

Credit Derivatives Vs Loan Sales: Evidence from the European Banking Market

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1. Introduction

Credit risk transfer (CRT) techniques such as securitisation, loan sales and credit derivatives (CDs) have been an important part of a wave of financial innovation during recent years. A fuller appreciation of these instruments and their implications for the banking sector requires some understanding of the role of such techniques within the general framework of financial innovation.

There are various ways of looking at innovation. As far as motivations for financial innovation are concerned, no such general – or at least generally accepted – explanation exists, although there is a wide body of literature that is concerned generally with financial innovation. Given the multiplicity of theories, motivations for loans sales and CDs can be studied according to different perspectives. Adopting a taxonomic framework, loan sales and CDs help financial institutions to perform different functions, primarily those of transferring credit risk and enhancing liquidity¹. Looking at the conditions that have stimulated financial innovation supply, improvements in both transaction and information technologies are considered fundamental incentives for both credit derivatives and loan sales. Improvements in the ability to acquire and treat information have made it easier to sell and buy assets subject to lemon-market problems such as loans. Finally, according to many authors regulatory constraints represent one of the most important motivations for transferring credit risk (both via CDs and loan sales).

This paper aims at comparing the role of credit derivatives and loan sales in transferring credit risk away from banks, from both a theoretical and an empirical perspective. In this respect, we first attempt to investigate to what extent these financial innovation tools are complements and to what extent their functions overlap, from a theoretical point of view. Secondly, we analyse how a sample of European banks has been using these instruments in practice. In particular, we aim at assessing which banks act as financial innovators in the CRT market, and how they choose between loan sales and CDs.

The existing literature on the comparison between loan sales and credit derivatives is quite small, and mainly theoretical. Under the assumption of no information asymmetries in the credit derivatives market, Duffee and Zhou (2001) analyse the consequences of introducing CDs and conclude that these instruments can help alleviate the lemons problem that affects the loan sales market. By relaxing this assumption, Thompson (2006) suggests that well capitalised banks will prefer loan insurance contracts, whereas poorly capitalised banks will be forced into the loan sales market. The only empirical paper we are aware of that jointly examines the use of credit derivatives and loan sales is by Minton et al. (2006). Based on a sample of US banks, the authors conclude that very few large banks

¹ Many authors adopt a functional approach, grouping products according to the functions they serve. Authors use slightly different list of functions, but there is much overlap in these descriptions. One of the most comprehensive taxonomy of functions of financial innovation is proposed by the BIS (1986). For other classifications, see Finnerty (1992).

use credit derivatives, due to the significant asymmetric information problems in the credit derivatives market. Banks who act as protection buyers in the market normally engage in asset securitisation and loan sales as well, and are typically poorly capitalised.

Making reference to the fundamental literature on financial innovation, we first discuss the *raison d'être* of loan sales and credit derivatives. We then move on to the investigation of similarities and differences between loan sales and credit derivatives, in order to identify whether some instruments are more appropriate for trading credit risk on loans, with respect to both the characteristics of the innovator (protection buyer / originator) and the nature of the loan to be insured / sold. From this comparison we will attempt to draw some conclusions on the preference that different banks are expected to show when choosing the most appropriate instrument for transferring credit risk. For instance, banks with liquidity shortage are more likely to participate to the loan sales market, whereas banks that are strongly “relationship oriented” will mainly access the credit derivatives market.

These predictions will then be contrasted to the empirical evidence. We focus the attention on a sample of European bank holding companies that have accessed the CD and / or the loan sales markets over the period 2003-2005 to reduce their credit risk. Information on the participation to the two markets is then cross-matched with balance-sheet information in order to investigate whether the preference shown by banks in accessing predominantly one of the two markets or both markets can be significantly linked to some measurable features such as: 1) bank size; 2) bank capitalization and liquidity; 3) loan portfolio diversification; 4) lending quality; 5) profitability. Using basic panel econometric tools, we attempt to identify which of the above elements are more closely related to the use of credit derivatives and / or loan sales.

We find that banks in our sample view CDs and loan sales mainly as complements, since most banks participate to both markets. In fact, the activity in the CD market seems to be mainly driven by trading purposes, whereas loan sales are comparatively more used for credit risk management purposes. However, a minority of banks consider CDs and loan sales as substitutes, given that they take part primarily to one of the two markets.

The paper is structured as follows. Section 2 introduces credit derivatives and loan sales within the financial innovation theory. Section 3 contrasts the two CRT techniques from a theoretical and practical perspective. Section 4 discussed the data and the methodology employed. Results from our empirical investigation follow in Section 5. Section 6 concludes.

2. Loan sales and CDs within the financial innovation theory

A wide body of literature on loan sales addresses the question of why the loan sales market exists. According to this literature, some motivations for loan sales are consistent with explanations for financial innovations in general. Similarly to loan sales, CDs qualify as an instrument of financial innovation.

Adopting the classification scheme for innovations proposed by the BIS (1986), loan sales and CDs can be considered as either risk-transferring or liquidity-enhancing innovations. As risk-transferring innovations, loans sales and CDs allow banks to reduce credit risk and manage it “actively”. If banks sell loans/buy protection via CDs or if they sell and purchase loans in order to increase the level of portfolio diversification, in both cases banks would be expected to manage their portfolio risk more efficiently. Several works focus on loan sales as active credit risk management tools. According to Pavel and Phillis (1987), Berger and Udell (1993), and Demsetz (2000) a bank may want to alter the diversification of its loan portfolio, selling certain types of loans in order to buy or originate other types of assets (diversification hypothesis). As for the relation between seller's bank risk and loan

sales, empirical results are ambiguous. According to Pavel (1989), on average, loan sales have little impact on bank risk while, more recently, Cebenoyan and Strahan (2004) conclude that increasingly sophisticated risk management practices in banking such as selling and buying loans are likely to improve the availability of bank credit but not to reduce bank risk. The use of credit derivatives by banks as instruments to improve portfolio diversification has been discussed by Das (1998). The impact of the introduction of credit derivatives on the CRT market has been modelled by Duffee and Zhou (2001), who conclude that CDs can help alleviate the lemons problem in the loan sales market. Thompson (2006) also investigates the conditions under which credit risk can be effectively transferred via CDs and loan sales.

As liquidity-enhancing innovations, both loans sales and CDs can effectively promote liquidity in the underlying debt market, by making negotiable assets, such as bank loans, which are traditionally non-marketable. Loan sales also allow banks to free up alternative and (in some circumstances) cheaper funds than deposits and equity. Pennacchi (1988) shows that loan sales can provide a lower cost method of financing loans for those banks that face a competitive deposit market. On the contrary credit derivatives, while transferring credit risk, do not generate financial resources.

