CDS Spreads: an Empirical Analysis on the Determinants

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Abstract
Since the financial crisis in 2007, policy makers and regulators have had an increasing interest in credit derivatives, in particular in credit default swap (CDS) agreements. The main point concerns the fears that speculative operations of these instruments on the market continue to generate and increase the tensions in the financial markets. The purpose of this paper is to examine the factors which define the changes of CDS premiums, therefore, to analyse the indicator ability of CDS spreads on the credit market. In detail, the empirical analysis is focused on a sample of 18 European corporate listed on the Stock Exchange holding five-year CDS spreads. The timeline considered is from 1st January 2005 to 31st December 2011, taking into account both the period before the financial crisis and that immediately after. Data has been elaborated from Datastream and Bloomberg. The choice to analyze the European companies has been made to verify the behaviour of the determinants of CDS in a market that has very different characteristics compared to the U.S (both structural and regulatory). An aspect that deserves special attention is the loss of significance of the "leverage" variable, as it is not consistent with the finding of the Merton’s Model.

Keywords: CDS; Credit risk; Credit spreads.
JEL classification: G120; G130; G29.

1. Introduction
Since the financial crisis in 2007, policy makers and regulators have had an increasing interest in credit derivatives – in particular in credit default swap (CDS) agreements. The main point concerns the fears that the speculative operation of these instruments on the market continue to generate and increase the tensions in the financial markets, causing destabilizing effects.

The credit derivatives represent an important instrument through which it is possible to separate, price, and transfer credit risk incorporated in a financial asset regardless the specific form it takes (bonds, bank loans, mortgages, etc.). The innovation generated by credit derivative is that a credit risk is not connected with any other risk elements which marks out assets and carries out a transfer of such risk on the market, without affecting the existing activities. The credit risk is evaluated and negotiated, favouring a more dynamic and flexible management of the related exposures. The CDS is a bilateral contract where a party (the protection buyer) transfers through the payment of a predetermined amount at a fixed deadline credit risk relevant to the financial instrument (reference entity)³ to the other party (the protection seller); the counterpart, in return for periodic premiums, engages itself to pay a sum to the protection buyer in case a

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³ In addition to CDS contracts related to a specific reference entity (the so called single name CDS), there are further contracts which are as widespread: index or basket CDS. In such case each reference entity accounts for the same aggregate nominal value of the contract. The most widespread of the index CDS are those managed by Markit, which include the indices of European issuers with single name CDS (iTraxx indices) and those covering USA issuers (CDX indices).
specific credit event occurs within a year. Generally, the duration of this instrument is 5 years but being a negotiable contract in the OTC markets and, therefore non standardized, the parties have free choice to decide the deadline. As to the payments made by the protection buyer in favour of the seller they are hold on a quarter, biannual or annual term basis (it is mostly on a quarter term basis). The value of the CDS is updated in real time; in the OTC markets the financial institutions often operate as market makers, committing to increase liquidity of the derivative instruments, exposing on an ongoing basis proposals of sale of purchase. The price of a CDS is the annual cost that the protection buyer must bear to protect himself from the credit risk of a specific issuer. Operatively, the spread on a CDS contract is obtained resolving, for the quarterly premium, the equation which equals the current value expected of the payments made by the protection buyer (premium part) to the current value expected of the insolvency costs borne by the protection seller (protection part).

The exceptional growth of CDS has been favoured by the numerous opportunities that these instruments offer their users. Credit default swap, as all the derivative securities, is an extremely effective instrument used not only for hedging and trading, but it also allows the operators to make use of probable arbitrage opportunities. CDS were issued as useful financial instruments providing protection and insurance against credit risk in a market where the buyer also owned the underlying and have soon been transformed in speculative instruments on the probability of default of the debtor with an increased volume to the point to become a multiple of the value of the securities or of the credit reference reports. This exceptional growth of CDS, traded in the over-the-counter markets without a regulation and control by the surveillance authorities, is considered as one of the main causes of the financial crisis.

In this setting of increasing importance for the activity of the credit risk management, the indicator ability of CDS spreads on the credit market have revealed a certain interest. The term “indicator” means to provide information, providing the economic operators elements regarding the changes of the expectations of the probability of default of an issuer. The flow of new information which is generated on the issuers is incorporated more rapidly in the prices of the CDS compared to the variations on the spreads of the underlying corporate bonds. The analysis of the tendency of the CDS spreads prices assume a leader role in the price discovery process, understanding in advance the variations of the credit quality of the reference entity. The value of the “indicator” of CDS spreads in the credit market has been recently highlighted due to the “failure” of the rating agencies as an indicator to represent and ‘monitor’ the credit risk associate to an established reference entity.

The objective of this study is to examine the factors which determine the changes of CDS premiums and therefore to identify the most significant variables when unfolding their volatility.

The empirical analysis is conducted in a sample of 18 European corporate listed in the Stock Exchange holding five-year CDS spreads. The time period considered is from 1st January 2005 to 31st December 2011, including both the period prior to the start of the financial crisis and that immediately after. Elaboration is based on data from Datastream and Bloomberg. The regression model align with the literature of the

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4 The purchase of CDS implies the taking over of a short position on the credit risk of the reference entity. Employing a short position on the credit risk may be achieved through short selling of bonds of the reference entity. This operation can be more complex and risk-taking compared with the purchase of a CDS for at least two reasons: 1) short selling is limited in the low uptake of securities lending on some debt instruments; 2) the securities lending contract has a short-term duration and therefore has to be renegotiated periodically generating risk bond to the volatility of the cost of securities lending. The buying of CDS instead allows to undertake a short position for a long period of time without incurring into the operational problems and risks typical of short selling of securities. In relation to the financial position, the CDS have a non-linear pay-off typical of the options, while a short selling has a linear pay-off typical of spot transactions. Consequently, buying CDS allows to have a leveraged position (as it is a derivative instrument that can be assimilated at put options on the credit merit of the reference entity) but it implies the payment of the periodic premium; short selling does not have costs of this type but it absorbs capital; and finally CDS involves taking counterpart risk which is normally much higher compared to the short selling one.
“structural model” includes, among the explanatory variables, the main factors which, according to theory, are important for the assessment of the credit risk of a firm.

The CDS is a useful source of information on the price of credit under normal circumstances. However, the CDS market is highly concentrated in the hands of a small group of dealers, which is European banks main concern as regards CDS counterparty risk. This concentration increases the liquidity risk in the event of another dealers failure.

