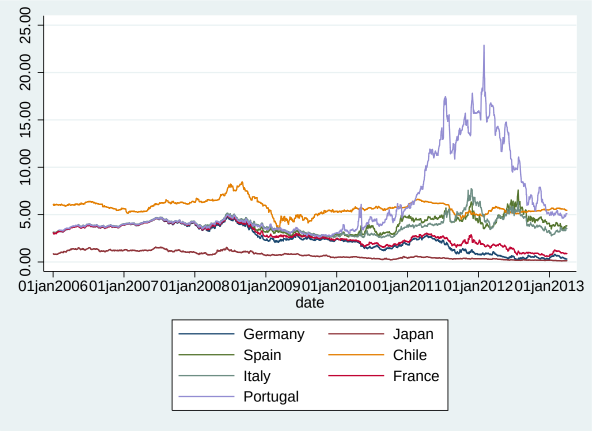


Figure : Government Bonds 5Y by country (daily data)

What this paper is about...

1. Should we worry about the apparent increased synchronization of CDS spreads across countries? Does CDS_i affect CDS_j? Can we talk about **contagion**?

2. If in fact we can make the case for **contagion** should we see credit spreads rising vis *à* vis CDS spreads?

Pass Through: CDS to Bond Markets

Literature Review

A Literature on Credit Risk

1. Structural models of valuation of risk: Merton (1974), Gapen et. al. (2008)
2. Timing of default as a hazard ratio: Lando (1997)

B Literature on no-arbitrage opportunities between CDS and bond yields

- Applications to corporate spreads: Blanco et.al. (2005), Norden and Weber (2009), Hull et.al. (2004). They all assume contemporaneous adjustment though
- I use a VAR approach to allow for non-instantaneous test of price convergence

Bond Risk Premia vs. CDS

Consider the following exercise,

- Stack Bond (in Euros) yields and CDS (in %) in a VAR(p) system and calculate the Impulse Response Functions (IRF) to assess (a) size (b) average life-time (c) statistical significance of the pass-through of a shock in CDS into bond yields.
- Consider 3 time windows (for robustness)

$$\begin{bmatrix} CDS_t \\ Y_t \\ x_t \end{bmatrix} = \Phi(L) \begin{bmatrix} CDS_t \\ Y_t \\ x_t \end{bmatrix} + \begin{bmatrix} \varepsilon_t^{CDS} \\ \varepsilon_t^{Y} \\ \varepsilon_t^{x} \end{bmatrix} \tag{1}$$

Bond Risk Premia vs. CDS: Germany

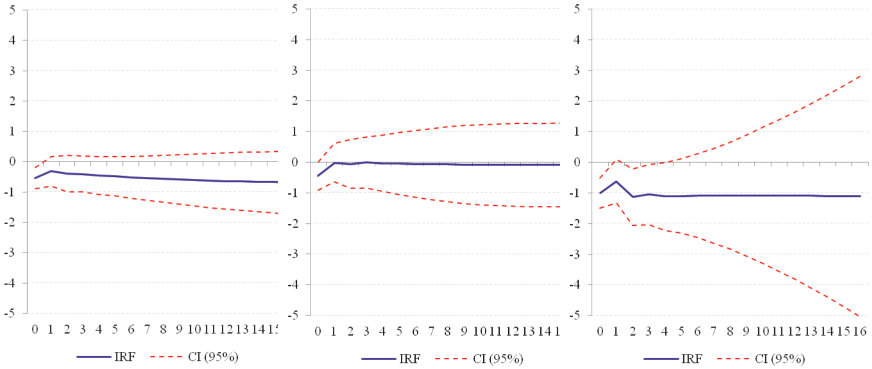
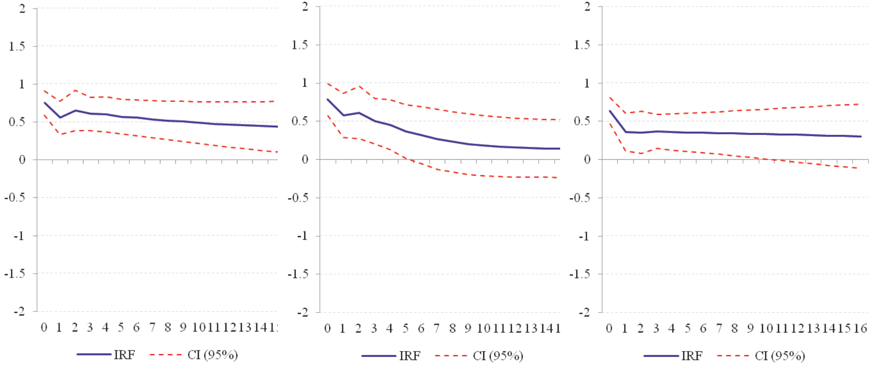