Considering the theory addressing the question of financial innovation through a demand/supply perspective, supply of innovation is strictly affected by some factors such as (1) regulation and (2) advances in technology. As far as the first factor is concerned, regulation leads to financial innovation by creating incentives for firms to skirt regulation requirements that restrict their ability to earn profits². Even adopting a dynamic framework, regulatory pressure is the basic factor of a continuative innovation process named “regulatory dialectic”³. In essence, the regulatory dialectic theory suggests that financial innovation is the reaction to inappropriate regulation and re-regulation is the response. The cycle “*regulation -> innovation -> re-regulation -> innovation*” embodies the regulatory dialectic and suggests that innovation has often been a consequence of regulation. Important policy implication of this theory is that regulators may not always achieve their aims, since some apparent risk-reducing regulation may paradoxically be risk-producing. Regulatory constraints matter also as motivations for loan sales and CDs. Pennacchi (1988) shows that banks may sell loans to avoid reserve requirements, capital requirements, and deposit insurance premiums; among them, capital requirements are the most often cited motivations for loan sales⁴. According to this body of literature, capital requirements in excess of what banks would hold in the absence of regulation make loans unprofitable. As a consequence, banks sell low-risk loans because they cannot afford to fund them (with the final effect of increasing portfolios riskiness). In principle, capital relief represents an incentive for credit derivatives too. In practice, this is true only to the extent that the derivative instrument constitutes a perfect hedge to a particular underlying reference obligation (bond or loan). In practice, in most cases, CD trades do not fully meet the requirements of a hedging transaction and therefore, do not benefit from any regulatory capital relief (see BIS 2005).

Beside regulatory pressure, improvements in both transaction and information technologies are considered important incentives for financial innovations⁵. Examples of technological changes in the banking industry are provided by Berger (2003); in this regard, financial engineering used to create new financial derivatives, credit risk models employed to improve portfolio managements, and modern credit scoring used to evaluate credit application are all examples of financial technologies particularly useful for promoting CRT tools.

²Regulatory pressure is a source of innovation even according to a sizeable body of literature attempting to understand the innovation phenomenon through market imperfections such as taxes, regulation, information asymmetries, transaction costs, and moral hazard and incompleteness theories. See Tufano (2003) for a comprehensive review of literature on market incompleteness and innovation.

³ Eisenbeis (1986) developed a specific theory of financial innovation based specially on US experience.

⁴ Greenbaum and Thakor (1987), and Pavel (1989).

⁵ See the classic work by Schmoockler (1967) and, more recently, White (2000).

According to Gorton and Haubrich (1990), Gorton and Pennacchi (1995), and Greenbaum and Thakor (1995) improvements in the ability to acquire, treat and transfer information have made it easier to sell and buy assets that are subject to lemon-market problems such as loans. From this point of view, developments in numerical analyses and simulation, hardware that enables faster processing and the Internet are examples of those mechanism arisen with the effect of allowing “buyers to reliably assess the quality of the sellers’ product” and to avoid “lemons”⁶.

3. Loan sales vs Credit derivatives: similarities and differences

Traditional CRT instruments such as loan sales have been available for some time, and new varieties of CRT mechanisms such as credit derivatives have developed over the last decade and quickly expanded. Statistics from the British Bankers’ Association show that the size of the market for credit derivatives has grown dramatically in the last few years, going from \$893 billion in 2000 to \$20 trillion in 2006. Although market surveys (see, for example, BBA 2006) indicate that only one third of banks’ credit derivatives volume is related to their loan book, these instruments have rapidly gained a key role in the CRT market. More traditional loan sales instruments have also experienced an increase in recent years, doubling in size from \$112 billion in 2002 to \$238 billion in 2006 (LSTA 2007).

While loans sales and CDs are both considered CRT mechanisms, some theoretical and practical differences arise, which will be important in determining the likelihood of choosing one instrument or the other for transferring credit risk. A typical loan sale is probably the simplest CRT mechanism, since the bank originating the loan sells all or part of payments from the underlying loan to a third party. Unlike securitisation, loan sales involve no creation of new securities and therefore they represent a sort of primitive form of securitization. Loan sales come in three basic types: participations, assignments, and novations. These types differ in the degree to which they transfer rights and obligations.⁷ Participations give the buyer only the right to receive (in a whole or part) future payments to be made according to the underlying contract, but do not transfer any of the rights and obligations of the original contract, and therefore allow to retain the relationship with the borrower. Assignments shift the direct debtor-creditor relationship from bank to the loan buyer together with seller’s rights; according to the cases, the contract may require the borrower to agree to the sale. Finally, a novation completely transfers all rights and obligations and implies a new contract stipulated between the buyer and the borrower; in practice, through novations the seller leaves the picture entirely, replaced by a new actor. Currently, because of the higher monitoring costs and risks involved in participations and legal cost involved in novations, the bulk of loan sales occur in the form of assignments.

Credit derivatives are over-the-counter financial instruments whose payoffs are linked to a specific credit related event such as a default, debt restructuring, or credit downgrade. The two main types of credit derivatives traded on the market are credit default swaps (CDS) and synthetic collateralized debt obligations (SCDO). In a CDS the credit protection seller agrees to pay the default payment to the protection buyer if a credit event has happened, in exchange for a fee to be paid at regular intervals until the credit event or maturity. CDS can be written on individual names (single-name CDS) or on baskets of names (CDS index), and overall they represent about 60% of the credit derivatives volume. Synthetic CDOs in principal are very similar to debt securitization, as a specialized entity (Special Purpose Vehicle) transforms a pool of assets into various tranches of securities with different levels of risk. However, in a SCDO, the pool of assets is given by a collection of CDS contracts, instead of a pool of bonds or loans. According to recent estimates, SCDOs account for about 15% of the credit derivative market size.

⁶ Gorton and Haubrich (1990).

⁷ About loan sales contract forms and legal issues, see Gorton and Haubrich (1990).

As far as the effectiveness in transferring credit risk is concerned, banks which sell loans / buy CDs obtain maximum benefit (e.g. by-passing capital requirements) if they can entirely remove the credit risk of the underlying loan. For this purpose, two basic criteria must be met in the loan sales market: (1) the loan transferred and the original loan must have identical terms and conditions; (2) loan sales must be without recourse. Doing so, the loan (and the related risk) can be removed by the bank's balance sheet. The higher the guarantee provided by the seller (through covenants or by transferring only a part of cash flows referred to the original loan) the less the credit risk transferred and capital requirements by-passed. In practice, most loan transactions occur without any explicit or implicit recourse.

