

An analytical review of credit risk transfer instruments

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Over the second half of the 1990s, the surfacing of credit derivatives and collateralised debt obligations enlarged the range of instruments for transferring credit risk. Although the characteristics and purposes of the former are very similar to those of the latter, the tradability of the new instruments has resulted in the creation of true markets for credit risk transfer (CRT), which are very rapidly developing.

CRT markets are of great interest as regards financial stability: while offering extended risk management opportunities for market participants, they also alter "traditional" relationships (between lenders and borrowers) as well as creating new types of relationships (lenders and credit protection sellers).

The present review relies on existing theoretical and empirical work as well as on contacts with market practitioners to explore, from an analytical standpoint, the financial stability implications of all types of CRT instruments. In particular, it analyses the characteristics of differing CRT instruments in light of risk management and asymmetric information problems arising in financial markets. It also proposes possible avenues for further work.

Four questions are successively raised: For what purposes are these products designed; why use one instrument rather than another? Who assesses credit risk: lenders, protection sellers or both? How are CRT instruments priced in practice: does pricing primarily reflect credit risk or does it also incorporate additional elements, such as counterparty, documentation or market risks? What are the potential macro-financial implications of CRT markets?

Over the second half of the 1990s, the surfacing of credit derivatives and collateralised debt obligations (CDOs) enlarged the range of more traditional instruments for transferring credit risk, such as bank guarantees, loan sales or securitisation. The market for the new instruments has experienced extremely rapid growth. Although no comprehensive aggregate data

on credit derivatives exposures exist ¹, the value of these exposures is estimated to reach 4,8 trillion USD by 2004, compared with an estimated value of 187 billion USD in 1997 ². Whereas the characteristics and purposes of the new instruments (to transfer and manage risk) are very similar to those of the traditional instruments, the tradability of the new instruments has resulted in the creation of global markets for CRT.

¹ See the report of the Committee on the Global Financial System Working Group on Credit Risk Transfer (CGFS, 2003) for a discussion of differing data sources, covering various segments of the market.

² These estimates are taken from regular surveys conducted by the British Bankers Association. A recent study by Fitch Ratings of 147 financial institutions active in credit derivatives markets finds the total value of credit derivatives exposures of these institutions to equal 1,3 trillion USD. However, as shown in the Bank for International Settlements (BIS) CRT report, there was a great difference in 2001 between private calculations (about 1,2 trillion USD) and the BIS triennial survey on derivatives (about 700 billion USD). As the main market players are taken into account in all sources, the reason for such a huge difference could arise from the fact that the BIS survey eliminates double-counting (as it identifies reporting institutions' exposure vis-à-vis other reporting institutions) so as to really identify the amount of underlying credit risk.

Such CRT markets are of great interest as regards financial stability: while offering extended risk management opportunities for market participants, they also alter “traditional” relationships (between lenders and borrowers) as well as creating new types of relationships (lenders and credit protection sellers). All of these dimensions are worth addressing both from a micro and a macro perspective.

Until now, rather limited research has been undertaken on CRT markets. Available work focuses on specific instruments, (such as credit default swaps – CDSs) and issues such as the relationship between CDSs and loan sales, the pricing of structured portfolio products, or the regulatory treatment of products (see Banque de France, *Financial Stability Review*, November 2002). A recent report by the CGFS Working Group on Credit Risk Transfer (2003) is one of the only studies that addresses CRT markets as a whole. Its purpose is to provide a broad review of how CRT markets effectively work and what role they now play in the global financial system, including available instruments, market participants, market dynamics, and regulatory issues.

The present review, which has evolved out of work first begun in conjunction with the CGFS group, also aims at addressing financial stability implications of *all types of CRT instruments*. However, its specificity is to review this issue *from an analytical standpoint*. Relying on existing theoretical and empirical work as well as on contacts with market practitioners, it proposes an analysis of the various available CRT instruments and markets and possible avenues for further work. In particular, it analyses characteristics of differing CRT instruments in light of risk management and asymmetric information problems arising in financial markets.

Four questions are successively addressed in four sections.

- A *first question* relates to CRT instrument characteristics: *for what purposes are these products designed; why use one instrument rather than another?* It is frequently the case that a given risk management function could be served by more than one type of CRT instrument, but market activity makes it clear that some instruments are more equal than others. This may be because a

large number of market participants have similar interests or, alternatively, because of the high degree of standardisation of certain instruments.

- A *second question* raised by these instruments is: now that CRT markets exist, *who assesses credit risk?* The existence of financial intermediaries is generally understood to be motivated by the role they play in reducing asymmetric information in financial markets. In this regard, it is worth considering how CRT instruments impact this role and what the resulting implications are for financial stability. One could ask if, in transferring credit risk to third parties, lenders/credit protection buyers also transfer responsibility for credit risk assessment to new participants (credit protection sellers) and whether the latter are in a position to perform this function adequately. Practice appears to suggest that a certain degree of pressure exists within CRT markets for arrangements that provide banks with the incentive to continue performing credit assessment.
- This leads to a *third question: how are CRT instruments priced in practice?* Does pricing accurately or primarily reflect credit risk and does it also incorporate additional elements, such as counterparty, documentation or market risks? We present general principles which are used for pricing marketable instruments and show that, although pricing of single-name instruments is rather straightforward, pricing of multi-name instruments is more difficult and relies on assumptions whose robustness has not been thoroughly tested so far. This suggests that prices of multi-name instruments may not accurately reflect the risk of these instruments.
- *Finally*, even if credit risk is correctly assessed and fairly reflected in CRT prices, it is worth considering whether CRT markets may have other macro-level implications. In particular, as the existence of CRT instruments enlarges the population of participants involved in the credit risk market, one could ask whether there is a chance that CRT markets will result in *more or less credit risk in the financial system*, or in a *better allocation of credit risk*. Given the relative youth of these markets, it is not surprising that these questions remain at this stage largely open ones.

1| Why use CRT markets and instruments?

CRT instruments help to complete credit markets by allowing market participants to separate credit risk from other types of risk. This leads to the creation of markets for credit risk, through which lenders may shed credit risk (*e.g.* for hedging purposes) and non-lenders may take on credit risk (*e.g.* allowing access to new categories of risk). In fact, numerous examples of the benefits of CRT instruments in dealing with different dimensions of credit risk can be identified.

These include the following:

- separation of credit risk from funding risk and market risk;
- isolation of time dimensions of credit risk;
- separation of classes of credit risk, which allows matching levels of risk and risk appetites;
- allowing banks to choose whether to retain ownership when transferring credit risk, which permits specialisation, “unbundling” of loan origination from credit risk, and easing of regulatory constraints.

The various available instruments provide different solutions for risk management, funding, regulatory capital and balance sheet disclosure. One of the questions addressed in this paper is the extent to which certain instruments might be better suited to particular transactions than others or whether some of these instruments are close substitutes. *Two tables in the appendix present a classification scheme for single-name and portfolio CRT instruments based on their relevant economic features*³. Depending on the pursued objective, some specific CRT instruments with relevant characteristics may prove more useful than others.

The credit protection buyer's preference is often to take the credit risk off the balance sheet and thus reduce its funding requirements as well as its risk. The appendix tables show that this can only occur *via* a loan sale, or the issuance of either an asset-backed security (ABS) or a CDO. However, if the underlying asset is not transferable (either for legal or customer-relations reasons⁴) synthetic transfer instruments (*i.e.* those involving credit derivatives) must be used; the latter encompass

CDSs, credit-linked notes (CLNs), total rate of return swaps (TRORs) and synthetic CDOs.

A portfolio approach becomes the preferred shedding alternative when transfer of individual credits is too expensive. While market participants often report that single-name CDSs are expensive, Rule (2001) speculates that information asymmetries may be a cost factor⁵. Among the portfolio CRT instruments, the synthetic structures seem to be growing in popularity. JP Morgan (2001) attributes some of this to the combination of low funding costs for active banks on that market and relatively high yields in conventional ABS/CDO markets, even on AAA tranches. Also, this study points out that, in most countries, conventional securitisation cannot be applied to undrawn commitments (like revolving credit lines, liquidity facilities or future receivables).

A final important decision factor is the degree of regulatory capital relief for credit risk shedders. Although synthetic transactions can be structured so that the risk transfers are almost perfect, they do not remove the assets from the balance sheet, which thus limits the reduction of capital requirements. Hence, synthetic risk transfer will not be useful if risk shedders are seeking funding leverage. Also, the protection buyer may face counterparty capital charges on a synthetic transfer. For example, capital charge considerations play a key role in the design of portfolio CRT instruments that are sold in “tranches”. Any risk retained, *e.g.* in the form of first loss protection, is treated as recourse and is subject to a 100% regulatory capital charge. If the amount of risk retained is less than 8% of the amount of loans securitised, then the bank can reduce its capital charge through securitisation (since if it did not securitise the loans it would have to hold 8% in capital). Jones (2000) offers several “prescriptions” for CDO originators that seem consistent with market practice: for example, he recommends that the equity or first-loss tranche is less than 8% of the total risk shed, which fits the typical market practice, as the originator usually retains between 3% and 5% of such risk.

Table 1 summarises how CRT instruments are used, including the types of assets which tend to be included in multi-name portfolio instruments as opposed to single-name instruments, and the impact on balance sheets and funding. It shows, for example, that credit

³ These tables are also referred to in sections 2 and 3 and to a lesser extent in section 4 below.

⁴ See the discussion in section 2.1. for more detail on the whys and wherefores of transferability.

