Credit Risk Transfer Practices in US Commercial Banks

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Abstract

Building on the main theoretical motivations for credit risk transfer (CRT), we compare, from an empirical perspective, the use of loan sales, securitization and credit derivatives for a sample of US commercial banks over the period 2001 - 2008. First, we investigate how intensively different CRT instruments have been used in practice. Second, we analyze whether certain bank characteristics can be associated with a preference expressed by the institution for a specific tool over the others. In line with the prevailing theoretical predictions, the main features considered are: bank capitalization and liquidity; bank size and reputation; business model; loan portfolio composition; loan portfolio quality; profitability. Using both univariate analysis and panel econometric tools, we attempt to identify which of the above elements are more closely related to the use of loan sales / securitization and credit derivatives. We find that the main theoretical predictions are generally fulfilled: banks with riskier loan portfolios, liquidity constraints and higher asymmetric information issues prefer to use traditional CRT tools, while large and well capitalized banks with less risky portfolios resort to credit derivatives when experiencing capital shocks.

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1. Introduction

At present, a number of questions arise regarding the impact of credit risk transfer (CRT) techniques on the stability of banks (and financial systems in general), as well as the use that has been made of CRT instruments.

Credit risk transfer techniques such as securitization, loan sales and credit derivatives are forms of financial innovation which have produced crucial effects on the banking business as well as on the financial sector in general. By making credit risk easier to trade and hedge, CRT instruments allow banks to reduce their credit risk exposure, lower capital requirements (and hence release capital for additional lending), access alternative channels for diversification, increase liquidity (Duffie, 2008).

Indeed, the dramatic growth experienced by CRT tools worldwide has changed the fundamentals of the banking business. Banks have been increasingly operating as originators and packagers of large quantities of credit risk, which is ultimately assumed by others. In a sense, CRT undermines the traditional banking function of providing highly nonstandardized credit and holding it, under continuous monitoring, in the form of non-tradable assets against capital resources.

Over the years, financial institutions have expanded the market for securitization and credit derivatives, and aggressively developed "originate-to-distribute models" of financial intermediation (Greenbaum and Thakor, 1987; Llewellyn, 1999). As a consequence, the widespread use of CRT instruments is now held responsible for the market turmoil that has been shaking the markets since Summer 2007. According to recent reports by the Financial Stability Forum (2008) and the Bank for International Settlements (2008), the financial crisis was the result of an exceptional boom in credit growth and financial leverage, driven primarily by structured products. As the turmoil spread, increased risk aversion, reduced liquidity, market uncertainty about the soundness of major financial institutions fueled the crisis. CRT markets froze and banks tightened lending

provisions.

Recent academic literature has focussed on the effects of CRT techniques on the users (performance, capitalization, riskiness, lending practices) and more generally, on the stability of the financial system.[1] Instead, very little attention has been devoted to the comparison amongst different instruments of CRT, i.e. loan sales, securitization and credit derivatives. The existing literature in this respect is quite small, and mainly theoretical. The contributions that compare, from a theoretical standpoint, different CRT instruments are limited to the works by Duffee and Zhou (2001), Thompson (2007), and Parlour and Winton (2008). According to these contributions, the choice among CRT instruments depends on some bank characteristics such as the intensity of information asymmetries, the severity of credit risk, and the cost / level of bank capital. If assets to be sold / hedged are opaque and risky, loan sales seem to dominate credit derivatives. When considering also the cost / level of bank capital, results are ambiguous and depend on the agency problems related to the underlying asset.

More in detail, under the assumption of no information asymmetries in the credit derivatives market, Duffee and Zhou (2001) analyze the consequences of introducing credit derivatives as a CRT tool, and conclude that these instruments can help alleviate the lemons problem that affects the loan sales market. By relaxing this assumption, Thompson (2007) suggests that well capitalized banks will prefer loan insurance contracts, whereas poorly capitalized banks will be forced into the loan sales market. Parlour and Winton (2008) claim that loan sales dominate credit derivatives when credit risk is high, defaults have negative signalling effects, and monitoring is crucial. If credit risk is relatively low and the cost of retaining capital reserves is high, credit derivatives and

[1] Recent theoretical contributions include Morrison (2005), Chiesa (2008), Parlour and Plantin (2008). Empirical evidence of the effects of loan sales has been investigated, among others, by Pavel (1989), Cebenoyan and Strahan (2004). The impact of credit derivatives has been studied by Goderis et al. (2006), Shao and Yeager (2007), Hirtle (2008). A brief recount of the crisis with a focus on the role of structured finance products is presented by Franke and Krahnen (2008).

loan sales may coexist.

