DO RATINGS AFFECT CDS? THE CASE OF BANKS

Abstract

In this paper we study the determinants of Credit Default Swaps (CDS) spreads in banks during the period 2009-2012. We empirically test the relationship between CDS spreads and ratings, and the role of some banks-specific factors (liquidity and leverage ratios) that appear to be important banks risk-determinants as suggested by Basel 3.

We aim at testing three research hypotheses: whether the credit rating influences the CDS premia in the banking system, whether and how a marginal variation of the rating class impacts the CDS spreads, and finally if there is a relation between the new liquidity and leverage ratios and the CDS premia. To test the hypotheses we first implement the Merton's model and, successively, we implement the basic model by adding the rating variable plus two vectors of bank specific variables and market variables. Our sample includes 100 banks located in different countries in the world, which are primary members of ISDA.

The results of the empirical analysis show that…

Keywords: CDS, ratings, banks, credit risk.

1. Introduction

In this paper we study the determinants of Credit Default Swaps (CDS) spreads in banks during the period 2009-2012. We are interested in explicitly considering the relationship between CDS spreads and ratings. We are also interested in empirically testing the role of some banks-specific factors focusing on some (liquidity and leverage) ratios that appear to be important banks risk-determinants as suggested by Basel 3.

CDS are credit derivatives functioning as insurance contracts: in exchange for a fee paid to the seller, they provide protection to buyers from losses that may be incurred on sovereign or corporate debt resulting from a credit event that may include failure to pay (interest or principal on) and restructuring (of, one or more obligations issued by the sovereign or the corporate) (IMF, 2013). What makes the difference between a CDS and an insurance contract is that CDS contracts are freely tradable while insurance contracts are not.

CDS market became very significant in terms of volume during the last years, although its values decreased during the financial crisis (Table 1).

Table 1 Gross notional of credit derivatives market in 2008-2013 (USD bn)

Anno	Totale	Single-name	Multi-name
2008	41.883	25.740	16.143
2009	32.693	21.917	10.776
2010	30.261	18.494	11.767
2011	28.626	16.865	11.761
2012	25.069	14.309	10.760
2013	21.020	11.324	9.696
Giu-14	19.462	10.845	8.617

Source: Bank for International Settlements

There are several motivations that suggests to further extend the research in this topic. First, banks CDS spreads dynamics are not well investigated since very few studies empirically focus on these special firms. Second, the new rules introduced by Basel 3 that encompass banks to maintain specific mandatory coefficients in terms of liquidity and leverage suggest to better reconsider the banks risk drivers. Third, as suggested by previous literature, the determinants of (CDS) credit spreads vary across time and especially during a crisis – that is the period specifically considered in the present work. Fourth, the CDS represent an important recent evolution of the financial markets so they have to be better studied. Fifth, the debate on CDS after the financial turmoil is still ongoing. As emphasized by IMF (2013) the role of CDS in the stability of financial system is the subject of a debate. They can be viewed as useful market-based risk indicators and valuable hedging instruments or as speculative tools suggesting their prices do not reflect underlying fundamentals or

actual risks and they can therefore unduly raise funding costs for governments (and corporations), threatening fiscal sustainability and exacerbating market tensions. Sixth, the role of CDS in the financial stability is particularly important when the banks are considered because they are strictly related to the real economy of a country.

We aim at testing three research hypotheses: whether the credit rating influences the CDS premia in the banking system, whether and how a marginal variation of the rating class impacts the CDS spreads, and finally if there is a relation between the new liquidity and leverage ratios and the CDS premia. To test the hypotheses we first implement the Merton's model and, successively, we implement the basic model by adding the rating variable plus two vectors of bank specific variables and market variables. Our sample includes 100 banks located in different countries in the world, which are primary members of ISDA.

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2. Literature

Since CDS are relatively new products, the literature on CDS spreads relies on the literature on credit spreads of corporate bonds. Only in recent years the literature became more specific and started focusing on CDS. Studies on CDS spreads can be divided into two groups focused on sovereign and on corporate (financial and non-financial) CDS, respectively. Finally, there exists a strand of literature specifically focused on CDS and ratings.

