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Advanced Financial Risk Management:

Tools and Techniques for Integrated Credit Risk, Market Risk, Liquidity Risk and Interest Rate Risk Management

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Part 3: Risk Management Techniques for Credit Risk Analytics

Chapter 15
An Introduction to Credit Risk: Using market signals in loan pricing and performance measurement

In the first fourteen chapters of this book, the fundamental emphasis has been to lay the foundation for an integrated treatment of credit risk, market risk, liquidity risk and interest rate risk. We now introduce the analysis of credit risk, building on the foundation we have established with our prior focus on the term structure of interest rates in a multi-factor Heath Jarrow and Morton framework.

Market Prices for Credit Risk

Our primary focus in this chapter is to introduce the use of market prices in credit risk analysis. In subsequent chapters we discuss the state of the art models that are used with this market data to construct an integrated approach to market risk, interest rate risk, liquidity risk and credit risk. Our primary focus in this and later chapters is on "best practice." Before we turn to that, it is important to add a word of warning about past practice and some of its dangers.

For a large insurance company or pension fund, the use of market signals in credit risk analysis is accepted without question because so much of the fixed income portfolio consists of bonds issued by large highly rated issuers. This is definitely not the case in the banking industry, especially with the demise of the purely wholesale oriented commercial banks like First Chicago, Continental Illinois, the old J.P. Morgan, and the Industrial Bank of Japan. Even today, outside of the investment portfolio, the dominant majority of transactions on the balance sheet of the bank are extensions of credit to small businesses and retail clients who obviously don't have ratings and don't issue debt in their own name that is readily traded in the market place. For these institutions, using market prices of credit risk in the management of the bank was a larger leap of faith. To put the numbers in perspective, a large bank in Beijing at press time has 700 million transactions on its balance sheet, but less than 1,000 are traded with a CUSIP or ISIN number you could look up on a common market data service.

Using market prices for credit risk analysis has enormous benefits to all financial institutions and we will spend a lot of time in subsequent chapters on the execution of these ideas. Some of the major benefits can be summarized as follows:

- **Increased accuracy in pricing**: Financial institutions create value-added for their owners by skillful asset selection and asset pricing. Market prices of credit risk can be used to sharply improve the accuracy of pricing on credit extended to all counterparties from retail clients to sovereigns.
- **Increased clarity in corporate strategy**: A skillful use of market prices allows senior management to see more clearly where value has been created in asset selection. More importantly, it allows senior management to see where future opportunities lie. Most importantly, senior management can also clearly see which areas to avoid.
- **Increased sophistication in risk management**: Market prices for credit risk provide invaluable insights about the correlation of risks among borrowers and about the macro-economic factors driving the correlation in default. This allows a sophisticated financial institution to hedge its portfolio of risks with respect to changes in these macro factors. This reduces the sharp cyclicality of the credit cycle.
- **Increased precision in measuring the safety and soundness of financial institutions**: Market prices of credit risk have helped regulators and shareholders alike more quickly and more accurately measure the safety and soundness of financial institutions.

We turn to each of these benefits in turn after a brief review of the kinds of market data that are critical in this regard. We close the chapter with words of caution about the market for credit-related securities, potential market manipulation, and the May 8, 2012 $2 billion loss announced by JPMorgan Chase.

Critical Sources of Market Data on Credit Risk

Not too many years ago, financial institutions weighted credit risk analysis very heavily toward the use of history:

- historical rates of default,
- historical movements in credit ratings,
- historical transition matrices of movements from one ratings category to another.

We discuss these historical data techniques with a critical eye in the next chapter. It is impossible to avoid these techniques in a large financial institution, but it is critical to supplement them heavily with market data from sources like these:

Bond Prices

There are many vendors who sell very large data bases of daily bond prices spanning most of the developed countries and literally more than 100,000 different bond issues. An institution which does not use this data extensively in setting corporate strategy, asset pricing, and risk management policies is destined to be a sub-par performing and more likely to end up as a troubled institution. The use of these bond prices should be very pervasive around the institution, not just restricted to one or two specialists in an analytical group. In recent years the TRACE system in the United States has made public each significant trade in corporate and municipal bonds. While this data is sporadic, it is the raw material from which a daily data base of "on the run" credit spreads for each major bond issuer can be constructed and analyzed.

Credit Default Swap Prices

The introduction of credit default swaps in the last decade has provided financial institutions with another view of the credit risk of the top credits in the world on a daily basis. This data has been over-hyped and oversold, so a sophisticated analyst has to use it with great caution. We discuss the risks in the use of credit default swap data at the end of this chapter. The use of credit default swap pricing has many potential benefits, however:

Transparency. The pricing of the credit default swap itself makes the market's assessment of the reference name's credit risk starkly apparent in the simplest of ways—it's the insurance premium for credit risk. There's no need to use the advanced techniques for measuring credit spread that we discuss in Chapter 18. That is, if the quote were real, not just a posting intended to mislead a potential investor in bonds. We investigate this issue below.

"On the run" maturities. Credit default swaps are most frequently quoted at five year maturities, but also at maturities from one to 10 year maturities for the most popular reference names. These quotes are the maturities at which many new transactions are done in lending markets, so they provide a concentrated view of credit risk at key maturities. Bond prices on existing issues, by contrast, are scattered at many maturities, and data at key "new issue" maturities is sparse by definition, since all outstanding issues now have shorter "off the run" maturities.

Cyclicality. The history of credit default swaps shows the cyclicality of credit risk at a constant maturity very clearly. We return to the drivers of this cyclicality in depth the next chapter when discussing reduced form credit models.

Recovery rates. Credit default swaps are traded in two forms. The digital default swap, a structure rarely traded, essentially pays $1 upon default. The more common credit default swap structure pays only the "loss given default" as carefully defined in ISDA contract language (see www.isda.org for model credit default swap contracts for various types of counterparties). Comparing the pricing for these two structures allows financial institutions to get the market's view on the expected magnitude of "loss given default," supplementing the notoriously sparse loss given default data maintained by most financial institutions and the legacy rating agencies.

