Issues of Margin Requirements Assessment for Central Clearing of OTC Derivatives

Kurbangaleev Marat

Junior Research Fellow, FERM Lab

National Research University “Higher School of Economics”

NATIONAL RESEARCH UNIVERSITY

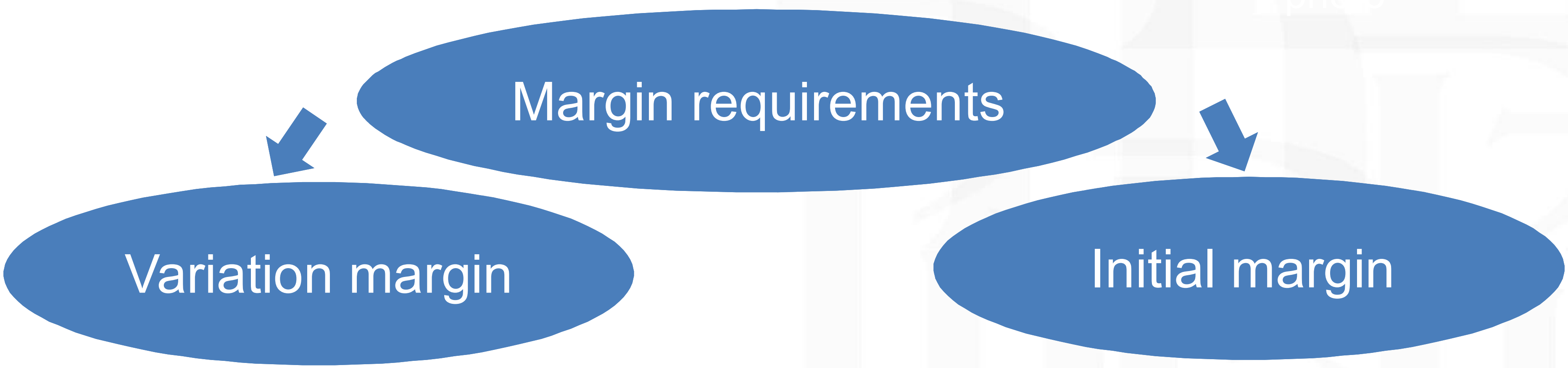
Context

- The recent financial crisis induced reform of infrastructure of global OTC derivative markets.
- Dodd-Frank Act in USA and EMIR in Europe.
- OTC derivative transaction **MUST** be either centrally cleared, if instruments comply with eligibility criterion, or properly collateralized and marked-to-market on a regular basis.
- A Central Counterparty (CCP) **MUST** demand margin requirements for all eligible derivative transaction.
- Regulatory innovations mostly concern interest rate swaps (IRSs) and credit default swaps (CDSs).

Margin Requirements

- Margin requirement systems are designed in order to collect and maintain a risk-adequate level of collateral for covering **TYPICAL POTENCIAL** losses on a derivative **PORTFOLIOS** over particular horizon.

- Margin requirements are function of portfolio-level counterparty potential future exposure (PFE). Most effective, when netting opportunities are strong.



Variation Margin

- A variation margin is designed for marking position to market and covering current exposure, assuring that taking over position of defaulting counterparty do not incur an immediate loss for CCP.

- Since variation margin is calculated at the portfolio level, correlations between value changes of different derivatives are supposed to be taken into account. Margin is also associated with cost for market participants, thus margin requirements should be applied only after netting of position.

- A dynamic model of “fair” value of a portfolio is required in order to determine future counterparty potential future exposure.

- The model is supposed to be consistent with mark-to-market methodology.

Variation margin: modeling exposure for IRSs

- The widest class of parametric dynamic models of forward rates is affine model class.

- Affine models are rather tractable and have quite simple analytical (semi-analytical) expressions.