Figure : IRF function, response of bond yields to shock in CDS in Germany

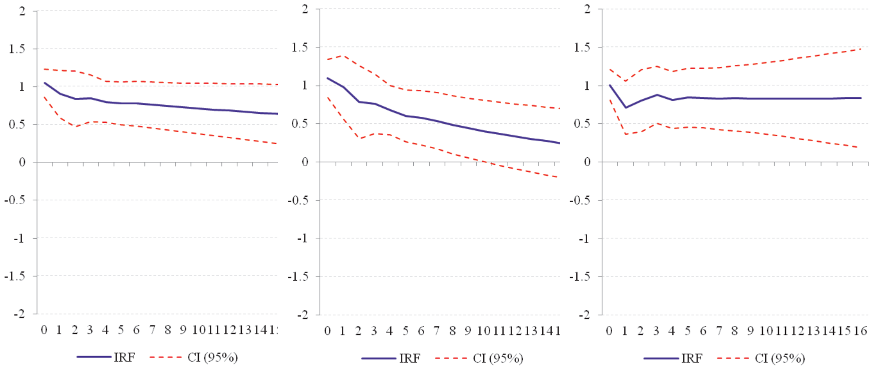
Bond Risk Premia vs. CDS: Spain

Figure : IRF function, response of bond yields to shock in CDS in Spain



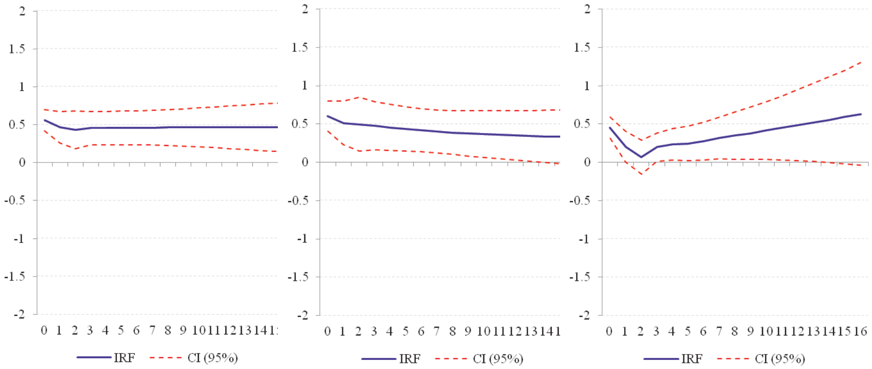
Bond Risk Premia vs. CDS: Portugal

Figure : IRF function, response of bond yields to shock in CDS in Portugal



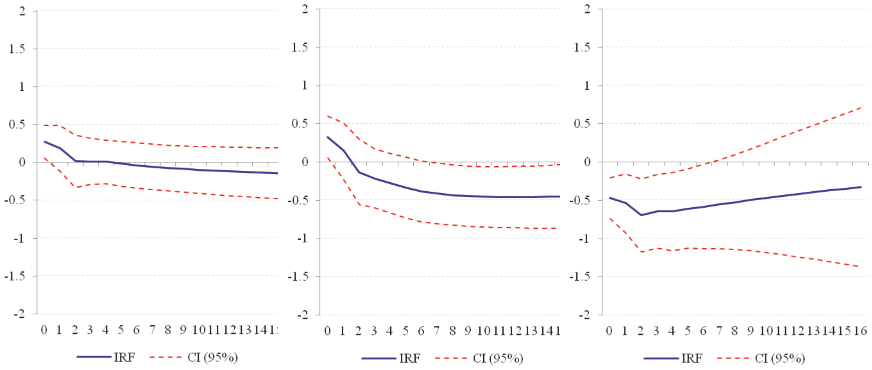
Bond Risk Premia vs. CDS: Italy

Figure : IRF function, response of bond yields to shock in CDS in Italy



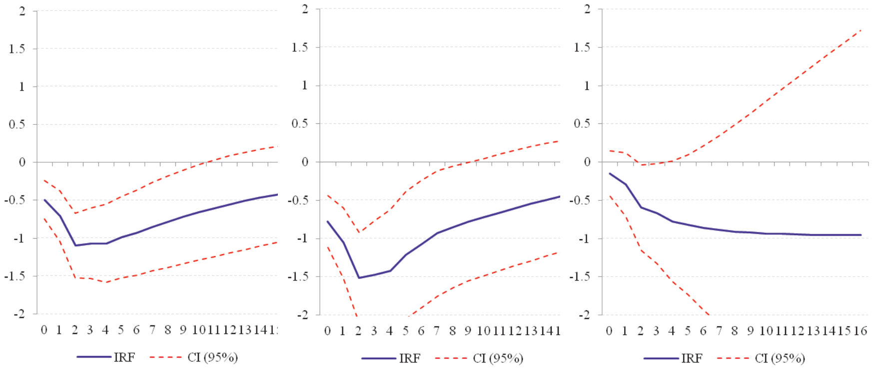
Bond Risk Premia vs. CDS: France

Figure : IRF function, response of bond yields to shock in CDS in France



