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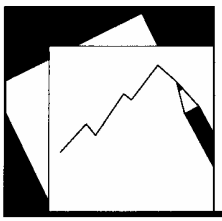

IMF Working Paper

The Credit Risk Transfer Market and Stability Implications for U.K. Financial Institutions

Jorge A. Chan-Lau and Li Lian Ong

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Monetary and Financial Systems Department

The Credit Risk Transfer Market and Stability Implications for U.K. Financial Institutions[1]

Prepared by Jorge A. Chan-Lau and Li Lian Ong[2]

Authorized for distribution by David Marston and Mark Swinburne

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Abstract

The increasing ability to trade credit risk in financial markets has facilitated its dispersion across the financial and other sectors. However, specific risks attached to credit risk transfer (CRT) instruments in a market with still-limited liquidity means that its rapid expansion may actually *pose* problems for financial sector stability in the event of a major negative shock to credit markets. This paper attempts to quantify the exposure of major U.K. financial groups to credit derivatives, by applying a vector autoregression (VAR) model to publicly available market prices. Our results indicate that use of credit derivatives does not pose a substantial threat to financial sector stability in the United Kingdom. Exposures across major financial institutions appear sufficiently diversified to limit the impact of any shock to the market, while major insurance companies are largely exposed to the "safer" senior tranches.

JEL Classification Numbers: G11, G18, G21, G22

Keywords: CDO, CDS, credit derivatives, credit risk transfer, structured credit products

Author(s) E-Mail Address: jchanlau@imf.org and long@imf.org

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I. INTRODUCTION

The increasing ability to trade credit risk in financial markets has facilitated the dispersion of risk across the financial and other sectors. Credit risk transfer (CRT) instruments—such as credit derivatives and structured credit products—enable institutions to reduce their concentration of risks by passing on the "unwanted" risks. In other words, they provide a stabilization mechanism similar to that of reinsurance for the insurance sector (IAIS, 2003). Banks, in particular, can diversify their credit risk exposure by transferring it to other banks, or more importantly, can achieve much larger diversification gains by shifting the risk outside the banking sector itself.[3] Theoretically, the net outcome of CRTs should be one of benefit, with a positive impact for overall financial stability and efficiency.[4]

However, there are specific risks attached to CRT instruments which could be heightened, in a relatively "new" market, by the still-limited liquidity and lack of transparency in some segments. Notably, the complexity of quantitative techniques required to value and hedge these instruments is not yet completely understood, exposing market participants to potentially large losses. The situation is compounded by problems associated with, among other things, the creditworthiness of transaction counterparties, and the adequacy of existing market and legal infrastructure. Increasing interlinkages between financial institutions raise the question of whether institutions fully understand their risk exposures. For instance, while banks are shedding credit risk to insurance companies, life insurers are using capital markets and banks to hedge some of their portfolio risks (Rule, 2001). Substantial losses in credit markets experienced by German Landesbanks in 2002−03 suggest that some active participants in the market might not have the capacity to adequately manage the risks associated with CRT instruments.[5]

Thus, a key concern among regulators is that the rapid expansion of CRT markets may actually *pose* problems for financial sector stability, if a significant market event were to occur. In their increasing search for yield in recent years, a wide variety of investors—some with little experience managing credit risk—have become active sellers of protection. Justifiably, regulators worry whether a major shock in credit markets could cause substantial and widespread losses among these investors, forcing a disorderly unwinding of credit risk positions. The general lack of accurate data on open positions in credit derivatives and structured credit instruments further increases the risks for financial stability by masking the extent of institutions' involvement with these products. Such risks arise from the ability of investors to leverage their positions substantially compared to similar positions in cash instruments such as loans or bonds.

This paper examines the financial stability issues related to CRT markets, focusing in particular on the use of credit derivatives in the banking and insurance sectors in the United

[3] See Rule (2001) for a discussion on the motivations for credit risk transfers.

[4] See Clementi (2001), Cousseran and Rahmouni (2005), Wagner and Marsh (2004).

[5] See Risk (2003).

Kingdom.[6] Within the financial sector in the United Kingdom, globally active banks such as Barclays, Hongkong and Shanghai Banking Corporation, and Royal Bank of Scotland are believed to be more exposed to CRT instruments than insurers. That said, other financial institutions have also become increasingly more active in the CRT market. Our findings suggest that diverse holdings across major financial institutions potentially active in the credit derivatives market may limit the extent of any impact from a negative shock to the market, and that insurance companies, at least the major publicly listed ones, appear to be more exposed to "safer" senior tranches.

The paper is structured as follows. Section II examines the growth of credit derivatives instruments and the proliferation of structured credit products in the global market. Section III considers the risks inherent in the CRT market, and the increasing interlinkages among financial institutions. Section IV presents the empirical evidence on the exposure of financial institutions in the United Kingdom to credit derivatives products. Issues of market regulation and supervision are covered in Section V. Section VII concludes.

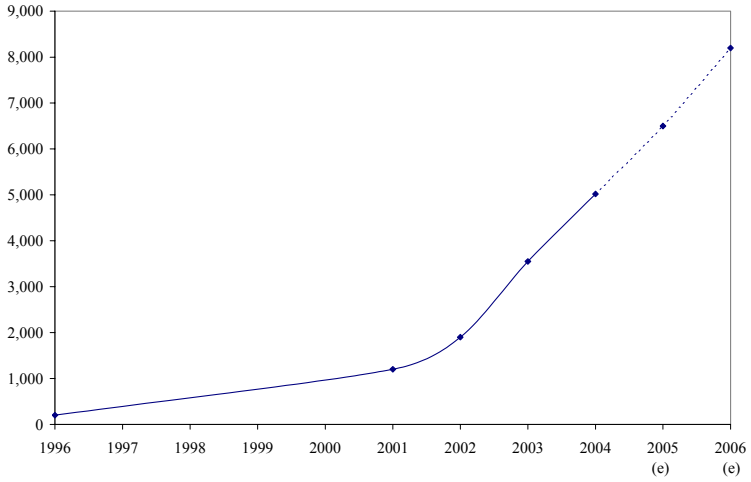
II. Credit Risk Transfer Instruments: Structured Credit Products and Credit Derivatives

The exponential growth of the global credit derivatives market since the instrument was first traded in 1996 has played a key role in the development of the CRT market. A credit derivative is a contract (derivative security) that is used to transfer to another party the risk that the total return on a credit asset would fall below an agreed level. This is usually achieved by transferring the risk on a credit reference asset. It does not require the transfer of the underlying asset, although the cash flow of the credit derivative instrument is determined by the credit quality of the underlying asset.[7] According to the British Bankers' Association (BBA), the value of credit derivatives products, which exceeded even the total volume of outstanding U.S. Treasury bonds at the end of 2004, is projected to surpass $8 trillion by 2006 (Figure 1).

