Credit risk transfer in U.S. commercial banks: What changed during the 2007–2009 crisis?

Mascia Bedendo*, Brunella Bruno

*Corresponding author. Tel.: +39 02 5836 5973; fax: +39 02 5836 5920.
E-mail addresses: mascia.bedendo@unibocconi.it (M. Bedendo), brunella.bruno@unibocconi.it (B. Bruno).

Article Info
Article history:
Received 9 November 2011
Accepted 16 July 2012
Available online 23 July 2012

JEL classification:
E44
G01
G21

Keywords:
Credit risk transfer
Financial crisis
Bank lending
Bank risk

1. Introduction

Loan sales, securitization, and credit derivatives are credit risk transfer (CRT) tools that have been extensively used by banks over the last decades to actively manage credit risk. Loan sales and securitization are techniques through which banks sell future streams of payments arising from underlying loans to third parties. Unlike a straight loan sale, securitization involves the creation of a special purpose vehicle and the issuance of new securities. In contrast, credit derivatives are contracts that insure banks against the default risk of their borrowers in exchange for a fee. While all CRT instruments enable banks to release capital, loan sales and securitization also generate cash (hence the term funded tools).

The contribution of CRT instruments to the 2007–2009 financial turmoil has been widely debated. A common view argues that CRT practices spurred excessive credit growth and increased risk taking as a result of reduced monitoring incentives in CRT users (Brunnermeier, 2009). Market agents have since called for tighter regulation of those activities. However, when most securitization segments stalled during the crisis, regulators rushed to approve emergency measures aimed at preserving sufficient liquidity in CRT markets. Examples of those measures in the U.S. include the federal bailout of Fannie Mae and Freddie Mac, as well as the acceptance of certain asset-backed securities as collateral in monetary policy operations (see Adrian and Shin, 2010, and references therein). Regulators justified these measures with the role CRT may have had in broadening the funding base of financial institutions and, ultimately, in supplying credit to the economy in times when most short-term funding channels had frozen (Brunnermeier, 2009).

To date, empirical evidence on the actual role played by CRT during the crisis is still scarce and this paper attempts to address some open questions. How did CRT strategies evolve in response to the financial crisis? Did banks resort to CRT primarily to release capital and raise funds during the turmoil? Were those resources employed to provide lending to the economy? Were CRT users more stressed than other banks during the credit crunch? Did the benefits and drawbacks of CRT differ according to the specific instruments used to transfer credit risk?

Addressing those issues has relevant policy implications. First, it provides a direct assessment of the actions undertaken by regulators to preserve CRT during the crisis. Since such measures were originally intended to reduce credit rationing, it is important to verify to what extent active CRT users contracted their lending less than other institutions. Second, a better understanding of the benefits and drawbacks of CRT across the cycle may help gauge whether the new regulatory initiatives involving CRT (e.g., Basel III and the Dodd-Frank Act) are well suited to promote a
sustainable CRT market, where recourse to riskier segments is discouraged and CRT can ensure effective credit risk management without undermining financial stability (Bank for International Settlements, 2011).

Specifically, our research aims at analyzing: (1) the incentives behind CRT and the impact of CRT practices on bank lending and riskiness, (2) how and why they have changed since the crisis, and (3) how they differ across various CRT instruments available to banks. We do so by examining CRT practices in a sample of medium-sized and large U.S. commercial banks both before the crisis (2001:Q2–2007:Q2) and during the crisis (2007:Q3–2009:Q2). To provide a comprehensive analysis of CRT strategies, we include all types of instruments available to banks, that is, loan sales, securitization, and credit derivatives. This also enables us to test for substitution effects across different tools.

We document a contraction in CRT during the crisis, which turns out to be much more significant for medium-sized banks than for large banks and for structured CRT tools than for loan sales and credit derivatives. The drop in securitization, due to the uncertainty surrounding the evaluation of asset-backed securities, is partly compensated in this period by an increase in outright asset sales, which represent a cheaper, more flexible, and more transparent alternative to transfer credit risk. In light of the severe funding challenges experienced by banks during the credit crunch, we find that loan sales and securitization become essentially driven by the need to raise additional financial resources. In line with the regulators’ view on the beneficial effects of CRT on the real economy, our estimates confirm that the resources generated via CRT are invested to boost bank loans, since we find higher loan growth rates in banks heavily involved in CRT practices, even during the financial crisis. However, while in the pre-crisis years we notice a positive impact of CRT on all loan categories, in the following period the effect is significant only for business and consumer loans, consistent with the sharp contraction in the demand and supply of mortgages due to the burst of the housing bubble. Despite the positive impact of CRT on bank lending, extensive involvement in loan sales/securitization turns out to be significantly associated with higher bank risk, which leads to higher default rates in recession. Finally, we observe that the effects of CRT are fairly heterogeneous across different instruments, since banks that use loan sales and securitization exhibit both higher loan growth rates and higher riskiness than net buyers of credit protection via credit derivatives.

Our paper is closely related to recent literature that investigates the effects of CRT instruments on bank lending. Loutskina (2011) shows that securitization in U.S. banks has a positive impact on lending since it reduces the need to hold liquid assets and weakens the traditional monetary channel. Similar findings are reported by Altunbas et al. (2009) for a European sample and by Panetta and Pozzolo (2010) and Gambacorta and Marques-Ibánez (2011) for large international samples. Hirtle (2009) finds only limited evidence that the use of credit derivatives in U.S. bank holding companies is associated with higher loan growth. Looking at detailed bank- and firm-level data from Spain, Carbó-Valverde et al. (2011) find that firms whose lenders are actively involved in securitization are less credit constrained in normal times but more severely rationed in recession.

A second strand of related papers analyzes the empirical effects of CRT on bank risk taking. While early evidence suggests that CRT activities help manage bank risk (Cebenoyan and Strahan, 2004), recent studies report detrimental effects on bank stability. Keys et al. (2010) document a significant decline in lending standards in U.S. banks following the securitization boom. Similarly, Kara et al. (2010) observe more aggressive loan pricing strategies prior to the crisis in European banks involved in securitization. Purnanandam (2011) shows that U.S. banks more active in CRT before

1 Notable exceptions include Gambacorta and Marques-Ibánez (2011), Carbó-Valverde et al. (2011), and Kara et al. (2010) on the effects of securitization in international and European banks, respectively. Purnanandam (2011) examines the impact of CRT measures on mortgage charge-off ratios in U.S. banks during the crisis. Two some relevant contributions in terms of comparative analyses of different CRT tools can be found in the theoretical literature. Duffee and Zhou (2001), and Parlour and Winton (2012) propose theoretical models aimed at explaining how banks choose among alternative instruments and under which conditions either credit derivatives disrupt the loan sales market or different tools can coexist.
period 2001:Q2–2009:Q2. Previous years are not considered due to the unavailability of detailed data on securitization activity. We exclude smaller institutions, given their limited involvement in CRT markets. We also remove all bank-quarters with zero values for total assets, total loans, bank capital, or total deposits, as well as those with asset growth or loan growth in excess of 50% and 100%, respectively. Finally, we correct for the effects of mergers and acquisitions by excluding the quarters before and after the event for the acquiring bank.