Few empirical papers have attempted to verify the theoretical predictions of those models and to compare different CRT tools. Most studies consider CRT instruments taken individually and investigate the motivations behind the choice of a particular tool. Possible motivations for CRT instruments are to manage credit risk and increase the diversification of the loan portfolio (see, among others, Berger and Udell, 1993; Pavel and Phillis, 1987; Demsetz, 2000; Das, 1998), as well as, with specific reference to loan sales and securitization, to reduce regulatory constraints and enhance liquidity (Pennacchi, 1998; Thomas and Wang, 2004). The only empirical work we are aware of that somehow analyzes the usage of different CRT techniques, although with a major focus on credit derivatives, is by Minton, Stulz and Williamson (2008). Based on a sample of US banks, the authors link the likelihood of using credit derivatives to a number of bank characteristics (capitalization, profitability, riskiness, usage of other derivatives or risk transfer tools). They conclude that banks that normally act as protection buyers in the credit derivative market usually engage in asset securitization and loan sales as well, have risky loan portfolios, and are typically poorly capitalized. An empirical comparison of the activity in loan sales and credit derivatives for a sample of European banking groups is provided by Bedendo and Bruno (2008).

In this paper we aim at comparing, from an empirical perspective, the use of loan sales, securitization and credit derivatives in order to better understand the motivations for different CRT techniques. In particular, the purpose of our analysis is to investigate: (1) how intensively different CRT instruments have been used; (2) whether certain bank characteristics can be associated with a preference for a specific CRT tool over the others. In this respect, we first analyze how a sample of commercial US banks have been using CRT instruments (loan sales, securitization and credit derivatives) in practice over the period June 2001 - June 2008. Information on their usage of the different tools is then cross-matched with balance-sheet data in order to investigate whether the

use of these instruments can be significantly linked to some measurable features such as: 1) bank size; 2) bank capitalization; 3) bank liquidity; 4) loan portfolio composition; 5) lending quality; 6) profitability. Using dynamic panel econometric tools, we attempt to identify which of the above elements are more closely related to the use of credit derivatives and loan sales / securitization. We find that banks with riskier loan portfolios, lower capital buffers, liquidity constraints and higher asymmetric information issues prefer traditional CRT tools, while large and well capitalized banks with less risky portfolios resort to credit derivatives when experiencing capital shocks. The latter, contrary to the former, are typically characterized by a non-traditional banking business model, more focused on trading rather than lending activities.

The rest of the paper is structured as follows: Section 2 presents the dataset and the variables employed. Section 3 illustrates the empirical findings of our analysis. Section 4 concludes.

2. Background Information

2.1. Credit Risk Transfer Tools

Traditional CRT instruments such as loan sales and securitization have been available for some time, while new varieties of CRT mechanisms such as credit derivatives have developed over the last decade and quickly expanded. Some theoretical and practical differences between different CRT techniques arise, which are important in setting the preference for one particular instrument over the others for transferring credit risk. A typical loan sale contract is the simplest CRT mechanism through which the loan originator sells all or part of payments from the underlying loan to a third party. Unlike securitization, loan sales involve no creation of new securities. In some cases, the direct debtor-creditor relationship is entirely shifted from the originator to the loan buyer, who also becomes responsible for monitoring the borrower. Finally, loan sales can occur with or without recourse.

Securitization is the process of transferring loans to third parties through the issuance of debt whose cash-flows are collateralized by the original loan pool. In a securitization deal, the originator bank often provides some forms of credit enhancement (e.g. by retaining the equity tranches of the debt issue or selling a larger loan portfolio than the debt issue). Furthermore, the originator bank often acts as a servicer, by collecting and transferring cash flows from the underlying debtors. Thus, by servicing the underlying loan portfolio, the originator retains the relationship with the borrower.

Despite some technical differences, loan sales and securitization provide similar benefits. In both cases, banks use loan transfers as a source of funding and a tool for risk management. In addition, the ability to transfer otherwise illiquid loans allows banks to focus on core competencies in banking such as origination, servicing, and management of loan portfolios.

Selling / securitizing loans give rise to agency problems, in terms of moral hazard and adverse selection: if a loan is resold without recourse by the seller, the latter will stop monitoring the borrower. Different mechanisms can be conceived in order to avoid such problems. Lemon problems might be reduced and the seller's incentive of monitoring might increase through selling only a fraction of the initial contract, by modeling incentive-compatible contracts and providing some form of recourse / credit enhancement (Pennacchi, 1988; Gorton and Pennacchi, 1995). As far as the effectiveness in transferring credit risk is concerned, the higher the proportion of loan retained or the recourse / credit enhancement provided by the selling bank, the lower the risk transferred and the capital relieved.

Transferring loans has also changed the fundamental economics of banking and the way that traditional banking business is undertaken. It essentially makes banks act more as "originators" and "distributors" rather than credit monitors (Pennacchi 1988) and the increasing separation of loan origination and fund provision is turning loan lending into loan underwriting (Berger and

Udell 1993). As a consequence, the fee income has become an increasing proportion of banks' total income relative to margin income.

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 of the obligor. In essence, they resemble an insurance on a particular credit. In a credit derivative contract the relationship between the protection buyer and the obligor is unaffected since the original credit contract stays with the protection buyer who, however, loses any incentive to monitor the borrower. To limit the agency problems that this would produce, the majority (around 60%) of underlying assets in credit derivative contracts are still rated investment grade (BBA, 2006). Unlike loan sales and securitization, credit derivatives are unfunded instruments, as they simply transfer credit risk, without generating liquid financial resources.