2. The Theoretical Determinants of CDS Spreads

The spread of a CDS is the annual amount the protection buyer must pay the protection seller over the length of the contract, expressed as a percentage of the notional amount. CDS spreads are expressed in basis points (bps), basically they are the premium paid for the risk of default undertaken by the protection seller. It is understandable how CDS spreads and the probability of default of the reference entity are connected by a relation of direct proportion. Greater is the probability of default of the issuer and therefore, the probability of a credit event agreed in contractual session, higher is the premium the protection seller will request to accept the credit risk. Therefore, on first approximation, CDS prices reflect the expectations of the default probability of the reference entity; in other words, it can be assumed that CDS prices are equal to the probability of default expected (default probability – PD) occurred for the recovery rate (RR). Therefore:

\[
\text{CDS spread} = \text{PD} \times (1 - \text{RR})
\]

where PD x (1-RR) is the expected loss (EL).

Actually, CDS prices also include an element connected to the risk premium, namely the compensation paid to investors for enduring exposure to default risk.\(^5\) Spread equals to the expected loss (EL) plus the risk premium (RP).

\[
\text{CDS} = \text{EL} + \text{RP}
\]

CDS spread = expected loss + risk premium
= expected loss × risk adjustment

where:

risk adjustment = 1 + price of default risk.

Spread is expressed as risk-adjusted expected loss, where the adjustment factor varies in proportion with the price of the default risk. This price may be interpreted as compensation per unit of expected loss and it is an indicator of default risk averse for the investors: a positive value means the investors demand to be compensated to a greater extent than actuarial losses.

Consequently, a risk premium reflects a subjective factor related to the level of risk averse of the investors and factors related to the level of volatility of the variables of the market which may affect the probability of default. The risk premium may vary over time, since it can change the risk averse of the participants, who will request, for the same risk loss, a higher risk premium. In theory, there are two distinct types of default risk which may require a premium. The former is a cyclic variation in expected losses which usually increase in phases of economic stall (systematic risk), when the overall income growth is low. The latter, the jump-at-default risk, is given by an actual default of an entity and by its impact on issuers’ wealth owing to the impossibility to exactly diversify credit portfolios. CDS prices can reflect many factors including the expected probability of default, the recovery rate in case of default, the risk premium for unexpected default and the risk premium for the volatility of the factors describing the probability of default. It is likely, for example, that an increase in CDS prices does not reflect an increase in the expected

\(^5\) Amadei et al. (2011).
probability of default but only an increase in the risk premium or a reduction in the expected recovery rate in case of default.

Two different approaches on risk credit have been identified in the literature: the reduced-form approach models and the structural approach models. The reduced-form models or intensity-based models are a relatively recent approach to credit risk. They were originally introduced by Jarrow and Turnbull (1992) and were further analyzed in other works\(^6\). The reduced-form models seek to deduce the arrival of default from the market data rather than to investigate the dynamics of the assets and liabilities of a company object of the study. In such way the attention is focused on the occurrence of default meant as an exogenous event model: the aim is to obtain a complete description of the statistic proprieties of the process which lead to bankruptcy or default of risk, in order to allow the assessment of the main financial instruments and the related assessment of the derivatives.

Regarding the decomposition of **CDS spreads**, this model assumes that defaults occur randomly where the probability of default over a short time interval (e.g. a day or a month\(^7\)) is represented by \(h^p\). In principle, \(h^p\) may be a variable which follows a stochastic process that varies according to macroeconomic, sector-specific or firm-specific conditions. Further inputs of the model include:

- loss-given-default (L);
- risk free interest rates (\(r\)) for discounting cash flows;
- the price of systematic risk and jump-at-default risk (\(\Gamma\)).

Each of these elements may in turn vary with economic conditions. In general, the risk-adjusted intensity (\(h^Q\)), which is relevant for pricing CDS contracts, differs from the actual intensity (\(h^p\))\(^8\). If the investors do not request a premium for the jump-at-default risk, then \(h^Q\), and \(h^p\) are equal; otherwise, it is expected that \(\Gamma > 0\), therefore \(h^Q > h^p\). The spread on a CDS contract is obtained by solving, for the quarterly premium, the equation which equals the expected present value of payments made by the protection buyer to the present value of default costs borne by the protection seller. CDS contracts state M quarterly payment dates, \(t = t_1, t_2, \ldots, t_M\) on which the premium is to be paid. It is expected that default can occur only on premium payment dates.

At the origination of a contract at time \(t\), the expected present value of the protection buyer is equal to the sum expected of the payments of the premium at an effective discount rate, \(r + h\), that is, the risk-free rate adjusted for the possibility of default:

\[
V_{prem}(t) = E_t^Q \left[ \sum_{i=2}^{M} \exp \left( - \int_t^{t_i} [r(s) + h^Q(s)] ds \right) \ast CDS(t) \right]
\]  

(3)

where:

- **CDS** (\(t\)) is the quarterly premium;
- \(E_t^Q(\cdot)\) denotes the expectations adjusted for systematic risk

The expected present value of the protection seller equals to the discount value of the expected loss at possible default dates:

\[
V_{prot}(t) = E_t \left[ \sum_{i=2}^{M} h^Q(t_i) \ast L(t_i) \ast \exp \left( - \int_t^{t_i} [r(s) + h^Q(s)] ds \right) \right]
\]  

(4)

\(^6\) Jarrow and Turnbull (1992; 1995); Duffie and Singleton (1999); Hull and White (2000; 2001); Lando (1994; 1998); Madan and Unal (1998).


\(^8\) Precisely \(h^Q = h^p (1 + \Gamma)\).
The premium is found by setting $V_{\text{prem}} = V_{\text{prot}}$ and solving for $CDS(t)$:

$$CDS(t) = \frac{\sum_{i=1}^{M} E_t^0 [h^Q(t_i) \cdot L(t_i) \cdot \exp(-\int_{t_i}^{t} r(s) + h^Q(s) \, ds)]}{\sum_{i=1}^{M} E_t^0 [\exp(-\int_{t_i}^{t} r(s) + h^Q(s) \, ds)]}$$

(5)

This equation implies that Cds spreads are weighted averages of the risk-adjusted expected losses, $E_t^0 (h^Q L)$; in other words: $CDS(t) \equiv E_t^0 (h^Q L)$.