- Examples:
- Vasicek (1977): $d\lambda_t = \kappa(\mu - \lambda_t)dt + \sigma dW_t$
- Cox-Ingersoll-Ross (1985): $d\lambda_t = \kappa(\mu - \lambda_t)dt + \sigma\sqrt{\lambda_t}dW_t$
- Hull-White (1990): $d\lambda_t = \kappa(\mu_t - \alpha\lambda_t)dt + \sigma\sqrt{\lambda_t}dW_t$

- These models are also known as short rate models. BUT those one-factor models reproduce a substantially limited range of yield curves shapes, thus may not replicate joint distribution of value increments for instruments with different maturities.

Variation margin: modeling exposure for IRSs

- During the last decade infinite-dimensional dynamic models interest rates have been actively discussed in literature of financial mathematics. [Filipović (2001), Cont (2005), Sornette et al(2008)]

- The FERM Lab developed a ***non-parametric approach*** based on HJM framework.

- On the one hand, a necessary and sufficient condition of absence of arbitrage is well for HJM framework; on the other hand, unlimited number of factors allows representation of complex, but still plausible curve shapes.

Variation margin: modeling exposure for IRSs

- In order to properly model potential value for IRSs with different underlying rate, the multi-curve framework might be needed (e.g. see Mercurio (2009)). In this case the joint dynamics of different curves has to be taken into account as well.

- This is a great challenge for CCPs!

- To avoid complex modeling CCPs may apply any factor model: impact of parallel shift and slope change of the yield curve on portfolio value.

Variation margin: modeling exposure for CDSs

- Consider CDS priced in terms of up-front:

$$R = \int_0^T \mathrm{LGD} \cdot d(\tau)\,\mathrm{d}\big(1 - Q(\tau)\big) -$$

$$- s \sum_{i=1}^{N} d(T_i)\alpha(T_{i-1}, T_i)Q(T_i) + \int_0^T d(\tau)\alpha(T_{I(\tau)}, \tau)\,\mathrm{d}\big(1 - Q(\tau)\big)$$

s is the CDS par spread, *d(t)* is the discount function, $\alpha(t_1, t_2)$ is the year fraction between t_1 and t_2, and

$$I(\tau) = \max\{T_i : i = 1, \ldots, N, T_i < \tau\}$$

Variation margin: modeling exposure for CDSs

- Central object of a credit risk is a term structure of hazard rates $\lambda_t(s)$, which are in essence a densities of probability to have a default at term conditional on information available at time s t . Hence survival probability is:

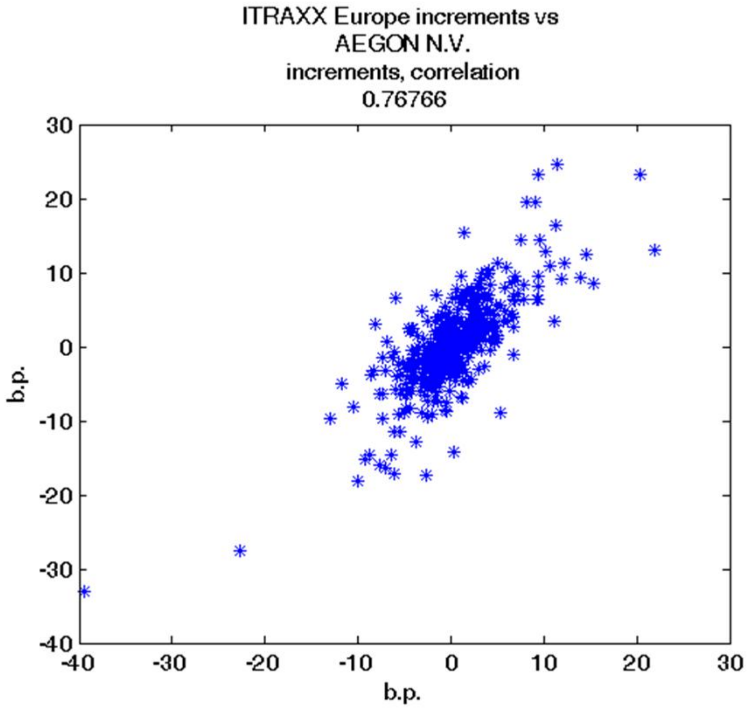
$$P(t,s) = e^{-\int_0^s \lambda_t(\tau)d\tau}$$