⁵ Section 2 discusses asymmetries of information in details.

risk associated with consumer loans is typically shed *via* ABS. Conversely, ABSs tend not to be used to securitise corporate debt, leveraged loans and emerging market debt, and they cannot be used for

non-transferable assets⁶. The table also shows that CDSs and other synthetic CRT instruments, like basket default swaps, CLNs and synthetic CDOs, can be used when the assets are non transferable.

Table 1
The CRT landscape

Underlying credit risk		Typical CRT mitigant and comments	Accounting	Funding (a)
Consumer loans	Residential mortgages Credit card receivables Auto loans and leases	ABS: underlying risk tends to be "local". That is, there is not a great deal of cross-border ABS volume. Also assets tend to be less diversified than those securitised <i>via</i> CDOs and CLNs	Loans transferred from risk shedder's balance sheet to risk taker's	Funding from the risk taker to the risk shedder
Transferable debt (loans and bonds)	Commercial mortgages Trade receivables Equipment leases	Loan sale or syndication: cheapest and cleanest alternative		
	Corporate debt (bonds and loans) Sovereign debt (emerging market) ABSs and CDOs (b)	CDO: allows for heterogeneous assets but expensive to set up and maintain		
Transferable and non-transferable debt		CLNs and synthetic CDOs: cheaper than conventional CDO	Loans remain on the risk shedder's balance sheet, although the CRT transaction qualifies for hedge treatment	No funding from the risk taker to the risk shedder
		Single-name credit derivatives (CDS), surety bonds and guarantees: standardised (CDS) but rather expensive and counterparty risk exposure		
		Multi-name (or basket) default swaps: counterparty risk exposure		

NB: An asset may not be transferable either for legal or customer-relations reasons.

(a) "Funding" is defined from the risk shedder's (credit protection buyer's) perspective and implies that the risk shedder/protection buyer receives funds from the protection seller at the time of the transaction.

(b) ABSs and CDOs can be both CRTs and underlying risks as a result of resecuritisations.

2 | Do CRT instruments have an impact on asymmetric information problems?

A large part of financial intermediation theory was built on the idea that banks, through screening of loan applicants and monitoring of borrowers, help to resolve problems of asymmetric information between agents who possess capital and those who have investment projects. It is therefore useful to consider whether the use of CRT instruments has an impact on banks' performance of these functions (do CRT

instruments weaken banks' incentives to perform them?) and what role protection sellers play. While CRT markets help to resolve problems of risk management, they indeed may also give rise to some new risks in financial relationships, and they may have an impact on pre-existing problems of asymmetric information.

⁶ The relationships between underlying credit risk and CRT mitigants are consistent with market practises as gleaned from various industry publications and the authors' discussions with market participants. For example, in a recent JP Morgan "Banking 101" report (Murray et al., 2002) it was stated that "whereas asset-backed securities are bonds backed primarily by consumer loans such as credit cards, auto loans, and home equity loans, CLOs (collateralised loan obligation)/CDOs are bonds backed by US high yield debt, emerging market debt, and investment-grade commercial and industrial loans or bonds". There is little theoretical literature that focuses on this dimension, although Benston (1992) suggests that conventional securitisation (i.e. ABSs and outright sales) is more likely to work for assets for which moral hazard and adverse selection problems are not too severe, like pooled home mortgages and consumer loans. At the other end of the asymmetric information spectrum, he identifies commercial and industrial loans, which also fits with the JP Morgan report.

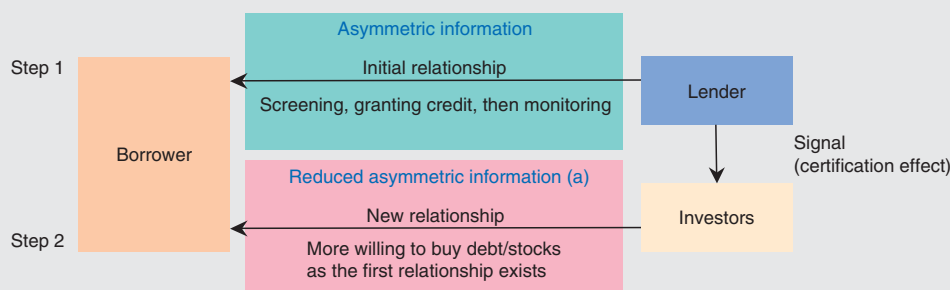
Asymmetric information and borrower-lender relationships

Asymmetric information problems in financial contracting are well acknowledged and inherent to the borrower-lender relationship. These problems include adverse selection regarding borrower quality and moral hazard on the part of the borrower.

- The adverse selection problem (Akerlof, 1970) – whereby the lender cannot observe the borrower’s quality – may lead to elimination of the safest borrowers from the market ¹ or to credit rationing by lenders (Stiglitz and Weiss, 1981). While adverse selection may lead to the self-elimination of the safest borrowers (because the cost of finance is driven up due to the presence of risky borrowers in the loan pool), rationing allows lenders to eliminate those which appear as the weakest. Problems of adverse selection can be alleviated by screening of the borrower by the lender prior to extending a loan, which enables the lender to learn something about the borrower’s type.
- The moral hazard problem exists when the lender cannot costlessly observe the borrower’s actions after a loan contract has been signed, and the borrower may take actions that are in his own but not the lender’s interest. Problems of moral hazard in the lending relationship can be mitigated by monitoring of the borrower by the lender (Diamond, 1984).

Much literature (following Leyland and Pyle, 1977 ; Diamond, 1984) has been devoted to understanding the special role played by banks in acquiring “inside” information about borrowers and in mitigating asymmetric information problems. A long-term relationship with a bank can allow a firm to develop a reputation for good quality, thereby benefiting from cheaper loan funding and ultimately facilitating access to market finance at lower cost – i.e. the idea of a certification effect (Diamond, 1991). The following diagram illustrates relationships when no CRT market exists and where banks mitigate problems of asymmetric information.

Case 1: No CRT and banks incited to reduce asymmetric information



(a) Since the bank is screening and monitoring

A related question is whether other agents (such as rating agencies) could assume the same function as banks. Diamond (1984) and others ² argue that banks have a comparative advantage with respect to other market participants in this regard, due to the special knowledge they acquire from performing complementary functions on a large scale (account keeping of borrowers, provision of payment instruments, etc.). Recent work suggests however that the advantage of banks tends to decrease for large corporates either because the latter increase transparency and disclosure so as to obtain good ratings or to increase their capital market access, or because they develop high tech activity which requires sophisticated credit risk assessment skills in the former (Diamond, 1991; Boot and Thakor, 1991 and 1997) ³.

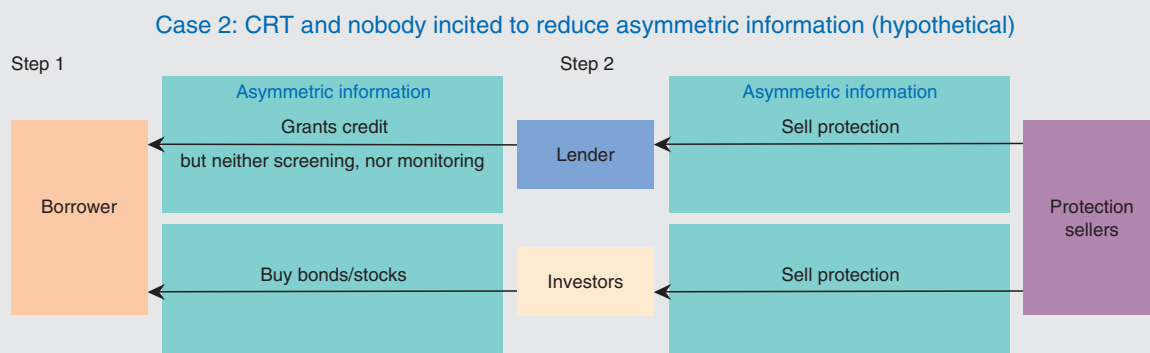
¹ Because the lender does not know the quality of the borrower, the lender must charge a price to every loan applicant which reflects the average quality of the borrower pool. If the average quality is low, borrowers with safe projects (low risk, low return) may find the financing cost too high for the project to be profitable.

² See for example, Nakamura (1993) and Longhafer and Santos (1998).

³ Considerable empirical evidence nevertheless exists to support claims of the unique role that banks play in resolving asymmetric information problems and their comparative advantage relative to other market players. This evidence includes event studies which find abnormal stock market returns of firms in response to bank announcements of new, renewed, or non-renewed loans or relating to the failure of a borrower firm's bank. See Gorton and Winton (2002) for a detailed discussion.

.../...

The introduction of CRT markets raises the question of whether banks which now benefit from hedging opportunities are still incited to screen and monitor credit risk. Diagram 2 illustrates a purely theoretical and extreme case where CRT markets are introduced and no one has an incentive to assess credit risk.



In this case asymmetric information problems are not mitigated, and the borrower's relationship with the lender no longer creates a certification effect. Although in reality the presence of CRT markets creates a situation in between the two cases depicted in the above diagrams, one of the purposes of section 2 is to examine, in a context of CRT markets,

- the extent to which relationships between borrowers and lenders remain close to case 1 (thanks to some specific CRT instrument characteristics) or, on the contrary, move in the direction of case 2;
- the extent to which new “case 1-type” information problems may also arise between lenders and protection sellers.

This section analyses whether the introduction of CRT markets creates new problems and risks⁷. The discussion focuses on the type of problems (moral hazard or adverse selection) and relationships (borrower-lender or lender-protection seller), see box. The analysis also highlights tradeoffs between instruments with respect to the identified problems. The main results are summarised in table 2.