3. Data and Methodology

The data employed in the analysis are taken from the *Consolidated Reports of Condition and Income* (Call Reports), whose filing is compulsory for all insured commercial banks and trust companies operating in the U.S. Our sample is limited to domestic commercial banks having total assets greater than one billion USD at the reporting date, over the period June 2001- June 2008. In line with previous literature on loan sales (see Demsetz, 2000; Cebenoyan and Strahan, 2004), we focus on commercial banks, rather than bank holding companies, in an attempt to limit the impact of the CRT activity of investment banks, which is typically driven by trading purposes. Since data are reported on a consolidated basis, we exclude institutions which are majority-owned subsidiaries of other reporting commercial banks in order to avoid duplications.

For our purposes, we need to identify those banks that use CRT instruments (loan sales, securitization, credit derivatives) for hedging their loan portfolios. As far as credit derivatives are

concerned, this is not straightforward, as banks are required to report the gross notional amounts of credit protection bought and sold, but not what part is separately attributable to hedging or trading activities. In fact, to qualify for hedge accounting treatment, a derivative position must be highly correlated with the underlying exposure: this is hardly the case for credit derivative hedges, as credit derivatives are marked-to-market, while the underlying loans or securities in the banking book are not (Yarish, 2003).

In an attempt to overcome this limitation, we compute the net credit protection purchased as the ratio between net credit protection (gross protection bought - gross protection sold) and the gross protection purchased. If the ratio is greater than 0.5 (i.e. the protection bought is at least twice as much as the protection sold), we label the bank as *net protection buyer*. Analogously, we define *net protection seller* a bank whose ratio between net credit protection and gross protection sold is less than -0.5.[2] Other credit derivative users are classified as *dealers*. We believe this approach to be more robust than simply looking at the sign of the net credit protection to classify credit derivative users, since a bank can have a net long / short position purely as a result of its dealer activities, especially when the gross amounts of protection bought and sold are very similar.[3] To check whether our approach is appropriate for distinguishing hedgers from dealers, we compare the values of derivative trading ratios and derivative hedging ratios computed for both credit derivative hedgers (buyers or sellers) and dealers. The derivative trading ratio is computed as the ratio of the gross notional amount of other derivatives used by the bank for trading over total assets, while the derivative hedging ratio is the ratio of the gross notional amount of other derivatives used for hedging over total assets. In relative terms, we expect our net credit derivative hedgers to use a

[2]Both net buyers and sellers might be using credit derivatives for hedging the overall credit risk of the loan portfolio. However, in order to run a comparison with alternative means of CRT, here we focus primarily on net credit derivative buyers, as we do not possess information on the positions of loans purchased on the secondary market.

[3]Previous empirical studies on credit derivatives (Shao and Yeager, 2007; Minton, Stulz and Williamson, 2008) define net protection buyers and sellers on the basis of the sign of their net credit derivative positions.

higher (lower) proportion of other derivative instruments for hedging (trading) purposes compared to credit derivative dealers. The average values of the derivative trading ratios are equal to 11.38 and 1.81 for banks qualified respectively as credit derivative dealers and hedgers according to our methodology. The average figures for the derivative hedging ratios are 0.33 and 0.29 respectively. This confirms our expectations.

Information on banks' activity in loan sales and securitization is available from Schedule RC-S of the Call Report. In fact, the only data available refer to asset sales and asset securitization activities with some type of recourse.[4] Since the vast majority of securitizations involve some form of credit enhancement, the data provides an accurate representation of the securitization activity of the banks in the sample. On the other hand, the available data on asset sold and not securitized may underestimate the overall loan sales activity, since the proportion of loans sold without recourse is usually significant.[5] In alternative, one could derive a proxy of loan sales activity from the loans held for sale included in the Call Reports. Specifically, one may assume that all loans available for sale at a generic reporting date t are sold between t and $t + 1$. In fact, this proxy clearly overestimates the loan sale activity as not all loans available for sale are placed in the secondary market. Also, this measure does not provide separate information on the loans sold directly on the market and those securitized by the originator.

3.1. Bank Characteristics

The purpose of our analysis is to investigate what motivates the usage of CRT instruments and what drives the choice of a commercial bank amongst different tools. In particular, we investigate

[4]More specifically, banks are required to report: 1) Bank Securitization Activities, i.e. the "outstanding principal balance of assets sold and securitized with servicing retained or with recourse or other seller-provided credit enhancements"; 2) Bank Asset Sales, i.e. "assets sold with recourse or other seller-provided credit enhancements and not securitized by the reporting bank" (however, they might be securitized by the buyers, as in the case of Fannie Mae and Freddie Mac). Data on loan sales and purchases without recourse was collected only until the end of 1993.

[5]In our sample, on average, the residual credit exposure from securitizations is between 5% and 10% of the gross notional amount, while the residual exposure from loan sales is around 60%-70%.

how some bank characteristics and their dynamics can affect the choice among different tools. Most of the indicators we use have been suggested by previous empirical work on either loan sales / securitization or credit derivatives.

