# Global Credit Products –

# Volume and Market Share Reporting

## Major Qualifying Project

In participation with

*Bank of America – Merrill Lynch*

*and*

*WORCESTER POLYTECHNIC INSTITUTE*

On December 14$^{th}$, 2011

In Partial Fulfillment of the Requirements for the Degree of Bachelor of Science

Submitted By:

**Hui Cheng, MA**

**Lauren Moloney, MGE**

**Advisor: Justin Wang, School of Business**

**Co-advisor: Jon Abraham, Department of Mathematical Sciences**

**Sponsor: Ekaterina Ratcheva**

# Abstract

One of the main goals for Global Credit Trading is the ability to aggregate Cash and CDS data and store all daily transactions (trades and inquiries) sent electronically or over voice. In addition, volume has become more central to performance analysis. An accurate picture of voice vs. electronic volume, volume by client, volume by sales person, etc. is frequently requested and important to the overall evaluation of the trading desk.

The current process for volume and market share aggregation across the business is fragmented over many systems and run independently under different methodologies in all regions. In order to control and classify the trade data, the Credit Trading Strategists have requested the creation of internal trade history database. The goal of this project was to improve the manual procedure by providing data analysis on the current reporting system and proposed solutions to build centralized internal database to store both Cash and CDS data. In addition, business requirements derived by the trading strategy teams globally was used for analysis on the existing trading data to provide the ability to customize and organize the reports using a front end application developed in Quartz.

# Acknowledgements

## Authorship

The project work, written work, and development of recommendations for the Global Credit Products Volume and Market Share Reporting project were created by both team members, Lauren Moloney and Hui Cheng.

# Executive Summary

Bank of America – Merrill Lynch was formed in 2009 when Bank of America acquired Merrill Lynch as an investment branch of the organization. Within the bank, Global Credit Products includes Cash and CDS trades that are made from the trading desks in the US, EMEA, and Asia Pacific. The Global Credit Products division of Bank of America – Merrill Lynch currently experiences difficulty producing Volume and Market Share Reports that contain reliable information in a timely process.

Upper management, including the head of Global Credit Products trading, expresses the need for comprehensive Volume and Market Share Reports in order to both gain an accurate picture of performance as well as a way to gauge the risk associated with the this division of the bank. This need is becoming more prevalent now, since the recent financial crisis and the need for accurate risk reporting is at the forefront of the organization. In order to produce these reports, trading strategists are currently compiling the information from several different sources and producing the final reports through several different manual calculations and data exports.

The current reporting process is a timely one and cannot guarantee accurate views of the current volume and market share that the trading desks are producing. Because of this current system, the trading strategists have expressed the requirement for a streamlined reporting process that can compile all relevant trade data and produce reliable trading reports in a timely manner.

This project works towards aggregating all relevant trade data for both Cash and CDS trades occurring on a global level for the Global Credit Products division. In order to accomplish this goal, this project works through the analysis necessary to determine the correct data sources for Cash and CDS trade data, the data manipulation required to filter out data not needed for the Volume and Market Share Reports, and the possible solutions and recommendations for future improvement of the reporting process.

At the conclusion of this project's analysis, Bank of America – Merrill Lynch has been able to determine the data sources for a new global Cash and CDS database and the developers are in the process of building this database into tables for Cash and CDS. Furthermore, analysis of the logic required to filter and manipulate the data according to business needs has been completed. An finally, analysis on the possible solutions a user-interface for a database and future improvements to the database and reporting process have been documented.

This project aids in automating and streamlining the reporting process and thus solves the business need of aggregating trade data and producing reliable volume and market share reports. This will allow the business to understand both the performance and risk associated with the current trade standings.

# Chapter 1: Introduction

Bank of America- Merrill Lynch is the corporate and investment-banking division of Bank of America formed through the combination of Bank of America and Merrill Lynch investing activities and it currently faces the problem of reporting on its Cash and CDS global trade data. Bank of America – Merrill Lynch provides services in mergers and acquisitions, equity and debt capital markets, lending, trading, risk management, research, and liquidity and payments management. Being a leader in global credit market, it provides innovative financing solutions to clients all over the world. Its credit team, with which we are going to work for our project, provides liquidity and makes markets for a broad suite of credit products including: investment grade and high yield corporate bonds, short-term trading vehicles, credit defaults swaps and other derivative products.

The financial crisis of 2007 to 2010 led to calls for changes in the regulatory system. In 2010, the Dodd – Frank Wall Street Reform and Consumer Protection Act were assigned into law. This new regulation asks for comprehensive regulation of financial markets and increased transparency of derivatives including bringing them onto exchanges. One of the key changes related to this project's topic was the requirement for trading of CDS to be done on a Swap Execution Facility (SEF). The rationale and driver for the new change is to reduce counterparty risk in the system and provide greater transparency to the regulators. Under this law, swaps now need to be traded electronically and cleared by central clearing counterparties (CCP) that guarantee the swap in case either counterparty fails. Furthermore, this regulation calls for the ability to aggregate and store all daily transactions, trades and inquiries, sent both electronically and over voice. In addition, an accurate picture of voice vs. electronic volume, volume by client, and volume by sales person is frequently requested and important to the overall evaluation of the trading desk because volume has become central to performance analysis.

Confronting the new requirements, Bank of America – Merrill Lynch is now seeking a way to stay ahead of the regulations and manage associated risks more efficiently. More specifically one of the

main goals of its Global Credit Product (GCP) trading group is to be one of the leaders in electronic trading, where corporate cash bonds and credit defaults swaps (CDS) are the largest traded products by volume. In this case, conducting technological innovation within the bank by utilizing Q as strategic central database solution becomes an urgent task.

Bank of America- Merrill Lynch currently experiences difficulty accessing accurate daily transaction information. The challenge of transferring information stems from the complexity of the systems brought upon by the combination of multiple technologies during the merge of Bank of America and Merrill Lynch. More specifically, the process for risk valuation of the Investment and High Grade trading desks is currently split among different systems and processes. Multiple systems are involved in calculating daily volume for the trading desk. The complexity of existing infrastructure is causing numerous outages, inaccurate data due to human errors and large support efforts. The data is not consistently available, insufficient or at many times incomplete.

This project aims to address the current challenges Bank of America – Merrill Lynch faces in its E-trading reporting system through detailed analysis and evaluation of the company's reporting process. Based on the analysis from this project, the technology team will be able to build a central database for complete global cash (bonds) and CDS related trade data and a corresponding application built off business requirements which can be integrated into Q gradually.

# Chapter 2: Background

## Bank Background

Amadeo Giannini founded bank of America in 1928 when he merged the Bank of Italy with Bank of America out of Los Angeles. Giannini became known as "America's bank" and this philosophy still hold true today. Bank of America is the fifth largest American company according to the 2010 Fortune 500 rankings and has a major holding in the global banking market (Fortune).

Bank of America remains one of the predominate banks in the United States and continually expands through mergers and acquisitions in order to increase its global presence. One of the main acquisitions in the recent history of the bank occurred in 2009 with Merrill Lynch. This was a strategic move on the part of Bank of America because of the added global offerings in retail brokerage and wealth management (Heritage). Merrill Lynch

With the acquisition of Merrill Lynch, Bank of America faces challenges both with the settlement arrangements and technical and human logistics. The technical integration of the two corporations reporting standards and information processes is still being worked on within the bank.

This project focuses in one division within Bank of America – Merrill Lynch and that is the Global Credit Products, or GCP, division. The Global Credit Products division covers the Cash and CDS trades for the US, the EMEA, and the Asian trade desks. In order to work through this division of the bank, obtaining global solutions for the future is imperative to the success of the Bank.

## E-Trading

The growing trend in investment is moving to electronic trading. This is growing because of customer preference and also government requirements for Credit Default Swaps to be traded on a Swap Execution Facility (Global). Electronic Trading allows buyers and sellers to come together more efficiently and exchange more accurate information. E-trading creates current and future conflicts within

the investment banks. Credit Suisse started an innovative technology to aid in the tracking and reporting of e-trades called Credit Suisse PLUS (Credit Suisse).

