CREDIT DEFAULT SWAP (CDS) INDEXES AND THEIR USAGE IN RISK MANAGEMENT BY TURKISH BANKS

SINAN CAFRI
106621028

İSTANBUL BİLGİ UNIVERSITY
INSTITUTE OF SOCIAL SCIENCES
MSc in FINANCIAL ECONOMICS

ENGIN KURUN
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ABSTRACT

The unprecedented growth in the use of Credit Default Swap (CDS) indexes in risk management in Europe and USA suggests that market participants find them to be effective tools for risk management. The objective of this thesis is to analyze the motivation behind using CDS indexes and potential uses of CDS indexes in risk management in Turkish Banks. Therefore, firstly, an overview of single name CDSs and CDS index markets are presented, followed by the introduction of most popular derivatives on CDS indexes. Especially, CDS Index Futures contracts are presented in a detailed way and their advantages are emphasized. Then credit exposures and credit risk management techniques of Turkish banks are examined based on the financial statements (31 December 2007) of four biggest Turkish Banks (Akbank, İş Bank, Yapı Kredi, and Garanti Bank) and the credit data (12/2002-09/2007) received from The Banks Association of Turkey. Findings revealed that although Turkish banks have disciplined risk management and well diversified loan portfolios in terms of economical segments; they have relatively high home country risk concentrations. Given the correlation and cointegration level between Turkish and European Markets, it is concluded that iTraxx Index Future contracts can be an effective risk management tools for Turkish Banks to reduce their home country concentration and diversify their loan portfolios internationally.

ÖZET

Avrupa ve Amerika'da finansal işletmelerin ve bankaların risk yönetiminde Kredi Temerrüt Swap endekslerini her geçen gün artarak kullanmaları, bu endekslerin risk yönetiminde verimli bir araç olduğuna işaret etmektedir. Bu çalışmanın amacı, Kredi Temerrüt Swap endekslerinin risk yönetiminde kullanımını analiz edip bu endekslerin Türkiye'deki kullanım olasılıklarını değerlendirmektir. Dolayısıyla, ilk aşamada Kredi Temerrüt Swaplarının ve Kredi Temerrüt Swap endekslerinin genel bir değerlendirmesi yapılmış ve ardından en çok kullanılan Kredi Temerrüt Swap Endeks türevleri sunulmuştur. Özellikle, "Kredi Temerrüt Swap Index Futures" sözleşmeleri detaylandırılmış ve bu sözleşmelerin kullanım avantajları vurgulanmıştır. Uygulama bölümünde dört büyük Türk bankasının (Akbank A.Ş., İş Bank A.Ş., Garanti A.Ş., Yapi Kredi Bankası A.Ş.) 2007 yıl sonu finansal raporlarına ve Türkiye Bankalar Birliği'nden alınan bankacılık sisteminin mevcut verilerine dayanarak (12/2002-09/2007), Türkiye'deki bankaların maruz kaldığı kredi riski ve bu bankalarda kullanılan kredi risk yönetim teknikleri değerlendirilmiştir. Eldeki veriler incelendiğinde, genel olarak Türkiye'deki Bankaların ekonomik alanlar açısından çeşitlendirilmiş kredi portföyüne sahip olmalarına rağmen göreceli olarak yüksek ülke riski taşıdıkları sonucuna varılmaktadır. Türkiye ve Avrupa ülkeleri arasındaki korelasyon ve kointegrasyon seviyesi dikkate alındığında, Türkiyedeki Bankaların "iTraxx Endeks Futures" sözleşmelerini kullanarak yurtiçi ülke risk konsantrasyonunu azaltıp kredi portföylerini uluslararası olarak da çeşitlendirebilecekleri önerilmiştir.

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LIST OF ABBREVIATIONS

AIC	Akaike Info Criterion
BBA	British Bankers' Association
BIS	Bank For International Settlements
BRSA	Banking Regulation and Supervision Agency
CBO	Credit Bond Obligation
CDO	Credit Debt Obligation
CDS	Credit Default Swap
CLN	Credit Linked Notes
FTD	First to Default
IIC	International Index Company
ISDA	International Swap And Derivatives Association
ISE	Istanbul Stock Exchange
LCDS	Loan Only Credit Default Swap
LSTA	Loan Syndication And Trading Association
TBB	The Banks Association of Turkey
TURKDEX	Turkish Derivatives Exchange
OTC	Over the Counter

1. INTRODUCTION

For years, the credit derivatives market was confined with a few instruments, but as new participants have entered into market and the documentation supporting these products has been more standardized by regulatory agencies (i.e. ISDA), a revolution has taken place in the market. Especially, CDS instruments have been the most widely used instrument and basic building block in the credit derivatives market.

Credit Default Swaps are used to transfer the credit risk between parties called *protection buyer* and *protection seller*. *Protection buyer* is the party who wants to buy protection against credit exposure of a reference entity. *Protection seller* is the party who earns fee for selling protection against credit exposure of a reference entity. *Reference entity* can be any borrower either government or private corporations who may default or experience credit event. *Credit event* is classified any one of following cases, 1) Failure to Pay, 2) Bankruptcy, 3) Obligation acceleration, 4) Obligation Default, 5) Repudiation/Moratorium, 6) Restructuring. If at least one of these credit events is experienced then *Credit Event Notice, Notice of Publicly Available Information* are delivered then settlement takes place in one of following formats; cash settlement and physical settlement.

Recently, standardized CDS indexes have also been introduced into derivatives market. These indices give investors the opportunity to buy and sell both industry-wide credit risks (i.e. finance, autos, and telecommunications) and regional credit risk (i.e. Japan, Asia, USA, Europe) depending on the risk appetite. In June 21, 2004, the main CDS indexes, iBoxx and Trac-x, were merged into the Dow Jones iTraxx index.

After that merger it has been very easy to gain large exposures (negative or positive) to a diversified pool of credit risks. Growing interest from market participants increased liquidity of the iTraxx markets and thus, has attracted new participants into the market such as hedge funds, capital structure arbitrageurs, and non-financial institutions.

In summary, introduction of liquid and standardized CDS indexes has derived broader universe of investors into the credit derivatives market. Nowadays, the use of credit derivatives is not only confined with the banks' risk management departments; many non-financial institutions have also started to use them for risk management purposes. Overall, the introduction of CDS indexes may open the door for new techniques in risk management based on these indices. This paper explores the vast area of credit default swaps indexes through understanding the literature on single CDS instruments. This study aims to discover what possible uses of iTraxx instruments in Turkish Banks may be and in which aspects iTraxx instruments can help Turkish banks to manage their credit risk.

The rest of the paper is organized as follows: Part II gives a general overview of credit default swap markets and explains the motivation for the use of credit default swaps with background in market needs and some regulatory principles.

In Part III, it moves on to introduce the most popular CDS indices exist in literature and compare those to single CDS instruments. Additionally, it gives an in depth analysis of CDS indices market in terms of product, size, counterparty, and analytics.

Finally, In Part IV it introduces and analyzes the risk management techniques applied in Turkish Banks and evaluates potential use of iTraxx instruments in risk management and introduces some possible strategies. As well as discussing possible risks inherited in the CDS products, and then it concludes the paper.

2. CREDIT DEFAULT SWAPS

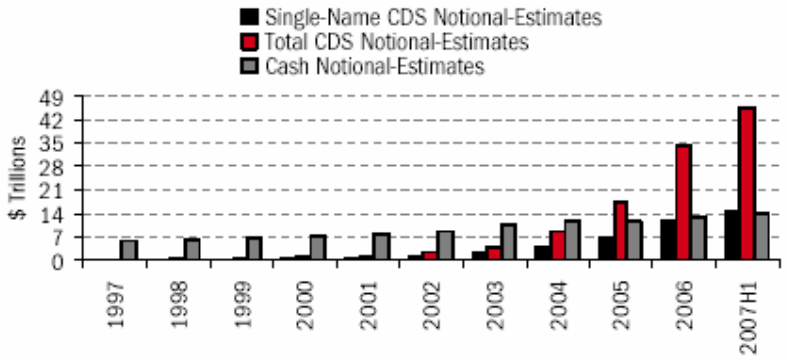
2.1 OVERVIEW OF CDS MARKET AND ISDA RULES

Defaults have always resulted in unexpected and severe losses for the companies involved in the defaulted entities (e.g. person, enterprise, company, or country). This has been the main motivation behind CDS and especially, the CDS market received an unexpected boost during the second half of 1997 with the Asian Crisis. Followed by Russian bond default in 1998, growth of CDS market has been triggered and steady growth caused by growing numbers of bankruptcies and particularly the rising frequency of insolvencies of larger enterprises beginning 2000s (e.g. Enron, WorldCom, Swissair, National Power, and Argentina crisis[1]). Naturally, these default events have caused a dramatic increase in the market participants' sensitivity against credit risks at the early stages of the credit derivative market. Therefore, market for outstanding credit-default swap contracts grew to $45.5 trillion during the first half of 2007 from $632 billion at the end of June 2001, according to the International Swaps and Derivatives Association. As of December 2007, CDS notional value reached to $ 62.2 trillion according to ISDA 2007 Year-End Market Survey[2].

[1] Argentina Crisis has been known for the largest ever sovereign default (A Practical Guide to the 2003 ISDA Credit Derivatives Definitions).
[2] In that survey, 81 firms provided responses on credit derivatives.

At the same time, continuous innovation and increasing standardization in the CDS market have led market participants to treat credit as an asset class within fixed income fund management. In addition, recent regulations[3] and Basel II requirements[4] for credit risk management in the banking sector contributed to greater use of CDS in risk management and even those remained on the sidelines are drawn into credit market (Gibson (2007)). Having the simplicity in transferring risk between parties, CDS has been the most popular instrument among credit derivatives and building block for next generation instruments (O'Kane (2005))[5]. Credit default swaps allow protection buyer to exchange the credit risk of a reference entity with protection seller in return for premium payments.

Figure 1. Estimated Growth in Single Name and Total CDS Notional, Globally(*by Bank of America)*



Single Name: CDS Notional Estimates are for the single name notional of the global credit derivatives market.
Total CDS Notional Estimates are for total notional of the global credit derivatives market, including CDOs and index products.
Cash Notional-Estimates are for the total notional of the global corporate bond market.
Source: *Bank of International Settlements, British Bankers' Association, ISDA, Federal Reserve, and Bank of America Securities LLC estimates.*

[3] Accounting changes in Europe have made it possible for banks to carry loans at fair value, reducing the conflict that was perceived between the accounting treatment of credit derivatives and their use in risk management (Joint Forum, p. 11).
[4] Basel II capital accord aligns regulatory capital charges more closely with actual credit risks and allows greater recognition of hedging.
[5] According to Risk Magazine Credit Derivatives Survey in 2003, CDS dominated market with 73 % of market outstanding notional.

What constitutes a credit event has always challenged market participants since the occurrence of a "credit event" during the term of the swap triggers contingent payment to protection buyer, the same time obligation of the protection seller, to "settle" the contract in accordance with a specific set of notice procedures and timeliness as stated in the agreement. Therefore, it has always been vital that the credit event triggers be drafted clearly and unambiguously in order to reduce the likelihood for dispute between parties.[6] This problem is first addressed by ISDA in 1998 and these predefined credit events are clearly outlined in the standards of the International Swaps and Derivatives Association (ISDA). According to ISDA Master Agreement, credit default is triggered by a credit event and ISDA provides market participant with six credit event definitions those are defined in relation to a reference asset. These events include bankruptcy, failure to pay, obligation acceleration, obligation default, repudiation/moratorium, and restructuring (see Table 1).[7]

As it can be seen at Table 1, ISDA provides defined credit event definitions with respect to reference asset in order to specify exactly the capital structure seniority of the debt covered. Besides, reference asset is still important if CDS is negotiated and traded especially for cash settlement. When one of credit events is experienced then it will be more practical to determine the recovery rate of underlying assets without causing any litigation.

[6] This problem was addressed first in 1998 by the International Swaps and Derivatives Association (ISDA) which issued a standardized Long Form Confirmation that made it possible to trade default swaps within the framework of the ISDA Master Agreement.

[7] Having done some improvements about some legal issues and definitions, ISDA introduced new definitions in July 1999 and this followed by amendments in 2003. Furthermore, ISDA is preparing to release updated ISDA Credit Derivatives Definitions including new rules governing CDS contracts, hard-wiring of cash settlement. (Source: Banc of America Securities LLC estimates).

Table 1. A List of the ISDA Specified Credit Events	
Credit Event	***Description***
Bankruptcy	Corporate becomes insolvent or is unable to pay its debts. The bankruptcy event is, of course, not relevant for sovereign issuers.
Failure to Pay	Failure of the reference entity to make due payments greater than specified payment requirement (typically $1), taking into account some grace period to prevent accidental triggering due to administrative error. A grace period may be specified, which may extend the maturity of the default swap if there is potential failure to pay.
Obligation Acceleration & Obligation Default	Obligations have become due and payable earlier than they would have been due to default or similar condition, or obligations have become capable of being defined due and payable earlier than they would have been due to default or similar condition. This latter alternative is the more encompassing definition and so is preferred by the protection buyer. The aggregate amount of obligations must be greater than the default requirement (typically $10 million).
Repudiation/ Moratorium	A reference entity or government authority rejects or challenges the validity of the obligations.
Restructuring	Changes in the debt obligations of the reference creditor but excluding those that is not associated with credit deterioration such as a renegotiation of more favorable terms.
Source: *ISDA master agreements,2003*	

For example, with Enron default there were nearly 800 credit derivatives contracts outstanding, representing more than $ 8 billion in notional amount terms. Yet they were settled with no litigation, which is a good sign of the market's maturity and resilience to shocks (C. Harding (2004)). However, ISDA settlement protocol is still one of the major concerns for many market players in Europe. It has never been tested in Europe and it is still ambiguous what would happen in a major default case (Pool and Mettler (2007)).

Nevertheless, growth of CDS market on the back of contract standardization and increase in market participants' sensitivity to default risk have attracted

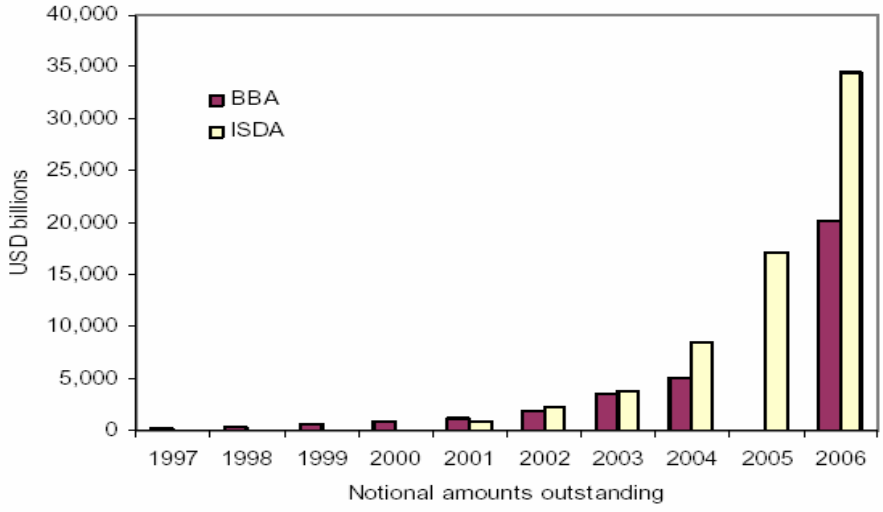
many institutional and non-institutional investors into the market and caused low transaction costs which fell further as the bid/ask spreads narrowed. Besides, simple mechanics behind CDS are used to create new financial instruments to better satisfy market participants' needs in risk management. Hence, derivatives markets have become more liquid and transparent in terms of broadening market participants' base and presenting more structured derivatives instruments for risk management.

2.2 STRUCTURE OF A SINGLE CDS

2.2.1 DEFINITION

According to both ISDA (2006) and BBA (2006), global credit derivatives market has experienced explosive growth over the past decade and CDS has been dominant in the credit derivative market counting more than two thirds of all outstanding credit derivatives.

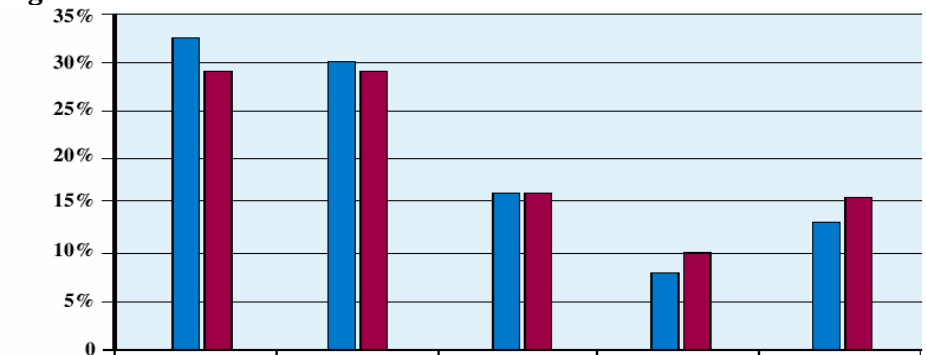
Figure 2. Growth of Credit Derivatives Notional



Source : *British Bankers' Association (BBA), ISDA market survey*

As it can be seen at Figure 3, Credit Default Swap is mostly traded credit derivatives product relative to other derivative instruments. A credit default swap enables protection buyer to transfer the credit risk of a reference entity or obligation to protection seller. In this bilateral agreement, protection buyer pays a periodic fee (usually quarterly) called swap premium to protection seller; in return protection seller makes contingent payment to protection buyer when credit event of reference entity is experienced. Buying CDS contract, protection buyer only transfers default risk without transferring the reference asset; hence, it can be stated that credit default swap covers only the credit risk inherent in the asset, while risks on account of other factors such as interest rate and exchange rate movements still remain with the protection buyer. The typical term of a single CDS contract is usually set as five years, although being an OTC derivative, credit default swaps of almost any maturity can be traded in the derivatives market (O'Kane (2005)).

Figure 3. Credit Derivatives Products



	Single-name credit default swaps	Full index trades	Synthetic CDOs	Tranched index trades	Others
End 06	33%	30%	16%	8%	13%
End 08	29%	29%	16%	10%	16%

Source: *British Bankers' Association, Credit Derivatives Report 2006*[8]

[8] 2008 percentages are estimated by British Bankers' Association

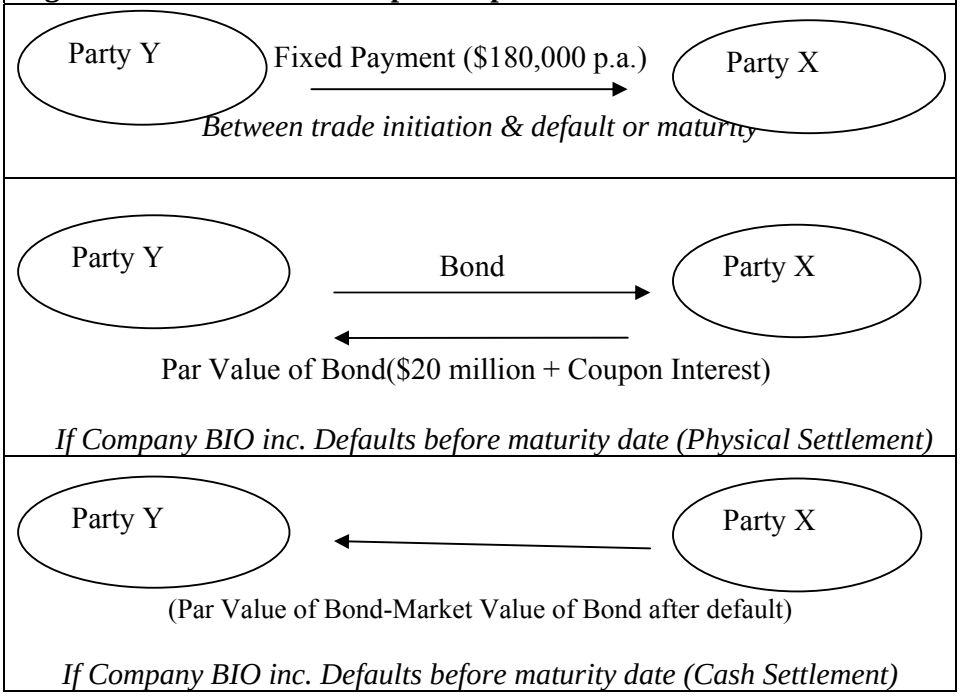
The swap premium is typically defined as a yield spread over the corresponding interest rate swap (quoted on basis points per annum on the notional amount and paid quarterly). Therefore, protection buyer pays the protection seller a premium based upon the yield spread each quarter. For example, suppose that party X is a market maker and party Y is an investor owning $ 20 million of notes issued by BIO Inc. Holding notes, Investor Y face several risks, among them credit risk-if a company's credit profile worsens (spread risk) or if the BIO Inc.'s financial position deteriorates to such an extent that it defaults on its debt (default risk). Therefore, investor Y wants to hedge credit risk inherited in the asset by buying protection with 5 year CDS. Suppose five-year CDS spreads referencing Company BIO are quoted at 0.9 % (i.e., 90 basis points) per annum. Dealer X offers to sell investor Y $ 20 million of protection on company BIO Inc. in a five-year CDS at a price (or premium) of 90 basis points. Then Investor Y, the protection buyer agrees to pay $180,000 ($ 20 million X 0.90) each year for five years to part X. In this way, Investor Y entered into CDS contract and transformed its credit risky asset into a credit risk free asset by purchasing default protection referenced to bonds issued by BIO Inc.

