

# Intensity models for portfolio credit derivatives

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Portfolio credit derivatives (such as basket credit default swaps) are financial instruments that transfer credit risk related to a portfolio of underlying entities from one party to another without transferring the underlying. They are effective tools to manage portfolio credit risk, and have regained their strength after the 2008 credit crunch. According to the International Swaps and Derivatives Association, the trading volume of (basket) credit default swaps has reached to \$1383 billion as of February 2018.

However, the valuation of portfolio credit derivatives and the modeling of underlying portfolio credit risk are still a challenging task. Intensity models have become an industry practice to price credit derivatives due to their tractability and easy-to-calibration feature.

In this project, the student is expected to first give an overview of intensity models for credit risk, in particular the multiple firms case with correlated intensities. Then, the student is expected to apply both the change of probability measure technique and the total hazard rate construction method to calculate the joint default probabilities. They will in turn be used to price basket credit default swaps.

In order to take this project, the student needs to be familiar with at least one programming language (e.g. Matlab, Python C++ etc), and is also supposed to be familiar with stochastic calculus. It would be preferable for the students who attended ST958 “Topics in Mathematical Finance” to take this project, because all the mathematical background material has been covered in ST958. However, attending ST958 is not a prerequisite to take this project.

## References

- [1] Collin-Dufresne, P., Goldstein, R., and Hugonnier, J. (2004): A general formula for valuing defaultable securities, *Econometrica* 72(5), 1377-1407.
- [2] Yu, F. (2007): Correlated defaults in intensity-based models, *Mathematical Finance* 17(2), 155-173.
- [3] Liang, G. (2019): Lecture notes on systemic risk and credit risk, <https://drive.google.com/file/d/1vHUI8opgV9-bY7kiY2TAj0WExiwYswkS/view>