Bank of America faces some of its individual challenges associated with e-trading. There are multiple platforms that the data that enter the investment floor is read in different formats. This problem has been brought upon through the acquisition of Merrill Lynch investment and also the rapid growth in the e-trading market (Global). The multiple systems in use causes further difficulties in evaluating the market and sales of customers and traders. In order to meet future requirements and understand the current market, it is essential that Bank of America find the ability to efficiently analyze the e-trading data.

## CDS and Dodd Frank Act

Credit Default Swaps (CDSs) are bilateral contracts in which a buyer agrees to make a payment in exchange for a payment provided by the seller of the contract in the case of a credit event affecting the reference entity or a portfolio of reference entities. It has been largely traded over-the-counter (OTC) since its birth in the middle of the 1990s. The CDS market has been rapidly increasing in gross market value, from USD 133 billion in December 2004 to USD 5.7 trillion in December 2008.

As European Central Bank *(Credit Default Swaps and Counterparty Risk,* European Central Bank*, 2009)* analyzes, one of the factors that contributes to this growth is the OTC nature of CDS contracts, as offsetting trades are often used instead of termination or replacement of former contracts. A chain of linked exposures arises, in which market participants know their direct counterparties but not the parties further down the chain. The market remains highly concentrated in a small group of dealers and is highly interconnected because of the nature of the CDS market. Dealers are tied to each other through chains of OTC derivative contract and problems exist all along this chain associated with this market. Furthermore, concerns arise including; large concentrated pockets of counterparty risk within the financial system cannot be assessed using aggregate data, since the data available are not broken

down to the level of specific counterparts, the data from different sources are not in line; linking of the different reporting frameworks is expected, and public disclosure from the most active institutions, for instance, the total gross notional amounts and gross market values, still needs to be improved.

In addition, current concerns also include the potential conflicts of interest, given the role of the banks as hedge fund counterparties in conjunction with their traditional role in a lending/credit function, legal risks, insider trading and the challenges associated with modeling and hedging the more complex of the credit derivatives (*Credit Derivatives, Macro Risks, and Systemic Risks*, Tim Weithers, Economic Review-Federal Reserve Bank of Atlanta, Fourth Quarter 2007).

As the late-2000s financial crisis revealed the devastating power of CDS, the Dodd-Frank Act was enacted by the United States. This act emphasizes the transparency and accountability to the derivative market, asking for elimination of regulatory gaps, central clearing and exchange trading, higher standard of conduct and financial safeguards, which ensure dealers and major swap participants to have adequate financial resources to meet responsibilities. Data collection and publication through clearing houses or swap repositories are required to improve the market transparency and provide regulators important tools for monitoring and responding to risks. (*Dodd-Frank Wall Street Reform and Consumer Protection Act,* 2011)

The realization of the necessity of a Central Counterparty (CCP) arises not only in the United States but also in European Union. Comparison between the markets with or without a CCP can be visualized as below:
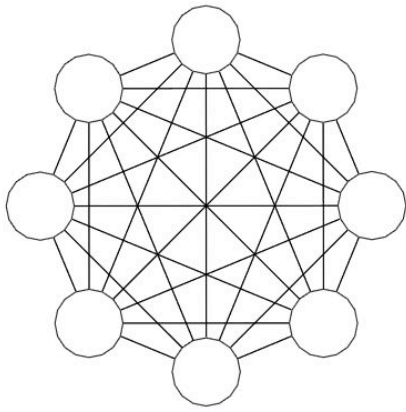
Figure 1: Bilateral Market—Too Interconnected to Fail
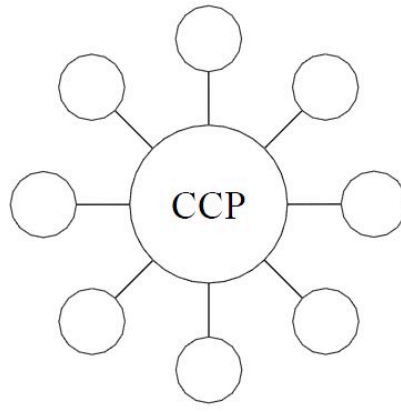
Figure 2: Central Counterparty Clearing

Without a CCP, the market gets too interconnected to the point that it poses a systemic risk and is too big to fail. The 2008 financial crisis revealed that a few financial institutions with large holdings of CDS portfolios could bring down counterparties and end up in a domino-like fall cascading through the financial market. A CCP, which offers advantages in customer segregation and portability, netting, independence and consistency of risk management, transparency, capital benefits and mutual fund, will effectively reduce the risk of the fail of the whole system (*Clearing Credit Default Swaps: A Case Study in Global Legal Convergence*, Anupam Chander and Randall Costa Chicago, Journal of International Law, Vol.10, No.639, 2010).

## Use of Technology

The use of technology within the banking industry is a key component of success for both trading and reporting. Technology supports the main business functions and aids in guaranteeing accuracy and efficiency. The importance of technology increases as reporting standards become more defined and the increased use of technology within the trading process.

Currently, Bank of America – Merrill Lynch uses many forms of technology within its reporting process. As e-trading becomes more relevant within the industry it is imperative for the bank to stay at the forefront of technology. Starting from the original trade, trades are booked either through the use of

an e-trading platform or over voice trading. The online platforms include the use of Bloomberg. Bloomberg is a trading platform that allows clients to book trade electronically with the use of an account and a Bloomberg identifier.

After the trade is booked, the trade data is stored in a database. It is through this project that the business was able to identify the databases that contain all the trade information for both Cash and CDS trades. However, prior to this project, the business was extracting the information from a multitude of different databases. These databases held the information in different formats. In order to extract the information from these databases, the analysts creating the reports would either have to query the databases or rely on the different platforms to supply the information.

The next step for the information in regards to reporting is to transform the original, raw trade data into a working format that consolidates the trade data and makes the format uniform. In order to accomplish this, logic must be applied to the data. Logic is the code that is written to manipulate the data into a way that can be used for reporting. The use of logic allows the business to aggregate the data and clean the data. For example, the data may have duplicate trades throughout the day if a change to the trade is made. The logic applied to this data would make this into one trade and track the changes throughout the day.

After understanding the technological system through which a trade is booked, this project also required an understanding of the technology used within the Global Credit Products trading group. Within the current reporting process, the use of excel data manipulation is widely used. Internal learning sessions allowed for further understanding of both Excel and Excel Macros. The Excel internal learning included the use of Vlookup, pivot tables, and being able to filter relevant information. The Vlookup assisted this project in being able to cross-check reports and data exports to ensure the data's integrity and highlight the missing fields or portfolios. The pivot tables are currently in the reporting process in order to generate the reports into a readable format. Finally, filtering information in excel is used to filter out business groups, portfolios, and ticket types that are not needed for the final report. Excel Macros is

used in the current reporting process as a temporary solution to automate the process. Excel Macros allows the user to record the different filters and data manipulations for one report and then repeat the process for other exports.

In addition to understanding the technology used in the current reporting system, this project required learning about the technology used in the future of the reporting system including Q and basic understanding of databases and queries. Q is the new internal technology currently under development within Bank of America – Merrill Lynch. It is going to replace the multiple systems currently in use within the bank and solve many of the problems that began to arise during the merger of Bank of America and Merrill Lynch. Q is an important aspect for this project because some of the possible front-end applications are built up from Q.

In order to understand Q fully, research and internal learning sessions were completed on databases. This learning centered on the use of databases and how information is stored. The internal learning sessions from Bank of America outlined the use of a SQL database and how this information can be extracted through the use of a user-interface. The user-interface allows users to interact with the information by both extracting the information and also manipulate the format of the data so that it can be used in a relevant format for business use.

## Current State of Reporting

Currently, Bank of America – Merrill Lynch Global Credit Product trading group experiences difficulty aggregating data in a way to stay both up to date and ahead of reporting standards called for both internally and externally. The financial crisis of 2007 to 2010 led to calls for changes in the regulatory system. One of the key changes experience internally at Bank of America – Merrill Lynch was to produce comprehensive volume and market share reports for the Global Credit Product trading groups.

A critical component in order to generate these reports is the ability to aggregate and store all daily transactions (trades and inquiries) including both electronic and voice trades. This system is currently a lengthy and manual process prone to both incomplete and misrepresented information. This is the result of multiple systems in use in the US and no clear, uniform standard for reporting on a global level.