There are potentially two differences between $E_t^0 (h^Q L)$ and actual expected loss, $E_t^P (h^P L)$, where $E_t^P (\cdot)$ denotes expectations based on the actual probabilities of the real world.

- $h^Q$ may differ from $h^P$ if the investors request compensation for the jump-at-default risk ($\Gamma > 0$).
- The expectations of $(h^Q L)$ are evaluated using the probabilities adjusted to take account of the aversion to the systematic risk. This means that $CDS$ spreads are approximately equal to the sum of the actual expected loss ($h^P L$), the jump-at-default risk premium ($\Gamma L$), and the systematic risk premium.

Within the credit risk, the structural models have been definitely preferred to the reduced-form models, although these models are acclaimed by professionals for their ability to better adapt to market data. The structural models come from the model of option pricing that have been developed by Black and Scholes (1973)\(^9\) and are based on the structural variables of the firm, considering the default function of endogenous elements. This approach based on the contingent claims analysis has been applied to the default risk for the first time by Merton (1974)\(^10\), who hypothesized that the default would arise solely and exclusively if at the due date of the bond the value of the assets was inferior to the value of the liabilities.

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\(^10\) The pricing model is related to the following formula:

$$F(V, \tau) = Be^{-r \tau} \{\Phi[H_2(d, \sigma^2 \tau)] + 1/d \Phi[H_1(d, \sigma^2 \tau)]\}$$

where:

- $F$ = value of the firm’s debt
- $V$ = value of the firm’s asset
- $B$ = nominal value of the debt
- $\tau$ = residual maturity of credit and therefore $\tau = (T - t)$ where $T$ is the maturity date of credit and $t$ is the date when credit is estimated
- $\Phi$ = cumulative probability density function with parameters of residual maturity of credit ($\tau$), the volatility of the firm’s assets ($\sigma^2$)
- $d$ = is the level of debt, evaluated as $Be^{-r \tau} / V$, where the debt is actualized at $r$ rate, risk-free
  
  $$h_1(d, \sigma^2 \tau) = -[1/2 \sigma^2 \tau - \log(d)]/\sigma \sqrt{\tau}$$
  $$h_2(d, \sigma^2 \tau) = -[1/2 \sigma^2 \tau + \log(d)]/\sigma \sqrt{\tau}$$

Yield differential between the risk debt and risk-free debt is expressed as in the following:

$$R(\tau) - r = -1/\tau \log[\Phi[H_2(d, \sigma^2 \tau)] + 1/d \Phi[H_1(d, \sigma^2 \tau)]]$$

Where:

$$exp[-R(\tau) \tau \equiv F(V, \tau)/B]$$

and $R(\tau)$ is the yield at maturity of risk debt, provided that the company does not go bankrupt. It is reasonable to name $R(\tau)$ “risk premium”, as the equation denotes the structure of interest rate risk. Risk premium is the function of solely two variables: the variance (or volatility) of the asset value and the debt ratio.

Merton’s model proposes two important values. Firstly, it allows to efficiently understand which are the variables related to determine the probability of default and therefore the related debt risk premium of a firm:
Secondly, Merton’s model allows to obtain, according to clear and objective parameters, the probability of default of a firm and the yield that a bondholder or financial bank should request as remuneration of the acquired credit risk\(^1\).

As regards the *CDS*, the main variables that influence the value of the spreads are identifiable in the *leverage ratio* (as an excessive level of debt implies a greater probability of default), the volatility of the *assets* (which also influences the probability of default) and the interest rate with no risk influencing the estimation of the acquired loss value\(^2\).

In detail:

- the risk-free interest rate influences the valuation of the expected loss value: an increase in the risk free interest rate entails an increase in the expected asset value and a decrease in the probability of default\(^3\). The movement of rate is influenced also by the inclination of the yield curve. A steeper yield curve with expected higher rate interests assumes a negative ratio among the risk-free rate, the slope of the yield curve and the CDS spreads. Low interest rates are usually seen during economic recessions and firm bankruptcy;

- the market value of the firm: when the market value of the firm declines, the probability of default tends to increase as it is more likely that there is an overshoot to the default boundary. Since the value of the firm is not directly observable it is possible to use the market capitalization as a proxy.

- the volatility of the underlying assets, where a higher volatility increases the credit spread value; the theoretical studies assume that a greater volatility of the firm value causes an increase in the probability of default and consequently an increase in CDS spreads. When it comes to volatility it is essential to distinguish three types or aspects of volatility: future, historical and implied. Future volatility refers to the volatility which will be at a future date. Historical volatility refers to the annualized standard deviation and defines the annual based variability of any financial statement. It measures the past variations and there is no certainty that it will also be valid for the future. Implied volatility is, instead, associated to options and represents the expectation of the investors with regards to the underlying future volatility. It is implicitly expressed in the prices of exchanged options. The structural default models use exactly the implied volatility as they make predictions of the future underlying expectations which allows them to identify the probability that the option will be actually exercised. Greater is the volatility of a bond, higher is the probability that the performance of

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\(^1\) However formally elegant this model is, it presents nevertheless different limits which can be grouped in three points:

- the liabilities of a firm are represented by a sole *zero coupon bond*;
- *default* can occur only at maturity of the debt;
- *volatility* is a constant for the entire period of the debt.

Precisely, the existence of the above-mentioned limits are the reason of the following generalization of the model where the probability of default occurs before the expiry date of the zero-coupon bond, alternately considering liabilities with coupons or fixing a threshold or default boundary beyond which the firm goes bankrupt. Cfr. Black and Cox (1976); Longstaff and Schwartz (1995); Zhou (2001).

\(^2\) It is possible to identify a connection between the real interest rate and the aversion to risk default: an accommodative monetary policy, making relatively low the cost of carry of leverage positions, may encourage greater risk-taking, as has happened in the banking system during the last years.

