

The xVA Challenge, Gregory, 3rd Edition

Chapter 17: Wrong-Way Risk

Key Points:

- Wrong way risk is the potential that the value of your exposure to a specific counterparty is very high at the very same time that the risk of that counterparty defaulting is very high
- Wrong way risk is very challenging to quantify
- Know the different approaches to modelling WWR and their advantages/disadvantages

17.1 Overview

- Wrong-way risk is generally used to indicate an unfavorable dependence between exposure and counterparty credit quality
- i.e. the exposure is high just when it is more likely the counterparty is likely to default
- WWR is sometimes ignored, but it can also have a dramatic effect
- Right-way risk is when there is a *favorable* dependence between exposure and credit quality

17.2 Overview of Wrong-Way Risk

Simple example

- In chapter 14, CVA was shown to be represented as credit spread multiplied by exposure
- But multiplication relies on independence!
- Need to consider how to integrate the quantification of default probability and exposure

Classic example and empirical evidence

- With a put option – imagine buying a put on a bank's stock and that put is purchased from another bank – when the put is very in-the-money (i.e. the stock price is down significantly) is also likely a time where the other bank is at a higher risk of default!
- FX swaps – if collateral is in other currency, the currency swaps value could be high when the value of the collateral is declining
- Interest rate swaps – smaller chance of wrong-way risk
- Commodity swaps – if done with a producer hedging the prices for their goods, should be right-way risk
- Credit Default Swaps – CDS benefit from widening credit spreads which is also a likely indication that the counterparty may have higher default risk

General and specific WWR

- General WWR – driven by macro-economic relationships

- May be seen in historical data
- Specific WWR – driven by causal linkages between exposure/causal and default of the counterparty
 - Note that the examples in the previous section are specific WWR examples
 - Require knowledge of the relevant market, counterparty, and economic rationale for transaction to be able to detect WWR

WWR Challenges

- Problems in modelling WWR:
 - Uninformative historical data – may not see relationships in historical data
 - Misspecification of relationship – correlation can be zero, but it does not imply independence!
 - Direction – the direction of WWR is not always clear – low interest rates usually indicates a recession and tough credit conditions, but high interest rates could lead to the same issue
- For example, European sovereign debt crisis led to a weakening of euro currency – this had not been seen in the past!

17.3 Quantification of Wrong-way Risk

Wrong-way risk and CVA

- Incorporation of WWR in the CVA formula can be achieved by representing the exposure conditional on default of the counterparty
- Can look at WWR quantification heuristically
 - Qualitatively compare the likely increase in the conditional expected exposure (EE) compared to an unconditional one

Simple example

- One approach is to model the relationship between exposure and counterparty default as a single correlation parameter
- In this example, it can be seen that WWR increases as the credit quality improves!

Wrong-way collateral

- Consider a payer interest rate swap collateralized by a high-quality government bond
 - This is general WWR
 - An interest rate rise would cause the swap value to increase while the collateral value would decline
- Another example would be a cross-currency swap collateralized by cash in one of the two underlying currencies
 - If collateral is held in the currency being paid, then an FX move may increase the exposure and reduce the value of the collateral at the same time

17. 4 Wrong-way Risk Modelling Approaches

Hazard rate approaches

- One approach is to introduce a stochastic process for the credit spread (or “hazard rate”) and correlate this with other processes required for modelling exposure
- Advantage – Can be implemented relatively tractably
 - Credit spread paths can be generated first and exposure paths need only be simulated in cases where some default is observed
- Disadvantage
 - Simple hazard rate approaches generate only very weak dependency between exposure and defaults
- i.e. easy to implement, but only ever generate small WWR effects

Structural approaches

- This approach involves specifying a dependency directly between the counterparty default time and exposure distribution
- Advantage – pre-computed exposure distributions are used and WWR is added on top of the existing methodology
- Disadvantage – may not be appropriate to assume that all the relevant information to define WWR is contained within the unconditional exposure distribution

Parametric approach

- This approach links the default probability parametrically to the exposure using a simple functional relationship
 - Can be calibrated using historical data
 - But requires the current portfolio to be similar in nature to the used in the historical calibration
 - And the historical data showing a meaningful relationship!

Jump approaches

- Jump approaches can be useful in specific WWR cases
- Advantage – empirical data shows that defaults can see a significant jump in FX rates
- Example – model FX exposures to assume the FX rate jumps at the counterparty default time

Credit Derivatives

- Credit derivatives are a special case as the WWR is unavoidable
- Calculate the fair price for buying and selling CDS protection as a function of correlation between the reference entity and counterparty
 - At extremely high correlations, the CVA is huge
 - When selling protection the impact on CVA is much smaller and reduces with increasing correlation due to right-way risk

Wrong-way risk and collateral

- Collateral is typically assessed in terms of its ability to mitigate exposure
- Since WWR can cause exposure to increase significantly, the impact of collateral on WWR is very important to consider
 - A jump in exposure can make collateral useless!
 - For example, a sudden 20% currency devaluation at the same time as a default

Central clearing and wrong-way risk

- CCPs may be particularly prone to WWR because of their reliance on collateral as protection
- CCPs tend to manage membership by requiring a certain level of credit quality
 - But then initial margins and default fund contributions are based on market risk of their portfolio
 - So this separation of credit risk and market risk may mean that CCPs end up ignoring WWR!!
- For CDS, CCPs have a problem in quantifying the WWR component in defining initial margins and default funds
 - Recall that higher credit quality can increase WWR (i.e. when things turn bad, they can turn really bad for previously highly rated credits)
- CCPs also face WWR on the collateral they receive
 - Particularly true if they accept a wide range of eligible securities for initial margin purposes