First to Default Swaps

A brief boom, now over, in "first to default swaps" provided the market's view on the implicit "correlation" between the (standard) five reference credits underlying the first to default swap. The reference names might be IBM, Ford, BP PLC, the Republic of Korea, and Toyota. If all of the reference names are likely to default at exactly the same time and if they all have similar probabilities of default, the pricing on the first to default swap will be very close to the pricing on a credit default swap for any one of the reference names. If, by contrast, there is very little correlation between the reference names from a credit risk perspective, first to default swap pricing will approach five times the cost of the credit default swap on any one of the reference names since you are five times more likely to have to pay on the swap.

The market's view on this degree of correlation is very valuable, when it is real, and we discuss it at length in later chapters, particularly in the context of counterparty credit risk. There is one important caveat emptor with respect to first to default swaps—those who truly believe that the pair-wise correlation between any two counterparties is equal for all pairs will be eaten alive in the market place!

Collateralized Debt Obligations

The CDO market has collapsed in the wake of the 2007-2010 credit crisis, the classic case of a financial fad with no fundamental economic reason for being. Pricing in the collateralized debt obligation market, when it was active, could potentially provide the same kind of implied correlation estimates among larger portfolios of 100 or so reference names which typically make up the collateral pool on a CDO. Price transparency in this market was always very poor, in part because of the typical "arbitrage" cycle on Wall Street where "smart people take money from dumb people" early in the life of a new and complex instrument.[1] An increase in price transparency offers similar benefits as the first to default swap market in understanding the market's implied correlation in defaults among the reference collateral. With the market's demise, that transparency is highly unlikely to come about in the near future.

Interest Rate Swap Prices

Very large international financial institutions are typically the counterparties on the dominant proportion of interest rate swaps in major currencies. Historical movements in interest rate swap spreads, then, potentially reflect (directly and indirectly) credit spreads of these large financial institutions. A major international pension fund, for instance, has shown the median default probabilities for large international financial banks[2] are highly statistically significant in explaining movements in interest rate swap spreads even in the era of very highly rated "special purpose vehicles" designed to insulate the swap market from credit risk. We discuss the impact of potential manipulation of the London interbank offered rate on the interest rate swap market in Chapter 17. We also discuss the reasons why interest rate swap spreads to U.S. Treasuries have turned negative at 30 years (and less often at 10 years), much to the surprise of most market participants.

Equity Prices

[1] Quote from a young trader at Barings Securities after his first year on the trading floor, circa 1998.
[2] Specifically, the Kamakura Risk Information Services "Jarrow Chava" default probabilities, KDP-jc, provided by Kamakura Corporation.

Equity prices contain extremely valuable information on credit quality on a much larger universe of companies than one can find in the bond markets or the markets for over the counter-credit derivatives. We review this in Chapter 18 on legacy credit risk techniques like the Merton model of risky debt and in Chapters 16 and 17 on reduced form models. Different modeling technologies make use of this equity market information in different ways, but the explanatory power of equity markets is undeniable at this point among sophisticated market participants.

We now return to the practical use of this market credit information in credit risk analytics.

Increased Accuracy in Pricing

Some of the uses of market credit information are very basic and yet they substantially improve financial institutions' performance. For example, one major lender in the Asia-Pacific region was lending to a borrower in Japan at yen libor plus 1.50% when the bonds of the borrower were trading at 9% (yes, nine percent) over the Japanese government bond rate. The maturities of the bond and the loan were similar, and the loan was unsecured just like the bond. The head of international lending sheepishly admitted they mispriced the loan and that the bank would have been much better off just buying the bonds. As simple as this comparison is, it is shocking how few financial institutions make this comparison in their lending activities—even though it's standard in their bond trading activities. Hedge funds have arisen in large numbers to arbitrage these price discrepancies, but the problems in the credit default swap market which we discuss below are large enough that price discrepancies can still be found.

In Chapter 36, we will revisit the topic of performance measurement in detail but a preview of that chapter is useful here. In a presentation to a risk management group, two executives of J.P. Morgan explained how the credit default swap market had changed the bank's thinking on measuring the shareholder value added on lending transactions.[3] A loan, they explained, was the economic equivalent of buying a Treasury bond with the same maturity and entering into a credit default swap to provide credit protection on the borrower. Therefore the bank measured the shareholder value added on a loan as the excess of the loan's interest rate over the sum of the Treasury yield and the pricing on the credit default swap. Very simple. Very accurate. No capital allocation. No bureaucracy needed. More on this in Chapter 36. It's all the more ironic that the $2 billion credit derivatives loss that JPMorgan reported on May 8, 2012 was due to trades in an instrument that provide no incremental risk-adjusted value by this measure from JPMorgan itself 11 years earlier. A risk manager's work is never done.

Increased Clarity in Corporate Strategy

From a corporate strategy point of view, one of the most critical decisions faced by senior management is the proper asset allocation for the institution. Where shareholder value is added the greatest? As we saw in the previous section, credit default swap pricing is providing new insights on a small subset of major corporate and sovereign names. More than that, however, we can use market prices of debt, equity and credit derivatives to compare asset classes and to answer questions like these:

- How much of the "credit spread" (see Chapter 17) is the loss component and how much is the liquidity component (i.e. everything other than the risk-adjusted potential loss)

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[3] Presentation to the North American Asset and Liability Management Association, September 2001, Toronto.

- How correlated are credit-risk adjusted returns in various sectors?
- What are the drivers of credit risk in each of these sectors?

Van Deventer and Imai [2003] analyze these issues in great length and we will devote considerable time to them in later chapters as well.

Increased Sophistication in Risk Management

Financial institutions have always needed to know how to simulate true credit adjusted portfolio performance for every counterparty from retail borrowers to major sovereign and corporate credit. They have always needed to know the default probability for each borrower and the macro factors which drive that default probability and which cause correlation in events of default. If we don't use the market prices of credit risk discussed above, we have to make some very simple assumptions to approximate true credit risk. Representative legacy examples of this are the Moody's Investors Service "diversity score" concept and the simple correlation and default probability assumptions in Standard & Poor's CDO Evaluator.[4]

If we use the credit information discussed above, however, we can make some substantial leaps forward in risk assessment from the transaction level to the portfolio level, the full balance sheet of a large financial institution. We do this in detail in Chapters 36 through 41.