Different typologies of loans have been transferred via loan sales. Two main segments can be identified.⁸ In the first segment, loans transferred differ in terms of borrower's characteristics and loan facilities. Consequently, these loans are not standardized – according to the terms defined above – and are mostly traded through on-line trading platforms. The second segment covers the majority of the deals and includes the most standardized transactions: standardization occurs with reference to facilities (mostly term loans), maturity (often three-to six-year maturities), covenants and seniority (loans are usually senior secured and with strong covenant protection), facility rating (often speculative grade), and coupon (floating rate tied to Libor, with normally 250 – 400 basis points above these rates)⁹. Loans meeting these criteria are Highly Leveraged Transaction (HLT) Loans, namely loans originated on the primary market through a syndication process in order to finance leveraged operations such as LBOs and M&As. Standardisation even occurs with reference to trading documents and market practices.¹⁰ As a consequence a more liquid and transparent market has arisen, to such an extent that the HLT loan secondary market is now provided with daily dealer-quote based mark-to-market pricing, similar to those existing in more efficient capital market segments.¹¹

In the CRT market, the seller of credit protection has a clear information disadvantage with respect to the original lender. Therefore, CRT instruments give rise to agency problems, in terms of moral hazard and adverse selection (Pennacchi 1988). Different mechanisms can be conceived in order to avoid such problems: for example, with reference to the loan sales market according to Pennacchi (1988) and Gorton and Haubrich (1990), it could be possible to reduce lemon problems and increase the seller's incentive of monitoring through selling only a portion of the initial contract, by stripping the loan, or modelling incentive-compatible contracts. Mostly, loan contracting through the inclusion of borrowers' restrictive covenants seems to be an effective tool for mitigating agency problems (Drucker and Puri 2006). With reference to CDs agency problems are limited by the fact that the majority (around 60%) of underlying assets in CDS contracts are rated investment grade, although the share of non-investment grade assets has expanded from 13% in 2004 to 23% in 2006 (BBA 2006). Also, banks often retain the equity tranches of the structured credit products in their portfolio, providing a signalling effect. Poor quality loans or non-performing loans are still channelled mainly via loan sales or securitization (ECB 2004).

CRT mechanisms can have major effects on the relationships between the original lender and the borrower. In a typical loan sale the borrower is notified of the sale and this may compromise future lending relationships with the selling bank. On the contrary, CDs allow banks to remove the credit risk of an asset without actually transferring the underlying credit, which remains on the balance sheet.

⁸ Saunders (2000).

⁹ Fabozzi ed. (1998), Saunders (2000).

¹⁰ The presence of standardized terms and conditions for loan trading has had the primary effect of dramatically reducing contractual problems, transaction costs, and trade disputes over a variety of issues.

¹¹ The growth of the HLT loan secondary market has highly improved after the formation of the Loan Syndication and Trading Association (LSTA), created with the primary scope of promoting “a more liquid, efficient, and transparent market for C&I bank loans”. See Bruno (2004) for a detailed analysis of the US loan secondary market structure.

This aspect is of crucial importance for protecting the special relationship that banks entertain with their borrowers. For certain types of loans, the relationship between borrowers and lenders is so important to make a clean loan sales or securitization undesirable for the bank. This is for instance the case of loans to SMEs and more generally to borrowers that might want to keep the amount or even the existence of the relationship confidential. In these cases, CDs can represent a more efficient way to transfer the underlying credit risk since the borrower is not aware of the transaction or part of it¹². In fact, according to some empirical literature loan sales effect on relationship is ambiguous. Due to credit risk management loan sales could be potentially beneficial to the relationship because they may actually increase the flexibility in future deals and as a consequence provide the borrowers with additional sources of capital. In this respect, according to Drucker and Puri (2006), borrowers whose loans are sold are more likely to retain their relationship, by keeping the same lender in the future. Duffee and Zhou (2001), Parlour and Plantin (2005), Morrison (2005) investigate the effects of the introduction of credit derivatives on relationship banking.

4. Data and Methodology

Our purpose is to test the CD and loan sales activity of a sample of European banks for the time period 2003–2005. The sample includes the 50 largest European bank holding companies in terms of total assets according to Bankscope. A large number of bank groups are based in Germany (14 out of 49), whereas the remaining ones are equally spread in Europe (see Table A.1. in Appendix for the geographical distribution of our sample). In order to investigate how the activity in those CRT markets is affected by bank characteristics, we construct a database using three different data sources. Loan data are collected from Loan Pricing Corporation's (LPC) Dealscan database, which provides loan contract terms for all loans (mostly syndicated) originated globally. Given the unavailability of exact data on loan sales and purchases on the secondary market for European banks, we use data on the loans originated by the sample banks as a proxy of their participation to the loan secondary market. We only include syndicated loans: a) originated in the type of term loan and institutional term loan; b) with covenants. This is consistent with both market practice (Fabozzi ed., 1998; Saunders, 2000) and recent empirical work (Drucker and Puri 2006), according to which almost all of the loans sold on the secondary market are syndicated in the primary market, have additional covenants, and are term loans¹³. As a measure of annual loan sales volumes, we collect annual flows of loans originated from 31 July to 30 June of each year from 2002 to 2005 (for example, the 2003 loan sales volume is given by loans originated between 31 July 2002 and 30 June 2003). We gather loans originated in the time period July-June (instead of January-December) as a proxy of loan sold in each year because of the common practice of selling loans within a few months after the date of origination¹⁴.

Data on the credit derivatives activity of individual European banks is very scarce, given that there are no common public disclosure requirements of CD activities by individual institutions. Information on banks' use of CD instruments is mainly available at an aggregate level, through general surveys (see, for example, ECB 2004, Fitch Ratings Special Annual Report, BIS 2005). For our purposes, we gather

¹² The second key issue that arises in CRT activities, related to asymmetric information problems, remains, as the bank, acting as protection buyer, possesses a significant information advantage on the borrower over the protection seller.

¹³ Syndicated loans are structured on the primary market in order to facilitate sale on the secondary market. Since selling loans can induce agency problems, loan contracting can increase the likelihood of selling loans. Term loans are more likely to be sold than credit lines because they require less ongoing information collection (Berger and Udell, 1995), while covenants can reduce reliance upon seller's information (Drucker and Puri, 2006). According to LSTA (2007), almost 80% of loans traded on the secondary market are term loans.

