# Risk management of Credit Default Swap

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**Abstract**

Credit derivatives are an up to date innovation in financial markets. These financial instrument have a potential to allow enterprises to trade and manage the credit risks and market risks. The striking growth of credit derivatives suggest that participant of financial markets find them to be useful instrument for risk management. The most popular and fundamental credit derivatives is a credit default swaps (CDS). In the paper we detailed the risk management of the credit default swaps and quantified the credit risk of investors in two way: (i) calculate the term structure of default probabilities from the market prices of traded CDS and (ii) calculate prices of CDS from the probability distribution of the time-to-default

Keywords: credit risk; credit default swap; risk management;

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## 1. Introduction

 Credit risk is becoming increasingly important theme for evaluation and risk management in the financial industry. Interest rate risk remains the most important risk factor to consider because it affects the entire market, but credit risk is essential when it comes to debt instruments based strictly on credit. There are many different types of credit derivatives products; we are focused on Credit Default Swap (CDS).

Credit default swap represents a tool developed for credit risk management. Credit default swap spreads can be used as an indicator of the potential situation of an enterprise. Financial market participants are interested in factors that determine price of these contracts and in other aspect that are related with the determination of credit default swap spreads.

## 2. Credit default swap

CDS is the simplest and most important credit derivative which is designed to protect investors against losses on bonds or loans after default by the issuing enterprises. (O´Kane, D., 2008). It is a bilateral financial contract in which one party of contract (protection buyer - buyer of hedging or the seller of credit risk) pays periodic payments (premium) to the other party of contract (protection buyer or the seller of credit risk) consider that it provides the hedging (protection) in case of a credit event that is linked to an underlying assets (Wagner, 2012).

The settlement of the contract depends on the particular conditions specified in the contract. There are basically three ways of settlement (Wager, 2012):

*(i)* Physical delivery – the most common method of settlement, the delivery usually takes place within 30 days after the credit event.
*(ii)* Cash settlement – this settlement is less common than physical, mostly takes place within five working days after the credit event.
*(iii)* Prearranged fixed amount – obtaining prearranged fixed amount regardless of the rate of return (recovery rate).

Lipton, A., Rennie, A. (2013) however indicate that determine how much I will in reality finally paid creditors may take many months, since it is necessary to determine the value of the debt, in reality, however, this time associated primarily with securing the needs of dealers.

More specifically, the credit events which result in a default occurs will be designed later in this paper. Figure 1 demonstrates the mechanism of the CDS contract. CDS buyer pays periodic payments to the seller until a credit event occurs or until CDS contract expires.
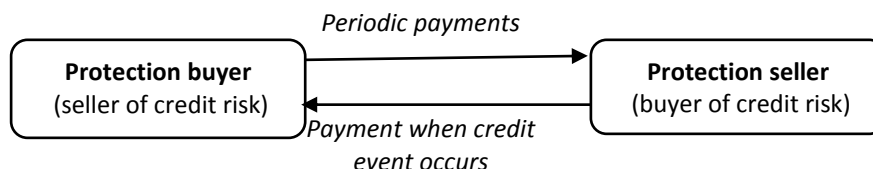


**Figure 1. CDS mechanism**
Source: Own processing

CDS can be subdivided by number of reference entities whose bond or debt is underlying instrument for the CDS contract. We distinguish between (Witzany, 2010):

*(i)* Single name CDS – it is a contract which is against credit risk provides one reference entity.

*(ii)* Multi name CDS – it is a contract represents with participates more the one reference entity, i.e. basket CDS or CDS indices.

### 2.1. Credit events

The standard CDS contract expires either at maturity day if the credit event has occurred during the duration of the contract, or when the credit event occurred. ISDA defines a standard set of these events, see the following table.

**Table 1.**

| EVENT | SPECIFICATION |
|---|---|
| Failure to pay | With the failure of the reference entities in payment (a certain time delay is tolerated – Grace period). |
| Bankruptcy | It refers to the enterprise bankruptcy that become insolvency or unable to pay its obligations. |
| Restructuring | It includes reduction in coupon or extension maturity instead of default. |
| Repudiation | This applies to government reference entities, mostly relevant for emerging economies. |
| Obligation acceleration or obligation default | Linked with technical defaults such failure of contract of commitment (rarely included). |

Source: Own processing according ISDA

## 3. Basic approaches to pricing of credit risk

The valuation of CDS contracts can be based on classical models of credit risk pricing. There are basically two kinds of approaches to cred risk modeling – *(i) structural approach and (ii) reduced form approach*. These approaches differ primarily in how they view the main variables that affect credit risk of financial assets, namely the probability of default, loss given default and exposure at default.

### 3.1. Structural approach

Structural approach includes models that are based on the values of society and investigate capital structure. According to Giesecke, K. (2004) within a structural approach shaped explicit assumptions about the dynamics of the company's assets, its capital structure, debt and owning shares. The company gets into default if its assets by inadequate certain benchmarks. In such a situation can be characterized as the company's obligations call option on the assets of the company.

