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The Use of Credit Derivatives and Banks' Risk Taking Behaviours

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Abstract

Credit derivatives are financial innovations that allow transferring credit risks separately from ownership. There is a common notion that credit derivatives are useful instruments in banks' credit risk management. However, the current credit crisis has raised a doubt towards the perception that credit derivatives make banks sounder. This paper presents empirical evidence about the effects of the use credit derivatives on banks' risk-taking behaviours. The study uses data of 179 large U.S. commercial banks that report to the Federal Financial Institutions Examination Council, with total assets at the end of 2009 equal or greater than 3 billion dollars. The methodology used is quantitative analysis methods - the "pooled" OLS regression. In consistent with existing literature, the results strengthen the statement that the use of credit derivatives does increase banks' risk-taking. Particularly, the volume of net credit derivatives bought is the dominant contributor.

Keywords: *Credit derivatives; Credit default swaps (CDS); Credit risk; Credit risk management.*

1. Introduction

One of the most important activities of commercial banks is to manage credit risk inherent in their loan portfolios since commercial banks are heavily dependent on lending activities. Recently, the evolution of a tremendous number of sophisticated financial instruments was believed to help banks in their risk management. One of those was the introduction and development of credit derivatives, which has raised a controversial debate among economists and regulators about potential impacts on the financial system, especially during the course of the recent financial crisis.

Credit derivatives come in various types of instruments. Among them, CDS is the most popular and sometimes is referred to as the representative of credit derivatives. According to the British Bankers Association (BBA, 2006), 63 percent of the total credit derivatives market is contributed by single-name and index products. The Triennial Survey of BIS (2007) reveals that single-name and multi-name CDSs constitute of 88 percent of the whole credit derivatives markets.

A CDS is a financial innovation that allows transferring the default risk of one or more reference assets or reference entities from one party to the other. Particularly, under the CDS agreement, the protection buyer (risk seller) makes periodical premium payments to the protection seller (risk buyer) during the contract's lifetime and, in return, receives a payoff if a pre-defined credit event occurs.

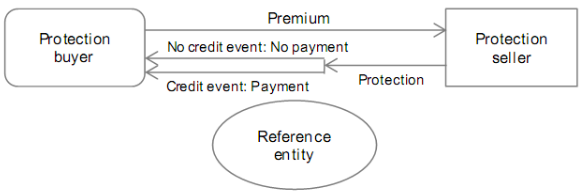

Figure 1. Mechanic of a single name CDS
Source: Weistroffer, 2009

According to the main data providers, which are *Bank for International Settlements* (BIS), *International Swaps and Derivatives Association* (ISDA) and the *Depository Trust & Clearing Corporation* (*DTCC)*, the market for CDSs is significantly large and has experienced rapid growth since CDSs were introduced in early 1990s until before the 2007-2008 financial crisis. The total notional amount of CDSs outstanding increased from vertically nothing to nearly 1 trillion U.S. dollars (USD) in 2001, approximately doubled every year since then to 2007, to a peak of over USD 62 trillion in 2007 (ISDA, 2010). The gross amount then dropped dramatically to USD 38 trillion in 2008, then to USD30 trillion at the end of 2009 (ISDA, 2010) and since then has steadily decreased to USD 12 trillion by the end of 2015 (ISDA, 2015), figure 2.

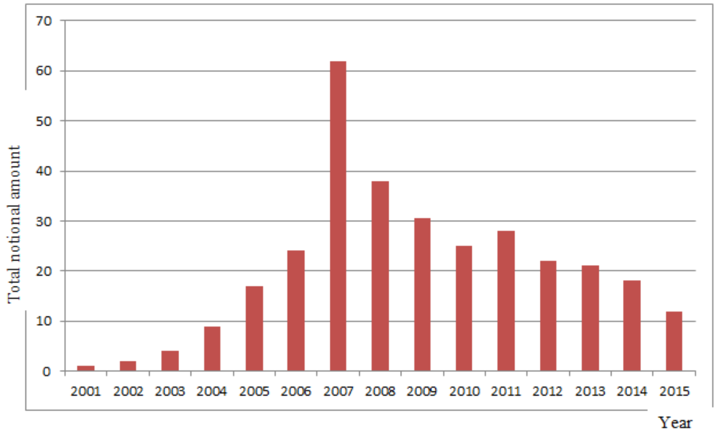

Figure 2. CDS market growth
Source: ISDA website online

Many commentators believe that credit derivatives, by enabling banks to transfer their credit risks in separation with ownership, help shed risks widely throughout the economy, create liquidity and price transparency which will finally build an efficient financial system (Wagner and Marsh, 2006; Partnoy and Skeel, 2007; Wallison, 2008; Weistroffer, 2009; Tuckman and Bruce, 2016). At the same time, many others are concerned about the potential risks that credit derivatives might pose, especially during the current crisis (Hu and Black, 2008; Stulz, 2010).