Bank size and reputation

Bank size (natural logarithm of total assets) may affect the use of CRT instruments in various ways. Large banks may have a comparative advantage in lending opportunities and therefore have an incentive to originate loans and sell them on the secondary market (Pennacchi, 1988). Analogously, fixed costs associated with CRT techniques (in particular, securitization and CDs), together with the high expertise required for pricing sophisticated CRT instruments favor the participation of large banks. For larger banks, CDs and securitization should dominate loan sales, since they possess the financial resources, tools and expertise necessary to service and organize securitization activities, as well as to assess prices and risks associated with credit derivative transactions. On the other hand, given the lemon problems associated with CRT transactions, bank reputation may also explain participation in CRT markets. Bank size is often linked to reputation effects in the CRT markets. Another variable related to a bank credit quality reputation is the net issuance of standby letters of credit, computed as standby letters of credit (financial and performance) minus standby letters of credit conveyed to others, divided by total assets (Demsetz, 2000). In this respect, more reputated banks (larger banks as well as banks issuing a higher percentage of standby letter of credits) are more likely to buy credit protection and sell / securitize loans.

Capitalization and liquidity

Existing theoretical and empirical literature predicts that capitalization and liquidity also play a significant role in the CRT mechanism.

We consider two measures of capitalization: the Tier 1 capital ratio (both unadjusted and risk-adjusted) and the total capital ratio (both unadjusted and risk-adjusted). In general, we would

expect that more regulatory constrained banks would use CRT tools in order to improve their existing level of capital, while according to the theory the way in which capitalization affects the choice among different CRT instruments is ambiguous and depending on the bank asset quality.

Higher funding constraints should represent an incentive to transfer credit risk away from the balance sheet, in particular via loan sales or securitization, which provide an immediate source of liquidity. Given the role played by liquidity in the recent market crisis, liquidity motivations are investigated through both asset and liability liquidity measures.[6] As indicator of asset liquidity we use a liquidity ratio measured as the amount of liquid assets (i.e. the sum of cash, Fed Funds sold and Government securities) over total assets. As liquidity liability measures we use: 1) an overall deposit ratio (i.e. total bank deposits minus interbank deposits over total assets) and a core deposit ratio, given by the core deposits (defined as the secured deposits only) over total assets); 2) the interbank ratio (measured as Fed funds purchased plus interbank deposits over total assets); 3) the funding cost, measured as the ratio of interest expenses over interest-bearing liabilities. We expect the liquidity motivation to play a significant role in explaining the preference granted to funded credit risk transfer tools. Therefore, liquidity constrained banks (i.e. banks with lower liquidity / bank deposits or higher funding costs / interbank ratio) are expected to be more active in the loan sales / securitization segment.

Lending quality

Riskier banks are expected to use more intensively CRT tools. Furthermore, most theoretical contributions on CRT agree on the superiority of loan sales / securitization (especially with recourse) over credit derivatives when credit risk is high or increasing as well as informational asymmetries are more intense and monitoring is crucial. In such situations, loan sales / securiti-

[6] Asset liquidity refers to the ease of converting an asset into cash with a minimum loss. Liquidity liability refers to the ease with which a bank can raise funds at competitive costs.

zation should dominate CDs. Two variables are used to measure the bank credit risk: the ratio of total risk weighted assets over total assets, as a measure of the overall credit riskiness of the bank assets; the net charge-off ratio (measured as charge-offs on loans minus recoveries, divided by total assets), as a measure of riskiness of the loan portfolio. The net charge-off ratio has also been used as an indicator of information asymmetries (see Demsetz, 2000).

Loan portfolio composition

We expect the composition of the loan portfolio to be a significant driver in the choice amongst loan sales, securitization and credit derivatives. Some types of loans (e.g. mortgages and retail, small business) have specific features (standardization, small size, asymmetric information issues) that make them particularly suitable for securitization (especially more standardized loans as retail and mortgages) or loan sales (especially more opaque loans such as those to SME). Loans to large commercial and industrial borrowers with good credit rating and low asymmetric information issues can be easily hedged using credit derivatives (Minton, Stulz and Williamson, 2008). Loan composition is measured as follows: percentage of loans to agriculture on total loans; percentage of loans secured by real estate on total loans; percentage of loans to individuals on total loans; percentage of commercial and industrial loans on total loans, divided into loans to domestic and foreign borrowers. We also calculate the percentage of loans to small businesses on total loans, which is also a useful indicator of information asymmetries in the loan portfolio.[7] When available, we use the proportion of medium (three to five year expiry) and long (over five year expiry) loans on total loans as further indicators of information asymmetries in the loan portfolio.

Profitability

Previous empirical literature argues that profitability may affect CRT participation in different

[7]Business loans with original amounts of $1,000,000$ USD or less. The information is provided only with the June Call Report. Figures for other reporting dates are obtained through interpolation.

ways. We use two measures of overall bank profitability: return on assets (ROA) and return on equity (ROE). More specific indicators of performance of traditional and non-traditional banking activities include loan profitability (interests on loans divided by total loans), interest income ratio (net interest income, divided by total assets), noninterest income ratio (noninterest income, divided by total assets). In general, less profitable banks are more likely to use CRT tools as hedging their risk becomes essential. On the other hand, stronger lending opportunities (proxied by higher loan profitability and interest income ratio) may motivate a preference for selling / securitizing loans instead of buying protection (Pavel and Phillis, 1987; Demsetz, 2000).