¹⁴ In this respect, Drucker and Puri (2006) find that over 60% of the loans are sold within one month after the date of origination and nearly 90% are sold within one year after origination.

information on the total notional amounts of CD instruments bought and sold by the bank holding companies in our sample during the period 2003-2005 directly from the consolidated financial statements. The level of disclosure of the activity in the CD market greatly varies amongst the banks in the sample, although has generally improved since 2003. In 2005, 33 bank groups (out of 49) report the notional amount of their CD transactions; 7 banks claim to use CDs for hedging / trading purposes, but do not report figures, whereas 9 banks do not mention CDs in their annual report. In line with previous empirical surveys (ECB 2004), the largest volumes of CD transactions seem to be for trading, rather than for hedging, purposes, especially for the biggest bank groups in our sample. In general, banks are active both as credit risk protection buyers and sellers¹⁵, and single name Credit Default Swaps seem to be the most popular CD instrument.

Table 1 summarizes the total volumes of CDs and loan sales recorded for our sample banks over the period under analysis¹⁶. In line with the explosive growth of the CD market, the notional amounts of CD instruments bought and sold have increased from 1,307 € bln in 2003 to 7,543 € bln in 2005. However, the increased popularity of CDs does not seem to have affected the activity in the loan sales market. These findings seem to suggest that CD and loan sales are perceived by banks as complements, rather than substitutes.

Our main purpose is to test whether and how the intensity of participation in CD and loan sales markets may be related to some banks characteristics, such as bank size, quality and diversification of the loan portfolio, capital structure and liquidity, profitability. We have chosen the following indicators as measures of the bank features under analysis, since they have been widely used in several related empirical studies and they are available for all bank groups in the sample:

Size:

Log of total assets

Lending quality:

Loan loss reserves / gross loans

Diversification of the loan portfolio:

- Total loans to retail customers / total loans to customers
- Herfindahl-Hirshman Index = $\sum_{i=1}^3 L_i$ where L_i is the proportion of loans (over total loans to customers) for loan geographical category i , where each category includes loans grouped by the nationality of borrowers (Domestic, other European, Rest of the world).

Capital structure/liquidity:

- Tier 1 ratio = (shareholders funds + perpetual non cumulative preference shares) / risk weighted assets and off balance sheet risks
- Capital adequacy ratio = (Tier 1 + Tier 2 capital) / risk weighted assets and off balance sheet risks
where Tier 2 capital includes subordinated debt, hybrid capital, loan loss reserve
- Deposit run off ratio = Liquid assets / customer and short term funds

Profitability:

¹⁵ Unfortunately, only a very limited number of banks report separate figures for credit risk protection bought / sold, and for CD transactions for hedging / trading purposes. A more detailed analysis of the activities of our sample banks in the credit derivatives market is therefore unfeasible, though desirable.

¹⁶ It is worth reminding that the figures for CD underestimate the real activity in this segment, since some bank groups participate in CD markets, but do not report the relative figures in the annual reports.

- Net interest income / average assets
- Other operation income / average assets
- Return on average assets (ROAA)
- Return on average equity (ROAE)

Bank size (natural logarithm of total assets) may affect CRT transactions in many ways. In general, large banks might have comparatively stronger lending opportunities and comparatively higher funding costs, and therefore are more likely to buy credit protection / sell loans (Pennacchi, 1988). For loan sales, because of agency problems, it might be easier for higher reputation lenders – that is larger banks – to sell or syndicate loans (Haubrich and Thomson, 1993; Denni and Mullineaux, 2000; Drucker and Puri, 2006). Fixed costs associated with CRT techniques¹⁷, together with the high expertise required for pricing sophisticated CRT instruments (in particular, CD) favour the participation of large banks (see Demsetz, 2000 for loan sales). On the other hand, if small banks have limited opportunities for diversified lending, they may have an incentive to diversify their loan portfolio by selling credit risk protection via CD or by buying loans on the secondary market. Alternatively, if small banks face binding legal lending limits, they may participate as loan sellers (Demsetz, 2000).

Our measure of loan quality (loan loss reserves / gross loans)¹⁸ may help explain participation in the loan sales / CD markets in different manners. In principle, riskier banks – that is banks with a lower loan portfolio quality – should sell more loans / buy credit protection in order to reduce potential distress and maintain their existing level of capital (Pavel and Phillis, 1987). On the other hand, considering the loan portfolio quality as a proxy of bank reputation and given that most of loan sales occur without recourse, loan buyers may shy away from sellers with poor or unknown asset quality. This is consistent with a lemons market problem associated with loan sales (Haubrich and Thomson, 1993; Demsetz, 2000).

Diversification is one of the leading drivers of loan sales / credit derivatives. Banks with poor opportunities for diversified lending can improve the mix of loans in their portfolio by using CD or by participating to the secondary loan market (Pavel and Phillis, 1987; Demsetz, 2000). We use two measures of diversification. The first measure is the incidence of retail loans over total customer loans: the higher the ratio the lower the portfolio concentration, the lower the intensity of participation to loan sales / CD markets. This is consistent with the fact that retail loans are *per se* more numerous and diversified – for instance in terms of loan types, maturity, and location – than non-retail loans. The second ratio – a version of the Herfindahl-Hirschman Index based on the nationality of borrowers - measures the degree of the loan portfolio geographical diversification. In this case, we expect banks with higher ratio - that is banks geographically more concentrated – to access the CD / loan sales market more actively than banks with lower geographical concentration.

Funding motive is probably the major reason for loan sales according to relevant theoretical and empirical literature. With respect to how capital structure and liquidity affect loan sales, we would expect that more regulatory and liquidity constrained banks would sell loans in order, respectively, to maintain their existing level of capital and fund new loans without recurring to deposit and capital markets. As capital structure measures we use Tier 1 ratio and capital adequacy ratio, both calculated under the Basle rules. As liquidity measure, we use a deposit run off ratio. For both capitalization and liquidity measures, the higher the ratio, the more capitalized and liquid is the bank, the smaller the expected volume of loan sales. Unlike loan sales, credit derivatives do not generate liquidity, therefore we do not expect the liquidity ratio to impact on the CD activity. On the other hand, previous

¹⁷ For example, transaction, IT, legal, and contracting costs.

¹⁸ Given a similar charge-off policy, the higher the ratio, the poorer the quality of the loan portfolio will be. With this respect, other asset quality measures could have been chosen (e.g, non performing ratio and net charge-off ratio) but the one we use is the best proxy for loan quality we could construct given data available on Bankscope.

empirical evidence (Minton et al. 2006) suggests an inverse relationship between capitalization and participation to the CD market.

To investigate the relation between profitability and participation to the CRT markets, we use four different measures of profitability. Beside the traditional measures of equity and assets profitability (ROAE and ROAA), we use net interest income ratio and other income ratio to gain insights into a bank's lending opportunities. Originating and servicing loans generate both interest income and fees. Consistently with the comparative advantage hypothesis, the more profitable the lending activity is, the more the bank sells loans, when originating and servicing loans is more profitable than warehousing them. Given that the largest volumes of CD transactions are for trading purposes, we expect the most active participants in the CD market to display a high ratio of other income on average assets.