Incorporating with a consideration of the previous empirical models, this study uses the "pooled" OLS regressions to investigate the effects of credit derivatives on bank risk-taking behaviours. By developing two regression models to examine the effects of the use of credit derivatives on bank's risk taking, this study attempts to contribute to the existing theoretical literature with empirical evidence about the effects of credit derivatives on bank risk-taking behaviours.

2. Literature Review

Many commentators claim that the ability to transfer credit risks is obtained at an expensive cost of reducing monitoring incentives of banks, negative incentives of investors, and dangerous inter-connections which might lead to disastrous contagion should a failure of an influential institution occur. Many others, however, believe that credit derivative is an inevitably development in financial system and argue that it is the misuse and mispricing rather than credit derivative per se is the cause of the crisis.

2.1 Benefits of CDSs

2.1.1 An active tool for managing credit risk

Unlike loan sale, with CDSs allow banks to hedge credit risks without damaging their customers' relationship and enjoying the potential benefits of existing customers (Weistroffer, 2009). In practice, ideal diversification is not easily achieved due to obstacles relating to financial resources or customer base (Mengle, 2007). CDSs allow banks to customize their credit risk portfolios. For instance, being aware that auto manufacturing and oil industries have negative correlation, a bank might wish to create a portfolio containing fraction of both industries' exposures. However, one bank may be heavily exposed to auto manufacturing industry while have limited access to oil industry. With CDS, the bank can sell CDS protection on oil industry, through which it has create a synthetic exposure to oil industry as they wish. This strategy can be viewed as an alternative to making loans or buying bonds on oil industry (Mengle, 2007).

2.1.2 Increasing liquidity

The second benefit of CDSs that is widely agreed by commentators is that CDS improves liquidity of the underlying asset markets. Stulz (2010) believes that with CDS, banks can make loans that "they would not otherwise be able to make". Unlike insurance, a CDS contract does not require the policy holder to have any insurable interest to be eligible to compensation; therefore, an investor can bet on his expectation about the future prospect of an asset. Such speculative activities spur the growth of CDS market which in turn has positive effect on liquidity to the market as well as price transparency (Mengle, 2007).

2.1.3 Source of information about credit risk

In comparison with bond yields, which are influenced by many other factors other than default risk, such as interest rate risk, liquidity risk, etc, CDS spreads are more favourable as an indicator of distress and becoming a benchmark for credit risk (Mengle, 2007; Weistroffer, 2009). Existing literature of CDS's functioning as price discovery is relatively extensive. Duffee and Zhou (2001) suggest that the credit risk decomposition into information sensitive component nts can help banks overcome the "lemon problem" associated with their credit risk management. Hull and Predescu (2004) find that, with the tendency to foresee future rating events, either credit spread changes or credit spread levels on CDS markets provide useful information to anticipate the probability of negative credit rating changes. "Lemon problem" refers to an asymmetry of information, where the seller might have more information about the product whereas the buyer has no certain information. Here, Duffee and Zhou (2001) refer to the difficulties in managing credit risks by banks due to the unbalanced or asymmetric information in the markets.

Blanco et al (2005) find that price discovery takes place first in the CDS market. Bris et al. (2006) suggest that although in the long term credit risks might be equally priced between derivatives and cash markets, derivatives market tends to lead underlying instrument markets in the short run. Acharya and Johnson (2007) provide evidence that there is an information flow from CDS markets to equity markets. Related to the valuable information generated by CDS pricing, Partnoy (2006) suggests that CDS spreads could be used in rating process. Similarly, Weistroffer (2009) consolidates this justification by presenting the fact that CDS spreads have been used by rating agencies to calculate "market implied ratings".

2.2 Costs of CDSs

2.2.1 Increasing banks' risk-taking behaviours

One of the most popular arguments against CDSs is directly linked to the fact that CDSs enable banks to make more loans. Commentators argue that with the assistance of CDSs, banks have motives to expand lending with less assessing concern, as they have a buffer to protect them against non-performance (Jackson 2007; Partnoy and Skeek, 2007; Mengle, 2009; Weistroffer, 2009; Stulz, 2010). In addition, Liu (2010) argues that banks who are able to hedge with CDS, in the attempt to expand their lending, have incentives to encourage its borrowers to take excessive risk in order to create more capital demand. Shan, Tang and Yan (2014) explain the argument from the perspective of banks being capable of evading regulations on capital ratios with CDSs. They document that with CDSs, bank can synthetically shift higher risk-weight assets to 0%-risk categories, enabling them to hold less capital while still complying with the regulatory requirements.

