When collateral is posted against an exposure, it can essentially be regarded as reducing that exposure in the event of counterparty default, i.e. it is not required to give back the collateral in this case. Collateral in the form of securities involves transfer of ownership, although the collateral giver remains the owner of the security for economic purposes (such as payments of coupons and dividends).

Derivatives collateral is fundamentally different in both type and nature from the use of physical assets as security for debts. Secured creditors have a claim on particular assets but their ability to realise the value of the assets is subject to delays in the bankruptcy process. It is possible for secured creditors to petition the bankruptcy court to release their security but this is a complicated process (for example, see Baird, 2001). In contrast, collateral posted against derivatives positions is, in most cases, under the control of the counterparty and may be liquidated immediately upon an "event of default". This arises due to the laws governing derivatives contracts and the nature of the collateral (cash or liquid securities under the immediate control of the institution in question). Exposure, in theory, can be completely neutralised as long as a sufficient amount of collateral is held against it. However, there are legal obstacles to this and aspects such as rehypothecation (or re-lending, discussed in detail in Chapter 3). This was a significant issue in the Lehman Brothers' bankruptcy of 2008.

Whilst collateralisation is a very powerful mitigation tool against counterparty risk, it does give rise to other risks such as market risk, operational risk and legal risk. Hence, collateralisation needs to be implemented carefully and represents a significant workload for an institution. However, it is increasingly common that many counterparties will simply not trade on an uncollateralised basis.

By the end of 2008 the total amount of collateral used in all OTC derivatives transactions was reported as being $4 trillion, an 86% increase.[6] Large US Commercial Banks have collateral covering 30–40% of net credit exposures. Collateralisation, although common, has been arguably still underused as a mechanism for reducing counterparty risk. Many market participants have been reticent to enter into stringent collateral agreements due to the need to post cash or high-quality securities and the operational workload associated with maintaining regular margining.

2.3.5 Walkaway features

Although standard OTC derivatives documentation dictates that exposure is as defined as in Section 2.2.6, in certain cases transactions may have "walkaway" or "tear-up" features. Such a clause effectively allows an institution to cancel transactions in the event that their counterparty defaults. They would clearly only choose to do this in case their overall MtM was negative (otherwise they would have a recovery claim on their exposure). Hence, a walkaway agreement means an institution can cease payments and will not be obliged to settle money owed to a counterparty on a mark-to-market basis. An institution can then gain in the event a counterparty defaults and may factor in this gain when assessing the counterparty risk (this will be assessed in Chapter 7).

In terms of defining exposure with a walkaway feature, we could write it simply as:

$$\text{Exposure}_{\text{walkaway}} = \text{MtM}. \tag{2.2}$$

[6] ISDA Margin Survey 2008, see *http://www.isda.org/c_and_a/pdf/ISDA-Margin-Survey-2008.pdf*

so that positive MtM represents exposure as before but negative MtM represents "negative exposure" meaning that an institution would gain if their counterparty were to default.

2.3.6 Monolines

An obvious way to control counterparty risk is to limit or reduce credit exposure. However, an alternative solution is to simply only trade with counterparties with very strong credit quality. This is essentially the route taken by monoline insurance companies, who have provided guarantees[7] on various credit products to banks. A bank can have a significant credit exposure to a monoline but this potential risk issue is "solved" by the monoline gaining a triple-A rating (since a triple-A institution will almost surely not default). The triple-A ratings granted to monolines are interesting in that they are typically achieved thanks to the monoline *not* being obliged to post collateral against transactions. Hence, an institution trading with a monoline is critically relying on this triple-A rating to minimise their counterparty risk. One might reasonably ask the question as to why an institution's credit quality is somehow improved by the fact that they do *not* post collateral (monolines would typically be unable to gain triple-A ratings if they entered into collateral agreements). Indeed, this point is a first clue to the fundamental flaw in the triple-A ratings granted to monolines as discussed in more detail in Chapters 8 and 13.

A credit derivative product company (CDPC) is a simpler version of a monoline, essentially entering into the same business with a similar business model. The credit crisis has caused serious problems for monolines and CDPCs[8] and shown their business model to be fundamentally flawed. The rating agencies, who assigned the much-coveted triple-A ratings awarded to these institutions, have also been heavily criticised. We will argue in Chapter 8 that monolines and CDPCs represent an extreme case of wrong-way risk and, far from minimising counterparty risk, that they create more of it in a particularly toxic and systemic form.