Based on the current system, the trading strategists and business analysts expressed the need to consolidate all of this information into one global system. In doing so, the information will be complete and can be used both regionally and globally for reporting and adjusting risk. On a global level, the information will be streamlined and the same reporting standards will be held throughout all regions. This will allow Bank of America – Merrill Lynch to achieve its business goals of becoming an industry leader by founding new technology ventures and understanding both the risks and opportunities within this industry.

# Chapter 3: Business Requirements

The requirements expressed from the business side of Global Credit Products is to create a GCP owned volume and market share database for Cash Bond and CDS trade level data from the U.S., EMEA and Asia. Furthermore, the business requires the use of logic, or rules, to be applied to the data and then an interactive User Interface from which final reports can be generated. The data will be used to create a fully accurate picture of trading volumes for GCP and also provide several new and unique views into the business including electronic volume growth, inquiry tracking, and market share and client trends. The detailed business requirements are summarized into three main phases.

In order to successfully complete all three phases outlined as business requirements, the business is in need of detailed analysis for each phase. This project centered on the analysis process and through this analysis, the Phase I was able to be completed in its entirety by the ending of this project. This project also left Bank of America – Merrill Lynch with in-depth analysis for Phase II and Phase III and in addition to that generated multiple recommendations for future advisement. Prior to completing this analysis and recommendations, each phase was outlined and designed based on business needs:

## Phase I

Phase I of this project requires the business and development teams to get a full import of Cash data for all regions in a single table and CDS data in another table. In order to accomplish the goal of centralizing the global trade data, the first step is to determine the right sources of all Cash Bond and CDS data. Currently, there are many different internal and external sources containing different fields of the raw trade data. Through the analysis of single sources and the combination of original sources and database, Phase I analysis was able to yield the most comprehensive of the trade data to be used for the creation of the new database. After determining the sources of the trade data on a global level, one database is expected to store the data in two separate tables for further filtering steps. This database

could be one in existence or could be built specifically for these business requirements. Phase I is expected to be accomplished by the end of 2011.

In order to successfully complete Phase I the following tasks must be accomplished:

1. Determine the fields necessary for generating the final reports that need to be stored in the database.

2. Analyze and conclude the best sources of global trade data for use in the table and database.

3. Determine how much information needs to be stored in the database and how far back this information needs to be available for reporting purposes.

## Phase II

Phase II centers on the data manipulation once the trade data is in the database. In order to generate the final reports, certain business rules or filtering logic must be applied to the original trade data. Certain types of data need to be removed before further calculation. For instance, the existence of both a cancelled trade and master trade in the same trade data set results in reporting problems because these trades are counted as two separate trades if the filtering logic is not applied. Other data issues may also exist which requires detailed data analysis. The filtering requirements will be derived by the trading strategy team globally to make sure all the trade data collected is clean, or that presents all relevant trade data to the final reports and only this information. This should be applied after Phase I implementation and in order to work through all the data and filtering issue needed. Phase II is expected to be completed by the end of the first quarter of 2012.

In order to successfully complete Phase II the following tasks must be accomplished:

1. Analyze the current reporting needs in terms of fields, portfolios, and ticket types required for current reporting process.

2. Analyze the filtering and data manipulation logic in EMEA and Asia and determine if any of that logic can be leveraged for a global solution.

## Phase III

The end goal of Phase III is to develop a technical solution to build a Trade and Inquiry Reporting application. A user-interface, or UI, is required by the business for three reasons. The first is to allow the user to view data based on existing reports currently produced manually. The second is to configure views and pivots to easily view and organize the data. And finally, a user-friendly UI would allow for the export of daily/weekly/ monthly reports in different formats. Furthermore, the addition of a reporting UI, such as the one currently used in Q or other lines of business, can be applied to the data for ad hoc requests. Phase III is expected to be completed by the end of the second quarter of 2012.

In order to successfully complete Phase III, the following tasks must be accomplished:

1. Determine if other regional UI solutions are relevant and can be leveraged for this project.

    a. Analyze the use of UIs currently in production in other lines of business.

    b. Analyze a UI currently in use in Asia called Application T.

2. Determine the reports that are needed both on a regional and global level.

3. Determine other features that would aid in the reporting process.

# Chapter 4: Phase I Analysis

Phase I centered around gathering and analyzing data sources and mapping in order to compile a comprehensive analysis of the current system and determine the optimal sources from which to receive Cash and CDS data. This analysis will aid in the building of the database encompassing both Cash and CDS trade level data.

## Methodology

In order to accomplish the goals of compiling analysis and determining the sources for Cash and CDS trade level data, the first step was to gain an understanding of the current reporting system. After receiving the four final reports being generated both on daily and weekly basis, the analysis focused on working backwards through the reporting process. This analysis led to the creation of documents for each of the reports including data dictions, data mapping, and steps involved in generating final reports. Based on the analysis of the current reporting system, this phase of the analysis also worked towards determining the correct source of information for both Cash and CDS for tables in the new database. This built off of the analysis of the current reporting system in that each original source of trade data had to be evaluated. After the analysis was complete, meetings with Bank of America – Merrill Lynch Trading Strategist allowed for final recommendations and decisions to be made on the sourcing for the information in the new database.

## Analysis

### Current Reporting System

The first step in this project was to analyze the current reporting process through detailed analysis of the original trade data sources and the data manipulation involved in generating the final reports. In order to complete the analysis on the current reporting process, this project went through

three analysis steps: the building of data dictionaries, analysis of the current trade data, and mapping of the steps involved in the creation of current volume and market share reports.

### Data Dictionary

The first step involved in understanding the current reporting process was the creation of data dictionaries for each source of information and each final report. Each report now can be associated with its unique data dictionary with the designated fields necessary for that report. This project created six distinct data dictionaries. There were four steps involved in constructing one data dictionary:

Step 1: Determine the fields needed for the report or export

Step 2: Define each field name, or header

Step 3: Provide an example of a sample field

Step 4: Document comments or issues associated with each field.

An example of a complete data dictionary can be found in *Appendix* 2. The fields that were included in each of these data dictionaries included all of the fields present in the final reports currently generated and also the fields from the original trade data. The examples for each field were based off of direct exports of the files. The comments or issues documented included if the field appeared in the report twice or if the field name was used for two separate definitions. This analysis will be applied in the second Phase of this project when the filtering and data definition logic is applied to the original data. Based on the data fields, this analysis was able to recognize the fields in the original sources of the global trade data. These data dictionaries were put together with the help of Bank of America trading strategists to ensure the document's integrity.

### Data Analysis

The second step involved in the Phase I analysis consisted of a detailed analysis of the data sourcing. This included both an analysis of the actual sources as well as an analysis of the steps from the original trade data through to the end reports. This step closely analyzed where the original trade level

data was sourced from in order to generate the current reports. Furthermore, this step examined the data manipulation involved in this process.

In order to produce this analysis, this project worked with four final reports. The data analysis on these reports was based on both meetings with producers of the reports as well as business analysts closely related to the reporting process. The conclusion of this analysis documented all of the original sources of each data field, how the data was extracted from the original source, and what data manipulation was completed. By looking at one field in the final report, users would be able to know what database that information was coming from and the nature of that database. Users would also know how that data field is extracted from the database, usually through either an email sent out or through an excel file export. Finally, looking at this analysis documentation, the user would be able to track the data field through any data manipulations stemming from the original trade data to the final report. These data manipulations could include filtering, VLookups, Pivot Tables, and some go through manual calculations. In the current system all of this is done through excel and it is manually repeated with the generation of each report or has a macros function which can be applied.

### Data Mapping

The final step involved in producing analysis for Phase I was to map the data from the original data source through to the final reports or final charts. This was done throughout the Phase I analysis and aided in documenting the systems and platforms involved in report generation. The flow charts depict each step involved and start with the original trade data. From there, it documents what databases or platforms are involved in storing the data and how this information is exported from these sources so that it can be manipulated into the final reports. Finally, these flow charts show what excel files and, more specifically, what excel tabs are used to store and manipulate this data before the final report can be created. The steps involved in this process are further analyzed in this project's Phase III analysis.

## Findings

At the conclusion of the Phase I Analysis, there were several findings. These findings are outline below and were critical to the building of the recommendations at the conclusion of this project.