\(^3\) The theoretical argument in support of this comes from the fact that the risk-free interest rate influences the risk-neutral in the assessment process of the company: a higher risk-free interest rate increases the drift of the risk-neutral and lowers the probability of default.
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A stock will be very positive or very negative: therefore, a greater volatility of the firm value generates an increase in the probability of default and consequently an increase in CDS spreads;

- the leverage ratio, that is, the debt level, which is measured by the ratio between the sources of finance and equity. Merton’s method suggests that a high leverage increases the probability of default which generates an increase in CDS spreads. This thesis is confirmed when reflecting on the performance of this ratio. A high leverage implies growing expenditure which could cause a reduction in the profit expectations and therefore cause a decline in the expected yields, as a result, a deterioration of the conditions of the firm and an increase in the spreads related to the stocks. Typically, the increase in the sources of finance leads to an increase in both the debt cost and the equity cost. Alternatively, it is possible to verify the hypothesis where the sources of finance are steady on the reduction of equity; however, in this circumstance, there is an increase in leverage and thus in spreads.

3. Sample Analysis and Selection of Variables

The empirical analysis is carried out in a sample of 18 European corporate listed on the stock Exchange that own CDS at 5-year maturity date, with a medium-high capitalization and belonging to different sectors. Data has been elaborated by Datastream and Bloomberg. Seven firms are Italian, five are German, five are Spanish and one is English. The sample is illustrated in Table 1. The choice to analyze the European companies has been made to verify the behaviour of the determinants of CDS in a market that has very different characteristics compared to the U.S (both structural and regulatory).

**Table 1: Sample of firms under analysis**
(Market Capitalization on 28th June 2013)

<table>
<thead>
<tr>
<th>FIRM</th>
<th>SECTOR</th>
<th>COUNTRY</th>
<th>MARKET CAP (in billions of €)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATLANTIA S.p.A</td>
<td>Industrial products and services</td>
<td>Italy</td>
<td>8.2</td>
</tr>
<tr>
<td>BAYERISCHE MOTOREN WERKE AG</td>
<td>Industrial-Automotive</td>
<td>Germany</td>
<td>44.45</td>
</tr>
<tr>
<td>BT GROUP PLC</td>
<td>Communications</td>
<td>United Kingdom</td>
<td>24.1</td>
</tr>
<tr>
<td>CONTINENTAL AG</td>
<td>Industrial</td>
<td>Germany</td>
<td>19.54</td>
</tr>
<tr>
<td>DAIMLER AG</td>
<td>Industrial-Automotive</td>
<td>Germany</td>
<td>49.7</td>
</tr>
<tr>
<td>EDISON S.p.A</td>
<td>Industrial</td>
<td>Italy</td>
<td>4.73</td>
</tr>
<tr>
<td>ENEL S.p.A</td>
<td>Energy</td>
<td>Italy</td>
<td>23.1</td>
</tr>
<tr>
<td>ENI S.p.A</td>
<td>Petroleum</td>
<td>Italy</td>
<td>56.66</td>
</tr>
<tr>
<td>FIAT S.p.A</td>
<td>Industrial-Automotive</td>
<td>Italy</td>
<td>6.68</td>
</tr>
<tr>
<td>FINMECCANICA S.p.A</td>
<td>High-technology</td>
<td>Italy</td>
<td>2.3</td>
</tr>
<tr>
<td>GAS NATURAL SDG S.A</td>
<td>Energy</td>
<td>Spain</td>
<td>n/a</td>
</tr>
<tr>
<td>HEIDELBERGCEMENT AG</td>
<td>Material edile</td>
<td>Germany</td>
<td>9.76</td>
</tr>
<tr>
<td>IBERDROLA S.A</td>
<td>Energy</td>
<td>Spain</td>
<td>n/a</td>
</tr>
<tr>
<td>PORTUGAL TELECOM SGPS S.A</td>
<td>Communications</td>
<td>Spain</td>
<td>3.33</td>
</tr>
<tr>
<td>REPSOL S.A</td>
<td>Petroleum</td>
<td>Spain</td>
<td>n/a</td>
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<tr>
<td>TELECOM ITALIA S.p.A</td>
<td>Communications</td>
<td>Italy</td>
<td>10.34</td>
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<tr>
<td>TELEFONICA S.A</td>
<td>Communications</td>
<td>Spain</td>
<td>n/a</td>
</tr>
<tr>
<td>TUI AG</td>
<td>Tourism</td>
<td>Germany</td>
<td>2.24</td>
</tr>
</tbody>
</table>

Sources: Elaborations from Bloomberg and Datastream
The selection of Credit default swap contracts are based on the ones at 5-year maturity date (as maturity benchmark), written on senior debt, Euro-denominated and belonging to non-financial companies. The credit default swaps quotes are expressed in spreads\(^{14}\). The daily frequency of CDS spreads has been aligned with other variables on a quarterly basis. The time horizon considered is between January 2005 and December 2011 taking into account the effects of the financial crisis; Figure 1 shows a sharp increase in prices.

**Figure 1: Performance of CDS in the sample**

To identify the most significant variables in explaining the volatility of CDS spreads, following the strand of literature regarding “structural models”, both firms’ and markets’ figures have been collected: they are relevant for the valuation of the firm’s credit risk. The variables are the following:

**Firm Variables**
- **Current liabilities**: are loans underway of short-term credit, hence they are funds drawn from outside source. Current liabilities are part of the borrowed capital also called loan capital. The borrowed capital, in return, include both financing debts and operational debts. The former are debts related to an amount of money (e.g. loans, advances, overdrafts, etc.), while the latter are extended payment terms obtained in connection with purchasing transactions. When it comes to current liabilities the loan must be settled within one year.
- **Long-term liabilities**: are loans underway of mid- and long-term credit. Long-term liabilities have a future benefit over one year.
- **Total liabilities**: can be calculated by summing the short-term and long-term liabilities.
- **Total assets**: represent the total amount of the investment in a given time (current assets + fixed assets). The current assets remain in the firm for a short period of time. As they are destined to a quick employment use, they are converted into cash in a short period of time within a year. The fixed assets represent multi-year investments in manufacturing equipment, plant and equipment, and fixed financial assets which are bound to the firm for a long-term, generating cash inflows over a period exceeding a year.
- **Cash and cash equivalents**: are liquid assets available and convertible into cash.
- **Leverage** otherwise called debt ratio\(^{15}\) is obtained by dividing the total resources acquired by the firm, whether as risk capital or debt equity, by equity capital.

\(^{14}\) The premium is listed on basis point per annum of the notional value of the contract and payment is made on a quarterly basis (a basis point equals to 0.01 percentage point).