Increased Precision in Measuring the Safety and Soundness of Financial Institutions

International supervisory agencies have worked for years on capital regulations labeled Basel II, Basel III, and Solvency II. The proposed capital accords are well-intentioned but highly convoluted, and many of their fundamental assumptions (like the risklessness of sovereign debt) have been proven false. More important, they result in financial ratios that still have not yet been proven as predictors of financial institutions failure. The 2007-2010 credit crisis has prompted many critics of the capital rules to call for their repeal and replaced with outright prohibitions on risky trading activities by financial institutions which are supported by government deposit insurance, such as the proposed "Volcker Rule" in the United States.

The market signals on credit risk discussed above have been proposed as key indicators of the risk of major international financial institutions:

- Their bond credit spreads are visible in the marketplace
- Their risk as embedded in traditional and digital credit default swaps is, in theory, visible in the marketplace. More on this controversial proposal below.
- Their default probabilities can be derived from stock prices and other data as we describe in Chapters 16 and 17

[4] See the web sites for each of the rating agencies for more detail on these concepts.

All of these measures will outperform the Basel II and III capital calculations as predictors of financial institutions failure. In part, this is the obvious result of the fact that the Basel process constrains the risk assessment to one financial ratio (or two or three in Basel III). The reduced form credit modeling approach (see Chapter 16) allows ANY financial ratio to be added as an explanatory variable, an unconstrained approach. If the Basel ratio has predictive power, the reduced form modeling approach can employ it along with all the other key explanatory variables like stock prices and macro-factors. The reduced form modeling approach to credit risk assessment cannot be outperformed by any single financial ratio, because that ratio can in turn be used as an input to the reduced form approach.

For that reason, efficient use of all available market-based credit information is the key to success in assessing the safety and soundness of financial institutions world-wide.

We plunge into that task in detail in the next three chapters. Before that, however, we warn the reader of the dangers of taking credit default swap quotes at face value as "observable market prices."

Credit Default Swaps: The Dangers of Market Manipulation

Financial market participants are often trained to leap into number crunching without questioning the integrity of financial market data that is visible on a computer screen. This tendency can and has been exploited ruthlessly by market participants who have the ability to artificially move the numbers on the screen. The most primitive example is the allegations of Libor manipulation that we discuss in Chapter 17 on the credit spreads of risky debt issuers. In the remainder of this chapter, we discuss potential manipulation of credit default swap spreads by the suppression of competition and control of price dissemination. We applaud the efforts of governments and financial exchanges around the world to combat these anti-competitive practices.

In the rest of this chapter, we look at weekly credit default swap data since the week ended July 16, 2010 to measure how much of existing single name CDS trading is the exchange of positions among a small group of dealers and how much is true "end user" trading. We analyze data from the Depository Trust and Clearing Corporation and made available from www.dtcc.com.

We are interested in how much of the "live trades" in the CDS trade warehouse maintained by DTCC represents transactions between two dealers and how much involve non-dealer end users on at least one side of the trade. The DTCC trade warehouse explanation above does not identify the dealers supplying data to DTCC at the current time. On June 2, 2010, however, DTCC listed the 14 "families" of contributing dealers as follows:

- Bank of America Merrill Lynch
- Barclays
- BNP Paribas
- Citibank
- Credit Suisse
- Deutsche Bank
- Goldman Sachs
- HSBC
- JPMorgan
- Morgan Stanley
- Nomura

- Royal Bank of Scotland
- UBS
- UniCredit

We presume the list of contributing dealers is somewhat longer than it was in 2010, but it is not clear that the highly concentrated nature of CDS trading has changed during that time interval. We analyze that issue below.

The table below is released weekly by the DTCC. It lists the number of contracts and notional values that are still "live" in the trade warehouse at that time. DTCC is careful to note that the data may not be complete if the inclusion of a particular trade would identify the parties to the transaction. We report here the composition of trades by four categories of "seller buyer" combinations in the trading of single name credit default swaps:

Combination of Seller and Buyer	**Seller**	**Buyer**
Dealer Dealer	Dealer	Dealer
Dealer Non-dealer	Dealer	Non-Dealer
Non-dealer Dealer	Non-dealer	Dealer
Non-dealer Non-dealer	Non-dealer	Non-dealer

Based on the number of trades reported by DTCC, the breakdown among these four buyer-seller combinations are as follows:

Dealer and Non-Dealer Single Name Transactions Outstanding in DTCC CDS Warehouse
Source: Kamakura Corporation and DTCC