### Data Sourcing

Through the Phase I Analysis, the multitude of different sources used in creating the daily and weekly trade level reports in the current system were able to documented. These sources included Bloomberg, database E, Realm, CSAR, database O, and database C, which are a combination of both trading platforms and databases. Each source uses a different format for the data and the use of so many data sources was making the system both a lengthy and difficult process to extract and make sense of all the information available on the trades.

### Final Sources for Database

The end goal of Phase I in respect to the Business Requirements is to build up a database containing all trade information for CDS and Cash. The main finding for the Phase I Analysis was determining the sources to be used in the new database for both Cash and CDS. This will start with the creation of two separate tables and in order to produce these two tables. The analysis for determining these sources was separated into Cash and CDS.

### CDS Data Source

The CDS analysis started with an analysis for database E trade data. There were two steps involved in determining if this was the right source for the CDS Data. The first step was to create a data dictionary for an export of this data. The creation of the data dictionary for E followed the same steps involved in creating them throughout the Phase I Analysis. Each field from the export has a definition, an example of the field, and comments associated with the field. The second step was to filter the portfolios and the fields so that the database would contain the information necessary for the reports.

The filter included narrowing the information down to only the fields and portfolio names associated with Global Credit Products. From this analysis and meetings with Bank of America – Merrill Lynch Trading Strategists, it was determined that this was the correct source of information for the CDS data to be put into the database. At the conclusion of the Phase I Analysis, a Spec was built for the use of E in the new database.

### Cash Data Source

The Cash analysis was initiated with an analysis of a report generated from Database C and sourced from Bloomberg. For the C Report, this analysis created a data dictionary for the report and completed similar filter to the one done on the E trade data export. Additionally, the analysis of the C Report required mapping the portfolios found in the C Report to an export from Realm, which is an application associated with the internal R database. The mapping of these portfolios revealed that many of the portfolios needed for use in the final reports were not present in the C data that was received from the database C Representative. Because of the portfolio-mapping problem and the fact that the initial analysis revealed that C only supplied trade data for the US trading desks, the project looked into other possible sources for the Cash data to be sourced for the new database.

The next source analyzed for the Cash Data was the A File. This file is sourced from Bloomberg. With just initial analysis on this file, there arose two problems with the implementation of this file into the database. The first problem was that the information contained in this file is for US data only. The second problem with the file is that it contains positional level data rather than trade level data. This is a problem when it comes to the reporting process because the positional level data will not show all trade actions and statuses.

After ruling out the use of the A File, another file was presented as a possible source. This file is also a Bloomberg file and called the F File. In order to gain access to this file, users must gain access to the FTP site and can then download or save the file. When the file is exported this file does not contain headers for each of the fields. A representative from Bloomberg provided a list of the headers and its'

corresponding byte range in relation to the fields. To complete the mapping of the headers to the fields, the Bloomberg file had to be exported into Notepad ++, an application that allows users to count the bytes based on the column that the field is associated with. Through the use of this program, the headers were mapped to the corresponding fields and a document was created in order to track all of the header names, and example of the corresponding fields, and also the bytes that each field takes up. This document would have been used for developers to store the information in the database. However, the F file was determined to not be the right file because the trade data was only available for the US and it was imperative that all of the global cash data came from the same source.

The next source that was analyzed was the CDR Report. This report was determined to be the sourced from the C Report that was the first source of Cash Data that was analyzed. Because of this, the focus was taken off of the CDR Report and instead, further analysis was completed on the C Report from Database C. The initial analysis of this data found that the trade data was only for the US trade data. However, upon further analysis, trade data from both EMEA and Asia trade data are available from this data source. In order to get the trade data from all regions, it will have to be retrieved from six different live feeds. While this data is considered to be the final Cash data, through the Phase II analysis, it was determined that the report is still missing 50 portfolios relevant to the final trade data reports. Through the use of C reports, the Cash data in the database will be complete and will be live feeds. Therefore, C is the end solution for the phase I analysis of Cash data. At the completion of the Phase I Analysis, a Spec for C was created for the use of developers in order to source and build out the Cash Database.

### Building the Database

After the sources for the Cash and CDS data were finalized to be from E and Database C databases, the developers could then proceed with the building of the new Cash and CDS database. The developers have begun the first stages of building this database. As of the completion of this project, the Cash and CDS data have been fed into the database and the data can now be accessed using VBA

scripts. This is not the end solution for the data access, however in the short-term strategists can now access the complete desired information from one central location.

In order to meet reporting requirements, all trade data must be stored for seven years. The database being built for this project will meet these requirements as necessary. The current concern with this amount of data storage is query time as the data grows. Early in next year, the developers will look into a strategic reporting database that could be leveraged from other lines of business.

One other concern raised with the current database is the solution is how to track changes and breaks within the full solution. These will be outlined within the recommendations section of this report and will be taken under advisement by developers and business analysts.

# Chapter 5: Phase II Analysis

Phase II was focused on how the information gets from the original trade data into a working format within the database. This included looking at both the current reporting process and understanding the current data manipulation. It also included examining the logic currently in use in the EMEA reporting system. The logic being used in this phase of the project includes the business rules that must be applied to the original trade data in order to filter out or manipulate irrelevant, duplicate, or misleading trade data. The final database will require the logic from the US, EMEA, and Asia to be consolidated and made into one global set of logic.

## Methodology

The first step in Phase II started with the examination of the US reporting process. This built off of Phase I. In the current reporting process, this Phase was concerned more with the data manipulation from the original trade data into the final reports. This phase took into account each step that was involved in changing the data and mostly tracked the changes made in excel.

The next step in this Phase was to examine the logic that is currently in use globally. The only logic available to examine was that of the EMEA Reporting logic. After gaining access to the code used to manipulate the data in EMEA, this phase worked to understand each step of the logic and determine if similar logic could be used in a final global solution.

## Analysis

### US Data Manipulation

The first step of this phase was to understand the current data manipulation in use in the US reporting system. This included building off of Phase I analysis and is also used within Phase III of this project. The analysis completed in Phase I included a broader look at the system and how data moved from the original trade data into the final reports. The Phase II analysis completed on this processed was

a more focused analysis on the actual data manipulation steps involved in transforming the data. The Phase III analysis of the data manipulation looks at how this information can be used to generate the final reports and

In order to complete determine these steps, this analysis started from the end reports and worked backwards to determine how each step worked back to the original data. A data manipulation chart was created which tracked the changes involved in generating the weekly report. There are three main steps involved in this data manipulation:

1. *Preparation*: The preparation of the data includes extracting the trade data from E. E is a trading platform used for CDS data. The data is also imported from the D site. There are only three fields extracted from this trade information. The two exports move the relevant fields into an excel formation and in doing so allows for the data to then be transformed within excel.

2. *Data into Report*: The second step in generating these reports is to move the data into relevant fields and map the data to the traders and trading desks. Mapping is the process from which two fields are put together based on a key. For example, one data source may only carry the information for trader name and the other may only carry the information for trading desk. In order to have both of these fields in the final report, the trader must be mapped to the trading desk based on a similar key piece of information, like a trading ID. At the end of this second step, all of the data is mapped and in the correct format for then generating the reports.

3. *Data Calculations:* The final step in this process is to make any calculations necessary on the data. These calculations include generating percentages of totals trades or highlighting high performance or high volume for the week. These final calculations are what generate the final reports.

In this current process, the data manipulation is done in excel and is often done manually by the trading strategists. The use of excel macros has somewhat automated the current process. However, as the volume of trades increases, the current reporting system is in need of a completely automated system.

The solution will include aggregated the information into the new database. In addition to this, there must be global logic created for the new database. In order to create this, it is necessary to understand the current steps in generating the current reporting process.

### EMEA Logic

The next step in the analysis of Phase II was to examine the current logic used in the EMEA Reporting System. This work was made possible with the help of the London team currently working on the technology and reporting process. The London team allowed access to its' current reporting logic. This logic is SQL code and includes both querying the database and also includes data manipulation and filters applied to the original trade data.

After the analysis of this logic, this Phase's Analysis produced a document which outlines the current logic, the steps involved, and the questions that need to be answered. The questions raised in this document must be answered before being leveraged into a global logic solution within the new reporting system.