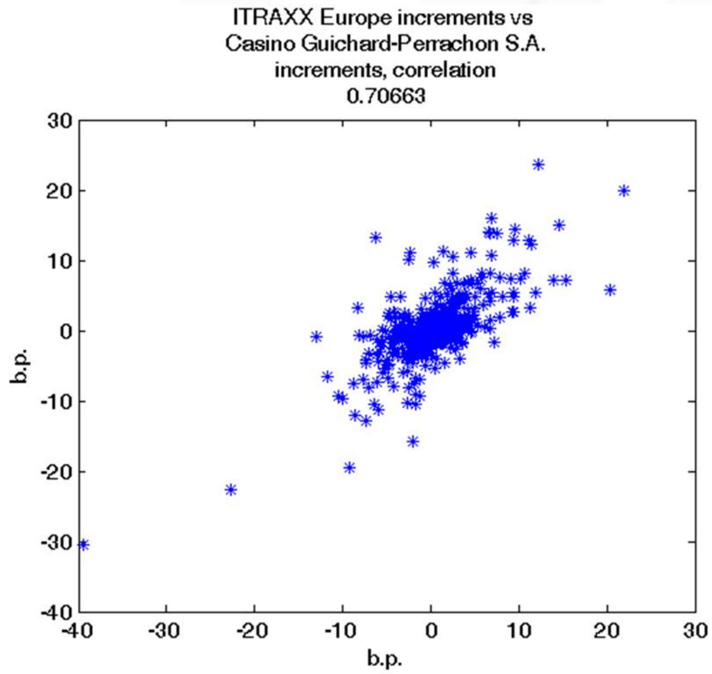
- $\lambda_t(s)$ may be modeled with the same way as term structure of risk-free yield, including non-parametric approach developed by FERM Lab.

Variation margin: modeling exposure for CDSs

- Joint distribution of value increments for different CDS is necessary for calculation variation margin at portfolio level.

- During the crisis CDS prices changes were and still are correlated among each other and with CDS index. Correlation coefficient varies from 0.3 to 0.8 (in Europe).





Similar results obtained in Cont, Kan (2011) for American market.

