

Can Credit Default Swaps Predict Financial Crises? A Markov Switching perspective

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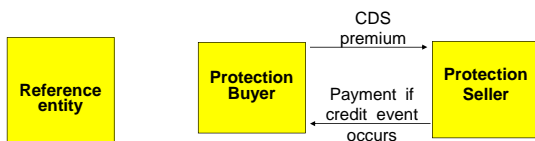
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Building Block

- To implement a Markov Switching Model (MSM) calibrated on CDS market quotes in a Bayesian framework.
- To investigate, via the estimated parameters, whether CDS quotes may anticipate stock market turmoils.

CDS Market

A CDS is an “insurance policy” protecting against the default of a reference entity. It is traded as an OTC-derivative.

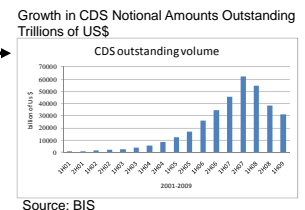


CDS are usually priced as a yield spread over the corresponding [(Libor/swap rate)-10b.p.].

CDS Market: a record growth

They allow to transfer and isolate credit risk from other sources of risks
They are the most liquid credit risk instruments

Market Development



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The CDS market

- Are they really “insurance” contracts?
 - OTC contracts
 - No real time information on traded volume
 - More CDS contracts than outstanding debt of the reference entities
 - Subject to moral hazard and asymmetric information (Acharya and Johnson, 2007)

Examples:

Telecom Italia : Debt 44 billions and 70,4 billions of CDS
Carrefour : Debt 12 billions and 29 billions of CDS

- Requirements of a standardized market

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Review of literature

Implied ratings

- Reyngold, Kocagil, Gupta (2007)
- Hamilton, Lam (2008)
- Castellano, Giacometti (2010)

Event studies

- Galil and Sorer (2008) M., S&P, F
- Norden (2008) M., S&P, F
- Hull et al. (2004) M., S&P
- Castellano and D'Ecclesia (2010) M., S&P, F

Markov-Switching Event study

- Castellano and Scaccia (2010) M., S&P, F

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A simple Hypotesis

Implement a MSM and calibrate it on CDS spreads.

- **Do CDS quotes anticipate financial turmoils?**
- **Do CDS quotes reflect future expectations of investors and allow for a clear view of investor's perception?**

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The main idea

To test whether CDS indexes are a leading indicator of financial turmoils, we follow a procedure that can be summarized into 2 steps:

- 1) identification of periods of crises in stock markets through the construction of indicator derived from Mishkin and White's (2002);
- 2) modeling of the state-dependent means and variances of the CDS spread changes via Markov Switching Models (MSM).

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Application to CDS market

- **Data set:** CDS and Stock Market Indexes (January 2004 – September 2010)

Europe: ITRAXX; STOXX Euro 50; STOXX Euro 600.
U.S.A.: CDX; D.J. Ind.; S&P 500; NASDAQ.
- **Number of regimes:** 3 regimes for the CDS returns generating process, i.e.:
 - > regime 1 : normal market conditions (low volatilities)
 - > regime 2 : low market turbolences (medium volatilities)
 - > regime 3 : abnormal market turbolences (high volatilities)

The proposed model

- Let y_{it} be the observation at time t (for $t = t_0, \dots, T$), for time series i (for $i = 1, \dots, N$)
 - A MSM assumes that the distribution of an observed data point y_{it} depends on an unobserved (hidden) "state" or "regime" $s_{it} \in \{1, \dots, K\}$
 - The elements of $s_i = (s_{it})_{t=t_0}^T$ follow a Markov chain with transition matrix $\Lambda_i = (\lambda_{i,jk})$, i.e. $p(s_{it} = j | s_{i,t-1} = k) = \lambda_{i,jk}$, and stationary distr. $\pi_i = (\pi_{ij})_{j=1}^K$
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- The full conditional distribution of y_{it} is $P_{s_{it}}(y_{it} | \theta)$

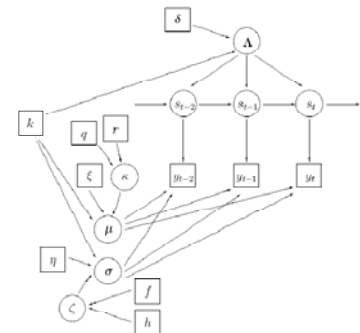
The proposed model (continued)

- When $s_{it} = j$, we assume that y_{it} is drawn from a $N(\mu_{ij}, \sigma_{ij}^2)$
 - μ_{ij} is the mean of the j -th regime, for the i -th time series
 - σ_{ij}^2 is the variance of the j -th regime, for the i -th time series
- Thus the marginal distribution of y_{it} is a mixture of Normal distributions:

$$y_{it} \sim \sum_{j=1}^K \pi_{ij} N(\mu_{ij}, \sigma_{ij}^2)$$
 - π_{ij} 's are the components of the stationary vector of the transition matrix

Prior distributions on the parameters

- $k = 3$
- $\lambda_i \sim D(\delta, \dots, \delta)$
- $\mu_i | \sigma_i^2 \sim N(\xi, \kappa \sigma_i^2)$
- $\kappa \sim IG(q, r)$
- $\sigma_i^2 \sim IG(\eta, \zeta)$
- $\zeta \sim G(f, h)$