[6] London is the main center of the global credit derivatives market, ahead of even New York. The size of the London market is estimated to have reached $2.2 trillion in 2004, about 44 percent of the total global market of $5 trillion, compared to the New York market at 40 percent.

[7] Examples of credit derivatives include credit default swaps (CDSs), credit-linked notes (CLNs), credit spread options (CSOs), and total return swaps (TRSs).

Figure 1. Growth of the Global Credit Derivatives Market
(In billions of U.S. dollars)



Source: British Bankers' Association.

Among the most popular structured credit products are collateralized debt obligations (CDOs).[8] CDOs are constructed by "pooling" the credit risk of different financial instruments and dividing the pooled credit risk into tranches with different risk and return characteristics (Appendix I).[9] CDOs generally combine three mechanisms common to all securitization structures (Cousseran and Rahmouni, 2005):

- the construction of a reference portfolio comprising a pool of bank loans and/or negotiable financial instruments and/or credit derivatives;
- the de-linking of the credit risk of the portfolio from that of the originator of the portfolio via the use of a Special Purpose Vehicle (SPV) that issues the CDO and holds the underlying assets; and
- the tranching of CDOs backed by this portfolio, with specific seniority rank in terms of rights to cash flows generated by the underlying assets.

Motivations to issue CDOs are varied. They include arbitrage opportunities (from attractive excess spreads coupled with low default rates); balance sheet management (reduced cost of funding and meeting regulatory capital requirements); providing fund managers with the opportunity to earn a stable fee income and to increase their assets under management; providing investment banks the opportunity to earn underwriting fees and cross-sell collateral into CDOs (Memani, 2005). In other words, legal, regulatory, and economic incentives have

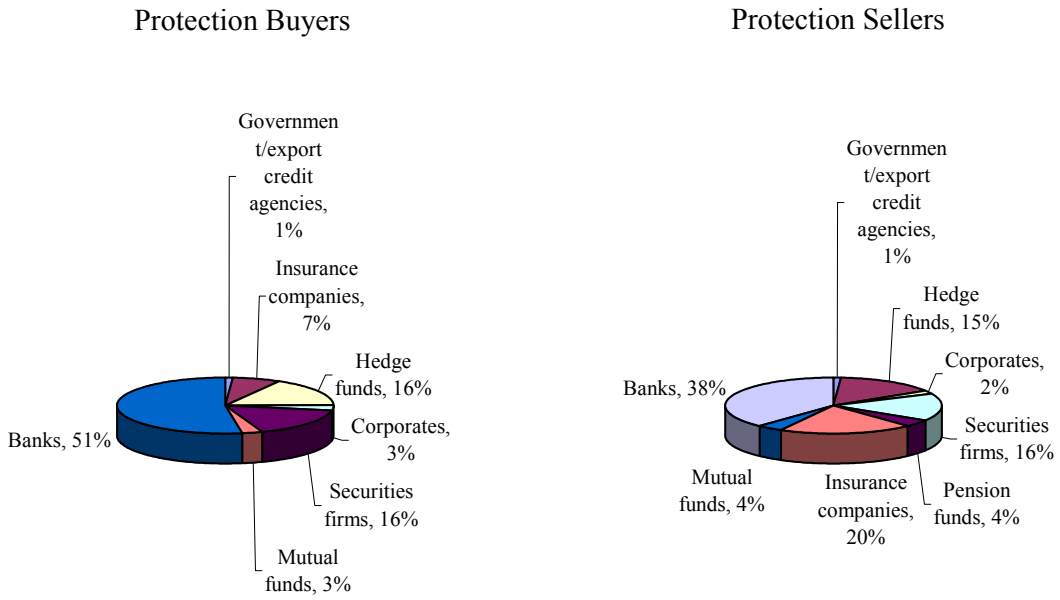
[8] Rule, Garratt, and Rummel (2004) define a structured credit product as "a bond combined with one or more options or forwards linked to market prices or indices" which can "take a variety of contractual forms depending largely on the nature of the target investors."

[9] A tranche is defined as a certain loss range.

typically been the key drivers of growth in the CDO market. In addition, the underlying bond and loan secondary markets are relatively illiquid. Thus, CDOs help to improve liquidity, raising the total valuation to the issuer of the CDO structure (Duffie and Garleanu, 2001).

Participants in the CRT market have also become increasingly diverse. According to Fitch Ratings (2005), the main participants in the CDO market are lending institutions, which are usually net buyers of protection or net sellers of CDOs, and insurance companies, which are net sellers of protection and net buyers of CDOs. The most recent credit derivatives survey by the BBA suggests that while banks, securities houses, and insurance companies still constitute the majority of market participants, hedge funds have emerged as key players, both as protection buyers and sellers (Figure 2).[10] According to data from Credit Suisse First Boston (CSFB), the investor base (sellers of protection) has broadened more recently to include hedge funds, proprietary traders, and the more traditional asset management industry, who participate in both the protection buyers' and sellers' markets (Figure 3). Even some pension funds, which have generally followed conservative investment strategies, are said to have started taking on the role of protection sellers.