### Asia Logic

The final step in the Phase II Analysis will be to look into the requirement and possibilities of applying Asian Logic to the current system. This analysis is still an outstanding item and will be completed during Phase II of the project, or during the first quarter of next year.

## Findings

### Global Logic

The final step in this Phase will be completed after the creation of the database, early in the first Quarter of 2012. This final step includes looking at the data manipulation needed for the global data. The final data manipulation will encompass all regions. In order to build this global logic, the first requirement will be to have a full understanding of the current data available in the database and then also an understanding of the business needs for the end reports. After looking into these requirements,

the global logic can then be built in order to encompass one solution than can then be applied to the global trade data.

# Chapter 6: Phase III Analysis

Phase III centered on two main tasks with the end goal of preparing sufficient analysis for the developer to design an application for the new reporting database and its corresponding UI while taking into account the needs and requirements outlined by the business. The first task was to analyze the detailed calculations in each U.S. report using trade data in order to document the report generating process for future automation. This analysis will be continued based on the analysis completed in Phase I and Phase II. The second task was to analyze the existing UI of other reporting applications, including Application T and R, in order to determine if these applications could be leveraged globally. This analysis will aid in building the application for the new global database which allows users to customize the reports based on business requirements regionally.

## Methodology

In order to accomplish the goal of designing an application with a user-friendly UI for the new global database, the analysis for Phase II took two steps in order to meeting the requirements of users for all regions. The first step in this analysis was to determine and document how each figure from the final reports were generated. The second step was to analyze the UI of Application T and R in order to determine if portions of these UIs can be leveraged globally. This analysis led to the creation of documents outlining the steps involved in generating final reports and also led to recommendations for the future UI.

## Analysis

### Calculation Steps Analysis

The first step involved in designing an application for the new global database with a user-friendly UI which meets the needs of users from all regions was to understand the calculation steps involved in each reports. This process built off of some of the analysis completed in Phase II. This task

was accomplished by comparing the final end reports to their direct sources, tracing the way each figure was calculated and document the build-in Excel formulas used in calculation.

Previous way to generate the final reports was to do some calculations among different tabs within one Excel spreadsheet which contained different fields gathered from different sources by exporting data manually or receiving email reports. The figures in the final reports were either from the direct source data or from the calculation based on the source data. Below is an example of the calculation steps documentation created for weekly report currently used in the U.S. These steps were further analyzed in the third phase of this project.

The calculation steps were documented in the order they had been done in the previous reports created manually. Then details of the calculation were grouped by tabs which made them easy to follow. In addition to it, comments of potential issues, for instance the typos, unnecessary steps etc., were added at the end of each step. This analysis will aid the developers in developing an algorithm to automate the final reports from the data in the aimed database and save the efforts of the strategists who used to manually generate the final reports. By the end of the project, documentation of calculation steps in two reports have been completed.

### Application T Analysis

As regulators require a report which provided intraday trade information on all products traded by BAML PacRim Credit desk, covering all trade capture systems on Merrill Lynch Capital Services (MLCS), Merrill Lynch International (MLI) and Bank of America North America (BANA) side, this has been developed by BAML GCP Asia team in order to enable users, the head of the desk and regulators, to have one interface to monitor the trade activity in the region. It was also improved later to have the function linking to centralized database, the database for Q. The back end SQL database cannot be utilized to store the data for our project since the data needed for the new project is trade level instead of positional level. However, the UI of Application T still can be utilized for the new database. The UI of

Application T has been designed to be simple and user friendly with straight forward, self explanatory options for the various functionality it provides. The Users will be able to export data in form of Excel reports for record keeping purpose.

There are three user types and access levels supported on the trade activity reporting system:

1) Default user – Users can access the Report and PortfolioSet modules, run, print, email, export etc the reports.

2) Superuser – Users can surpass the default users for PortfolioSet deletion and related activity.

3) Admin user – Users can access the User Admin module on the PortfolioSet area and can create new users or modify the existing ones.

In the UI, an area allows users to choose different reports which are currently used in Asia. After choosing the report, users will be able to filter the data by selecting the time period, choosing the system and portfolio set needed to be included in the report, as seen in the green box area in the screenshot above. Furthermore users are allowed to export the report in Excel format.

More features which allow users to customize the reports are available in Application T UI, including field chooser which enables users to choose the fields they care about in the report, sorting feature which can be used to sort the data in ascending or descending order in respect to the data in the column selected.

Compared to the previous web-based Application T UI, the current Application T UI has been improved in the way that it can be integrated into Q. A new option seen in the latest Application T UI is Application T on S which is an object database of Q. The option is currently inactive and need further development.

### Application R Analysis

R is an application currently being used in the Mortgage Team of Bank of America Merrill Lynch and it's built in Q. It functions as a database-based pivot table, allowing users to arrange the

fields in the database according to their specific requirements by dragging them to the horizontal pivots box or vertical pivots box.

Users can choose the time period they need for the data and are allowed to further organize the data by using concern filtering logic and the sorting feature. The data can be grouped and sorted by fields according to the order the user selects them.

## Findings

### Calculation Steps Documentation

Through the Phase III Analysis, the multitude of different calculation steps used in creating the daily and weekly trade level reports in the current system were able to be documented. The Excel formulas used in generating each report were documented in the order which in they had been used previously so that the developers of the aimed application in Phase III would have a better idea of how each report was been generated.

### Potential Features of the UI based on Application T UI

The fact that Application T UI can be possibly leveraged by the application of the new database in Phase III, as suggested by the developers, led to the question that what other features should be included into it. Based on the assumption that Application T UI will be leveraged in Phase III, the following items or features would be considered while developing the new UI in addition to the existing feature in Application T.

1. Add  options which allow users to select different regions

Since the Application T was built for Asia only, it currently doesn't contain any data for the U.S. and EMEA region. By the end of Phase II when the data for all regions is ready in the database with cleanup work done, a user-friendly UI of the application built on the database, the goal of Phase III, should be able to allow users choose the region and view and manage the reports in each region respectively. Access restrictions on a region basis would be a suggestion such that only high-level

managers will be able to view and manage the reports. These restrictions should be applied to default users and superusers.

2.  Add the feature of displaying and exporting the final reports

The Application T was designed to display trade data only as there were not any final reports needed in Asia. However the automation of the final reports is needed in the other regions; in fact the EMEA reporting system has already been able to generate some of the final reports automatically through X, a reporting application built on the centralized reporting database in EMEA. The feature of displaying and exporting the final reports should be added to the UI in order to save human efforts in generating the final reports from the trade data manually. Users should also be able to export the final reports according to their specific filtering requirements, for example a report from certain time period.

3.  Allow users to export the reports in different format

Once the customized final report is generated based on user's specific filtering requirement, the system should allow the user to exported in different format, for instance xls, pdf, doc etc., such that further modification could be made to it. If no final report is needed, users should be allowed to export the trade data in editable format for further use.

4.  Enable users to request the customized reports to be sent via email automatically

In addition to the three features above, the new UI should also allow users to request the customized reports to be sent via email automatically on a daily, weekly or monthly basis. The system should be able to save the filtering requirements of each user such that it can generate the reports and send it out at the time the users set in advance. This feature will save users efforts in repeatedly logging in the system and customizing the report.

**Potential Features of the UI based on R**

Due to the fact that R is also not able to generate end reports and other similar characteristics with Application T, the following points should also be considered when utilizing it in addition to its existing features.

1. Add  options which allow users to select different regions

2. Add  the feature of displaying and exporting the final reports

3. Enable users to request the customized reports to be sent via email automatically

Other suggestions include enabling users to create charts based on the pivot table as charts and graphs are better in showing the trend of the change and currently no such feature exists in R.


The conclusion of Phase III is based on the whole analysis process done for the potential application of the desired global Cash and CDS database. Further detailed analysis is needed for the needs or requirements of the features in the application. Opinions should be gathered not only from U.S. business side, but also from EMEA and Asia in order to make sure that this new application and its UI meet the requirements of all regions by providing a long term solution instead of a temporary one.