2.3.7 Diversification of counterparty risk

The basic idea of diversification is to avoid putting all your eggs in one basket. Market participants can achieve this by limiting credit exposure to any given counterparty, in line with the default probability of that counterparty. This is the basic principle of credit limits discussed in Chapter 3. By trading with a greater number of counterparties, an institution is not so exposed to the failure of any one of them. Diversification is not always practical due to the relationship benefits from trading with certain key clients. In such cases, credit exposures can become excessively large and must be mitigated by other means.

2.3.8 Exchanges and centralised clearing houses

The credit crisis of 2007 onwards triggered grave concerns regarding counterparty risk, catalysed by events such as Lehman Brothers, the failure of monoline insurers (with

[7] Monolines are not allowed to trade derivatives but are allowed to enter into insurance contracts which essentially achieve the same goal.
[8] Although some CDPCs have escaped due to a late entry into the market.

triple-A ratings), bankruptcy of Icelandic banks (more triple-A ratings) and losses arising from some (yes, you've guessed it, triple-A) structured products. Whilst there are many ways to control and quantify counterparty risk better, in times of crisis it is natural to look for the silver bullet solution also. A centralised clearing house offers such a solution since counterparties would simply trade with one another through the clearing house that would effectively act as guarantor to all trades. All OTC derivatives traded through a clearing house would then be free of counterparty risk. The only issue is to ensure the default-remoteness of the clearing house itself.

Whilst clearing houses certainly constitute one of many ways to control and reduce counterparty risk, it is unlikely that they will offer a complete solution to the problem. We will discuss this in more detail in Chapter 14 but for now we just emphasise that it is rather easy to pass counterparty risk around (like a hot potato) but very difficult to actually get rid of it. Indeed, attempts to reduce counterparty risk have often led to a redistribution of the risk in another, potentially more toxic, form. Monolines represent a classic example of this mistake and it is important to ensure that similar errors are not made. Clearing houses also create moral hazard problems that may lead to the creation of subtle long-term risks whilst appearing to reduce the obvious short-term risks.

2.4 QUANTIFYING COUNTERPARTY RISK

Whilst counterparty risk can be strongly reduced via some combination of the methods described above, it certainly cannot be eradicated completely. Hence, it is important for an institution to correctly quantify the remaining counterparty risk and ensure that they are correctly compensated for taking it. Broadly speaking, there are three levels to assessing the counterparty risk of a single transaction:

- *Trade level.* Incorporating all characteristics of the trade and associated risk factors.
- *Counterparty level.* Incorporating risk mitigants such as netting and collateral for each counterparty individually.
- *Portfolio level.* Consideration of the risk to all counterparties knowing that only a small fraction may default in a given time period.

It is important to evaluate also the benefit of hedging counterparty risk with credit derivative transactions as this is another mechanism for reducing risk and should be considered alongside pricing aspects.

2.4.1 Credit lines

Throughout the rest of book, we will see many cases where the characterisation of exposure is important for pricing, risk management and regulatory purposes. For now though let us consider the first and most basic use of exposure, which is as a means to control the amount of risk to a given counterparty over time. This is achieved via attributing a credit line or credit limit to each specific counterparty as illustrated in Figure 2.4. The idea is to characterise the potential future exposure (PFE) to a counterparty over time and ensure that this does not exceed a certain value (the credit line). The credit line will be set arbitrarily according to the risk appetite of the institution in

- downgrade probability (worsening credit quality) of counterparty;
- correlation between counterparties.

All of the above variables are likely to be built into the defined credit line in some way. For example, a low default probability or high recovery may lead to a larger line, whilst a significant chance of downgrade may mean the credit line is decreased over time (as is the case in Figure 2.4). Finally, a counterparty that is highly correlated to others should have a lower credit line than a counterparty of the same credit quality but lower correlation. However, such decisions are made in a qualitative fashion and the nature of credit lines leads to either accepting or rejecting a new transaction with reference to exposure alone and not the actual profitability of the transaction. This is a key motivation for the pricing of counterparty risk.