2|1 Borrower-lender relationship

The introduction of CRT markets may actually worsen asymmetric information problems in the borrower-lender relationship, relative to the state of equilibrium that would exist in the absence of such markets. Indeed, authors such as Diamond (1984) warned early on that loans sales for example can be potentially dangerous, as they could weaken a bank's incentive to perform screening and monitoring activities.

Adverse selection

Insofar as the lender believes that it will be able to hedge his exposure on its borrowers (in purchasing credit protection through CRT once the loan contract is signed), the lender may have less or no incentive to screen borrowers. As a result, the adverse selection problem (which results in risky borrowers receiving funds and safe ones possibly not) may no longer be mitigated by the bank. This implies that there may be little or no borrower selection, since the bank may be willing to provide credit to all applicants as long as protection sellers are willing to take on the credit risk. However, if the protection sellers in CRT markets conduct their own screening before agreeing to sell protection on an exposure, and if they have equal access to information and screening technologies as do lenders, then the problem of weakened lender incentives to screen will not arise: in this case, the lender knows that protection sellers will refuse to sell protection on “bad” borrowers and he will therefore be incited to screen borrowers in order to avoid making loans to risky ones.

⁷ The impact of CRT instruments on asymmetric information problems applies primarily to the loan market and not to the bond market, as information in the latter market is more of a public nature.

Reputation offers another potential solution to the problem of weakened lender incentives to screen. A lender might want to avoid developing a reputation for bringing bad loans to the CRT markets, in which case the lender would continue screening potential borrowers even in the presence of these markets. The desire to maintain a good reputation might also motivate lenders to offer implicit guarantees when transferring credit risk; *i.e.* the lender implicitly agrees to reassume some of the credit risk if the exposure goes bad. Yet, such implicit guarantees might give rise to a new potential problem: *undercapitalisation*. If the lender has purchased credit protection *via* an instrument which removes the exposure from the lender's balance sheet, such as a loan sale or securitisation (without any explicit recourse), then the lender might not have set aside any capital to cover the risk of having to reassume the exposure. Determination of the "true" amount of risk that is being removed from the bank's balance sheet in such cases is a relevant regulatory concern.

Moral hazard

Moral hazard by borrower

A lender who has purchased credit protection may have less incentive to monitor the borrower than in the absence of CRT markets (Gorton and Pennacchi, 1995; Morrison, 2002)⁸. Assuming that other market players cannot perform monitoring as well as the bank, a lower incentive for bank monitoring would worsen the moral hazard problem relative to the state of equilibrium in the absence of CRT markets.

Morrison (2002) analyses the problem of weakened lender monitoring in the presence of a market for CDSs. He shows that the existence of a CRT market may have a negative impact on welfare relative to the absence of such a market. When no CRT market exists, banks will monitor borrowers and force them to carry out "good" projects (low risk, high profitability). Firm borrowers benefit from this "bank certification" and are able to combine cheaper bond finance with more expensive bank finance for their project⁹. When a CRT market is introduced, banks' purchases of credit protection may remove their incentive to monitor

borrowers. Because borrowers (and market investors) know that they will not be monitored, borrowers no longer benefit from bank certification and thus cannot use bank finance as a "commitment" to choose a good project. Rather, borrowers may now choose to issue junk bonds and to choose "bad" projects (risky and less profitable – but yielding high private benefits to the borrower). *Thus, although at first glance the possibility for a bank to hedge its loan exposures might have been thought to improve welfare, it is possible that it reduces welfare* (since high profitability projects are no longer being financed). However, such a result does not take into account the need for the lender to signal to the protection seller its commitment to continue monitoring (see section 2|2).

Moral hazard by lender

A new problem in the borrower-lender relationship that may be created by CRT markets is one of lender moral hazard. This problem arises *when the lender can purchase credit protection against the borrower's wishes or without informing him*. The potential negative impact for the borrower is twofold: the lender's purchase of credit protection may send a negative signal about the borrower's quality and/or (as discussed above) may prevent the borrower from obtaining the benefits of bank certification¹⁰. For these reasons, a borrower may be opposed to the lender having recourse to CRT markets.

Depending on the type of CRT instrument, the nature and impact of the signal generated by the bank's purchase of credit protection on a borrower may vary. Important instrument characteristics include the balance sheet impact; *i.e.* whether the instrument allows a full transfer of the underlying exposure (*e.g.* a loan sale or securitisation) versus only hedging of credit risk (credit derivatives, guarantees), and whether *the lender retains some exposure* (*i.e.* is not entirely hedged in case of a single-name or retains a first loss position for portfolios). *If the lender retains a large enough exposure, then the incentive to monitor will not be weakened* and the signal regarding the borrower will be less (if at all) negative.

The severity of this problem is of course also influenced by the *observability or transparency of the bank's purchase*

⁸ Except if lenders benefit so much from the higher expected return generated by monitoring that they would choose to purchase only partial protection in the CRT market and to continue monitoring the borrower.

⁹ Bond finance is assumed to be cheaper than bank finance, since the cost of bank finance includes the cost of monitoring activities.

¹⁰ It is, however, worth noting that the certification effect may not be the only relevant consideration. Professionals generally cite two main reasons for borrowers to be opposed to the transfer of their loans: borrowers traditionally think of their loans as private transactions and do not wish to give too much publicity to their financing structure and indebtedness; in a case of a restructuring, borrowers prefer to deal with an identified counterparty than with a large number of unknown holders of their debt. Such an attitude is also reported in Caouette, Altman and Narayanan (1998) and cited in Morrison (2002). This widespread belief of practitioners might well be wrong. Alternatively, the certification effect may be of lesser importance than academics traditionally think.

of credit protection (which relates to the bank's reporting requirements for use of CRT instruments or to requirements to notify the borrower). As Morrison (2002) points out, if the bank's purchase of credit protection is observable, then the amount of credit protection to be ultimately purchased by the bank may be negotiated with the borrower at the time of signing of the loan contract. For example, loan sales generally require notification of the borrower and are therefore observable. On the other hand, banks often prefer CDSs as they do not require notification of the borrower and thus cannot be detected by the borrower. *The problem of lender moral hazard is thus more severe when unobservable instruments (such as CDSs) are used to transfer credit risk than when loan sales are used.* As a remedy for this problem, Morrison proposes imposing reporting requirements on the use of CDSs.

The context in which the instrument is used also plays an important role with respect to the problem of lender moral hazard *vis-à-vis* the borrower. Credit insurance, financial guarantee insurance, and surety bonds are, for instance, typically sought by the borrower, in the creditor's interest, from a third party prior to the signing of the loan contract. In this case, the protection seller will often screen the borrower prior to agreeing to sell protection. Thus, use of these types of CRT instruments are not expected to send a negative quality signal (and on the contrary should send a positive one) about the borrower. In addition, if these instruments include clauses requiring the bank to monitor the borrower, the borrower should not lose the bank certification effect.

A second form of lender moral hazard arises in cases in which it may be in the interest of the lender, once it has purchased credit protection, to *prematurely trigger a credit event*. Although this problem is discussed below in the context of the lender-protection seller relationship, it may also adversely affect the borrower through, for example, negative reputational effects associated with restructuring or bankruptcy.

2|2 Lender-protection seller relationship

Adverse selection

Lenders might have an incentive to buy credit protection for their lowest-quality assets – some of

the reputational argument addressed in section 2|1 may also apply here. This will not necessarily create a problem for protection sellers, as long as they are able to price CRT instruments to accurately reflect the low asset quality. Conversely, *to the extent that protection sellers' knowledge of asset quality is inaccurate or that pricing is difficult, then an adverse selection problem might arise.* In addition, high CRT prices due to adverse selection may prevent lenders with good-quality assets from purchasing protection for those assets (Duffee and Zhou, 2001). These questions are also addressed in section 3 on pricing.

In a manner similar to the above discussion, *the context in which the instrument is used* could influence the severity of this problem. That is, *the use of instruments (such as guarantees) for which credit protection is obtained from a third party by the borrower prior to the signing of the loan contract may help avoid the problem*, although it may also affect the financing conditions faced by weaker borrowers. In this case, the protection seller may conduct its own screening of borrowers.

Inclusion of due diligence clauses in credit protection contracts, whereby the lender must provide to the protection seller all relevant information relating to the borrower, could also help mitigate the adverse selection. The advantages of such tailor-made clauses may, however, be counterbalanced by higher legal and documentation risks¹¹ with these instruments relative to standardised ones, which tend to involve a limited number of simple clauses.

Relying on external ratings – by selling credit protection only on rated assets or on blue-chip firms – may be another way for protection sellers to solve the adverse selection problem. Some support for this idea is provided by the observations that the market for single-name CDSs is largely limited to rated firms, and that this market is liquid primarily for blue-chip firms. Similarly, asset-backed securities (such as CLOs and CDOs) are rated prior to sale or may be restricted to rated names. Limiting sales of credit protection to rated products should help alleviate the problem of adverse selection¹², because even if the individual names in the portfolio are not rated, the rating agency will have assessed the quality of the assets included in the portfolio in order to assign a rating (to the entire portfolio or to the tranches). Yet, problems of adverse selection, even in rated portfolio products such as CDOs, are increasingly acknowledged by market participants

¹¹ Documentation and legal risks represent an important category of risks linked to the incomplete nature of contracts. (See section 3|3 for discussion).

¹² At least if the bank has no private information that is not reflected in the rating – which may be a strong assumption.

and rating agencies alike, and rating agencies are currently conducting empirical studies to quantify the impact of adverse selection on CDO riskiness¹³.