Credit Risk Bond (Bio Inc.) + Credit Default Swap (buy protection) = Risk Free Bond

To simplify our example let's assume bond has exactly 5 year maturity and trades at par value and also assume that defaults occurs only at discrete times, for example at the times the coupon payment made. If credit event occurs between quarters then following formula should be used to include day count conventions. CDS traders buy or sell these contracts usually in million-dollar increments and generally over five-year terms (Whalen (2006)).

Notional Amount X (Basis Points X Days/Day Base) = Term Payment or Quarterly Payment

Figure 4: Credit Default Swap Example



Source: *Adapted from Paper: The Credit Default Swap, Richard K. Skora Skora & Company (Pp. 5)*

If company BIO suffers no credit events, such as bankruptcy, during the term of the contract, then Dealer X keeps the annual premium payments that it has collected from Investor Y and, at the end of five years, the contract expires.

Conversely, if Company BIO Inc. experiences a credit event then one of following two options take place;

If the CDS contract calls for physical delivery, then Dealer X must pay $20 million cash to investor Y. Investor Y will deliver $20 million face value of BIO Inc. debt securities to Dealer X.

If the CDS calls for cash settlement, then Dealer X will pay Investor Y the difference between the face value and the market value of BIO Inc. debt securities after default. If, for example, BIO Inc. debt securities are valued 40 percent of face value following the credit event, then Dealer X will pay $12 million to investor Y (i.e., the difference between $20 million face value and $ 8 million market value).

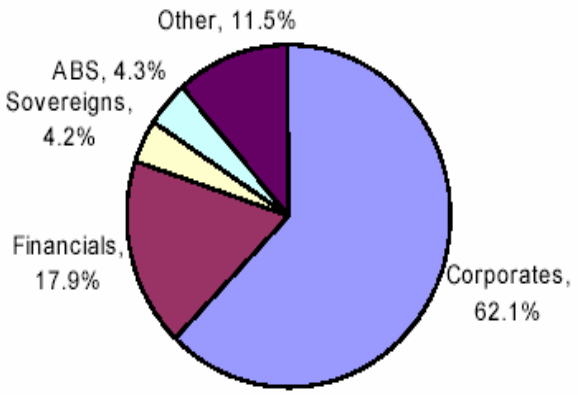
Once credit event is experienced the *Credit Event Notice* and *Notice of Publicly available information* are delivered then settlement takes place. As it is illustrated above example, settlement can be of these two forms: 1) *physical settlement*: the protection buyer will deliver the reference entity obligations (bonds, stocks, and etc.) to protection seller; and in return protection seller will deliver the par value of the obligations to protection buyer. 2) *Cash settlement:* protection seller pays the notional amount of the swap multiplied by difference between par and market price of the obligations (recovery rate) to the protection buyer. Following the credit event recovery rate is commonly determined by a dealer poll in 2-4 weeks[9]. A key distinction between these two settlement processes is that in physical settlement the protection seller has the right to be owner of the defaulted asset and attend workout process to claim for final payment from reference entity.

A typical buyer of CDS is a bond or loan owner who wants to hedge itself against default risk of reference entity. Reference assets can be any assets mainly including corporate bonds, commercial loans, sovereign debts, notes, and even stocks. As market has experienced a tremendous growth depending on macro economic conditions, weight of the underlying assets changed dramatically and there is an increasing trend in the type of reference assets. In contrast to 1996, when they represented 54 percent of

[9] If a certain recovery rate is not determined in the CDS contract then, dealer survey is conducted after 2-4 weeks following the credit event because high volatility of spreads following the credit event. Therefore, 2-4 weeks is waited for defaulted entity's bond to reach a stable price in the market.

reference entities, sovereign entities were present in only 4.2 percent of deals in 2006 (Figure 5), while corporate reference entities made up 62 percent of deals. (Fitch Ratings Global Derivatives Survey (2006)). This considerable shift is mainly caused by not only increasing corporate insolvencies during 2000s and also new entrance of investors (such as hedge funds) into the market to hedge them against credit risk.

Figure 5. Global Reference Entities by Type



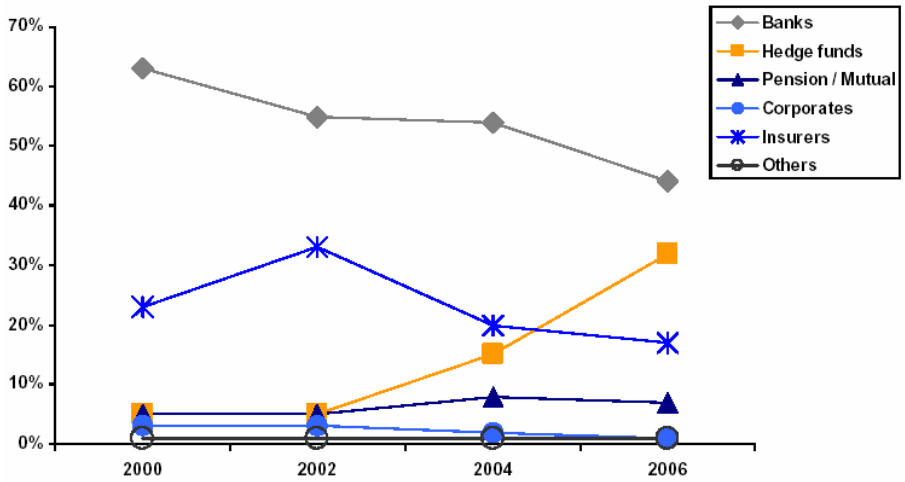
Source: *Fitch Ratings Global Derivatives Survey, September 2006*

2.2.2 MARKET PARTICIPANTS AND USES OF CDS CONTRACTS

During early development of the market, banks have been main issuers and users of CDS instruments, especially for trading and risk management purposes (Figure 6). As the benefits of credit derivative markets have become widely understood, both the users of those instrument and type of the products have diversified in the market. In recent years institutional investors including hedge funds, insurance firms, corporations, and pension and other based-bonds funds are derived into CDS markets as dealing with credit risk has taken on a much greater significance.

CDS market, being the largest credit derivatives market, presents investors a wide range of products. Increasing needs to hedge credit risk, commercial banks have been the active users of credit derivatives to shed risk in several areas of their portfolios (Gibson (2007)). In other words, banks can use credit default swaps to hedge their credit exposure to not only to specific borrowers including large corporate loans, loans to smaller companies, and counterparty credit risk on over-the-counter(OTC) derivatives also to different economic segments. Therefore, in addition to single name CDSs, the most important advancement in the CDS market has been the emergence of CDS index products.[10] The composition of these products can be an economic segment (such as finance or energy), a specific country or regional market such as Brazil or Europe.

Figure 6. Sellers of Credit Protection-market share by type 2000-2006



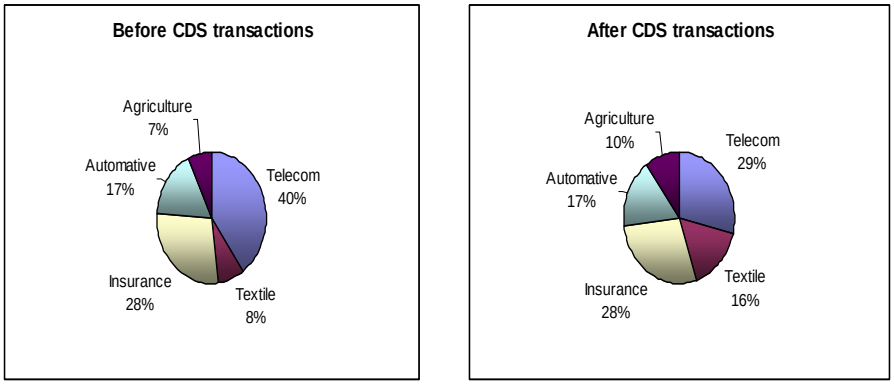
Source: *BBA Credit Derivatives Survey 2006*

Banks can change the risk concentration of their loan portfolio and as well can free up credit lines for more profitable businesses by using CDS products (Malhotra, Garritt, and Russel (2001)). Some commercial banks concentrates on a specific industry and increase their risk appetite in that

[10] CDS index products will be discussed in detail later in Part III

sector opening credit lines to companies in that specific sector. However, once they have reached to a certain level of risk on that sector, they may take short or long position in other sectors by buying issued CDS for other sectors. For example, let's say Bank A opens credit lines mainly for telecommunications sector and, relatively, has a high credit exposure in that industry. Using CDS contracts, Bank A manage its credit concentration without any need for an underlying relationship with the reference entity. Bank A can buy protection for Telecommunication sector and sell CDS written on Textile or Agriculture sector and hence, build up more balanced credit exposure (Figure 7). Thus, as an investment tool, banks can use CDS instruments to diversify their assets based on their risk appetite. For example, some banks can gain exposure to specific undervalued regions or sectors simultaneously diversify their revenue generating portfolios.

Figure 7. Credit Exposure Example-by Category



Besides, banks can better manage their return on regulatory capital using CDS and CDS based instruments (C. Harding (2004)). Traditionally, as BRSA requirements, banks have hedged their exposures to default by keeping provisions and adequate economical capital. Undoubtedly, CDS enables banks to implement a more dynamic and customized risk

management techniques with more less opportunity cost. Furthermore, banks can also act as intermediary for buying and selling CDS contracts over the market and create another revenue pipeline for profit.

Corporate treasuries can use CDS contracts in the same way to hedge their receivable books against single customer in return reducing company overall risks. The most important benefit of CDS contracts lie in the ability without any need for relationship with the customer which may damage future relationships. Corporations can hedge their overexposed credit risk and keep that client in their business. Being customizable, CDS takes the form of an agreement which perfectly suits the more specific need of corporate firms, of course, with less liquidity. As benefits of CDS market has been widely known by corporate firms, they increasingly come to the market, primarily acting as protection buyers.

According to BBA Derivatives Survey in 2006, at early development of CDS market, hedge funds were not primary market participants; however, nowadays by growing number of individual funds they become one of the primary market participants. With the credit oriented hedge funds, they increasingly participate in all segments of the credit markets by pursuing credit strategies even in less liquid credit instruments. Furthermore, recent years credit risk from insurance companies has been transferred to the hedge funds. Without doubt, they add liquidity to the CDS markets due to their higher trading volume and risk appetite to invest in higher risk markets. Consequently, their impacts in global credit markets become greater than their assets under management (W.Merritt and C. Linnel (2006)).

According to several market observers, increasing their market activities and acting both as protection sellers and protection buyers, hedge funds

become very active in perceiving and trading mispriced securities between cash and CDS markets and thus increasing the market efficiency. Hence, hedge funds' contributions to CDSs markets facilitate significant efficiency in the pricing and distribution of credit risk among market participants. Obviously, CDS products provide hedge funds with better investment opportunities for managing the risk-return profile of their portfolios by separating default and interest rate risk. On the contrary to bond market, CDS markets also offers greatest possible short sales possibilities, hence; making hedge funds increasingly enter into positions in that market to implement their different investment strategies (Deutsche Bundesbank (2004))[11].

For example, a proactive hedge fund dealer can perceive 'credit risk' for a specific bond is overvalued and decide to issue a CDS contract as protection seller instead of buying the bond. On the other side, some market participants will believe on the opposite and will buy that CDS contracts. Meanwhile, other market participants will aware of the same overvaluation and try to earn some premium by actively trading that CDS contracts. By the same token, awareness of mispricing in the bond is disseminated over the market, market participants will start to trade that bond more actively. At last, right premium for 'credit risk' will reach to a certain point where supply and demand of market participants intersects for that specific credit risk.

Although insurance firms act as both protection sellers and protection buyers in the CDS markets, their dominate market as protection sellers using their expertise at valuing risk. Unlike to other market participants, pension funds and other bond-based funds had limited share in CDS

[11] Anonymous, Monthly Report of Deutsche Bundersbank (2004), Credit Default Swaps, Functions, Importance, and Information Content.

markets. And their focus has more been on CDS indices and Collateralized Debt Obligations[12].

2.2.3 MOST RECENT CDS BASED INSTRUMENTS

Undoubtedly, burgeoning credit derivatives markets represent the best of financial innovation, a flexible way for investors and corporations to parse their risk and maximize returns. According to BBA, single name CDS, having been a cornerstone for other credit derivatives instruments, accounts for approximately 51 % of the global credit derivatives market. Actually, remarkable pace in CDS markets has been both in volume and in the type of instruments. Thanks to their simple structure, investors are applied credit default methodology in creating new instruments like Loan-Only Credit Default Swaps (LCDSs), Credit Debt Obligations (CDOs), Basket Default Swaps and CDS indices.[13] It is still expected to grow in types as they provide investors with the ability to hedge against dynamic credit exposure driven by market variables.

2.2.3.1 LOAN ONLY CREDIT DEFAULT SWAPS

A new type of default swap is the "loan only" credit default swap (LCDS). LCDS are structure quite similar to single name CDS in those having protection buyer, protection seller, reference entity, reference obligation, and premium payment. Although LCDS is conceptually very similar to a

[12] Synthetic Collateralized Debt Obligations are securitized debt instruments backed by Credit Default Swaps.
[13] Although there are many derivatives instruments- like forward credit default swaps and european credit default swap options- based on CDS, here it is discussed only credit derivatives insruments that have been relatively more popular in recent years.

standard CDS; however, the underlying protection is sold on syndicated loans of the reference entity rather than the broader category of "Bond or Loan".

Unlike CDS contracts, LCDS contracts have not yet been standardized and simplified clearly by International Swap and Derivatives Association (ISDA) and Loans Syndication and Trading Association (LSTA); therefore, they don't have *standard-form* of documentation and *predefined* credit events. Nevertheless, LCDS instruments have ignited much interest in investors including hedge funds, LCDS contracts have been traded at a growing volume on the both side of the Atlantic with different standards with respect to cancellation terms, settlement issues, and recovery rates.

Furthermore, although CDS contracts are mainly designed to cover unsecured debts, LCDS contracts are designed for secured debts. There is still a great potential for LCDS contracts in near future because defaults rates was very low a few years ago and start to increase again making investors to hedge themselves even against secured debts, too. Without doubt, this increase in LCDS volumes will increase even more after settlement, pricing and standard-form documentation problem are addressed. Once Basel II rules takes affect LCDS contracts will be traded even more widely because they enables bank to decrease the amount of capital it is required to be hold.

2.2.3.2 COLLATERALIZED DEBT OBLIGATIONS

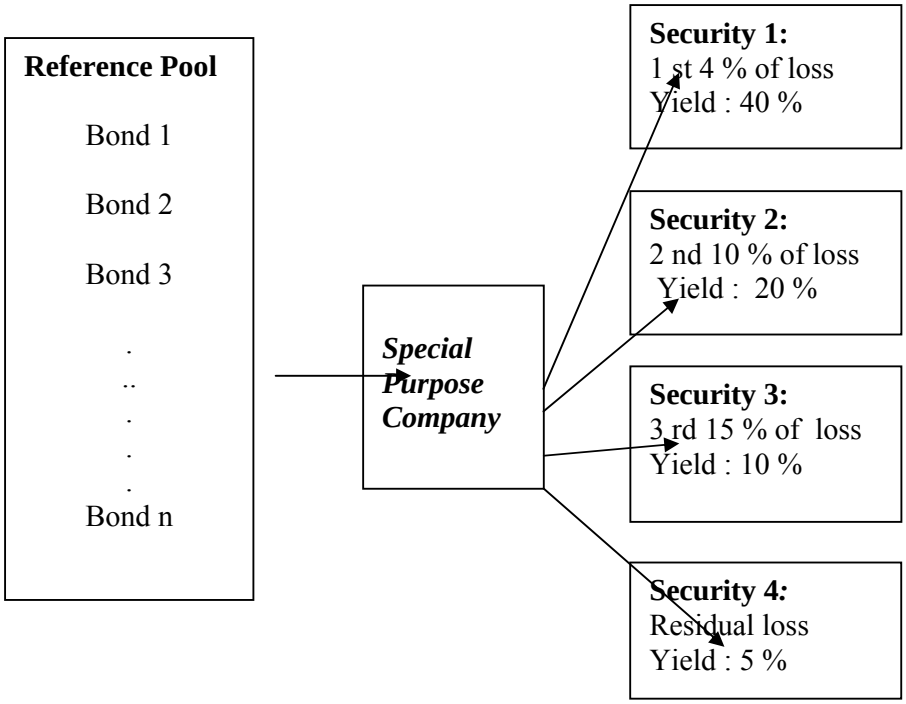
The CDOs are among the most complex credit derivatives products and one most talked about since the outbreak of the subprime mortgage crisis. A

collateralized debt obligation (CDO) is a way of creating securities (tranches) with widely different risk characteristics from a portfolio of debt instruments (Figure 8). Cash flows from CDOs are linked to the incidence of default in a pool of debt instruments. These debts may be loans, other asset-backed securities, emerging market corporate debt, mortgage loans, and etc. When the collateral is mainly consists of loans, the derivative instrument is called a Collateralized Loan Obligation and if it is mainly composed of bonds, the structure is called a Collateralized Bond Obligation (CBO) and so on.

The issuer of the CDO normally retains the equity security and sells the remaining securities in the market since there is high probability of default in equity tranche. A CDO provides a way of creating high quality debt from average quality debt and offers investors much flexibility in buying into an investment that closely matches their risk return profile.

The structure of a typical CDO is shown in Figure 8. The bond or loan is placed in a special purpose vehicle, which then issues several securities of notes according to different level of seniority. The fundamental idea behind a CDO is that one can take a pool of defaultable bonds or loans and issue securities whose cash flows are backed by the payments due on the loans or bonds. Through CDOs it is possible to redistribute the credit risk of the pool of assets to create securities with a variety of risk profiles. As a result, assets that individually had a limited appeal to investors can be transformed into securities with a range of different risks that match the risk-return appetites of a larger investor group.

Figure 8. Collateralized debt obligation



Source: *Adapted from the Options, Futures and Other Derivatives by J.C Hull*[14]

In the above figure the first security has 4 % of the total bond principal and absorbs all credit losses from the portfolio during the life of the CDO until they have reached 4% of the total bond principal. The second security has 10 % of the principal and absorbs all losses during the life of the CDO in excess of 4 % of the principal up to a maximum of 14 % of principal and so on. The yields in the figure below are the rates of interest paid to security holders. These rates are paid on the balance of the principal remaining in the security after losses paid. Consider the first security; at the beginning the return is 40 % is paid on the whole amount invested by the security 1 holders. But after losses equal to 1 % of the total bond principal have been experienced, security 1 holders have lost 25 % of their investment and the return is paid on only 75 % of the original amount invested. Security 1 is

[14] Original version of the example and other detailed information is available on pages between 516-517 of the book called Options, Futures, and Other Derivatives, Sixth Edition, C.J.Hull.

referred to the equity tranche. A default loss of 2 % on the bond portfolio translates into a loss of 50 % of the security's principal. Security 4 by contrast is usually given an AAA rating (Hull and White (2004)). Defaults on the bond portfolio must exceed 29 % before the holders of this security are responsible for any credit losses.

CDOs backed primarily by asset-backed securities and mortgage-backed securities. Mortgage backed security is an asset-backed security whose cash flows are backed by the principal and interest payments of a set of mortgage loans. Payments are typically made monthly over the lifetime of the underlying loans. Residential mortgagors in the US have the option to pay more than the required monthly payment (curtailment) or pay off the loan in its entirety (prepayment). Because curtailment and prepayment affect the remaining loan principal, the monthly cash flow of a MBS is not known in advance, and therefore presents an additional risk to MBS investors.

In the US, the increase in default of low credit rating mortgage loans, known as subprime mortgages, has brought substantial losses to investors who hold assets backed by subprime mortgage collateral. In return, this has also caused increase in interest rate premiums demanded for these assets. But one of the characteristics of credit derivatives mentioned in this paper is that they require a very small investment compared with the value of the underlying assets. Therefore, with a small investment it is possible to obtain a relatively high return. At the same time, risk exposure is high because it increases the capacity to multiply the losses and gains of these instruments. If the buying off MBS is carried out or guaranteed using credit, the multiplier effect is expected much enormous. Finally,-as it is recently experienced in the market-in the current subprime mortgage crisis, CDOs have functioned as multipliers of the losses produced in the underlying assets.