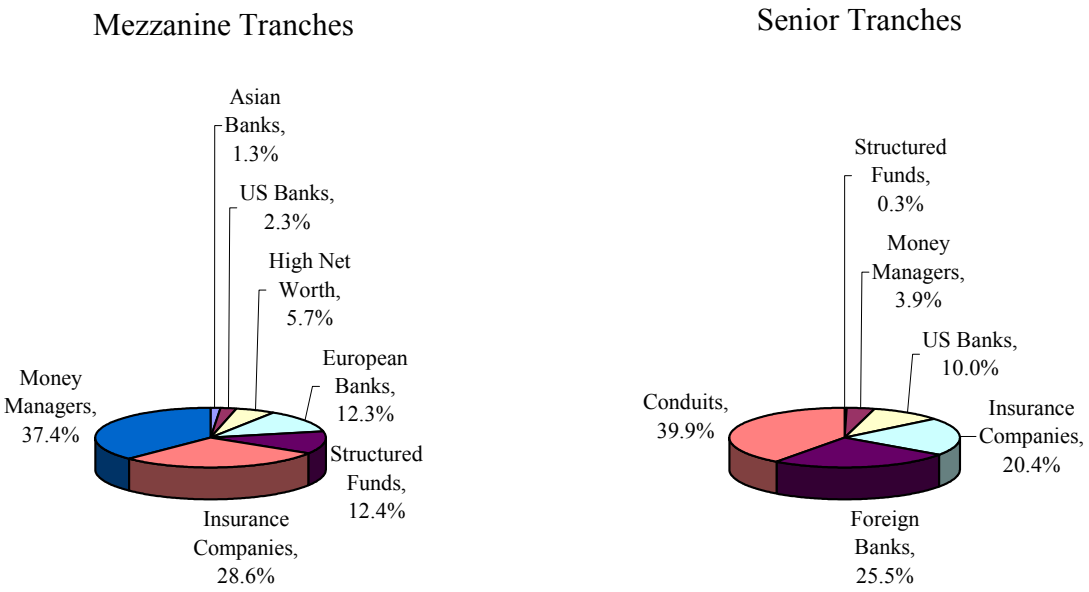
Figure 2. CDOs: Protection Buyers and Sellers



Source: British Bankers' Association.

[10] See BBA (2004).

Figure 3. Composition of Protection Sellers (Buyers of CDOs)



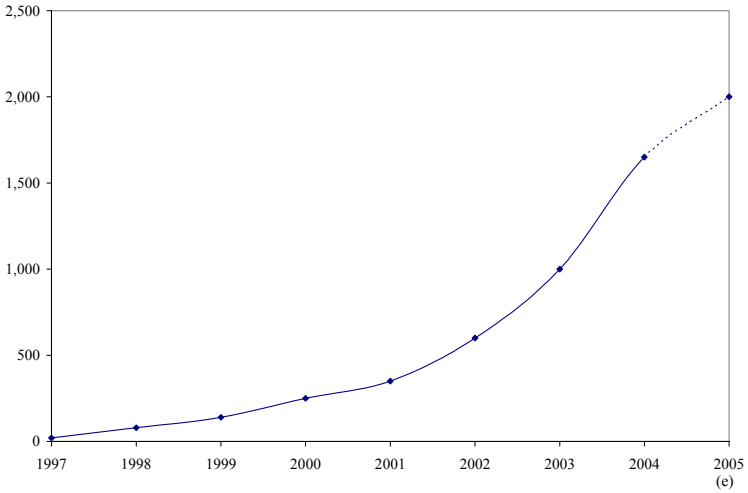
Source: Credit Suisse.

The growth of credit derivatives has provided the impetus for the sharp growth in *synthetic* CDOs since the latter are easier to assemble and disperse than their cash counterparts (Figure 4).[11] According to BBA (2004), synthetic CDOs make up about 16 percent of the credit derivatives market, behind CDSs, which have a 51 percent market share. Indeed, synthetic CDOs, which insured less than $400 billion of the face amount of U.S. corporate bonds in 2001, are estimated to have covered some $2 trillion by the end of 2005, according to JPMorgan. As a benchmark comparison, this would represent about 40 percent of the entire U.S. corporate bond market of almost $5 trillion.[12] The demand for these instruments has been particularly strong in Europe, driven by the existing legal and taxation barriers to securitization transactions involving the true sale of underlying assets and the limited interest in these transactions for refinancing purposes (Cousseran and Rahmouni, 2005). Further, the outstanding volume of corporate bonds in Europe is much smaller than in the United States, making it more difficult to source assets for cash CDOs.

[11] See Appendix I.

[12] CDOs issued in Europe targeted at European investors may also include U.S. underlying assets.

Figure 4. Growth of the Global Synthetic CDOs Market
(In billions of U.S. dollars)



Source: JPMorgan.

III. Interlinkages across Financial Institutions

Within the financial system, there are increasing linkages across different financial sectors, especially among banks and insurers.[13] Insurance companies are major investors in banks' equity and debt instruments, which exposes them to risks taken by banks. Insurers also cover banks and their customers for the usual insurable risks; they provide companies with trade credit insurance, while banks often finance these "receivables," supported by insurance. Meanwhile, banks provide insurers with liquidity facilities to enable them to pay current claims and with letters of credit as evidence of their ability to pay future claims.

The formation of bancassurance groups through the merger of banks with insurers represents another example of cross-sector linkages. In the United Kingdom, for example, ownership interests of U.K. banks in insurance companies have been significant, with 6 of the 10 largest U.K.-owned banks having equity shares in life insurance subsidiaries at end-2003. This is in contrast to the direct credit exposure of U.K. banks to the life insurance sector, with loans to insurers and pension funds amounting to just over 6 percent of the major banks' Tier 1 capital. Existing empirical evidence shows that the equity prices of individual bancassurers in the United Kingdom were adversely affected by disruptions in the U.K. life insurance sector over the 2001–03 period, suggesting a spillover effect though ownership links (Monks and Stringa, 2005).

Meanwhile, the development of techniques to repackage credit risk into "slices" has facilitated the increasing shift of credit risk away from the banking sector.[14] Credit risk has

[13] See Rule (2001).

[14] These techniques, to a large extent, have been borrowed from mortgage-backed securities (MBSs). Lessons learned in this market have been transferred to the credit derivatives market.

been transferred to insurance companies and to other capital market participants such as hedge funds, mutual funds, and pension funds.[15] Banks account for the major share of CRT market activity—they use CRT instruments for diversifying or hedging risks in their banking books (portfolio management). Banks also provide investor services by devising and intermediating CRT products and make markets for credit derivatives (ECB, 2004). Individual banks could be involved in both portfolio management and intermediation activities. In the United Kingdom, the larger banks (by assets) participate in the CRT market.

Within the European Union, insurance companies are the largest buyers of credit risk outside the banking system (ECB, 2004). Different types of insurers have been using CDOs and CDSs to take on credit risk at varying levels of seniority and forms, commensurate with their balance sheet needs and regulatory restrictions (see Rule, 2001). In countries such as Denmark, German, Japan, the Netherlands, and the United Kingdom, life insurers are reportedly seeking more credit risk in order to increase the yield on their assets. Ironically, these investors may then have to seek recourse from their respective banks by drawing on their credit lines if losses crystallize during a credit event, in order to meet their obligations under these CRT instruments.