2.2.2 Reducing loan monitoring

Similar to the effect on loan assessing incentives of banks, the use of CDS also encourages banks to expand loans with less monitoring (Arnold, 2014; Partnoy and Skeek, 2007; Stulz, 2010; Weistroffer, 2009; Mengle, 2007), because, with the protection provided by CDS, the prosperity of borrowers would mean much less to banks. Technically, the final risk bearers will take-over the risk exposures from banks; hence they will be more interested in monitoring debtors' performance (Partnoy and Skeel, 2007). However, the debate focuses on the fact that the protection sellers have less information, skills and experience in supervising loans. Furthermore, Dickinson (2008) argues that even when the counter-party of the CDS may wish to efficiently monitor the debt, they could only have the confidential information from the protection buyers. Overall, it is suggested that CDSs reduce loan monitoring or transfer the monitoring responsibilities to those who are less experienced and skilful.

*2.2.3 **"**Empty creditor problem" and "negative economic interest"*

When the lenders no longer have interest in the efficient continuation of the debtor, such "empty voting creditors" will be reluctant in renegotiating or in making any concession on the loans in order to prevent the underlying company from default, as they will finally get paid the same in either case (Hu and Black, 2008; Dickinson, 2008; Bolton and Oehmke, 2010). "Empty voting creditors" refers to the lenders who might have greater voting right than their real economic ownership, since they have bought credit protection against defaults of the underlying stocks (Hu and Black, 2008). Hu and Black (2008) explain such behaviours as the consequences of "debt decoupling" – the phenomenon in which economic interest of creditors and control rights are taken apart. Economic interest includes receiving payment, risk of default, while control rights refer to the rights to enforce, waive, or modify debt contracts, including the right to participate in bankruptcy proceedings (Bolton and Oehmke, 2010). More severely, creditors with "negative economic interest" have incentives to push the debtor into inefficient and costly bankruptcy by taking advantage of their control rights upon the underlying company (Bolton and Oehmke, 2010; Hu and Black, 2008; Bris et al., 2006). "Negative economic interest" refers to the fact that lenders might benefit more in case the reference company defaults since they have bought protection on the reference company (Hu and Black, 2008). "In this way, creditors with a negative economic interest can profit by destroying a productive; competitive company that may have just missed an interest payment" (Hu and Black, 2008). With a similar explanation, Partnoy and Skeel (2007) raise the case of Tower Automotive (Tower) as an example of the "incentives to affirmatively destroy value" of hedge funds, who have control rights towards the company but had short-sold Tower stocks hence would benefits more in case Tower defaults (Partnoy and Skeel, 2007). It is worth to note that some commentators (Yadav and Yasha, 2014) claim that 'empty creditor' theory is not always true as the protection buyers (the lenders) and the protection sellers should have incentives to maintain their reputation by cooperating in monitoring the debt.

2.2.4 Problems associated with the unregulated OTC market for CDSs

During the current crisis, the market in which CDSs are traded is also an important part of the controversy. The majority of related literature blames on the opaqueness and uncertainty of the unregulated huge OTC market as an important contributor to the crisis (Partnoy and Skeel, 2008; Stulz, 2010). Other commentators argue that, instead of being banned, CDS should be traded on exchange-traded markets, or at least several features of exchange-traded market should be required for the existing market (Mengle, 2007). Partnoy and Skeel (2008) argue that in such opaque markets, it is difficult for a firm to be sure about the risk of its counterparty. The attitude of a lender to renegotiate or make concessions on a loan will be different in case it hedged its risk associated with the loan. Failing to understand the lender's hedging policies makes it difficult for the debtor to assess counterparty risks they are exposed to and to adjust their behaviour accordingly (Partnoy and Skeel, 2008; Stulz, 2010). Moreover, the uncertainty of the OTC market can make it possible for powerful participants to manipulate the market in the way that benefits themselves but harms the whole system (Partnoy and Skeel, 2008; Stulz, 2010).

