Pricing credit derivatives with *R*

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Since the end of the eighties, in order to allow the exchange of credit risk, new financial instruments have arisen. These instruments are generically dubbed credit derivatives. Among the most important instruments traded in this market there are: Credit Default Swaps (CDS), Basket Default Swaps (BDS) and Collateralised Debt Obligations (CDO). The relevance of these instruments in the market for securitisation springs from their features that allow to trade credit risk in the same way as it is possible to trade market risk (for example see Gibson [1]). Securitization is grounded on the principles of pooling and successive tranching of a portfolio of assets. This process is schematically shown in the following figure. (1)

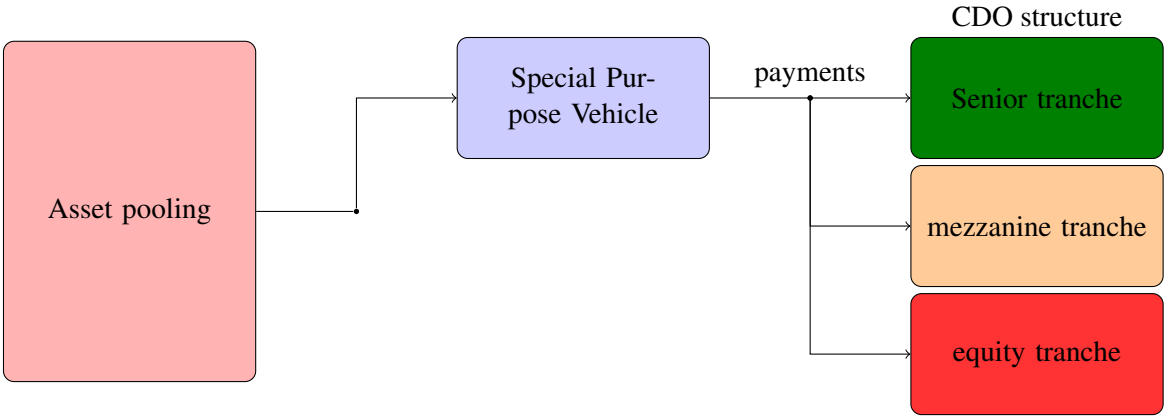

Figure 1: CDO scheme

Pricing of BDS and CDO often lacks analytical solution. For this reason it is required to resort to some kind of numerical simulation.

The most important quantity in pricing multi-name credit derivatives is the portfolio loss process. In the case of CDOs this stochastic process can be derived from individual times to default of underlying reference obligors (see Mounfield [2]).

In this paper we address the issues of implementing in the *R* software environment some of the most widespread algorithm for pricing credit risk derivatives such as Basket Default Swaps and synthetic CDO instruments. We first present the models allowing a closed form solution and then we tackle the issue of improving the Monte Carlo methods by comparing the relative performances with the employment of some variance reduction techniques such as antithetic variates and two different Quasi Random numbers procedures. On theoretical grounds, all these techniques should improve upon the traditional $(\sqrt{N})$ speed of convergence of the classical Monte Carlo methods. The use of variance reduction techniques along with the frameworks for parallelization available in the *R* environment allow the deployment of reasonably fast Monte Carlo algorithms.

References

[1] Gibson, M. S. (2004). Understanding the Risk of Synthetic CDOs. *FRB Working Paper*.

[2] Mounfield, C. C. (2009). *Synthetic CDOs, Modelling, Valuation and Risk Management*. Cambridge: Cambridge University Press.