The transfer of credit risk between institutions also gives rise to several other risk factors.[16] Market risk is associated with changes in the credit spreads of names in the underlying portfolio of a CDO tranche. The seller is often exposed to liquidity risk as well, as it may be difficult to sell an asset quickly in an insufficiently liquid secondary market. That said, investors with less liquid liabilities than banks such as life insurers and hedge funds may benefit from the liquidity premium. The use of standardized tranches on credit derivatives indices to hedge exposures to single tranches gives rise to basis risk, since the instruments are not perfectly matched. Counterparty risk arises from the possibility that the risk buyer may default in settling a claim, while legal risk refers to the lack of complete and timely documentation, in the event of a dispute over a particular transaction. Ratings risk arises from the fact that ratings tend to reflect the average risk of a security, without factoring in the dispersion of risk around its mean (Cousseran and Rahmouni, 2005). This may limit the usefulness of ratings given the structured nature CDOs.[17] There is also the possibility of "ratings arbitrage," wherein CDO issuers may be tempted to choose rating agencies based on

[15] As an example, credit risk in the banking sector spiked up in early May 2005 on rumors that hedge funds active in credit derivative markets might have incurred large losses following the ratings downgrade of automobile companies General Motors (GM) and Ford. The influence of hedge funds on the banking industry is largely due to the substantial contribution of hedge funds to investment banks' fee income. The banks generate these fees by providing trading ideas, financing positions, and executing trades on behalf of hedge funds. Hence, factors affecting hedge funds' performance affect banks' profitability. For instance, idiosyncratic shocks that reduce hedge funds' creditworthiness increase counterparty risk to banks involved in financing these funds' positions. It was not entirely surprising, then, that banks' equity prices fell and credit spreads widened when hedge funds' investment strategies underperformed following the automobile companies' downgrades.

[16] See Appendix II for a detailed discussion on the individual risk factors. It should be noted that these risks are not unique to CRT instruments.

[17] It should be noted that rating agencies are constantly refining the rating criteria applied to structured products.

the best rating that is assigned to their particular issue or tranche, to minimize funding costs. Model risk arises in the valuation of CDOs using a myriad of complex models that continue to evolve.

IV. Exposure of U.K. Financial Institutions to Credit Derivatives

A *direct* assessment of the exposures of financial institutions in the United Kingdom to credit derivatives—and their implications for financial stability—is not possible, given the lack of available information in this area. To overcome this limitation, we estimate the exposure of a firm to the credit derivatives market by examining the extent to which developments in the credit derivatives market explain the variability of the firm's equity returns in the longer run. The assumption that such a relationship exists is reasonable, given that gains/losses on holdings of CRT instruments are quickly manifest in a company's financial data in an efficient market.[18] We assess this exposure indirectly by using the vector autoregression (VAR) approach first suggested by Hasbrouck (1991a, 1991b). In this case, we estimate the model using daily data for the period August 28, 2003–September 15, 2005.

The choice of factors in our model is guided by the requirement that the econometric model captures both systemic risk in the financial system and the specific risk associated with credit derivatives products. The major financial services groups analyzed here represent either the largest life insurers or major banking groups, which list their shares locally in the United Kingdom: Aviva, Barclays, Halifax Bank of Scotland (HBOS), Hongkong and Shanghai Banking Corporation (HSBC), Lloyds, Legal and General, Royal and Sun Alliance, and Royal Bank of Scotland (RBS).

Market prices are used in our analysis, because they are readily available on a daily basis (as opposed to accounting data), and quickly transmit financial information about individual companies.[19] Equity prices for the major financial groups are obtained from Bloomberg L.L.P. The slope of the yield curve, measured as the difference between the yields on the 10-year and 2-year U.K. government bonds, is included as a measure of contemporaneous economic conditions that would lead to simultaneous movements in equity returns and structured credit product prices. The yield data are obtained from the generic 2-year and 10-year yield series constructed by Bloomberg L.L.P.

While there has been a rapid proliferation of CRT products, credit derivatives are among the most widely used products. Consequently, the introduction and rapid acceptance of benchmark credit derivatives indices, specifically iTRAXX in Europe, has helped develop a two-way market for standardized CDOs. Given that the tranche seniority of a CDO affects its riskiness, we include as factors the prices of the equity tranche and a number of mezzanine

[18] See, for instance, Tett (2005).

[19] See Monks and Stringa (2005).

tranches with varying degrees of seniority.[20] The super-senior tranche is not included in the analysis since its time series just started in mid-2004. Price data for the different tranches are obtained from JPMorgan.

Given the vector of n endogenous variables, $Y_t=(y_{1t}, y_{2t},..., y_{nt})'$, the corresponding unrestricted VAR system of order p is given by:

$$Y_t = c + \Phi_1 Y_{t-1} + \ldots + \Phi_p Y_{t-p} + \varepsilon_t, \tag{1}$$

where c is an n-vector of constant terms, Φ_i ($i=1,...,p$) are n-by-n coefficient matrices, and ε_t is a vector of uncorrelated, independent, and identically distributed error terms. The error terms are also serially uncorrelated. Under certain technical conditions, described in detail in econometrics texts like Hamilton (1994), the vector autoregression system in equation (1) admits the following vector moving average representation (VMA):

$$\begin{bmatrix} y_{1t} \\ \vdots \\ y_{it} \\ \vdots \\ y_{nt} \end{bmatrix} = \begin{bmatrix} \psi_{11}(L) & \ldots & \psi_{1i}(L) & \ldots & \psi_{1n}(L) \\ \vdots & & \vdots & & \vdots \\ \psi_{i1}(L) & \ldots & \psi_{ii}(L) & \ldots & \psi_{in}(L) \\ \vdots & & \vdots & & \vdots \\ \psi_{n1}(L) & \ldots & \psi_{ni}(L) & \ldots & \psi_{nn}(L) \end{bmatrix} \begin{bmatrix} \varepsilon_{1t} \\ \vdots \\ \varepsilon_{it} \\ \vdots \\ \varepsilon_{nt} \end{bmatrix}, \tag{2}$$

where $\psi_{ij} = \sum_{k=1}^{\infty} \psi_{ij}^k L^k$, $i,j=1,...,n$ are lag operators.