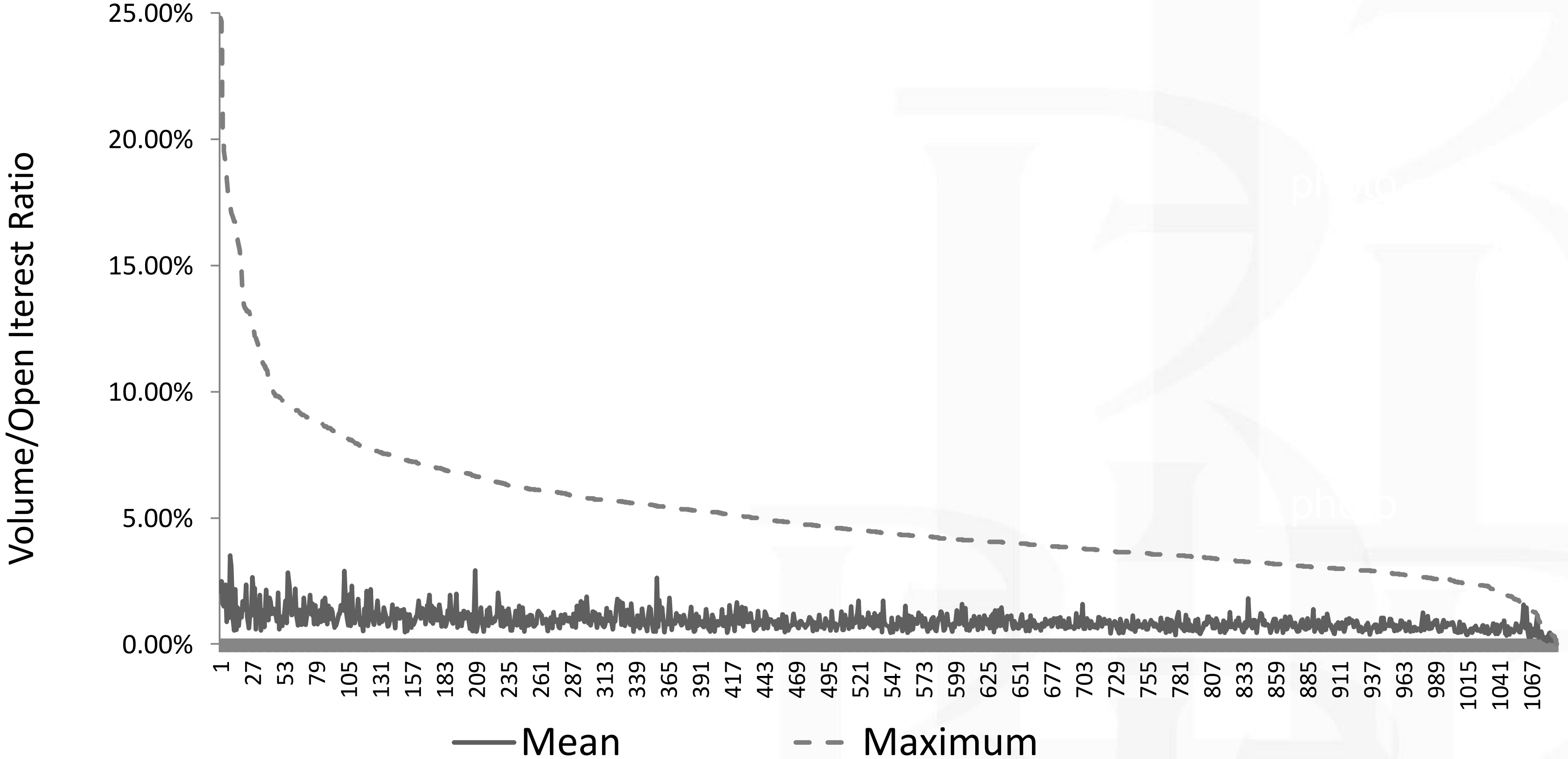
Variation margin: which loss is typical?

- Default on reference obligation of CDS do not require modeling for a variation margin assessment!
- A default on a single contract is to rare event to consider it as a typical event.
- Although for highly diversified portfolios or index CDS is more likely, it’s impact on portfolio value increments. 1 of 125 single-name CDS of index contributes maximum -0.8% of notional amount to return of portfolio.