Information on bank activity in securitization and loan sales is obtained from Schedule RC-S of the Call Reports.\textsuperscript{4} We measure securitization as the outstanding principal balance of assets sold and securitized by the bank with servicing retained or with recourse or other seller-provided credit enhancements. We proxy loan proxy by the difference between: (1) the outstanding principal balance of assets owned by others with servicing retained by the bank and (2) the outstanding principal balance of assets sold and securitized by the bank.\textsuperscript{5} Since servicing is commonly retained by the originator following asset sales or securitization, we believe our measures represent valid proxies of the overall principal amount of loans sold and/or securitized by the banks in the sample.

The information available from the Call Reports allows us to derive estimates of loan sales and securitization separately for: (1) 1–4 home mortgages and (2) all other types of loans, including multifamily residential mortgages, commercial mortgages, home equity lines of credit, credit card receivables, auto loans, commercial and industrial (C&I) loans, and all other loans and leases. The distinction may be relevant, given that the securitization of 1–4 mortgages remained quite liquid over the entire sample period in comparison to other securitization channels, thanks to the continued activity of government-sponsored enterprises (i.e., Fannie Mae and Freddie Mac).

To assess the goodness of our measures, we first compare our proxy for the amount of 1–4 mortgages sold and/or securitized to the overall amount outstanding of 1–4 mortgages securitized in the U.S. economy (i.e., the sum of the relevant items from Tables L.125 and L.126 of the “Flow of Funds Accounts of the United States” provided by the Federal Reserve). Second, we compare our proxy for the amount of all other loans sold and/or securitized to the sum of mortgages (excluding 1–4 mortgages), consumer credit, trade credit, and other loans securitized in the U.S. economy (from Table L.126 of the “Flow of Funds Accounts of the United States”).\textsuperscript{6} We find our measures to account, respectively, for 77% and 86% of the overall figures for the U.S. market; hence, they seem to accurately describe the loan sales and securitization activity of the banks under investigation.

The activity in credit derivatives of commercial banks is documented in Schedule RC-L of the Call Reports. Credit default swaps account for about 70% of the overall notional amount of credit derivatives, on average, over the sample period and the remaining part is split among total return swaps, credit options, and other credit derivatives.\textsuperscript{7} For our purposes it would be helpful to distinguish those banks that use credit derivatives for hedging from those that use them for trading. This is not straightforward, since 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 an attempt to overcome this limitation, we label a bank as a net protection buyer when the gross protection bought is at least twice as much as the gross protection sold. Analogously, we define a net protection seller as a bank whose protection sold is at least twice as much as the protection purchased. The remaining credit derivative users are classified as dealers. We expect banks that use derivatives for trading purposes to hold nearly matched long and short positions, while significantly unbalanced positions are more likely to characterize hedging or directional activity.

We believe this approach to be more robust in classifying credit derivative users than examining the sign of the net credit position (as do Minton et al. (2009)), since a bank can report a long/short net position purely as a result of its dealer activities. To assess whether our approach is helpful in distinguishing hedgers from dealers, we compute derivatives trading and hedging ratios based on banks’ positions in other derivatives (i.e., derivatives on interest rates, foreign exchanges, equity, and commodities) from Schedule RC-L of the Call Reports. We compare the values of those ratios for credit derivative hedgers (net protection buyers) and dealers, defined according to our measures. The derivatives trading ratio is computed as the ratio of the gross notional amount of other derivatives used by the bank for trading to total assets, while the derivatives hedging ratio is the ratio of the gross notional amount of other derivatives used for hedging to total assets. In relative terms, if banks are consistent in their usage of derivative products, we expect our net credit derivative hedgers to use a higher (lower) proportion of other derivative instruments for hedging (trading) purposes compared to credit derivative dealers.

The average values of the derivatives trading and hedging ratios are equal to 0.89 and 1.31, respectively, for banks qualified as credit derivative hedgers according to our methodology. The average figures for the derivatives trading and hedging ratios are, instead, 11.38 and 1.33, respectively, for credit derivative dealers. Hence our approach, however imperfect, seems to correctly identify as dealers (hedgers) those institutions more actively involved in using derivatives for trading (hedging) purposes. A further look at the credit derivative users classified according to our approach reveals that less than 20% of the banks belonging to any group (net buyers, net sellers, or dealers) migrate to a different group during the sample period under investigation. Such persistence seems to suggest that the classification method adopted in our study is reasonably accurate.\textsuperscript{8}

3. CRT activity through the cycle: descriptive results

This section conducts some descriptive analyses to illustrate how the usage of loan sales, securitization, and credit derivatives

---

\textsuperscript{5} One can argue that we ignore a significant component of CRT activity by working with commercial banks instead of bank holding companies. We find this not to be the case since, according to our calculations, the commercial banks affiliated with the top 30 bank holding companies (by total assets) account, on average, over the sample period, for 92%, 91%, and 85% of overall holding activity in credit derivatives, securitization, and asset sales, respectively.

\textsuperscript{6} Similar measures of securitization and loan sales are used by Han et al. (2010). The construction of CRT measures and of all other variables employed in our analyses is detailed in the Appendix.

\textsuperscript{4} Alternatively, one could proxy loan sales with the asset sales measures provided in Schedule RC-S, item 11, as do Minton et al. (2009). However, those variables only include assets sold with recourse or other seller-provided credit enhancements. Since a significant proportion of loans in the U.S. banking sector are sold without recourse to achieve true capital relief, such measures would underestimate the amount of assets sold on the market.

\textsuperscript{7} In making such comparisons, we implicitly assume that all home mortgages and other loans sold by the commercial banks in our sample will be eventually securitized in the economy. While this is a reasonable assumption for mortgages and consumer loans, many business loans are exchanged among banks but never securitized. In this respect, the figures from the “Flow of Funds” may underestimate the overall amount of loans (other than 1–4 mortgages) sold or securitized on the market.

\textsuperscript{8} We include only non-structured credit products in our definition of credit derivatives. Structured credit derivatives are classified instead as securitization products.

\textsuperscript{9} As a robustness check, we replicate the following analyses by redefining as net protection buyers (sellers) those banks whose protection purchased (sold) is at least 1.5 times the protection sold (purchased). The results, available from the authors, are very similar.
in U.S. commercial banks has evolved over the last decade, particularly in response to the 2007–2009 crisis.