The usefulness of *tranchéd portfolio structures* (like CDOs, CLNs and basket swaps) might also relate to the severity of the adverse selection problem. DeMarzo and Duffie (1999) have shown that pooling and tranching may be optimal when the lender/credit risk shedder has superior information. They argue that *the tranching process allows the lender/risk shedder to concentrate the "adverse selection risk premium" in the small first-loss or equity tranches and create relatively large, low-risk senior tranches*. Also, the lender/shedder's retention of the subordinate tranches reduces the total adverse selection problem by aligning the interests of the lender/risk shedder and the investors.

Duffee and Zhou (2001) have described another set of circumstances in which the adverse selection problem might be less severe. If there exists a time period (probably early in the life of a loan contract) during which no asymmetric information exists between the lender and outsiders regarding the borrower's probability of default, then the lender's purchase of credit protection during this period could not result from an adverse selection problem. Any CRT instrument for which coverage could be limited to this time period could be used. On the other hand, an instrument such as a loan sale or a CLO (without any accompanying repurchase agreement), which removes the asset from the lender's balance sheet, implicitly represents a purchase of credit protection up to maturity of the asset and would thus not avoid the problem.

Moral hazard

Moral hazard by the lender

CRT instruments potentially embody several possibilities for moral hazard by the lender *vis-à-vis* the protection seller.

A *first potential problem* is one in which, as mentioned above, *the lender stops monitoring the borrower once the lender's exposure is fully hedged/transferred*: the protection seller cannot costlessly observe whether the lender still monitors or not. Gorton and Pennacchi (1995) analyse this problem in the case of the loan sales market, which experienced rapid development in the 1980s. As a result of the moral hazard problem, loan buyers should be expected to require high

returns and, insofar as a bank enjoys low funding costs, it has no incentive to sell loans. In the 1980s, however, deregulation and stricter capital requirements increased competition within the banking sector and raised internal funding costs, providing banks with greater incentives to resort to loan sales. Yet, because of the moral hazard problem with respect to lender monitoring, loan sale contracts needed to be made "incentive compatible" – *i.e.* providing the lender with incentives to continue monitoring.

Two potential mechanisms cited by Gorton and Pennacchi for preserving incentive compatibility are: *implicit guarantees* (as described above) and *retention of a portion of the loan* by the originating bank. Gorton and Pennacchi found, in tests on a sample of about 900 individual loan sales, that *banks selling loans convinced loan buyers of their commitment to monitor borrowers by retaining a portion of the loans*. The riskier were the loans, the higher was the observed portion retained.

Characteristics of CRT instruments that influence the severity of this problem are, therefore, whether *the lender retains some exposure* (which most instruments allow) and whether *the instrument is standardised/tradable*. With respect to the issue of standardisation, one advantage of non-standardised instruments – such as credit-linked notes, credit insurance, surety bonds, or bank guarantees – is that they allow a protection seller to include clauses in the contract requiring the lender to undertake monitoring activities. This obviously induces the lender to monitor. In contrast, standardised and tradable instruments such as CDSs or CDOs cannot allow such individually tailored provisions.

Thus, *it may be the case that non-tradable CRT instruments perform better than traded instruments with respect to the problem of reduced lender monitoring*. However, these instruments also entail greater documentation and legal risks than standardised ones. Furthermore, protection sellers using these traditional instruments must possess enough information about the borrower and/or the lender, so as to be able to verify whether the latter has properly monitored the former. This may restrict the number of potential protection sellers who can use traditional instruments. Finally, enforceability of monitoring clauses in CRT contracts may be difficult.

A *second potential problem* in terms of moral hazard by the lender is that the lender who has purchased credit protection on a loan may have *an incentive to prematurely trigger a credit event*, such as a restructuring

¹³ Because a given rating may include firms with varying probabilities of default, an adverse selection problem can still arise in a portfolio of rated assets: within any given rating category, the lender can include the firms with the higher probabilities of default.

of the loan, if it is in its interest to do so. Whether this problem arises depends upon *the nature of the trigger events* specified in the credit protection contract. An interesting example is given by the case of Conseco in September 2000, where the borrower faced a restructuring of its debt without going bankrupt¹⁴. In this case the lender was able to realise a twofold benefit: payment by the protection seller (against delivery of the cheapest assets the lender could find on the market) and redemption of the restructured loans.

Whereas CDSs have in the past included credit events, which some observers have judged to be too broad with respect to the notion of default (such as restructuring and acceleration¹⁵), financial guarantee insurance and bank guarantees are only triggered upon non-payment by the borrower. Use of the latter types of instruments or *inclusion of a narrower set of credit events in CDSs may prevent the moral hazard problem from arising*.

A *third potential problem* of moral hazard by the lender may arise with respect to *managed securitised portfolios*¹⁶: in arrangements that allow for substitution of (for instance) maturing assets, the lender may have the incentive to substitute lower quality assets for the maturing ones. *Arrangements which establish independent management boards and stipulate strict rules for substitution can minimise this risk*. This problem represents a current area of concern among market participants, and there is ongoing discussion of the appropriate design of managerial compensation contracts for aligning the interests of the portfolio manager with those of the investors.

Moral hazard by protection seller

The protection seller might *delay payment, refuse to pay, or litigate the claim* when a credit event is triggered¹⁷. It is a fact that insurance companies regularly verify (sometimes through extended procedures) a claim's materiality before paying, which delays payment. Indeed, rating agencies

have begun issuing ratings of insurance companies' willingness to pay¹⁸.

Whether the instrument is funded or unfunded is a critical feature of CRT instruments in relation to this problem. The use of funded instruments, such as credit-linked notes, CDOs and loan sales prevents the moral hazard problem from developing, since protection sellers must provide the funds up front, prior to any default by the borrower. Conversely, for unfunded instruments, the *form of settlement following the trigger event* becomes an important consideration. Whereas CDSs specify payment by the protection seller upon the triggering of the credit event, instruments such as credit insurance and surety bonds allow the protection seller (usually an insurance company) to investigate the losses before making payment. Instruments such as financial guarantees, by which the guarantor (protection seller) assumes the payments to the lender (bank) and at the same time takes over the claim on the borrower, would also appear to limit the risk of moral hazard by the protection seller.

2|3 Trade-offs between CRT instruments

The above discussion of the differences in CRT instrument characteristics and the trade-offs between instruments points to an open question: is there an "optimal" form of CRT contract, *i.e.* a single contract that minimises the cost for all types of asymmetric information problem? For example, is the CRT instrument, that best resolves the adverse selection problem between the lender and the protection seller, also the instrument that best addresses the problem of the lender's reduced incentives to monitor borrowers, once credit protection has been purchased? Although formal analysis of the trade-offs between CRT instruments in differing circumstances is still at its earliest stages, the optimal form of CRT contract would

¹⁴ Conseco's bankers granted it additional credit in order to help it avoid bankruptcy. As this was technically considered as a restructuring, the banks were able to activate their credit protection, and they delivered long-dated Conseco bonds to protection sellers. Such a case was part of the reason why International Securities Dealers Association (ISDA) issued a new standard contract with a restructuring clause. However, this contract is not universally used.

¹⁵ Acceleration is the lender's exercise of its contractual right, under certain circumstances, to declare a debt immediately due and payable.

¹⁶ Initially, portfolio CRT instruments were static, or "unmanaged" (*i.e.* the maturity of the instrument corresponded to the maturities of the assets included in the portfolio). More recently, however, many portfolio instruments have become dynamic, or managed. The managers of these portfolios are allowed to substitute new assets for the maturing exposures within the portfolio. Substitution may also occur for other reasons, such as replacing an asset which has been downgraded or even re-designing the content of the basket according to some general contractually agreed upon guidelines.

¹⁷ This situation should be distinguished from one where the protection seller defaults on its obligation to the protection buyer because of unanticipated financial distress. The latter situation would not be classified as a problem of moral hazard by the seller.

¹⁸ Standard and Poor's began issuing Financial Enhancement Ratings for insurance companies in 2000. These ratings include an assessment of an insurance company's willingness, as well as its capacity, to pay to in CRT contracts.

appear to depend upon the nature of the problem existing in financial relationships.

Differences between standardised/tradable and non-standardised instruments will likely be important to any assessment of the design of CRT contracts. Non-standardised instruments allow for contracts to be tailored to particular lenders' circumstances or to borrower-lender relationships. Yet, these same instruments appear to leave the lender more vulnerable to protection seller moral hazard and to legal or documentation risk. In addition, too large

a diversity in tailor-made CRT instruments may give rise to extended risk management concerns on the sides of both the protection buyer and protection seller. Standardisation of CRT contracts lowers documentation risks in the lender-protection seller relationship. Thanks to the efforts of the International Swaps and Derivatives Association (ISDA), CDSs now represent one of the most standardised forms of contracts¹⁹. Reduction of documentation risk, however, appears to come at the expense of greater inefficiency owing to problems of asymmetric information.