Week Ended	Number of Contracts by Seller/Buyer Combination						
	Dealer Dealer	Dealer Non-Dealer	Non-Dealer Dealer	Non-Dealer Non-Dealer	Subtotal	Reported Total	Differential
20100716	1,780,463	182,384	150,791	2,795	2,116,433	2,116,433	0
20100723	1,780,076	185,012	153,225	2,795	2,121,108	2,121,108	0
20100730	1,782,563	186,941	155,006	2,755	2,127,265	2,127,265	0
20100806	1,787,765	188,671	157,025	2,743	2,136,204	2,136,204	0
20100813	1,782,549	192,840	160,952	2,747	2,139,088	2,139,088	0
20100820	1,779,499	194,426	162,957	2,760	2,139,642	2,139,642	0
20100827	1,772,297	196,213	165,346	2,764	2,136,620	2,136,620	0
20100903	1,831,602	198,254	167,417	2,771	2,200,044	2,200,044	0
20100910	1,847,971	199,310	168,649	2,786	2,218,716	2,218,716	0
20100917	1,860,287	198,839	168,728	2,775	2,230,629	2,230,629	0
20100924	1,801,130	195,451	166,213	2,660	2,165,454	2,165,454	0
20101001	1,802,108	196,497	167,436	2,655	2,168,696	2,168,696	0
20101008	1,811,610	197,018	169,094	2,661	2,180,383	2,180,383	0
20101015	1,808,791	198,179	171,116	2,662	2,180,748	2,180,748	0
20101022	1,841,753	199,019	173,292	2,677	2,216,741	2,216,741	0
20101029	1,837,673	199,810	174,510	2,643	2,214,636	2,214,636	0
20101105	1,825,202	201,591	176,823	2,649	2,206,265	2,206,265	0
20101112	1,808,864	202,721	177,462	2,644	2,191,691	2,191,691	0
20101119	1,784,575	204,428	178,984	2,632	2,170,619	2,170,619	0
20101126	1,770,485	204,364	178,211	2,629	2,155,689	2,155,689	0
20101203	1,766,147	204,963	178,725	2,650	2,152,485	2,152,485	0
20101210	1,769,277	205,987	179,788	2,646	2,157,698	2,157,698	0
20101217	1,767,108	205,634	180,193	2,654	2,155,589	2,155,589	0
20101224	1,704,570	201,612	175,678	2,562	2,084,422	2,084,422	0
20101231	1,701,714	201,191	175,291	2,563	2,080,759	2,080,759	0
20110107	1,843,074	131,034	106,671	2,567	2,083,346	2,083,346	0
20110114	1,848,471	131,801	108,391	2,586	2,091,249	2,091,249	0
20110121	1,850,185	131,923	109,154	2,604	2,093,866	2,093,866	0
20110128	1,707,914	204,737	181,179	2,628	2,096,458	2,096,458	0
20110204	1,713,247	206,161	183,531	2,628	2,105,567	2,105,567	0
20110211	1,719,386	206,554	185,363	2,626	2,113,929	2,113,929	0
20110218	1,715,585	207,507	186,799	2,632	2,112,523	2,112,523	0
20110225	1,718,783	208,780	187,808	2,638	2,118,009	2,118,009	0
20110304	1,724,481	209,898	189,062	2,605	2,126,046	2,126,046	0
20110311	1,719,551	211,080	190,595	2,620	2,123,846	2,123,846	0
20110318	1,729,472	210,623	191,208	2,615	2,133,918	2,133,918	0
20110325	1,696,420	206,646	187,273	2,504	2,092,843	2,092,843	0
20110401	1,701,147	209,337	189,958	2,516	2,102,958	2,102,958	0
20110408	1,698,877	210,121	191,680	2,558	2,103,236	2,103,236	0
20110415	1,691,980	214,881	196,208	2,607	2,105,676	2,105,676	0
20110422	1,767,950	215,877	197,448	2,613	2,183,888	2,183,888	0
20110429	1,768,403	216,455	199,153	2,635	2,186,646	2,186,646	0
20110506	1,767,951	221,487	204,053	2,668	2,196,159	2,196,159	0
20110513	1,775,603	221,418	204,421	2,677	2,204,119	2,204,119	0
20110520	1,776,098	222,736	206,106	2,702	2,207,642	2,207,642	0
20110527	1,776,285	223,582	206,802	2,709	2,209,378	2,209,378	0
20110603	1,777,392	224,485	207,867	2,714	2,212,458	2,212,458	0
20110610	1,781,903	225,460	208,261	2,717	2,218,341	2,218,341	0
20110617	1,795,267	224,688	208,761	2,710	2,231,426	2,231,426	0
20110624	1,734,126	222,474	206,059	2,607	2,165,266	2,165,266	0
20110701	1,737,889	219,851	204,321	2,610	2,164,671	2,164,671	0
20110708	1,733,924	216,168	201,352	2,606	2,154,050	2,154,050	0
20110715	1,741,867	218,505	203,424	2,609	2,166,405	2,166,405	0
20110722	1,743,470	220,040	204,686	2,619	2,170,815	2,170,815	0
20110729	1,747,442	220,074	203,771	2,631	2,173,918	2,173,918	0
20110805	1,748,126	219,130	204,122	2,634	2,174,012	2,174,012	0
20110812	1,757,042	219,698	206,192	2,643	2,185,575	2,185,575	0
20110819	1,747,003	221,249	207,548	2,666	2,178,466	2,178,466	0
20110826	1,722,290	222,923	208,693	2,685	2,156,591	2,156,591	0
20110902	1,727,885	223,004	208,856	2,693	2,162,438	2,162,438	0
20110909	1,731,784	221,123	206,972	2,658	2,162,537	2,162,537	0
20110916	1,743,133	220,175	207,120	2,659	2,173,087	2,173,087	0
20110923	1,716,596	212,569	200,507	2,550	2,132,222	2,132,222	0
20110930	1,727,811	213,012	200,692	2,559	2,144,074	2,144,074	0
20111007	1,732,673	212,648	202,830	2,555	2,150,706	2,150,706	0
20111014	1,735,075	211,921	202,804	2,555	2,152,355	2,152,355	0
20111021	1,739,757	211,990	202,523	2,553	2,156,823	2,156,823	0
20111028	1,742,992	210,870	201,771	2,553	2,158,186	2,158,186	0
20111104	1,746,669	210,765	200,437	2,540	2,160,411	2,160,411	0
20111111	1,741,147	212,293	201,296	2,556	2,157,292	2,157,292	0
20111118	1,744,612	214,899	203,250	2,569	2,165,330	2,165,330	0
20111125	1,754,536	216,581	203,995	2,587	2,177,699	2,177,699	0
20111202	1,758,625	216,953	203,838	2,597	2,182,013	2,182,013	0
20111209	1,742,749	217,496	203,376	2,605	2,166,226	2,166,226	0
20111216	1,747,392	215,732	202,668	2,562	2,168,354	2,168,354	0

In percentage terms, the dealer-dealer share of single name CDS contracts traded has ranged from 79.86% to 88.47% with an average of 81.68%. Trades between non-dealer parties were only 0.12% of total trades on average. The results are similar if one looks at the dealer-dealer share of trades by notional principal. Dealer-dealer trades ranged from 73.40% to 88.36% of the total, with an average of 76.28%. Trades involving two non-dealers were only 0.16% of total notional principal traded. There is anecdotal evidence that the dealer-dealer share of total trades is over-stated by hedge funds which execute CDS trades via a CDS dealer in "prime broker" role, but we have no alternative, until the DTCC makes more open disclosure, but to use the DTCC definitions.