Table 1 reports annual summary statistics on the usage of CRT instruments in our sample. Following the widespread involvement of financial institutions in CRT techniques, we observe in Panel A that about 70% of the banks use at least one of the tools under investigation. Interestingly, around 80% of CRT users employ one instrument only, whereas the percentage of users engaging in all tools is only 5–6%. The most commonly used instruments, both in isolation and jointly with other tools, are loan sales, followed by securitization. In particular, around 45% of the banks that access CRT markets only sell 1–4 residential mortgages, which are typically purchased and then securitized by Fannie Mae or Freddie Mac.9 The overall percentage of loan sellers ranges from 90% in 2001 to 96% in 2009, while the corresponding figure for banks that securitize decreases from 36% to 16%. The largest drop in the number of securitization users is observed between 2002 and 2004 as a consequence of more stringent rules introduced in the aftermath of Enron’s bankruptcy, which led a number of commercial banks to limit their CRT activity to loan sales only or to exit the CRT market.10 A second contraction in the number of securitization users is recorded during the 2007–2009 crisis, due to the illiquidity that characterized most securitization segments in this phase. Again, a substitution effect between securitization and asset sales took place for some banks in this period.11

Around 10% of CRT users report positions in credit derivatives, which in most cases (85%) are employed in association with funded tools, in accordance with previous evidence provided by Hirth (2009) and Minton et al. (2009). Panel B of Table 1 shows that the proportions of credit derivative users that take long, short, or nearly matched positions are, on average, fairly similar. Net protection buyers are more numerous (around 37%, on average, over the entire period), although their proportion slightly decreases during the financial crisis, in favor of net sellers.

Table 2 details the distribution of the usage of CRT instruments by bank size for year-end 2008. Since the banks in our sample are very heterogeneous in size, we define three classes according to total assets: from USD 1 billion to USD 5 billion, from USD 5 billion to USD 20 billion, and above USD 20 billion. Around 90% of the banks belong to the first two groups. However, they account for only about 15% of total assets in the sample, highlighting strong sector concentration.12

As expected, large banks are the most active users of CRT tools, since more than 90% of large institutions use at least one instrument. However, almost two-thirds of banks in the bottom category of asset size also lay off credit risk, predominantly via loan sales. Securitization becomes a more popular tool as bank size increases, used both in isolation and jointly with other tools. Credit derivatives are primarily used by large banks, which act mainly as net protection buyers and dealers. Interestingly, as discussed later, smaller banks tend to sell credit protection when engaging in credit derivatives. As bank size increases, the set of CRT instruments used widens. Smaller banks typically use one CRT tool only, given the simplified composition of their loan portfolios. In contrast, more than 80% of large banks transfer credit risk via two or three instruments, which is in line with the complexity of

---

9 Our statistics are consistent with those of Han et al. (2010) once we adjust for sample composition. However, they differ from the statistics reported by Minton et al. (2009), given that their study only accounts for asset sales with recourse.

10 Following Enron’s default, regulators considered moving the securitization conduits on banks’ balance sheets. In July 2004 it was eventually decided that banks could keep the conduits off balance, provided that they held some capital aside. Nonetheless, securitization had become too expensive for a significant number of institutions.

11 It is worth noting that about one-fourth of the decrease in the percentage of securitization users over the sample period can be explained by sample composition. As we discuss, securitization is normally carried out by medium-sized and large banks; some of these were involved in merger activities during the period under consideration and therefore their proportion of the total number of banks in the sample has decreased.

12 Analogous tables computed for all years in the sample reveal a very similar composition over time of CRT users according to size. Consistent with the findings in Table 1, the percentage of securitization users is significantly larger in the first years of the sample period than in 2008. In particular, it is three times larger for smaller banks and two times larger for middle-sized banks, while it is essentially unchanged for larger banks.
The joint usage of different CRT tools that emerges from Tables 1 and 2 suggest that those instruments are normally seen by banks as complements rather than as substitutes (Hirtle, 2009; Minton et al., 2009). To better investigate this aspect, Fig. 1 presents scatter plots of CRT activities (taken pairwise) for users of multiple instruments over the sample period. To derive comparable measures of CRT activity, the amounts outstanding of assets sold and/or securitized, as well as the amount outstanding of net credit protection and heterogeneity of their balance sheet and the resulting sophistication of their funding and risk management needs.

The table reports: (1) the number of banks in the sample that have used CRT instruments in 2008 and the number of banks that have not used CRT instruments in the same year, grouped by classes of asset size; (2) the percentage composition of CRT users according to the type(s) of instrument used (in isolation or in combination with other tools), by classes of asset size. Net protection buyers are institutions whose amount of credit protection purchased via credit derivatives is at least twice as much as the amount of protection sold. Net protection sellers are institutions whose amount of credit protection sold via credit derivatives is at least twice as much as the amount of protection purchased. All other credit derivative users are classified as Dealers. The sample includes commercial banks with total assets larger than 1 billion USD.
purchased (i.e., protection bought minus protection sold), are normalized by total assets. We report two main findings. First, in line with the theoretical predictions of Parlour and Bruno (forthcoming), there is no significant association, on average, between the usage of funded CRT tools and the amount of loan insurance purchased via credit default swaps. In fact, banks heavily involved in securitization or asset sales tend to behave like dealers rather than hedgers in the credit derivatives market. Second, we find further evidence of a substitution effect between asset sales and securitization since activity in the former segment strengthens as the corresponding activity in the latter weakens (and vice versa). This finding is also confirmed by significant (at the 1% confidence level) correlation coefficients between: (1) levels of activity in loan sales and in securitization, equal to −0.09 prior to the crisis and to −0.10 during the crisis and (2) quarterly changes in loan sales and in securitization ratios, equal to −0.72 prior to the crisis and to −0.83 during the crisis.

Table 3 provides some univariate evidence of the effects of the 2007–2009 crisis on the intensity of CRT usage by comparing the mean and median values of CRT activity in medium-sized and large banks prior to the onset of the financial crisis and during the crisis. Medium banks have total assets between USD 1 billion and USD 20 billion, while large banks have total assets larger than USD 20 billion. In computing the summary statistics, we include all available observations for those banks that engage in a given CRT segment in at least one quarter over the period 2005:Q1–2007:Q2 (pre-crisis) or the period 2007:Q3–2009:Q2 (during the crisis). By removing the first years of the sample, we avoid a potential bias in estimating the crisis’ effects on CRT activity, which can arise as a consequence of the large drop in the number of securitization users observed in 2002–2004. As before, we use the ratios of the amounts outstanding of loans sold, loans securitized, and net credit protection to total assets. We report the values of the t-test on the mean and of the Wilcoxon test on the median in the last two columns. To compare CRT usage to lending activity, we also provide the mean and median values of loan portfolio composition over the two subperiods for CRT users.