# Chapter 7: Recommendations

## Centralized Data Dictionary

Based on the Phase I analysis of the reports and sources used in the current reporting process, a main issue with the data is the multitude of the field names which lead to confusion in understanding the data. Differences in field names not only lie between different platforms and databases, as analyzed in Phase I, but also between the front-end UI and back-end system within a database. It takes great human efforts in interpreting the data especially when field matching between files is needed. For example, there were in fact a lot of common fields appeared in different names in H file from Bloomberg and the C report from Database C, making it hard to compare and match, as shown in the following table. Some of the fields whose names varied were easy to recognize. Examples were found in ACCTSHORTNAME vs. ACC_SHORTNAME or SECURITYCURRENCY vs. SEC_ISOCODE.

| Matched fields in H file | Matched fields in C |
|---|---|
| ACCTSHORTNAME | ACC_SHORTNAME |
| ACCRUED_INTRST_OVRDE_IND | ACCD_INTRST_OVRRIDE |
| AFFILIATEDTICKETNUMBER | AFF_TIKT_NUM |
| AGENCYTRADEREFTKTNUMBER | AGENCY_TRD_REFTKTNUM |
| COSTREPOAMOUNT1 | AMT_REPO1 |
| COSTREPOAMOUNT2 | AMT_REPO2 |
| COSTREPOAMOUNT3 | AMT_REPO3 |
| TRADESIDE | BUYSELL_FLAG |
| COUPONRATE | COUPON |
| DATETRADEWASAUTHORIZED | DATE_TRADEWASAUTH |
| JAPANESEBONDTYPE | JAPAN_BONDTYPE |
| CPNREINVDATE2 | REPO_CPNREINVDATE2 |
| CPNREINVDATE3 | REPO_CPNREINVDATE3 |
| RRELATEDSLATETICKETNUMBER | RLTD_SLATE_TKTNUM |
| RETAILFEEDWEBTRADEFIELD | RTAL_FEEDWEBTRD_FLD |
| SALESPERSONLOGIN | SALESPERSON_LOGIN |
| SBBSREPOINTEREST | SBBS_REPOINTEREST |
| SBBSREPORATE | SBBS_REPORATE |
| SECURITYCURRENCY | SEC_ISOCODE |
| SECURITYISPENCEQUOTED | SEC_ISPENCE_QUTD |
| PAYFINAMT | SWAP_PAYFINAMT |
| PAYINITAMT | SWAP_PAYINITAMT |
| TRADEAMOUNT | TRD_AMT |

An example of the variation of field names in front-end UI and back-end system could be found in the E database, as seen in the table below:

| Name in the front-end UI | Name in the back-end system |
|---|---|
| Trade Event Type | NetdownTradeType |

Standardizing the field names will help eliminate the confusion caused by the multitude of the field names. It will also benefit other tasks that need to be done across different internal databases or platforms. In addition to the standardization of the names, building a dictionary for all fields is also a potential solution to the problems that associated with the confusion of the names. A comprehensive data dictionary can be used to distinguish fields with similar names within one report for people who are not familiar with them; or it can be used in the field mapping when comparison between data from different sources is needed.

## Search Engine Feature

Based on the observation of the work flow during this project, the following phenomenon was captured that when people in GCP group needed to know something about some database or platform which they were not familiar with, they had to go through a time-consuming process looking for the right contact person for even general questions. This process turned out to be inefficient and tedious since response from the person being asked usually did not come back promptly, making the actual speed of the progress rather slow. This situation was particularly obvious when a new project is initiated.

In order to solve the problem, a comprehensive dictionary of all sources, including information of all databases, projects, contact people etc., will be a possible solution. Furthermore a corresponding web-based user-friendly UI based on the dictionary which allows users to search for what they want to know is also a need. To be specific, the whole search engine is expected to have the following features:

1. Users should be able to search by key words.

By typing the key words of the searched item, the user should be able to find the item among similar result items which also contain the key words.

2. Users should be able to search by browsing the categories.

All items in the search engine will be grouped in several ways, for example by business group, by database usage. Other than searching by key words, users should be allowed to search the item by browsing different categories. All items can possibly be grouped by business hierarchy, business group, or databases usage etc.

3. Comprehensive information should be included in each item.

Each result item should consist of comprehensive information. For example, the item "E database" item will including a brief description of the database, where it gets the source data, the contact person of the database, the projects related to the database, the users of the database etc. By providing enough accurate information, the search engine will be able to save human efforts in searching for the right source and contact person especially when a new project is initiated.

4. Proper links should be built up between different items.

When two items are related to each other, then proper links should be built up between them which allow users to reach more detailed information. As in the above E example, link should be built between "E database" and its related projects, like this e-Trading reporting project.

5. The information should be updated periodically to guarantee the accuracy.

The accuracy of the information of each item in the search engine requires the information to be updated regularly, for example, on a monthly basis so that the information will always be reliable and consistent to the users.

## Standardization of Reporting Structure for All Regions

The current reporting structures of Bank of America – Merrill Lynch Global Credit Product Group vary among regions. Each region has its own perspective of interpreting the data, doing statistical analysis separately. GCP Asia group doesn't have end reports based on the trade data; the reporting application built on the SQL data base only provides position level trade data in excel for records keeping purpose. GCP EMEA group currently have 8 different reports. Some of them are already

generated in the final reports format, providing end results calculated automatically by X, the application built on the centralized database for the EMEA regional trade level data. The rest of the reports, like the reports in Asia, only provide raw trade data. All the reports in EMEA are delivered to the traders and relevant people via email in an editable format. There are currently 4 reports in GCP US group, providing exact figures of the Cash and CDS market share and trading volume on a daily or weekly basis.  Standardizing the final volume and market share reports for U.S., EMEA and Asia will give a better view of the trading performance to the readers, the traders and the senior managers, so that they can discover problems, if any, and adjust in time the trading strategies in order to achieve higher goals. Furthermore, standardized reports will also contribute to a cross region volume and market share reports compare the trading performance of the three regions which will be used to evaluate the trading performance of GCP group as a whole.

## Implementation of Process Controls to the Database

Based on the Phase I analysis of the possible Cash and CDS data sources for the new global database for all three regions, we were able to determine the right sources, that is, Bloomberg live feeds listened by Database C for Cash transactional data and E U.S. instance and EMEA instance for CDS data. In order to gather the Cash data into the new global database, developers need to import the data from each of the 6 Bloomberg live feeds via Database C. As for the CDS data, two queries will be needed to run separately, one for EMEA instance in order to get the transactional data in EMEA and the other for U.S. in order to get the data in U.S. and Asia as they share the same instance.

Breaking on each single link will lead to inaccuracy of the data and furthermore affect the results in the final reports. As a result, the notifications of any issue that may cause a breaking point in the data in flow chain should be delivered promptly to the developers, the strategists and any other people

associated with the database such that a quick solution will be worked out to solve the problem and minimize the data lose.

Regular checks and other process controls should be implemented to ensure that the new global Cash and CDS reporting database stays accurate. If new desks or portfolios are added, these processes should highlight them right away to make sure they are added to the database. By implementing process controls to the database successfully the database developers will be able to manage the database in a proper way and keep the data reliable such that the end reports based on the trade data stay an accurate reflection of the trading performance.

## Retirement of Database C with New Database

Based on the Phase I analysis of the current reporting process, a main concern within the organization is the use of multiple sources and platforms for the storage and sourcing of data. The current system that this project examined utilized five separate databases as original sources of trade data. The end goal of this project is to use one new database for this reporting process. In doing so, based on the Phase I Analysis, Bank of America can also retire one of the databases currently in use with the implementation of the new database.

## Implementation of EMEA Application

Currently this project is working towards generating reports for volume and market share using global trade level data. The new database will have applications that can export both the raw trade data and customized reports based on the business needs. These applications will be use by strategists, analysts, and the trading desks to measure volume and performance. Using this same data from the new database, Bank of America has the opportunity to add additional applications within this database. One recommendation for these applications is to implement an application currently in development for use in the EMEA reporting system.

## Chapter 8: Conclusion

The Global Credit Products Volume and Market Share project works to consolidate and automate the reporting process for all Cash and CDS trade data on a global level. This project is imperative to the future success of Global Credit Products within Bank of America – Merrill Lynch so that the business can have a clear understanding of what transactions are currently being completed and the performance levels related to these transactions. This will not only allow the business to understand current performance levels but more importantly, it allows for a clear picture of the current risk that the business is facing and position within the market.