\(^{15}\) Bloomberg calculates the leverage of the single companies as “Total Debt and Total Capital” ratio
- **Total debt** is the total amount of the firm’s debt. It is calculated by adding short-term and long-term debts excluding contingent liabilities alleged\(^{16}\).

**Market Variables**

- **Enterprise value** is calculated as follows:

\[
EV = \text{market capitalization} + \text{net financial position} - \text{non core activities value.}
\]

Market capitalization, which expresses the value attributed to the company by the market, equals to the product between the market price of the bond and the number of shares issued by the company. The net financial position is given by the sum of short-, mid- and long term financial debts, financial credits and cash. The *non core* activities cover all the activities which fall outside the core business of the firm.

The *EV* calculation is based on the study carried out by Modigliani and Miller\(^{17}\); according to the calculation the value of the firm depends solely on its assets and not on the structure of its liabilities.

The enterprise value in the database is obtained following the calculation:

Market capitalization

Cash and cash equivalent

+ Preference capital

+ Minor interests

+ Total financial debts

\[
= \text{Enterprise value}
\]

- **Dividend Yield** shows how much a company pays out in dividends relative to its shares as a proxy.

- **Implied volatility** refers to the volatility of the capital. It has been calculated as a daily average of the implied volatility of the options *call* and *put* of the single companies. The values have been therefore aligned to a quarterly basis.

- **CDS spreads**: daily quotes of *CDS spreads* have been selected, with 5-year maturity date issued on *senior* debt and Euro currency. The values have been then aligned on a quarterly basis.

- **Theoretical CDS spreads**: credit risk premium, calculated with Merton’s model.

- **Risk-free rate**: represents the interest rate of a risk-free activity. 5-year *Euro Swap Rate* has been considered; while the difference between a 10-year and 1-year rate has been carried out to identify the slope of the *risk-free* curve.

- **VSTOXX volatility Index**: *VSTOXX Volatility Index* is a proxy of market volatility. Generally *VSTOXX* indices are based on real prices of *STOXX EUROPE 50* options and are designed to reflect the market expectations from short-term to long-term volatility by measuring the square root of the implied variance across all options of a given time to expiration.

- **STOXX EUROPE 50**: *STOXX EUROPE 50* provides a representation stock return index. It is Europe’s leading *Blue-chip* index and provides a representation of the principal European *leaders*. It covers 50 stocks in 18 countries: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxemburg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom. *STOXX Europe 50* Index is licensed to financial institutions to serve as underlying for a wide range of investment products (e.g. *ETF*-Exchange Traded Funds), *futures*, options and structured products worldwide\(^{18}\).

\(^{16}\) Bloomberg gives the following value:

\[
\text{Short time borrowings} + \text{Long time borrowings} = \text{Total Debt}
\]

\(^{17}\) Modigliani and Miller (1958).

\(^{18}\) For further information visit www.stoxx.com
- **iTRAXX EU HIVOL Index**: *iTRAXX EU HIVOL Index* at 5-year maturity date provides a representation of the required premium from the investors for riskier investments. *iTRAXX* indices are published by *Markit, leader* in the European and Asian credit derivatives indices market. They are synthetic and able to simulate credit default swaps issued by the companies identified as “quality” according to the criteria listed by Markit. *iTRAXX EU HIVOL* include credit default swaps of 30 companies belonging to the investment grade universe (which have a BBB- rating according to *Standard & Poor’s* or Baa3 for *Moody’s*).

4. **Theoretical Model Proposed**

There are numerous empirical studies aimed at analysing credit spreads movements. Zhang et al. (2005) examine the determinants of CDS spreads. They are concentrated on the effects of the volatility in firms and of the jump-to-default risk using variables such as ROE, leverage, dividend payout ratio or macro-financial variables, such as the inclination of the yield curve, etc. In their studies monthly quotes on 307 issuing entities have been taken into account for a period which ranges from January 2001 to December 2003. The results of the regression show that the volatility and the jump-to-default risk explain approximately 54% of the credit spread. The $R^2$ index increases up to 77% when including also the macro-financial and balance variables and the jump-to-default risk, although these two factors mainly explain the variations of the spread.

Ericsson et al. (2005) investigate the relationship between the theoretical determinants of default risk and the actual market values of CDS on the firms’ debt, using linear regressions, both in cross-section and panel forms.

More recent is the study of Avramov et al. (2007) which analyzes the ability of the structural models to explain the variations in the credit risk using a set of common factors and company-level fundamentals. In particular, the variables used are: interest rate, inclination of the rate curve, stock market yield, leverage and the related volatilities. Furthermore, in this analysis the authors also include the idiosyncratic stock volatility, the price-to-book ratio “P/B” and the momenta the stock returns may generate.

Di Cesare and Guazzarotti (2010), analyze the factors that determine the variations of the premium on the derivative credit risk (CDS) for a sample of non-financial firms (167 companies), considering both the run-up of the financial crisis and the subsequent period (January 2002 - March 2009). It is shown that the contribution of the financial leverage to explain the variations of the CDS spreads is much higher during the crisis then in the previous period, the investors seem to have taken more awareness of the individual risk factors. It is evidenced that the overall ability of the model to explain the variations of the CDS is almost the same, before and after the turbulence, highlighting that the underlying risk factors have been able to keep their explicative power in a period of considerable stress for the credit default swap market.

Tang and Yan (2012), study determinants of CDS spread changes between two consecutive trades. Considering transactions data from 2002-2009, they find that changes in firm and market fundamentals are the most significant determinants of CDS spread changes, while excess demand for CDS contracts plays an important role.

Our analysis has been carried out through two models at random effects to exploit both the information within and that between included in the dataset through a GLS analysis. The model is also assessed with a fixed-effect panel regression to check its stability.

As described in the previous sections, Merton’s model states that credit spread is function of the value of the asset volatility, risk-free rate and leverage. The first empirical model denotes the following structure:

$$ s(i, t) = \beta_0 + \beta_1 \sigma_E(i, t) + \beta_2 L(i, t) + \beta_3 r(t) + \beta_4 \text{crisis} + \epsilon(i, t) $$

where

- $i = 1, \ldots, n$ indicates the specific firm
- $t = 1, \ldots, m$ indicates the time period
- $\sigma_E$ is the implied volatility calculated as average of the implied volatility of the call and put options;
- \( L \) is the leverage calculated as a ratio between the total liabilities and total assets;
- \( r \) is the risk-free rate;
- \( \text{crisis} \) is a dummy variable where 0 represents the periods January 2005/June 2007 and January 2010/December 2011; 1 represents the period July 2007/December 2009.