A typical representative model belonging to the structural approach is the Merton model that was presented in the study Merton (1974), which builds further on the concept looking at the company's liabilities from the study of Black and Scholes (1973) and therefore uses principles option valuation. The assumptions of the model, according to a study Merton (1974) include:

- the absence of transaction costs, taxes or problems with the indivisibility of assets,
- the existence of a sufficient number of investors with comparable wealth levels, while each investor believes he can buy and sell at the market price of such amount assets it wants,
- received and granted loans bear interest at the same interest rate,

- the existence of options, short selling,
- trading assets takes place in continuous time,
- the validity of Modigliani-Miller theorem,
- the yield curve is flat, the risk free rate is constant over time,
- the dynamics of the value of the company at a time can be described by a diffusion stochastic through a process of differential equations:

$$dV = (\alpha V - C)dt + \sigma V dz \tag{1}$$

Where:

$\alpha$ - is instantaneous expected rate of return on the enterprise´s value per unit of time.

$C$ – is a summary of pay-outs to shareholders and creditors of the enterprise per unit of time (dividends or interest payments).

$\sigma$ – is a standard deviation of the random component, the value of the enterprise per unit of time.

$dz$ – is a standard Gauss-Wiener process.

The Merton idea is to model the default as an event that occurs when the value of assets is less than the value of its debt.  This model assumes a very simplified capital structure consisting of (i) the nominal value of the "F" bonds with zero coupons for a total value "D" and maturity "T" and (ii) shares of a total value "E" with pays no dividends. At any time the value of the enterprise assets "A" coupled with enterprise debt "D" and the equity "E". The value of enterprise assets is therefore equal to the sum of the values of debt and equity.  According Merton, default can only occur at time "T", i.e. the maturity of debt.  The enterprise can then be located either in solvency (if A(T) ≥ F) or in insolvency (if A(T) < F) (O´Kane, 2008).

For holder of shares is valid at time T the following equation:

$$E(T) = \max[F - A(T), 0] = min\,[F, A(T)] \tag{2}$$

And for holder of bonds is valid:

$$D(T) = F - \max[F - A(T), 0] = min\,[F, A(T)] \tag{3}$$

Payment at maturity to the bondholder is thus equivalent to the nominal value of the bond reduced by a call option issued to the enterprise on a strike price equal to the nominal value and the bond maturity equal to the maturity of the bond. Merton by this basic intuition derived a formula for risk bonds which can be used to determine the probability of default of the enterprise or to estimate the difference in profitability between risk and riskless bonds (Lipton & Rennie, 2013).

Witzany, J. (2010) indicates that the model has a number of drawbacks, e.g., that the process of determining the market value of assets is hidden and is not observable in most cases, this problem is It can be overcome by using stock market data, because the value of the assets follows about the value of assets. Among other shortcomings ranks that assets have different liquidity or that the default can occur at any time prior to maturity only at maturity.

According to O 'Kane, D. (2008) are among the main weaknesses of the model:

(1) Greatly simplified capital structure,

(2) A default may occur in only one moment at a time of debt maturity T,

(3) The model operates with zero-coupon bonds,

(4) Transparency regarding is limited the value of corporate assets,

(5) Credit spread for companies with A (t)> F is close to zero.

Despite these restrictions, the study Merton became the basis for a series of studies dealing with measurement of credit risk, in which authors try to liberate especially unrealistic Merton's original assumptions of the model. The study is based on Merton example Art. Black and Cox (1976), Geske (1977) or Vasicek (1984). As part of their research are rate return and probability of default function of the structural characteristics of the company. Rate return is an endogenous variable. In other studies, e.g. the authors of Hull and White (1995) and Longstaff and Schwartz (1995), then the rate of return is an exogenous variable, independent the value of company assets.

The study also derives some authors who are dedicated to finding the factors that affect the price these contracts, for example. Abid and Naifaru (2006), Ericsson et al. (2009), Cesare and Guazzarotti (2010), Annaert et al. (2013) and others.

### *3.2. Reduced form approach*

In response to the weaknesses of the structural models started in the 90´discover studies attempting to eliminate them. According to Giesecke, K. (2003) the reduced form approach does not address the question of why the company gets into default, instead it exogenously given dynamics of default through the default rate, which is based on market prices.

Reduced models in principle from the typical structural models differ in step predictability of default, since they can incorporate failures that can occur randomly. Typical reduced model assumes that the default is controlled by exogenous random variables and that probability of default during any time interval is not equal to zero. Default occurs in case the discrete random variable crosses the threshold. Reduced models deemed a failure based on the Poisson process for unpredictable events. Time when occur, cannot be predicted on the basis of the information available today (Lipton and Rennie, 2013, p. 43). Reduced models also represent separate explicit assumptions on the dynamics of both the probability of default and rates of return that are modeled independently of the structural characteristics of. The rate of return is exogenous variable independent of the probability of default.

Reduced models can be found e.g. in studies by the authors Jarrow and Turnbull (1995), Jarrow, Lando and Turnbull (1997), Duffie (1998) and Duffie and Singleton (1999).

## 4. Conclusion

The original purpose of credit derivatives was to protect banks and other financial institutions against losses caused as a result of credit events (Fabozzi, 2002). In the early days of the market for credit derivatives therefore they acted primarily banks, which are through these derivatives secured against credit risk on loans, which held. Currently credit derivatives used broad spectrum of market participants immediately for several reasons, as it allows them to actively manage credit risk. Allow this risk diversify, but also move to another subject. According Revenda, Z., (2004) credit Derivatives allow for hedging against credit risk of bond issuers or debtors from loans, but also give the opportunity to the creditworthiness of these entities to speculate.

## Acknowledgements

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