2.1 Studies on (bond) credit spreads

The theoretical literature on the determinants of credit spreads relies on the seminal paper of Merton (1974). He develops a theory for pricing bonds when there is a significant probability of default. He argues that the debt of a firm can be represent as a zero coupon bond characterized by a face value D and maturity T. Merton demonstrates that a default occurs when the value of a firm (enterprise value) at time T is lower than D. In this case, the shareholders de facto transfer the ownership of the firm at the creditors; so, the creditors of a firm can be seen as holding at the same time a long position in a risk free zero-coupon bond and a short position in a European put option granted to the shareholders. In this scheme, fixed the maturity at T, the asset underlying the option is represented by the value of the firm and the strike price by D. If we consider the high volatility of the value of a firm, we can consider the value of the debt at time t as the difference between the enterprise value and the equity value. We can now consider the cost of default as the difference between the *face value* of the debt and the *market value* of the debt (discounted at the risk-free rate).

According to the credit risk theory deriving from Merton model the credit spreads depend on four factors: the risk-free interest rate, the level of the firm's debt (face value), the market value of the firm, the volatility of the firm's assets.

The Merton theory is accepted by academics however empirical studies following the theory generally do not confim that structural default factors suggested by the model are able to completely explain the credit spreads of bonds. Two types of problems have been highlighted by the empirical studies: i) starting from the fact that in the real word bond spreads appear to be much more higher than what would be implied by expected default losses alone – this dyscrasia is commonly called "credit spread puzzle", the estimates on the explanatory power of the structural factors on the credit premia show that the variables suggested by the theoretical model actually are able to explain only a limited part of the bond spread changes; ii) the impact of structural default factors is time-varying.

With reference to the credit spread puzzle, this empirical literature identifies several other factors – different than structural credit risk factors – helping to explain the credit spread changes. Overall these factors include a non-diversificable credit risk (systematic risk), a liquidity premium, different market-wide variables, different firm-specific factors. The strand of literature aimed at testing the explanatory power of structural factors suggested by the theory starts focusing on the credit risk factors derived from the structural model by Merton and successively enriches the analysis developing more complex models in which the credit spreads are related not only on the structural factors but also to other variables aimed at capture further dimensions of the firm's risk and the general conditions of the market and the economy as a whole.

Amato and Remolona (2003) study the behavior of bond spreads – the difference between yields on corporate debt subject to default risk and risk-free government bonds -, generally understood as the compensation for credit risk but it has been difficult to explain the precise relationship between spreads and such risk. The credit spread puzzle can be thought as the (wide) gap between spreads and expected default losses. They argue that the existence of the credit spread puzzle might lie in the difficulty of diversifying default risk due to the nature of the distribution of returns on corporate bonds that is highly negatively skewed. Given this skewness, to completely diversify the default risk and to avoid unexpected losses, investors would be required to have an extraordinarily large portfolio. They conclude that spreads on bonds are so wide because they are pricing undiversified credit risk.

Collin-Dufresne et al. (2001) investigate the determinants of credit spread changes. First, from a contingent-claims perspective, credit spreads are investigated taking into account the risk of default (changes in the probability of future default) and the changes in the recovery rate. He enriches the analysis examining the extent to which credit spread changes can be explained by proxies for

liquidity changes. They find that only a small part of credit spread changes (25%) can be explained by changes in default probability and changes in recovery rate; the residuals from the regressions are highly cross-correlated, and principal components analysis implies that they are mostly driven by a single common factor that is likely not firm-specific. When the regression is rerunned including liquidity, macroeconomic, and financial variables results show that any set of variables is able to explain the bulk of this common systematic factor.

Elton et al (2001) show that the main components of credit spread are the expected default loss, a tax premium, a risk premium for the systematic risk. Driessen (2005) employs a model in which the liquidity premium is explicitly considered. Their model model allows for six different components of expected excess corporate bond returns: risk premia on market-wide changes, risk premia on firm-specific changes in credit spreads, default-free interest rates, risk premium on the default , tax and liquidity effects.

2.2 Studies on CDS spreads

Given the extraordinary growth of the credit derivatives market, and of CDS market in particular, in recent years literature started focusing on CDS spread changes. These studies rely on the Merton model and try to empirical focus on CDS market and spreads. Focusing on CDS is important because they are representative of important structural development in financial markets (Boss and Scheicher, 2005). Furthermore, it is generally recognized that CDS permit to study the credit spreads better than bond for several reasons. First, CDS are directly observable while bond spreads have to be derived by comparing corporate bonds to a risk-free asset that could implies problems when the choice has to be done (Annaert et al, 2013). They are “light” instruments in that one does not need to fund an entire bond position, for example, to have essentially the identical credit risk exposure (Fitch, 2007).