Following the burst of the housing bubble, the proportion of 1–4 mortgages on banks’ balance sheets generally declines. However, we report a contraction only in the ratios of home mortgages sold or securitized by medium banks, with no significant changes in the corresponding ratios for large banks. As for the remaining loan categories, we document a substantial reduction in securitization activity across all bank sizes, which is partly compensated for by an increase in loan sales, confirming the evidence of a substitution effect between the two instruments. This can be explained with the increased uncertainty regarding the evaluation of structured products during the crisis, which makes banks prefer the simpler and cheaper alternative of selling loans. Consistent with these changes in CRT activity, we observe a decrease in the proportion of consumer loans and an increase in the share of other mortgages (mainly commercial) in medium-sized institutions, as well as an increase in the share of C&I loans in large banks.

Our preliminary findings confirm that, despite the generalized contraction in the securitization business, significant activity in CRT markets was preserved during the crisis. This holds particularly for the largest banks in the sample, while smaller institutions considerably reduced their recourse to CRT.

As far as credit derivatives are concerned, medium-sized banks surprisingly tend to become net sellers of credit protection during the crisis while large banks increase, on average, the proportion of credit protection purchased in 2007–2009. The determinants of credit derivative usage in large banks are investigated in detail in the next section. Medium-sized credit derivative users, however, are too scarce to allow us to perform a rigorous econometric analysis, hence we analyze them here. Prior to the crisis, nine of those

13 For example, to compute the mean and median values of the loan sales ratio for residential mortgages, we include all banks that sell residential mortgages in any quarter either before or during the crisis.
banks were classified as net protection buyers and 11 as net protection sellers, while in the recession the number of net protection buyers decreased to six and the number of net sellers increases to 15. We look for an explanation for the increase in the credit protection sold in the annual reports of the protection sellers. In most cases, the reports reveal that the short positions stem from single-name credit default swaps where the bank sells protection on a commercial loan customer who entered into a contract (typically a foreign currency or an interest rate derivative) with an unaffiliated dealer counterparty who purchases the credit protection. These forms of credit insurance become particularly valuable to commercial loan customers in times of uncertainty and increased credit risk, which explains their popularity over the last few years.

4. The dynamics of CRT incentives

This section investigates which incentives drive CRT practices and how they vary across the business cycle. We thus assess how changes in certain bank characteristics translate into an increase or a decrease in loan sales, securitization, or credit derivatives.\(^\text{14}\)

Specifically, we use a panel approach where we regress: (1) quarterly changes in the loan sales/securitization ratio, measured as total volumes outstanding of assets sold and/or securitized over total assets and (2) quarterly changes in the net credit derivative hedge, measured as net credit protection over total assets, on lagged quarterly changes in a number of bank and market variables. We derive separate estimates for the years before the crisis (2001:Q2–2007:Q2) and during the crisis period (2007:Q3–2009:Q2). Loan sales and securitization activities are pooled together since they possess very similar features in terms of liquidity origination, capital relief, and CRT. The analysis is performed separately on the sales/securitization of 1–4 residential mortgages and of other loans to highlight potential differences in the CRT drivers for different types of loans. Finally, we investigate the motivations behind credit insurance only for net protection buyers, since we are interested in institutions engaging in activities whose aim, at least in principle, is to transfer credit risk. Formally, the model for the determinants of loan sales/securitization activity is:

\[
\Delta \text{LSSec}/TA_c = c_1 + \sum_{i=1}^{11} \beta_i \cdot \Delta X_{it-1} + \sum_{j=1}^{3} \gamma_j \cdot \Delta M_{jt} + \alpha
\]

\[
\cdot \Delta \text{LSSec}/TA_{c-1} + \epsilon_{st}
\]

while the model for the credit derivatives activity of net protection buyers can be written as:

\[
\Delta \text{CDnet}/TA_c = c_2 + \sum_{i=4}^{11} \beta_i \cdot \Delta X_{it-1} + \sum_{j=4}^{3} \gamma_j \cdot \Delta M_{jt} + \delta
\]

\[
\cdot \Delta \text{CDnet}/TA_{c-1} + \epsilon_{st}
\]

where \(X_t\) denotes bank characteristics and \(M_t\) represents macroeconomic variables. The bank characteristics we select as independent variables are well consolidated in the relevant literature and include size, loan portfolio composition, the liquidity asset ratio, the capital ratio, the deposit ratio, the cost of funding, the non-interest income ratio, the z-score, and the non-performing loan ratio. Bank size is measured as the natural logarithm of total assets. Loan portfolio composition is captured by the percentages of 1–4 residential mortgages, other mortgages, C&amp;I loans, and consumer loans to total loans. We investigate the role of liquidity on CRT using both asset and liability liquidity measures. Following Kashyap and Stein (2000), our proxy for asset liquidity is defined as the amount of liquid assets (i.e., federal funds sold, securities purchased under agreement to resell, securities held to maturity or available for sale) over total assets.\(^\text{15}\) To measure funding liquidity we use both an indicator of funding cost, computed as the ratio of interest expenses over total liabilities, and the ratio of total deposits over total liabilities. Bank capitalization is measured by the total capital ratio. Bank riskiness is captured by both the proportion of non-performing loans over total loans and the logarithm of the z-score of the bank, which represents a widely used measure of distance to default (Boyd and Runkle, 1993). Finally, we include the ratio of non-interest income over total assets to account for those CRT transactions arranged specifically for the purpose of increasing the non-interest income component through servicing and origination fees, or net gains on asset sales.

To capture potential business cycle effects in CRT activity, we include as market variables quarterly changes in the logarithm of the GDP, the logarithm of the S&amp;P 500 stock index, and the logarithm of the house price index. Data on the U.S. GDP, the S&amp;P 500 stock index, and the house price index are from the U.S. Bureau of Economic Analysis, the Center for Research in Security Prices, and the Federal Housing Finance Agency, respectively. To mitigate some of the endogeneity concerns that may arise due to the fact that bank features themselves may be affected by previous usage of CRT instruments, we use lagged changes in the explanatory variables and add a lagged change to the dependent variable.

The panel estimates over both subperiods, derived by employing the dynamic generalized method of moments (GMM) panel methodology of Arellano and Bond (1991), are displayed in Table 4. We provide separate estimates for medium-sized and large banks with respect to funded instruments, whereas we only consider large net buyers of credit derivatives.