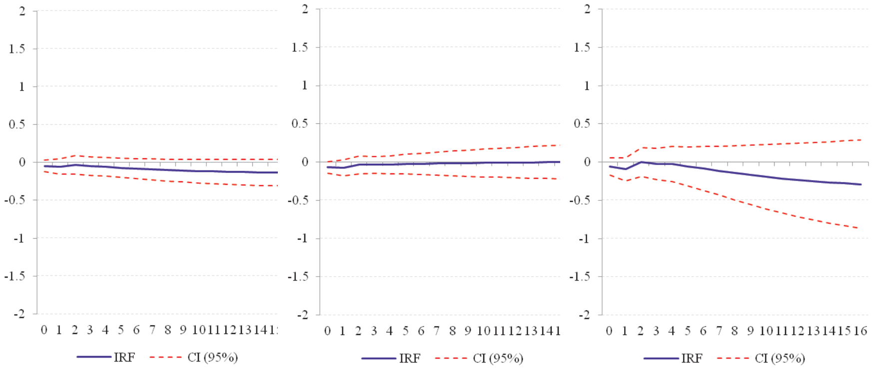
Bond Risk Premia vs. CDS: Chile

Figure : IRF function, response of bond yields to shock in CDS in Chile



Bond Risk Premia vs. CDS: Portugal

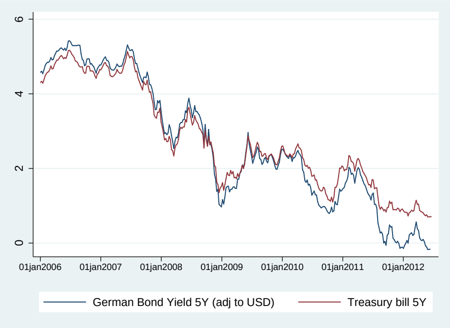
Figure : IRF function, response of bond yields to shock in CDS in Japan



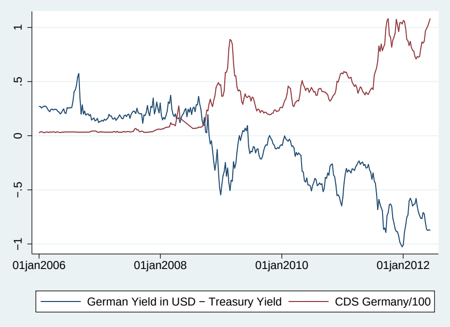
Interpretation: Risk Premia for Germany vs. CDS

The negative correlation of the German Bond yield & its associated CDS, together with assuming the supply for CDS contracts is sort of inelastic, *hints* to a demand-led escalation of CDS spreads together with rising demand for risk-free assets (flight to quality)

(a) Germany and USA yields (both in USD)