5. Empirical analysis

To investigate the distinctive features of the bank holding companies that act as top players in the CD and loan sales market, we proceed as follows.

First, we select the top 15 players in each market (for each year under analysis) based on a proxy of market participation calculated respectively as:

- Total notional amount of CDs bought or sold / total assets¹⁹
- Annual flows of loans / total assets

We then compute the average values of the banks' indicators for the top 15 players and compare them with the average values for all other players (Table 2). A simple t-test for equality of means under the assumption of unequal variances is provided to formally check for significant differences between averages.

This preliminary analysis has been integrated with a more formal panel estimation of the impact of the various bank characteristics on the intensity of participation to CD and loan sales markets, respectively. For this purpose, we only focus on the period 2004-2005, to avoid potential distortions in the results induced by changes in the accounting standards since 2004. The dependent variables of the two panel regressions are the proxies for market participation to the CD and to the loan sales market illustrated above. To avoid multicollinearity issues, we exclude from the analysis those explanatory variables which are more closely correlated with the other variables (Proportion of retail loans, Tier 1 ratio, ROAA).²⁰ Random effects have been included in the panel specification and the Hausman test for model misspecification has been performed. The results are presented in Table 3.

Loan sales

The results in table 3 show that bank's size has a coefficient that is negative but insignificant. Therefore we do not find evidence of either a reputation effect or a presence of scale economies in the loan sales market.

Diversification appears to be an important reason for selling loans. Our proxy for geographic diversification suggests, and somewhat to our surprise, that well diversified banks sell more loans than concentrated banks. In fact, this result is not entirely surprising. Interpretation of the diversification coefficient may be confounded by the fact that the volume of loan sales includes transfers of loans

¹⁹ For credit derivatives, this indicator has been integrated with the League Tables of the main participants to the CD market.

²⁰ See Table A.2. in Appendix for correlation coefficients.

between affiliates in a given bank holding company²¹. In this respect, transfers of loans among banks subsidiaries of a bank holding company are more likely in geographically diversified entities, as many bank groups of our sample (Demsetz, 2000).

The coefficient of the lending quality is negative, meaning a lemons problems instead of a capital relief purpose associated with loan sales, but not statistically significant.

As for capital structure and liquidity, we do not find evidence of a capital and liquidity shortage as a motivation for loans sales. The negative coefficient for liquidity is consistent with the comparative advantage hypothesis – banks affected by a liquidity shortage should sell more loans than liquid banks - but it is insignificant. On the contrary, the positive and significant coefficient on the capital ratio means other reasons rather than funding motive could explain loan sales activity. The positive coefficient may reflect a reputation effect: buyers prefer loans from stronger, better-capitalized banks in order to avoid lemons (Haubrich and Thomson, 1993). Furthermore, a multi-countries bank holding effect may occur. According to Cebenoyan and Strahan (2004), multi-state bank holding companies may be often overseen by multiple regulatory agencies, which may increase their need to hold regulatory capital. At the same time, it may be more difficult for multi-state banking companies to move capital between affiliates compared to multi-bank holding companies with subsidiaries in just one state.

As expected, banks with good lending opportunities are more active loan sellers than banks with less profitable loans. Consistently with the comparative advantage hypothesis, the positive and significant coefficient on the net interest margin / average assets supports this interpretation, as high margin over assets indicate a bank with a good supply of profitable loans. Further, the positive and highly significant other income is consistent with the practice of originating loans with the intent of immediately reverse that trade with subsequent counterparts. Actually, according to LSTA, the current flow activity in the loan sales market is driven by portfolio management; indeed, a growing part of secondary markets participants is constituted by banks acting as traders and market makers (Fabozzi ed., 1998; Coffey, 2000; LSTA 2007). Both these roles generate non interest income, in the form of fees and bid-ask spread.

Credit Derivatives

Our empirical findings confirm our expectations on the relation between CD activity and bank size. In line with previous empirical findings (Minton et al. 2006), the most active players in the CD market are significantly larger than other bank groups. Somehow unexpectedly, banks groups with a better diversified loan portfolio (especially geographically) make larger use of CDs. When CDs are used for transferring credit risk of the banking book, we expect a positive relation between loan portfolio concentration and CD activity. However, in our case, most of the CD volume comes from trading book transactions, which are normally carried out by large bank holding companies that are usually well diversified. This explains our “counterintuitive” findings. The quality of the loan portfolio does not seem to have a significant impact on the use of CD instruments. This can be explained by the fact that the most liquid CDs are written on investment grade obligors and, therefore, CDs are not routinely used as credit protection instruments for the riskiest loans. Again, contrary to previous empirical evidence, we find that better capitalized bank groups access the CD markets more intensively. As previously mentioned, large bank groups operating in more than one country (who play a leading role

²¹ Membership in a multibank holding company may help explain participation to the secondary loan market, since transactions between holding company affiliates are not subject to agency problems. See Haubrich and Thomson (1993), Demsetz (2000), Cebenoyan and Strahan (2004).

in the CD markets) may be required to hold larger amounts of capital.²² Overall profitability measures (ROAA and ROAE) do not appear to be significantly related to the intensity of participation to the CD market. However, it is interesting to notice that the top players in the CD display lower margins from traditional financial intermediation and higher income from non traditional operating activities, typical features of large, well diversified bank groups. Again, this is in line with the fact that most of the CD transactions originate for trading, rather than hedging, purposes. As expected, the liquidity ratio does not play a significant role in explaining bank's activity in CDs, which are unfunded CRT instruments.

Credit Derivatives vs Loan Sales: Complements or Substitutes?

At this stage, it is interesting to investigate whether the banks which are particularly active in the loan sales market are also active participants to the credit derivatives market. If banks perceive CDs and loan sales as complements, they would engage in both activities, whereas if they see them as substitutes, they would concentrate on one particular market. For this purpose we calculate the percentage of bank groups highly active in both markets, highly active in one market but not very active in the other market, and not very active in both markets for the years 2004-2005.²³ The composition of the sample is reported in Figure 1.