Table 2
Potential CRT asymmetric information issues

	Potential problem	Affected relationship	Instrument characteristics offering potential solutions
Adverse selection	Reduced incentives for lender to screen loan applicants	Borrower-lender Lender-protection seller	Credit enhancements provided by lender Partial risk retention by lender
	Adverse selection problem: lender buys protection on low-quality assets, drives up cost of protection on high-quality assets	Lender-protection seller	Independent evaluation (e.g. ratings) Protect only near-term risks
	Incentives for asset manager to select low-quality assets (managed securitisations)	Lender-protection seller	Independent governance Strict asset selection rules Partial risk retention by manager
Moral hazard	Reduced incentives for lender to monitor loans	Borrower-lender Lender-protection seller	Credit enhancements provided by lender Partial risk retention by lender Monitoring provisions in documentation
	Increased incentives for lender to prematurely trigger defaults	Borrower-lender Lender-protection seller	Narrowly-defined default triggers
	Protection seller reneges (partially or fully) on contingent payouts	Lender-protection seller	Objective trigger definitions Use of funded CRTs
	Borrower deprived from "bank certification" because of use non-transparent CRT instruments	Borrower-lender	Increase transparency of all CRT markets

3| How are CRT instruments priced in practice?

CRT markets participants naturally have to accurately assess credit risk. However, the question is: what do they do in practice? CRT markets are of utmost interest from a risk management perspective: not only do they allow a lender to insure itself against a borrower's default (and the possible resulting financial distress), but they allow an institution to add credit risk, where appropriate, by selling protection. Therefore, for the credit risk transfer to effectively occur, both parties must agree on a price that is based (among other things) on

the intrinsic credit risk of the underlying asset. In addition, both counterparties to such transactions have to deal with *other risks that are bundled* in the CRT instrument: market risk, counterparty risk and documentation risk.

Basically, credit derivatives are financial instruments that allow the "trading" of credit risk by isolating it from other kinds of risks such as interest rate and currency risk. As a result, should the market be

¹⁹ However, even after the introduction of its "modified restructuring" clause, the definition of credit events remains uncertain (as shown in June 2002, when Xerox renegotiated a credit facility). A group of insurers asked ISDA to clear up whether debt restructuring triggers a default swap after a group of New York swap dealers agreed to pay (Bream, 2002).

perfectly liquid and flexible, the value of the default protection should relate to the spread between the yield on the underlying debtor bonds and the cost of funding the purchase of such bonds. However, one still has to determine the true price of the underlying asset. This could be quite straightforward if the underlying bond or loan is traded in a transparent market, but if not, more sophisticated modeling approaches must be used. In addition, there is a risk that CRT instrument price dynamics diverge from those of the underlying assets (“basis risk”).

Basis risk relates to hedge imperfections caused by various technical factors. Kessler and Levenstein (2001) call particular attention to the technical differences between financial guarantees (where default events are very narrowly defined) and default swaps (where default events can cover a wide range of situations). Other more fundamental reasons can cause the price behavior of CRT instruments to diverge from that of the underlying assets. O’Kane and McAdie (2001) show how factors, such as funding cost differentials, delivery options, and regulations, can cause cash market and CDS spreads to diverge. More generally, unexpected price changes can result in less than perfect hedging, so hedgers should have a solid understanding of CRT price dynamics. Beyond the underlying credit risk, a remaining question is whether market prices adequately reflect counterparty and documentation risks. Market risk is not explicitly covered here, since there is already a large body of literature that discusses the use of interest rate and currency derivatives for mitigating it.

As the next subsections will show, there is a fairly mature and well-understood single-name CRT instrument pricing literature. However, multi-name portfolio CRT instrument pricing appears to be still very much a work in progress.

3|1 Pricing single-name CRT instruments

Among single-name credit derivatives, CDSs are the most commonly traded credit derivatives, as well as the simplest ones from a conceptual viewpoint: they are relatively well standardised contracts that provide protection against the risk of default of a given debtor.

Loan sales and syndication are not covered here, since by their very nature, prices are directly observable to market participants. In addition, other tradable “synthetic” CRT instruments like TRORs and single-name CLNs are not explicitly covered since their price dynamics derive so directly from those of CDSs. Also, “insurance-type” instruments (e.g. surety bonds and guarantees) are not discussed, since they are not, in general, tradable, although their pricing dynamics would be very similar to those of CDSs.

The pricing of any synthetic CRT instruments is *closely tied to funding costs*, the TRORs being the most obvious case, since its risk-return profile is virtually identical to that of a “cash” position in the underlying asset. In the TRORs case, the periodic fee should lie somewhere between the funding costs of the two counterparties. The link to funding costs for CDSs is somewhat more complex because only credit risk is being transferred, but Duffie (1999) and Bomfim (2002) show that, in a market in which all participants are assumed to fund themselves in floating rates at LIBOR, the premium on a single-name CDS is equal to the spread (over LIBOR) on a maturity-matched floating-rate note issued by the underlying entity. Even in the absence of an underlying floating-rate note, a maturity-matched fixed-rate bond issued by the same entity can be swapped into a synthetic floating-rate note for pricing purposes (*i.e.* an “asset swap”). This methodology is sometimes called the *replication* approach²⁰.

Houweling and Vorst (2001) show that CDS spreads derive directly from the replication approach for *investment-grade credits* but that they are wider than asset swap spreads for *credits rated below “A”*. O’Kane and McAdie (2001) run through some of the factors that might lead to such spread divergences:

- factors that increase default swap spreads include the protection seller’s exposure to counterparty risk, “technical default” risks caused by the CDSs typically broader default definitions and the delivery option usually held by the protection buyer, (typically, the protection buyer can choose from a basket of deliverables in the event of a “default”). Also, CDS spreads tend to be wider in the less liquid parts of the curve – for example, in the three-to-five-year area. In addition, CDS spreads tend to be wider if the cheapest-to-deliver bond is trading below par (and *vice versa*);

²⁰ The replication approach to valuing default risk is also consistent with the market’s practice of valuing corporate liabilities off the swap curve, rather than government bond yield curves. Collin-Dufresne, Goldstein and Martin (2001), and Elton, Gruber, Agrawal and Mann (2001) and Rappaport (2001) show that conventional (versus government bond yield) corporate bond yield spreads have little connection to credit-risk factors. In addition, Collin-Dufresne and Solnik (2001) show that swap contracts are virtually devoid of credit risk, and Liu, Longstaff and Mandell (2000) show that changes in the spreads between swap and US government bond yields are little influenced by credit-risk factors.

- factors that decrease CDS spreads include the protection buyer's exposure to counterparty risk and the fact that most market participants fund themselves above LIBOR ²¹.

Although numerous more “fundamental” approaches have been developed for situations where replication does not work, the *differences between “defaults” and “technical defaults”* (or “soft defaults”) is worth emphasising (see section 3|3).

Theoretical models can be called on to replace or validate the prices generated by replication. The theoretical single-name models can be segregated into two distinct groups:

- *structural models*, based on ideas presented by Merton (1974) and operationalised by KMV and CreditMetrics. A detailed explanation of the Merton model is given in Lubochinsky (2002) and the KMV model is described in Crouhy, Galai and Mark (2000). In these models, credit risk is modeled in terms of the firm's assets relative to its liabilities. Pan (2001) and Finger (2002) have applied this approach to CDS pricing. However, structural models have only limited applicability to the pricing of credit risk on sovereign bonds ²², and they seem to have difficulties with modeling financial institution credit risk ²³. Also, empirical tests of structural model bond pricing have not been overly promising ²⁴;
- *reduced-form models*, which associate credit risk with exogenous events that can be modeled with statistical tools most often associated with actuarial science. Essentially, they relate credit derivative prices to distributions of default probabilities and recovery amounts. The theoretical underpinnings of this approach have been laid out in Jarrow, Lando and Turnbull (1997) and Duffie and Singleton (1999). The approach has been applied to credit derivatives by (among others) Acharya,

Das and Sundaram (2002), Cheng (2001), Hull and White (2000 and 2001).

Anecdotal evidence would suggest that *structural models have the upper hand for pricing single-name default swaps* on trading desks, given the important role that KMV and CreditMetrics play on the risk management side. However, the only academic empirical research that has actually been published to date (Houweling and Vorst, 2001) focuses on a reduced-form model. Several recent papers (Altman *et al.*, 2001; Delianedis and Lagnado, 2002) have also called attention to the sensitivity of reduced-form credit derivative pricing models to the assumptions made about post-default recovery values. Three different parameters may be used in this respect: first, the market value of the risky debt prior to default, second, the market value of an otherwise similar riskless debt instrument, and third, the risky debt's face value. Delianedis and Lagnado (2002) show that the two market value-based assumptions produce very similar risk-neutral default probabilities and default swap prices, whereas the face value assumption tends to underestimate probabilities and overestimate swap prices, particularly on longer-dated speculative-grade credits. Indeed, this was confirmed by Houweling and Vorst (2001), who use the face value assumption ²⁵.

There is very little literature devoted to the pricing of credit spread put options largely due to the small size of this segment of the credit derivatives market, and also because the contracts are far from standardised. McDermott (1993), Longstaff and Schwartz (1995) and Das and Sundaram (2000) effectively apply the Black (1976) commodity option pricing model to put options on forward yield spreads. However, another spread put variation, which gives the holder the right to sell the risky bond at the strike spread, has been modeled by Duffie and Singleton (1999) and Schonbucher (2000).

²¹ Working the other way, to some extent, is the fact that high-grade sovereigns and supranationals swap into sub-LIBOR asset swap levels. Since default swap spreads cannot be negative, there should be a positive bias versus asset swap spreads.

²² Westphalen (2002) develops a structural-like model that accounts for some of the factors that make sovereign debt different from corporate debt. These unique factors revolve mainly around the greater incentives for sovereigns to strategically default and the impossibility of taking a sovereign borrower to bankruptcy court.

²³ Finger (2002) points out that the typically high leverage of banks and finance firms results in structural models significantly overestimating credit default swap spreads. He posits that actual spreads are tighter for these sectors because banks benefit from government oversight and implicit guarantees, plus their effective leverage is much lower than what it appears to be on the surface, because so many of their assets are secured.