Well-intentioned academics and journalists, plus many politicians, well-intentioned or not, discuss trading levels on single name credit default swaps as if such numbers were gifts from heaven itself. Instead, we see that roughly 76-82% of all single name credit default swaps are trades between Bill Smith at Goldman Sachs and John Smith at JPMorgan or other dealer firms. As a sophisticated observer of financial markets, should an investor take these traded prices as meaningful information on the credit worthiness of the underlying reference name? Is it safe to assume that Bill Smith and John Smith do not talk to each other?

Let's look at examples from other markets in which the same dealer firms have participated for many decades:

1. London interbank offered rate market. This lawsuit by Charles Schwab, which we discuss in more detail in Chapter 17, accuses 12 firms of colluding to manipulate libor. Nine of the 12 firms are also dealers listed by DTCC in single name credit default swaps:

   http://www.lieffcabraser.com/media/pnc/4/media.904.pdf

2. Municipal bond market. This recent article on Reuters summarizes the repeated legal violations stemming from collusion in the market for municipal bonds in the United States. 6 of the 8 firms named are also dealers in single name CDS that were listed by DTCC in 2010:

   http://blogs.reuters.com/muniland/2012/01/03/munilands-serial-offenders/

Given that the majority of dealers listed by DTCC in single name credit default swaps are, in the words of the Reuters article, "serial offenders," a sophisticated observer should assume that both traded CDS spreads and quoted spreads are highly likely to have been affected by collusion. Credit risk modelers who use manipulated CDS spreads as inputs to their models will find their fate determined by the CDS dealers posting these CDS quotes.

We now analyze CDS trading volume for the 1,090 reference names for which CDS trades were reported by DTCC during the 77 week period from July 16, 2010 to December 30, 2011. The weekly trade information is from the Section IV reports from DTCC. The data is described this way in the DTCC document "Explanation of Trade Information Warehouse Data" (May, 2011):

> "Section IV (Weekly Transaction Activity) provides weekly activity where market participants were engaging in market risk transfer activity. The transaction types include new trades between two parties, a termination of an existing transaction, or the assignment of an existing transaction to a third party. Section IV excludes transactions which did not result in a change in the market risk position of the market participants, and are not market activity. For example,

central counterparty clearing, and portfolio compression both terminate existing transactions and re-book new transactions or amend existing transactions. These transactions still maintain the same risk profile and consequently are not included as 'market risk transfer activity.'"

Our emphasis is not on gross trading volume. As mentioned above, dealer-dealer volume is 81.68% in the single name credit default swap market and it would be nearly costless for dealers to inflate gross trading volume by trading among themselves. Instead, we focus on "end user" trading where at least one of the parties to a trade is not a dealer. Accordingly, we make the following adjustments to the weekly number of trades reported by DTCC for each reference name:

1. We divide each weekly number of trades by 5 to convert volume to an average daily volume for that week
2. From that gross daily average number of trades, we classify 81.68% of trades as "dealer-dealer" trades, using the average "dealer-dealer" share of trades in the DTCC trade warehouse during the 77 week period studied.
3. The remaining 18.32% is classified as daily average "non-dealer" volume, the focus of the reporting below.

Daily Non-Dealer Trading Volume for 1,090 Reference Names

Before reporting on the 1,090 reference names in the DTCC warehouse, it is important to note a very important fact. Kamakura Risk Information Services' default probability service produces daily default probabilities on 30,764 public firms around the world, including 5,222 in the United States. The DTCC weekly reports were designed to report the top 1,000 reference names ranked by daily trading volume. In none of the 77 weeks, however, were there as many as 1,000 reference names reported by DTCC. In essence, the weekly reports contain every reference name in which there was non-dealer trading volume in the DTCC. For all other reference names, then, trading volume was zero. This means that more than 29,600 of the public firms in KRIS had zero credit default swap trading volume over the entire 77 week period studied. We now turn to the 1,090 reference names for which there was at least 1 credit default swap trade during the 77 week period.

We first analyzed daily average non-dealer CDS trading volume by calculating the daily average, as described above, for all 1,090 reference names for the entire 77 week period. The distribution of the reference names by non-dealer daily average trading volume contains some very surprising results:

Kamakura Corporation
Distribution of Average Non-Dealer
Single Name CDS Trades Per Day for 1090 Reference Names
From Week Ended July 16, 2010 to December 30, 2011
Source: Kamakura Corporation and DTCC

Number of Contracts				
Minimum Trades per Day	Maximum Trades per Day	Number of Reference Names	Percent of All Reference Names	Cumulative Percent of All Reference Names
0.00	0.25	332	30.5%	30.5%
0.25	0.50	211	19.4%	49.8%
0.50	0.75	174	16.0%	65.8%
0.75	1.00	114	10.5%	76.2%
1.00	2.00	189	17.3%	93.6%
2.00	3.00	47	4.3%	97.9%
3.00	4.00	12	1.1%	99.0%
4.00	5.00	6	0.6%	99.5%
5.00	6.00	0	0.0%	99.5%
6.00	7.00	2	0.2%	99.7%
7.00	8.00	0	0.0%	99.7%
8.00	9.00	0	0.0%	99.7%
9.00	10.00	2	0.2%	99.9%
10.00	11.00	0	0.0%	99.9%
11.00	12.00	1	0.1%	100.0%
12.00	13.00	0	0.0%	100.0%
13.00	14.00	0	0.0%	100.0%
14.00		0	0.0%	100.0%
Total		1090	100.0%	

Among the surprising conclusions are these facts:

- 76.2% of the reference names had 1 or fewer non-dealer contracts traded per day.
- 93.6% of reference names had 2 or fewer non-dealer contracts traded per day.
- 99.0% of reference names had 4 or fewer non-dealer contracts traded per day.
- Only 5 reference names averaged more than 5 non-dealer contracts traded per day.
- Only 1 reference name averaged more than 10 non-dealer contracts traded per day.

These trading volumes are miniscule to say the least, and it is astonishing that financial journalists have not made the appropriate disclaimers when quoting “CDS prices” (many of which are quotes, not trades) for specific reference names.