Second, bond spreads are more prone to be affected by several factors such as market and institutional factors (liquidity, tax effects, market microstructure effects) (Annaert et al, 2013). They can be considered fairly pure indicator of credit risk because the structure separates the credit risk component from the other asset risks, such as interest rate and currency risk (Fitch, 2007).

Third, given their derivative nature, CDS spreads are more efficient and more rapid than bond in signaling changes in the credit quality of the borrowers so that their power in price discovery process is more efficient (e.g., Coudert and Gex, 2010; Blanco et al., 2004; Zhu, 2004; Ammer and Cai, 2007; Aktung et al., 2009; Carboni, 2011;). This last advantage of the CDS is confirmed by the signage importance that CDS assumed during the recent financial turmoil when also regulators started to focus on financial markets information and signals to take their the policy actions.

The literature on CDS spreads can be virtually divided into two groups, the first focuses on sovereign CDS, the second on corporate CDS. This last strand of literature can consider financial or non-financial firms CDS. Furthermore, in recent years, several studies investigates the CDS market before and during the crisis.

Given the objectives of this paper, we are not specifically interested in empirical works analyzing sovereign and non-financial firms CDS spreads. The literature on sovereign CDS spreads has assumed importance especially in recent years when there has been the sovereign debt crisis in several European countries1. Most of these studies aim at investigating the real determinants of CDS spreads (e.g., Fontana and Scheicher, 2010; Heinz and Sun, 2014; Drago and Gallo, 2014). With regard to the literature focused on non-financial firms CDS spreads, as for (bond) credit spreads, mostly confirm that structural factors are not fully able to explain the CDS spreads (e.g., , Zhang et al., 2005; Di Cesare and Guazzarotti, 2010).

Banks CDS spreads

Studies focused on banks credit spreads determinants are not numerous. It is not still clear why. One hypothesis is that the financial industry is considered to be an opaque industry where traditional credit risk models are likely to be less successful (Annaert et al., 2013). Another hypothesis is that for banks other risk indicators are considered important such as the Basel ratios. However, in recent years, and after the financial turmoil, also in the banking industry there has been a reconsideration of more traditional risk factors such as the liquidity level and the leverage. This trend is confirmed by the rules recently introduced by Basel 3 that encompass two mandatory liquidity ratios and a leverage ratio (where the assets of the banks have to be considered at their value not risk-weighted).

Düllmann and Sosinska (2007), considering a sample of (only) three German banks during the period 2002-2005, analyze CDS spreads focusing on the explanatory power of three risk sources: idiosyncratic credit risk, systematic credit risk and liquidity risk. They show that structural models based on equity prices and reduced form models based on the prices of credit derivatives have their specific advantages and that together they can provide a more comprehensive assessment of the riskiness of the banks monitored.

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[1] Heinz and Sun (2014), focusing on the period 2007-2012, study the determinants of 24 European countries' sovereign CDS spreads. They find that sovereign CDS spreads are affected by global investor sentiment, macroeconomic fundamentals and liquidity conditions; the relative importance of these factors changes over time.

Drago and Gallo (2014) study the relationship between ratings announcement and CDS premia with reference to sovereign. Using the event study's methodology they test the impact of rating changes announcements (given by Standard & Poor's) on the euro-area sovereign CDS market from during the period 2004-2013. They show that when downgrades are considered there is a a significant effect on the CDS market, especially for speculative grade countries. When upgrades are considered they demonstrate the existence of a more limited impact only on the announcement day and on the following day. Furthermore they find that outlooks are not significant while negative reviews have an impact only on the days following the announcement.

Raunig and Scheicher (2008) compare (41) major banks to (162) non-banks during the period 2003-2007. They investigate the determinants of CDS premia and by means of regression analysis study how CDS traders discriminate between banks and non-banks and how their assessment has varied over time. They show the risk premia differ across time and across the two types of firms. During the subprime turmoil there exists a substantial repricing of banks' CDS relative to the CDS of other firms because banks have large exposures to securitisation instruments.