2.2.3.3 FIRST-TO-DEFAULT BASKETS

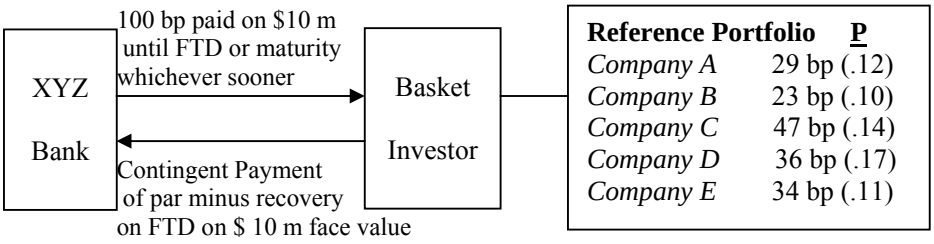
The intuition behind the creating Basket Default Swaps lies under the approach of redistributing the credit risk of a portfolio of CDS. The number of assets included in that portfolio may change from 5 to 200 more. When issuer creates Basket Default Swap, he assigns some losses on the credit portfolio to the different securities in specified order. Usually, the riskiest securities have been first losses in the portfolio and so ranked in lower order, whereas, safer securities are ranked in higher order indicating later losses.

Although mechanism behind creating basket swaps is the same as single CDS, the trigger of credit event is not the same; nth credit event in a specified basket triggers the credit even in default baskets. In the particular case of a first-to-default (FTD) basket, n=1, and it is the first credit event in basket of underlying credits that triggers a contingent payment to the protection buyer and the protection buyer in FTD CDS is protected against only the first default. The advantage of FTD is the opportunity to leverage the risk of probability of a triggering event without increasing the notional at risk.

FTD Baskets provide investors with the opportunity to take advantage of both their view on default probability of reference entities and the correlation between those default probabilities. Upper and lower bounds for FTD Basket spreads are determined by the default correlation between reference entities. When the correlation between reference entities is 0 %, the FTD CDS premium corresponds to the sum of the individual CDS premiums as an upper bound. On the other side, if default correlation between defaults is 100 %, then the basket will behave as a single entity and

the riskiest credit in the basket will always be the first to default. Therefore, the maximum of the individual CDS spreads will be the lower bound for the FTD basket spread. For example, in the basket in Figure 9, if the default correlation is 0%, then FTD spread would be 169 bp; on the other side, if the default correlation is 100 %, then FTD spread would corresponds to 47 pb which is equal to the spread level of the riskiest entity. However, since the default correlation is between 0 % and 100 %, FTD basket correlation is 100 pb.

Figure 9. Mechanics of a First-to-Default (FTD) Basket on Five Credits



Source: *Fabozzi, Frank J. Handbook of Fixed Income Securities*[15]

Defaults basket can be used to construct lower risk assets. Third-to-default baskets, where n=3, trigger after three or more assets have undergone credit events. In fact, since we have only 5 assets in the portfolio above, the likelihood of these 3 assets defaulting is significantly smaller than the probability of any asset in the portfolio defaulting if there is no or low correlation between assets. Hence, default baskets can be used to express a view on default correlation between assets. Increasing default correlation between reference entities may cause credit to survive together and to default together. However, decreasing correlation makes credit events independent from each other and decreases the probability of multiple defaults in the basket. Accordingly, default baskets can be used to hedge a

[15] Original version of the figure can be found in Fabozzi, Frank J. Handbook of Fixed Income Securities, on page 1354.

portfolio of credits more cheaply than buying single CDS on each of the individual credits.

Perhaps the most important development of CDS market has been the emergence of standardized CDS index instruments. The indices are created to reflect the performance of a selection of a single name CDSs. These indices can vary in underlying assets as they can be region, country or segment specific CDS. [16]

2.3 CDS SPREADS AND PRICING ISSUES

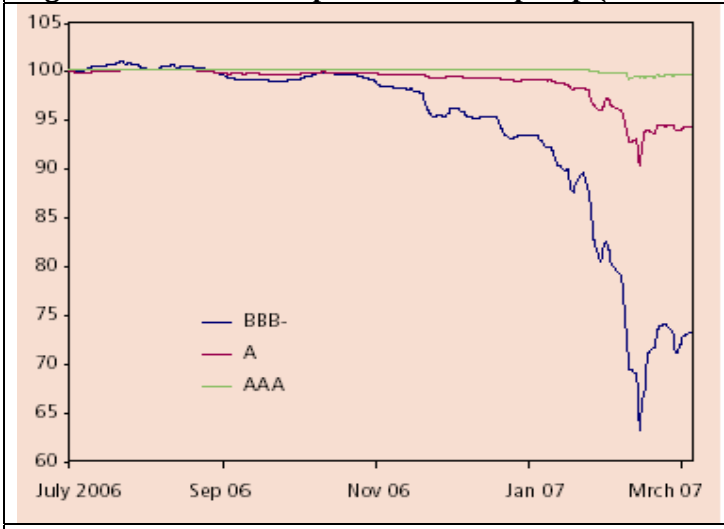
2.3.1 DETERMINANTS OF CDS SPREADS

There have been a few models in pricing credit risk and they all have different assumptions regarding default likelihood, time of default (e.g. continuous or discrete time), time and amount of recovery on default (e.g. random recovery or fixed recovery), and the evolution of interest rates (e.g. random interest rates or fixed interest rates). Although Chen, Fabozzi, Pan, and Sverdlole in their studies showed assumptions like random recovery, and random interest rates play an important role in explaining CDS spread, however, it is not enough to determine which assumptions are more important for determining actual price levels. For example, Merton (1974) model assumes single default time and barrier, fixed interest rates, and random recovery, while Longstaff-Schwartz (1995) assumes a continuous default barrier, random interest rates, and fixed recovery.[17]

[16] CDS indices will be discussed more in detailed in the Part III.
[17] Detailed information about the models can be found in the article called "Source of Credit Risk: Evidence from Credit Default Swaps by Chen,R., J. Fabozzi, F., Pan, G., and Sverdlove, R. (2006) The Journal of Fixed Income, Winter 2006, pp. 7-21.

Although it is subject to discussions, once credit risk is priced in the market, protection buyer can buy the CDSs contract and pays protection seller a periodic premium called CDS spread.[18] In other words, CDS spread is the price of CDS and reflects the credit risk of the reference entity. On the other side, in their studies examining the relationship between credit default swaps spreads, bond yields, and credit rating announcements; Hull, Predescu, and White (2004) showed that CDS spreads are closely tracked with bond yield spreads that are good indicators of credit risk. Besides investing and arbitraging purposes, many market participants use CDS contracts for speculative purposes. At this context, it should be valuable to look at the underlying determinants of CDS spreads. Main factors affecting CDS spreads are Credit Rating, Interest Rates, variance of stock price, leverage, and liquidity in the CDS market and in the other markets.

Figure 10. Price of Subprime-risk Jumps Up (ABX-indices)[19]



Source: *KBC Asset Management*

Credit rating is the most important source of the credit risk. Although credit ratings usually lag information in the market and provide little information,

[18] Spread is quoted in terms of basis points per annum of the contract's notional value and is usually paid quarterly.
[19] ABX-indices are based on home equity asset backed securities.

they still have enormous affect in pricing credit risk (A. Nerin, Cossin, Hricko, and Huang (2001)). Default probabilities can be produced for different terms based on historical credit ratings. Furthermore, Hull, Predescu, and White (2004) also show that there exist a relationship between credit ratings and CDS spreads; however, the sensitivity of the level of credit default swap rates to ratings is different for high-rated and for low-rated loan. As an illustration (Figure 10), when US mortgage-market experienced delinquencies and foreclosures in subprime segment last year, reaction of different subprime loans were different. While low-rated loans credit risk spreads experienced dramatic changes, higher quality subprime mortgages hardly moved.

On the other hand, CDS spreads, at times of succession events, may diverge from observed credit quality pattern into completely uninformative path.[20] When a succession event occurs, the issue of debt between parties will arise and market participants may be bemused. As an example, merger activities involve some restructuring. However, mergers where the two companies are still operating very independently afterwards also exist. Although credit quality of the companies is not changed it may be perceived in positive or negative way in the market and causes credit spreads to tighten or worsen without any reason (Gonenc, Schorer, and Appel (2007)).

Interest rates matters for all CDS pricing models. The first issue has been which risk free rate should be used when discounting cash flows either Treasury zero curve or LIBOR zero curve (swap zero curve)? Many derivative traders working for large financial institutions tend to use the swap zero curve in their pricing since the swap zero curve corresponds to

[20] The 2003 ISDA definition for a succession event is as follows: succession event means an event such as a merger, consolidation, amalgamation, transfer of assets or liabilities, demerger, spin-off or other similar event in which one entity succeeds to the obligations of another entity, whether by operation of law or pursuant to any agreement.

their opportunity cost of capital (Hull, Predescu, and White (2004)). Therefore, if the swap zero curves is used in the pricing model, CDS spreads would represent accurate credit risk levels in terms of including taxation, regulation, and liquidity aspects. Also US interest rates are very important for the issuers of other countries since it stands benchmark for other countries in determination of local interest rates. Therefore, timing and level of interest rate changes is also very important for CDS spreads.

In all the structural models like Longstaff and Schwartz (1995) and Leland (1994), default is triggered by the firm value process. Therefore, it can be stated that the other factors influencing credit spread is the value of the assets of the company and the volatility of the value of the company. Stock prices contain best information regarding these issues and reflect this information faster than rating results. Negative information will result as the stock price decrease while positive information will result as the stock price increases. In the market, investors' reaction to positive information results as increase in the stock price and decrease in the probability of default. That means increase in the stock price will make distance further from default boundary.

On the other hand a decrease in the stock price may point out negative information about the company and will make the distance lower to default boundary. That means, contrary to the increasing price, decreasing price leads to a higher risk (Nerin, Cossin, Hricko, and Huang (2002)). Besides, high volatility of stock prices in the market is also associated with higher credit risk. In return, credit spreads tends to be larger during high volatility of stock prices.

Leverage also has a significant effect on the default spreads. All of the structural models agree that leverage has a significant influence on the probability of default. In fact, the intuition behind that is quite straightforward because as company's debt to equity ratios increases comparing to benchmark companies' ratio, it bears more risk to default. In return any CDS written on this company's debt/bond will have wider spread.

Liquidity is also one of significant factors in determining the CDS spreads. At early stages of the derivatives market, lack of liquidity caused CDS bid/ask spreads to be larger, however, as many investors in different markets increasingly become aware of benefits of this market, bid/ask spreads have narrowed much. As a result, liquidity of other markets (corporate bond, stock, and option markets) spilled over the CDS markets causing CDS spreads to narrow. On the other side, liquidity premium component of the credit spread will decrease substantially once CDS becomes exchange traded. In terms of maturity, the most liquid CDS is the five-year contract, followed by three-year.

At more detailed level, the pricing of the CDS contract also depends on the creditworthiness of the protection seller, as well as the correlation between the protection seller and the reference entity. In our example, creditworthiness of X (market maker) and correlation between BIO Inc. and X (market maker) affects the price/spread of the CDS contract. Then it can be stated that the exposure of Y is very sensitive to the correlation between the X and BIO Inc. and yet this correlation is one of the parameters that is most difficult to estimate with precision (C. Finger (1999)).

2.3.2 VALUATION OF A CDS POSITION

In theory CDS spreads should be closely related to bond yield spreads. If we say r_b to be yield from an n-year par yield bond issued by a company, r_f to be yield from an n-year par yield risk free bond, and s as the n-year CDS spread then it is expected that s is to be equal the difference between r_b and r_f if there is no arbitrage opportunity exist in the market.

$$s = r_b - r_f \qquad \textbf{(Equation 1)}$$

Although it is very rare to have this equation holds perfectly in real life cases, at least it is supposed to be holding approximately. Otherwise, there will be an arbitrage opportunity in the market. If s is greater than $r_b - r_f$ then, arbitrageur will find it profitable to buy risk free bond, short a corporate bond and sell the credit default swap. On the contrary, if s is less than $r_b - r_f$ then, the arbitrageur will buy a corporate bond, buy the credit default swap and short a risk free bond.

At the time of initiation, the value of CDS contract is zero. Thereafter, its value may change depending on market CDS spreads caused by change in one of or more determinants of CDS spread. Valuation of CDS contracts depending on changes in the market CDS spreads is called mark to market (MTM)[21].

Once protection buyer buys CDS from protection seller, it means that expected present value of the protection equals expected present value of the premium in the market. After that exchange occurs, CDS position has been

[21] Mark to Market(MTM) is defined as the amount the market would pay us to unwind the CDS position before maturity.

established and value of this position changes in the market depending on the changes in CDS spread and equations doesn't hold anymore. Consider the previous example, when contract was first traded it was 90 basis points. After one year later the credit quality of BIO Inc. has worsened, and the corresponding CDS spread has widened so that four-year CDS protection trades at 120 basis points reflecting higher risk of default. At this stage, the value of the CDS position is:

MTM= expected present value of premium leg of 90 basis points-expected present value of protection for four years (expected present value of premium payments at 120 basis points)

Or

MTM= (S (t)-S (0)) X RPV01 where RPV01 is the risky PV01 which is given by

$$RPV01(t) = \frac{\left(1 - e^{-(r+\lambda)(T-t)}\right)}{(r+\lambda)} \qquad \textbf{(Equation 2)}$$

, and where

$$\lambda = \frac{S(t)}{1 - R_{22}} \qquad \textbf{(Equation 3)}$$

On the other side, since both premium legs are paid on the same schedule and are subject to the same contingent credit event, they can simply be netted as:

MTM=expected present value of premium leg of -30 basis points[23]

For example, an investor buys $10 million of five year protection at 90bp. One year later, the credit trades at 120bp. Assuming a recovery rate of 40 %,

[22] λ stands for hazard rate and R stands for Recovery Rate.
[23] See Fabozzi, Frank J. "Handbook of Fixed Income Securities," pp 1350.

the value is given by substituting, r=3 %, R=40%, S(t)= 0.012, S(0)=0.009 and t=4 into above equation to give λ=2 % and an MTM value of $108, 762.

In that scenario, negative change in the creditworthiness of BIO Inc. causes CDS spread to go up while creating positive market value for protection buyer Y. Thereafter, as long as creditworthiness of BIO Inc. remains sound, as a protection buyer, Y is hedged against a major loss due to a change in BIO Inc.'s credit quality. Not only is Y fully compensated in the event of a default, but the mark-to-market value of the CDS partially compensates it for the depreciation of the BIO Inc.'s bond in the case of downgrade.

There have been further steps in calculating value of CDS position; however, they requires models to anticipate a time of credit event and weight each premium payment by the probability of not having credit event till the maturity. Market standard model can be found on the Bloomberg under the CDSW function.[24]

2.4 BASEL II DRAWS ATTENTION TO CDS CONTRACTS

Comparing to Basel I, Basel II introduced major changes regarding charges on credit risk. Basel Committee categorizes the credit concentrations into two parts; i) conventional credit concentrations that includes concentrations to single borrowers, a group of affiliated borrowers, or an industry ii) concentrations based on common or correlated risk factors, i.e. market disturbances such as Russian bond default.

[24] See O'Kane, D. and Turnbull, S. (2003), "Valuation of Credit Default Swaps," Lehman Brothers Quantitative Credit Research Quarterly.

As it can be seen from the figure below Basel II changed the minimum capital requirements for the bank and brought an enhanced approach for the credit risk. In order that, Basel II requires public ratings, internal ratings and mitigation for credit risk. Therefore, it can be stated that capital charges for credit risk will become more risk sensitive as they are linked to credit ratings (Debuysschier (2005)).

On the other side, concerns about how to tackle with credit derivatives contract has been vague among the market participants. To market players, however, credit derivatives have not only mitigated credit risk, but also contributed to revenue pipeline with multibillions profits (Kentouris (2004)). For this purpose, banks still want to enter into CDS contracts to diversify their portfolios and the question arises regarding how much regulatory capital should be set aside against the credit risk.

The current Basel II has a conservative approach regarding credit derivatives because for capital charges concerning credit risk, it only looks at the counterparty. However, likelihood of default is lowered with CDS agreements via having protection against credit risk because double default of reference entity and protection seller is less likely than default of any party in a single time.

Consequently, in the years to come the key beneficiaries of Basel II will be those who hold a majority of high grade assets, while those who that a hold a majority of low-grade assets are likely to lose out as a result of these changes (Debuysschier (2004)). Also Basel II should create a proactive approach for risk management, nevertheless market participants anticipate the changes in the market and adapt to them in advance. Furthermore,

regulatory capital freed up through use of CDS can be used to back other risk that banks face.

Table 2. Basel II Capital Accord

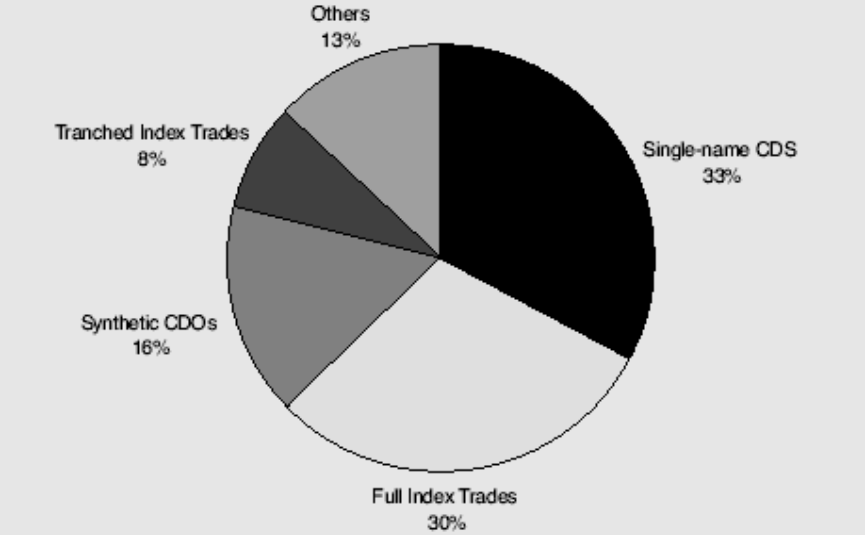
1.Minimum Capital Requirements	***2.Supervisory Review of Capital Adequacy***	***3. Market Discipline***
Set minimum acceptable capital level	Bank must access solvency versus risk profile	Improved disclosure of capital structure
Enhanced approach for credit risk -Public Ratings -Internal Ratings -Mitigations	Supervisory review of bank's calculations and capital strategies	Improved disclosure of risk measurement practices
Explicit treatment of Operational Risk	Bank should hold in excess minimum level of capital	Improved disclosure of risk profile
Market Risk framework, capital definition/ratios are unchanged	Regulators will intervene at an early stage if capital levels deteriorate	Improved disclosure of capital adequacy

Source: *Mercer Oliver Wyman "The New Rues of the Game-Implications of the New Basel Capital Accord for the European Banking Industries"*

3. CDS INDEXES

A CDS index is a credit derivative used to eliminate credit risk or to gain exposure to a basket of credit entities. In other words, CDS indices enable investor to go long or short the credit risk of CDS portfolio in a single transaction. Comparing to single CDS, CDS index is completely standardized in terms of liquidity, transparency and diversification. Especially, the recent merger of the two main credit indices, iBoxx and Trac-x, into DJ iTraxx have established near-universal market acceptance. Furthermore, the pool of market-makers guarantees tight bid-offer spreads and sufficient liquidity for investors. Liquidity of the product has attracted many new participants and thus, hedging credit portfolios with CDS indices have become cheaper than buying protection for each single credit in the portfolio. According to BBA Credit Derivatives Report 2006 statistics, the index derivatives products represent substantial section of the market and the share of these products has increased to 30 % in 2006 from 9 % in 2004.

Figure 11. Market Shares of Credit Derivatives by Type



Source: *British Bankers' Association. Credit Derivatives Report 2006*

Although there are currently two families of CDS indices: CDX and iTraxx, in this study we are focusing potential use of iTraxx product series in Turkish Banking system. These indexes basically facilitate easy entrance into or exit from a well-diversified credit portfolio. Both index series are referencing a portfolio of the most liquidly traded 125 CDS names in the US and Europe, respectively. These indices are currently issued twice a year, in March and September and mainly managed by CDS Index Company (CDS Index Co). CDX indices are marketed by Markit Group Limited and include only North American and Emerging Market entities. Besides, iTraxx is managed by International Index Company (IIC) and contains companies from the rest of the world including Europe, Japan, Australia and etc.