In order to better understand the data, we next analyzed each week of data for all 1,090 reference names. In aggregate, there should be 77 x 1,090 = 83,930 “reference name-weeks” of data reported, but there was no data reported on 14,632 occasions because there were no trades in that week for that reference name. Dividing these 14,632 observations by 1,090 reference names shows that, on average over the 77 week period, there were 13 weeks for each reference name in which there were zero CDS trades. The daily average non-dealer trade volumes for these 83,930 observations have the following distribution:

Kamakura Corporation
Distribution of Non-Dealer Weekly Average
Single Name CDS Trades Per Day for All Reference Names and All Weeks
From Week Ended July 16, 2010 to December 30, 2011
Source: Kamakura Corporation and DTCC

Number of Contracts				
Minimum Trades per Day	**Maximum Trades per Day**	**Number of Observations**	**Percent of All Observations**	**Cumulative Percent of All Observations**
0	0	14,632	17.4%	17.43%
0.01	0.25	22,427	26.7%	44.15%
0.25	0.5	13,679	16.3%	60.45%
0.5	0.75	8,480	10.1%	70.56%
0.75	1	5,813	6.9%	77.48%
1	2	11,046	13.2%	90.64%
2	3	4,112	4.9%	95.54%
3	4	1,782	2.1%	97.67%
4	5	853	1.0%	98.68%
5	6	412	0.5%	99.17%
6	7	245	0.3%	99.47%
7	8	133	0.2%	99.62%
8	9	71	0.1%	99.71%
9	10	58	0.1%	99.78%
10	11	34	0.0%	99.82%
11	12	30	0.0%	99.85%
12	13	20	0.0%	99.88%
13	14	25	0.0%	99.91%
14	15	14	0.0%	99.92%
15	16	8	0.0%	99.93%
16	17	4	0.0%	99.94%
17	18	7	0.0%	99.95%
18	19	8	0.0%	99.96%
19	20	6	0.0%	99.96%
20	21	9	0.0%	99.97%
21	22	6	0.0%	99.98%
22	23	0	0.0%	99.98%
23	24	0	0.0%	99.98%
24	25	2	0.0%	99.98%
25	26	1	0.0%	99.98%
26	27	1	0.0%	99.99%
27	28	2	0.0%	99.99%
28	29	1	0.0%	99.99%
29	30	1	0.0%	99.99%
30	31	1	0.0%	99.99%
31	32	2	0.0%	99.99%
32	33	1	0.0%	100.00%
33	34	0	0.0%	100.00%
34	35	1	0.0%	100.00%
35	36	0	0.0%	100.00%
36	37	1	0.0%	100.00%
37	38	0	0.0%	100.00%
38	39	0	0.0%	100.00%
39	40	1	0.0%	100.00%
40	41	0	0.0%	100.00%
41	42	0	0.0%	100.00%
42	43	0	0.0%	100.00%
43	44	0	0.0%	100.00%
44	45	0	0.0%	100.00%
45	46	0	0.0%	100.00%
46	47	1	0.0%	100.00%
47		0	0.0%	100.00%
Total		83,930	100.0%	

Again, this analysis allows us to draw some more surprising conclusions about all weekly trading in single name CDS for all 1,090 reference names, a total of 83,930 observations:

- 17.43% of the observations showed zero non-dealer daily average CDS trading

- 77.48% of the observations showed less than 1 daily average non-dealer CDS contract traded
- 90.64% of the observations showed less than 2 daily average non-dealer CDS contracts traded
- 99.17% of the observations showed less than 6 daily average non-dealer CDS contracts traded
- There were only 10 observations of the 83,930 where more than 28 daily average non-dealer CDS contracts traded

We now turn to the trading volume of single name credit default swaps for major financial institutions.

On December 28, 2011, Prof. Scott Richard published an article in the *Financial Times* advocating the use of credit default swap spreads in setting of deposit insurance rates. This section explains why such an idea, attractive in theory, would be extremely dangerous in practice. Prof. Richardson argued in his article "A Market-Based Plan to Regulate Banks" that the credit default swap market should be used to price deposit insurance. He states, "How can the FDIC determine the correct price for its insurance? The answer is to use the large and active market in bank insurance via credit default swaps."

Unfortunately, there are several very practical reasons why the credit default swap market cannot be used as Prof. Richard suggests.

1. There is no "large and active market" in bank credit default swaps. Using data reported by Depository Trust & Clearing Corporation, during the 77 weeks ending December 30, 2011, there were credit default swaps traded on only 13 reference names among U.S. banking firms:

   ALLY FINANCIAL INC.

   AMERICAN EXPRESS COMPANY

   BANK OF AMERICA CORPORATION

   CAPITAL ONE BANK (USA), NATIONAL ASSOCIATION

   CAPITAL ONE FINANCIAL CORPORATION

   CITIGROUP INC.

   CITIGROUP JAPAN HOLDINGS CORP.

   ISTAR FINANCIAL INC.

   JPMORGAN CHASE & CO.

   METLIFE, INC.

   MORGAN STANLEY

   THE GOLDMAN SACHS GROUP, INC.

   WELLS FARGO & COMPANY

   These 13 reference names represent 11 consolidated corporations, four of which would not be considered banking firms by most observers prior to the recent credit crisis (American Express, Goldman Sachs, MetLife, and Morgan Stanley). During the 77 weeks of data on all live trades in the DTCC credit default swap trade warehouse, there were no other trades on any other of the 6,453 banks insured by the FDIC in the United States as of March 31, 2011.

2. Even on the firms listed above, there was an average of only 2.3 non-dealer credit default swap trades per day during the 77 weeks ended December 30, 2011. None of the banks listed above averaged more than 5 non-dealer trades per day over the 77 week period studied.

3. Six of the 11 firms listed are in a conflict of interest position as major dealers in the credit default swap market: Bank of America, Citigroup, JPMorgan Chase, Morgan Stanley, Goldman Sachs, and Wells Fargo. Dealer-dealer trades made up 81.68% of live trades in the DTCC over the 77 week period studied. The dealers would be setting deposit insurance rates for themselves if Prof. Richard's proposals were adopted.

