Discussion: Counterparty risk session

Areski Cousin
ISFA, Université Lyon 1

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Specific characteristics of counterparty risk

- Counterparty Risk is the risk that the counterparty to a financial contract will default prior to the expiration of the contract and will not make all the payments required by the contract
- Similar to credit risk : the cause of losses is due to the default of an economic agent
- But several specific features :
  - Uncertain exposure when counterparty defaults
  - Bilateral nature of credit risk
  - Wrong-way risk : losses due to wrong-way movement of the contract's mark-to-market price at the time when counterparty defaults
  - Simultaneous default risk (CDS) : losses due to unexpected simultaneous defaults of both the counterparty and the reference entity
  - Concentration risk, Circularity nature of counterparty risk, Liquidity risk, Systemic risk
- Risk management of counterparty risk is very topical, especially given the surge of failures in the financial sector during the crisis

Risk management issues

Several issues are associated with the risk management of counterparty risk

- Risk management of counterparty risk can be considered at different scales (contract level, counterparty level, trading-book level)
  - Bilateral Netting agreement such as the industry standard ISDA Master agreement

$$E^{Net}(\tau) = \max\left(\sum_{i=1}^{n} MtM_i(\tau), 0\right) \leq \sum_{i=1}^{n} \max\left(MtM_i(\tau), 0\right) = E^{NoNet}(\tau)$$

- Margin/collateral agreement (as for example described in the Credit Support Annex of the ISDA Master agreement), Design of the collateral account's mechanism
- Unilateral vs Bilateral counterparty risk
- Modeling credit exposure

Modeling credit exposure

- Probabilistic description of default times, recovery rates and information sets
- Several measures of counterparty risk :
  - Market-value of the contract accounting for the potential default of the counterparty
  - CVA (Credit Value Adjustment) : market value of counterparty risk
  - EPE (Expected Positive Exposure at default)
  - effEPE (Effective EPE)

- All these quantities strongly relies on the assumption made about the contractual nature/characteristics of counterparty risk such as netting agreement/no netting agrement, collateral agreement/no collateral agreement or unilateral /bilateral (asymetric/symetric prices)

Review of the literature

Survey papers - General aspects of counterparty risk

- Canabarro and Duffie, 2003, *Measuring and Marking Counterparty Risk*
- Pykhtin and Zhu, 2007, *A Guide to Modelling Counterparty Credit Risk*
- Pykhtin and Zhu, 2007, *Measuring Counterparty Credit Risk for Trading Products under Basel II*
- Gregory and Kelly, 2009, *The Evolution of Counterparty Credit Risk - an Insider's View*
- European Central Bank, 2009, *Credit Default Swaps and Counterparty Risk*

Review of the literature

General pricing formula : Unilateral Counterparty Risk

- Brigo and Masetti, 2005, *Risk Neutral Pricing of Counterparty Risk* : Modeling of counterparty risk for different OTC derivatives, computation of a general counterparty-risk pricing formula (i.e., formula for CVA)
- Brigo and Chourdakis, 2008, *Counterparty Risk for Credit Default Swaps* : Unilateral CVA for counterparty risk of CDS in an intensity model with default correlation (wrong-way risk)
- Yi, 2010, *Dangerous Knowledge : Credit Value Adjustment with Credit Triggers* : General CVA formula when the investor has the possibility to terminate the contract as the counterparty hits a pre-specified credit trigger

Review of the literature

General pricing formula : Unilateral Counterparty Risk

- Li, 2009, *Double Impact on CVA for CDS : Wrong-Way Risk with Stochastic Recovery* : Computation of unilateral CVA accounting for a Gaussian copula dependence structure among defaults and stochastic recoveries
- Crépey, Jeanblanc and Zargari, 2009, *Counterparty Risk on a CDS in a Markov Chain Copula Model with Joint Defaults* : Unilateral CVA for counterparty risk of CDS in a Markov Copula Model accounting for simultaneous defaults with no specific spread risk
- Crépey, Jeanblanc and Zargari, 2009, *Counterparty Risk on a CDS with Joint Defaults and Stochastic Spreads* : Extension of the latter paper to the case of stochastic credit spreads

Review of the literature

General pricing formula : Bilateral Counterparty Risk

- Brigo and Capponi, 2009, *Bilateral Counterparty Risk Valuation with Stochastic Dynamical Models and Application to Credit Default Swaps* : Extension of Brigo and Chourdakis (2008) to the case of bilateral CVA
- Gregory, 2009, *Being Two-Faced Over Counterparty Credit Risk* : Discussion on the problems that can be raised when considering bilateral CVA
- Assefa, Bielecki, Crépey, Jeanblanc, 2009, *CVA Computation for Counterparty Risk Assessment in Credit Portfolio* : General pricing formula for bilateral/unilateral CVA, counterparty-level, with possibly netting agreement and collateralization scheme. Application to bilateral CVA for CDS and Unilateral CVA associated with a portfolio of CDS with the same counterparty in a multivariate Markov-copula model where dependence amongst defaults stems from the possibility of simultaneous defaults