Every six months, a group of investment banks come together and based on a set of rules -basically concerning liquidity-determine which credit entities will be included in the next indices series. This process is intended to ensure indices up-to-date with existing instruments. Premium for the indices based on credit spread of the entities in the indices and fixed on the issuance date. Each year, quarterly, the protection buyer pays the protection seller the initial price of the index (i.e. 50 basis points) on a given notional amount of the index. If the index value changes over the next quarter, the protection buyer will make a payment to the protection seller equal to the present value of change in the value of the index over the remaining life of the contract. Therefore, entering into an index at a later date involves an up-front payment of the mark to market of the index (Fabozzi (2005))[25].

3.1 ITRAXX INDEX

[25] See Fabozzi, Frank J. "Handbook of Fixed Income Securities", 2005. pp 1352-1353

iTraxx is the brand-name for the series of CDS indices and covering different industries in regions of Europe, Japan and non-Japan Asia. iTraxx indices cover a large sector of the overall credit derivatives market and enable hedge or speculative positions to be taken in sectors at a relatively cheap cost resulting from tight bid/ask spread (Table 3). Entities included in all indices are equally weighted and if the number of index constituents cannot be divided equally to two decimal places, weighting adjustments (+/- 0.01%) are made in alphabetical order.

Table 3. iTraxx Index Series 8 Data

Index	Maturity	Fixed Rate (%)	Date	Bid	Ask
iTraxx Europe	5 - year	0.45	March 3, 2008	130.08	130.96
iTraxx Crossover	5 - year	3.75	March 3, 2008	606.38	609.13
iTraxx HiVol	5 - year	0.65	March 3, 2008	195.20	197.10

Source: *Compiled from IIC Ltd. Data*

The most popular index is iTraxx Europe index and consists of 125 equally-weighted European investment grade entities. The iTraxx Europe is the most liquid index and for this reason, it may be perceived as a credit benchmark in the market. Therefore, it is increasingly viewed as a leading market indicator of the credit market overall. Consisting of highly liquid credit pool, iTraxx Europe is mainly used for hedging and creating credit exposures at macro level. It is composed of 25 financial, 20 TMT, 20 industrials, 20 energy, 30 consumer and 10 auto names. Besides, HiVol is created with 30 most risk credits included in iTraxx Europe and associated with high volatility, return and beta iTraxx. Crossover index is created in similar manner but constituents are 50 sub-investment grade credits that provide high yields.

The iTraxx LevX index is also created from the pool of European corporations with leveraged loan exposures basically including 35 equally-weighted leveraged loan credits for a first Lien Senior Index and 35 for a $2^{nd}/3^{rd}$ Lien Subordinated Index.

iTraxx Asian indices comprise an Asia ex-Japan index , an Australia index and two Japan indices. Asia ex-Japan index consists of 50 equally-weighted Asian investment grade and 20 equally-weighted Asian High Yield CDS and it can be split further into a 50-name investment grade and 20-name high yield index. Australia index is based on 25 equally-weighted Australian entities while two Japan indices are created through 50 and 80 equally-weighted CDS on Japanese entities. In terms of maturity, the main Japan index trades 3, 5 and 10-year maturities, the Australian index trades 5 and 10 year and Asia ex-Japan, Japan 5 and Japan HiVol trade 5 year maturities only.

Table 4. Markit iTraxx Asia

iTraxx Asia Ex-Japan 70 entities	**iTraxx Australia** 25 entities	**iTraxx Japan** 50 entities
Sub-Indices iTraxx Asia Ex-Japan IG iTraxx Asia ex-Japan HY		**iTraxx Japan 80** 80 entities **iTraxx Japan HiVol** 25 entities

Source: *Compiled from* www.markit.com

The latest series is S9 which is recently launched on 20 March, 2008. This series consists of three benchmark series; iTraxx Europe, iTraxx Europe Hivol, iTraxx Crossover. On the other side, it is divided into three major

sectoral indices; non-financials, Financial Senior, and Financial Sub. It can be further divided into more specific sectors like autos, consumer, and energy and so on. Although the most common maturity is the 5 years for all index types, other maturities for indexes are also available as 3 years, 7 years and the 10 years. The launch of iTraxx series every six months have represented the next phase in the evolution of Euro credit markets and development of CDS trading in Europe. Furthermore, International Index Company (IIC) is still expanding the range of credit default swap indices with launch of new indices in different currencies.

Table 5. iTraxx Europe Series	
iTraxx Europe Top 125 names in terms of CDS volume traded in the six months prior to the roll.	**Non-Financials** 100 entities
iTraxx Europe Hivol Top 30 highest spread names from iTraxx Europe	**Financials Senior** 25 entities
iTraxx Europe Crossover Exposure to 50 European sub investment grade reference entities	**Financials Sub** 25 entities
Source: *Compiled from* www.markit.com	

Furthermore, market-makers[26] agree to quote tranches on these portfolios from an equity or first loss tranche (0-3 %) to the most senior (12-22 %) tranche. Each tranche is defined by its attachment and detachment points[27]. Equity tranche (0-3 %) represents the riskiest tranche in iTraxx portfolio which bears the first default losses up to 3 % of notional amount. Default

[26] The following are licensed marketmakers for the Markit iTraxx Europe indices: ABN AMRO, Bank of America, Bank of Montreal, Barclays Capital, Bayerische Landesbank, BBVA, Bear Stearns, BNP Paribas, CALYON, Citigroup, Commerzbank, Credit Suisse, Deutsche Bank, Dresdner Kleinwort, DZ Bank, Goldman Sachs, Helaba Landesbank Hessen-Thüringen, HSBC, HSH Nordbank, HypoVereinsbank, ING, IXIS, JP Morgan, Landesbank Baden-Württemberg, Lehman Brothers, Merrill Lynch, Morgan Stanley, Natixis, Nomura, Nord LB, Nordea, Royal Bank of Scotland, Santander, Société Générale, Straumur Burdaras and UBS

[27] Attachment point represents the minimum level of losses in a portfolio to which a tranche is exposed. Detachment point represents the maximum level of losses in the portfolio to which a tranche is exposed.

losses more than 3 % of notional amount are absorbed by Junior Mezzanine tranche (3-6 %) up to the 6 % of notional amount and losses between 6-9 % are absorbed by Senior Mezzanine tranche. Mezzanine tranches represents the level as the middle of a capital structure that ranks below the highest ranking debt, but above equity. When default losses exceed 9 % of notional amount, senior tranche (9-12 %) and super senior (12-22 %) tranche bear the subsequent losses. Higher attachment points for senior tranches indicates that more defaults should be experienced to cause tranche principal losses. Intuitively, this results in lower spreads for higher subordination levels while higher spread for less subordinated tranches (Fabozzi (2005))[28]. Furthermore, the prices of index tranches are based on standardized pricing models and set by market demand and official pricing is collected by Markit Group Limited on a daily basis from the licensed trading desks. This fixing is often used as a reference price for trading other structured credit instruments.

3.2 CDX SERIES

These indices series are also very efficient way to hedge a macro credit position in U.S. market and emerging markets.[29] As a result, they are also traded by a wide range of users including hedge funds, asset managers, insurance companies, and treasuries.

The most actively traded CDX indices is CDX.NA.IG index which consists of 125 equally-weighted North American investment grade entities. The

[28] See Fabozzi, Frank J. "Handbook of Fixed Income Securities" 2005, pp.1361
[29] Emerging markets includes only sovereigns: Brazil, Bulgaria, Colombia, Korea, Malaysia, Mexico, Panama, Peru, the Philippines, Romania, Russia, South Africa, Turkey and Venezuela.

CDX NA IG indices series is distributed to following 5 sub-indices; financials (24), consumers (34), energy (15), industrials (30), TMT (22). The composition of IG Index and the removal of names from IG index are determined by a member poll[30] 10 business days prior to the roll date on a continuing basis.[31] Generally, each IG Index is issued with a fixed rate on September 20 and March 20 of each year.

Similar to iTraxx, each CDX standard tranche is denoted by its subordination and its upper limit expressed as a percentage of the size of he underlying reference portfolio. For the U.S. DJ CDX index, the standard tranches have slightly higher subordinations as follows: an equity 0-3 %, followed by a junior mezzanine 3-7 %, a 7-10 % senior mezzanine, a 10-15 % senior, and a 15-30 % super senior tranche.

Table 6. CDX Index Series Data (Maturity 20 December 2012)

Index	***Maturity***	***Fixed Rate (%)***	***Date***	***Series***	***Spread***
CDX.NA.IG	5 - year	0.600	March 7, 2008	9	178
CDX.EM	5 - year	1.750	March 7, 2008	8	270
CDX.NA.XO	5 - year	2.450	March 7, 2008	9	414
CDX.NA.HY	5 - year	3.750	March 7, 2008	9	759

Source: Compiled from IIC Ltd. Data

Furthermore, CDX.NA.XO index is created with 35 entities that have an eligible rating (BBB/Baa or BB/Ba). CDX.NA.HY index consists of 100

[30] Member poll includes following major international banks: ABN AMRO, Bank of America, Barclays Capital, Bear Sterns, BNP Paribas, Citigroup, Credit Suisse, First Boston, Deutsche Bank, Goldman Sachs, HSBC, JP Morgan, Lehman Brothers, Merrill Lynch, Morgan Stanley, UBS, and Wachovia.

[31] For detailed information about the Polling Process in connection with a roll please see the "Index Methodology for the CDX Indices.

non-investment grade entities with equal weighting of 1.0% and each entity is determined by members. CDX.EM Index is composed sovereign issuers from three regions including; i) Latin America; ii) Eastern Europe, the Middle East and Africa; and iii) Asia. The composition of EM index is determined by the submission of each EM Members choice based on EM Index rules. Currently, there are 14 emerging economies in CDX.EM index and Turkish BB rated Governmental bonds represent 11 % weight in that index.

The main difference from single name CDS is that a buyer of protection on the index is implicitly have to pay the same premium, fixed rate, on all the names in the index. Besides, in both index families, credit event is defined to be bankruptcy or failure to pay.

3.3 PRICING CDS INDICES AND DEFAULT CORRELATIONS

Similar to single CDS, the price of an index is the spread paid by the protection buyer that equates the expected present value of protection leg to expected present value of premium leg. However, present value of protection leg is mainly determined by index size, the recovery rate and the timing of defaults. For premium leg, index contracts specify M quarterly payment dates, $t=t_1, t_2,\ldots..,t_m$, on which the buyer of protection makes payments to the seller provided that effective notional of the index at time t_i, denoted by $N(t_i)$, is positive. It should also be assumed that investors discount expected future income streams using the (uncertain) discount factors $D(0, t_i)$. Pricing CDS indexes is similar to the pricing the index tranches or first to default baskets. Given those assumptions and the index Premium S, in their studies Amato and Gyntelberg (2005) indicated how to

price index tranches. They expressed expected present value of the Premium leg with the following formula;

$$V_{prem} = S \cdot E\left[\sum_{i=1}^{M} D(0,t_i) \cdot N(t_i)\right]$$

(Equation 4)

Then, they stated that the present value of the premium leg would be lower if; i) the premium is low, ii) the recovery rate is low, and iii) default losses are incurred early. On the other side, they expressed the present value of the protection leg as follows;

$$V_{prot} = E\left[\sum_{i=1}^{M} D(0,t_i) \cdot (N(t_i) - N(t_{i-1}))\right]$$

(Equation 5)

Also they indicated that, the present value of protection leg would be lower if; i) index size is low, the recovery rate is high, and defaults occur later during the contract period. To find tranche premium, they solved the following eqution for S ; $V_{prem} = V_{prot}$ for S:

$$S = \frac{E\left[\sum_{i=1}^{M} D(0,t_i) \cdot (N(t_i) - N(t_{i-1}))\right]}{E\left[\sum_{i=1}^{M} D(0,t_i) \cdot N(t_i)\right]}$$

(Equation 6)

At this stage, it can be stated that the price of an index is the spread which equates present value of protection leg to present value of premium leg.

As it can be seen from the equations above, a model for valuing indices obviously requires estimation of many parameters including mainly S: future effective index premium and discount factors. Most of the market participants use Bloomberg CDSW screen to value index products. At

CDSW screen Bloomberg model (B)[32] is available along with three different models; JP Morgan (J), Hull-White (H), and Discounted Spreads (D). Each model differs slightly in underlying assumptions and necessary inputs: 1) recovery rates; 2) default probabilities; 3) default correlations. As a result, these differences leads each model to calculate marked to market value of index differently and this is illustrated in Appendix I where iTraxx Europe 12/10 is calculated using different models.

As a market practice, recovery rates can be estimated from data (based on historical recovery rates) published by rating agencies although historical ratings tends to lag information. After assuming a certain recovery rate, the required risk-neutral default probabilities can be calculated from credit default swap spreads or bond prices using recovery rates (Hull and White (2004))[33].

Estimating default correlation continues to challenge market participants. Mainly, two types of default correlation models are common in the market; reduced-form models (i.e. Duffie and Singleton (1999)) and structural models (i.e. Merton's models (1974)). However, both of these model families have been computationally very time-consuming for valuing indices. This derived market participants to use Copula Model[34] in the estimation of correlation. The advantage of Copula Model over other models is being able to create a tractable multivariate joint distribution for a set variable that is consistent with known marginal probability distributions for the variables. (Bo-Chih (2004))

[32] For the details about Bloomberg Model CDS pricing, see Eurox Report (2008), "The World of Credit: A chronology from 1999 to 2008"
[33] See Hull, John and White, Alan (2004), "Valuation of a CDO and an n-th to Default CDS Without Monte Carlo Simulation", Journal of Derivatives, pp. 18-19.
[34] In a factor copula model, joint probability distribution for the times to default of many companies is constructed from the marginal distributions. For more detailed explanation see: Hull, John and White, Alan, "Valuation of a CDO and an n-th to Default CDS without monte carlo simulation" Journal of Derivatives. Winter 2004.

As it is indicated in BIS Quarterly Review, March 2005, one-factor Gaussian copula[35] model has become the standard market model with the assumptions of constant pairwise correlations, constant CDS spreads, and constant default intensities for all companies in the reference portfolio. Gaussian Copula model quantifies the correlation between the times to default for different companies. C. Hull (2005)[36] illustrates Copula model to quantify the default correlation between two companies and define t_1 is the time to default for company 1 and t_2 is the time to default for company 2. If the probability distributions for both these companies would be normal N (0, 1) then it would be quite straight forward to assume that the joint probability distribution of t_1 and t_2 is bivariate normal. However, in real life the probability distribution of a company's default is not even approximately normal. Therefore, using this model, C. Hull (2005) transforms t_1 and t_2 into new variables where Q_1 and Q_1 are defined as the cumulative probability distribution for t_1 and t_2 respectively. N^{-1} is the inverse of the cumulative normal distribution.

$$X_1=N^{-1}[Q_1(t_1)] \quad , \quad X_2=N^{-1}[Q_2(t_2)] \quad \textbf{(Equation 7)}$$

Then probability distributions for both companies are transformed into standard normal distribution on percentile-to-percentile bases. For example, the 5-percentile point in the probability distribution for a company is transformed to X_1 = -1,645 point, which corresponds to the 5-percentile point in the standard normal distribution. Then it can be assumed that the joint distribution of X_1 and X_2 is bivariate normal with correlation ρ_{12} and this assumption is referred to as using a Gaussian Copula. The advantage of this model is the ability to extend it for many companies. In that case, after

[35] The term "copula" is meant to emphasise that this type of model "couples" individual-name default probability distributions together to form a joint default probability distribution (see Nelsen (1999)).

[36] See C.Hull, J. (2005). Options Futures and Other Derivatives. New Jersey, Prentice Hall. Pp. 496-497.

each probability distribution for companies is transformed into standard normal distribution on percentile to percentile bases then it can be assumed, x_i are multivariate normal distribution. This process is conducted as the same for all companies. Credit risk correlation between t_i and t_j is measured as the correlation between x_i and x_j after transformation.

At this stage, it is quite straightforward to state that there is a direct mapping from a latent random variable X_i to default times, where the evolution of X_i is given by (D Amato and Gyntelberg (2005)) equation below where M stands for common factor affecting defaults for all companies, the Z_i stands for a company specific risk, and ρ stands a common correlation for all i.

$$X_i = \sqrt{\rho} \cdot M + \sqrt{1-\rho} \cdot Z_i$$

(Equation 8)

Assuming the probability that company i will default by a particular time T is $Q_i(T)$, under the Gaussian copula model, a default happens when $N(x_i) < Q_i(T)$ or $x_i < N^{-1}[Q_i(T)]$ (C. Hull (2005)).

As it can be seen from copula model, there is a direct relationship between credit risk correlations and default risk of CDS index tranches. The high degree of sensitivity to default correlations is clearly included in the pricing of tranches. For one-factor Gaussian copula approach, it can be interpreted that X_i is the value of assets held by entity i, and entity i defaults if its assets fall below some threshold. Again as a market practice, the correlation parameter in Equation 8 can be estimated from correlations of equity returns.

Besides, similar to calculation of volatility from option prices using Black-Scholes model, it is becoming a common practice in the market to calculate implied correlations from the spreads at which tranches trade using the standard market model. At this sense, implied correlation for a tranche is the correlation that causes the value of the tranche to be zero. Although many different copula models can be generated by using different assumptions in the factor model, Hull and White in their studies[37] proved that the double t-distribution copula where both the market factor and the idiosyncratic factor have heavy tails provides a good fit to CDX and iTraxx market data.

3.4 MARKET PARTICIPANTS

According to several market observers, banks and hedge funds have been most active players on iTraxx. Different departments within banks can trade iTraxx for different purposes. Loan portfolio managers can use iTraxx instruments to hedge their portfolio against industrial or macroeconomic fluctuations. Adding CDS index protection into a loan portfolio, credit managers may reduce their returns slightly, while significantly reducing their potential loss due to default. This can be achieved through a short or long position in CDS indexes. Taking a short position in iTraxx index, fund manager can protect the value of his loan portfolio against any default in the portfolio. Besides, buying protection through an index reduce the credit duration of a loan portfolio. Premium paid for protection will decrease the interest payments being paid to banks and therefore, will cause the duration to decrease. On the other side, investors can buy iTraxx index (sell protection) to enhance income while increasing the portfolio's overall exposure to credit risk.

[37] See Hull, John and White Alan (2005), "Valuation of a CDO and an n-th to Default CDS Without Monte Carlo Simulation", pp 13-14.

On the other side, structured product unit in the treasuries can use iTraxx tranches or options to hedge their correlation or volatility positions or even to generate new products. Indices can also be used to draw on additional income. Different indices series in terms of type, maturity, and sector enables investors to execute curve trading strategies and relative-value between different sectors. A trader even has the opportunity to trade in the same sector. For example, if trader believes Renault will perform relatively better in the market, he sells the protection for Renault and buys iTraxx Autos index protection. Turkish banks have also recently realized the opportunities and benefits of credit derivatives, and therefore, some banks have already established structured product unit in their treasury. For example, leading banks (Akbank, Garanti Bank, İş Bank, Yapi Kredi Bank, Finansbank) in Turkey have already established their structured product units and currently trading credit risk embedded in Turkish sovereign debts.

The growth in the use of CDS indices has also been driven by hedge funds using these instruments as a way to discover arbitrage opportunities. During a credit forum in 2004, Donnat[38] statetated that hedge funds are specifically very active in alpha strategies using iTraxx as a benchmark. Therefore, they mainly do relative value trading including single entity versus sector, sector versus sector, or sector versus benchmark. In turn, these trading strategies are increasing CDS index markets efficiency and thus, attracting more investors into the market.

Asset managers use CDS indices to diversify into European and North American credit risk portfolio and as well trade iTraxx and CDX to balance their portfolios. CDS indices can be used to manage Asset/Liability effectively. For instance, buying protection via CDS indices, an asset

[38] Philippe Donnat is the Head of Credit Indexes and Options Trading in Corporate and Investment Banking at Societe Generale.

manager can shift the average duration of his portfolio or selling protection, he can extend the sensitivity to changes in overall credit levels (Stangi (2004)). At this context, it can be stated that CDS indices enables investors to catch accurate timing in the implementation of their strategies with higher degree of diversification and less cost.

Insurance companies are also active users of CDS indices and they proxy hedge against senior CDO credit portfolio. Active trading strategies and highly expertise at risk management enables insurance companies to separate the three major risk components of their portfolio: interest rate duration, credit duration, and views on the relative value performance of individual sectors. This enables insurance companies to manage each risk segment in more effective ways and enhance their performance in risk management.

Corporate issuers have not been trading on the CDS indices although it would obviously be an interesting tool for them. With tight bid-ask spread, CDS indices enables corporations to lock in spread levels for their future funding requirements. Besides, they have enhanced access to diversify different credit risk regions/segments. Therefore, it can be stated that CDS indices provides with more flexibility and cost saving for corporations to manage their potential risk.