2.2.5 Systemic risks

Partnoy and Skeel (2007) argue that although CDS can function as a risk sharing tool to mitigate systemic risk, there is possibility of the opposite effect. They argue that, the highly leveraged bets, the interconnected nature of CDS contracts and size and geographically wide spread of CDS markets can together create a domino effect, in which a failure of a relatively small group of participants might lead to "convulsions throughout the international financial markets". Song and Uzmanoglu (2010) examine the effects of institutional lenders' liquidity problem on their borrowing clients. CDS spread is employed as an indicator of borrowers' liquidity problems. Accordingly, they find evidence that, in comparison with the group of borrowers from healthy lenders, borrowers from unhealthy institutions faced more severe liquidity problem, through the evidence that they experienced remarkably higher increases in the spreads of CDS contracts in which they are reference names. The study also finds a concentration of this domino effect among non-investment grade firms ("Investment grade" refers to a company's credit quality. A company is considered an "investment grade" when it is rated at "BBB" or higher by Standard and Poor's or Moody's; otherwise, the company is considered "non-investment grade"), who have to suffer from liquidity problem transmitted from their unhealthy lenders, whereas investment grade firms are mainly hit by systemic risk. Dickinson (2008) argues that although there has not been any large institution that are let fail entirely, due to the involvement of third party as heroes to take over their obligations; Dickinson (2008) is still concerned about the threat of systemic risk, that in case there is no third party willing to support, the contagion of CDS market collapse might lead to systemic failures. To this point, it is interesting that there are arguments against systemic risks inherent in CDSs. For instance, Otero (2012) poses the idea that the volume of CDSs contracts represents a very small ratio in the balance sheet assets, implying the insignificant level of systemic risk caused by this product.

3. Emperical Analysis

3.1 Data description

The models will use data on a sample of large U.S. commercial banks with assets not less than USD 3 billion, during the period from 2005 to 2009. Data is obtained from the Uniform Bank Performance Report (UBPR) available at the Federal Financial Institutions Examination Council (FFIEC). As credit derivative users are very large banks, we construct the sample including commercial banks in the category with assets equal or greater than USD 3 billion. Examined period is from 2005 to 2009. Data are observed at the end of each calendar year. The examined period covers the time when the financial crisis hit which is believed to have distinctive effects on banks' hedging activities in particular and risk-taking behaviour in general.

We first consult the list of commercial banks with asset not less than USD 3 billion from FFIEC. There are 180 banks in the report at year-end 2009. Out of the 180 banks from the list, one bank's report is not available on UBPR; some other banks' reports for 2005, 2006 and 2007 are not available. Observations of banks with missing data for the independent and dependent variable calculations are then excluded. Finally, the sample includes 883 bank-year observations.

Table 1. Breakdowns of total sample banks (units for asset: billion usd)

	2005	2006	2007	2008	2009	Total period
Panel A: Number of banks, the means and medians of assets for all banks						
Number of banks	174	176	176	178	179	883
Asset mean	35.5	40.6	47.8	54.1	55.8	46.9
Asset median	5.3	5.9	6.5	8.3	8.5	6.7
***Panel B: Number of banks, the means and medians of assets for non-users of credit* derivatives**						
Number of banks	152	150	147	145	145	739
Asset mean	9	8.7	10.7	11.1	12.1	10.3
Asset median	4.5	5.1	5.7	6.1	6.4	5.4
***Panel C: Number of banks, the means and medians of assets for users of credit* derivatives**						
Number of banks	22	26	29	33	34	144
Asset mean	219	224	236	244	242	235
Asset median	82.0	87.0	95.9	102.0	79.5	85.9
***Panel D: Number of banks, the means and medians of assets for net buyers of credit* derivatives**						
Number of banks	15	17	15	19	18	84
Asset mean	285	237	269	373	383	313
Asset median	82.9	88.1	116	147	116	99.1
***Panel E: Number of banks, the means and medians of assets for users other than net* buyers**						
Number of banks	7	9	14	14	16	60
Asset mean	78.8	201	200	69.6	82.6	124
Asset median	57.6	52.7	51.5	45.6	50.7	51.9

Source: Authors' Calculations

A brief description of data is provided in Table 1, comparing the number of credit protection users as beneficiary and guarantee. Apart from the whole group of all sample banks, the sample is divided into smaller sub-groups. Firstly, the sample is divided into credit derivative users and non-users. Credit derivative users are banks that either buy or sell credit derivatives or both; otherwise they are non-users. Then, within the group of credit derivative users, banks are divided into net protection buyers and other users. Net protection buyers are those who have positive net credit derivative bought. In other words, net buyers are those who buy more credit protection contracts in terms of notional value compared to the value of contracts they sell.