Annaert et al. (2013) study the determinants of (32) European listed banks CDS spreads during the period 2004-2010. They consider tree sets of variables: credit risk variables (derived from Merton model), liquidity variables, market wide factors. Their analysis confirms that the variables affecting the CDS spread vary across time (but not so much across rating classes). After the start of the crisis structural factors gain significance while liquidity maintain its importance before and after the crisis. Some variables proxying the general economic conditions are important but their significance and signs change with the start of the crisis.

Hasan (2014) studies the determinants of (161) global banks CDS spreads from 22 countries during the period 2001-2011. He focuses on three groups of variables: structural model variables, CAMELS factors[2], country-level economic, governance and regulation factors. They show that some structural factors (leverage measures, equity return volatility, and government bond yield) are significant determinants of bank credit risk but that, as in previous studies, they are able to explain only 20% of CDS spreads. CAMELS indicators provide incremental explanatory power: together structural and CAMELS indicators are able to explain 30%. Asset quality (loan-loss provisions to total loans) is the most significant determinant of bank CDS spreads (after controlling for time and bank fixed effect.). Furthermore, they show that systematic risk and risk aversion (proxied by stock market return) are important determinants of CDS spreads. Also some country-level factors are significant because they influence the risk-taking behavior of the banks: some regulation factors such as financial conglomerate restriction (that is negatively related to bank CDS spreads, implying that competition helps to reduce bank credit risk), the presence of deposit insurance (that is positively related to CDS spreads). Finally, since with time and bank fixed effects the model reaches 60-80%, they show that cross-bank variations in systematic risk and some unobserved time-varying factors have important explanatory power for bank CDS spreads. During the crisis the impacts of leverage and asset quality on CDS spreads become much stronger.

Differently from previous studies that analyzed the CDS spreads determinants starting from the Merton model, Chiaramonte and Casu (2013) focus on balance-sheet indicators, suggesting that in periods of financial stress, market data fluctuate wildly and changes in market data during a crisis

[2] The acronym CAMELS is derived from the components of a bank's condition that supervisors assess using a mix of publicly available and private information to assign a composite overall rating. These components are: C (Capital Adequacy, A (Asset Quality), M (Management), E (Earnings), L (Liquidity), and S (Sensitivity to Market Risk).

period do not necessarily reflect the changes in credit risk. They investigates the determinants of credit default swaps (CDS) spreads and whether CDS spreads can be considered a good proxy of bank performance during the period 2005-2011. Their sample includes 57 international banks, 43 of which European, 7 are US, 4 are Australian and 3 Japanese banks. They show that the determinants of CDS spreads vary across time. As determinants od CDS spreads they consider balance sheet ratios, rather than considering both market-specific and firm-specific factors; with the sole exception of leverage. They demonstrate that bank CDS spreads reflect the risk captured by bank balance sheet ratios, the relationship between bank CDS spreads and balance sheet ratios becomes stronger during the crisis and post-crisis period, variables that a priori would be considered as determinants of CDSs spread, the TIER 1 Ratio and the Leverage, appear insignificant in all of the periods considered, the liquidity indices were not important before the crisis.

2.3 Studies on CDS and credit ratings

Literature focused on CDS and ratings mainly use the event study methodology to test the presence of abnormal movements (in CDS spreads) in presence of rating changes.

Hull et al. (2004), after examining the relationship between CDS spreads and bond yields, test the relationship between CDS spreads and announcements, reviews and outlooks by rating agencies during the period 1998-2000. Their data set includes over 200,000 CDS spread bids and offers collected by a credit derivatives broker over a 5-year period. They analyze the relationship between the CDS market and rating announcements by carrying two sorts of tests. First they condition on rating events and test whether credit spreads widen before and after rating events. They find that reviews for downgrade contain significant information, but downgrades and negative outlooks do not and that there is anticipation of all three types of ratings announcements by the CDS market. Successively, they condition on credit spread changes and test whether the probability of a rating event depends on credit spread level and changes. They find that credit spread changes or credit spread levels provide helpful information in estimating the probability of negative credit rating changes. In the case of positive rating events the results are much less significant.