Initial margin

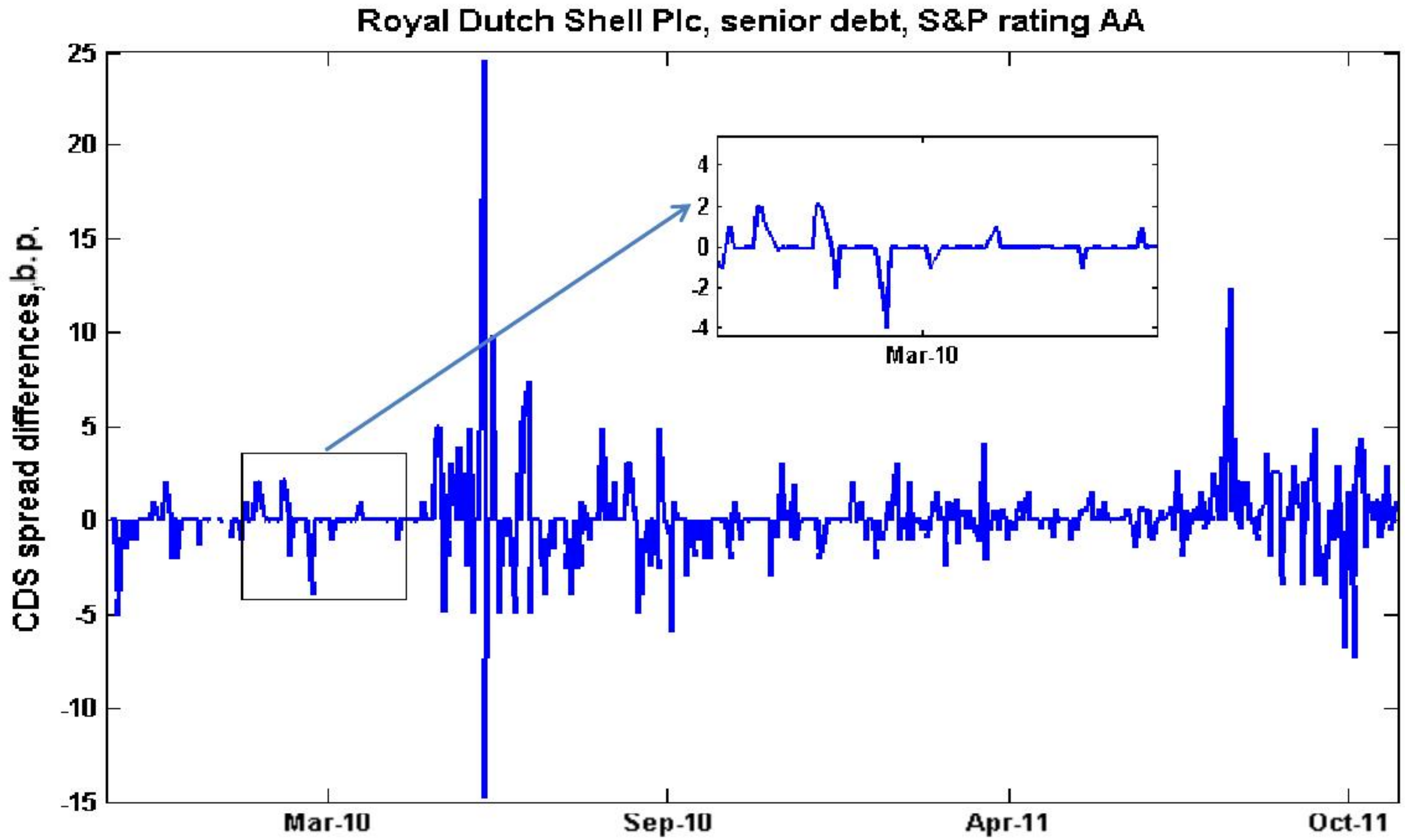
- An initial margin is designed to cover losses that CCP might incur while closing out of a defaulter’s position.
- In contrast to variation margin, an initial margin is determined by real quotes or trade prices.
- An initial margin depends on activeness of trading process, market liquidity and time from last variation margin adjustment till position is closed-out.
- OTC derivatives markets are not only less active and less liquid than organized markets (exchanges), those characteristic are also less stable.
- E.g. DTCC weekly volume trade data on 1101 CDS shows that 137 contracts were traded every week from July 2010 – June 2012.

Initial margin: liquidity issue



Source of the data: DTCC. Weekly data. July 2010-June 2012 (106 weeks). 1101 names. http://www.dtcc.com/

Initial margin: liquidity issue



Initial margin: close-out procedure

- In OTC derivative market CCP cannot rely on immediate or fast liquidation of defaulter’s position. Different strategies of closing-out position should be applied.

- Determining an initial margin CCPs also cannot rely on the same data they use to calculate variation margin.

- Alternative strategies:
  - For non-dealer participants: partial liquidation + hedging.
  - For dealers: position transfer to remaining dealers (clearing members) through specially organized auction.

- Modeling close-out action is nontrivial problem.

Conclusions

- OTC derivative markets face few, but important issues in a context of margin requirements.
- Variation margin: PFE exposure modeling.
- Initial margin: data, liquidity and close-out procedures.

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Thank you for your attention!

20, Myasnitskaya str., Moscow, Russia, 101000
Tel.: +7 (495) 628-8829, Fax: +7 (495) 628-7931
www.hse.ru