3.5 CREDIT EVENT VERSUS NO CREDIT EVENT

During the life of CDS index, if any of the reference entity in the portfolio experience credit event then index buyer (protection seller) is obliged to pay to market maker an amount depending on the weight of defaulted entity. In

return, market maker delivers to index seller (protection buyer) nominal face value of deliverable obligations of the reference entity. Following this credit event, notional amount on which premium is paid is reduced the same amount as nominal face value of insolvent entity and post credit event, index buyer (protection seller) receives premium based on last nominal amount of index until maturity subject to any further credit events.

For instance, iTraxx Europe is issued with the premium of 48 bps and counterparty wants to buy €5 million iTraxx Europe exposure in CDS. Market maker starts to pay 48 bps per annum quarterly to counterparty on notional amount of € 5 million. A credit event occurs on one of reference entities in 2.5 years and weight of reference entity in the index is 0.8 %. Counterparty pays to market maker (0.8 % x 5,000,000) = €40,000 and market maker delivers to counterparty € 40,000 nominal face value of Deliverable obligations of the reference entity. Post credit event, counterparty receives premium of 48 bps on € 4.96 million until maturity subject to any further credit events.

On the other side, if no credit event is experienced then market maker pays to counterparty 48 bps per annum quarterly on notional amount of € 5 million until maturity.

3.6 DERIVATIVES ON CDS INDICES

3.6.1 TRANCHED CDS INDICES

Main derivatives on CDS indices are index tranches, iTraxx options, and iTraxx futures. With the introduction of the iTraxx and CDX indexes, new generation of credit derivatives are generated: credit index tranches. Each

index consists of 5 tranches and each tranche has a defined subordination level. In addition to such index tranches and derivative products, there has been still an increase in the type and volume of second and third generation products based on the iTraxx indexes.

As it can be seen from table 7, each tranche has a defined attachment point and detachment point.

Table 7. Derivatives on CDS indices

Tranche	**Tranched Markit iTraxx**	**Tranched CDX.NA.IG**
Equity *Junior Mezzanine* *Senior Mezzenine* *Senior* *Super Senior*	0-3% 3-6% 6-9%- 9-12% 12-22%	0-3% 3-7% 7-10% 10-15% 15-30%
Markit iTraxx Options		**CDX Options**
Markit iTraxx Futures Markit iTraxx Europe exposure traded as a futures contract		**CBOT CDX Futures**

For example, the 9-12 % tranche in the table has an attachment point of 9% and a detachment point of 12 %. A buyer of protection for this tranche will pay premium to the seller on a quarterly basis until the maturity of the contract or until credit events result in the tranche. In the event of defaults the protection seller will pay the protection buyer as long as the losses lie between the tranche's 9-12% boundaries.

The methodology behind tranches is applied to all products under iTraxx Europe series and investors have opportunity to buy the trance depending on

their segment choice and risk aversion level. Furthermore, Bloomberg offers investors opportunity to create their own tranches and compare it with standardized tranches. Let's say a bank in Turkey have correspondent banks operating all over the Europe. Bank may perceive that in the long run one of these correspondent banks may default and does not exactly which one. At this stage, bank can create basket of 5 reference entities based on five riskiest correspondent banks, and trade it in the market as FTD instrument so that it can hedge any unexpected default of these correspondt's banks.

3.6.2 CDS INDEX OPTIONS

Standardized and liquid CDS indexes have enabled investors to trade OTC and exchange-traded CDS index options. CDS index options are the right to buy or sell at a future date current standard CDS indexes at a given price and it can be written on single CDSs, CDS indices and index tranches. In that transaction, option payer is the party who has the option to buy protection or short credit risk; while option receiver is the party who has the option to sell protection or long credit risk.

The price of a CDS index option reflects the expected spread volatility for that underlying index. Therefore, CDS index options also allow speculators to take a position on the volatility of CDS index spreads. CDS options can also be used to hedge credit risk; however, exchange traded options will not be as close of a hedge for the credit risk since it is more standardized than the custom products available in the OTC market.

Pricing CDS index options also required to estimate the correlation among the each CDS instrument underlying the index based on historical data

series or current CDS index tranche prices (implied correlation). Similar to delta hedging in an option, CDS index options also enables investor to delta hedge the CDS index options with the underlying index. The delta of an iTraxx option is the ratio of the change in the price of the iTraxx option to the change in the price of the underlying iTraxx instrument. It is the number of units of the iTraxx product an investor should hold for each option sold in order to create a risk free hedge.

CDS index options can be settled one of two following ways; physical settlement and cash settlement. If there is any credit event before option expiry, depending on the contract specification, option payer will still have the right to buy option if it is traded without knock-out. On the other side, in terms of option receiver, credit event is not relevant, since option would be out of money shortly before the credit event is experienced.

3.6.3 ITRAXX FUTURES

Perhaps, recent emergence of exchange traded iTraxx futures contracts based on the iTraxx indexes is the most exciting result of increased liquidity and transparency in CDS market. CDS index futures are mainly written on iTraxx Europe, iTraxx HiVol, iTraxx Crossover. CDS index futures are quoted as an average credit spread, directly in terms of underlying index, in basis points and hundredths of basis points. At expiration, the CDS index future contract is settled as the value of the underlying index on the contract's last trading day. Besides, CDS index futures expire by cash settlement and so removing the delivery considerations that currently exist within most CDS trades. Buying CDS index futures contract enables similar position to owning CDS index protection and selling CDS index future contract causes exposure similar to selling protection. At this stage, these

contracts enables investors a new dimension to manage their portfolios' credit risk.

Broadly speaking, users of CDS index futures gain several advantages. CDS index futures enables market participants a convenient and standardized way to obtain exposure, long or short, to underlying CDS index without having to own CDS index. Unlike to single CDS or iTraxx indices, positions in CDS index futures can be entered or liquidated without extensive documentation.

Furthermore, cash settlement provides the advantage removing cheapest to deliver and lack of deliverable asset issues. CDS index futures are exchange traded derivatives which means allow participants have greatest transparency in the market in terms of price and information with independent daily valuations. As with all exchange-based derivatives, clearing house guarantee provides market participants with the opportunity to allocate significant counterparty risk reserves for other profitable investments.

Eurex is responsible for the creation of the Eurex iTraxx Credit Futures contracts specifications. Eurex iTraxx Europe 5-year index futures are quoted in percent with three decimal places while Eurex iTraxx Europe HiVol and iTraxx Europe Crossover 5-year index futures are quoted in percent with 2 decimal places. Each basis point is worth € 100,000. The minimum price change is 0.005 percent (€ 5) for Eurex iTraxx Europe 5-year Index Futures and 0.01 percent (€ 10) for iTraxx Europe HiVol 5-year Index Futures and iTraxx Europe Crossover 5 year index futures (Table 8).

Table 8. CDS Index Futures Contract Specifications (F5EO, F5HO, F5CO)	
Contract Value	EUR 100,00
Settlement	Cash Settlement, payable on the first exchange day following the Final Settlement Day.
Price Quotation	In percentage, with three decimal places for the iTraxx Europe 5-year Index Futures and with two decimal places for the iTraxx Europe HiVol and iTraxx Europe Crossover 5-year Index Futures.
Minimum Price Change	iTraxx Europe 5-year Index Futures: The Minimum Price Change is 0.005 percent, equivalent to a value of EUR 5. iTraxx Europe HiVol 5-year Index Futures and iTraxx Europe Crossover 5-year Index Futures: The Minimum Price Change is 0.01 percent, equivalent to a value of EUR 10.
Contract Months	The nearest semi-annual month of the March and September cycle will be available for trading; trading in the back month starts on the 20th calendar day if this is an exchange day; otherwise on the next exchange day.
Last Trading Day	The 5th exchange day following the 20th of the respective contract month.
Daily Settlement Price	The Daily Settlement Price for the current maturity month is determined during the closing auction of the respective futures contract.
Final Settlement Price	The Final Settlement Price is established at 17:00 CET on the Last Trading Day in percent as the sum of: *the basis determined as the $\sum n_i$, whereby n_i represents the weight of the i'th reference entity in the underlying index series, which has not experienced an actual credit event (basis=100, as long as no credit event has occurred); *the present value change of the underlying index series resulting from the change of the credit spread in relation to the basis. The present value calculation on the final settlement day is based on the official iTraxx Index levels as published by IIC at 17:00 CET and the deal spread (coupon) of the underlying index. The mid spread reflecting the mid point between the bid and ask spreads of the official iTraxx Index levels are considered for the present value calculation; *the accrued premium calculated from the effective date of the underlying index series based on the coupon fixed for the underlying index series; *and, if applicable, the proportional recovery rate of the reference entity in the underlying index series, which experienced an actual credit event.
Trading Hours	08:30-17:30 CET. On the Last Trading Day trading ceases at 17:00 CET.
Occurrence of a Credit Event	Upon occurrence of a credit event, the credit futures contract will continue to trade in its original form including the reference entity subject to the credit event. In addition, Eurex will list a futures contract based on the new version of the underlying index (for example 124 reference entities).
Source: www.eurexchange.com	

Contract prices are settled daily and cash settlement is done on final settlement day. Eurex iTraxx index futures expire the nearest semi-annual month of the March and September cycle. After a credit event situation, expiration of index futures can be in one of two following ways[39]: a) Futures contract expires after an actual credit event and after a recovery rate determination, b) Futures contract expires after an actual credit event but before the recovery rate has been determined.

Pricing of credit future contract is based on the present value change of the underlying iTraxx index. Present value of iTraxx index changes due to changes in the perceived default probability of by the market. Eurex and market participants use Bloomberg CDS pricing model in CDSW screen and FCDS screen in pricing credit futures contracts.

According to Eurex pricing methodology, credit futures pricing consists of three different contributing elements:

- A static base number of initially 100 (the basis).This represents the sum of the weighting component of index, at the launch of contract it is 100 and over time in the case of any credit event it is reduced to by the weight of defaulted entity (100- n_i). [40]

- The PV change, reflecting the change in credit spread of the index, due to change in markets current perception of default risk. It is basically the risk present value of the difference between the initial fixed coupon of the index and the current market quote. In figure 12, the index started trading at 165 bps, and then credit spread decreased

[39] For a detailed explanation please see following: Eales, Brian A. "The Case for Exchange-Based Credit Futures Contracts", May2007.
[40] The basis is determined for an index with N reference entities as the $\sum n_i$, with each entity i having a weight of n_i within the index.

to 107.833 bps, lower than the fixed coupon. It means that the market is expecting lower default risk since inception of the index and we would expect the Eurex Credit Futures prices to rise. As a result, it can be seen that market value is changed by 2.57318 Euros.[41]

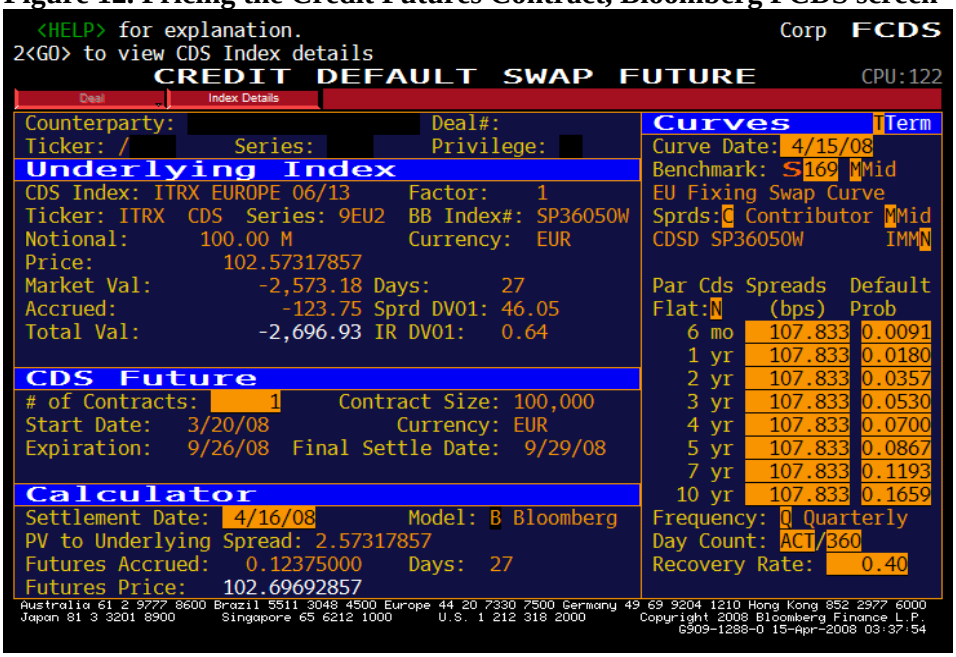
- The premium, reflecting the payment done by protection buyer (future seller) to the protection seller (future buyer). This premium accrues linearly over the term of the future contract. [42] Above example premium coupon is fixed at 165 basis points (bps) per annum which can be seen from contract details at Bloomberg. As the fixed coupon is set at inception, the premium is calculated according to following formula, where B is the basis (100 in the case of no default), C is the fixed coupon in basis points, and x is the number of days from the effective date of the series.

Premium= B * (C/10000) * (x/360)

In the case of credit event, Eurex lists an additional futures contract based on new version of the iTraxx index, where the weight of the reference entity impacted by the credit event is set to zero on the business day following the credit event. Then premium will be calculated accordingly.

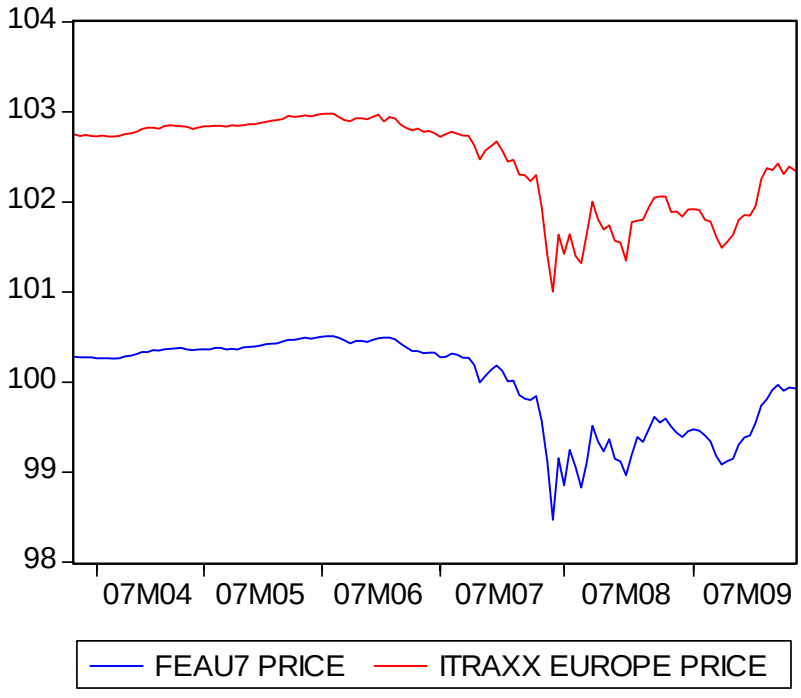
[41] PV change is evaluated based on the Bloomberg pricing model for CDS.
[42] For more detailed explanation for Credit Futures Pricing and Bloomberg CDS pricing model, please see "Credit Futures Pricing and Final Settlement Price Calculation" available at www.eurex.com

Figure 12. Pricing the Credit Futures Contract, Bloomberg FCDS screen



Source: *Used by permission of Bloomberg*

Figure 13. Price relationship between iTraxx Europe Futures and iTraxx Europe indice



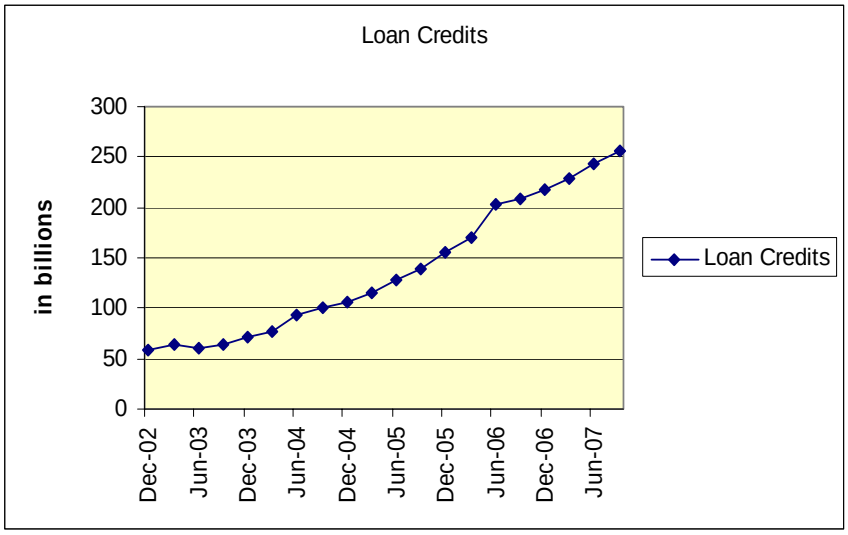
Source: *Data is obtained from Bloomberg*

4. TURKISH BANKING SECTOR

4.1 CREDIT EXPOSURE AND RISK MANAGEMENT

Credit risk is defined as the all transactions where losses might occur due to the fact that counterparties may not fulfill their contractual payment obligations. This definition basically refers counterparty risk in the trading activities, country risk and settlement risk. Credit risk makes up the largest part of Turkish banks' risk exposure. As the main role of CDS products is to hedge default risk on balance sheets and improve diversification of exposure, a short overview of Turkish banks' credit portfolio is given below.

Figure 14. Loan Portfolio of Turkish Banks 12/2002-09/2007[43]



Source: *Compiled from* www.tbb.org.tr

As increasing merger and acquisitions by global banks and corporations, Turkish economy has gradually integrated into the international markets in recent years. These have brought more fierce competition into the credit

[43] "Loan credits" are net loans before deductions for loan losses.

market and lead banks to offer new range of products and services to their clients whilst they increase their credit portfolio. Simultaneously, this has also drawn attention to credit risk management and lead banks to follow very tight credit policies in strict compliance with the relevant banking legislation.

Basically, banks have measured and managed their credit risk following the below principles:

- In all banks consistent standards are applied in the respective credit decision processes.

- The approval of credit limits for counterparties and the management of individual credit exposures are followed by credit committees in the banks. Even, any extension of credit to any counterparty is followed and approved by that committee.

- A primary element of the credit approval process is a detailed risk assessment of every credit exposure associated with counterparty. Therefore, Turkish banks have also established their own in-house assessment methodologies, internal scoring and rating scale to evaluate creditworthiness of lending parties. These methodologies are not only affects the outcome of the credit decision, but also influences the level of collateral required for the loan and monitoring procedures during ongoing exposure.

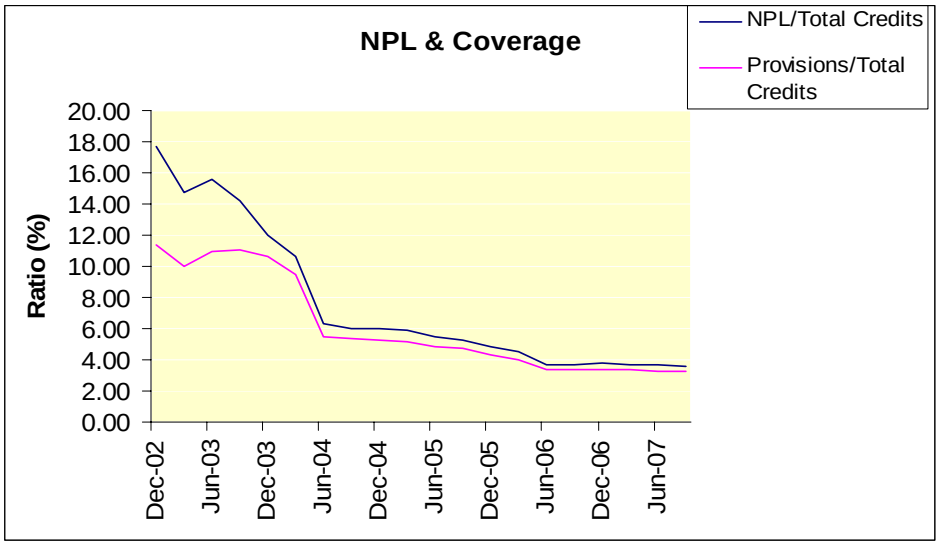
- Using these risk management tools, banks monitor their credit exposure on a continuing basis and have the opportunity to identify at an early stage credit exposures for which there may be an increasing default risk. Then, counterparties that demonstrate the likelihood of default are identified in advance so that banks can

effectively manage the credit exposure and maximize the recovery of default.

- Also, in order to further enhance risk management and improve returns and use capital more efficiently; Turkish banks started to manage credit exposures by utilizing techniques such securitization, single-name credit default swaps, credit debt obligations and credit link notes. However, credit mitigation by way of these techniques is structured for the credit risk of the less liquid underlying positions.