Norden and Weber (2004) study the informational efficiency of CDS and stock markets focusing on the impact of credit rating announcements during the period 2000–2002. Their sample includes CDS data provided by a large European bank, which represents one of the most important of credit derivatives counterparties in the world. They employ the event study methodology to test whether these markets respond to rating announcements in terms of abnormal returns and adjusted CDS spread changes. Both stock markets and CDS market demonstrate to be able to anticipate rating downgrades and reviews for downgrade. Furthermore they show that the magnitude of abnormal

returns is affected by the level of the old rating, previous rating events and, only in the CDS market, by the pre-event average rating level.

Di Cesare (2006) studies the ability of market-based indicators (CDS spreads, bond spread and stock prices) to anticipate rating agencies. He considers a sample of the largest publicly listed international banks from 11 countries during the period 2001-2005. He verifies the presence of "abnormal movements" of the three market-indicators before, in concomitance and after rating events – the set of events includes review for rating changes and actual rating changes. They show that all indicators contain useful information to anticipate rating actions, especially for negative events and that, overall, CDS spreads are relatively more efficient in anticipating negative rating vents – stock prices are better predictors in the case of positive rating events.

Burchi e Drago (2012) study the alignment between ratings and CDS focusing on a sample of US firms. in order to demonstrate the existence of a significant difference between the ratings and the Cds that could affect the lending policy of a bank.

Drago and Gallo (2014) study the relationship between ratings announcement and CDS premia with reference to sovereign. Using the event study's methodology they test the impact of rating changes announcements (given by Standard & Poor's) on the euro-area sovereign CDS market from during the period 2004-2013. They show that when downgrades are considered there is a a significant effect on the CDS market, especially for speculative grade countries. When upgrades are considered they demonstrate the existence of a more limited impact only on the announcement day and on the following day. Furthermore they find that outlooks are not significant while negative reviews have an impact only on the days following the announcement.

3. Sample

Our sample includes 100 banks located in different countries in the world, which are primary members of ISDA. There are several reasons for studying the relation between the CDS spreads in the banking sector and the rating assigned by a credit rating agency. First, the literature reviews on the topic are only focused on the relation between the rating score and the CDS spread of a panel of firms belonging to all sectors, or between the sovereign debt and the rating score. Therefore, it does exist a gap in the literature on this topic which results very interesting to fill and clarify.

Second, according to regulatory framework, banks must fulfill their capital requirements in relation to risks of first and second pillar of Basel II (and III). Among these, in particular, the regulatory provisions related to credit risk represent an unfair very challenging. This contributes to explain the recent development of derivatives which are able to transfer, and thus reduce, the credit risk of the banks. Another factor that has led to the growth of this market is the fact that large firms tend to

gradually reduce the number of banking relationships, focusing on a smaller number of banks. This implies that banks take on more risk and they need to reduce it transferring it to third parties.

Third, banks occupy a central role in every economic system. The solvency of a bank has a very strong interconnection with the economy of a country. Systemic risk caused by a default of a bank is so dangerous that the regulator (Basel 3) proceeded to regulate the behavior of banks through the imposition over the time of regulatory changes which had to ensure compliance with some ratios of liquidity, solvency and leverage. On the liquidity, is useful to confirm that the problem about the necessary level of liquidity is a key driver in the bank management, in relation to the fiduciary relationship between the borrower and the same bank. A dangerous reduction of liquidity in the bank could certainly lead to increased profitability, but would put the bank in a crisis that would certainly lead to default. The same argument can be made regarding the leverage ratio. A very high level of this index determines probably an increase in the Return on Equity ratio, but submits the same bank at an increasing level of solvency risk. This ratio, as well as the liquidity ratio, even if it does not appear connected with the CDS spread (based on the credit risk), determines significant implications for the solvency of a bank and therefore, indirectly, should influence the CDS spread.

As already stated, the relation between CDS spread and rating score is very interesting to investigate. The Table 2 contains the classification adopted by the major rating agencies for different classes of risk.