(b) Risk Premia for Germany vs. CDS



Contagion

Literature Review

C Literature on Contagion: Three main reasons

1. Correlated information or Price discovery channel: Dornbusch et. al (2002), Kiyotaki and Moore (2002), Longstaff (2010)
2. Liquidity channel: Cross regional deposits model of Allen and Gale (2000), Krodes and Pritsker (2002) and the funding-problem model of Brunnermeir and Pedersen (2009)
3. Risk aversion channel: Vayanos (2004) and Acharaya and Pedersen (2005)

Stylized fact # 1: Increased synchronization of CDS spread across countries

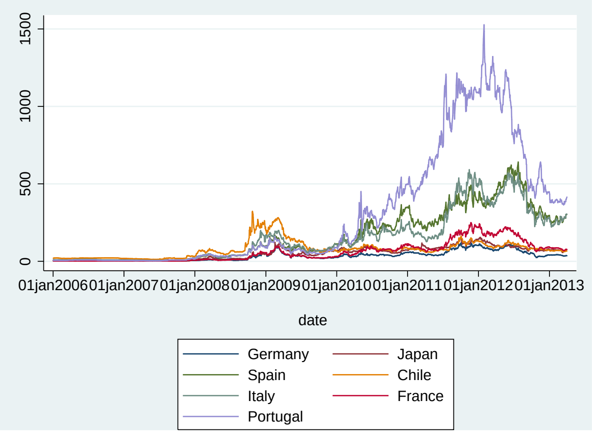


Figure : CDS by country (daily data)

Closer look at synchronization

Take cross correlations of Germany CDS spread and other countries

Table : Pairwise correlations for Germany's and other countries' CDS: Weekly data

	2006-2007	2008-2009	2010	2011	2012
Portugal	0.44	0.90	0.63	0.79	*-0.12*
Spain	0.52	0.89	0.72	0.90	*0.51*
France	0.38	0.98	0.76	0.98	0.83
Italy	0.35	0.91	0.70	0.96	0.90
Japan	0.36	0.81	*0.33*	0.90	*0.30*
Chile	0.43	0.82	0.48	0.96	0.89

Source: Author's calculations on Bloomberg data.
Note: All non-italic pair-wise correlations are significant to the 1% level, using the Bonferroni-adjusted significance level.

Mechanics of the Diebold-Yilmaz (2010) Index

- General idea: Stack CDS spreads for the seven economies (and other x_t) in a VAR(p), and rescue the fraction of **forecast error variance** that can be attributed to other countries. This is a standard measure of contagion once we have accounted for feedback in crossed dynamics
- Intuition: The larger the error in predicting variable x that can be accounted for by *other* errors, then the larger the contagion
- Consider this exercise also for volatility of the series

Contagion Index

Consider the simple first order two-variable VAR

$$\mathbf{x}_t = \Phi \mathbf{x}_{t-1} + \varepsilon_t \tag{2}$$

where $\mathbf{x}_t = (x_{1,t}, x_{2,t})$ and Φ is a 2×2 parameter matrix. Then covariance stationarity implies

$$\mathbf{x}_t = \Theta(L)\varepsilon_t$$

where $\Theta(L) = (I - \Phi L)^{-1}$. It can also be written as,

$$\mathbf{x}_t = A(L)\mathbf{u}_t \tag{3}$$

with $A(L) = \Theta(L)Q_t^{-1}, \mathbf{u}_t = Q_t\varepsilon_t, E(\mathbf{u}_t\mathbf{u}_t') = I$ and Q_t^{-1} is the unique lower triangular Cholesky factor of the covariance matrix of ϵ_t

Contagion Index

- Then the one-step ahead error is

$$\mathbf{e}_{t+1,t} = \mathbf{x}_{t+1} - E(\mathbf{x}_{t+1}|\mathbf{x}_t \ldots \mathbf{x}_1) = \mathbf{A}_0\mathbf{u}_{t+1} = \begin{bmatrix} \alpha_{0,11} & \alpha_{0,12} \\ \alpha_{0,21} & \alpha_{0,22} \end{bmatrix} \begin{bmatrix} u_{1,t+1} \\ u_{2,t+1} \end{bmatrix}$$

