The Credit Default Swap

Richard K. Skora
Skora & Company, Inc.

This article shows how risk neutral pricing theory can be applied to price a credit default swap. The price is obtained by explicitly constructing a hedge from the underlying cash market instruments.

A credit default swap is the most straightforward type of a credit derivative. It is an agreement between two counterparties that allows one counterparty to be “long” a third-party credit risk, and the other counterparty to be “short” the credit risk. Explained another way, one counterparty is selling insurance and the other counterparty is buying insurance against the default of the third party.

For example, suppose that two counterparties, a market maker and an investor, enter into a two-year credit default swap. They specify what is called the reference asset, which is a particular credit risky bond issued by a third-party corporation or sovereign. For simplicity, let us suppose that the bond has exactly two years’ remaining maturity and is currently trading at par value.

The market maker agrees to make regular fixed payments (with the same frequency as the reference bond) for two years to the investor. In exchange the market maker has the following right. (For simplicity assume default can occur only at discrete times, namely, at the times the coupon payment is due.) If the third party defaults at any time within that two years, the market maker makes his regular fixed payment to the investor and puts the bond to the investor in exchange for the bond’s par value plus interest. The credit default swap is thus a contingent put – the third party must default before the put is activated (Figure A).

In this simple example there is little difference in terms of risk between the credit default swap and the reference bond. Because the swap and the bond have the same maturity, the market maker is effectively short the bond and the investor is long the bond. (In the real world, it is often the case that the bond tenor is longer than the swap tenor. This means that the swap counterparties have exposure to credit risk, but do not have exposure to the full market risk of the bond.)

The simplicity of our example helps clarify how the instrument is priced. Pricing the credit default swap involves determining the fixed payments from the market-maker to the investor. In this case it is sufficient to extract the price from the bond market. One does not need to model default or any other complicated credit risk process. To apply risk neutral pricing theory one needs to construct a hedge for the credit default swap. In this simple example, it is sufficient to construct a static hedge. This means the cash instruments are purchased once, and once only, for the life of the credit default swap; they will not have to be sold until the termination of the credit default swap.

The hedge is different for the market maker and investor. If the market-maker were to hedge the credit default swap, then it would need to go long the bond. As illustrated in Figure B, the market-maker borrows money in the funding markets at Libor and uses those funds to purchase the corporate bond, which pays Libor + X basis points. The hedge is paying the market-maker a net cashflow of X basis points.

If the reference asset does not default, then at the termination of the swap the market maker simply unwinds the hedge at no net cost. If the reference asset defaults, then the market-maker immediately unwinds the hedge. It delivers the bond to the investor in exchange for the par amount, and repays its borrowed funding with the principal. This perfectly hedges the market-maker’s risk in the credit default swap.

Now apply the same reasoning to the investor. If the investor were to hedge the credit default swap, then he would need to short the bond. As Figure C illustrates, the investor borrows the bond in the repo markets. In order for the investor to borrow the bond, he must lend the face value of the bond to the repo market at what will certainly be a sub-Libor rate. Suppose the investor lends the par value of the bond at Libor – Y basis points in exchange for borrowing the bond. The bond lender keeps the bond’s coupon payments.

The value Y can be quite large, for two reasons. Firstly the investor is making a collateralised loan. The bond is collateral against the loan, so the borrower expects a low borrowing rate. And secondly, the market for shorting the credit risky bond is inefficient. The value of Y might be anywhere from 20 to 150 basis points.
The investor then sells the bond in the debt markets and must pay Libor + X basis points to the bond buyer. The hedge is costing the investor a net cashflow of X + Y basis points. This perfectly hedges the investor’s risk in the credit default swap.\(^2\)

Notice that the hedges are not symmetric. The market maker is receiving X basis points from his hedge while the investor is paying X + Y basis points from his hedge. So the hedges determine the price of the credit default swap up to a range. The market is left with a spread of approximately Y basis points which cannot be arbitraged away.

Exactly where the price of the credit swap falls in the range of X to X + Y depends on the counterparties and their motivations. Counterparties to credit default swaps are entering into a customised, off-balance sheet transaction that has certain intangible advantages over the cash markets. Market-makers or commercial bank lenders looking for credit protection on a certain name might be willing to pay as much as X + Y or more. On the other hand an investor looking for some extra premium may be willing to accept as little as X or less. Market makers with sub-Libor funding rates, and investors with above-Libor funding rates, would find the credit default swap even more favourable.

In general, pricing credit default swaps is not this simple. We mentioned above that the bond tenor may well be longer than the swap tenor, but it is also often the case that the bond is not trading at par, or that coupon payments are fixed instead of floating. The price also depends on the particular terms of the swap agreement and the reference security.

Despite the simplicity, the exercise demonstrates several things. Firstly, risk neutral pricing theory both works and does not work in the credit markets. It gives a good bound for the price of the credit default swap, but it does not give a single price because the assumptions of risk–neutral pricing (market completeness, liquidity and lack of transaction costs) do not apply. Note that the market uses risk neutral pricing (with care) to price credit default swaps and other credit derivatives. In particular, pricing models are calibrated to the bond market, as opposed to calibrating to the historical price of credit. Sometimes looking at historical default rates and recovery rates serves as a good check of the final price.

---

\(^2\) Actually this is not a perfect hedge. The investor has taken on a very small amount of additional credit risk to the Repo markets.
Secondly, the credit default swap is somewhere in-between a cash instrument and a derivative product. The more complicated credit default swaps may not be perfectly replicated in the cash markets, but the cash markets give some guidance to the correct price of default swaps.

The credit default swap market will follow the interest rate swap market. While the credit default swap market will never be as deep nor as liquid as the interest rate swap market, the bid/ask spreads will decrease and the credit default swap will function like its own primary market. Thus the default swap curve should serve as the starting point to pricing all other credit derivative models, just as the interest rate swap curve is the input into pricing all other interest rate derivatives.
Credit Default Swap

Counterparty A \(\rightarrow\) Fixed Payment \(\rightarrow\) Counterparty B

Counterparty A \(\rightarrow\) Bond + fixed payment \(\rightarrow\) Par Value of Bond + Interest \(\leftarrow\) Counterparty B

Default

Counterparty A \(\leftarrow\) Par Value of Bond + Interest \(\leftarrow\) Counterparty B

No Default

Credit Default Swap
Figure A

Debt Market \[ \text{Libor + X} \] Counterparty A

Libor

Funding Market

Market Maker’s Hedge

Figure B
Investor's Hedge

Figure C
Skora & Company Inc. is a new credit risk management advisory firm which offers numerous products and services to successfully manage, trade, sell, model and structure credit risk. It has the expertise and experience to support its clients at every stage of their business development.

Skora & Company has already helped financial and non-financial institutions set up profitable credit derivatives trading desks, build cutting edge portfolio credit risk management systems, and design efficient credit risk/return performance analytics.

Richard K. Skora is the founder of Skora & Company. He worked in the credit risk management since 1992. He also traded various exotic credit derivatives including default swaps, default options, and basket swaps.

Mr. Skora received a B.S. in mathematics from The University of Illinois in Champaign-Urbana and a Ph.D. in mathematics from The University of Texas in Austin. He held academic positions at The Institute for Advanced Study in Princeton and Columbia University in New York.