Business model

Finally, the particular bank business model adopted (i.e. traditional versus innovative intermediation) may explain the participation into CRT markets as well as the choice among different CRT tools. We use both loan ratio (total loans divided by total assets) and trading asset ratio (trading assets divided by total assets) as indicators of traditional and innovative banking activities.[8] We expect in general largest values of loan and trading asset ratios to be followed by a more intense CRT activity. For those banks that have an advantage in originating loans (higher loan ratio) we expect a more intense use of loan sales / securitization versus CDs.

4. Empirical Analysis

4.1. Credit Risk Transfer Usage: Summary Statistics

Table 1 reports yearly summary statistics on the usage of CRT instruments by the commercial banks in our sample. The most striking evidence is that only about 35% of the banks in the sample use at least one of the tools under investigation.

In line with our expectations, commercial banks are more actively involved in CRT in times of

[8]It is worth noticing that trading assets are recorded at their fair value, instead of nominal value as other assets.

financial distress (2001-2002 and 2007). We observe that, over time, the percentage of banks using asset sales has increased from 19% to 27%, while the percentage of banks who securitize internally has halved from 25% to 12%. In line with previous evidence (see Minton, Stulz and Williamson, 2008), we observe that the percentage of credit derivative users has slightly increased in the last years, but it remains very low at about 7% of the total sample. As expected, the proportion of net protection buyers tends to be larger in distressed times. Credit derivative dealers (according to our definition) usually account for 25%-35% of credit derivatives users, with the exception of the period 2003-2004, when the amounts of gross protection bought and sold by the banks were very similar. On average, less than 3% of the banks in the sample use all three instruments of CRT.

The banks in our sample differ widely in terms of size. Table 2 illustrates how the distribution of the usage of various CRT instruments differs across classes of asset size for year 2007.[9] We define four size classes according to the bank total assets: from one to five billion USD (small), from five to 20 billions (medium), from 20 to 100 billions (large), and above 100 billions (extra-large). Nearly 90% of the banks belong to the first two groups. However, they only account for about 16% of the total assets of the sample, which highlights a strong concentration in the sector. As expected, large banks are the most active users of CRT tools (nearly 70% of the extra-large banks use all three instruments). A large proportion of small banks (75%) do not lay off credit risk, while those who choose to do it, mainly use loan sales. Securitization becomes a more popular tool as the bank size increases. Credit derivatives are almost exclusively used by large and extra-large banks. For the latter, in particular, the majority of banks act as credit derivative dealers, rather than hedgers.

[9] Similar tables are available for all years from the authors upon request.

4.2. Credit Risk Transfer Tools and Bank Characteristics

The first step in analyzing what drives commercial banks when choosing among different CRT tools is to compare the features of those banks that prefer to sell, securitize or insure their assets. Table 3 reports in the second and third columns the mean values of various bank characteristics (calculated over the sample period) for institutions who do not use any CRT tools and for those who use at least one instrument. Focusing on the users, in order to better investigate the drivers leading the choice among different CRT options, we first compare the average characteristics of banks using exclusively unfunded instruments to those that only use funded tools. We then compare the average features of banks that only securitize internally to those of banks that only sell their assets. This allows us to better emphasize the features of those banks expressing an exclusive preference for one instrument over the others, and avoids confounding effects in the mean values due to partial overlaps in the samples.

As expected, CRT users on average show worse capitalization ratios than non-users, as less capitalized banks have a stronger need to hedge and to manage capital in a more effective way. However, contrary to previous empirical evidence (Minton, Stulz and Williamson, 2008) we observe that banks who use credit derivatives have significantly larger capitalization than banks using securitization or loan sales. This is in line with the theoretical predictions of Thompson (2007), who argues that better capitalized institutions prefer to lay off credit risk via credit derivatives. As for liquidity, CRT users show stronger funding constraints than non users, as highlighted by lower deposit and liquid asset ratios, higher interbank ratios and funding costs. Looking at CRT users, net CD protection buyers rely less on traditional funding instruments but hold significantly larger proportions of liquid assets than traditional CRT users. On the other hand, those who exclusively sell loans seem to be less liquidity constrained than securitization only users.

The loan quality and, more in general, the asset quality of CRT users is significantly worse

than that of non-users. Among the users, those who sell or securitize loans display much larger net charge-off ratios than those who insure. Again, this is in line with the theory which predicts that when credit risk is high and the loan portfolio requires active monitoring, loan sales prevail. On the contrary, the overall asset quality is slightly worse (but not significantly) for net protection buyers.