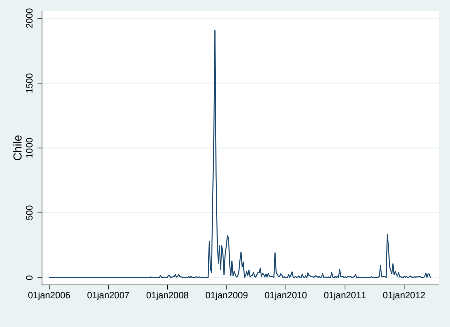
  which has covariance matrix $E(\mathbf{e}_{t+1,t}\mathbf{e}'_{t+1,t}) = \mathbf{A}_0\mathbf{A}'_0$, since $E(\mathbf{u}_t\mathbf{u}'_t) = I_k$, with $k = \#$ of countries. If we were considering a one-step-ahead error in forecasting $\mathbf{x}_{1,t}$, its variance would be $\alpha^2_{0,11} + \alpha^2_{0,12}$.
- The relative contribution to the FEVD for x_1 from x_2 is $\widehat{\alpha}^2_{0,12} = [\alpha^2_{0,12}/(\alpha^2_{0,11} + \alpha^2_{0,12})]$ with (conveniently) $\widehat{\alpha}^2_{0,12} \in [0, 1]$.

The Data: Calculating intra-week Volatility

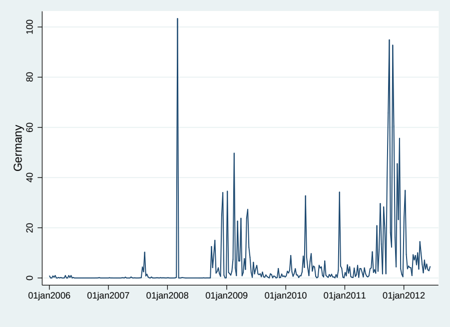
Use Garman and Klass (1980) measure of weekly volatility

$$\sigma_{it}^2 = 0.511(H_{it} - L_{it})^2 - 0.383(C_{it} - O_{it})^2 \quad (4)$$
$$-0.019\left[(C_{it} - O_{it})(H_{it} + L_{it} - 2O_{it}) - 2(H_{it} - O_{it})(L_{it} - O_{it})\right]$$

(a) Chile



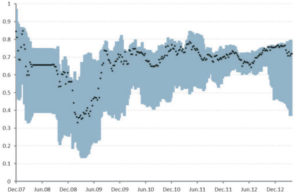
(b) Germany



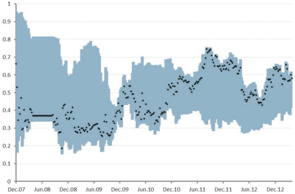
Contagion Index for returns on CDS

Index based on Diebold and Yilmaz (2010)

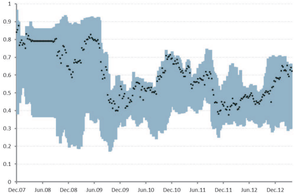
(a) Germany



(b) Chile



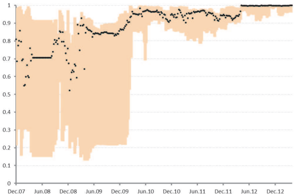
(c) Japan



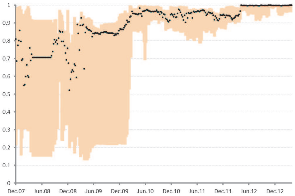
Contagion Index for returns on CDS

Index based on Diebold and Yilmaz (2010)

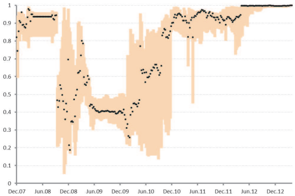
(a) Germany



(b) Chile



(c) Japan



Conclusions

- I examine the relation of credit spreads in sovereign debt with CDS spreads in a 16 week horizon
- There exist two groups of countries
  i) CDS shocks affect bonds yields positively: pass-through
  ii) Safe-havens, in which effect is negligible or negative
- Possible to estimate an index of contagion in a weekly basis: No evidence for contagion in levels from troubled economies to safe-havens in 2012. Not possible to say the same regarding volatility.