Although the number of credit derivatives increased from 22 banks out of total 174 banks in 2005 to 34 out of 179 banks in 2009, it is clear that the number of users is remarkably small compared to the whole sample's number of banks. Not surprisingly, the mean assets of participating banks are extremely large compared to that of non-users. While the mean asset of total sample is more or less USD 10 billion, the mean asset of the users' group is approximately twenty times larger in every year. In total, out of the 883 bank-year observations with total assets of USD 41,407 billion, the 144 participating bank-year observations contribute USD 33,778 billion, accounting for nearly 82 percent of total assets of the whole sample. Table 1 also shows that the sample's asset mean is much larger than its median, which reflects the extremely skewed distribution of bank sizes.

Out of 883 bank-year observations, there are only 84 net protection beneficiaries, accounting for less than 10 percent of the whole sample. Other users include net protection guarantees and banks with credit derivative netting positions are zero. Netting of credit derivatives is zero does not mean that banks are not exposed to credit risks (other than counterparty risks, operational risks, etc). This is because of the fact that those contracts bought and sold might be different in terms of reference assets or maturity, etc. Unfortunately, there is no way to comprehensively understand these issues as there is a lack of disclosure of CDS transactions. However, one who is really interested in these issues might find them somewhere in footnotes of individual banks' reports. Although net protection buyers tend to have higher mean asset than other users, the difference is not remarkable. The mean assets of both groups are approximately USD 200 billion in each year.

3.2 Dependent variable

To proxy for bank risk-taking behaviour, the variable RISK – the ratio of total risk-weighted assets to total assets is used. This is a general risk measure adopted by regulators under Basel II, reflecting the total risk aggregating from the composition of various risk category assets in a portfolio. This measure generally includes various types of risks, including credit risk, foreign currency risk, and interest rate risk. According to Ashraf et al. (2006), provided that the risk weightings reflect the economic risk of an asset category, this measure can be used as a measure of a bank's decision on risk-taking.

3.3 Independent variables

We use the variable TCDS (total notional amount of credit derivatives scaled by total assets) to proxy for the extent that a bank participates in credit derivative transactions. We understand that total notional amount of credit derivatives might be a misleading measure of the use of CDSs since this does not imply the purpose of a bank participating in CDS contracts. However, the purpose is to measure the extent to which a bank transacts in credit derivative markets. Therefore, this measure can be a reasonable proxy to be used (Carter and Sinkey, 1998; Ashraf et al., 2006). We expect that the extent that a bank relies in credit derivative will increase its inherent asset portfolio's risk.

Table 2. Summary of expected signs for independent variables' coeffecients

Variables	Explanation	Expected coefficient sign in Model I, II
SIZE	The natural logarithm of total assets is included in the models to measure the size of banks	-
TIER1CAP	The ratio of Tier-I capital to total assets	Mixed
TLOAN	The ratio of total loans to total assets	+
TDEPO	The ratio of total deposit to total assets	-
IM	The net interest margin (IM), calculated by net interest income divided by total assets	+
LIQUID	The ratio of liquid assets to total assets	-
DUMMYEQUI	Takes value of 1 if a bank transacts in equity and commodity derivatives and 0 otherwise	+
DUMMYSECU	Takes value of 1 if a bank has asset securitisation activities and 0 otherwise	+
TCDS	Total notional amount of credit derivatives scaled by total assets	+
NETCDSBEN	The difference between credit derivatives bought and sold, scaled by total assets	+

Note: "+" presents expected positive coefficient; "-" presents expected negative coefficient; "mixed" presents either positive or negative expected coefficient

Source: Author's Estimation

Alternatively, TCDS is replaced by NETCDSBEN (the difference between credit derivatives bought and sold, scaled by total assets). NETCDSBEN is utilized as a proxy for the extent that a bank hedges with credit derivatives. According to hedging theories, credit derivatives bought function as insurance for a bank in case its debtors default. Therefore, credit derivatives bought might increase a bank's risk-taking. In other words, the coefficient is expected to be positive. In addition to the independent variables TCDS and NETCDSBEN which we seek to find the causal relation with bank's RISK, other independent variables are added in the models for control purpose. The expected signs for coefficients are presented in Table 2.

