Discussion: Counterparty risk session

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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

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

- 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 agreement, collateral agreement/no collateral agreement or unilateral/bilateral (asymmetric/symmetric 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, 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
General pricing formula: Unilateral Counterparty 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.
General pricing formula: Unilateral Counterparty Risk


- **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**


- **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
Structural approaches for modeling counterparty risk


- **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.
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
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 $\xi_0^\tau$, the PFED (Potential Future Exposure at Default) with no collateralization 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)