4. Credit default swaps, to the extent they trade, represent supply, demand, probability of default and the probability of rescue, not the probability of failure alone. Our September 29, 2009 blog on www.kamakuraco.com "Comparing Default Probabilities and Credit Default Swap Quotes: Insights from the Examples of FNMA and Citigroup" showed how credit default swap quotes for both firms were far below their probability of failure because senior debt holders correctly anticipated that the depositors of Citibank and the senior debt holders of Citigroup and FNMA would be rescued by the U.S. government. This rendered the credit default swap spreads on both failing firms severe underestimates of their probability of failure.

5. Because of the thinness of non-dealer trading and the very small number of dealing firms world-wide, there is high risk of collusion. Indeed, on April 29, 2011 the European Union launched an investigation of possible collusion among dealers in the credit default swap market.

For these reasons, Prof. Richard's proposal to use credit default swaps to price deposit insurance would not work given current market conditions and the lack of competition in the market for credit default swaps.

Credit Default Swap Trading Volume in Municipals and Sub-Sovereigns

We now look at weekly credit default swap trading volume for sub-sovereigns and municipals among those 1,090 reference names. We find, unfortunately, that (in the words of Gertrude Stein) "there is no there there."

Of the 1,090 reference names for which DTCC reported credit default swap trades in the 77 week period, only 9 were sub-sovereigns of any type:

HONG KONG SPECIAL ADMINISTRATIVE REGION

STATE OF CALIFORNIA

STATE OF FLORIDA

STATE OF ILLINOIS

STATE OF NEW JERSEY

STATE OF NEW YORK

STATE OF TEXAS

THE CITY OF NEW YORK

THE COMMONWEALTH OF MASSACHUSETTS

Eight of the 9 reference names were in the United States and 7 of the 9 reference names were U.S. states. The only cities on which credit default swaps had any trades in the 77 weeks ended December 30, 2011 were the City of New York and Hong Kong. We can summarize the trading volume in these 9 reference names as follows:

- There were 9 x 77 = 693 weekly observations, but there were only 309 weeks in which trades were reported. That means in 55.4% of the 77 weeks, on average, there would be no trades on these 9 reference names.
- The average number of non-dealer trades per day on all 9 reference names over the 77 week period was 0.11 trades per day.
- The median number of non-dealer trades per day over the 77 week period among the 9 reference names was 0.06 trades per day.
- The highest average number of non-dealer trades per day for the full 77 week period among the 9 reference names was 0.36 trades per day.
- The lowest average number of non-dealer trades per day for the full 77 week period among the 9 reference names was 0.00 (rounding to two decimal places).
- The highest number of gross trades in one week was 84, which is the equivalent of 16.8 gross trades per day and 3.1 non-dealer trades per day.

The obvious conclusion is that there is minimal trading volume in credit default swaps on sub-sovereign and municipal reference names and that any pricing indications should be regarded with a high degree of skepticism.

Credit Default Swap Trading Volume in Sovereign Credits

We now turn to weekly credit default swap trading volume for sovereigns among those 1,090 reference names. We find that, in a small subset of sovereign names, there is regular trading, but in modest volume.

Of the 1,090 reference names for which DTCC reported credit default swap trades in the 77 week period, only 57 were sovereigns:

ABU DHABI

ARAB REPUBLIC OF EGYPT

ARGENTINE REPUBLIC

BOLIVARIAN REPUBLIC OF VENEZUELA

COMMONWEALTH OF AUSTRALIA

CZECH REPUBLIC

DUBAI

FEDERAL REPUBLIC OF GERMANY

FEDERATIVE REPUBLIC OF BRAZIL

FRENCH REPUBLIC

HELLENIC REPUBLIC

IRELAND

JAPAN

KINGDOM OF BELGIUM

KINGDOM OF DENMARK

KINGDOM OF NORWAY

KINGDOM OF SAUDI ARABIA

KINGDOM OF SPAIN

KINGDOM OF SWEDEN

KINGDOM OF THAILAND

KINGDOM OF THE NETHERLANDS

LEBANESE REPUBLIC

MALAYSIA

NEW ZEALAND

PEOPLE'S REPUBLIC OF CHINA

PORTUGUESE REPUBLIC

REPUBLIC OF AUSTRIA

REPUBLIC OF BULGARIA

REPUBLIC OF CHILE

REPUBLIC OF COLOMBIA

REPUBLIC OF CROATIA

REPUBLIC OF ESTONIA

REPUBLIC OF FINLAND

REPUBLIC OF HUNGARY

REPUBLIC OF ICELAND

REPUBLIC OF INDONESIA

REPUBLIC OF ITALY

REPUBLIC OF KAZAKHSTAN

REPUBLIC OF KOREA

REPUBLIC OF LATVIA

REPUBLIC OF LITHUANIA

REPUBLIC OF PANAMA

REPUBLIC OF PERU

REPUBLIC OF POLAND

REPUBLIC OF SLOVENIA

REPUBLIC OF SOUTH AFRICA

REPUBLIC OF THE PHILIPPINES

REPUBLIC OF TURKEY

ROMANIA

RUSSIAN FEDERATION

SLOVAK REPUBLIC

SOCIALIST REPUBLIC OF VIETNAM

STATE OF ISRAEL

STATE OF QATAR

UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND

UNITED MEXICAN STATES

UNITED STATES OF AMERICA

No credit default swap trades were reported in the 77 weeks ending December 30, 2011 for any other sovereign credit.