In the second model instead other variables, considered as determinants of CDS spreads in literature, have been added: the inclination of the yield curve (different EURO SWAP RATE at 1 and 10 years), Dividend Yield of every firm as a proxy for the yield of the shares, stock return of STOXX EUROPE 50 and the VSTOXX volatility Index as a proxy of the market volatility; ITRAXX EU HIVOL at 5 years as index of the premium required from the investors for riskier investments.

\[
\begin{align*}
  s(i, t) &= \beta_0 + \beta_1 s(i, t) + \beta_2 \sigma_E(i, t) + \beta_3 L(i, t) + \beta_4 r(t) + \beta_5 DY(i, t) + \beta_6 \text{SLOPE}(t) + \beta_7 \text{EUX}(t) + \\
  &\quad + \beta_8 \text{iHIVOL}(t) + \beta_9 \text{VSTOXX}(t) + \beta_{10} \text{crisis} + \varepsilon(i, t) \tag{11}
\end{align*}
\]

where:

- \( s \) is the theoretical CDS spread calculated using Merton’s model;
- \( DY \) is the Dividend Yield of every firm as a proxy of the stocks return;
- \( \text{SLOPE} \) is the inclination of the risk-free rate curve;
- \( \text{EUX} \) identifies the index of the EUROPE STOXX 50 stock market;
- \( \text{iHIVOL} \) is the iTRAXX EU HIVOL index that represents the premium required by the riskiest investment market;
- \( \text{VSTOXX} \) is the VSTOXX Price Index that represents the uncertainty of the market.

In the empirical model proposed the CDS theoretical spreads or credit risk premium play a significant role among the explanatory variables as foreseen by Merton. The introduction of the theoretical spread in the model is important to face further non-linear relations between the specific characteristics of the firm and the CDS spreads.

To this purpose please note the formula applied\(^{19}\):

\[
\begin{align*}
  s_t &= -1/\tau \times \ln[\Phi[h_2(d, \sigma^2 \tau)] + 1/d \Phi[-h_1(d, \sigma^2 \tau)]]
\end{align*}
\]

where “\( d \)” is the so called quasi debt ratio, a measure of the level off the financial leverage of the firm, calculated as:

\[
\begin{align*}
  d &= B/V \times \exp[-r(T - t)] \tag{13}
\end{align*}
\]

where:
- \( B \) = nominal value of the debt
- \( V \) = value of the firm’s assets
- \( \tau \) = residual duration of the loan, therefore \( \tau = (T - t) \) where \( T \) is the maturity date of the loan and \( t \) is the date when the loan is evaluated;
- \( \Phi \) = cumulative probability density function where \((\tau)\) is the duration of the loan and \((\sigma^2)\) is the volatility of the firm’s assets;

\[
\begin{align*}
  h_1(d, \sigma^2 \tau) &\equiv - [1/2 \sigma^2 \tau - \log(d)]/\sigma \sqrt{\tau} \\
  h_2(d, \sigma^2 \tau) &\equiv - [1/2 \sigma^2 \tau + \log(d)]/\sigma \sqrt{\tau}
\end{align*}
\]

\(^{19}\) For further information refer to paragraph 2.
The theoretical *spread* is calculated on the following possibilities: the nominal value of the debt at five-year maturity equals to the “total debt”; the value of the assets of the firm equals to the “enterprise value” and the volatility of capital equals to the average of the implied volatility calculated by the options *call* and *put*; the *risk-free* interest rate is provided by *EURO SWAP RATE* at 5 years.

Table 2 shows the descriptive statistics of the variables of the sample divided in sub-periods and carried out on a quarterly basis. The average value of the *CDS* in the first period of studies (pre-crisis) are in a range that goes from 5,310 basis points (Eni S.p.A.) to 565,221 (Fiat S.p.A.). In the period of crisis (July 2007 – December 2009) there had been a significant increase of the values, indeed it went from an average value of 59,168 to 243,496 basis points; to confirm even more the upward trend of the *spread* there is a significant standard deviation which underlines the increase of the variability generated by the crisis. Another important variable is the volatility: it is clearly shown in the descriptive table how it increased dramatically from 23.32% in the pre-crisis period to 40.78% in the period of crisis.