Prior to this project, understanding the risk and performance of the Cash and CDS was a timely and manual process. By completing analysis on the current global reporting system, Bank of America – Merrill Lynch can now successfully implement the use of a new database for the Cash and CDS global trade data. Furthermore, through the analysis completed in this project, the developers will be able to understand what is available and what is still needed for the implementation of logic and a UI for the database.

Upon implementation of the new database and reporting system, Bank of America – Merrill Lynch will be able to streamline the reporting system and furthermore the reports will be more reliable and relevant to the business needs.

# Resources

1. Bank of America: Heritage. http://message.bankofamerica.com/heritage/#/merger-history/merrill-lynch.

2. Bank of America Merrill Lynch Company Website. http://corp.bankofamerica.com/.

3. "Best E-Trading Platform for Corporate Bonds and CDS: MarketAxess." Risk.net. July 19, 2010.
   http://www.risk.net/credit/feature/1723268/best-trading-platform-corporate-bonds-cds-marketaxess

4. Beinstein, Eric and Scott, Andrew. "Credit Derivatives Handbook: Detailing Credit Default Swap Products, Markets, and Trading Strategies." JP Morgan Chase & Co.Corporate Quantitative Research. September 30, 2006.
   www.morganmarkets.com

5. "Clearing Credit Default Swaps: A Case Study in Global Legal Convergence," Anupam Chander and Randall Costa, 2010.

6. "Credit Default Swaps and Counterparty Risk." European Central Bank. August 2009.
   http://www.ecb.int/pub/pdf/other/creditdefaultswapsandcounterpartyrisk2009en.pdf

7. "Credit Derivatives, Macro Risks, and Systemic Risks" Tim Weithers, 2007
   http://www.atl.frb.org/filelegacydocs/erq407_weithers.pdf

8. "Credit Suisse Offers Single Name CDS e-Trading Via Bloomberg." Credit Suisse. February 7, 2011.

9. "Dodd-Frank Wall Street Reform and Consumer Protection Act." (9/28/2011)
   http://banking.senate.gov/public/_files/070110_Dodd_Frank_Wall_Street_Reform_comprehensive_summary_Final.pdf

10. Fortune 500: 2010. CNN Money. http://money.cnn.com/magazines/fortune/fortune500/2010/full_list/. Retrieved October 4, 2011.

11. "Global Credit Products – eTrading Reporting Project Proposal." Bank of America Merrill Lynch. (9/15/2011).

12. "Global Round Up – Bonds: US Treasury 10-Year Bonds widens 6.0 Basis Points." News Bites Pty Ltd. January 13, 2010.

13. "Regulation Services Discipline Decisions (Securities Trading)." LexisNexis Canada.

14. Stempel, Jonathan. "Bank of America Completes Merrill Lynch Purchase." Rueters. (1/1/2009).

15. "Who Made America?" PBS: They Made America.
    http://www.pbs.org/wgbh/theymadeamerica/whomade/giannini_hi.html. Retrieved October 4, 2011.

# *APPENDIX* 1: Volume and Market Share Reporting BRD

## EXECUTIVE SUMMARY

Create a GCP owned volume and market share database complete with all regions Cash Bond and CDS trade level data. This data will be used to create a fully accurate picture of trading volumes for GCP. It will be used to provide several new and unique views into our business including electronic volume growth, inquiry tracking, and market share and client trends to name a few.

The current process for volume and market share aggregation across our business is fragmented over many systems and run independently under different methodologies in all regions.

## SCOPE

### In Scope

The scope of the project in a phased approach based on business requirements:

#### ♦ __Phase 1__

Get full import of Cash data for all regions in a single table. Based on initial analysis Bloomberg suggested that F files for US should be the source for the Cash trade level data. There might be another place to get the Cash data (analysis in progress).

In addition, get full import of CDS data in another table for all regions. The CDS data can be sourced from E stored proc aimed at the appropriate regional E trading desks. Both Cash and CDS data should start as of Jan 1, 2012. Following that day, we need to all Cash and CDS data for at least the next 7 years.

*Phase 1- completed by end of 2011*

#### ♦ __Phase 2__

Apply Cash and CDS filtering logic. These requirements will be derived by the trading strategy team globally to make sure all the correct trading data is being cleaned up. This should be applied after Phase 1 implementation and in order to work through all the data and filtering issues needed.

*Phase 2 – completed by end of 2011 if possible or early Q1*

➕ **Phase 3**

Report UI and automated reports. Once we get all the data and apply the filtering logic the last phase will be the ability users to be able to generate standard reports or create their own.  Further the addition of a reporting UI such as the Q cube that can be applied to the data for ad hoc requests.

*Phase 2 – completed by Q2*

## Out of Scope

➕ Store inquiry transaction information currently provided by H History tool

➕ Store transaction data for other products outside Cash and CDS

➕ Ability to access the data intraday

## BUSINESS REQUIREMENTS

There are currently three main requirements for this project. The first requirement is to understand the fields associated with the Database C output report for Cash trade transactions from Bloomberg. The second requirement is to analyze the same process with the E output report for CDS trade transactions. In addition, certain mappings and logic would need to be applied in the backend in order to clean up the data and produce reports in a desired format. The final requirement for this project will be to develop a technical solution to build Trade and Inquiry Reporting Database with a goal of centralizing data needed for CDS and Cash Risk and Volume Reporting. This application would show daily/weekly/monthly reports which would allow the users to organize the data in a user friendly way (but only in phase 3).

Other requirements gathered from the business:

- Users should be able to configure views and pivots to easily view and organize the data

- Users should be able to view data based on exiting reports currently produced manually

- The application should allow users to export daily/weekly/monthly reports in different formats

- Reporting should be reasonably fast as YTD trade level transaction data will need to be stored and aggregated

- Depending on speed we may need to replicate globally

## PROPOSED SOLUTIONS

Based on the initial analysis done for the project, there are three possible technical solutions to this project. This section will outline a basic description, benefits, and risks associated with each of the solutions.

### Build Internal Database *(Business Proposal)*

The first solution would require implementation of internal database initially used for US reporting for Cash and CDS trades only. The database would hold information from selected fields from E and Database C. In addition, this solution would require implementation of front end application to be able to query and export data in a user friendly way.

### Utilize Application T on S application in Q

Currently Asia is working on a similar solution to produce reports intraday trade information on all products traded by PacRim Credit desks.

- Head of Asia Credit Trading and Credit Business Supervisor expressed the need to have a single platform to monitor Credit Intraday trade activities across different trading systems in the region

- Consolidated trade activity reporting for Business Supervision Group

- Middle Office Group - Trade availability in the DB allows further reconciliation/specific trade reporting efforts be leveraged on the platform.

Users will have one interface to monitor the trade activity in the region. The information would be detailed and can be exported out in form of excel reports for record keeping purpose.

### Application T using S Database

This first option in this solution uses the S Database to access all of the data information necessary to complete the reports. However, it would take further analysis to ensure that a S Database has all of the required fields and reliable information to put into the reports.

- ❖ Mapping different Qz Products deal attributes to respective columns
- ❖ Add more columns that are useful
- ❖ Improve user controls on choosing Favorites
- ❖ Add query metrics

### Application T using SQL Database

The second option for this solution uses an existing SQL relational Database which covers all trade capture systems on MLCS, MLI and BANA side, including Bloomberg, Aurora, Advantage, VMaster and Misty.

**Risks**

*The risks involved in this solution is that the export of this application is an excel file not the final report. It will take further analysis to determine the final reports from the excel export. In addition, this reporting tool is currently used only in Asia. Also, analysis of the data would be needed and evaluated based on the requirements in US. Further only Asia requirements have going into this solution from the beginning so going back to re-incorporate the rest of the businesses trading activity will take further analysis.*

**Benefits**

*The benefits of this proposal are seen both in the short-term and long-term. In the short-term, we can use the UI which is already developed and can be easily customized to the needs of the risk reporting in the US. In the long-term, this application provides a global solution that can be used to report Asia, EMEA, and US E-Trading.*

## Integrate with QzPositions

This solution will integrate the database used to generate reports for CDS and Credit with the internal technology. The current goal for the Qz Positions is to have an end of day view and the capability to produce one

risk report by the year's end. Eventually, this solution will have intraday reporting capabilities and will be a part of a "golden copy" of information, meaning that the data is reliable and accessible.