3.4 The regression models

Two regression models are developed, using OLS regressions to test the effects of TCDS and NETCDSBEN on RISK. Based on previous models established to examine bank risk-taking behaviours (Saunders et al., 1990; Knopf and Teall, 1996; Demsetz et al., 1997; Lepetit et al., 2007; Beck et al, 2009), the following two models will be established, employing OLS regressions, to empirically examine the effects of credit derivatives on bank risk-taking:

Model I

$$RISK_{i,t} = \beta_1 + \beta_2 SIZE_{i,t} + \beta_3 TIER1CAP_{i,t} + \beta_4 IM_{i,t} + \beta_5 TLOAN_{i,t} + \beta_6 TDEPO_{i,t} + \beta_7 LIQUID_{i,t} + \beta_8 DUMMYSECU_{i,t} + \beta_9 DUMMYEQUI_{i,t} + \beta_{10} TCDS_{i,t} + u_{i,t}$$

Model II

$$RISK_{i,t} = \beta_1 + \beta_2 SIZE_{i,t} + \beta_3 TIER1CAP_{i,t} + \beta_4 IM_{i,t} + \beta_5 TLOAN_{i,t} + \beta_6 TDEPO_{i,t} + \beta_7 LIQUID_{i,t} + \beta_8 DUMMYSECU_{i,t} + \beta_9 DUMMYEQUI_{i,t} + \beta_{10} NETCDSBEN_{i,t} + u_{i,t}$$

While Model I uses the total notional amount of credit derivative contracts as an indicator for the volume of credit derivatives used, Model II employs the net notional credit derivative bought – the difference between credit protection contracts bought and sold – as the proxy for the hedging activity of banks using credit derivatives. The dependent variable used in these models is the ratio of total risk-weighted assets to total assets (RISK).

The OLS estimation is employed to estimate the coefficients of independent variables. Following Lepetit et al. (2007), pooled OLS regression, incorporating robust standard error technique to control for heteroscedasticity problem, is employed to estimate the coefficients of independent variables.

4. Results and Discussion

Empirical result of the model is presented in Table 3. This section will present in depth the empirical results and compare with previous studies on the similar issues.

Table 3. Estimation results for the pooled ols regressions

Dependent variable: Total risk (RISK)	Model I				Model II			
	Coeff.	S.error	p-value		Coeff.	S.error	p-value	
SIZE	-0.0148	0.0056	0.008	***	-0.0116	0.0053	0.028	**
TIER1CAP	-0.2008	0.0371	0.000	***	-0.1921	0.0342	0.000	***
IM	1.0226	0.7939	0.198		1.35797	0.7547	0.072	*
TLOAN	0.3582	0.0705	0.000	***	0.4116	0.0689	0.000	***
TDEPO	-0.1166	0.0749	0.120		-0.0897	0.0712	0.208	
LIQUID	-0.2588	0.0671	0.000	***	-0.2161	0.0585	0.000	***
DUMMYSECU	0.0133	0.0134	0.322		0.01879	0.0130	0.150	
DUMMYEQUI	0.0730	0.0152	0.000	***	0.07022	0.0146	0.000	***
TCDS	0.0254	0.0132	0.055	*				
NETCDSBEN					0.50798	0.1334	0.000	***
Constant	0.8986	0.1029	0.000	***	0.76799	0.1493	0.000	***
Sample period	2005-2009				2005-2009			
No. of observations	883				883			
R-squared	0.3652				0.4007			
F-statistics	37.5				37.9			
p-value	0.000				0.000			

*Note: ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively*

Table 3 presents the results of the OLS estimations. The model focus on the effects of the use of credit derivatives on banks' risk-taking behaviours, controlling for typical bank-specific characteristics including banks' size, profitability, capitalization, loan size, deposit size, liquidity strength and activities in other derivatives and other credit risk managements. The models yield highly significant F-statistics at significant level 99 percent, indicating that the overall models are statistically significant. Regarding the model performance, it has relatively high R-squared of 36.52% and 40.07%, respectively, indicating that the two models explain approximately 36.52% and 40.07% of the "risk's story".

Concerning banks' size the negative and significant coefficients of SIZE in both models show that larger banks are associated with less level of risk. Although we expected that large banks are more risky in terms of aggregate asset risks since they are more capable of taking on more risk asset. Besides, large bank are more capable of taking higher leverage and more risky portfolios in pursue of profit (Saunders et al., 1990). However, this finding reveals negative coefficients at significant level of 99% in both models, which is tend to support the evidence found in studies of Garcia-Marco and Robles-Fernandez (2008) that larger banks are more likely to have relatively less risky assets. They explain that large banks tend to have more available access to cheap capital and are able to diversify their activities across industries and geographical regions.