Especially, after banking crisis in 2001, banks start to pay special attention to the concentration of credit risk in particular sectors and to individual borrowers. Supported by stable economic conditions after 2002 and disciplined risk management, banks managed to decrease their non-performing loans dramatically and release the specific provisions in the balance sheets.

Figure 15. NPL and Provisions Ratio between December 2002-September 2007[44]

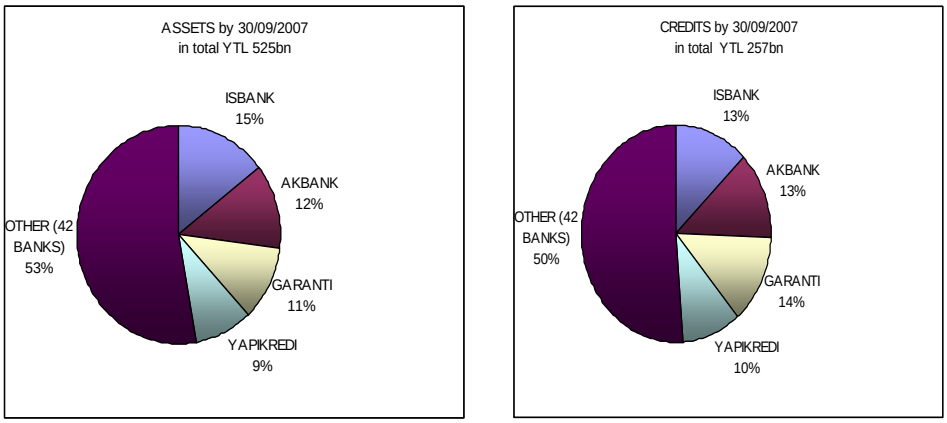


Source: *Compiled from* www.tbb.org.tr

[44] This figure covers all banks in Turkey.

There are 46 banks operating in Turkey with YTL 525 billion asset and YTL 257 billion credit portfolios. In terms of asset and credit concentrations, four big private banks (İşbank, Akbank, Garanti, and Yapı Kredi) have 47 % and 50 % of market share by the end of September 2007. Therefore, in that study, these four big banks' credit portfolios and credit risk management techniques are used as a representative for Turkish banking sector. The following charts break down assets and credit distribution in banking sector.

Figure 16. Assets and Credit Portfolios breakdown by banks



Source: *Compiled from* www.tbb.org.tr

In Turkey, credit exposure (excluding securities) of banks basically consists of claims on companies (52%), households (21 %), and banks (19%)[45]. These exposures consist mainly of loans, letters of credit, guarantees, and counterparty risks arising OTC trading.

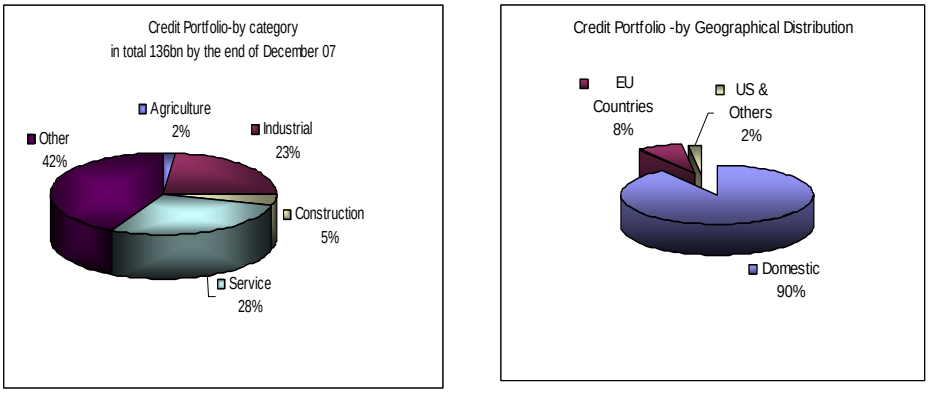
[45] Credit exposure is calculated at gross amount of exposure without taking into account any collateral, other credit enhancement or credit risk mitigating transactions. Also these percentages are based on the financial statements of four biggest banks (Akbank A.Ş., YapiKredi A.Ş., İş Bank A.Ş., and Garanti A.Ş.) in Turkey. Remaining 8 % of total exposure consists of Government (2 %) and other loans (6 %).

As it can be seen in the released financial reports of the banks, the credit policy of banks is founded on the principle that all lending activities should be made after careful credit analysis and rating/scoring procedure and also be proportionate to the repayment capacity of the counterparty. Furthermore, depending on the counterparty's capacity to repay the loan, collateral and netting agreements are used to some extend.

Excluding households, all counterparties are assigned to an internal risk grade that reflects the risk of default on payment obligations. Depending on bank's internal classification, this information is used to make decisions on credit limits and to monitor and manage the credit portfolio effectively. Credit limits are set to express bank's willingness to assume maximum credit exposures over specified periods. The most basic practice to manage credit exposures is to establish a limit on the amount of loans to an individual borrower or to a sector depending on the internal rating/scoring result. As well as depending on the macroeconomic conditions and counterparty specific issues, total limits and risk classes are updated periodically by a credit approval authority in each bank.

The aggregate credit portfolios in each bank are reviewed regularly by industry, risk class, product type and size. Below figures break down Turkish Banks' main credit exposures by category and geographical region. Turkish banks' credit risk management policy allows credit portfolio diversification through segmentation. As it can be seen from the graph bellow, the main segments - credit portfolio of four big banks –are industry and service sector and 90 % of the credit portfolio consists of domestic lending.

Figure 17. Credit Risk Profile by category and geographical distribution



Source: *Data is compiled from* www.imkb.gov.tr

Four big private banks' exposure, excluding contingent liabilities, derivatives contracts, bonds and Repos, amounted to TRY 136bn. Lending to the corporate customers and households has showed strong growth in recent years, and still expected to grow as the new products become eligible for Turkish market and benchmark interest rate decrease.

Turkish banks' have also derivatives related credit exposure. Currency and interest rate swaps, currency options and currency forward agreements are predominantly traded derivatives products in Turkey. Payables and receivables arising from these derivatives transactions are booked and followed in off balance sheet accounts at their face value. Banks generally enter an offsetting position to reduce their derivatives currency and interest rate risk. When necessary, derivatives products are exercised to manage credit risks those can especially arise form foreign exchange and interest rate fluctuations. Although some of derivatives transactions provide effective economic hedging, however, they are not qualified for hedge accounting under the specific rules in IAS 39, and therefore, they are treated as "financial assets at fair value through profit or loss".

"Financial assets at fair value through profit or loss" are treated at fair value and therefore, if fair value of the derivative product is positive, it is booked under the main account "financial assets at fair value through profit or loss" in "trading derivative financial asset" and if the fair value difference is the negative, it is booked under "trading derivative financial liability". These positive/negative values of derivative instruments go under the trading income/loss in income statement. On the other side, however, banks don't have any other derivatives agreements to hedge their derivatives related credit risk.

4.2 DERIVATIVES MARKET IN TURKEY

Turkish Derivatives Exchange (TURKDEX), being the first private exchange in Turkey, is established in 2005 with the purpose to design and develop markets where financial and commodities derivative contracts are traded in a liquid and transparent environment.

The main goal of TURKDEX has been to develop and provide a wide range of derivatives products that would help investors to manage and hedge their risks effectively. Comparing to major exchange derivatives, however, TURKDEX is still in a nascent stage both in terms of product range and technological infrastructure. Therefore, to establish an efficient and successful risk management platform to meet the needs of investors heavily depends on the product range available to investors and technological platform to provide transparency and liquidity in the market. In the long term, these might provide the opportunity to integrate with international markets and becoming a derivative exchange at global level.

At this stage of the derivatives market development in Turkey, there are very limited product ranges available to investors. At present, under four category there are 10 products in the market; i) Currency Futures Contracts: TRYUSDollar and TRYEURO, ii) Interest Rate Futures Contracts: 91 Day T-Bill Futures, 365 Day T-Bill Futures, and T-Benchmark Futures, iii) Equity Index Futures Contracts: Turkdex-ISE 30 Futures and Turkdex-ISE 100 Futures, iv) Commodity Futures Contracts: Cotton Futures Contracts, Wheat Futures Contracts, and Gold Futures Contracts. As it can be seen from Table 9, Equity Index Futures tend to be most actively traded and followed financial derivative. Especially, Turkdex ISE-30 Index Futures seems to have relatively high recognition and acceptance in the market. However, specializing in only one product to mitigate risk may bear some other risks. According to a paper titled Derivatives Market Development from Alberta Market Solution Ltd. (2003), in some cases, the index may be dominated by a few stocks or one sector because of high market capitalization. In such case, Turkdex ISE-30 Index Futures can be nothing more than an index on those stocks or that sector. On the other side, concentrating only on Turkdex ISE-30 Index Futures may not provide effective risk management strategies for banks. This occurs primarily due to the differences in components of ISE-30 Index Futures and structure of the portfolios that are being hedged and thus, difference in sensitivities to market movements may result in unsuccessful hedging.

Besides, at present, there are three Interest Rate Futures contract-91 Day T-bill Futures, 365 Day T-Bill Futures, and T-Benchmark Futures and there seems to be no trading those contracts. The availability of few products in the market do not provide an effective hedging and may actually cause banks to bear a costly trade-off between interest rate risk and basis risk (Venkatesh (2003)). For example, assume a bank which wants to hedge its bond portfolio that has an average duration of 5 years. Hedging with T-

Benchmark Futures contract whose underlying bond may have duration of 16 years will not serve for an effective hedging because the duration of the portfolio is lower than the duration of the futures contract. This means that sensitivity of the futures contract to interest rate changes is higher than that of the bank's portfolio.

Table 9. Derivatives Product Traded in TURKDEX, Volume and Value

	Dec-05		Dec-07		Apr-08	
Equity Index Futures	***Trading Volume(m)***	***Value (TRYmm)***	***Trading Volume(m)***	***Value (TRYmm)***	***Trading Volume(m)***	***Value (TRYmm)***
ISE-30 Index	139	563	1,705	10,598	3,673	19,444
ISE-100 Index	26	95	2	8	0.2	0.9
Currency Futures						
TRYUSD Dollar	1545	2142	7833	10395	1771	2331
TRYEURO	58	98	17	31	17	36
Inerest Rate Futures	2	20	0.4	3	-	-
Commodity Futures						
Cotton	0.35	0.68	0.03	0.07	-	-
Wheat	0.04	0.09	-	-	-	-
Gold	-	-	0.08	0.24	0.014	0.05

Source: *Date is compiled from* www.turkdex.org.tr

Therefore, the key achievement for the TURKDEX would be to launch of its futures and options contracts for a wide range of underlying securities for a varying term structure so that it can widen its product scope beyond the currency and stock market. Then, increasing liquidity and product range in Turkish derivative market will enable banks to compare their internal ratings with external ratings assigned to their counterparties by other market participants. For example, a futures contract written on Company A's stock or bond will enable bank closely monitor Company A's creditworthiness through following movements of derivative contract's market value. However, cash market in Turkey is still not enough mature to develop derivatives for hedging and therefore, almost every financial institutions in the country have become more sensitive to global fluctuations.

4.3 POTENTIAL USES OF ITRAXX EUROPE INSTRUMENTS IN TURKEY

4.3.1 DATA AND METHODOLOGY

4.3.1.1 METHODOLOGY

Credit risk is the risk defined as "all transactions where losses might occur due to the fact that counterparties may not fulfill their contractual payment obligations". Managing the credit risk has always been one of the major challenges in risk management since it makes up the largest part of banks' risk exposures. After financial crisis in 2001, Turkish banks have steadily increased their loan portfolios and thus, their credit risk. Introduction of Basel II principles and heavy regulations from regulatory authorities have made the task of managing these credit exposures more challenging and more important than ever. Based on Basel II compliance, banks measure and manage their credit risk following the below principles:

-In most of the banks, internal standards are applied in the respective credit decision processes.

-The approval of credit limits for clients and the management of individual credit exposures must fit within banks' credit strategies.

-Every extension of credit or material change to a credit facility to any client requires credit approval from credit committee.

Based on the principles above, many banks have developed internal risk procedures and activities basically including credit risk ratings, credit risk limits, and credit risk monitoring activities. [46]

Credit risk rating activities stands as a primary element in the credit approval process. It basically covers detailed risk assessment of every credit exposure associated with counterparty. For risk assessment procedures, like leading international banks, Turkish banks (i.e. Akbank, İş Bank and etc.) have also developed their in-house assessment methodologies and ratings for evaluating the creditworthiness of their clients. This not only affects the outcome of the credit approval process and structure of the loan, also credit limits are defined and reviewed based on this rating results.

As a part of credit risk management process, banks set credit limits for each clients indicating maximum credit exposure they are willing to assume over specified periods. These limits are established for total exposure on individual clients, economic segments, and countries. Credit limits are reviewed periodically and they are increased or decreased based on changes in clients' credit quality and given macroeconomic conditions.

Credit monitoring activities include reviewing the portfolios regularly by clients, industry, geography, risk class etc. In other words, banks monitor their credit exposure on a continuing basis using the risk management tools. Besides, banks perform specific analyses and stress tests to estimate their sensitivity for potential credit default losses. These enable banks to identify

[46] See credit risk management policies of bank in their financial statements (Yapikredi, İş Bank, Akbank, Garanti, Finansbank, and more) at www.imkb.gov.tr And for international example please see the financial statements of the following banks Deutsche Bank (www.db.com), SEB bank (www.sebgroup.com), Unicredit Bank(www.unicreditgroup.eu), HSBC (www.hsbc.com) , Dexia Bank (www.dexia.com), Citibank (www.citi.com) and other international banks.

at an early stage credit exposure for their clients and effectively manage the credit exposure while maximizing recovery.

Using these risk management tools and following disciplined credit policies have obviously resulted in high quality loans and less non performing loans on the balance sheets. However, credit risk is still remained on the banks' balance sheets that require them to allocate high economical capitals depending on the size, default risk, loss given default expectations, and tenor of a loan (The Risk Management Association (2006)).

On the other side, in addition to these risk management techniques and principles, an increasingly common way of managing credit risk is to use credit derivatives, especially CDS instruments. When managing loan portfolios, it is unpractical to consider each piece of the portfolio on individual basis. A bank may have thousands of positions in the credit market with different maturities, currency, amount, and etc., in its portfolio. Many European (Deutsche Bank, SEB, ABN Amro etc.) and US banks (Bank of America, JP Morgan, and Citibank etc.) have started to manage their credit portfolios using standardized derivatives index products. [47]

Recently, standardized CDS indices, run by IIC (International Index Company), have introduced into derivatives markets and become attractive risk management tool for loan portfolio hedging. These indices are going under the family names of iTraxx in Europe and CDX in the US. The particular type of credit derivative I studied, the iTraxx Europe CDS series, has been one of these indices that enhance access to diversified European credit risk market. As well as, these indices allow market participants to

[47] Those banks indicated here share their credit risk management strategies and techniques with shareholders. For more information about their credit risk management policies, please look at their financial statements under investor relations section on their websites.

implement their view on credit markets in a timely manner. For instance, last summer most investors rushed to take more defensive stance on credit market, partly due to the worsening news from the US mortgage markets. The other way could be to sell the securities in those stress times; however, during these times, it is impossible to find enough buyers since cash credit markets tends to stop functioning. Kinsey (2007), Senior Portfolio Specialist at ING bank, stated that the credit derivatives market is three times the size of the cash credit market and it is much liquid and flexible.

Using credit derivatives products in loan portfolio management increases the efficiency of risk management by allowing banks to follow active portfolio strategies. Relationship between the CDS market and the stock market is very important for anyone involved in hedging with CDS instruments and this relationship is first studied by Byström (2005). In his paper, particularly the relationship between iTraxx sectoral indexes and corresponding sectoral stock indexes is examined. Data used in that study consists of daily closing quotes for seven sectoral iTraxx CDS Europe indexes traded with 5 as well as 10-year maturities. The time period covered is from June 21, 2004 to April 2005. Since all 125 names in the indexes have traded equity that makes it possible to construct sectoral stock indexes comprising the same names as the reference portfolios behind the sectoral iTraxx indexes. Stock indexes were constructed equally and all underlying stocks were converted into Euro on a daily basis.

In Byström's study, firstly descriptive statistics are presented proving all data series to be stationary at the same order. Then correlations and rank correlations are examined in detail among stock index prices, CDS index spreads and stock volatilities. Correlations between spread changes and stock returns are also examined. As a result, the large negative correlations between CDS spread levels and stock price valuations indicated strong

negative relationship between CDS spread levels and stock price valuations, while significant positive relations are found between CDS spreads and stock volatilities for all sectors. Besides, Byström regressed daily CDS spread changes on yesterday's stock CDS spread changes and on today's and yesterday's stock returns. Results of these OLS-regressions strengthened the correlation results proving strong negative link between CDS spread changes and stock returns.

Results of Byström study revealed that there is a close link between iTraxx CDS market and stock market. CDS spreads have a strong tendency to widen when stock prices fall; tighten when stock prices increase. Furthermore, it suggested that stock returns were found to explain the movements in CDS spreads. In other words, stock markets lead the CDS markets in transferring firm specific information. Overall, these findings are in line with the structural models like Merton (1974) and Longstaff and Schwartz (1995) those implicitly suggest that factors influencing credit spreads are stock prices and stock price volatilities.

Findings of Byström are also in line with previous studies conducted to examine the relationship between single-name CDS, bond, and stock markets on individual firm level. Norden and Weber (2004) focused on the intertemporal comovement among stock, bond, and CDS market for a sample of 58 firms from Europe, US, and Asia analyzing daily and weekly data over the period 2000-2002. They find stock returns to lead CDS and bond spread changes. Besides, they also find an inverse relationship between stock returns and CDS spreads. Using data from a small cross section of US and European firms; Blanco, Brennan, and Marsh (2004) investigated the validity and implications of a theoretical relationship equating credit default swap prices and credit spreads. They find firm

specific equity returns (stock returns) and implied volatilities have more of an impact on CDS spreads than for corporate bond spreads.

Those studies explaining the relationship between CDS spreads and stock prices are very important for active portfolio management. In an article by Baldwin and Ulrich (2007), it is outlined that a close relationship between iTraxx CDS market and stock market would suggest that should be a divergence between these two markets, in the long run they will converge again to reestablish historical relationship. Besides, introduction of Eurex iTraxx CDS futures contracts make it more possible to establish such a relative value/cross-asset class positions on exchange more cheaply and efficiently with the added benefits of transparency, independent mark-to-market valuation and a central clearing house.

Furthermore, Baldwin and Ulrich (2007) outlined the method on how to structure such relative value/cross asset class positions. One method to establish such strategy is to calculate the ratio of the monetary value of each of the respective contracts' risk positions based on historical volatility.

In a recent paper, A. Eales (2007) studied the growth in the use and application of credit derivatives analyzing possible strategies. In one strategy, A. Eales combined a portfolio of bonds designed to track the Bloomberg/EFFAs Euro Market 3-5 Year Tracker Index[48] with a long credit risk position in the iTraxx Europe 5-year index. Thus, he created a synthetic corporate bond portfolio. His findings based on past data suggests that the inclusion of credit index positions up to a level of 10 % of the portfolio value would have reduced risk and increased return over the period studied. Furthermore, result of his study also reveals that a movement along the

[48] Euro Market Tracker 3-5 Year Bloomberg/EFFA index comprises 41 unequally weigthed sovereign issues.

efficient frontier to the point where 20 % would have had a large positive effect on the portfolio's return for a small increase in risk. Specifically, the result of his study showed that 10 % inclusion of iTraxx Europe 5-year Index reduced risk by 0.19 % and increased return by 1.63 %, while 20 % inclusion increased risk by 0.10 % but increased return by 3.27 %.

Besides, A. Eales extends this strategy to other less diversified underlying portfolios using iTraxx HiVol Index and iTraxx Crossover Index. He combined Bloomberg/EFFAS Euro Liquid 3-5 Year Bond Index[49] with a long credit risk position in iTraxx Europe Crossover 5-year Index. On September 22, a short position on the index had been entered into at index quote 287.5bp to obtain a short term speculative exposure. Thus, the seller of the iTraxx Crossover 5-year index receives an up-front payment and fixed premium on quarterly basis during the period. On December 19, the position is cleared at quote of 225.6bp by buying protection/buying index. At the end of this strategy on a notional principal of EUR 10,000,000, a gain of around 62bp is achieved and including the accrued interest 13.6 % profit is earned.