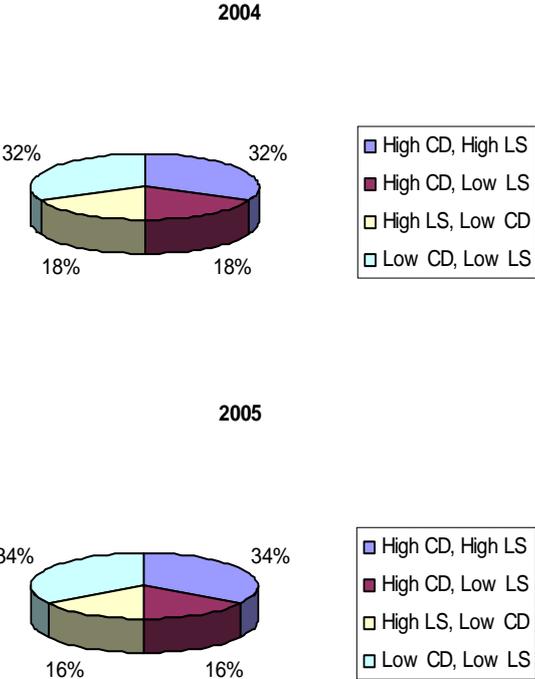


Figure 1. Sample composition by intensity of participation to the CD and loan sales markets.

According to our findings, banks in our sample view CDs and loan sales mainly as complements, since around 66% of the financial institutions take similar positions in both segments of the CRT market

²² It is worth noticing that some findings may be distorted by the effect of the CRT activity on the bank's indicators. For example, banks with a large participation in loan sales and CD markets may be more diversified, more capitalized and more profitable as a consequence of their CRT activity. Unfortunately, given that data is available to us on an annual basis only and for a limited time period (especially for credit derivatives), it is particularly difficult to assess the causality relationship between CRT activity and these variables.

²³ High and low participation are calculated with respect to the average activity of the sample of banks.

(high participation to both markets for 33% of the sample and low participation for an equivalent proportion).²⁴ In fact, the bank groups in our sample seem to access the CD market mainly for trading purposes given the high standardization and liquidity of those instruments, whereas loan sales are comparatively more used for credit risk management purposes. The most active players in both markets are typically very large and well diversified bank holding companies having easy access to either market due to reputation effects and significant scale economies associated with CRT activities. On the contrary, a limited activity in the CRT market seems to be associated with less sophisticated banks having smaller size and capital ratios. In addition, the propensity to adopt innovative CRT instruments can be linked to national factors such as the lending customer's base and the country-specific development of new financial market segments.²⁵

It is interesting to notice that around 34% of the banks in our sample consider CDs and loan sales as substitutes, given that they participate actively only to one of the two markets. In general, smaller banks with a higher proportion of retail loans in their portfolio tend to prefer loan sales, whereas banks with a higher percentage of corporate / public loans make a more intensive use of CDs. This can be explained by considering that non-retail loans are more subject to relationship lending problems, for which CDs represent more appropriate instruments for transferring credit risk. Also, retail loans are easier and less costly to sell on the secondary loan market, after appropriate bundling.

6. Conclusions

In the present work we attempted to investigate whether two very popular instruments, loan sales and credit derivatives, are complements or substitutes for the purposes of transferring credit risk from both a theoretical and a practical perspective.

While similar under many aspects, loan sales and CDs differ under several respects. In particular, loan sales are funded instruments that allow to transfer the credit risk via a true sale of the underlying loan. Credit derivatives are unfunded instruments that allow to transfer the risk of the underlying obligation by retaining the ownership of the credit. Credit derivatives are very standardized and mainly written on investment-grade obligors, whereas loan sales can be more flexible and speculative-grade.

Our empirical investigation is based upon the CD and loan sales activity of a sample of European banks for the time period 2003–2005. The sample includes the 50 largest European bank holding companies in terms of total assets according to Bankscope. We test whether and how, in line with theoretical predictions, the intensity of participation in CD and loan sales markets may be related to some banks characteristics, such as bank size, quality and diversification of the loan portfolio, capital structure and liquidity, profitability.

We find that bank size is the main factor affecting the participation to the CD market, which is mainly driven by trading-book, rather than banking-book, transactions. Large, well capitalized and well diversified banks are the top player in this market. As for loan sales, well diversified banks with high capital ratios and good lending opportunities seem to be the major participants in the loan secondary market. We find evidence that, in general, banks have not substituted loan sales with CDs for credit risk management of their lending portfolio. Therefore the two instruments are normally used as complements, rather than substitutes. However, a non negligible percentage of the bank groups in our samples tend to concentrate predominantly in one of the two CRT segments, suggesting that for some banks the two instruments can be considered quite close substitutes.

²⁴ Similar findings have been provided by Minton et al. (2006) on a sample of US bank holding companies.

²⁵ For instance, Italian banks are not very active on loan sales and CD markets. The majority of their loan portfolio is made of small loans to unrated SME, which are not easily negotiable on the secondary market and do not represent adequate underlying reference obligations for liquid CD instruments.

References

- Berger A., 2003, The Economic Effects of Technological Progress: Evidence from the Banking Industry, *Journal of Money, Credit, and Banking* 2 (35), 141-176.
- Berger A., Udell G.F., 1993, Securitization, Risk, and the Liquidity Problem in Banking, In: M. Klausner and L. White, eds, *Structural Change in Banking*, Irwin Publishing, Homewood, IL.
- Berger A., Udell G.F., 1995, Relationship Lending and Lines of Credit in Small Firm Finance, *Journal of Business* 68, 351-381.
- BIS, 1986, Recent Innovations in International Banking, Basel.
- BIS, 2005, Credit Risk Transfer, the Joint Forum, Basel.
- Bruno B., 2004, *Il mercato secondario dei prestiti bancari*, Banca Editrice, Roma.
- Carlstrom C.T., Samolyk K.A., 1995, Loan Sales as a Response to Market-Based Capital Constraints, *Journal of Banking and Finance* 19, 627-646.
- Cebenoyan S., Strahan P., 2004, Risk Management, Capital Structure and Lending at Banks, *Journal of Banking and Finance* 28, 19-43.
- Coffey M., 2000, The US Leveraged Loan Market: from Relationship to Return, In: T. Rhodes, *Syndicated Lending. Practice and Documentation*, Euromoney Books, London.
- Das S., 1998, Credit Derivatives-Instruments, In: S. Das ed., *Credit Derivatives: Trading and Management of Credit and Default Risk*, John Wiley and Sons, Singapore.
- Demsetz R., 1994, Economic Conditions, Lending Opportunities and Loan Sales, Federal Reserve Bank of New York, Research Paper 3.
- Demsetz R., 2000, Bank Loan Sales: A New Look at the Motivations for Secondary Market Activity, *Journal of Financial Research* 23, 192-222.
- Dennis S.A., Mullineaux D.J., 2000, Syndicated Loans, *Journal of Financial Intermediation* 4, 404-426.
- Drucker S., Puri M., 2006, On Loan Sales, Loan Contracting, and Lending Relationships, Working Paper.
- Duffee, G., C. Zhou, 2001, Credit Derivatives in Banking: Useful Tools for Managing Risk?, *Journal of Monetary Economics* 48, 25-54.
- Eisenbeis R.A., 1986, Inflation and Regulation: Effects on Financial Institution and Structure, In: R.C., Aspinwall, R.A. Eisenbeis eds., *Handbook for Banking Strategy*, John Wiley, New York.
- European Central Bank, 2004, Survey on Credit Risk Transfer in the European Market.
- Fabozzi F. ed., 1998, *Bank Loans: Secondary Market and Portfolio Management*, Frank J. Fabozzi Associates, New Hope, Pennsylvania.