The coefficient ψ_{ij}^k measures the effect k periods ahead of a unit shock or innovation to variable y_j on variable y_i. Therefore, the long-term cumulative impact of variable y_j on variable y_i can be measured by adding up the coefficients associated with the lag operator $\psi_{ij}(L)$:

$$\sum_{k=0}^{\infty} \psi_{ij}^k = \text{information content of } y_j \text{ on } y_i. \tag{3}$$

Equation (3) suggests that variance decomposition can be used to quantify the overall importance of innovations to variable y_j for explaining subsequent realizations of variable y_i vis-à-vis the other endogenous variables. Specifically, the overall importance of variable y_j is captured by the relative share of the variance of variable y_i that it explains:

[20] The equity tranche has attachment points of 0–3 percent, and the mezzanine tranches have the following attachment points: 3–6 percent, 6–9 percent, 9–12 percent, and 12–22 percent (Appendix I provides definitions of attachment and detachment points).

$$\frac{\left(\sum_{k=0}^{\infty}\psi_{ij}^{k}\right)^{2}\sigma_{\varepsilon_j}^{2}}{\sum_{m=1}^{n}\left(\sum_{k=0}^{\infty}\psi_{im}^{k}\right)^{2}\sigma_{\varepsilon_m}^{2}}, \tag{4}$$

where $\sigma_{\varepsilon_j}^2$ is the variance of the innovation to variable y_j. Note that our VAR framework does not choose a particular ordering of the variables entering equation (1), and hence it is a statistical description of the dynamic interrelations among the variables analyzed. While a structural VAR may offer some advantages for interpreting the data, it requires specifying a priori a causal ordering of the variables, which we do not deem appropriate for this study.

In interpreting the results, we do not make any assumption as to whether a particular institution is long or short the credit exposure. We assume that, in case of defaults, losses fall within the attachment and detachments points of the benchmark iTRAXX. Therefore, the higher the fraction of equity return volatility explained by a senior tranche, the lower both the credit exposure of the firm and the potential impact on financial stability.

Our empirical results suggest that U.K. insurance companies tend to have more conservative exposures to the CRT market. Table 1 shows the longer-term impact of volatility in the credit derivatives market on the stock price returns of our sample companies.[21] The major insurance companies tend to be more exposed to volatility in the more senior mezzanine tranches, with attachment points of 9–12 percent and 12–22 percent.

In contrast, the bancassurance businesses tend to be more exposed to riskier CRT products. They appear to have greater exposure to the junior mezzanine tranches (with attachment points of 3–6 percent and 6–9 percent), with the exception of HBOS. The apparent conservatism of HBOS, which is substantially exposed to the senior mezzanine tranche (with attachment points 12–22 percent), could possibly be explained by the fact that it is also the biggest life insurer in the United Kingdom, in addition to being one of the five biggest banks in the country. Barclays also appears to be most exposed to the senior mezzanine tranche.

The empirical evidence suggests that the CRT market does not pose a substantial threat to financial sector stability in the United Kingdom, at this point. While our sample of financial institutions is admittedly rather small, thus making it difficult to generalize this finding, the results suggest that: (i) there are sufficiently diverse holdings across major institutions in the U.K. market, which are potentially active in the CRT market, to limit the extent of any impact if markets were to experience a negative shock; and (ii) insurance companies—at

[21] In this model, the shocks are not orthogonalized. This means that the variance decomposition ranks the importance of every shock, but does not represent the actual percentage that each shock contributes to a particular share price, since the shocks may be correlated. In other words, the sum of the individual variances would not be equal to the total variance because of the covariance terms, but the rankings hold since it is equivalent to a renormalization.

least the major ones—which are risk buyers, appear to prefer the tranches that better insulate them from first losses.[22]

In our view, an important threat posed by a credit event in the credit derivatives market is that of reputation risk, which could result in contagion. In other words, the failure of one financial institution could have the knock-on effect of denting public confidence in the financial sector in general, especially given the increasing interlinkages among different segments of the financial sector. In the United Kingdom, inter-relationships between the banking and insurance sectors are especially significant, as discussed earlier. In the current environment, where the market is rapidly evolving and credit yields remain relatively low, institutional investors may be tempted to take riskier bets and move down the credit spectrum to increase the returns on their investments. It is thus important for authorities to continue monitoring developments in these markets and to obtain more detailed information on the exposure of institutions—identified by supervisors as being potentially systemic—to CRT products.

[22] The data are subsequently divided into two subperiods—August 28, 2003 to September 6, 2004, and September 7, 2004 to September 15, 2005—and the VAR approach is applied to each sub-sample. The results suggest that the major U.K. financial institutions have become more conservative in their involvement in credit derivatives over time. These institutions became more exposed to volatility in the more senior mezzanine tranches over the two subperiods, with the exception of RBS. The holdings across institutions remained diverse over time.

Table 1. Impact of Volatility in the CRT Market on Major U.K. Financial Groups, August 2003–September 2005
(In percent)

	Bank	Bancassurance				Insurance		
	Barclays	HBOS	HSBC	Lloyds	RBS	AVIVA	Legal &	RSA
Dependent variable	0.2	3.6	9.3	0.4	0.9	1.8	26.0	0.3
iTRAXX tranches								
Equity tranche								
0-3 percent	8.6	0.3	17.9	0.2	2.4	7.3	0.7	3.3
Mezzanine tranches								
3-6 percent	2.1	10.4	51.6	32.7	38.9	12.5	13.2	0.7
6-9 percent	24.1	0.4	0.9	35.3	14.9	27.4	4.7	33.9
9-12 percent	17.3	12.3	5.2	6.6	13.9	35.8	5.0	53.7
12-22 percent	47.6	72.9	15.0	24.6	28.9	15.2	50.4	8.0
10 less 2 year govt yield	0.1	0.0	0.1	0.2	0.0	0.0	0.0	0.0

Sources: Bloomberg L.L.P. and IMF staff calculations.
Note: Shaded numbers represent individual institutions' biggest exposure to the corresponding credit derivatives tranche.

V. Regulatory and Supervisory Initiatives

Credit derivatives markets allow for a better distribution of risks across different segments of the financial sector. As such, the development of the credit derivatives market should be encouraged. The challenge for regulators is to implement regulatory measures and provide adequate supervision and surveillance to prevent the misuse of these instruments, while providing an environment that encourages further development of this market. This section briefly discusses key initiatives taken by the financial authorities in the world's two biggest CRT markets, namely, the United Kingdom and the United States.