Lack of liquidity in cash market during severe times and standardization based on ISDA master agreements has attracted many investors into the market and thus, these resulted in increase in liquidity in these derivative products. Therefore, nowadays, investors are increasingly using iTraxx instruments since the price of this credit derivative index moves first in response to economic news and shifts. These has caused iTraxx series to be market benchmark products and even new derivatives to be written on iTraxx such as iTraxx Futures contracts, iTraxx options and iTraxx tranches (A. Eales (2007)). Especially, iTraxx Europe series has become an attractive hedging tool; while it enables European market participants to hedge and

[49] At the time of writing, it includes DBR 5.00 % of July,2011, DBR 5.25 of January 4,2011, and BTPS 5.5 % of November 1, 2010.

diversify their credit portfolios, it also makes it easy for other market participants from other regions to have quick access into the European credit markets via these products to diversify their loan portfolios geographically.

In theory, market participants can use iTraxx Europe series for geographical diversification and decrease their home country systematic risk embedded in their balance sheets. At this stage, on the basis of the four biggest private banks' financial data by end of December 2007 from the database of ISE, it can be stated that Turkish banks have high home country concentration and thus, iTraxx Europe series might be an effective risk management tool for Turkish Banks to decrease their home country concentration while decreasing the systematic risk to the level lower than home country's systematic risk. However, in practical life, using iTraxx Europe indexes in Turkey also bring new concerns about pricing, accounting/booking, settlement, back office and other legal issues.

On the other side, Eurex have recently launched *exchange traded* credit Futures contracts; iTraxx Europe, Crossover, and HiVol CDS index futures. These new range of products have many advantages over iTraxx indices. They alleviate many concerns about pricing, accounting, settlement, back office, and other legal issues. These exchange traded derivatives products have been increasing in popularity because of transparency, the introduction of a central clearing house, counterparty risk, and independent daily fixings (Pool and Mettler (2007)).

Buying/selling these iTraxx futures contracts creates the same exposure to the CDS iTraxx Europe and more flexibility to switch and balance composition of the loan portfolios. To illustrate this strategy, consider a loan portfolio manager who manages YTL 300 million loan exposure to Turkish

corporate clients whose stocks is included in ISE-30. The loan manager expects a short term market fluctuations in Turkish economy and decides to switch 50 % of Turkish credit exposure to a European credit exposure using the ISE-30 futures and iTraxx Europe credit futures contracts. Depending on the correlation level between loan portfolio and ISE-30, loan manager sells a certain number of ISE-30 futures contracts in the TurkDex, and simultaneously, buy a certain amount of Eurex iTraxx Credit Futures. By means of this portfolio overlay strategy; loan manager can quickly switch part of Turkish credit exposure to a European credit exposure, whilst leaving his existing portfolio intact. When the loan portfolio manager feels the fluctuation in the market is stabilized, he can unwind the short ISE-30/long iTraxx Europe Credit Futures position.

As the practical aspect of this strategy, the correlation and integration level among markets should be analyzed since the degree of integration among the European and Turkish credit markets have implications for the risk management strategies involving international diversification. The degree of benefits from risk diversification in a portfolio depends on the degree of correlation among credit markets. Intuitively, the increase in integration among Turkish and European credit markets is not desirable in terms of loan portfolio diversification. Correlation and co-integration analysis based on stock indices in Appendix II provides a preliminary verification for the presence of very low integration level among Turkey and European credit markets.

The statistical procedures employed in the study make it possible to perceive if the correlation and co-integration level exists among Turkish and European markets has favors Turkish banks to use iTraxx Europe series for international credit exposure diversification. The analysis of these markets provides essential information to conclude iTraxx Europe CDS indices can

be used for credit risk diversification. The methodology is composed of three parts: 1) Unit Root Tests, 2) Correlation Analysis, and 3) Co-integration tests.

Besides, of particular concern of these strategies is the development level of Turkish derivatives market in terms of product range and technological infrastructure and as well as integration level between Turkish credit market and European credit market. Finally, one has to be aware that using iTraxx for credit risk diversification relies on the well-developed home country derivative market and, correlation and integration level between Turkish and European markets. Therefore, Turkish derivative market and co-integration level between markets will be examined in the next sections.

4.3.1.2 SAMPLE AND DATA

The price of iTraxx Europe CDS is indicated by its spread, which in turn is determined by how creditworthy Europe Credit market is. In other words, the value of a credit derivative is based on the probability of default risk embedded in reference entity at some point in the future. Market participants are using stock prices to quantify the creditworthiness for the companies listed on the stock exchanges. In derivatives market, Merton (1974) model and CreditGrades[50] approach are the best known methods calculating this probability by using stock market information (Byström (2006))[51]. Broadly speaking, these two approaches are mainly based on equity prices, balance sheet information, and also a standard set of assumptions. Based on these parameters, models produce instantaneous

[50] CreditGrades has been suggested by Deutsche Bank, Goldman Sachs, JP Morgan, and Risk Metrics. The CreditGrades Technical Document can be found at www.riskmetrics.com/cgtdovv.html

[51] Byström, H. (2006). "CreditGrades and the iTraxx CDS Index Market." *Financial Analysts Journal*;Vol 62. No 6.

updates of default probabilities of reference entities and corresponding CDS spreads.

Besides, some studies have tried to test the credibility of these models and as well as to discover the link between CDS spreads and stock prices. In their studies; Blanco, Brennan, and Marsh (2005) found that stock returns have great impact on CDS spreads. Blanco also discovered a significant link between implied stock volatilities and CDS spreads. In his study[52], testing iTraxx CDS indexes and their relationship with the stock price movements of underlying entities, Byström found that credit spreads calculated using CreditGrades and empirically observed spreads were found to be highly correlated. This significant correlation indicates a close relationship between the stock market and CDS market.

Since the most determinant of CDS price is the default probability derived from stock market, in this paper country stock index correlations and co-integration levels are tested to perceive credit market movement among countries. The countries those are included in the sample are Austria (ATX), Belgium (BEL), France (CAC), Germany (DAX), Netherlands (AEX), Finland (HEX), UK (UKZ) and Turkey (ISE 100). For each country, the respective stock market index daily time-series is downloaded from FOREX for the period between January 2006 and March 2008. The daily logarithmic index values are index returns are calculated from these time series.

4.3.2 TURKISH BANKING MARKET OVERVIEW

[52] Byström, H. (2005). "Credit Default Swaps and Equity Prices: The iTraxx CDS Index Market". Working Paper, Lund University

Currently, the derivative market in Turkey is in the developing stages with the majority of banks having recently established "structured products" unit in their treasury. Also, risk management tools and quantitative models are still in the development, and many banks are in the early stages of implementing disciplined risk management methodologies according to home host supervision within the context of Basel II.

Credit risk makes up the largest part of banks' risk exposure that needs to be managed, measured, and even priced. Although banks have a well diversified portfolio depending on the economic structure of each segment and macroeconomic conditions; however, in terms of country concentrations domestic loans make up 90 % of credit portfolio of Turkish Banks. Therefore, in the case of economic downturn, Turkish banks will immediately be forced to cut the amount of loans they issue, and in return, this will create a "credit crunch" effect. Also, this typically causes higher borrowing costs, and ultimately defaults, which will affect other economic segments and spread over the economy.

Table 10. TRY Risk Exposures of Four Biggest Turkish Banks, 31/12/2007

Bank Name	*Credit Risk*	*Operational Risk*	*Market Risk*
İş Bank	42,627,319	6,408,553	3,726,425
Akbank	47,014,071	6,737,514	2,408,788
Garanti Bank	41,927,303	4,520,072	579,538
Yapikredi Bank	38,688,000	3,640,891	331,825

Source: *Data is compiled from publicly available financial statements at* www.imkb.gov.tr

Banks, in Europe and USA, increasingly use iTraxx and other CDS products for reducing their credit exposures on their balance sheets while simultaneously allowing them to meet the needs of their corporate

customers. They have also continuously constructed new products that covers different credit exposures ranging from different economic segments (banking, auto, telecommunications) to other economic regions beyond Europe and USA (Australia, Japan, emerging markets).

Growing use of credit derivatives in those markets has also enabled bank to free up more economic capital to make more loans and generate more fees, without having to allocate more economical capital aside for regulatory purposes.

On the other side, as it can be seen from financial statements, Turkish banks are managing their credit exposures by utilizing techniques mainly including loan sales, securitization via collateralized loan obligations, single name CDS and CLN contracts. Besides, their European credit market exposure is only around 8% of their loan portfolio and they are not trading any iTraxx products for risk management purposes. However, iTraxx instruments can be used to manage and internationally diversify banks' credit portfolios rather than to buy protection for underlying assets. Therefore, degree of correlation between Turkish and European markets plays a crucial role in portfolio diversification. The more integration between Turkish and European markets will result in the less portfolio diversification benefits and consequently, the benefits using iTraxx for gaining European credit markets exposure will decrease, too.

The existence or non-existence of the correlation between Turkish and European credit markets is important in terms of credit portfolio diversifications. To analyze the degree of correlation among these markets, stock market returns are assumed to be as a leading indicator in that study. As it can be seen in Appendix II; in general, the European markets stock

exchange returns have high correlation among them; however, medium correlation with ISE 100 index. It is quite straightforward to assume high correlation among European markets since they share the same long-term macroeconomic strategies and also most of them have already changed their currency into euro. These obviously have direct effects on the correlation among these markets.

iTraxx Europe series covers well-diversified European credit risk while Turkish Banks' European exposure is limited to only the customers and countries where banks have foreign representative or branch office. Therefore, buying protection through iTraxx for such an exposure would not be an effective risk management practice since there might be low level of correlation between underlying entities and iTraxx Europe. On the other side, Turkish banks can sell protection through buying iTraxx Europe series and would gain exposure to the European credit market. Although this option would generate additional income for banks, it also brings questions regarding pricing, fair value, and back office support.

There are four models (JP Morgan, Discounted Spreads, Modified Hull-White, and Bloomberg) available at Bloomberg CDSW screen. Although market participants predominantly use Bloomberg and JP Morgan models, they have two more options to use for pricing iTraxx products. Each model has certain assumptions regarding basket correlation, default probability calculation and default swap spreads.[53] These differences lead each model to price the same iTraxx product differently as it can be seen at Appendix I.

As it has been mentioned above, under the specific rules in IAS 39, derivatives products are treated as "financial assets at fair value trough

[53] For detailed explanation about models please see Help section under CDSW screen at Bloomberg.

profit or loss". Since market participants quote their bid/ask price based on the model they use, it would raise new questions regarding which price will be benchmark for accounting fair value.

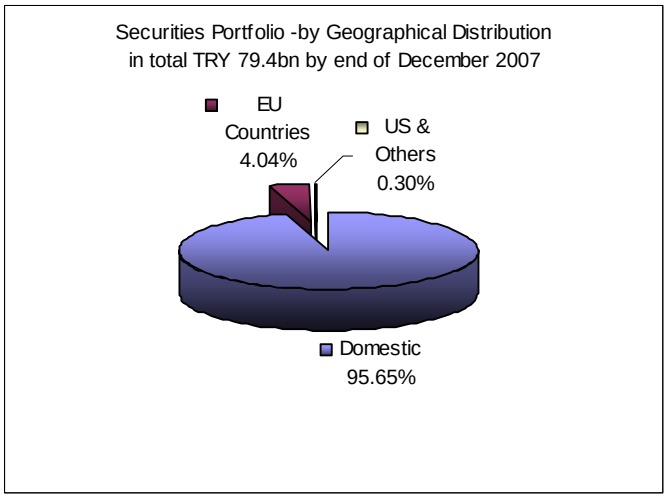
Trading iTraxx indices may also bring other risks like operational risk, settlement risk and legal risk. The way how Turkish banks will be processing these contracts in their back offices will play a key role in preventing these risks. Turkish banks' back offices have not familiar enough to process these transactions without any risk. These contracts have some peculiar features those requires huge paperwork. On the other side, these contracts are not valid until all parties sign the documents, or confirm electronically. This requires special back office attention, as market participants recognize that the problem of unsigned confirmations had reached excessive proportions, even some transactions going unconfirmed for months (Eurex (2008)). Therefore, at this stage using iTraxx Europe indices in risk management would not be appropriate in Turkish banks since it raises new concerns about accounting, operational risk, and pricing.

On the other side, Eurex have recently launched iTraxx Credit Futures contracts. These new range of products have many advantages over iTraxx indices. First of all, they do not require advanced calculation or model for pricing and so remove concerns about the pricing and fair value. iTraxx Futures price calculations are done only on Bloomberg pricing model (B) and based on the pricing methodology used by Eurex.

Turkish banks can use exchanged traded iTraxx futures contracts to synthetically create a similar exposure to the CDS iTraxx indices market. Buying and selling these contracts, banks will able to buy and sell the risk position in iTraxx. The following charts shows securities portfolio of four

big private banks by geographical distribution. Turkish banks can use iTraxx Credit Futures contracts to switch their Turkish bond exposure in their credit portfolio to European credit exposure either using CDS written on Turkish Sovereigns or the products available in Turkdex and iTraxx Europe Credit futures contracts. However, lack of enough product range and liquidity in Turkdex presents a problem in constructing such a strategy. These equity and interest rate instruments are limited to only ISE-30 Futures, ISE-100 Futures, 91 Day T-Bill Futures, 365 Day T-Bill Futures, Benchmark bond futures.

Figure 18. Securities Portfolio Distribution



Source: *Data is compiled from www.imkb.gov.tr*

To illustrate how iTraxx Europe futures contracts can be used to manage the country concentration in bond portfolio, let's simply assume that one of the banks' 3 billion YTL Turkish government bond portfolios consists of equally weighted three different bonds maturing on 2/5/2025, 1/15/30, and 3/5/38. Modified duration of these three bonds are extracted from Bloomberg (screen DURA and see Appendix III) and portfolio modified duration is calculated as 10, 33. In that case, portfolio BPV (Price value of a 0,01 change in yield) can be calculated as follows;

Portfolio BPV= Portfolio Modified Duration*Portfolio Value*0.0001

= 10, 33*3 billion*0, 0001= YTL 3,100, 000

And assuming there is no cheapest to deliver option, price of the T-Benchmark Futures contract is quoted as 80,55. Therefore, to calculate the appropriate number of T-Benchmark Futures to sell synthetically reduces the bank's Turkish government bond exposure:

*Number of T-Benchmark Futures to sell= YTL 3,100,000/80.55= 38,485. At this stage, bank has hedged its bond portfolio against any interest rate/price movement in the Turkish bond markets.

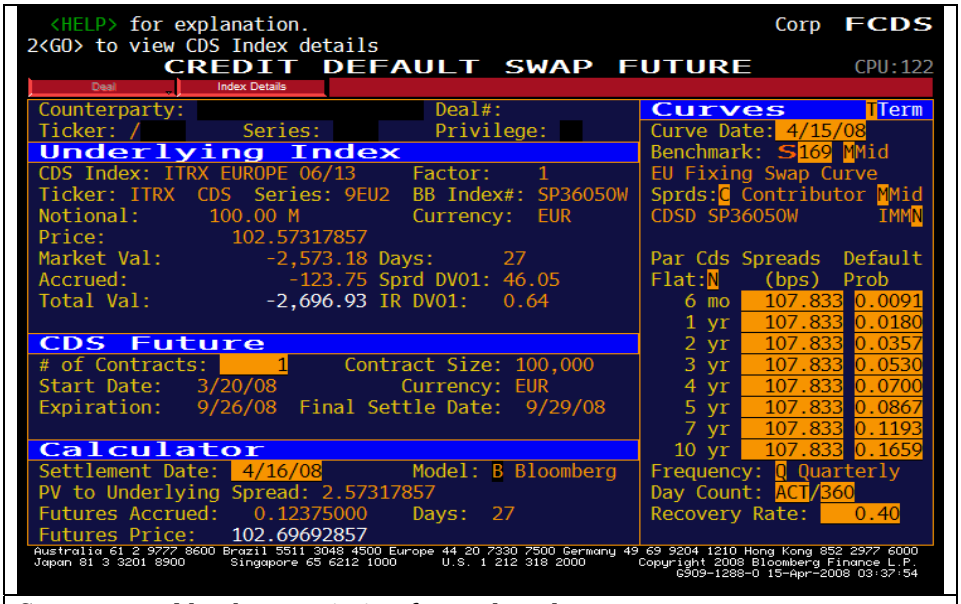
On the other side, bank can calculate the number of iTraxx Europe Future contracts necessary to buy so that it can gain exposure to European credit market instead of Turkish government bonds. As it can bee seen in the Bloomberg screen in Fig. 19, the price value of a basis point change in the CDS curve in terms of the iTraxx Europe Credit future is € 46.05 (YTL 89.798). Therefore, the ratio is 0.897; one T-Benchmark Future corresponds to 0.897 iTraxx Europe future.

Bank can sell 38,485 T-Benchmark futures and buys 34,522 Eurex iTraxx Europe Credit futures to synthetically switch its Turkish government bond exposure to a European credit exposure. By means of this portfolio overlay strategy, the bank can quickly switch part of country exposure to a European credit exposure. It may be a problem for the bank to concentrate only in Turkish market, and this hedging opportunity gives the bank to balance its country exposure by lessening home country concentration.

This overlay strategy can be performed if bank can buy protection for bonds in its portfolio. For example, Akbank started to actively trade CDS written on Turkish Sovereigns. It can buy protection from an international bank for its bond portfolio and at the same time it can buy iTraxx futures contract to synthetically buy credit risk position in iTraxx. Thus, while it hedged its Turkish sovereign, it gains exposure for European credit market. Finally, this strategy results in an increase in European credit exposure and decrease in home country concentration.

This strategy can be extended any segment or category of the loan portfolio depending on the available product range. Banks can hedge their Turkish market exposure and gain exposure to European Credit Market. These strategies can be executed more effectively in the long run as Turkish Derivative market matures in terms of liquidity and product range. On the other side, given the instruments in TurkDex, banks can still diversify their loan portfolios if they find high correlation between any part of their loan portfolio and the product available in TurkDex.

Figure 19. Price Calculation for iTraxx Europe Futures



Source: *Used by the permission from Bloomberg.*

5. CONCLUSION

Credit derivatives market has been among the fastest growing and liquid markets as the standardized and exchange traded instruments are become increasingly popular. This rapid growth and liquidity of the credit market has enabled portfolio managers to hedge using single CDSs, basket CDSs, and CDS indices. Enhancing access to well-diversified European, Asian, Japan, and Australian credit market, different iTraxx instruments offers investors a means of diversifying their credit concentrations. In this study motivation and pricing methodologies for single CDS and iTraxx instruments are first presented and then possible uses of these products in Turkish banks are discussed.

Credit risk still makes up the largest part of banks' exposure that has to be managed effectively in a proactive way. High concentrations of credit exposure in home country can pose risks to the earnings and capital of any banks in the form of unexpected losses. Diversifying the credit concentrations via iTraxx instruments is the key in reducing those concentrations of credit exposure by client, segment, country, or geographical region.

Many banks in Europe and USA are diversifying their credit concentrations via credit derivatives so as to reduce the risk of an institution's exposure to the unexpected failure of single borrower, or a significant downturn in a particular industry or geographical area. Even in some banks, half of the corporate credit exposures is being hedged or securitized. Furthermore, better credit risk management in high volatility times has affected banks' reputations and they are either punished or rewarded by shareholders depending on their risk and portfolio management strategies.

In Turkey, leading banks have also recognized the value of credit risk management and have taken a number of steps to mitigate potential losses. Basically, they have put place good credit risk measurement both at standalone and at portfolio level. As well as they have started to actively manage credit portfolios according to following principles; i) reducing concentrations, ii) increase capital velocity and uses effectively, iii) improve returns and risk capital. These methodologies have obviously affected banks' balance sheet as causing a decrease in Non-Performing Loans and Specific Provisions.

On the other side-as it is indicated in financial reports of leading banks in Turkey-banks are heavily concentrated in domestic lending activities. These resulted in having approximately 96 % of securities portfolio (mostly Turkish government sovereigns) and 90 % of credit portfolio to be concentrated in Turkey. Although banks also increasingly engaged in monitoring and limiting activities as a part of a credit risk management methodologies, credit risk is still on balance sheets and home country risk concentration may crop up almost any where in banks' loan portfolios. Therefore, it can be stated that country idiosyncratic risk plays a vital role in banks loan portfolio and increase in that risk have direct negative influence on the loan portfolios.

Furthermore, four big banks' European credit exposure is only 8 % of total credit exposure and this 8 % percent is estimated to be confined to European countries where banks have foreign branches. Given the size of economic segment and countries under coverage, the role of iTraxx instruments as an international standardized CDS index is very important. This may enable Turkish banks to diversify their credit exposures internationally and to hold

credit portfolios with a systematic risk level that is lower than the home country's own systematic risk.

