In Part 2, we have discussed the validation of models for credit risk by looking at the three components of the regulatory formula for risk-weighted assets: probability of default, loss given default and exposure at default. In this chapter we turn to a type of credit risk that has become extremely important in the wake of the 2008 financial crisis and the numerous and unexpected downgrades of counterparties (including the largest investment banks) which generated large migration losses in derivative trading books. Consequently, counterparty credit risk proved to be relevant not only for the trading activities of financial institutions, but also, in light of the many interconnections amongst them, for the stability of the financial system as a whole. Counterparty credit risk is relevant in the context of over-the-counter (OTC) derivatives and securities financing transactions (SFT)\(^1\). Risk in over-the-counter transactions and the combination of credit and market risk has been discussed in Duffie and Singleton (2003), the modelling of CCR is analysed in Pykhtin and Zhou (2006, 2007) and in Canabarro (2010), while Martin (2010) provides an overview of model risk in CCR systems.

Since a derivative contract can have a positive or a negative market value, the default of a counterpart will cause a loss equivalent to the replacement cost of the contract, i.e., its market value if such value were positive. The counterparty exposure will be the larger between zero and the market value of the portfolio of derivative positions with a counterparty that would be lost in the event of counterparty default. The distribution of the CCR exposure in the future will depend on the various market factors underlying each OTC contract and will usually represent only a fraction of the total notional amount of trades with a counterparty. This market value will depend on the credit quality of the counterpart and will go down in case of a downgrade even in absence of any changes in the market parameters. On the other hand, in a derivative contract, even if credit quality does not change, the exposure at default will depend on the future level of market factors. In other words, rather than the current exposure (i.e., the loss that would be expected if the derivative cash flows were known with certainty or if the counterparty defaulted today) one needs to take into account the potential exposure (the loss that would be expected given a range of potential future market scenarios and if the counterparty...
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defaulted at some time before the contract’s maturity). As we have seen when
discussing the EAD (Exposure at Default) component of the regulatory formula
for credit risk, uncertainty on the actual level of exposure at the time of default
also needs to be modelled. Counterparty credit risk (CCR) is usually defined as the
risk that the value of a portfolio changes due to unexpected changes in the credit
quality of trading counterparts, i.e., outright default or downgrading. Because of
the nature of the contracts, however, and unlike the case of credit risk on loans,
besides the uncertainty on credit quality, one needs also to consider (and model)
the uncertainty on the actual exposure. The latter being driven, sometimes in very
complicated ways, by market factors, one needs in practice to model the value of all
portfolio transactions over, possibly quite long, time horizons, combine this forecast
with an estimate of default probabilities and recovery rates, and aggregate the results
on a counterparty basis, without forgetting to take into account collateralization and
netting arrangements.

The Second Basel Accord provisions on CCR include a capital charge for default
risk to cover losses in case the counterparty defaults on its obligations (assuming
the instrument is held to maturity). Following the losses incurred during the
financial crisis the so called Third Basel Accord (or Basel III) introduced a capital
requirement to cover losses from changes in the market value of counterparty
risk, as for other risks, proposing different approaches, with increasing levels of
complexity. To compute regulatory capital in respect of counterparty credit risk for
both OTC derivatives and SFT, a financial institution needs to determine its EAD
by using any of four different methods (the original exposure method, the current
exposure method, the standardized method and the Internal Model Method, IMM).
Specifically, the Capital Requirements Regulation (CRR), specifies the following
approaches:

- The original exposure method estimates the exposure at default based on nominal
  value and time to maturity (only allowed for banks without a trading book).
- The mark-to-market method estimates the exposure at default based on market
  value, instrument types and time to maturity.
- The standardized method estimates the exposure at default based on a standardized
  formula regarding market value, instrument type and time to maturity.
- The IMM allows certain approved banks to develop their own models to calculate
  their exposures at default.

IMM is the most advanced and risk-sensitive method to determine EAD, and the
financial institution needs to take into account the interaction between the three
components of credit risk (PD, LGD and EAD) as well as the so-called wrong-way
risk. The latter is the risk originating from the fact that exposure may be negatively
correlated to the counterparty’s creditworthiness. For example, a rise in interest
rates may have a negative effect on the counterparty’s credit rating while at the same