In the United States, the advent of securitization exposed major deficiencies in regulatory and supervisory practices.[23] The U.S. authorities realized that while regulatory and accounting reforms were important, proper supervision of the market would require adequate resources and relevant experience on the part of supervisors.[24] As a result, the Office of the Comptroller of Currency (OCC) implemented supervisory reforms related to securitization exercises by banks. These include:

- developing a cadre of specialized experts to examine securitization programs;
- recognizing that these examinations require extraordinarily high person-hour expenditure;
- developing independent valuation capabilities for the residual risk component;[25] and
- obtaining information on every securitization vehicle for every bank.

In terms of banking practice, the OCC has recommended that banks should:

- encourage an independent legal and accounting review of every vehicle;
- perform "stress to breakage" risk analysis to complement their residual risk valuation; and
- put in place contingency liquidity and reserve planning.

In the United Kingdom, the Financial Services Authority (FSA) posits that understanding the extent to which real risk is transferred is key when monitoring the CRT market.[26] To this end, the FSA has engaged in surveys—in particular, through the Joint Forum—to understand who

[23] See Carhill (2005).

[24] In the United States, the regulation and supervision of banks are undertaken by the Federal Reserve and the Office of the Comptroller of Currency, as well as by individual state regulators and supervisors.

[25] This refers to the issuing bank's equity piece of a securitized instrument.

[26] The approach to supervision and regulation taken by the authorities in the United States and the FSA in the United Kingdom is different, reflecting the differences in the structure and history of the banking system in each country.

the end investors are and how well the risks are managed.[27] The FSA maintains a conservative approach with respect to data collection on a regular basis given its view that such exercises incur high costs and provide limited benefits, under its existing cost-benefit framework for regulation. The supervisor is also prioritizing the issue of model risk by initiating the *hypothetical portfolio exercise* to better understand how firms are modeling CRT instruments and to discover the challenges across firms. In the meantime, the FSA and the New York Federal Reserve are currently working with major participants in the CRT market to resolve the issue of backlogs in trade confirmations and assignments.

Meanwhile, the strengthening of reporting standards will likely improve disclosure in the financial sector. Notably, the promulgation of International Financial Reporting Standards (IFRS) points to the likelihood of more accurate valuations of structured credit and credit derivatives instruments in the financial statements.[28] International Accounting Standard (IAS) 39, which is still undergoing revisions, introduces the use of fair value accounting for financial assets and liabilities of *listed* companies. Essentially, credit derivatives held in the trading book of a bank would have to be recorded at fair value under this standard. Within the banking book, the *purpose* of the instrument is key to determining its valuation in the financial statements. Credit derivatives used to hedge underlying transactions in the banking book would have to be recorded at fair value, while the same instruments may be recorded at cost if the objective is to hold them to maturity.[29]

There are several areas where improvements in supervision and surveillance could be effected in markets where CRT instruments are becoming more important. Specifically, the authorities should: (i) ensure that supervisory staff are always up to date with the latest techniques and tools; (ii) ensure that all paperwork relating to CRT transactions are timely and kept up to date; (iii) ensure that risk management systems are adequate to cope with stresses in the credit derivatives market and encourage continued improvements in credit risk management; (iv) require financial institutions to regularly stress test their open positions in CRT instruments, notably in structured credit exposures; (v) encourage market participants to consider richer and more consistent risk measurement techniques, in addition to formal ratings of CRT instruments; and (vi) consider the need for greater disclosure by financial institutions of their holdings in CRT instruments.

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[27] International initiatives on surveillance of the credit derivatives market include the Joint Forum and the Financial Stability Forum (see Joint Forum, 2004).

[28] The United Kingdom adopted IFRS on January 1, 2005. The European Commission brought in fair value accounting for derivatives on November 16, 2005. The Commission initially accepted most of the proposals presented by the International Accounting Standards Board in 2004, but opted out of its recommendations on fair value accounting and on hedge accounting. It then drew up a restricted fair value option, which was approved in July 2005, and came into force on November 16, 2005, retroactive to January 1, 2005.

[29] The financial institution is required to fully disclose the criteria for which the instrument is used and to detail how the instrument supports its investment or hedging strategy. Disclosures of details on credit derivatives is covered by IFRS 7, *Financial Instruments Disclosure*s.

VI. Conclusion

The increasing ability to trade credit risk in financial markets has facilitated the dispersion of risk across the financial and other sectors. Theoretically, the net outcome of CRTs should have a positive impact on overall financial stability and efficiency. However, there are specific risks—such as modeling risk, legal risk, and counterparty risk, among others—attached to CRT instruments which could be heightened by the still-limited liquidity in the market. Thus, a key concern is that the rapid expansion of CRT markets may actually pose problems for financial sector stability in the event of a major negative shock in credit markets.

This paper focuses on the use of structured credit products in the banking and insurance sectors and its implications for financial sector stability in the United Kingdom. Given the lack of publicly available information on the exposures of financial institutions to CRT instruments, an indirect method using VAR is applied instead, to readily available financial market data. We do not make any assumption as to whether a particular institution is long or short the credit exposure; rather, we merely assume that losses fall within the attachment and detachment points of the standardized credit derivatives benchmark, in case of defaults.

Our empirical results indicate that the structured credit market may not pose a substantial threat to financial sector stability in the United Kingdom at this point. U.K. insurance companies tend to be more conservative in taking on CRT exposures, preferring the "safer" senior tranches, while their bancassurance counterparts tend to be more exposed to the junior mezzanine tranches. The apparent diverse holdings across these major financial institutions, which are potentially active in the structured credit market, may limit the impact of any significant negative shock to the market.

In this relatively "new" market, the challenge for regulators is to ensure adequate regulation, supervision, and surveillance, while encouraging the development of this market. Financial authorities in key CRT markets have taken important regulatory and supervisory initiatives to mitigate the risks posed by the rapid growth and evolution of this market and are continuing to enhance their supervision and surveillance techniques.