²⁴ See Eom, Helwege and Huang (2002) for a recent empirical test of various structural bond pricing models, and a summary of other empirical work. They conclude that some models are more accurate than others, but accuracy is still lacking. Nevertheless, Campbell and Taksler (2002) show that the structural model idea of linking the price of credit risk to equity values is not altogether without merit, particularly for highly leveraged firms.

²⁵ Hayt (2000) had suggested that default swap prices should be insensitive to recovery rate assumptions, but his argument holds only if in a single-period world with only one claim type. Delianedis and Lagnado (2002) extended the analysis to multiple periods and claim types (bonds and default swaps).

3|2 Pricing portfolio CRT instruments

There is not really an ABS theoretical pricing literature²⁶, but the CDO pricing literature is growing rapidly. However, in either case, the empirical work is very lean. Two key conclusions stand out in almost all of the studies devoted to multi-name instruments:

- default risk explains such a small part of observed corporate bond spreads that there are serious doubts as to whether those spreads could be used in a multi-name product pricing model²⁷;
- defaults are rare and extreme events, which makes it difficult to estimate default correlations.

Market ABS pricing practice seems to revolve around either the inferred-rating approach or option-adjusted spread (OAS) calculations²⁸.

Inferred-rating methodologies infer a credit rating for the ABS from an analysis of the underlying collateral, the collateral manager and any credit/liquidity enhancements. The inferred ratings are then used to price the ABS off similarly-rated fixed-income securities.

An ABS's OAS represents an approximation of its yield compensation for its combination of credit and liquidity, plus, in some cases, prepayment risk. The OAS pricing approach (the accuracy of which, to our knowledge, has never been empirically tested), described in such practitioner publications as Hayre (2001), involves a three-step process:

- project all of the ABS cash flows, including scheduled amortisation, coupons and prepayments;
- discount the projected cash flows using the appropriate discount rate (a spot rate inferred from either a government bond or swap yield curve) plus a constant spread (across all maturities);

- if the total present value so-calculated equals the ABS's price, the spread chosen is the OAS. If not, an iterative process is followed until the OAS is determined.

Mahadevan and Schwartz (2001) identify three broad types of CDO pricing methodologies:

- *re-rating* methodologies, that infer a credit rating for the CDO from the ratings of its constituent parts and the relationships between them, which is then used to price the CDO off similarly-rated bonds and CDOs²⁹. For example, Cifuentes and O'Connor (1996) describe the process used by Moody's, and how they calculate "diversity scores" by which the analysis of a portfolio of correlated assets is effectively simplified into an analysis of a portfolio of uncorrelated assets³⁰;
- *market value* methodologies, that essentially equate the CDO price to the sum of the market values of the constituent parts. Duffie and Garleanu (2001) present such a model, although Mashal (2002) says that such risk-neutral "reverse-engineering" models are fundamentally flawed, because of the large size of the non-default-risk components imbedded in the prices of typical corporate credits;
- *cash flow* methodologies, much like the ABS OAS approach described earlier, that involve discounting back simulated future cash flows. Mina (2002) presents a case study of such an approach.

Although none of these models has been subject to rigorous empirical testing, there is a fairly extensive investment banking "literature" that focuses on the apparent "free lunch" in the CDO market, whereby CDOs trade consistently cheap relative to corporate bonds of the same credit rating. Most point to the relative illiquidity of CDOs versus corporate bonds as the main reason, but King (2002) posits that some of this may relate to an imperfection in the market for corporate bonds that the CDO tranching process arbitrages. Basically, it is said that the market overprices

²⁶ Childs, Ott and Riddiough (1996) used a contingent-claims pricing methodology to examine mortgage-backed securities pricing dynamics, but they did not attempt to test it empirically.

²⁷ See Collin-Dufresne, Goldstein and Martin (2001); Elton, Gruber, Agrawal and Mann (2001); Rappaport (2001) and Lubochinsky (2002).

²⁸ Prior to the development of OAS-type ABS pricing methodologies market practitioners used "average life" approaches, whereby some sort of average prepayment parameters were used to determine a single cash flow vector that was then discounted back using risk-free spot rates (Dunn and McConnell, 1981)

²⁹ Some controversy has arisen, as to how Moody's and Standard and Poor's treat CDO assets that they have not themselves rated. Lyon (2002) describes how these two agencies take off up to four rating "notches" (for example, one "notch" being from "A+" to "A" on the Standard and Poor's scale) of another agency's rating, for CDO rating inference purposes. Fitch, whose ratings are often the brunt of such "notching", has accused Moody's and Standard and Poor's of uncompetitive practices.

³⁰ As an alternative to the "diversity score" approach, Davis and Lo (1999) develop an "infectious default" contagion model of default correlation.

very-low-rated and very-high-rated corporate bonds due to a market segmentation effect which puts many investors at the extreme ends of the credit risk spectrum (many are constrained to buy only “AA” rated loans and bonds, while many others are constrained to buy exclusively high-yield assets). Hence, assets rated “A” through “BB” trade with larger illiquidity premia. In the CDO portfolio creation and tranching process, these “surplus” illiquidity premia can be shared amongst the high-grade and high-yield tranches, and the originating bank.

Most of these rationales would apply to synthetic CDOs, although, as shown in Goodman (2002), enhanced opportunities for regulatory arbitrage (versus “cash” CDOs) could provide an even larger surplus to spread around.

Most of the recent multi-name credit derivative pricing literature basically refines the techniques put forward by Li (2000) which uses the method of copulas to model the connections between the marginal default probability distributions of the underlying credit risks (See Frey, McNeil and Nyfeler, 2001; Mashal and Naldi, 2002).

3|3 Counterparty and documentation risks

As indicated above, market prices for CRT instruments should reflect (beyond credit risk) counterparty and documentation risks.

Counterparty risks include the risk that the protection seller (unintentionally) defaults on required payments once a credit event is triggered or that the lender/protection buyer defaults on the payment of premia.

As regards settlement, two aspects are worth underlining.

- The *timing of payments* from CRT instruments can have an impact on the liquidity of the protection buyer. Whether CRT instruments are *funded or unfunded* obviously plays a role, as does the nature of the *trigger events*. CDSs may have broader definitions of credit events than some other instruments, and payments may be triggered

prior to the point at which the borrower defaults. *Settlement following trigger events* also influences the timing of payments. Instruments that allow the protection seller to investigate losses will imply slower repayment than those which do not.

- The *amount of payment* is determined both by *settlement following trigger events* and *associated counterparty risks*. Unfunded instruments leave open the possibility of counterparty default. Among unfunded instruments, those which provide more freedom for the protection seller to contest the claim embody a greater risk than those which require payment upon the trigger of the credit event.

Along these lines, *documentation (or legal) risks* represent an important category of risks that is fundamentally linked to the incomplete contracting nature of credit protection contracts: at the time the contract is written it is impossible to envisage or to contract upon all possible future contingencies. As a consequence, unanticipated situations sometimes arise *ex post* (for example, once a credit event is triggered) in which one party has an incentive to act opportunistically³¹. This implies that CRT instrument documentation may entail differences in the degree of credit risk exposure from that embodied in the underlying asset (Tolk, 2001; Merritt, Gerity and Lench, 2001).

The nature of trigger events will have an influence on the severity of documentation risks. CDSs often involve “soft” default clauses, which are much broader than “the common understanding of default” (see Tolk, 2001 and Merritt *et al.*, 2001). The soft default clauses include restructuring and acceleration clauses. As noted by Tolk and Merritt *et al.*, standard default swap restructuring event definitions fail to differentiate between “good” and “bad” restructuring. In addition, the acceleration event is particularly problematic because it is an event that the lender (*i.e.* risk shedder) can trigger.

In contrast, financial guarantees have narrowly defined default events. However, documentation risks can be particularly severe when financial guarantees are hedged with CDSs (Kessler and Levenstein, 2001). Although these risks can be mitigated by tight documentation and objective mechanisms for verifying loss determinations, there

³¹ Problems such as these are sometimes referred to as *incomplete contracting problems*.

may nevertheless be systemic concerns, to the extent that risk is being transferred out of the banking sector (which concentrates the experience and expertise in such matters). In addition, documentation risks for products which experience rapid development (with increasing underlying exposures) could be cause for concern³².

Another common type of documentation risks arises through the settlement of the CRT contract when there is room for interpretation as regards the nature of deliverable assets. It is indeed in the lender's interest to deliver the cheapest assets he can find to the protection seller. In particular, recent cases have shown that it remains unclear whether convertible obligations are deliverable or not due to their contingent nature.

The relevancy and importance of *other risks* vary depending on the instrument:

- CDSs, credit insurance, financial guarantee insurance, surety bonds, and bank guarantees do not embody additional *market risk* but they do entail *counterparty, documentation and basis risks*;
- CLNs and CDOs may reduce or eliminate counterparty and documentation risks, but they do embody market and basis risks.

However, it is still not clear whether these additional risks are really reflected in observable CRT prices. For instance, it is not rare that CDS prices are very close (if not identical) to asset-swap prices.

Table 3
Potential CRT risk management issues

Potential problem	Instrument characteristics offering potential solutions
Counterparty risk: protection seller defaults on contingent payouts or buyer defaults on premia	Embedded mitigants like downgrade clauses, reserve/trust accounts and collateralisation Use of funded CRTs
Documentation risk: "credit event" definitions do not completely cover all potential risks	Careful documentation and solid understanding of CRT dynamics
Basis risks: hedge imperfections caused by funding cost differentials, delivery options and regulations	
Market risk: bundled interest rate and currency risks (only on CLNs and funded CDOs)	Use other derivatives to unbundle other risks

4| Could CRT markets have macro-financial implications?