# APPENDIX 2: Data Dictionaries

## *Report 1*

| | Field | Definition | Example | Source | Comments / Issues |
|---|---|---|---|---|---|
| CSAR Daily Volume Reports | | | | | |
| | Industrial IG Cash Volume | *Daily Total Volume (in dollars) of Industrial IG Cash trades* | x.x | | |
| | HY Cash Volume | *Daily Total Volume (in dollars) of High Yield Cash trades* | x.x | | |
| | Retail Cash Volume | *Daily Total Volume (in dollars) of Retail Cash trades* | x.x | | |
| | Financial Cash Volume | *Daily Total Volume (in dollars) of Financial Cash trades* | x.x | | |
| | IG CSD Volume | *Daily Total Volume (in dollars) of Investment Grade CDS* | x.x | | |
| | HY CDS Volume | *Daily Total Volume (in dollars) of High Yield CDS* | x.x | | |
| | Index CDS Volume | *Daily Total Volume (in dollars) of IG CDS Index* | x.x | | |
| | Financial CDS Volume | *Daily Total Volume (in dollars) of Financial CDS* | x.x | | |
| IG New Issue Report | | | | | |
| | YTD IG Corp | | x.x | | manual input |
| | YTD IG Fin | | x.x | | manual input |
| | YTD IG SSA | | x.x | | manual input |
| HY New Issue Recap Report PDF | | | | | |
| | YTD HY Corp | | x.x | | manual input |
| | YTD HY Non $ | | x.x | | manual input |

## *Report 2*

| Field | Definition | Example | Source | Comments / Issues |
|---|---|---|---|---|
| Reval Dt | Date of which trade data is generated | xx/xx/xxxx | Realm | **Runs on a t-1 Basis Date |

| | | | | |
|---|---|---|---|---|
| Bus Grp | *Business group* | GCP or blank | Realm | |
| Bus Type | *Business type* | CST or blank | Realm | |
| Desk Grp | *Desk Group* | IG TRAD | Realm | |
| Desk | *Trading Sector* | IG TRAD | Realm | |
| Portfolio | *Code for Portfolio. Usually represented by 3 letters followed by 1 number.* | HAB1 | Realm | |
| Trader | *First and Last Name* | John Smith | Realm | |
| **Bond Owner Grp** | ***Ownergroup where the Bond/CDS belongs to*** | **1. Gallagher, Terrence 2. GCP AMRS - Retail Trading** | **Realm** | |
| Issuer | *Name of the corporation that issued the bond* | BANK OF AMERICA CORPORATION | Realm | |
| Bbg Ticker | *Unique BBG identifier for a security* | BAC | Realm | |
| CUSIP | *Committee on Uniform Sercurity Identification Procedures. Combination of numbers and letters used to uniquely identify each bond in the aution.* | 06048WAY6 | Realm | |
| Net Ntl | *Net Notional of trades traded for the day* | 1. (xx,xxx) 2. xx,xxx | Realm | |
| **Gross Ntl** | ***Absolute Value of the Net Notional of all trades traded for the day*** | **x,xxx** | **Realm** | |
| **Gross Adj Ntl** | ***Adjusted Absolute Value of the Net Notional of all trades traded for the day based on TRACE adjustments*** | **x,xxx** | **Realm** | |
| **Trace Amt** | ***TRACE Adjusted Amounts for all trades traded for the day*** | **x,xxx** | **Realm** | |
| **Trace Market Share %** | ***Amount Traded Versus the Total Market based on Trace Amounts*** | **xx.xx%** | **Realm** | |

| % of Amt Outstanting Traded | Amount Traded divided by Amount Outstanding displayed as a percentage | xx.xx% | Manually created | |
|---|---|---|---|---|
| Trader Name | Name of trader in group | 1. Not US GCP<br>2. John Smith<br>3. Smith / O'Hare | O | Trader name appers twice in this report |
| Product Type | Classification of the Type of Bond (Street Convention, Convertible, In Default, Fix-To-Float Bonds, Multi-Step Cpn Bnd, Long Odd-Last Bnds, Odd Coupon Method) | STREET CONVENTION | Bloomberg | |
| Amt Outstanding | Outstanding amout for the security | xxx,xxx | Bloomberg | |
| Maturity Date | Day, Month, Year of Maturity | xx/xx/xxxx | Bloomberg | |

## Report 3

| Field | Definition | Example | Source | Comments / Issues |
|---|---|---|---|---|
| Trade Date | Day-Month-Year the trade takes place | 25-Oct-11 | TWQ transactions report | |
| Trade Time | Time trade takes place | xx:xx:xx | TWQ transactions report | |
| Market | broker code displayed on the trade ticket (denotes where the trade comes from) | BMLE or TWB-CDS | TWQ transactions report | |
| Negotiation ID | Unique Identifier of an Inquiry/Order ID Sent by ECN (proprietary electronic trading platform and underlying proprietary system) | xx | TWQ transactions report | |
| TEA ID | Unique Identifier within E | BMLE_2011_10_25_16 | TWQ transactions report - Stored in E | |
| CDS Name | Reference name of the security | CDX.IG.17(5Y) | TWQ transactions report | |
| Side | Transaction Type of the Trade (Sell/Buy) | S OR B | TWQ transactions report | |
| Quantity | The Calculation amount of protection being bought or sold | xxx,xxx | TWQ transactions report | |
| Trade Status | Indicated the State of the Trade | Done | TWQ transactions report | |
| Executing Trader | Trader's nbk ID | nbkxxxx | TWQ transactions report | |

| | | | | |
|---|---|---|---|---|
| Portfolio | *Portfolio Name where the Trade is Booked* | XBOX (Flow Cash) | TWQ transactions report | |
| Price/Spread | *Numerical Value of either the price or the spread (difference in yield between a bond of a certain credit rating and a comparable maturity Treasury security)* | xx.xx | TWQ transactions report | |
| Price Type | *Price Type of the Request from the Customer (Price/Spread/Yield/DM)* | Price | TWQ transactions report | |
| Deal Spread | *Deal Spread for CDS trades (difference in yield between a bond of a certain credit rating and a comparable maturity Treasury security)* | 100 OR 500 | TWQ transactions report | |
| Fee | *Upfront Fee for CDS Trades* | xxx,xxx OR xxx,xxx | TWQ transactions report | |
| Currency | *Three Letter Accronym for the Transaction's Currency* | USD | TWQ transactions report | |
| Customer Name | *Name of the user who placed the order on the platform* | John Smith | TWQ transactions report | |
| Account ID | *unique identifier of the counterparty* | RNBNY0NY | TWQ transactions report | |
| Account Name | *Company Name of the Counterparty* | HSBC SECURITIES (USA) INC | TWQ transactions report | |
| Sales Person | *First and Last Name of the Sales Person* | Jane Doe | TWQ transactions report | |
| Trade Type | *Type of the Counterparty's Request - Order/Inquiry* | ORDER | TWQ transactions report | |
| BBG Ticker | *Unique Bond/CDS identifier* | ABCDE123 | TWQ transactions report | |
| RedCode | *Unique CDS Identifier (9 digits)* | 2I65BYCN3 | TWQ transactions report | |
| Maturity | *Day-Month-Year the trade matures* | 20-Dec-16 | TWQ transactions report | |
| Exceptions | *Notifies/Flags any trade status besides a done trade (cancelled, expired, ect.)* | Flagged Expired | | |
| Client/Internal Desk | *Internal Name for the Client or Desk* | | | |
| Client Industry | *Internal Name for Client Industry (Hedge Fund, Asset, Mgr, ect.)* | Hedge Fund | | |
| Primary Internal Book | *Internal Book Name* | | | |

# Spec for E Report

## Description

The query will have to be run on the E Reporting DB only so EOD or night time run is fine.

The query will have to be run on both the US and UK DB's. All the trades sit on E desks.UK and ASIA desks reside on the UK DB and all the US desks are on the US instance of the E database. Reporting DB is live replication from production, so data is identical and could be pulled at any time.

# Spec for C Report

## Description

The query will have to be run from the files associated with US, UK, and Asia trade data. The books involved in this reporting process will have to be mapped to the correct departments. Furthermore, the ticket types will have to be confirmed for the different tables. The benefits of this report are that it contains all trade level data for all regions.