HOW COLLATERALIZED DEBT OBLIGATIONS (CDOS) WORK

In a CDO transaction, investors have the choice of purchasing different tranches of the instrument, commensurate with their risk-return preferences. An investor could purchase the riskiest tranche, which offers the highest return by far, but which also bears the initial losses that the pool suffers from any default among all its bonds. In other words, the risk-taking investor is taking a bet that any such loss would not occur, in return for the opportunity to earn double-digit returns. Alternatively, the investor could purchase a more conservative tranche, which pays a lower return but is insulated from initial defaults in the bond pool. The super-senior, senior, mezzanine, and equity tranches bear increasing risks of defaults. Specifically, holders of mezzanine, senior, and super-senior tranches of a CDO have some protection from the risk of loss from their respective more junior tranches.[30]

In order to estimate the rates of return at which to offer each tranche of the instrument, the originator (usually an investment bank) first has to estimate distribution of losses in the pool. The distribution of losses depends largely on the correlation of default among the names referenced in the CDO. In general, the lower the default correlation, the higher the compensation paid to the equity tranche investor and vice versa. This is because lower default correlations suggest that the probability of observing a limited number of defaults is higher. The limited number of defaults is sufficient to wipe out the equity tranche investor's capital. The opposite is true for the senior tranche investor—higher default correlations imply that the senior tranche is more likely to suffer losses, and thus the senior tranche investor would expect to be paid a higher compensation.[31] The dependence of the compensation paid to mezzanine tranche investors on correlation lies between the equity and senior tranche extremes (Gibson, 2004).

The *synthetic* CDO is one of the most popular products derived from the regular CDO instruments.[32] This instrument has the potential to intensify both the risks and returns of the regular CDO, by replacing the pool of bonds with credit derivatives, specifically, credit default swaps (CDS).[33] The synthetic CDO is classified as a credit derivative. In a synthetic

[30] These tranches may also be protected by credit enhancements such as the overcollaterization of assets, reserve accounts, or trapping excess spread, which would allow them to achieve a higher credit rating than the average rating of the underlying portfolio.

[31] From the equity tranche investor's perspective, the higher chance of a large number of defaults (fatter tails in the distribution of the number of defaults) due to high correlation is inconsequential since the investor's position is no longer affected beyond the first losses.

[32] Cousseran and Rahmouni (2005) provide details on the types of CDOs available in the market, including the criteria for issuing these instruments, the nature of credit risk transfers being effected and the CDO instruments available.

[33] A credit default swap is essentially an insurance policy that insures against a bond default. Holders of bonds could purchase credit default swaps on their bonds as protection—if the bond defaults, the seller of the CDS (seller of protection) acts as an insurer and pays the buyer. In return, the seller of the CDS receives an immediate payment up front without investing any funds, just in return for pledging to play if a default occurs. The price of protection naturally increases with the perceived likelihood of default. Investors who do not own bonds may also purchase credit default swaps, in order to benefit from any rise in value.

CDO transaction, the credit risk on the reference portfolio is transferred using CDS instruments:

- the special purpose vehicle (SPV) sells protection to the originator of the deal in return for agreed fees;

- the risk is then transferred from the SPV to investors through the issuance of tranches of fully-funded synthetic CDOs, credit default swaps (which are unfunded), or a combination of both (that is, partially funded CDOs).[34]

The risk levels of a synthetic CDO are determined by the total accumulated loss of the reference pool of assets. In a CDO, the default losses borne by a tranche range between the attachment point and detachment point. The lower bound of the range is called an attachment point and the upper bound a detachment point. For example, a 3−6 percent tranche has an attachment point of 3 percent and a detachment point of 6 percent. When the accumulated loss of the reference pool is no more than 3 percent of the total initial notional of the pool, the tranche will not be affected. However, when the loss has exceeded 3 percent, any further loss will be deducted from the tranche's notional until the detachment point 6 percent is reached. At this point, the tranche is wiped out.

The demand for synthetic CDOs has grown exponentially (see figure), and is displacing the regular CDO instruments. The introduction of single-tranche CDOs (also known as "bespoke tranches") has been an important innovation in synthetic CDO structures. This instrument was created in 2003 as a more flexible alternative to traditional CDOs. With single-tranche CDOs, only one tranche of the structure—usually a mezzanine tranche—is sold to the investor, while the arranger becomes the direct counterparty of the investor since there is no SPV in the structure. This specialized structure allows the seller to meet specific needs of the investor, and in a more timely and cost effective manner compared to traditional CDOs, which require that all the different classes of tranches (equity, mezzanine, senior)—usually to different investors—be sold to do the deal.[35]

Since synthetic CDOs could be created without holding any actual bonds as an underlying asset, the supply of these instruments appears limitless. However, this causes problems in the event of a default if contracts specify physical settlement because there may not be enough

[34] Synthetic CDO tranches could be either "funded" or "unfunded." If a tranche is funded, the CDO investor pays the notional amount of the tranche at the beginning of the transaction—the funds are put into a collateral account and invested in low-risk securities—and any default would result in a write-down of the principal. In return, the investor receives LIBOR plus a spread that reflects the riskiness of the investment. If a tranche is unfunded, no money changes hands at the initiation of the transaction. Rather, the investor (protection seller) receives a spread and pays out in the event that a default in the reference portfolio affects the investor's particular tranche. Since unfunded tranches depend on the investor's future ability and willingness to pay, they create counterparty credit risk for the protection buyer. A credit default swap is an unfunded credit derivative.

[35] See Cousseran and Rahmouni (2005) for a detailed description of the structure of a single-tranche CDO and the risks attached to this instrument.

bonds available for settlement. Markets have started to address this situation. For instance, in the default incidents involving Delphi and Collins & Aikman, auction mechanisms were introduced to cash settle index trades.

KEY RISK FACTORS IN CREDIT RISK TRANSFER (CRT) MARKETS

Market risk largely affects sellers of single tranche CDOs (buyers of protection). Hedging the short credit risk positions requires selling protection periodically on the names referred in the CDO in credit markets. The originator/seller of the CDO is exposed to risk associated with changes in the credit spreads of names in the underlying portfolio of the tranche. However, any dynamic hedging techniques entered into by the seller would only be effective if the instruments used (CDSs, corporate bonds, CDS indices) are sufficiently liquid. Thus, the seller is often exposed to liquidity risk as well, which could exacerbate losses in the event of market stress.