4|1 Can CRT have an impact on the overall amount of credit in the system?

Beyond their effects on micro-relationships, CRT instruments could have an impact on the overall access to financing at a macro-level. At first glance, however, the overall impact of CRT instruments on borrowers' access to financing (as a whole, as it is relevant both on the loan market and on the bond market) is unclear.

More available credit?

CRT instruments may have a positive impact for borrowers in enlarging the potential population of "lenders" because in principle they allow new investors (such as insurance companies) to take on credit risk to which they would not have had access before. For a given level of imperfect information, a greater demand for credit risk, resulting from the existence of CRT instruments, could allow borrowers to benefit from extended financing opportunities and thus reduce the risk of credit rationing (see box in

³² *Cebenoyan and Strahan (2001) attempt to show empirically that banks that are more active in loan sales markets tend to take on more underlying risk than those that do not. Demsetz (2000) has also shown that smaller banks that lack good opportunities for diversified originations are more likely to be big loan sellers.*

section 2). At a first stage, this may occur whatever the credit quality; lenders would be more willing to grant credit as they would dispose of larger possibilities of hedging/transfer. At a second stage, the price of protection itself would be expected to decrease, insofar as competition among protection sellers would intensify. Larger and/or cheaper access to liquidity would also reduce the risk of elimination of the safest borrowers. To this extent, CRT instruments would complete the market for credit risk and increase its efficiency.

CRT markets could also have an impact on the way monetary policy exerts its effects on credit distribution. For example, an empirical analysis (Estrella, 2002) shows that mortgage securitisation has made US output less sensitive to monetary policy. In the spirit of the Bernanke and Gertler (1995) bank lending channel monetary policy transmission mechanism theory, Estrella posits that securitisation mutes the impact that monetary policy tightening is supposed to have on banks' ability to fund themselves, and hence provide loans. However, Stanton (2002) warns that this conclusion cannot be automatically extended to all securitisation activity as there are reasons to suspect that the impact of non-mortgage securitisation would be different. For example, Stanton (1998) and Minton, Opler and Stanton (1999) show that banks and industrial firms securitise more during recessions, whereas mortgage securitisation tends to decline during recessions. In fact, Stanton (1998) goes on to say that "procyclicality differences in lending activity should become less severe as markets for securitised loans develop".

Or risks of restriction of the loan channel?

CRT instruments may, however, entail some drawbacks (and reduce the market's efficiency) for borrowers' financing, insofar as they could trigger a fundamental change in the functioning of the loan market. If banks move from an "originating and holding" attitude to one of "originating and transferring", credit distribution would be determined by their possibilities of hedging on the CRT market.

- One can therefore ask whether lending conditions by banks – and credit distribution to the economy as a whole – would not endure increased pressure from market-linked factors. As shown in section 3, although credit risk pricing methods have recently advanced, they remain imperfect and are often

difficult and costly to implement. As a result, liquidity conditions – either for a given CRT instrument or more generally for the whole market segment – play a key role in forming prices of CRT instruments. Such prices may thus prove highly volatile. If these prices influence lending conditions, the impact of financial market strains on the business cycle could be magnified.

- In addition, if loan prices were to be determined as a function of hedging costs, not only could loan prices become more volatile, but loans themselves could become more expensive and scarce and the scope of available financing might be reduced. Such developments could thus reduce the specificity of the loan market *versus* the bond market. As previously mentioned (see also Diamond, 1991), when asymmetric information exists, young, small, non-rated or poorly rated firms rely on loan financing – in order to benefit from reputation effects – before coming to the market and issuing bonds. If bank loans were to become closer to marketable instruments and more closely resemble classic bonds, such firms might experience additional difficulties for their financing. The cost of loans (which are already higher than market financing due to monitoring costs) would further increase, which might lead to some renewed form of credit rationing.

4|2 Resilience of the global financial system

Interactions between CRT and other markets: more or less overall protection?

The discussion in sections 1 and 2 has noted that whereas CRT markets help to "complete incomplete" credit markets, individual CRT instruments embody differing characteristics and thus vary in their impacts on financial markets. This suggests that the introduction of a new type of CRT instrument can have an impact not only on the underlying market for loans or bonds but also on the markets for other CRT instruments³³. Along these lines, Morrison (2002) notes that according to practitioners, credit derivatives possess two advantages compared with secondary loan markets: first, they facilitate portfolio diversification management as they are more easily traded and, second, they protect relationships rents, as their use is unobservable.

³³ At a later stage, the adequacy of capital requirements for banks moving from primary warehouseers of credit risk to diversified originators and distributors should be addressed (see Froot, 2001).

Duffee and Zhou (2001) offer one of the rare studies of interactions between CRT markets. These authors analyse the effect of introducing a market for credit default swaps when a market for loan sales already exists. One difference in the characteristics of CDSs and loan sales drives the results; namely, loan sales (without recourse) transfer credit risk for the full term of the loan, while CDSs allow credit protection to be purchased for a shorter period than the entire life of the loan. As noted in section 2, this difference can be important if the problem of asymmetric information between the lender and protection seller varies over the life of the loan. Duffee and Zhou assume that the quality of the borrower (which is known to the lender but not to the protection seller) has no effect on the borrower's default probability during the early period of the loan but does affect the default probability later in the life of the loan. Thus, credit protection through a CDS can be purchased during the early time period without giving rise to adverse selection (as explained in section 2|1).

Under these assumptions, the introduction of a CDS market can have a significant impact on equilibrium in the loan sale market. In some cases, the introduction of a CDS market will result in a reduction in the overall amount of loans that are sold, and the average quality of loan sold will also be lower. For those loans which would have been sold in the absence of the CDS market, the lender now uses a CDS to purchase protection during the early period of the loan. However, because the CDS only covers a portion of the life of the loan, the total amount of credit protection purchased is now less than it would have been in the absence of the CDS market. In other cases, introduction of the CDS market allows protection to be purchased in the early period for loans for which no sale would have occurred in the absence of the CDS market. In this case, the CDS market causes the total amount of credit protection to increase, since loans for which CDSs are used would not have been sold in the absence of such instruments. The ultimate effect on welfare of the introduction of the CDS market will thus depend upon the relative importance of each of these cases.

Interactions between CRT and other markets: impact on reference assets and entities

A great deal of market commentary has focused on the impact of CRT markets on the underlying reference assets and entities. For example, front-running arbitrage CDO managers have been said to narrow credit spreads on the bonds that they accumulate ahead of issuance³⁴. On the other hand, some market participants have accused hedge funds of aggressively selling synthetic credit risk protection, in order to push credits that are barely investment grade ("BBB+" and above, on the Standard and Poor's credit rating scale) into the speculative grade rating range ("BB+" and below)³⁵. Under such circumstances, many institutional investors are forced to liquidate bonds that drop through the investment grade threshold, thereby accelerating credit spread widening and making their short positions more valuable. However, this implies that CDS premia movements *cause* bond yield spread movements, and that furthermore, credit rating agencies take their leads from market spread movements.

In fact, several recent empirical studies of CDS premia and bond yield spreads indicate that CDS premia movements lead bond yield spread movements. However, this does not necessarily point to a causal link between the two markets. As pointed out in Blanco *et al.* (2002), "price discovery will take place where relative costs are lower and where trade is easier" (*i.e.* the CDS market). Also the results of Brousseau and Michaud (2002) and Hull *et al.* (2002) suggest that the linkage is somewhat asymmetric: when spreads are widening CDS premia lead bond yield spreads; when spreads are narrowing, they tend to move more closely together. This is consistent with the fact that "betting" on spread widening in the CDS market is much cheaper and easier than in the cash market, where bond short selling is often hampered by illiquidity in corporate bond lending and repo markets.

³⁴ "Balance sheet" CDOs are initiated by the holders of the assets, whereas "arbitrage" CDOs are driven by asset managers and investors.

³⁵ For example, see Sender (2002).

More dispersion of credit risk?

In 2001-2002, the global financial system was faced with a series of shocks: the first synchronised slowdown of the globalisation era, September 11 terrorist attacks, continued bursting of the equity bubble... Among the explanations advanced regarding the resilience of the system was that CRT had allowed a better dispersion of credit risk (IMF, 2002; BIS, 2002b; several speeches of officials at the US Federal Reserve – including A. Greenspan and R. Ferguson; Persaud, 2002).

As shown in previous sections, CRT markets potentially allow a broadening of the population of end-risk holders as well as extended portfolio diversification. To this extent, they could have helped financial intermediaries mitigate risk and thus could have played a role in reducing systemic risk. Moreover, at the current developing stage of CRT markets, one can even assume that the total amount of outstanding credit risk is increasing at a slower pace than the growing capacity of ultimate risk-bearers, which may have resulted in a decrease in the average exposure of investors to credit risk.

On the other hand, one must bear in mind three potential risks. First, there exists a high degree of concentration in intermediation on CRT markets, which could mean that even credit-risk brokers could be faced with significant residual credit risk exposures (due for instance to potential hedging mismatches). Second, as shown by existing public data, CRT markets remain to a large extent inter-banking markets. Although likely to increase as the market develops, the portion of non-bank investors

who take on credit risk is at present rather limited. As a result, the “dispersion” argument should not be overstated. Furthermore, as noted in IMF (2002) and BIS (2002b), regulatory arbitrage preoccupations could have resulted in a concentration of credit-risk in lesser capitalised institutions (including Special purpose vehicles – SPVs) entailing reputational risks for their promoters. Third, a dispersion of credit risk among a larger population of end-investors may reduce systemic risk only to a certain extent: were these investors to face repeated defaults, their resulting financial difficulties could exert negative pressure on the business cycle and hence on financial intermediaries themselves.