We notice that the main drivers behind sales and securitization are essentially the same for both home mortgages and other types of loans. As far as medium-sized banks are concerned, prior to the crisis they intensified their usage of such instruments, primarily as a result of tighter liquidity and capital constraints, or following an increase in bank size. We find some evidence (significant only for home mortgages) that a more active involvement in the funded CRT segment is also aimed at generating fees following a contraction in the non-interest income component. Given the specialization in loan origination that normally characterizes CRT users, an increase in loans sales and the securitization of 1–4 mortgages is also explained by a larger proportion of 1–4 residential mortgages in the bank portfolio. Similarly, an increase in C&amp;I loans translates into an intensification of sales and securitization of the non–1–4 loan component. During the crisis, most of the variables that turned out to be significant determinants of CRT in previous years lose strength and become insignificant. This evidence can be explained by the combination of two factors: (1) the increased illiquidity in the market for funded CRT instruments and (2) the inability of medium-sized banks to affect such illiquidity, given their relatively limited participation share in CRT markets: At the onset of the crisis only 5% of the outstanding volumes of loans sold and 3% of the outstanding volumes of loans securitized pertain to banks in this size group. As a result, the (reduced) activity in loan sales and securitization for those banks during the crisis becomes less sensitive to specific bank characteristics and mainly driven by the overall liquidity of CRT markets.

\(^{14}\) In this respect, the methodology we follow differs from the approaches traditionally adopted in the literature, which are more appropriate for examining the characteristics of first-time users of CRT instruments (Panetta and Pozzolo, 2010).

\(^{15}\) Cash is excluded from the liquidity measure since it primarily includes required reserves. However, during the financial crisis, banks’ cash holdings increased significantly due to large excess reserves accumulated following the measures implemented by the Federal Reserve (Adrian and Shin, 2010). For robustness, we use a measure of asset liquidity that includes cash holdings. The results, available on request, are unchanged.
When examining large institutions, we find that their activity in loan sales and securitization seems primarily motivated by liquidity/funding constraints and loan portfolio specialization (home mortgages for the sales/securitization of 1–4 mortgages, consumer loans and non-home mortgages for the sales/securitization of other loans) in the years before the crisis. However, in contrast with the evidence reported for smaller banks, the role played by funding needs remains (or becomes even more) significant in large banks during the financial downturn. Furthermore, a deterioration in the credit quality of the loan portfolio gains significance in explaining an increase in sales/securitization of loans other than 1–4 mortgages. As a result of large loan losses and of the increased illiquidity in ex-deposit short-term funding channels, large institutions faced severe capital and funding constraints in this period (Brunnermeier, 2009; Adrian and Shin, 2010). In this context, our findings suggest that CRT markets have been used as a safety valve in helping banks to alleviate funding shocks.

Finally, the analysis of the main drivers behind credit insurance purchases reveals that, before the crisis, purchases of credit protection seem to be aimed mainly at preserving adequate levels of regulatory capital and funding constraints in this period. In this context, our findings suggest that CRT markets have been used as a safety valve in helping banks to alleviate funding shocks.
effectively hedge the credit risk arising from those loans by using credit derivatives. In this respect, it is worth noting that the market for non-structured credit derivative products remained fairly liquid during the crisis, compared to other CRT segments.

5. The effects of CRT activity

5.1. CRT and bank lending

Following our evidence that liquidity and funding constraints represent major determinants of CRT activity in U.S. commercial banks, this section ascertains whether the financial and capital resources released via CRT are then employed to increase banks’ lending activities. Therefore we investigate whether banks that use CRT intensively tend to increase their loan supply more than other banks in normal times and, more importantly, contract their lending less during the crisis.

To test this prediction, we regress quarterly log loan growth against our indicators of CRT activity (i.e., the loan sales and securitization ratio for 1-4 residential mortgages and for all other loans and the net credit derivatives ratio) plus a set of variables that may have a significant impact on bank lending, namely, a set of additional bank characteristics, quarterly changes in a monetary policy indicator (plus two lags), and quarterly changes in macroeconomic variables. The empirical specification we adopt is fairly standard and broadly follows that of Kashyap and Stein (2000):

\[
\Delta \ln(\text{loans})_t = c_3 + \sum_{i=1}^{10} \theta_i \cdot X_{i,t-1} + \sum_{q=0}^{2} \rho_q \cdot \Delta \text{IRF}_{t-q} + \sum_{i=1}^{6} K_i \cdot X_{i,t-1} - \Delta \text{IR}_{t} + \sum_{j=1}^{2} \phi_j \cdot \Delta M_{j,t} + \mu \cdot \Delta \ln(\text{loans})_{t-1} + \epsilon_t
\]

(3)

Bank characteristics \(X_i\) include lagged values of both of our CRT measures and a number of variables that previous literature has found to be relevant determinants of loan growth, such as size, the asset liquidity ratio, the capital ratio, the deposit ratio, the annualized return on assets (RoA), the non-performing loan ratio, and a flag liquidity (Kashyap and Stein, 1995), liquidity (Kashyap and Stein, 2000), capital ratios (Kishan and Opiela, 2000), securitization (Altunbas et al., 2009; Gambacorta and Marques-Ibanez, 2011), or the availability of highly securitize assets in the loan portfolio (Loutskina, 2011). As before, we estimate the model separately over the pre-crisis period and during the recession to capture differences in the impact of CRT on loan growth over the business cycle. Finally, we add to our specification the lagged value of loan growth to control for endogeneity issues. The dynamic panel model in (3) is then estimated by using the dynamic GMM panel methodology introduced by Arellano and Bond (1991).

It is worth investigating whether the usage of CRT techniques has the same effect on different loan categories. Hence we estimate the model in (3) for 1-4 residential mortgages, other mortgages, C&I loans, and consumer loans. We perform the analysis separately on medium and large banks to assess whether the impact of CRT on bank lending varies across banks of different size. The results are shown in Table 5, where, for clarity of exposition, we report the coefficients and standard errors only for the CRT indicators, the changes in the federal funds rate, and their cross-effects.

The effects of CRT on loan growth are heterogeneous for banks of different size and across the four categories of bank loans. In detail, we find that the sales and securitization of home mortgages boost the growth of this loan segment for banks of all sizes before the crisis. Similarly, over this period the growth rates of non-home mortgages in both medium-sized and large banks are positively affected by the sales and securitization of loans other than residential mortgages. However, the positive effects of funded CRT tools on mortgages become statistically insignificant during the crisis: While the securitization channel for these loans remains open and fairly liquid, the weak conditions that characterize the real estate sector in this period lead to a contraction in the supply of new mortgages. In contrast, we observe higher growth rates of C&I loans in large financial institutions that engage in the sales and securitization of loans (ex-home mortgages) both before and during the crisis. In medium-sized banks CRT activities do not significantly impact the offer of C&I loans prior to the crisis, while the growth rate of business loans benefits from the sales and securitization activity of home mortgages during the economic downturn. This evidence of a cross-effect of the sales/securitization of a given loan class on the offer of other types of loans has been documented before (Loutskina, 2011) and can be explained with the banks’ attempt to channel resources from their CRT activity to loan segments where either the demand from borrowers is stronger or the risk-return profile is more appealing. Finally, we find the contribution of sales and securitization activity to loan growth to be especially relevant for consumer loans offered by large banks, consistent with the practice of generating those contracts on an ongoing basis for securitization purposes. This effect weakens in economic terms but remains significant also in the recession, since demand and supply for those loans contract less than for other loan categories over this period. However, the impact of CRT on the growth rate of consumer loans in smaller banks is not statistically significant, either in good times or in recession. This is not surprising, considering that consumer loans only represent a small proportion of the loan portfolios (less than 7%, on average) for those banks.