As for the characteristics of the loan portfolio, we observe that CRT users and non-users differ significantly in terms of loan maturity and composition. Looking more in detail at the loan composition for CRT users, we find that, on average, the loan portfolios of banks who sell loans is heavily concentrated in loans secured by real estate (70%). In fact, most of those loan sales refer to residential mortgages sold to Fannie Mae and Freddie Mac by the small and medium commercial banks in our sample. As expected, banks who securitize have loan portfolios concentrated in secured real estate loans and retail loans, which represent the natural pool for securitization activities. Net credit derivative buyers, instead, lend primarily to commercial and industrial companies, both domestic and foreign, confirming the results by Minton, Stulz and Williamson (2008). Again, in agreement with the theory, banks having loan portfolios with significant information asymmetries (bad loan quality, large proportion of loans to small and medium companies, or medium and long term loans) resort primarily to direct loan sales or loan securitization to reduce their level of credit risk.

CRT users on average show a significantly higher profitability than non-users. This is especially true for banks active in securitization, who display superior performance both in traditional intermediation and in non-traditional banking (mainly attributable to the servicing fees of the securitization process). Banks who sell loans also display a satisfactory performance from traditional intermediation, in line with the theoretical prediction of the comparative advantage argument in loan origination (Pavel and Phillis, 1987; Demsetz, 2000). On the contrary, net protection buyers

are characterized by a significantly lower profitability, both on the traditional banking activity and overall. A look at the asset composition confirms that banks who sell or securitize loans have very large loan ratios (68% and 63%, respectively), while net credit derivative buyers invest more heavily in non traditional assets, as displayed by the a loan ratio below 50% and a markedly higher trading asset ratio.

Not surprisingly, CRT users are larger and more reputated than non-users. In particular, banks who transfer credit risk only by means of credit derivatives are the largest, followed by those active in securitization.

4.3. What Drives the Usage of Credit Risk Transfer Instruments? A Panel Study

So far, we have provided some generic evidence of a significant association between certain bank characteristics and the preference expressed for a given CRT instrument over others. The simple univariate comparison presented in the previous section is insightful, but not sufficient to draw clear conclusions on the matter. Also, the bank characteristics themselves could have been affected by previous use of specific CRT tools and, therefore, the association we have found could be biased by endogeneity issues.

In order to better isolate those variables that play a significant role in explaining changes in the asset sales / securitization and in the credit derivative activity we use a dynamic panel approach. Specifically, we verify how changes in the loan sales / securitization activity, as well as changes in the credit derivative position of net protection buyers are related to variations in the bank characteristics.

Loan sales and securitization activities are pooled together since the two CRT instruments have similar features in terms of loan types to be sold (retail, secured by real estate) and asymmetric

information issues, are both funded tools and, in our sample, are both with recourse.[10] The loan sales / securitization activity is measured as the ratio of the notional amounts of loans sold or securitized over total assets. Analogously, the activity of net protection buyers is measured as the ratio of the net credit protection position (gross amount of protection purchased minus gross amount of protection sold) over total assets. This indicator is computed only for net protection buyers, according to our definition given in Section 3.

Semi-annual changes in the activity ratios of both loans sales / securitization and credit derivatives are separately regressed on lagged changes in the bank and loan portfolio variables.[11] The rationale behind our analysis is that variations in the loan composition, bank riskiness or profitability, capitalization or liquidity shocks occurring in one period should drive future changes in the CRT activity. In particular, we test whether the impact of changes in the variables is different across the two CRT tools. Working with lagged regressors helps avoid endogenous effects that changes in the CRT activity may have on these variables.

To avoid multicollinearity issues in the regressors, we only keep some of the variables employed for the univariate analysis. The results of the panel regressions for both changes in loan sales / securitization and changes in net credit derivative protection are displayed in Table 4.[12]

Given the significant heterogeneity of traditional CRT tools' users in terms of asset size, we decide to perform separate panel regressions for small / medium sized banks (with total assets not greater than 20 billion USD) and large banks. This is not necessary for investigating the motivations driving CD net protection buyers, as they are mostly concentrated in the large segment.

[10]Hence, they both preserve the bank's monitoring function. Moreover, part of the loans sold on the market may be later securitized.

[11]A six month time period represents a reasonable compromise between an annual time frame, which would be more prone to endogeneity issues, and a three-month period, which would be too short to capture significant lagged effects.

[12]The panel analysis has been performed using the Arellano-Bond linear dynamic approach, which ensures consistent estimates of the parameters in the dynamic panel framework. Yearly dummies have been included to account for seasonal effects in CRT activities.

Looking at the drivers of the loan sales / securitization activity for small and medium banks, we find that it is significantly affected by: an increase in the traditional intermediation activity and, particularly, in the proportion of loans more apt to be sold / securitized; an increase in net interest income; an increase in asset size; an increase in the riskiness of the loan portfolio (net charge-off ratio); an increase in the liquid asset ratio. The link with the riskiness of the loan portfolio, the lending opportunities, the profitability from traditional intermediation, the asset size is in line with the theoretical predictions arising from the credit risk management framework and the originate to distribute theory. The positive relation with the liquid asset ratio, instead, is in conflict with the funding motivation behind asset sales and securitizations. Interestingly, we observe that there is a positive relation between this period's activity in the loan sales market and last period's one, i.e. banks who sell or securitize do it on a regular basis. This provide support to the ongoing process of unbundling core bank activity.