2.4.2 Pricing counterparty risk

Traditional counterparty risk management, as described above, works in a binary fashion. The use of credit lines, for example, gives an institution the ability to decide whether to enter into a new transaction with a given counterparty. If the credit line would be breached then a transaction may be refused (unless it was made a special case). The problem with this is that the risk of a new transaction is the only consideration whereas the return (profit) should surely be a consideration also.

By pricing counterparty risk, one can move beyond a binary decision-making process. The question of whether to do a transaction becomes simply whether or not it is profitable once the counterparty risk component has been "priced in". As we will show in Chapter 7, the risky price of a derivative can be thought of as the risk-free price (the price assuming no counterparty risk) less a component to correct for counterparty risk. The latter component is often called CVA (credit value adjustment). As long as one can make more profit than the CVA, then the transaction is a good one. This counterparty risk charge should be calculated in a sophisticated way to account for all the aspects that will define the CVA:

- the default probability of the counterparty;
- the default probability of the institution (in the case of bilateral pricing covered in Chapter 7);
- the transaction in question;
- netting of existing transactions with the same counterparty;
- collateralisation;
- hedging aspects.

No transaction will be refused directly but an institution needs to make a return that more than covers the incremental counterparty risk of the transaction, i.e. the increase in risk taking into account netting effects due to any existing trades with the counterparty. Other aspects such as collateralisation should also be considered. Pricing aspects are considered in detail in Chapters 7 and 8.

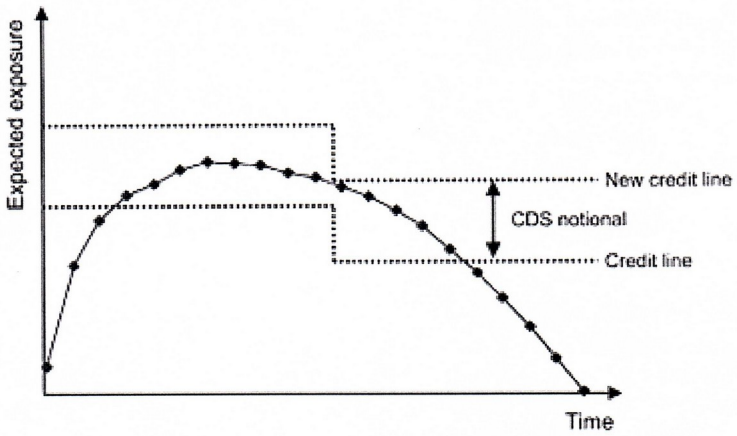

Figure 2.5. Illustration of CDS hedging in order to increase a credit line.

2.4.3 Hedging counterparty risk

The growth of the credit derivatives market has facilitated hedging of counterparty credit risk. Suppose an institution has a $10m netted exposure (uncollateralised) which is causing concern and furthermore preventing any further trading activity with the counterparty. Buying $10m notional of credit default swap (CDS) protection referenced to this counterparty will hedge this credit exposure. The hedging depends on the ability to trade CDS on the counterparty in question and comes at a cost. However, hedging enables one to reduce the exposure to zero and hence provides a means to transact further with the counterparty. CDS hedging can be considered to therefore increase a credit line by the notional of the CDS protection purchased.[9] This provides a means to use CDS protection to hedge the extent to which a transaction exceeds a credit line. The combination of hedging some portion of the exposure may be considered the most economically viable solution to trading with some counterparties. This is illustrated in Figure 2.5.

More tailored credit derivative products such as CCDSs (contingent credit default swaps) have been designed to hedge counterparty risk even more directly. CCDSs are essentially CDSs but with the notional of protection indexed to the exposure on a contractually specified derivative. They allow the synthetic transfer (to a third party) of counterparty risk related to a specific trade and counterparty. Suppose institution A trades a contract with party X and has counterparty risk. If A now buys CCDS protection from a party Y referencing both counterparty X and the underlying contract involved, then it has effectively passed the counterparty risk to Y (without X needing to be involved in the arrangement). Institution A now has risk to only the joint default or "double-default" of counterparties X and Y. This concept of mitigating counterparty risk will be discussed in more detail in Chapter 10.

[9] There are some technical factors that should be considered here, which may mean that the hedge is not effective. These will be discussed in detail in Chapters 6 and 9