The result shows a negative and significant coefficient of TIER1CAP – the indicator of a bank's capitalization. Accordingly, the more capital strength a bank has, the less willing they are to take on risks. Particularly, the coefficients in both models show that when a bank increases 1 percent in Tier-I capital ratio, it is likely to reduce approximately 0.2 percent of RISK. Existing literature on the relationship between capitalisation and banks' risk-taking behaviour contains two opposite schools of thought. There exists an argument that banks with strong capital base have less incentive to assume risky asset, in order to protect the equity capital value (Furlong and Keeley, 1989). On the other hands, others argue that strong capitalisation may induce banks to take on excessive risks (Blum, 1999). My result is consistent with the latter argument, implying that banks with relatively high equity might assume more risky assets as they might treat their equity as a buffer for distress.

Being consistent with expectations, the coefficients of the ratio of liquid assets to total assets (LIQUID) are negative and significant. Banks with stronger liquidity tend to be less risky. This finding is consistent with the part of literature that regards deposits and liquidity as a buffer of financial distress (Wager, 2007; Altunbas et al., 2009). Regarding the effect of deposits ratio (DEPO), neither model outputs significant coefficients. However, I would explain this by the distinction of my data set. I consist on the argument that DEPO is associated with less RISK.

In contrary to size, capitalisation or profitability which all have negative effects on a bank's risk-taking, higher profitability, measured by net interest margin divided by total assets (IM) and higher lending activities, measured by the ratio of total loans to total assets (TLOAN) imply higher level of risk. The empirical results show significantly positive coefficients for TLOAN. With respect to IM the coefficient is significant at 90% level of significance in Model II but not significant in Model I; however, this result does not affect my conclusion. This result is in line with Altunbas et al. (2009) who argue that profitable banks are more confident in pursue of high profit by assuming risky assets. The coefficient of IM in Model II is 1.36, indicating that 1 percent increase in IM is associated with 1.36 percent increase of the ratio of risk-weighted assets to total assets, assuming that other thing hold the same.

Regarding TLOAN – the ratio of total loans to total assets, used to measure the volume of lending activities, although the result reveals a positive correlation with bank's risk-taking, I would not explain risk-taking behaviour by the lending activities, as the compositions of loans themselves are used in the calculations of risk-weighted assets. Therefore, TLOAN might not a good indicator that explains for risk-taking behaviour. Rather, I would take TLOAN simply as an indicator of a bank's past performance instead.

In accordance with expectations, both models show positive and significant coefficient of DUMMYEQUI, the dummy variable that presents whether a banks use other derivatives. The positive coefficient reinforces the notion that banks using credit derivatives tend to take more risky assets (Purnanandam, 2006). However, I could not make any conclusion for the DUMMYSECU, the dummy variable constructed to present whether a banks use other credit risk management, although I expect that this would have positive relationship with a bank's risk-taking.

The effects of credit derivative usage, measured by the total notional amount of credit derivative contracts regardless bought or sold, scaled by total assets (TCDS), and the use of credit derivatives as a hedging tool, measured by the net notional amount of credit derivative bought, scaled by total assets (NETCDSBEN), on the total risk inherent in a bank's asset portfolio and operations, measured by the ratio of total risk-weighted assets to total assets (RISK) are estimated in Model I and II, respectively. The effects of TCDS and NETCDSBEN on RISK during the examined periods are shown in Table 3. Not surprisingly, coefficients of both TCDS and NETCDSBEN are positive and significant in both models, presenting positive relationships between the uses of credit derivatives in general, and the use of credit derivatives as a hedging tool, with bank risk-taking behaviours.

From the result of Model I, we can conclude that the higher the level of transactions in credit derivative markets, regardless bought or sold position, the more risky assets a bank is willing to take. This is consistent with the most of previous (theoretical) literature of credit derivatives, which indicates that credit derivatives do induce banks to assume more risks (Partnoy and Skeel, 2007; Dickinson, 2008). Particularly, the coefficient for the explanatory variable TCDS is 0.025. Accordingly, other things equal, when the total notional amount of credit derivatives scaled by total assets increase by 1 percent, the possibility a bank takes on more RISK increases by 0.025 percent.