Review of the literature

Structural approaches for modeling counterparty risk

- Redon, 2006, *Wrong-Way Risk Modelling* : country-risk due to currency depreciation in a Merton-like model of default risk
- Blanchet-Scaillet and Patras, 2008, *Counterparty Risk Valuation for CDS* : Explicit formula for counterparty risk of CDS and first-to-default swaps in a bivariate Black-Cox structural model with correlated Brownian motions
- Lipton and Sepp, 2009, *Credit Value Adjustment for Credit Default Swaps via the Structural Default model* : Original method for computation of CVA for CDS in a jump-diffusion multivariate structural model with correlated Brownian motions

General comments on the presented papers

- The two papers are carefully written, in quite compact style however.
- They both contain a very rigorous theoretical part on the computation of CVA in different contexts
- In the two papers, the authors subsequently specify a default-time model based on the promising Markov-copula approach developed by Bielecki, Vidozzi and Vidozzi (2008) and further investigated by Bielecki, Cousin, Crépey, Herbertsson (2010)
- Then, in both papers, thorough numerical experiments illustrate the practicability of the approaches
- These two papers clearly constitute additional research contributions in the field of counterparty risk modeling

Comments on the first paper - Crépey, Jeanblanc and Zargari (2009)

- Paper focuses on unilateral counterparty risk for Credit Default Swaps
- Extension of Crépey, Jeanblanc and Zargari (2009) to the case of stochastic credit spreads
- Dependence between default of the counterpart and the reference entity stems from the possibility of simultaneous defaults and the existence of a common factor governing credit spreads.
- Default indicators form a bivariate Markov-chain copula
- Explicit formula provided for risky CDS price, CVA and EPE
- Two Specifications of an affine CIR intensity model for the dynamics of credit spreads
  - Analytical formulas for prices of risk-free CDS
  - Discussion on the calibration of model parameters
  - Numerical results given for three different specifications of default intensities
- Conclusion : in most cases, the effect of dynamic CDS spreads on CVA is insignificant compared to the effect of potential simultaneous defaults

Questions/Comments on the first paper

- Analytical formula for prices of risk-free CDS : Is it possible to derive equivalent formulas for risky CDS/CVA/EPE ?
- p.12 : Give more intuition for the condition $f_i(t) \geq l_3(t)$ to be satisfied (single-name intensities must be larger than the joint-default intensity)
- Remark 5.1 p.12 - Parameter of the CIR process not restricted to the inaccessible origin case. Is it not dangerous in practice for the condition $f_i(t) \geq l_3(t)$ to be satisfied ?
- Formula (19) p.13 : Be aware that $p_{1,2}(t)$ may not be a bivariate distribution function for all t if the correlation $\rho(t)$ is a function of time.

Comments on the second paper - Assefa, Bielecki, Crépey, Jeanblanc (2009)

- Computation of a very general model-free pricing formula for CVA associated with generic OTC derivatives including
  - unilateral/bilateral approaches
  - counterparty-level, with possibly netting agreement
  - possibly collateral agreement (two particular case investigated : no collateral/extreme collateral)
- Model-free CVA detailed for two applications :
  - Bilateral CVA for Credit Default Swaps with a collateral agreement
  - Unilateral CVA for Portfolio of Credit Default Swaps, counterparty-level with a netting agreement and a collateral agreement
- Default times described as in a multivariate Markov-copula model : dependence stems from the possibility of simultaneous defaults. Specific individual spread dynamics are also considered

Comments on the second paper - Assefa, Bielecki, Crépey, Jeanblanc (2009)

- Numerical results given for univariate CVA for a portfolio of 100 CDS with netting/no netting, collateral/no collateral agreement
- The CDS portfolio is divided in three groups with ranked risk level. Names in each group may default simultaneously.
- Conclusion :
  - Netting significantly reduces CVA
  - The collateral agreement has a small effect to CVA compared to the simultaneous default effect
  - The spread dynamics effect has a small impact on CVA compared to the simultaneous default effect

Questions/Comments on the second paper

- p.8 Formula (4) : Give a name to the random variable $\chi_(\tau)$
- p.11 Formula (18) : Give more intuition (or a reference) on the choice of this margin process
- Extreme collateralization : I would say full collateralization
- p.15 Formula (31) : What happens for ξ_τ^0, the PFED (Potential Future Exposure at Default) with no collaterization from the receiver-CDS point of view ?
- Section 3.2.1 p.15 : It should be interested to compute at least numerically the fair spread of a risky-CDS (risk-free CDS adjusted for counterparty credit risk)