In line with previous literature (Altunbas et al., 2009; Gambacorta and Marques-Ibanez, 2011; Loutskina, 2011), we document evidence of further effects of CRT activities on the bank lending channel following changes in monetary policy. In particular, we observe positive effects of loan sales and securitization through the lending channel for smaller banks both before the crisis (for home mortgages other mortgages, and business loans) and during (for business loans and consumer loans).

As far as credit derivatives are concerned, we do not find the amount of net credit insurance purchased to have a significant direct impact on bank lending, consistent with the general findings of Hirtle (2009). Nonetheless, for funded tools, we record a positive effect of net credit protection purchased on the growth rate of business loans following a monetary policy intervention on interest rates, which is significant in quiet times for smaller banks and in recession for large banks.

To summarize, our findings confirm that recourse to CRT helps relieve some of the constraints that affect bank lending and translates into higher growth rates. More interestingly, this positive effect remains significant, albeit weaker in economic terms, for

\footnote{It is worth noting that mortgages (especially residential) tighten considerably over most of the period 2007:Q3–2009:Q2, while the contraction in business and consumer loans becomes significant starting from the beginning of 2009 (Federal Reserve Board, 2010).}
Table 5
Effects of credit risk transfer activity on loan growth.

<table>
<thead>
<tr>
<th></th>
<th>1–4 Mortgages</th>
<th>Other mortgages</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Medium banks</td>
<td>Large banks</td>
</tr>
<tr>
<td>Pre-crisis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΔFed funds rate</td>
<td>–0.352</td>
<td>(0.26)</td>
</tr>
<tr>
<td>Loan sales/sec l–4–1</td>
<td>0.195*</td>
<td>(0.08)</td>
</tr>
<tr>
<td>Loan sales/sec other loans,1</td>
<td>0.001*</td>
<td>(0.00)</td>
</tr>
<tr>
<td>CD net ratio,1</td>
<td>2.859</td>
<td>(2.4)</td>
</tr>
<tr>
<td>ΔFF + loan sales/sec l–4–1</td>
<td>0.039*</td>
<td>(0.02)</td>
</tr>
<tr>
<td>ΔFF + loan sales/sec other loans,1</td>
<td>0.056*</td>
<td>(0.03)</td>
</tr>
<tr>
<td>ΔFF + CD net ratio,1</td>
<td>–1.036</td>
<td>(1.68)</td>
</tr>
<tr>
<td>Constant</td>
<td>4.689***</td>
<td>(0.68)</td>
</tr>
<tr>
<td>Wald test (p-value)</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>MA(1) (p-value)</td>
<td>0.002</td>
<td>0.034</td>
</tr>
<tr>
<td>MA(2) (p-value)</td>
<td>0.264</td>
<td>0.345</td>
</tr>
<tr>
<td>Sargan test (p-value)</td>
<td>0.083</td>
<td>0.984</td>
</tr>
<tr>
<td>Crisis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΔFed funds rate</td>
<td>–0.034</td>
<td>(0.07)</td>
</tr>
<tr>
<td>Loan sales/sec l–4–1</td>
<td>0.092</td>
<td>(0.19)</td>
</tr>
<tr>
<td>Loan sales/sec other loans,1</td>
<td>–0.021</td>
<td>(0.08)</td>
</tr>
<tr>
<td>CD net ratio,1</td>
<td>–0.229</td>
<td>(1.36)</td>
</tr>
<tr>
<td>ΔFF + loan sales/sec l–4–1</td>
<td>0.032</td>
<td>(0.02)</td>
</tr>
<tr>
<td>ΔFF + loan sales/sec other loans,1</td>
<td>0.002</td>
<td>(0.05)</td>
</tr>
<tr>
<td>ΔFF + CD net ratio,1</td>
<td>0.591</td>
<td>(1.63)</td>
</tr>
<tr>
<td>Constant</td>
<td>1.038</td>
<td>(1.71)</td>
</tr>
<tr>
<td>Wald test (p-value)</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>MA(1) (p-value)</td>
<td>0.001</td>
<td>0.390</td>
</tr>
<tr>
<td>MA(2) (p-value)</td>
<td>0.469</td>
<td>0.467</td>
</tr>
<tr>
<td>Sargan test (p-value)</td>
<td>0.006</td>
<td></td>
</tr>
<tr>
<td>Bank-characteristics controls included</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Market controls included</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Interactions ΔFF + indep variables included</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Lagged dependent variable included</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Overall # observations</td>
<td>11,500</td>
<td>1380</td>
</tr>
</tbody>
</table>

The table reports panel estimates of the impact of credit risk transfer (sales/securitization ratio of 1–4 mortgages, sales/securitization ratio of other loans, net credit derivatives ratio) on the quarterly growth rate of four loan categories. Medium banks have total assets between 1 and 20 billion USD. Large banks have total assets larger than 20 billion USD. Bank and market variables are computed as specified in Section 5 and in the Appendix. The models are estimated following the GMM approach of Arellano and Bond (1991). Data are from 2001-Q2–2007-Q2 (pre-crisis) and 2007-Q3–2009-Q2 (crisis). Robust standard errors in brackets. Wald test is for the null hypothesis that all coefficients except the constant are zero. MA(1) and MA(2) are Arellano–Bond tests for zero autocorrelation in first-differenced errors. Sargan test is the test of overidentifying restrictions, derived from GMM estimates.

* Statistical significance at the 10% level.
** Statistical significance at the 5% level.
*** Statistical significance at the 1% level.
some loan segments also during the financial crisis, which suggests that the Federal Reserve's measures aimed at preserving CRT liquidity have been beneficial to the real economy in terms of lower credit contraction. We find this effect to be stronger for large banks, which are generally the main players in CRT markets and maintain intense activity in CRT even in recession.

5.2. CRT and bank risk

Despite the benefits of CRT in terms of credit supply to the economy, intense recourse to CRT practices can have detrimental effects on bank stability. In this respect, we are interested in assessing whether banks more engaged in CRT become more distressed or default more frequently than other institutions, especially during the financial crisis.