**Table 2: Descriptive statistics of the sample**

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Median</th>
<th>Standard deviation</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Complete period (January 2005 - December 2011)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CDS spread</td>
<td>178.07</td>
<td>96.64</td>
<td>281.15</td>
<td>5.31</td>
<td>3073.89</td>
</tr>
<tr>
<td>Theoretical Spread</td>
<td>429.90</td>
<td>61.48</td>
<td>1243.85</td>
<td>0.00</td>
<td>13380.39</td>
</tr>
<tr>
<td>Leverage</td>
<td>58.41%</td>
<td>61.41%</td>
<td>18.02%</td>
<td>14.82%</td>
<td>140.6%</td>
</tr>
<tr>
<td>Implied Volatility</td>
<td>33.37%</td>
<td>29.68%</td>
<td>15.40%</td>
<td>11.42%</td>
<td>134.06%</td>
</tr>
<tr>
<td>Enterprise Value</td>
<td>50,752.45</td>
<td>34,426.94</td>
<td>67,505.77</td>
<td>1,877.93</td>
<td>1,252,135.67</td>
</tr>
<tr>
<td>Vstoxx</td>
<td>24.90%</td>
<td>23.17%</td>
<td>10.45%</td>
<td>12.36%</td>
<td>54.61%</td>
</tr>
<tr>
<td><strong>Pre-crisis period (January 2005 - June 2007)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CDS spread</td>
<td>59.17</td>
<td>34.486</td>
<td>76.97</td>
<td>5.31</td>
<td>565.22</td>
</tr>
<tr>
<td>Theoretical Spread</td>
<td>40.46</td>
<td>28.78</td>
<td>47.32</td>
<td>0.00</td>
<td>191.88</td>
</tr>
<tr>
<td>Leverage</td>
<td>55.77%</td>
<td>57.83%</td>
<td>18.60%</td>
<td>14.82%</td>
<td>107.79%</td>
</tr>
<tr>
<td>Implied Volatility</td>
<td>23.32%</td>
<td>23.07%</td>
<td>5.17%</td>
<td>13.24%</td>
<td>38.94%</td>
</tr>
<tr>
<td>Enterprise Value</td>
<td>45,659.07</td>
<td>35,685.03</td>
<td>37,211.92</td>
<td>6,292.59</td>
<td>151,294.22</td>
</tr>
<tr>
<td>Vstoxx</td>
<td>15.67%</td>
<td>15.28%</td>
<td>2.29%</td>
<td>12.36%</td>
<td>19.76%</td>
</tr>
<tr>
<td><strong>Crisis period (July 2007 – December 2009)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CDS spread</td>
<td>243.50</td>
<td>106.29</td>
<td>400.35</td>
<td>9.97</td>
<td>3,073.90</td>
</tr>
<tr>
<td>Theoretical Spread</td>
<td>707.40</td>
<td>29.11</td>
<td>1818.38</td>
<td>0.00</td>
<td>13380.39</td>
</tr>
<tr>
<td>Leverage</td>
<td>59.11%</td>
<td>63.46%</td>
<td>15.97%</td>
<td>26.32%</td>
<td>98.80%</td>
</tr>
<tr>
<td>Implied Volatility</td>
<td>40.78%</td>
<td>36.05%</td>
<td>18.85%</td>
<td>15.62%</td>
<td>134.06%</td>
</tr>
<tr>
<td>Enterprise Value</td>
<td>49,752.22</td>
<td>37,307.53</td>
<td>37,602.73</td>
<td>3,902.28</td>
<td>154,605.54</td>
</tr>
<tr>
<td>Vstoxx</td>
<td>32.06%</td>
<td>28.50%</td>
<td>11.26%</td>
<td>20.80%</td>
<td>54.61%</td>
</tr>
<tr>
<td><strong>Post-crisis period (January 2010 - December 2011)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CDS spread</td>
<td>244.92</td>
<td>169.67</td>
<td>205.70</td>
<td>49.85</td>
<td>1,304.06</td>
</tr>
<tr>
<td>Theoretical Spread</td>
<td>350.51</td>
<td>162.89</td>
<td>561.73</td>
<td>0.00</td>
<td>3,956.08</td>
</tr>
<tr>
<td>Leverage</td>
<td>60.83%</td>
<td>59.87%</td>
<td>19.34%</td>
<td>30.40%</td>
<td>140.60%</td>
</tr>
<tr>
<td>Implied Volatility</td>
<td>31.25%</td>
<td>31.42%</td>
<td>10.38%</td>
<td>11.42%</td>
<td>73.59%</td>
</tr>
<tr>
<td>Enterprise Value</td>
<td>58,346.72</td>
<td>30,379.60</td>
<td>111,426.91</td>
<td>1,877.93</td>
<td>1,252,135.67</td>
</tr>
<tr>
<td>Vstoxx</td>
<td>27.47%</td>
<td>26.34%</td>
<td>7.02%</td>
<td>19.62%</td>
<td>42.96%</td>
</tr>
</tbody>
</table>

Sources: Elaborations from Bloomberg and Datastream

The historical performance of some variables are visible in Figure 2 and 3.

The first chart shows the significant increase of the *spread* after the beginning of the crisis in contrast with the trend of the opposite sign of EUROPE STOXX 50 Index which records a share decrease in correspondence to the increase of the *credit spread*. Indeed, in the period of crisis, the average *credit spread*...
of our sample jumped from 148.33 to 573.40 basis points, while the STOXX EUROPE halved from 4377.22 to 2166.22 index points\(^\text{20}\).

**Figure 2: EUROPE STOXX 50 and CDS Spread**

Figure 3 shows other two variables of our analysis: the risk-free rate trend and the volatility (uncertainty) of the market represented by VSTOXX INDEX. It is obvious that in the period of crisis VSTOXX INDEX increased dramatically growing more than twice (indicating that the crisis creates a lot of uncertainty in the markets), while EURO RATE SWAP at 5 years decreased by about one percentage point going from 5.15% to 4.17%.

**Figure 3: VSTOXX PRICE INDEX and EURO SWAP RATE at 5 years**

5. **The Results of the Regressions**

Results of the empirical analysis carried out are illustrated in this section. The model has been estimated through a random-effects GLS regression\(^\text{21}\) by taking first differences on all the observations of the sample. In the first model *credit spread* is set as a dependent variable while the independent variables are the three

\(^{20}\) A value equal to €10 is assigned to each index point.

\(^{21}\) The *Hausman test* has been carried out as well for a better interpretation: it brings us to accept the null hypothesis of the first model, therefore, preferring the fixed-effects model and to refuse the null hypothesis in the second model and therefore to prefer the random-effects model due to a higher efficiency.
factors denoted as important by the theory and that is, asset volatility, risk-free rate and leverage. It is evident that both the interest rate and the volatility are significantly high (Table 3). The volatility presents a coefficient equal to 3.98***22 which shows a positive and increasing relation, that is, a one percentage increase of the volatility corresponds to an average of approximately 4 basis points increase of the credit spread. Instead there is a negative relation between the risk-free rate and the credit spread; an increase of one percent of the credit spread rate brings to an average of approximately 46 basis point decrease, which simply shows that an high interest rate should imply an improvement of the economic conditions and consequently a decrease of the credit risk. The leverage is significant when it reaches a 10% threshold. In addition, the variable dummy included shows that the financial crisis has affected the performance of the credit spread.

Table 3. The determinants of variations in CDS spreads: first model

<table>
<thead>
<tr>
<th>Fixed-effects</th>
<th>Model 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volatility</td>
<td>3.98***</td>
</tr>
<tr>
<td>Leverage</td>
<td>1.22*</td>
</tr>
<tr>
<td>Interest rate</td>
<td>-45.51***</td>
</tr>
<tr>
<td>Crisis</td>
<td>-23.85***</td>
</tr>
<tr>
<td>Intercept</td>
<td>15.36***</td>
</tr>
<tr>
<td>R-sq: within</td>
<td>0.4212</td>
</tr>
<tr>
<td></td>
<td>0.5062</td>
</tr>
<tr>
<td>overall</td>
<td>0.4141</td>
</tr>
<tr>
<td>No. obs.</td>
<td>347</td>
</tr>
<tr>
<td>Hausman's Test</td>
<td>9.70 [0.045]</td>
</tr>
</tbody>
</table>

The above table shows the results of regression in the first model. The following variables are included: implied volatility of the capital, leverage and risk-free rate (EURO SWAP RATE) at 5 years. Significance levels: ***= 1%; **= 5%; *= 10%.