Finnerty J.D., 1992, An Overview of Corporate Securities Innovation, *Journal of Applied Corporate Finance* 4 (4), 23–39.

Fitch Ratings, 2003, Global Credit Derivatives: Risk Management or Risk?

Gardener E.P.M., 1986, Securitization and the Banking Firm, *Research Papers in Banking and Finance* 15, Institute of European Finance, University of Wales, Bangor.

Gorton G.B., Haubrich J.G., 1990, The Loan Sales Market, *Research in Financial Service*, Volume 2, 85-135.

Gorton G.B., Haubrich J.G., 1987, Loan sales, Recourse, and Reputation: an Analysis of Secondary Loan Participations, Rodney L. White Center for Financial Research, University of Pennsylvania, Working Paper 14.

Gorton G.B., Pennacchi G.G., 1995, Banks and Loan Sales: Marketing Non-Marketable Assets, *Journal of Monetary Economics* 35, 389-411.

Greensbaum S., Thakor A., 1987, Bank Funding Modes: Securitisation versus Deposits, *Journal of Banking and Finance* 11, 379-402.

Greensbaum S., Thakor A., 1995, *Contemporary Financial Intermediation*, The Dryden Press, Harcourt Brace College Publishers.

Haubrich J.G., Thomson J.B., 1993, Loan sales, Implicit Contracts and Bank Structure, Federal Reserve Bank of Cleveland, Working Paper 7.

LSTA, 2007, The LSTA Trade Data Study, February.

Minton, B.A., Stultz, R. and Williamson R., 2006, How Much Do Banks Use Credit Derivatives to Reduce Risk?, NBER Working Paper 11579.

Morrison A.D., 2005, Credit Derivatives, Disintermediation and Investment Decisions, University of Oxford, Working Paper.

Parlour C.A., Plantin G., 2006, Credit Risk Transfer, Carnegie Mellon University, Working Paper.

Pavel C., Phillis D., 1987, Why Commercial Banks Sell Loans: An Empirical Analysis, Federal Reserve Bank of Chicago, *Economic Perspectives*, May/June.

Pavel C.A., 1989, Loan Sales Have Little Effect on Bank Risk, Federal Reserve Bank of Chicago, *Economic Perspectives*, January/February.

Pennacchi G.G., 1988, Loan sales and the Cost of Bank Capital, *The Journal of Finance* 43, 375-396.

Saunders A., 2000, *Financial Institutions Management: a Modern Perspective*, Irwin Mc Graw-Hill, International Edition.

Schmookler J.A., 1967, *Invention and Economic Growth*, Harvard University Press, Cambridge, MA.

Thompson J.R., 2006, Credit Risk Transfer: To Sell or to Insure?, Queen's University Working Paper.

Tufano P., 2003, Financial Innovation, In: G. Constantinides, M. Harris and R. Stultz, *The Handbook of Economics of Finance* (1), North Holland, The Netherlands.

White L.J., 2000, Technological Change, Financial Innovation, and Financial Regulation in the U.S.: The Challenge for Public Policy, In: P. Harker and S. Zenios eds., *Performance of Financial Institutions*, Cambridge University Press, Cambridge, UK.

Table 1. Credit Derivatives and Loan Sales Activity

	2005	2004	2003
Credit Derivatives			
Notional amount (€million) of credit protection bought and sold	7,543,338	2,986,582	1,307,484
<i>as a percentage of total assets</i>	41.22%	20.27%	12.63%
<i>as a percentage of total loans</i>	108.87%	51.22%	32.15%
N. bank holding companies disclosing figures on credit derivatives	33	31	26
Loan Sales			
Volumes originated / sold (€million)	111,792	114,554	56,963
<i>as a percentage of total assets</i>	0.45%	0.56%	0.33%
<i>as a percentage of total loans</i>	1.10%	1.34%	0.77%
N. bank holding companies involved	46	48	47

Table 2. Distinctive features of top players in credit derivatives and loan sales markets.

Average values of the main characteristics of the bank holding companies of our sample that are very active in the credit derivatives and the loan sales markets (top 15 players). The top players have been chosen based on the ratio between credit derivative volumes and total assets and on the ratio between loan sales volumes and total assets, respectively. The average values for the top players are compared with the average values of the remaining banks in the sample. The test for equality of means between top players and other banks is a simple t-test under the assumption of unequal variances.

	Credit Derivatives			Loan Sales		
	2005	2004	2003	2005	2004	2003
Size						
Mean Top 15	13.477	13.276	13.160	13.093	12.912	12.808
Mean other banks	12.570	12.417	12.249	12.739	12.578	12.404
Mean equality test (p-values)	<i>0.000*</i>	<i>0.000*</i>	<i>0.000*</i>	<i>0.126</i>	<i>0.130</i>	<i>0.052⁺</i>
Loan diversification						
Mean Top 15	37.854	37.307	39.266	39.670	41.491	42.038
Mean other banks	35.604	36.177	35.180	34.802	34.332	33.278
Mean equality test (p-values)	<i>0.682</i>	<i>0.839</i>	<i>0.833</i>	<i>0.374</i>	<i>0.194</i>	<i>0.107</i>
Geographic diversification						
Mean Top 15	0.463	0.490	0.520	0.518	0.496	0.513
Mean other banks	0.644	0.659	0.648	0.619	0.656	0.661
Mean equality test (p-values)	<i>0.001*</i>	<i>0.001*</i>	<i>0.004*</i>	<i>0.065⁺</i>	<i>0.002*</i>	<i>0.005*</i>
Loan quality						
Mean Top 15	1.881	2.485	2.573	1.739	2.129	2.516
Mean other banks	2.017	2.270	2.281	2.079	2.428	2.602
Mean equality test (p-values)	<i>0.795</i>	<i>0.705</i>	<i>0.150</i>	<i>0.514</i>	<i>0.597</i>	<i>0.867</i>
Tier 1 ratio						
Mean Top 15	8.867	8.556	8.576	8.500	8.536	8.553
Mean other banks	7.909	8.029	8.118	8.071	8.038	7.950
Mean equality test (p-values)	<i>0.024*</i>	<i>0.204</i>	<i>0.294</i>	<i>0.323</i>	<i>0.230</i>	<i>0.166</i>
Total capital ratio						
Mean Top 15	12.547	12.397	12.291	12.053	12.257	12.307
Mean other banks	10.944	11.306	11.412	11.162	11.368	11.138
Mean equality test (p-values)	<i>0.000*</i>	<i>0.009*</i>	<i>0.000*</i>	<i>0.045*</i>	<i>0.036*</i>	<i>0.006*</i>
Net int. margin / Average assets						
Mean Top 15	0.973	1.083	1.228	1.363	1.436	1.525
Mean other banks	1.265	1.333	1.249	1.036	1.128	1.316
Mean equality test (p-values)	<i>0.093⁺</i>	<i>0.085⁺</i>	<i>0.302</i>	<i>0.067⁺</i>	<i>0.070⁺</i>	<i>0.072⁺</i>
Other income / Average assets						
Mean Top 15	1.327	1.298	1.186	1.220	1.309	1.389
Mean other banks	0.872	0.919	0.926	0.919	0.870	0.953