Less transparency as regards who bears credit risk?

As pointed out in IMF (2002) and CGFS (2003), credit risk transfer instruments “can reduce the transparency about who owns credit risk” and result in more difficult counterparty and credit risk assessment. The BIS (2002) report on bank disclosure and the CGFS CRT report (2003) identified a number of areas where the reporting of CRT activity by banks was lacking. “Pillar 3” of the proposed new Basel Accord (see BIS, 2001) may resolve this problem for regulated banks. However, non-bank disclosure standards will still leave much to be desired. Although financial accounting standards setters appear to be in the process of tightening the rules for removing assets from the balance sheet *via* credit risk transfer, there may remain shortfalls in the reporting of how the removal is achieved.

This paper has analysed the micro and macro-levels effects of markets for credit risk transfer and their potential financial stability implications.

At the micro-level, CRT instruments provide benefits to financial institutions in managing their credit risk, yet these instruments also alter the nature of relationships among financial market players and, as a result, introduce new asymmetric information and risk management problems. These problems – such as weaker incentives on the part of banks to screen and monitor borrowers or increases in counterparty risk – can be mitigated to greater or lesser degrees via the choice of CRT instrument. Nevertheless, the problems can raise financial stability concerns if not properly addressed. In addition, pricing of CRT instruments remains difficult, which raises the prospect that CRT prices do not adequately reflect the risk.

At a macro-level, CRT markets have the potential of dispersing credit risk. While there is evidence that CRT markets have moved some credit risk out of the banking sector, the true degree of dispersion achieved via these markets is at present unknown. In addition, intermediation in CRT markets is highly concentrated. CRT markets may also affect the total availability of credit, but the effect may go in either direction. On the one hand, the enhanced ability of banks to transfer credit risk off their balance sheets may increase their willingness and ability to lend. On the other hand, if banks monitor borrowers less, as a result of purchasing credit protection, lesser known firms may lose their “bank certification” benefits and, in turn, access to certain forms of finance.

Given the growing importance of CRT markets and their rapid expected future expansion, the potential of these markets to affect financial stability is likely to increase over time. Improved disclosure of CRT activities would go a long way toward enabling market observers to judge their true impact.

Table A
Key characteristics of single-name credit risk transfer instruments (a)

	Credit default swap (CDS)	Credit linked note (CLN)	Total rate of return swap (TORS)	Credit insurance or surety bond	Financial guaranty insurance	Letter of credit	Loan sale
Protection buyer / risk shedder cashflows	Pays regular premia over life of swap; receives contingent amount upon credit event	Pays periodic payments linked to a market interest rate plus a credit premia and principal at maturity; interest and/or principal reduced following a credit event	Pays all cashflows on a reference asset	Pays regular insurance premia	Pays regular insurance premia	Pays regular or one off fee	Receives loan market value upfront
Funded or unfunded?	Unfunded	Funded	Unfunded	Unfunded	Unfunded	Unfunded	Funded
Protection seller / risk taker cashflows	Receives regular premia over life of swap; pays contingent amount following credit event	Pays principal upfront	Pays cashflows linked to a market interest rate plus periodic cash adjustment to reflect change in market value of reference asset	Pays amount (based on policy documentation) following a loss event	Pays interest and principal on original schedule following non-payment	Pays amount following a failure to pay by the borrower	Pays market value of loan upfront; receives all subsequent loan cashflows
Balance sheet impact?	No	No	No	No	No	No	Yes
Trigger events (if applicable)	ISDA standard credit events (bankruptcy, obligation default, failure to pay, restructuring – may also include repudiation for sovereigns and obligation acceleration in trades based on “old” ISDA standards)	Typically ISDA standard credit events but documentation less standardised than CDS (e.g. MTN documentation may use “old” ISDA standards)	Not applicable	Loss events to insured as defined in policy	Non payment of interest or principal	Failure to pay by borrower	Not applicable
Settlement following trigger events	Typically through delivery of an obligation of the borrower by the risk shedder to the risk taker in exchange for its face value in cash; occasionally through establishment of a market price for the borrower’s debt following the credit event (e.g. by polling dealers) and cash payment of the difference between this value and the debt’s face value	Typically through establishment of a market price for the borrower’s debt following the credit event (e.g. by polling dealers) and payment of the difference between this value and the face value of the debt. This amount is deducted from the nominal principal value of the note and interest payments reduce accordingly.	Not applicable	Insurer pays out the insured’s losses less any excess (deductible) and up to any limit. Losses usually claimed by the insured and investigated by the insurer before payment is made (loss adjustment).	Interest and principal paid to risk shedder on original schedule; risk taker takes over claim on borrower.	Bank repays lender face value of debt and takes over claim on underlying borrower.	Not applicable
Protection buyer’s counterparty risk exposure	Exposed to protection seller up to potential settlement amount	Exposed to risk that high-quality collateral pool, seeded by the initial issue amount, is insufficient to cover default losses	Exposed to protection seller up to potential settlement amount but risk mitigated by periodic payments to reflect changes in market value	Exposed to protection seller up to potential settlement amount	Exposed to protection seller up to potential settlement amount	Exposed to protection seller up to potential settlement amount	None
Protection seller’s counterparty risk exposure	Exposed to protection buyer for transaction replacement cost	Exposed to protection buyer for value of note	Exposed to protection buyer for transaction replacement cost	Exposed to protection buyer for transaction replacement cost	Exposed to protection buyer for transaction replacement cost	Exposed to protection buyer for transaction replacement cost	None
How these are typically managed?	Collateral support and downgrade triggers	Not managed	Collateral support and downgrade triggers	Not managed	Not managed	Not managed	Not applicable
Any other risks bundled?	No (except risk shedder may be long a delivery option, which may have value if the borrower’s liabilities differ in value following credit event)	The note may pay a fixed or floating interest rate in addition to the cashflows on the embedded single name default swap	Credit risk bundled with any other risks associated with the underlying instrument to which the swap is linked e.g. interest rate, fx or equity risk	No	No	No	Credit risk bundled with any other risks associated with the sold loan

(a) Appendix table A (on single-names) was developed on the basis of the CGFS (2003) CRT report, Appendix 3 Instrument characteristics.

Table B
Key characteristics of multi-name credit risk transfer instruments

	Basket credit default swap	Collateralised debt obligation (CDO)	Synthetic CDO	Asset-backed security (ABS)
Protection buyer / risk shedder cashflows	Pays regular premia over life of swap; receives contingent payment upon n th default	Receives loan/bond market values upfront from special purpose entity (SPE). May retain residual interests (e.g. equity tranche)	Pays regular premia over life of swap; receives contingent amounts from SPE upon credit events. May retain residual interests (e.g. equity tranche)	Receives loan market values upfront from SPE. May retain residual interests (e.g. excess spread)
Funded or unfunded?	Unfunded	Funded	Unfunded	Funded
Protection seller / risk taker cashflows	Receives regular premia over life of swap; pays contingent amount following n th default	SPE receives all subsequent loan/bond cashflows, less any fees paid to managers and enhancers	SPE issues various securities and invests proceeds in high-quality collateral (e.g. US Treasuries)	SPE receives all subsequent loan cashflows, less any fees paid to managers and enhancers
Balance sheet impact?	No	Yes if loans/bonds were on originator's balance sheet; otherwise no	No	Yes
Trigger events (if applicable)	ISDA standard credit events (bankruptcy, obligation default, failure to pay, restructuring – may also include repudiation for sovereigns and obligation acceleration in trades based on “old” ISDA standards)	Not applicable.	ISDA standard credit events (bankruptcy, obligation default, failure to pay, restructuring – may also include repudiation for sovereigns and obligation acceleration in trades based on “old” ISDA standards)	Not applicable
Settlement following trigger events	Typically through delivery of an obligation of the borrower by the risk shedder to the risk taker in exchange for its face value in cash; occasionally through establishment of a market price for the borrower's debt following the credit event (e.g. by polling dealers) and cash payment of the difference between this value and the debt's face value	Not applicable	Typically through delivery of an obligation of the borrower by the risk shedder to the risk taker in exchange for its face value in cash; occasionally through establishment of a market price for the borrower's debt following the credit event (e.g. by polling dealers) and cash payment of the difference between this value and the debt's face value	Not applicable
Protection buyer's counterparty risk exposure	Exposed to protection seller up to potential settlement amount	Not applicable	Exposed to risk of collateral mismanagement	Not applicable
Protection seller counterparty risk exposure	Exposed to protection buyer for transaction replacement cost	Exposed to risk of collateral and portfolio mismanagement	Exposed to risk of collateral and portfolio mismanagement	Exposed to risk of collateral mismanagement
How these are typically managed?	Collateral support and downgrade triggers	Structural enhancements like over-collateralisation and excess spread traps	Structural enhancements like over-collateralisation and excess spread traps	Structural enhancements like over-collateralisation and subordination
Any other risks bundled?	No (except risk shedder may be long a delivery option, which may have value if the borrower's liabilities differ in value following credit event)	SPE may be exposed to basis mismatches between the underlying asset (the loans) and the securities issued.	SPE may be exposed to basis mismatches between the high-quality collateral, contingent payouts and the securities issued.	SPE may be exposed to basis mismatches between the underlying asset (the loans) and the securities issued.

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