Table 2 Long-term ratings classification

Rating	Moody's	Fitch	S&P	Classification
AAA	Aaa	AAA	AAA, AAA-	Investment grade
AA	Aa, Aa1, Aa2, Aa3	AA, AA-, AA+	AA, AA-, AA+	Investment grade
A	A, A1, A2, A3	A, A-, A+	A, A-, A+	Investment grade
BBB	Baa, Baa1, Baa2, Baa3	BBB, BBB-, BBB+	BBB, BBB-, BBB+	Investment grade
BB	Ba, Ba1, Ba2, Ba3	BB, BB-, BB+	BB, BB-, BB+	Non investment grade
B	B, B1, B2, B3	B, B-, B+	B, B-, B+	Non investment grade
CCC	Caa, Caa1, Caa2, Caa3	CCC, CCC-, CCC+	CCC, CCC-, CCC+	Non investment grade
CC	Ca	CC, CC-, CC+	CC, CC-, CC+	Non investment grade
C	C	C, C-, C+	C	Non investment grade
DDD	DDD	DDD	DDD	Non investment grade
DD	DD	DD	DD	Non investment grade
D	D	D	D	Non investment grade

It's very useful for our analysis to look at the breakdown between investment grade/non investment grade indicated by the three major rating agencies and try to understand the default rates related to each category. As we could expect, looking at the corporate default rates in the period 1981-2012, the non-investment grade companies exhibited a very high default rate, while the investment grade companies showed a very low default rate (Table 3). Therefore, in our analysis we expect to find a positive incremental marginal effect in term of spread connected to a downgrade.

Table 3 Corporate default rates (1981-2012)

Year	Total defaults (no.)	Default rate (%)	Investment-grade default rate (%)	Speculative-grade default rate (%)	Year	Total defaults (no.)	Default rate (%)	Investment-grade default rate (%)	Speculative-grade default rate (%)
1981	2	0.14	0.00	0.62	**2000**	136	2.46	0.24	6.17
1982	18	1.19	0.18	4.41	**2001**	229	3.75	0.23	9.77
1983	12	0.76	0.09	2.93	**2002**	225	3.54	0.41	9.33
1984	14	0.91	0.17	3.26	**2003**	120	1.90	0.10	4.98
1985	19	1.11	0.00	4.31	**2004**	55	0.77	0.03	1.99
1986	34	1.72	0.15	5.66	**2005**	40	0.60	0.03	1.49
1987	19	0.95	0.00	2.79	**2006**	29	0.45	0.00	1.12
1988	32	1.38	0.00	3.84	**2007**	24	0.37	0.00	0.89
1989	43	1.73	0.14	4.67	**2008**	127	1.77	0.42	3.61
1990	70	2.74	0.14	8.10	**2009**	266	4.09	0.32	9.60
1991	93	3.27	0.14	11.05	**2010**	83	1.17	0.00	2.88
1992	39	1.50	0.00	6.10	**2011**	53	0.76	0.03	1.73
1993	26	0.60	0.00	2.50	**2012**	84	1.10	0.00	2.47
1994	21	0.62	0.05	2.10	**Average**	67	1.47	0.10	4.22
1995	35	1.04	0.05	3.52	**Median**	40	1.14	0.07	3.57
1996	20	0.51	0.00	1.80	**St. deviation**	67	1.04	0.12	2.79
1997	23	0.63	0.08	2.00	**Minimum**	2	0.14	0.00	0.62
1998	56	1.27	0.14	3.65	**Maximum**	266	4.09	0.42	11.05
1999	109	2.13	0.17	5.55					

Sources: Standard & Poor's Global Fixed Income Research and Standard & Poor's CreditPro®.

4. Research hypotheses and methodology

Previous studies on the role of the credit rating in the determination of CDS spreads have been focused on companies belonging at all economic sectors or on the sovereign debt. As already highlighted there is a lack of empirical evidence on the banking sectors. We aim at fulfill this lack of research. In detail, the present paper aim at testing the following research hypotheses:

H_0: Does the credit rating influence or not the CDS spread in the banking system?

H1: Whether and how a marginal variation of the rating class impacts the CDS spread.

H_2: Is there a relation between the new liquidity and leverage ratios and the CDS premia?

Our analysis wants to test the relation between the banks CDS spreads and the credit ratings assigned by the major rating agencies.

We consider a sample of CDS with the following features:

- 5 years maturity;
- € 5 million of notional capital;
- reference obligation consists of senior notes;
- credit event (or trigger event): default, failure to pay, complete restructuring.

The source of CDS spreads is Datastream Thomson Reuters in the period January 1st 2009-August 31 2012.

We consider a sample of CDS characterized by a 5Y maturity and € 5 million of notional capital because they are the most liquid in the market.

Our research is based on a sample of 100 banks located in different countries in the world, which are primary members of ISDA, giving rise to ….. observations (Table 4).