When substituting the explanatory variable that proxies for the general usage of credit derivative (TCDS) by the indicator of the particular position that a bank takes, the notion whether a bank is a net buyer or net seller of credit derivative is taken into account. In model II, the variable that proxies for the extent that bank hedge with credit derivative, using the net notional value of credit derivative contract, scaled for total assets (NETCDSBEN) is used. Not surprisingly, the result shows a positive and highly significant relationship between NETCDSBEN and RISK. Noticeably, the coefficient for NETCDSBEN is much larger than that for TCDS observed in model I. When recalling the calculation of NETCDSBEN – the difference between the notional values of credit derivative bought and sold, NETCDSBEN might take negative value, in case a bank sells more credit derivatives than the amount of contracts it buys; and, when a bank has negative NETCDSBEN, the bank is effectively at a net seller position. In the empirical results, the coefficient for the variable NETCDSBEN is 0.51, indicating that, other things equal, 1 percent increase in the value of net protection bought will lead to the increase of 0.51 percent increase in the total risk of the bank. This result lends a conclusion that the positive effect of total credit derivatives contract on RISK is derived merely from their protection bought position rather than credit derivatives sold. This empirical result is primarily consistent with the existing literature about credit derivatives. The argument is that banks have incentives to take on more risky assets (Wagner, 2004; Partnoy and Skeel, 2007; Stulz, 2010). The explanation is simple. Credit derivatives allow bank to transfer credit risks. If a bank is in the net protection bought position, it has transferred some amount of credit risk away from its asset portfolio. Therefore, net protection bought can be treated as a buffer for a bank in case its borrower defaults, hence the bank has more incentives to assume more risky assets as the defaulted assets now mean much less to its prosperity.

5. Conclution and Recommendation

Credit derivatives, particularly CDSs, have been innovated for the purposes of banks' hedging for credit risks. However, it reveals that these instruments have developed far beyond the initial expectations. The debate surrounding the costs and benefits of credit derivatives has been there long time ago but has emerged remarkably during the current financial crisis. While many commentators blame on credit derivatives to be one of the main contributors to the crisis, many other are insist that those innovative instruments will contribute to build a far more flexible and efficient financial markets. This study has presented a summary of the existing arguments for and against credit derivatives by discussing the bank-wide as well as system-wide costs and benefits of credit derivatives. On one hand, credit derivatives are believed to help construct a far more efficient financial market in long term, by shedding risks widely throughout the financial system creating liquidity and transparency. On the other hand, credit derivative are blamed to spur the rapid growth of the subprime mortgages, which is the centre of the crisis. Besides, the negative incentives of investors, the concentration of transactions, the systemic risk and the uncertainty of the OTC markets are those to blame.

While there is a strong argument that credit derivatives induce banks to take more risky assets, it seems that there has not been any empirical evidence. Therefore, in the attempt to reinforce this argument with empirical evidence, I have developed two regression models, using the pooled OLS estimations to empirically test the effects of credit derivatives usage on a bank's risk. . The data sample includes 179 large commercial banks with asset at the end of 2009 not less than USD 3 billion during a five-year period from 2005 to 2009, is obtained from FFIEC website. The empirical evidence reinforces that banks which are more active in credit derivatives markets tend to assume more risky assets. Furthermore, there is evidence that this effect is associated with the credit derivative contract bought rather than the protection sold.

This paper contributes to the existing literature of bank's risk-taking to the extent that it inspires an new explanatory indicator related to the use of credit derivatives. More importantly, this study shed the initial idea about empirically testing the effects of credit derivatives on banks' risk. The study can be regarded as a very primary step to support future research with larger samples expanding to the European banks or with more specific sub-samples and with longer time period. Generally, banks' managers, economists and regulators might be interested in these issues.

This paper is subject to a number of limitations. Firstly, the dependent variable used in Model I and II to proxy for bank risk-taking behaviour is the ratio of total risk-weighted assets to total assets (RISK). Although it was suggested by Ashraf et al. (2006) that this ratio is a reasonable measure for the aggregate risk inherent in a bank's asset portfolios, this measure is used as an independent variable indicating a bank's total risk, rather than the dependent variable to present a bank's risk-taking behaviour. Another important constraint is, unlike other derivatives which reports the volume of notional amount that serves the purpose of hedging or dealing, we have no access to knowing about the extent that a banks use credit derivatives for trading or hedging purpose. This is extremely important, given the fact that I use NETCDSBEN to proxy for the extent to which a bank hedges with credit derivatives while there might be a case that the position of net credit derivative bought is a part of the bank's dealing activities. Alternatively, a credit protection might be sold by a bank for risk diversification purpose. Therefore, further research may address at the evaluation of the risks created by credit derivatives for banks when they hold such contracts in their role as dealers in comparison with the case when they hold them for hedging or diversifying asset portfolios.

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