Further explanatory variables, considered important credit spread determinants in literature, have been included in the second model (Table 4).

The first independent variable added relative to the first model is the theoretical spread based on Merton’s model. It has a coefficient equal to 0.013*** and it is highly important. The same occurs for the other variables such as the volatility, the performance of the individual securities, and the risk-free interest rate. In particular, a one percent increase of the volatility threshold generates an average increase of 1.83 basis point of CDS spread; while a negative relation occurs between the risk-free rate and the CDS spread: a one percent increase of the risk-free rate generates an average decrease of about 24 basis points of credit spreads. The remaining variables are not particularly significant except for the premium the investors are requested for riskier investments “iHivol” [0.51 ***]; and the market securities yield identified in the "Dividend Yield" variable. An aspect that deserves special attention is the loss of significance of the "leverage" variable, as it is not consistent with the finding of the Merton’s Model. Our study shows that the “leverage” (in the descriptive statistic table) display a trend almost constant also during the crisis period to

---

22 The number of stars indicates the significance levels: ***= 1%, **= 5% e *= 10%. 

demonstration the fact that European companies have financial structure balance and resistant to stress the market. The explicative power of the second model increased significantly shifting from 41% to 55%.

Table 4. The determinants of the variations in CDS spreads: model extension

<table>
<thead>
<tr>
<th>Random-effects</th>
<th>Model 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theoretical spread</td>
<td>0.013***</td>
</tr>
<tr>
<td>Volatility</td>
<td>1.83***</td>
</tr>
<tr>
<td>Leverage</td>
<td>0.75</td>
</tr>
<tr>
<td>Interest rate</td>
<td>-24.42**</td>
</tr>
<tr>
<td>Dividen Yield</td>
<td>11.39***</td>
</tr>
<tr>
<td>Slope of yield curve</td>
<td>3.29</td>
</tr>
<tr>
<td>Eux</td>
<td>-0.001</td>
</tr>
<tr>
<td>iHivol</td>
<td>0.51***</td>
</tr>
<tr>
<td>Vstoxx</td>
<td>-0.54</td>
</tr>
<tr>
<td>Crisis</td>
<td>-12.76</td>
</tr>
<tr>
<td>Intercept</td>
<td>8.67*</td>
</tr>
<tr>
<td>R-sq: within</td>
<td>0.5578</td>
</tr>
<tr>
<td>Between</td>
<td>0.5477</td>
</tr>
<tr>
<td>Overall</td>
<td>0.5524</td>
</tr>
<tr>
<td>No. obs.</td>
<td>341</td>
</tr>
<tr>
<td>Hausman's Test</td>
<td>12.12 [0.28]</td>
</tr>
</tbody>
</table>

This above table shows the results of the second model from the GLS regression with random effects. The variables are: the theoretical spread calculated with Merton’s method; the implied volatility of the capital; the leverage; stock yield; the risk-free rate (EURO SWAP RATE at 5 years), the slope of the yield curve (difference EURO SWAP RATE at 10 and 1 year/s), stock market yield (identified through Stoxx Europe 50 index), the premium the investors are requested for riskier investments. (identified iTRAXX EU HIVOL INDEX), market volatility (identified in VSTOXX volatility Index) and ultimately the dummy “crisis” variable. Significance levels: ***= 1%; **= 5%; *= 10%.

6. Conclusions

In this paper study determinants of CDS spreads for a sample of 18 European corporate from different countries and sectors, for the period between 1st January 2005 to 31st December 2011.

In this present study determinants of CDS spreads have been examined in a sample of European corporate.

23 Higher is the debt ratio, riskier is the firm and the related economic activity: an increase of risk corresponds to an increase of the remuneration expected from the financiers and therefore of the financial charges that the firm will have to undertake in order to find additional financing.
Our analysis has been carried out through two models at random effects to exploit both the information within and that between included in the dataset through a GLS analysis. In the first model we included the variables considered fundamental from Merton’s model to explain the changes in the credit spread as asset volatility, risk-free and leverage. While, in second model we have been added other variables considered as determinants of CDS spreads in literature: the inclination of the yield curve, dividend yield of every firm as a proxy for the yield of the shares, stock return of STOXX EUROPE 50, VSTOXX as a proxy of the market volatility and iTRAXX EU HIVOL at 5 years as index of the premium required from the investors for riskier investments.

An aspect that deserves special attention is the loss of significance of the "leverage" variable, as it is not consistent with the finding of the Merton’s Model. Our study shows that the “leverage” display a trend almost constant also during the crisis period to demonstrate the fact that European companies have financial structure balance and resistant to stress the market.

The empirical analysis affirms the conclusions of the structural models which emphasize the role of the firm and market variables in explaining CDS spreads. Especially, the most significant variables are the theoretical spread, risk-free rate, the implied volatility of the capital, stock yield, and the premium the investors are requested for riskier investments. The explanatory power of the model results to be 55% to illustrate the dynamics of the variations of CDS spreads.

Other factors, not directly related to the credit risk, could influence the CDS spreads. They include:

- assets: compared with government bonds and shares, the credit default swaps usually have high transaction costs, therefore the issuers demand a greater compensation; in addition, these financial instruments are mostly negotiated in related thin markets;

- systemic risk factors that strongly influence the institutions or the markets.

In effect various structural features in the CDS market have helped to transform counterparty risk into systemic risk. First, the majority of the CDS market remains concentrated in a small group of dealers as JPMorgan, Morgan Stanley and others.

Second, the case of Lehman Brothers had shown that the interconnected nature of this dealer-based market can result in large trade replacement costs for market participants in the event dealer failures. Finally, the low levels of liquidity resulting from the crisis and the current high levels of concentration in the market have both increased trade replacement costs and result in significant bid-ask spreads for market partecipants, particularly for non-dealers. However the size of the CDS market, combined with its structural opacity, concentration and interconnectedness, may be a sign that the CDS market also poses a systemic risk to financial market stability. The study of these factors is interesting topic for further research.

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Acknowledgements

The authors are grateful to Rapposelli Agnese and Agovino Massimiliano for the collaboration in the elaboration of data.

The responsibility for the contest of this analysis rests with the authors.