Table 4 Sample banks

Country	Number	Nationality	Number
AUSTRALIA	5	MALESIA	2
AUSTRIA	3	NORVEGIA	1
BELGIO	1	OLANDA	5
CINA	4	PORTOGALLO	3
EMIRATI ARABI	2	REGNO UNITO	8
FRANCIA	5	RUSSIA	3
GERMANIA	10	SINGAPORE	1
GIAPPONE	3	SPAGNA	4
GRECIA	2	SVEZIA	5
INDIA	4	SVIZZERA	2
IRLANDA	2	TURCHIA	1
ITALIA	7	USA	10
KOREA	7		

To test the research hypotheses, first we use the basic Merton's model (Equ. 1):

$$(1)\quad \text{Cds Spread} = \alpha + \beta_1 \text{Risk\_Free} + \beta_2 \text{Firm value} + \beta_3 \text{Net Debt} + \beta_4 \text{Asset volatility} + \varepsilon$$

where:

- *Risk_free is the risk interest rate* calculated as the yield obtained over long-term government bond;
- *Firm value* is the market capitalization of each bank at December 31 of each year;

- *Net debt* is the difference between gross debt and cash of each bank;
- *Asset volatility* is the medium standard deviation of the market price of each bank for each year.

Successively, we implement the basic model by adding the rating variable plus two vectors of bank specific variables and market variables (Equ. 2):

$$(2)\ \text{Cds Spread} = \alpha + B_1\ \text{rating} + \beta_2\ \text{Risk\_Free} + \beta_3\ \text{Firm value} + \beta_4\ \text{Net Debt} + \beta_5\ \text{Asset volatility} + \beta_6\ \text{Banks\_variables} + \beta_7\ \text{Market\_variables} + \varepsilon$$

Bank specific variables

These variables are include those suggested by the previous literature. Furthermore, we add liquidity ratios as requested by Basel III, plus other specific risk variables requested by Basel Accord (Table 5).

The level of leverage used by the banks during the years, represents a variable which should positively or negatively influence the level of the CDS price assigned to a bank depending on the level reached. A small increase in the leverage ratio could be positive because it increases the profitability of a bank and reinforces its capability to repay bondholders and depositors. On the other hand, above a certain threshold, it produces an exponential growth of the risk. As highlighted by Hasan (2014), in the case of banks it is controversial whether higher levels of leverage implies an increase of the bank's credit risk because banks have different asset and liability structures from corporations due to the fact that their leverage ratios are considerably greater than those in other corporate sectors, and there is less variation among banks: the ability to draw on more deposits is a signal of greater growth potential but at the same time too much debt relative to equity can lead a bank to fail

In our model, we use two different leverage ratios: a classical accounting ratio (Lev) (Otker-Robe and Podpiera, 2010; Chiaramonte and Casu, 2013) and, as suggested by Basel 3, the relation between *tier1 and total assets (*T1lev*).* The use of the leverage ratio imposed by Basel 3 permits to add new light on this dimension according to the new regulatory perspective

The solvency variables set includes the solvency ratio (Solvency) as indicated by Basel 3 which represents a global riskiness indicator of the banks. A higher value of this ratio would be connected with a lower value of CDS spread. We can also expect a positive relation between our dependent variable and some explanatory variables belonging to this subset: loan-loss provision (Loan-loss) (Hasan, 2014), non performing loan (NPL), Sensitivity market risk (Hasan, 2014) (Sensitivity).

The use of two profitability indexes, ROA and interest margin (Int_marg) (Hasan, 2014), permit us to study the relation between CDS spread and the capability of the management in banks to create value. We expect a positive sign in both regressors.

Table 5 Bank specific variables and expected signs on the coefficients of the regression

Variables	Name	Description	Predicted sign
Leverage variables	Lev	debt/debt+equity ratio	+/-
	T1lev	tier 1/total asset: the relationship between the tier 1 and the total asset of a bank	-
Solvency variables	Solvency	Total capital ratio (ex Basel II and III)	-
	NPL	non performing loans of a bank	+
	Sensitivity	sensitivity market risk: non interest income net of deposit fees plus fiduciary income to total assets	+
	Loan-loss	loan-loss provisions: the loss provisions on the non performing loans of a bank	+
Profitability variables	Roa	the profitability on invested capital	-
	Int_marg	Interest margin: the interest income of a bank	-
Liquidity risk variables	LCR	Liquidity coverage ratio (ex Basel III)	-
	NSFR	Net stable funding ratio (ex Basel III)	-
Other variables	Mgt	Management quality: personnel cost to net banking income (intangible)	-
	Volatility	Asset volatility: changes in weekly historical standard deviations computed using the banks daily stock	+
	Loan	Total loans	+/-
	Dep	deposit insurance: dummy variable: obtains value 1 if the deposit insurance is imposed by the legislation of the country and 0 otherwise	-