Very different results arise from the investigation of the drivers for large banks. Unexpectedly, in this case, only an increase in the loan ratio and / or a capital shock lead to a significant increase in loan sales / securitization activity. These findings are consistent with both capital management and originate to distribute approaches. However, little support is found for the liquidity and credit risk management motivations.

The analysis of the main drivers of the credit derivatives activity reveals that, as expected, an increase in net protection purchased follows a rise in the percentage of commercial and industrial loans in the loan portfolio and / or a capital shock. We also find that a reduction in the traditional intermediation activity (as highlighted by a decreasing loan ratio and net interest income, and an increase in the interbank ratio) leads to a more intense participation to the CD market, which however would be expected especially for banks acting as dealers. Quite surprisingly, given the unfunded nature of CDs, liquidity shocks seem to significantly increase the protection purchased.

5. Concluding Remarks

Building on the main theoretical motivations for choosing among different CRT instruments (see Duffie and Zhou, 2001; Thompson, 2007; Parlour and Winton, 2008), we compare, from an empirical perspective, the use of loan sales, securitization and credit derivatives for a sample of US commercial banks over the period 2001-2007.

We first perform a detailed analysis of how the banks in our sample have been using traditional and innovative CRT instruments. In fact, we find that, on average, more than 60% of the banks examined do not use CRT tools. Most CRT users prefer more traditional instruments and only very large banks resort to credit derivatives.

Second, we analyze the main drivers in the choice among different CRT tools, by comparing the features of those banks that prefer to sell, securitize or insure their assets. Contrary to previous empirical evidence, but in line with some theoretical predictions, we observe that large and well capitalized banks with less risky portfolios and lower profitability buy credit derivative protection when experiencing capital shocks. Again, in line with the theory, banks with riskier loan portfolios, liquidity constraints and higher asymmetric information issues prefer to sell or securitize loans. In fact, their activity in loan sales / securitization intensifies as the riskiness and opacity of their loan portfolio increase, or as their loan activity strengthens, providing support for both the credit risk management and the originate to distribute motivations behind CRT.

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Table 1
Credit Risk Transfer: Summary Statistics

	2001	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Non users	62.76%	64.00%	64.35%	67.51%	66.31%	64.67%	63.94%
Users							
Loan sales	18.88%	19.00%	21.05%	23.11%	23.82%	25.83%	27.29%
Securitization	24.49%	21.75%	20.33%	14.87%	14.16%	12.40%	11.75%
Credit derivatives	6.89%	5.75%	5.74%	5.95%	6.22%	7.64%	7.17%
Net protection buyers	*51.85%*	*34.78%*	*37.50%*	*38.46%*	*41.38%*	*35.14%*	*38.89%*
Net protection sellers	*25.93%*	*34.78%*	*12.50%*	*15.38%*	*24.14%*	*35.14%*	*33.33%*
Dealers	*22.22%*	*30.43%*	*50.00%*	*46.15%*	*34.48%*	*29.73%*	*27.78%*
Users of all three	3.06%	2.00%	2.63%	2.97%	2.15%	2.69%	2.59%
Number of banks	398	401	420	440	468	487	504

Table 2
Credit Risk Transfer Usage by Bank Size at year-end 2007

	All banks	$1-5$ bln	$5-20$ bln	$20-100$ bln	>100 bln
Non users	63.94%	74.52%	49.43%	17.65%	0.00%
Users					
Loan sales	27.29%	22.19%	32.18%	44.12%	81.25%
Securitization	11.75%	3.01%	20.69%	50.00%	81.25%
Credit derivatives	7.17%	1.10%	6.90%	32.35%	93.75%
Net protection buyers	*38.89%*	*25.00%*	*33.33%*	*45.45%*	*40.00%*
Net protection sellers	*33.33%*	*75.00%*	*66.67%*	*36.36%*	*6.67%*
Dealers	*27.78%*	*0.00%*	*0.00%*	*18.18%*	*53.33%*
Users of all three	2.59%	0.00%	0.00%	5.88%	68.75%
% Banks	100.00%	72.71%	17.33%	6.77%	3.19%
N. Banks	504	368	86	34	16
Total assets	100.00%	7.47%	8.36%	16.65%	67.52%