Bayesian Inference

• We use MCMC to sample from the posterior joint distribution of the parameters

• update Λ , s , μ , σ^2 , κ and ζ through Gibbs steps

• From the sample $(\Lambda^{(m)}, s^{(m)}, \mu^{(m)}, \sigma^{(m)}, \kappa^{(m)}, \zeta^{(m)})$, for $m = 1, \dots, M$, we estimate quantities of interest, i.e.:

• posterior probabilities of being in a certain regime at each time t

$$\hat{p}(s_t = i | y) = \frac{1}{M} \sum_{m=1}^M I\{s_t^{(m)} = i\}$$

Some Results: EUROPE

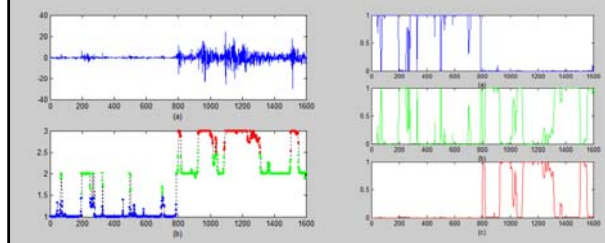
$$\mu_1 = -0.0361; \mu_2 = 0.0494; \mu_3 = 0.1930$$

$$\sigma_1^2 = 0.2032; \sigma_2^2 = 5.9083; \sigma_3^2 = 45.1851$$

ITRAXX EUROPE

First jump in the third regime at 801: July 25, 2007.

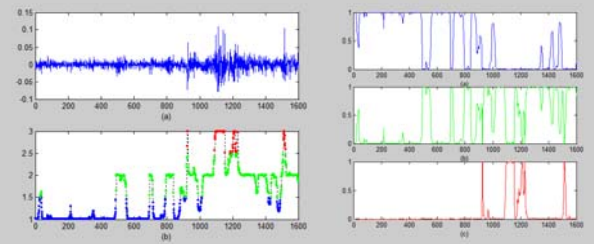
$$\Lambda = \begin{matrix} 0.9838 & 0.0147 & 0.0016 \\ 0.0176 & 0.9676 & 0.0148 \\ 0.0027 & 0.0202 & 0.9771 \end{matrix}$$



Some Results: EUROPE

STOXX EURO 50

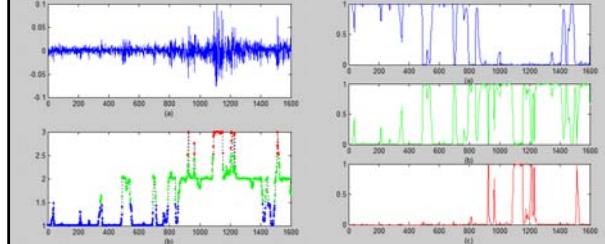
First jump in the third regime at 924: January 16, 2008.



Some Results: EUROPE

STOXX EURO 600

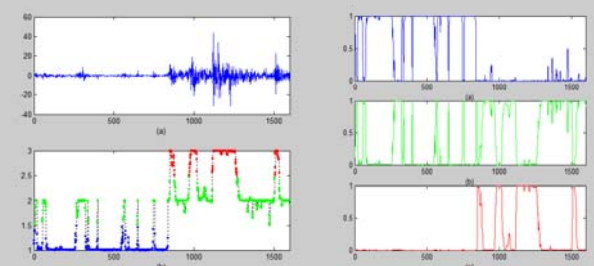
First jump in the third regime at 922: January 14, 2008.



Some Results: U.S.A.

CDX

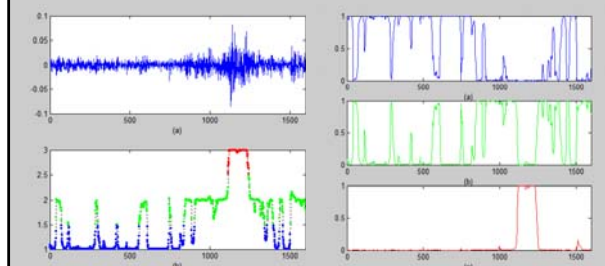
First jump in the third regime at 850: July 25, 2007.



Some Results: U.S.A.

D.J. Ind.

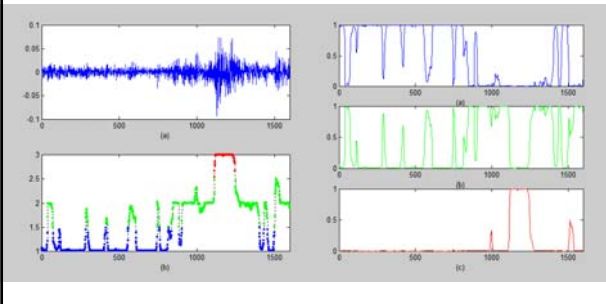
First jump in the third regime at 1113: September 3, 2008.



Some Results: U.S.A.

S&P 500

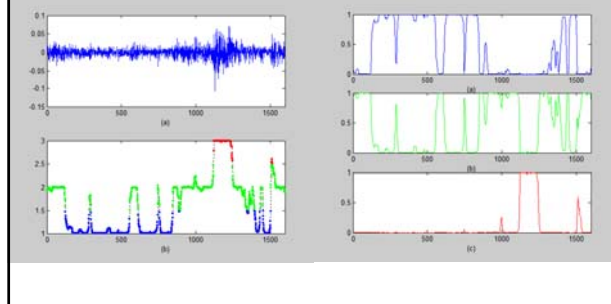
First jump in the third regime at 1114: September 4, 2008.



Some Results: U.S.A.

NASDAQ

First jump in the third regime at 1120: September 12, 2008.



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Thank you for your attention!!!!!!