We also consider some liquidity variables. In this subset we consider both LCR and NSFR ratios adopted by Basel 3. Such analysis appears original on the whole with respect to the literature on this topic because, as is known, it represents a peculiarity of the new regulatory system of the banks in

Europe. We expect a positive sign for both coefficients: an higher level of bank liquidity should reduce the bank credit risk and CDS premia.

Finally, we test the impact on CDS premia of other explanatory variables suggested by the literature:

- the management quality regressor (Mgt) (Hasan, 2014) proxies the intangible value of the banks. We expect that a higher ratio will reduce the value of our dependent variable because the credit risk provision on the banking book should be smaller;
- the deposit insurance dummy (Dep) proxie the level of depositors protection in a bank and it obtains value 1 for the countries where it is present and 0 for those where it is absent. We expect that the lower the depositor risk the lower will be the CDS spreads;
- the asset volatility (volatility) (Hasan, 2014) represents the changes in weekly historical standard deviations computed using the banks daily stock. We expect a positive relation between this regressor and our dependent variable;
- the total loans regressor (Loan) offers the possibility to understand if the analyzed banks are commercial or investment banks, and it also permits to assess the relation between the CDS spread and the size of the banking book.

Market variables

These variables include those suggested by the previous literature (Table 6).

In our regression we test whether our dependent variable is influenced by the following regressors:

- the weekly changes in the difference between bid-ask spread of CDS (Bid-ask);
    - three different scenarios of slope of term structures (Di Cesare, 2006), used as proxy of the business cycle: the difference between 10 y- 5Y yield of the benchmark series; the difference between 5 y- 2Y yields of the benchmark series; the difference between 10 y- 2Y yields of the benchmark series;
- the yield of the most important stock market indexes (Stock), calculated for 2Y, 5Y, 10Y;
- the market volatility (VIX);
- the market risk premium (Mkt_risk), calculated as difference between the medium value of OAS of Merril Lynch indexes with rating BBB and AA (Di Cesare, 2006);
- the GPL of each country in which the bank is located for the all period of our sample;
- the CDS sovereign premium for each country in which the bank is located;
- the relation between sovereigns CDS (Sov) and banks CDS: it's very useful to assess this relation because, as shown by the recent Asset Quality Review and Stress Testing made on European banks, they invest more or less significant portions of their total assets in

government bond. Therefore, the increase of the sovereigns CDS spreads, connected to an increase in the risk of the counterparty, makes it more risky assets of the bank and, consequently, should induce an increase of the banks CDS premia;

- the MSCI World Index Bank (MSCI): it dealt with a composed stock market index grouping the banks around the world and permit to measure the stock market performances all over the world, both in developed markets than in emerging ones;
- the Barclays Cap Glob Agg Financ Bond Index (Bond): it represents a general measure of the global fixed income market.

Table 6 Market variables and expected signs on the coefficients of the regression

Name	Description	Predicted sign
Bid-ask	Bid-ask spread CDS: a measurement of liquidity in the Cds market	+
Slope	Slope of Term structure: a proxy of the business cycle	-
Stock	Stock market index: trend of the most important stock market indexes in the countries where the banks are located	-
Mkt_ risk	Market risk premium: index of the premium required by investors to hold riskier assets	+
Vix	Volatility index which allows to evaluate the "fear" of markets	+
GPL	GPL of each country in which the bank is located	-
Sov	Cds sovereign premium: the Cds sovereign premium for each country in which the bank is located	+
MSCI	MSCI World Index Bank: Financial index composed of shares belonging to banks located around the world	-
Bond	Barclays Cap Glob Agg Financ Bond Index: a financial index composed of bonds belonging to banks located around the world	-

Table 7 Descriptive statistics

5. Conclusions

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