We first analyze the 77 week averages for the 57 sovereigns for which CDS trading volume was greater than zero during the 77 weeks ending December 31, 2011. The daily average non-dealer trading volume, calculated as described above, was distributed as follows:

Kamakura Corporation
Distribution of Average Non-Dealer
Single Name CDS Trades Per Day for 57 Sovereigns
From Week Ended July 16, 2010 to December 30, 2011
Source: Kamakura Corporation and DTCC

Number of Contracts				
Minimum Trades per Day	Maximum Trades per Day	Number of Reference Names	Percent of All Reference Names	Cumulative Percent of All Reference Names
0.00	0.25	10	17.5%	17.5%
0.25	0.50	7	12.3%	29.8%
0.50	0.75	6	10.5%	40.4%
0.75	1.00	7	12.3%	52.6%
1.00	2.00	5	8.8%	61.4%
2.00	3.00	6	10.5%	71.9%
3.00	4.00	7	12.3%	84.2%
4.00	5.00	5	8.8%	93.0%
5.00	6.00	0	0.0%	93.0%
6.00	7.00	1	1.8%	94.7%
7.00	8.00	0	0.0%	94.7%
8.00	9.00	0	0.0%	94.7%
9.00	10.00	2	3.5%	98.2%
10.00	11.00	0	0.0%	98.2%
11.00	12.00	1	1.8%	100.0%
12.00	13.00	0	0.0%	100.0%
13.00	14.00	0	0.0%	100.0%
14.00		0	0.0%	100.0%
Total		57	100.0%	

The conclusions that can be drawn from this table are summarized here:

- 52.6% of the 57 sovereigns averaged less than one non-dealer CDS trade per day
- 93.0% of the 57 sovereigns averaged less than five non-dealer CDS trades per day
- The remaining 4 sovereigns had the highest levels of non-dealer CDS trades per day of the 1,090 reference names reported by DTCC, but those figures were only 11.28, 9.52, 9.32, and 6.61 trades per day. The sovereigns with the 3 highest average number of non-dealer trades per day were all members of the European Union.
- The average 77 week daily average number of non-dealer trades per day for the 57 sovereigns was 2.08 trades per day
- The median 77 week daily average number of non-dealer trades per day was 0.92 trades per day
- The United States of America 77 week average non-dealer trades per day was approximately equal to the median (see disclosure restrictions imposed by DTCC below)

We conclude that trading volume for the most active sovereigns is higher than it is for the most active corporations, which is only logical given that such sovereigns issue more debt than the most active corporations. The correlation between trading volume and debt outstanding is weak, however, with the United States and Japan well down on the ranking of trade volume even though those two countries have the largest amount of debt outstanding.

We now analyze all 77 weeks of data, not just the average over that period, for all 57 sovereigns for which DTCC reported non-zero trade volume. There were 4,389 (= 57 x 77) observations on CDS trading volume for these 57 sovereigns, and there were no trades during 265 observations, 6% of the total. The distribution of non-dealer trades per day over these 4,389 observations is summarized in the following chart:

Kamakura Corporation
Distribution of Non-Dealer Weekly Average
Single Name CDS Trades Per Day for 57 Sovereigns and All Weeks
From Week Ended July 16, 2010 to December 30, 2011
Source: Kamakura Corporation and DTCC

Number of Contracts				
Minimum Trades per Day	Maximum Trades per Day	Number of Observations	Percent of All Observations	Cumulative Percent of All Observations
0	0	265	6.0%	6.04%
0.01	0.25	931	21.2%	27.25%
0.25	0.5	560	12.8%	40.01%
0.5	0.75	331	7.5%	47.55%
0.75	1	244	5.6%	53.11%
1	2	662	15.1%	68.19%
2	3	452	10.3%	78.49%
3	4	297	6.8%	85.26%
4	5	191	4.4%	89.61%
5	6	127	2.9%	92.50%
6	7	73	1.7%	94.17%
7	8	50	1.1%	95.31%
8	9	32	0.7%	96.04%
9	10	30	0.7%	96.72%
10	11	24	0.5%	97.27%
11	12	19	0.4%	97.70%
12	13	12	0.3%	97.97%
13	14	19	0.4%	98.41%
14	15	13	0.3%	98.70%
15	16	5	0.1%	98.82%
16	17	4	0.1%	98.91%
17	18	5	0.1%	99.02%
18	19	7	0.2%	99.18%
19	20	6	0.1%	99.32%
20	21	9	0.2%	99.52%
21	22	6	0.1%	99.66%
22	23	0	0.0%	99.66%
23	24	0	0.0%	99.66%
24	25	1	0.0%	99.68%
25	26	1	0.0%	99.70%
26	27	1	0.0%	99.73%
27	28	2	0.0%	99.77%
28	29	1	0.0%	99.79%
29	30	1	0.0%	99.82%
30	31	1	0.0%	99.84%
31	32	2	0.0%	99.89%
32	33	1	0.0%	99.91%
33	34	0	0.0%	99.91%
34	35	1	0.0%	99.93%
35	36	0	0.0%	99.93%
36	37	1	0.0%	99.95%
37	38	0	0.0%	99.95%
38	39	0	0.0%	99.95%
39	40	1	0.0%	99.98%
40	41	0	0.0%	99.98%
41	42	0	0.0%	99.98%
42	43	0	0.0%	99.98%
43	44	0	0.0%	99.98%
44	45	0	0.0%	99.98%
45	46	0	0.0%	99.98%
46	47	1	0.0%	100.00%
47		0	0.0%	100.00%
Total		4,389	100.0%	

One can draw the following conclusions over 4,389 weekly observations:

- 53.11% of the observations showed 1 non-dealer trade per day or less
- 92.5% of the observations showed 6 non-dealer trades per day or less

- 96.72% of the observations showed 10 non-dealer trades per day or less
- Only 0.32% of the observations were for more than 25 non-dealer trades per day
- The highest volume week featured 1,271 gross trades per week, 254.2 gross trades per day, and 46.6 average non-dealer trades per day.
- Just 10 sovereigns account for 52% of the total trading volume in credit default swaps over the 77 week period ending December 30, 2011.

Implications of CDS Trading Volume Data

Although, in theory, the credit default swap market should provide major price discovery benefits, trading is very thin and highly concentrated among a small number of dealers who are under investigation for manipulation of Libor and the U.S. municipal bond market. We conclude that use of CDS data in default modeling would make the modeler a potential accomplice in creating the appearance of legitimacy for a market that, at least at the present time, "not there."

For that reason, in the next chapter, we introduce state of the art credit models which use the much more transparent market for common stock as key market inputs. We turn to that task now.