Mean equality test (p-values)	<i>0.004*</i>	<i>0.019*</i>	<i>0.076⁺</i>	<i>0.053⁺</i>	<i>0.005*</i>	<i>0.019*</i>
ROAA						
Mean Top 15	0.559	0.411	0.480	0.662	0.643	0.504
Mean other banks	0.598	0.514	0.463	0.553	0.412	0.405
Mean equality test (p-values)	<i>0.691</i>	<i>0.351</i>	<i>0.109</i>	<i>0.263</i>	<i>0.033*</i>	<i>0.479</i>
ROAE						
Mean Top 15	16.141	9.875	10.266	16.431	12.032	8.009
Mean other banks	14.648	11.236	10.156	14.521	10.284	8.481
Mean equality test (p-values)	<i>0.456</i>	<i>0.651</i>	<i>0.041*</i>	<i>0.340</i>	<i>0.561</i>	<i>0.897</i>
Liquidity ratio						
Mean Top 15	14.947	20.629	18.842	13.000	12.955	22.891
Mean other banks	16.847	16.514	16.887	17.706	19.899	25.096
Mean equality test (p-values)	<i>0.735</i>	<i>0.450</i>	<i>0.606</i>	<i>0.400</i>	<i>0.200</i>	<i>0.620</i>

*: Statistically significant at 5% confidence level.

⁺: Statistically significant at 10% confidence level.

Table 3. Activity in credit derivatives and loan sales and bank characteristics: Panel estimation

Estimates from panel regressions of a measure of bank activity in the credit derivatives and loan sales markets over the years 2004-2005 on various bank characteristics. The ratio between notional amounts of credit derivatives and total assets and the ratio between loan sales volumes and total assets have been chosen as measures of bank activity in the two markets. Random effects have been included in the panel specification. The last row reports the results of the Hausman test of model misspecification (fixed vs. random effects, null hypothesis: no misspecification).

	Credit derivatives		Loan sales	
	Coefficient	p-values	Coefficient	p-values
Constant	-183.666*	0.0212	1.166	0.3378
Size	12.642*	0.0251	-0.079	0.3301
Geographic diversification	-0.638*	0.0489	-1.183*	0.0010
Loan quality	-2.096	0.3402	-0.003	0.9083
Total capital ratio	5.593*	0.0370	0.058*	0.0406
Net int. margin / Average assets	-21.087*	0.0163	0.247*	0.0195
Other income / Average assets	33.380*	0.0018	0.231*	0.0421
ROAE	-0.132	0.7191	-0.007	0.0934
Liquidity ratio	-0.222	0.3888	-0.001	0.7982
Adj. R-squared	0.4188		0.3220	
Cross-sections included	33		49	
Hausman Test (p-value)	0.5601		0.0672	

*: Statistically significant at 5% confidence level.

Appendix A

Table A.1.: Sample of bank holding companies by country / geographical area

<i>France</i>	
Credit Agricole	BNP Paribas
Societe Generale	Credit Mutuel - CIC
Groupe Caisse d'Epargne	Groupe Banques Populaires
<i>Germany</i>	
Deutsche Bank	WestLB
Dresdner Bank	Eurohypo
Commerzbank	Norddeutsche Landesbank Girozentrale
Landesbank Baden-Wuttenberg	HSH Nordbank
DZ Bank	Landesbank Hessen-Thuringen
Bayerische Landesbank	Hypo Real Estate Holding
Bankgesellschaft Berlin	Deutsche Postbank
<i>United Kingdom</i>	
Barclays Bank	HBOS
HSBC	Lloyds TSB Group
Royal Bank of Scotland	Standard Chartered
<i>Italy</i>	
Unicredit	San Paolo IMI
Banca Intesa	Banca Monte dei Paschi di Siena
Capitalia Gruppo Bancario	
<i>Switzerland</i>	
UBS	Credit Suisse Groupe
<i>Benelux</i>	
ABN Amro	Dexia
ING Bank	Rabobank Group
Fortis Bank	KBC Group
<i>Spain</i>	
Santander Central Hispano	Caja de Ahorros y Pen. De Barcelona (Caixa)
Banco Bilbao Vizcaya Argentaria	
<i>Ireland</i>	
Allied Irish Banks	Bank of Ireland
<i>Scandinavia</i>	
Danske Bank	Skandinaviska Enskilda Banken
Nordea Group	Svenska Handelsbanken
DnB NOR Group	

Table A.2. Pearson correlation coefficients of explanatory variables

	Size	Retail loans	Geographic divers.	Loan quality	Tier 1 ratio	Total capital ratio	Net int. margin / AA	Other income / AA	ROAA	ROAE	Liquidity
Size	1	0.450**	-0.313*	-0.182	0.365**	0.338*	-0.233	0.282	-0.090	0.224	-0.232
Retail loans		1	0.137	-0.409**	0.242	0.227	0.422**	0.437**	0.543**	0.339*	-0.603**
Geographic divers.			1	0.233	-0.197	-0.374**	0.511**	0.063	0.305*	-0.004	-0.167
Loan quality				1	-0.264	-0.253	0.082	0.061	-0.128	-0.299*	0.002
Tier 1 ratio					1	0.627**	-0.233	0.195	-0.085	0.096	-0.046
Total capital ratio						1	-0.197	0.281	-0.008	0.102	-0.016
Net int. margin / AA							1	0.488**	0.779**	0.242	-0.515**
Other income / AA								1	0.633**	0.389**	-0.528**
ROAA									1	0.617**	-0.496**
ROAE										1	-0.316*
Liquidity											1

*: statistically significant at 5% level.
 **: statistically significant at 1% level.