Table 3
Credit Risk Transfer Tools and Bank Characteristics

	Non Users	Users	Credit Derivatives	Sales or Securit.	Loan Sales	Securit.
Capitalization						
Tier1 risk-adjusted	**0.1228**	**0.1085**	**0.1317**	**0.1072**	**0.1058**	**0.1194**
Tier1	**0.0885**	**0.0846**	**0.1017**	**0.0832**	**0.0790**	**0.0968**
Capital ratio risk-adjusted	**0.1364**	**0.1283**	0.1178	0.1047	**0.1216**	**0.1300**
Capital ratio	0.1059	0.1058	**0.1589**	**0.1262**	**0.0993**	**0.1192**
Loan Composition						
% Agriculture	0.0105	0.0087	**0.0012**	**0.0096**	0.0113	0.0077
% Secured Real Estate	**0.6534**	**0.5808**	**0.3539**	**0.6189**	**0.7189**	**0.4508**
% C&I U.S.	0.1819	0.1810	**0.2716**	**0.1631**	0.1430	0.1635
% C&I non U.S.	0.0068	0.0073	**0.0334**	**0.0039**	**0.0005**	**0.0031**
% C&I total	0.1888	0.1883	**0.3050**	**0.1669**	0.1614	0.1579
% Retail	**0.0984**	**0.1442**	**0.0663**	**0.1530**	**0.0767**	**0.3132**
% Small Businesses	**0.1728**	**0.1303**	**0.0549**	**0.1379**	**0.1759**	**0.0902**
% Medium term	0.1273	0.1197	**0.0509**	**0.1216**	**0.1362**	**0.0914**
% Long term	0.0995	0.0939	**0.0392**	**0.0950**	**0.0984**	**0.0821**
Asset Quality						
Net charge-off ratio	**0.0025**	**0.0046**	**0.0017**	**0.0050**	**0.0019**	**0.0119**
RWA ratio	**0.7502**	**0.7879**	0.8103	0.7823	**0.7569**	**0.8107**
Profitability						
Loan profitability	0.0908	0.0643	**0.0478**	**0.0659**	**0.0648**	**0.0717**
Cost of funding	**0.0225**	**0.0257**	**0.0311**	**0.0245**	0.0236	0.0256
Net interest income	**0.0354**	**0.0340**	**0.0210**	**0.0353**	**0.0342**	**0.0394**
Non interest income	**0.0138**	**0.0246**	0.0249	0.0251	**0.0133**	**0.0513**
ROA	**0.0122**	**0.0134**	**0.0112**	**0.0137**	**0.0116**	**0.0187**
ROE	**0.1254**	**0.1343**	0.1209	0.1366	**0.1253**	**0.1594**
Size & Reputation						
Log(TA)	**14.65**	**15.95**	**17.39**	**15.83**	**15.07**	**16.16**
Net standby letter credit	**0.0146**	**0.0221**	**0.0531**	**0.0180**	0.0142	0.0145
Intermediation						
Trading assets ratio	**0.0028**	**0.0111**	**0.0522**	**0.0082**	**0.0018**	**0.0063**
Loan ratio	**0.6667**	**0.6505**	**0.4701**	**0.6656**	**0.6832**	**0.6269**
Liquidity / Funding						
Liquid assets ratio	**0.1531**	**0.1412**	**0.2187**	**0.1343**	0.1374	0.1406
Interbank ratio	**0.0315**	**0.0384**	0.0547	0.0402	**0.0299**	**0.0558**
Deposit ratio	**0.7255**	**0.6496**	**0.5031**	**0.6621**	**0.7176**	**0.6098**
Core Deposit ratio	**0.5956**	**0.5324**	**0.4383**	**0.5414**	**0.5967**	**0.4720**
Other borrowings	**0.1471**	**0.1759**	**0.1633**	**0.1787**	**0.1568**	**0.1977**
N. Banks	1770	950	68	839	460	232

Figures in bold express mean values significantly different at 5% level of the t-test between:
1) users and non-users; 2) classes of users, taken pairwise.

Table 4
Credit Risk Transfer Drivers: Panel Test

	Δ Loan Sales / / Securitization				Δ Credit Derivatives	
	Small-Medium Banks		Large Banks		Large Banks	
Δ LogTA(-1)	0.5597	(0.0538)*	0.0262	(0.0485)	-0.0380	(0.0448)
Δ % Real estate / Retail (-1)	0.8838	(0.2083)*	-0.0120	(0.2012)	-	-
Δ % C&I (-1)	-	-	-	-	0.1143	(0.0608)**
Δ Net charge-off (-1)	2.8886	(1.5069)**	-1.3283	(3.2533)	-4.2467	(4.0077)
Δ Liquid Assets (-1)	0.3775	(0.1174)*	0.1636	(0.2088)	-0.1276	(0.0642)*
Δ Loan ratio (-1)	1.2283	(0.1263)*	0.5212	(0.1576)*	-0.3180	(0.0819)*
Δ Deposit ratio (-1)	0.6812	(0.1176)*	-0.0054	(0.1369)	0.0635	(0.0661)
Δ Interbank ratio (-1)	0.2339	(0.1746)	0.1012	(0.1673)	0.2101	(0.0914)*
Δ Net interest income (-1)	2.9463	(1.7759)**	-0.4825	(1.3997)	-2.3479	(0.9847)*
Δ Tier1 RA (-1)	0.1301	(0.3282)	-0.6369	(0.3589)**	-0.4042	(0.1890)*
Δ Dependent var. (-1)	0.4998	(0.0350)*	-0.0220	(0.0486)	-0.2416	(0.1274)**
Constant	-0.0216	(0.0155)	0.0173	(0.0143)	0.0221	(0.0102)*

* and ** denote significance at 10% and 5% confidence level, respectively.
Standard errors in brackets.