We choose as our first measure of bank risk the (log) z-score of the bank, which equals the RoA plus the capital ratio divided by the standard deviation of asset returns $\sigma(\text{RoA})$. The z-score is a widely used indicator of distance to default (Boyd and Runkle, 1993): Since insolvency occurs when bank capital is entirely absorbed by losses, higher values of the z-score identify more stable institutions. To understand to what extent CRT techniques affect the z-score through the volatility of asset returns, as opposed to the leverage component, we use $\sigma(\text{RoA})$ as an additional indicator of bank risk. We then complement our risk measures by including zero autocorrelation in first-differenced errors. Sargan test is the test of overidentifying restrictions, derived from GMM estimates.

### Statistical significance
- ***: Statistical significance at the 1% level.
- **: Statistical significance at the 5% level.
- *: Statistical significance at the 10% level.
Credit risk transfer activity and bank failure.

Table 7
Credit risk transfer activity and bank failure.

<table>
<thead>
<tr>
<th>Default within 1 year</th>
<th>Model 1</th>
<th>Model 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loan sales/sec, t−1</td>
<td>-0.523</td>
<td>(0.48)</td>
</tr>
<tr>
<td>Loan sales/sec 1–4, t</td>
<td>-1.803</td>
<td>(1.48)</td>
</tr>
<tr>
<td>Loan sales/sec other</td>
<td>1.217*</td>
<td>(0.68)</td>
</tr>
<tr>
<td>loans, t−1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CD net ratio, t−1</td>
<td>71.541</td>
<td>(181.32)</td>
</tr>
<tr>
<td>LogTA, t−1</td>
<td>0.177</td>
<td>(0.13)</td>
</tr>
<tr>
<td>Liquid asset ratio, t−1</td>
<td>-3.673***</td>
<td>(1.06)</td>
</tr>
<tr>
<td>Capital ratio, t−1</td>
<td>-36.393***</td>
<td>(6.07)</td>
</tr>
<tr>
<td>RoA</td>
<td>-51.792**</td>
<td>(29.00)</td>
</tr>
<tr>
<td>Non-performing loan ratio, t−1</td>
<td>6.927***</td>
<td>(1.75)</td>
</tr>
<tr>
<td>Constant</td>
<td>-0.522</td>
<td>(1.91)</td>
</tr>
<tr>
<td>Market controls included</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>1039</td>
<td>1039</td>
</tr>
</tbody>
</table>

The table reports estimates of panel probit models where the dependent variable is equal to one if the bank defaults within a year and zero otherwise. The sample includes medium-sized banks (total assets between 1 and 20 billion USD) with available observations in June 2007, June 2008, and June 2009. Bank and market variables are computed as specified in Section 5 and in the Appendix. Robust standard errors in brackets.

* Statistical significance at the 10% level.
** Statistical significance at the 5% level.
*** Statistical significance at the 1% level.

Credit risk transfer activity and bank failure.

credit derivatives ratio) plus a set of control variables that earlier literature shows to be significant determinants of bank risk:

\[
Risk_t = \alpha_4 + \sum_{i=1}^{9} \lambda_i \cdot X_{it-1} + \lambda_{10} \cdot \text{RevGrowth}_t + v \cdot \Delta \ln GDP_t + \omega \cdot \text{Risk}_{t-1} + \epsilon_t \tag{4}
\]

Bank characteristics \( X_t \) include logged values of CRT ratios, size, the asset liquidity ratio, the deposit ratio, the loan ratio, and the BHC flag, as well as the revenue growth rate. When risk is measured as \( \sigma(\text{RoA}) \) or the non-performing loan ratio, we add the logged value of capital ratio to our list of control variables. We include the GDP growth rate to account for the impact of macroeconomic conditions on bank risk. As before, we add the logged value of the dependent variable to control for endogeneity issues and estimate the panel models in (4) via a dynamic GMM approach. We compute the z-score and \( \sigma(\text{RoA}) \) over four quarters of data; hence we choose to estimate the models in (4) on annual non-overlapping observations (instead of quarterly, as in the previous models) to derive unbiased estimates. For consistency, the model for the non-performing loan ratio is also estimated from annual observations.

Table 6 displays our findings separately for medium-sized and large banks over both the pre-crisis and crisis years. In line with previous empirical evidence on the negative effects of securitization on bank stability (Keys et al., 2010; Michalak and Uhde, 2010; Purmanandam, 2011), we find that, in general, financial institutions that use funded CRT tools intensively are riskier and have lower-quality loan portfolios.

In detail we observe that, prior to the economic downturn, banks that are more active in the loan sales and securitization business report significantly lower z-scores and are therefore closer to the default boundary. This evidence holds for banks of different sizes, although it is stronger for smaller institutions. In recession, the positive association between the usage of funded CRT tools and bank risk persists in economic terms but is not statistically significant.\(^{17}\) We document similar findings in medium-sized banks when examining the impact of loan sales and securitization on \( \sigma(\text{RoA}) \), since higher CRT activity increases the volatility of asset returns, particularly in the years before the crisis. Interestingly, we do not observe a significant association between the recourse to funded CRT tools and \( \sigma(\text{RoA}) \) in large banks. This can be explained by the fact that heavy CRT users report low z-scores mainly as a result of high leverage ratios rather than of high volatility in asset returns, since they benefit from the stabilizing effect on RoA of a significant non-interest income component, which persists during the crisis. Finally, we observe that banks more engaged in loan sales and securitization have a higher proportion of non-performing loans on their balance sheets. This evidence holds for both medium-sized and large banks and is significant both in expansion and during recession.

Contrary to what is documented for funded CRT tools, our results suggest that large banks that are net buyers of credit protection via credit derivatives are less risky (i.e., have higher z-score values and lower volatility of asset returns) and hold loan portfolios with a lower proportion of non-performing assets, in line with a number of theoretical predictions (Parlour and Winton, forthcoming).

Following our evidence of a significant link between intense recourse to funded CRT tools and bank risk, we analyze whether the usage of such techniques translates into a higher probability of bank failure during the crisis. In this respect, we consider commercial banks that are part of our sample in June 2007, June 2008, and June 2009 and identify which of those institutions defaulted within the next year, based on the “Failed Bank List” provided by the Federal Deposit Insurance Corporation. We count 49 failed banks in total (47 medium-sized and two large). Based on this information, we compute annual default frequencies for medium-sized banks that sell or securitize (distinguishing between those that transfer 1–4 mortgages and those that transfer other loans) and for those that do not use CRT tools.\(^{18}\) We note that the average default rate is smaller for banks that sell or securitize: 2.43% against 3.60% for non-CRT users. However, it is substantially larger (4.44%) for banks that sell or securitize loans other than home mortgages than for those that sell or securitize 1–4 mortgages (1.75%).

To substantiate this evidence, we also run a panel probit for the sample of medium-sized banks described above. The dependent variable equals one if the bank defaults within a year, and zero otherwise. As potential determinants of the probability of failure we include size, the capital ratio, the asset liquidity ratio, the RoA, the proportion of non-performing loans, and GDP growth, to which we add our CRT indicators, that is, the loan sales and securitization ratio (overall as well as separate for 1–4 residential mortgages and all other loans) and the net credit derivatives ratio.