Liquidity risk arises from the difficulty of selling an asset quickly in an insufficiently liquid secondary market. This risk tends to be higher for new or rapidly growing markets, compared to well-established, mature ones. The secondary market for customized CDOs is non-existent. One potential concern is that some participants in credit derivatives markets may overestimate the liquidity of these products in constructing and hedging their correlation-based portfolios. The issue is not whether occasional losses are sustained by well-diversified large investors, but rather that one of the key player's portfolios may be too highly concentrated in these instruments. While CDS indices have a certain level of liquidity due to their standard nature, they are not perfect hedges, and thus give rise to basis risk.

Basis risk arises when the hedging instruments available are not perfectly matched to the risks that are to be transferred. Indeed, most hedges are imperfect. For example, standardized tranches on credit derivatives indices are increasingly being used by arrangers to hedge their exposure to single (or "bespoke") tranches.[36] Given that the attachment points of the tranches of a substantial number of CDO structures, which determine the potential losses faced by CDO investors and arrangers, are different from the attachment points of standardized tranches, these market participants would be exposed to basis risk. This risk is particularly high at the more subordinated end of the capital structure, namely, equity and lower-rated mezzanine tranches, where idiosyncratic factors tend to be important.[37] Furthermore, arrangers may not be able to hedge unanticipated event risk arising from a sudden default as experienced in the Delphi and Collins & Aikman bankruptcies.

Counterparty risk arises from the possibility that the risk buyer (seller of protection) may default in settling a claim. A fully-funded CDO structure incurs higher costs but is less

[36] As an example, the Dow Jones iTraxx index was created from the merger between two existing CDS indices (TRAC-X and iBoxx) in June 2004. Standardized tranches of CDOs based on the iTraxx—which replicate the behavior of unfunded synthetic CDO tranches whose reference portfolio comprises names in the basket of the CDS index—were issued. These tranche prices are continuously quoted and have contributed to improving the transparency and liquidity and lowering the trading costs of the CDO market. Appendix I briefly discusses single-tranche CDO structures.

[37] See IMF (2006).

exposed to counterparty risk.[38] The concentration of counterparty risk may be unavoidable during periods of rising credit risk; in some large CDO transactions, it may become prohibitively expensive to fund the credit risk transfer beyond a certain point (Rule, 2001). Thus, buyers of unfunded protection must assess whether the protection seller would be able to pay up during an extreme credit event, that is, determine the correlation between the realization of credit events and the creditworthiness of the protection seller.

Market imperfections also work against fully realizing the benefits from credit risk transfer. In particular, the lack of comprehensive legal and supervisory frameworks, the still-developing trading infrastructure, and rating arbitrage could contribute to financial instability in the event of an adverse shock in the credit markets.

Legal risk in the relatively new CRT market has largely arisen from imperfect documentation, although the maturing of the market has resulted in the setting of precedents over time. Legal risk is fundamentally important since legal and documentary issues are key considerations in defining the roles of the different parties involved in a CDO structure, and ensuring the efficiency and validity of the risk transfer itself (Cousseran and Rahmouni, 2005). Unsound market practices such as incomplete documentation of trades in the credit derivatives market are key examples of legal risk. In the United Kingdom, the FSA recently asked banks for an update on delays and errors that are occurring in processing credit derivatives trades. The authorities have expressed concern about the apparent high levels of unsigned trade confirmations between credit derivatives counterparties in transactions conducted outside of exchanges.[39]

The inadequacy of the trading infrastructure is evident by the substantial backlog for processing trades. However, a number of private sector initiatives have been advanced to deal with this problem. Recently, 14 leading investment banks pledged to U.S. and European regulators to address the issue backlogs in trade processing and to improve operational practices. These initiatives include commitments to (i) reduce backlogs; (ii) provide regulators with information on the progress; and (iii) use a new procedure for or transferring trades according to the ISDA protocol produced in September, which requires consent before trading. Additionally, there are plans to increase automation of trade processing via the Depository Trust and Clearing Corporation, and a proposal that cash settlement become the standard and that offsetting trades between the same parties are cancelled.

Ratings risk arises from the fact that the structured nature of CDOs limits the usefulness of their ratings, since ratings only reflect certain aspects of their credit risk. Ratings reflect the average risk of a security and merely represent an opinion on the probability of default and

[38] Counterparty exposure is usually greater for *synthetic* CDOs, where the risk transfer is usually unfunded. Further, these exposures could potentially increase very sharply if the creditworthiness of the counterparty deteriorates quickly.

[39] When assignments of trades are effected without the correct notifications and/or consents, this could result in institutions having out-of-date or inaccurate information on their exposures to individual counterparties. Tracking down these assignments has contributed to the existing confirmations backlog.

expected loss. They do not factor in the dispersion of risk around its mean (Cousseran and Rahmouni, 2005), nor can they convey the complexity of a structure or its sensitivity to embedded assumptions, for example, default correlations and recoveries post-default (Miles, 2005). In cases where investors rely on ratings for their CDO investments, model risk is also related to the specific model the rating agency uses to size the credit enhancement for a given tranche and rating (Fender and Kiff, 2004).[40]

Different methodological approaches used by to rate CDOs could result in "ratings shopping" activity. For instance, Moody's ratings are based on the concept of expected loss, while Standard and Poor's and Fitch base their ratings on probabilities of default, which could result in clear differences in the ratings assigned by the agencies to certain tranche structures (Peretyatkin and Perraudin, 2002). Thus, CDO issuers may be tempted to choose rating agencies based on which one assigns the highest rating to their particular issue or tranche, in order to minimize funding costs.[41] One possible solution is to encourage investors to require more than one rating as part of their internal control procedures.

Model risk arises in the valuation of CDOs using myriad complex models that continue to evolve. A major shortcoming of existing models is that they do not adequately capture the co-movements of credit spreads and default correlations, leading to some simplifications in modeling the correlation structure. These simplifications, however, may be incorrect (Appendix I). Essentially, model-based prices cannot replicate observed market prices and the associated correlation skew, and hence, may be misleading for assessing risks. Moreover, since market prices are only available for tranches of CDS indices, these cannot be used for valuing synthetic CDOs with nonstandard underlying portfolios.

[40] The asset pool for a CDO may sometimes need to be enhanced by one or more types of credit in order to attain the desired credit risk profile for the security being issued. Such enhancements are usually derived from internal sources, that is, they may be generated from the assets themselves or supplied by a third party.

[41] See Fender and Kiff (2004) for a detailed discussion on the practice of ratings arbitrage.

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