The estimates reported in Table 7 confirm that, when examining the aggregate measure of loan sales and securitization, we do not find evidence that CRT practices impact the probability of default. However, if we separate sales and securitization according to asset class, we observe that more active involvement in the sales and securitization of loans other than residential mortgages is associated with a significantly higher failure rate in the recent financial crisis.

In short, we document that users of funded CRT instruments are, on average, riskier than other institutions both before and during the crisis, which confirms that those tools were mainly used for

\(^{17}\) The lack of statistical power during the crisis can be partly attributed to the reduced sample size in this subperiod.

\(^{18}\) We ignore large banks, given the small number of failed institutions in this group. In addition, the default frequency of credit derivatives users is equal to zero, irrespective of whether we consider all credit derivative users or only net credit protection buyers. In this respect, it is worth noting that the number of medium-sized credit derivative users is small.
risk-taking purposes. However, intense usage of credit derivatives for hedging has not produced detrimental effects on bank stability, since we observe an inverse relation between net credit protection positions and bank risk, which in fact turns out to be stronger during the crisis.

6. Concluding remarks

The goal of this paper is to explore the role played by CRT practices in U.S. commercial banks and to investigate to what extent it changed during the recent financial crisis. We record during this period a contraction in securitization due to the increased uncertainty regarding the evaluation of structured products, while recourse to simpler and cheaper tools such as loan sales and non-structured credit derivatives remains significant, especially for the largest banks in the sample. Our results suggest that the principal incentive driving CRT during the credit crunch is the need to raise additional financial resources, following the drying up of most short-term funding channels. We then find evidence that the financial resources released through CRT have been invested to expand bank lending not only in good times but also, to a lesser extent, during the crisis. In this respect, the decision to bail out government-sponsored enterprises and, more generally, the Federal Reserve’s measures aimed at preserving a sufficient level of liquidity in CRT markets have proven beneficial to the real economy in terms of lower credit contraction.

On the negative side, our findings suggest that funded CRT instruments have been mainly used over the years to increase the return on bank assets at the expense of higher risk exposure. In detail, we report higher overall bank risk and lower loan portfolio quality in banks that engage intensively in loans sales and securitization, which results in a higher default rate in recession for banks more active in some segments of funded CRT markets. The effects of CRT on credit supply and bank risk, however, vary across different CRT instruments, since they turn out to be much stronger for funded tools than for credit derivatives.

Based on this empirical evidence, post-crisis regulatory initiatives such as the Dodd-Frank Act appear to be consistent with the goal of re-establishing CRT on a sustainable basis by promoting adequate risk retention, reducing the incentives to originate riskier loans, and improving transparency in CRT markets. Nonetheless, our findings suggest that some of the new rules may excessively undermine the demand for CRT. This is the case, for example, with the new Basel III framework, whose stricter capital, liquidity, and leverage requirements may actually lead to excessive downsizing of CRT (Bank for International Settlements, 2011). Such an outcome is undesirable if it translates into a tightening of the economy’s credit supply or discourages recourse to instruments, such as single-name credit derivatives, that do not have detrimental effects on bank stability when used as hedging tools.

Acknowledgements

The authors benefited from comments by Christophe Pérignon, Tim Yeager, Andrea Sironi, Emilia Garcia-Appendini, and participants at the EFM Symposium on Risk Management in Financial Institutions, the Financial Management Association meetings in Turin and Reno (NV), and the European Financial Management Association meeting in Milan.

---

Appendix A

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total loans</td>
<td>RCFD1400 (gross total loans and leases)</td>
</tr>
<tr>
<td>Total assets</td>
<td>RCFD2170</td>
</tr>
<tr>
<td>1–4 Residential mortgages</td>
<td>RCON1415 + RCON1420 + RCON1460 + RCON1480</td>
</tr>
<tr>
<td>Other mortgages</td>
<td></td>
</tr>
<tr>
<td>Commercial and industrial loans</td>
<td>RCFD1600 (C&amp;I loans) + RCFD1590</td>
</tr>
<tr>
<td>Consumer loans</td>
<td>RCFD1975</td>
</tr>
<tr>
<td>Non-performing loans</td>
<td>RCFD1407 (loans over 90 days late) + RCFD1403 (non-accruing loans)</td>
</tr>
<tr>
<td>Total deposits</td>
<td>RCFD2200</td>
</tr>
<tr>
<td>Liquid assets</td>
<td>RCFD1350 (fed funds sold and securities purchased under agreement to resell) + RCFD1754 (securities held to maturity) + RCFD1773 (securities available for sale)</td>
</tr>
<tr>
<td>Return-on-Assets (RoA)</td>
<td>RIAD4300 (income before extraordinary items and other adjustments)/RCFD2170 (total assets)</td>
</tr>
<tr>
<td>Interest expenses</td>
<td>RIAD4073</td>
</tr>
<tr>
<td>Total liabilities</td>
<td>RCFD2948</td>
</tr>
<tr>
<td>Total capital</td>
<td>RCFD3210</td>
</tr>
<tr>
<td>Non-interest income</td>
<td>RIAD4074</td>
</tr>
<tr>
<td>BHC flag</td>
<td>1 if only bank in the sample with a given regulatory high holder from RCFD9348 0 Otherwise</td>
</tr>
<tr>
<td>z-Score</td>
<td>(Mean RoA + mean capital ratio)/standard deviation of RoA, Mean RoA, mean capital ratio and standard deviation of RoA are computed over the past four quarters (1 year). For the purposes of z-score computation, we extend our sample backwards to include the period 2000:Q2–2001:Q1</td>
</tr>
<tr>
<td>Total revenues</td>
<td>RIAD4107 (interest income) + RIAD4074 (non-interest income)</td>
</tr>
<tr>
<td>Securitization of 1–4 mortgages</td>
<td>RCFD8705</td>
</tr>
<tr>
<td>Securitization of other loans</td>
<td>RCFD8706 + RCFD8707 + RCFD8708 + RCFD8709 + RCFD8710 + RCFD8804 + RCFD8805 - securitization</td>
</tr>
<tr>
<td>Sales of 1–4 mortgages</td>
<td>RCFD8711</td>
</tr>
<tr>
<td>Sales of other loans</td>
<td>RCFD02591 - securitization of other loans</td>
</tr>
<tr>
<td>Credit protection purchased via CD</td>
<td>For period 2001:Q2–2005:Q4 RCFD535</td>
</tr>
<tr>
<td>Credit protection sold via CD</td>
<td>For period 2006:Q1–2009:Q2 RCFD0569 + RCFD971 + RCFD973 + RCFD975</td>
</tr>
</tbody>
</table>

References