Given the correlation and co-integration level with European markets, it is very clear that Turkish Banks can benefit from using iTraxx instruments to diversify their credit exposure. As well as with the further development of the derivatives market in Turkey especially for futures and options and increase in corporate bond issuance, we expect Turkish banks to use CDS indices in managing credit concentrations. Furthermore, banks are forced by regulatory agencies to have enough economical capital for credit exposure; especially single-CDS instruments in Turkey will have their impact on banks' economical capital as they are mostly used and specifically designed to reduce the credit exposure to single counterparties. This product enables bank to closely follow credit risk and compare the credit rating of single borrower with market's view. Variation in CDS spreads reflects change in credit quality of the single borrower so that banks can have a proactive approach on that risk.

Eurex recently launched the world's first exchange-traded credit derivatives contract, a future based on the iTraxx Europe index, which is the most actively traded index in OTC market. These futures contacts alleviate many concerns of market players in terms of settlement, liquidity, pricing, daily MTM, no counterparty risk, no ISDA agreements, efficient trading and execution. At this stage, it can be stated that iTraxx futures contracts can be also useful risk management tools for Turkish banks. Given the correlation and cointegration level between Turkish and European markets, as a conclusion, Turkish Banks can use iTraxx futures contracts to diversify their home country concentration effectively without causing other risks to increase.

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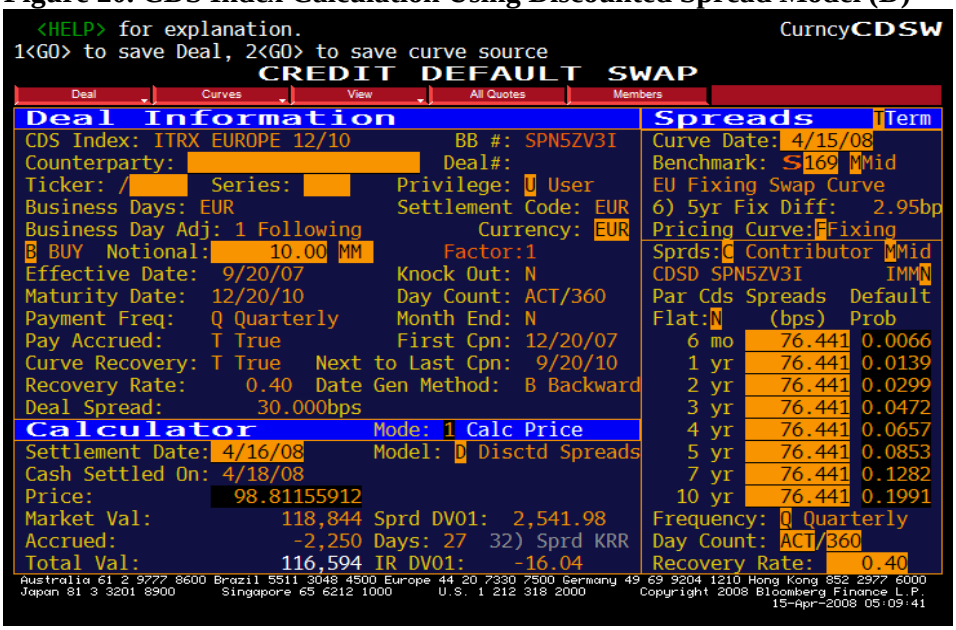
APPENDICES

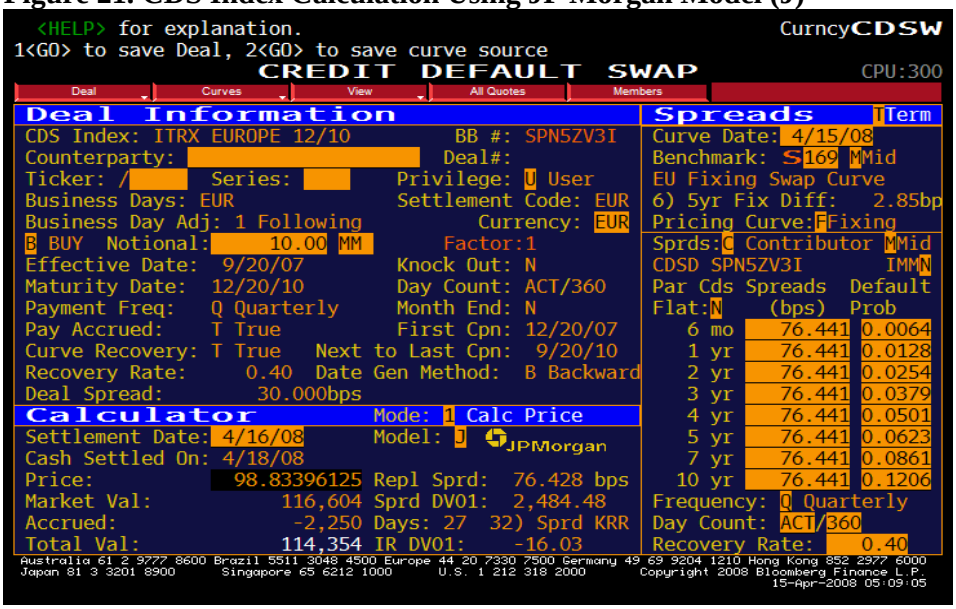
APPENDIX 1: MTM CALCULATION WITH FOUR DIFFERENT MODELS

Figure 20. CDS Index Calculation Using Discounted Spread Model (D)



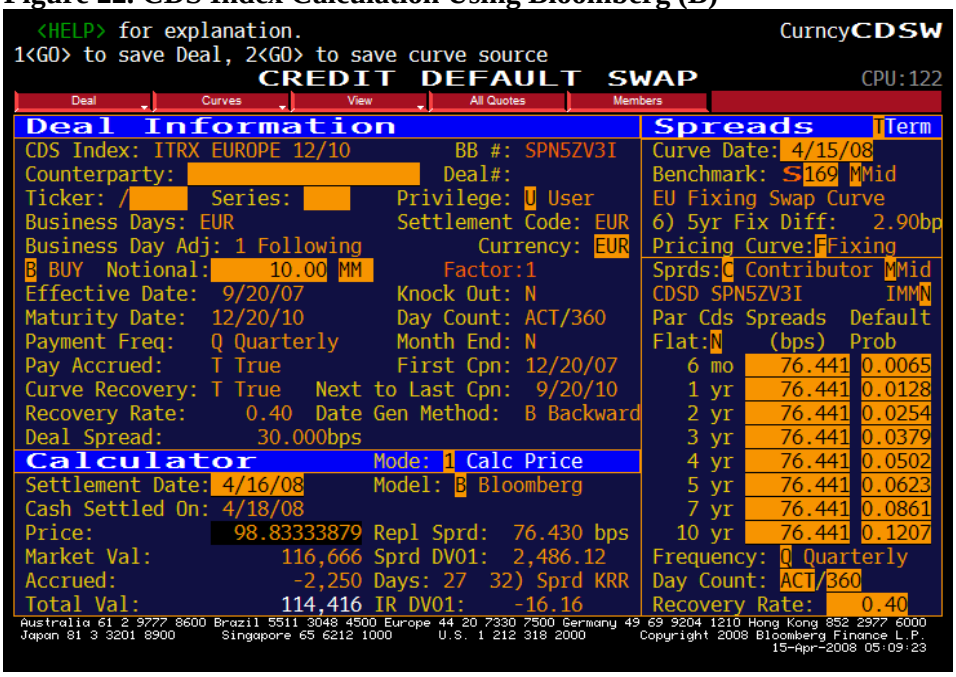
Source: *Used by permission from Bloomberg*

Figure 21. CDS Index Calculation Using JP Morgan Model (J)



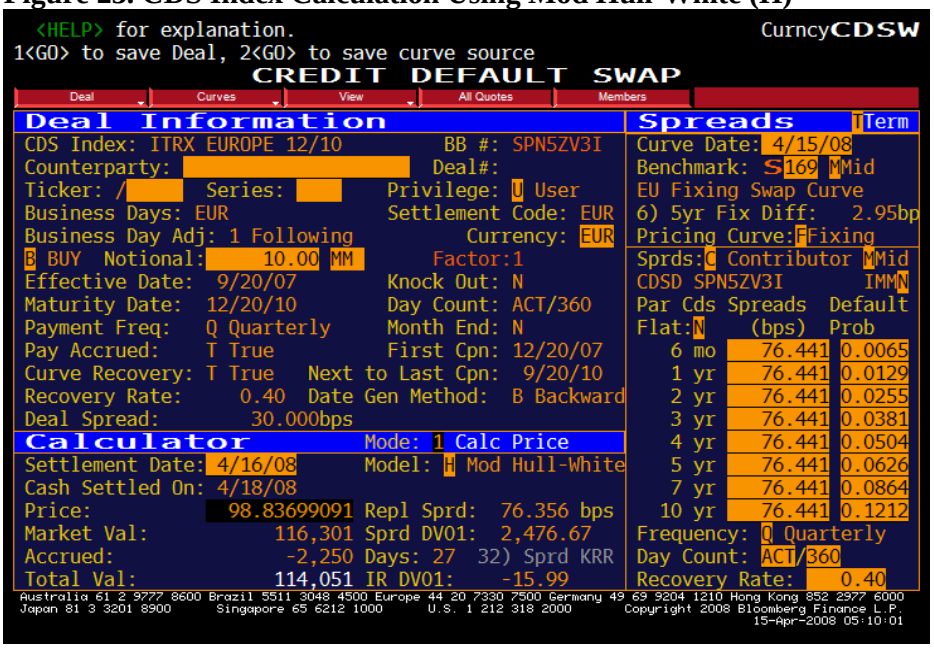
Source: *Used by the permission from Bloomberg*

Figure 22. CDS Index Calculation Using Bloomberg (B)



Source: *Used by permission from Bloomberg*

Figure 23. CDS Index Calculation Using Mod Hull-White (H)



Source: *Used by permission from Bloomberg*

APPENDIX II-CORRELATION AND CO-INTEGRATION ANALYSIS

The countries included in the sample are Austria (ATX), Belgium (BEL), France (CAC), Germany (DAX), Netherlands (AEX), Finland (HEX), UK (UKZ) and Turkey (ISE 100). For each index, the daily closing time-series is downloaded from FOREX database for the period between January 2006 and March 2008.

In order to utilize the international diversification, Turkey and European markets should not have a high degree of interdependence. In other words, correlation level among Turkey and European markets should not be perfectly positive so that investing into European market instruments can make it possible to decrease the home country concentration.

To analyze the co-movement of these markets, the methodology is constructed as 1) Unit Root Tests, 2) Correlation Analysis, and 3) Co-integration Tests.

1) UNIT ROOT TESTS

In performing co-integration analysis, the first step is to determine the order of integration of the each stock index. Therefore, before co-integration markets can be tested between Turkey and any of European stock markets, it has to be proven that the index series from each stock market in the sample are integrated of the same order and that their residual sequences are stationary. Time series are called stationary if their mean, variance and covariance are stationary. Therefore, we start by investigating the unit roots in the individual stock index series. Financial price series are said to be

usually non stationary at I (0) and called unit root series; therefore, first difference is taken to make series stationary.

Table 11. Augmented Dickey Fuller Test Results[54]						
Country	**ADF t-stat I(0)**	**Lag**	**ADF t-stat I(1)**	**Lag**	**Critical Value***	**Critical Value****
Austria	-0.1473	17	-7.1149	16	-2.56961	-1.94146
Netherlands	-0.0300	2	-15.6788	1	-2.56914	-1.94139
ISE-100	-0.1110	0	-23.6748	0	-2.56912	-1.94139
UK	-0.0900	14	-6.7826	13	-2.56923	-1.94141
Finland	0.40789	1	-24.5676	0	-2.56931	-1.94148
Belgium	0.1046	0	-24.4903	0	-2.56915	-1.94139
Germany	0.5800	2	-15.3689	1	-2.56919	-1.94140
France	-0.1219	1	-6.9820	0	-2.56913	-1.94139

* test critical value at 1% level
** test critical value at 5 % level

In Eviews, Augmented Dickey Fuller Test is utilized to test the stationarity of the series using the Akaike info Criterion with maximum lag of 18 and then lags are automatically assigned based on Akaike Info Criterion. Unit root tests are conducted by regressing return at time t with return at time t-1. Therefore, no trend or constant term (none option) is selected in Eviews and it can be expressed with the following formula:

$X_t=\beta X_{t-1}+\varepsilon_t$ where ε_t is a standard normal variable (**Equation 9**)

In Augmented Dickey Fuller Test, the null hypothesis states that return series has a unit root. Based on the test results above, at 1% and 5% level, it can be stated that although stock index series are non stationary at I(0), they are all stationary at the same integration level at I(1). In this section, unit root test has been the initial step for co-integration tests because co-integration can be tested only for series integrated of the same order. Thus,

[54] All variables are in log forms. Lag lengths are determined automatically using Eviews based on AIC.

co-integration between the stock market indices can be tested for these index price series.

2) CORRELATION ANALYSIS

According to modern portfolio theory, a portion of risk in any investment portfolio can be reduced by means of diversification. As it can be seen in the table 13, Turkish stock market has a higher risk (standard deviation) relative to European stock markets. Therefore, we will try to answer the question whether correlation level between Turkish and European markets at a level where Turkish banks can benefit from international diversification.

On the other side, with EU establishment and launch of Euro into European markets caused these markets to be highly integrated and stabilized. Furthermore, the growth of iTraxx products has added this financial integration much in terms of providing a means of European exposure and hedging. Financial globalization among these European countries caused them to benefit less from international diversification.

Therefore, it is tested either Turkish banks can benefit from international diversification via using iTraxx products. If the answer is yes, then we can conclude that it is possible for Turkish banks to diversify their credit exposures internationally to decrease their home country risk concentration. In other words, based on the correlation matrix (Table 12) and descriptive statistics (Table 13), it can be concluded that systematic risk on Turkish Banks' balance sheets can be reduced to levels lower than the home country systematic risk provided that Turkish market is not perfectly correlated with European markets. On the other side, in his paper Professor Alexander, C.

(1999) stated that whilst standard deviations of stock index returns are based on the variances of individual return distributions, correlations depend on the characteristics of joint distributions between two related market returns and, therefore, this extra dimension adds great deal of uncertainty to correlation measures. [55]

Indeed, it is quite straightforward to calculate the correlation between two markets; however, it may change dramatically from day to day since the correlation is a dynamic parameter. Therefore, in the next section, co-integration tests are conducted between Turkish and each of European stock markets as a method of measuring co-movements between markets that overcomes some of the limitations of correlation. Comparing to correlation tests in this section, co-integration refers not to co-movements in returns, but co-movements in asset prices, hence stock index values.

[55] For more explanation about different approaches to measuring correlations and their advantages and limitations, see Alexander, C. (1999). "Correlation and Co-integration in Energy Markets." Managing Energy Price Risk (2nd Edition). Risk Publications pp. 291-304.

Table 12. Pairwise correlation matrix among Turkish and European Markets

	NETHERLANDS	AUSTRIA	BELGIUM	FRANCE	GERMANY	UK	FINLAND	TURKEY
NETHERLANDS	1.000000							
AUSTRIA	0.736519	1.000000						
BELGIUM	0.895171	0.743016	1.000000					
FRANCE	0.940613	0.751194	0.904468	1.000000				
GERMANY	0.911516	0.733988	0.852816	0.938378	1.000000			
UK	0.905335	0.761723	0.860673	0.926320	0.875907	1.000000		
FINLAND	0.854197	0.791571	0.827943	0.857968	0.828776	0.850878	1.000000	
TURKEY	0.578268	0.663113	0.605815	0.596192	0.583199	0.614408	0.628230	1.000000

Note: Daily stock index returns are used for the period 01/01/2006- 31/03/2008.

Table 13. Descriptive Statistics for Stock Index Returns

	TURKEY	FINLAND	UK	GERMANY	GERMANY	BELGIUM	AUSTRIA	NETHERLANDS
Mean	-0.000366	0.000335	2.88E-07	0.000297	-2.62E-05	0.000122	-3.42E-05	2.01E-06
Median	-0.000580	0.001021	0.000132	0.001178	0.000467	0.000575	0.000790	0.000664
Maximum	0.064843	0.069166	0.046416	0.057610	0.058335	0.062828	0.053585	0.062945
Minimum	-0.086708	-0.053279	-0.056374	-0.074335	-0.070774	-0.056404	-0.077676	-0.063354
Std. Dev.	0.019503	0.012638	0.010939	0.011388	0.011622	0.010912	0.013620	0.010924
Skewness	-0.306499	-0.204246	-0.270006	-0.638495	-0.461875	-0.282168	-0.643513	-0.328899
Kurtosis	4.464780	6.274635	5.935811	7.934576	6.853799	6.632135	6.318556	7.438103
Jarque-Bera	56.41517	241.3972	206.8001	602.9697	368.4151	314.1279	280.3072	472.2035
Probability	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Sum	-0.196428	0.178143	0.000160	0.165178	-0.014743	0.067907	-0.018181	0.001131
Sum Sq. Dev.	0.203869	0.084805	0.066528	0.072107	0.075908	0.066327	0.098318	0.067064

Note: Daily stock index returns are used for the period 01/01/2006- 31/03/2008.

3) PAIR WISE CO-INTEGRATION ANALYSIS FOR TURKEY (1% and 5% level)

Co-integration is a recently developed concept for testing and modeling equilibrium or long run relations of financial variables. Before performing co-integration tests, it was determined that the order of integration of individual stock index series is I (1). A set of I (1) variables is called co-integrated if a linear combination exists that is I (0). In this part, co-integration analyses are conducted for each pair I(1) variables at 1% and 5 % level and it has been tried to detect if these country stock index pairs have a common long run development. If two series are co-integrated, this proves a statistical equilibrium which can often be interpreted as long-run relationship (Kirchgassner and Wolters (2007)). [56]Thus, the objective is to identify the presence of a long term relationship among Turkish and major European stock markets included in the sample. At earlier stage, it has been proved that stock indexes are non stationary at I (0) and; however, they are stationary when first difference is taken; therefore they are said to be integrated at the same order at level I (1). Thus, it can be tested whether Turkey is co-integrated with any European markets.

In performing co-integration test, Johansen co-integration test is utilized in that study and we will try to answer the question whether Turkey and any other European market are co-integrated. Previously, index prices have been already shown to be I (1) and it will be tested whether a linear function of ISE 100 and any European market is stationary at I (0). Further, since all index price series are shown to be integrated of the first order, these country stock index pairs may be co-integrated. Also long-run relationship between the variables should be taken into consideration; therefore, the deviations from the long-run relationship should be included as an explanatory variable

[56] For more detailed information about co-integration, please see Kirchgassner, G. and Wolters, J. Introduction to Modern Time Series Analysis. 2007, pp. 204-244.

in the model. The long-run relationship is estimated with the following formula:

$X_t=a_0+a_1Y_t + u_t$ **Equation (10)**[57]

where

$u_t= [X_t-a_0-a_1Y_t]$ can be I(0).

As a next step, in the co-integration analysis, the residual term, u_t , from this regression model is tested to be stationary in its level form. These calculations are done automatically in the Eviews.

On the other side, an important preliminary stage in the co-analysis is to determine the appropriate lag length. Lag length has been very important for the accuracy of the co-integration test. If lag length is selected to be too short, the model may be misspecified or if it is selected to be too long, degrees of freedom is unnecessarily decreased during the co-integration tests. Therefore, after showing each variable in the sample is I(1), another step has been to run the VAR (Vector Autoregression Estimates) model[58] to determine the optimal lag length. AIC (Akaike Info Criteria) is chosen to decide on the optimal lag length and based on the results, for all country pairs lag length is selected to be 2.

[57] This formula is derived from both G. MacKinnon, J. (1996). "Numerical Distribution Functions for Unit Root and Cointegration Tests." Canada, Queen's Economics DepartmentWorking Paper No. 198 and Salvatore, D. and Reagle, D. (2002). "Theory and Problems of Statistics and Econometrics" USA, Schaum's Outlines Statistics and Econometrics (2nd Edition). pp. 247-248.

[58] VAR model is a dynamic correlation model used to investigate the causal flows between index series.

Table 14. Pair-Wise Co-integration Analysis for Turkey			
	Lag Order	Max-Eigen Value(# of co-integration relationships)	
		1 %	5%
Turkey-Austria	1	0	0
Turkey-Belgium	2	0	0
Turkey-UK	2	0	0
Turkey-France	2	0	0
Turkey-Germany	2	0	0
Turkey-Netherlands	2	0	0
Turkey-Finland	2	0	0

The Johansen approach is based on two test statistics: i) the trace test and ii) the maximum eigenvalue test. In our analysis, we utilized the maximum eigenvalue test and in the maximum eigenvalue test the null hypothesis is stated as there are exactly r co-integrating equation(s) against the alternative hypothesis stating there are r+1 co-integrating equations. Firstly, co-integration tests are conducted at 1 % level for each pair in the sample and based on the maximum eigenvalue test, null hypothesis is rejected for all country pairs indicating there is no pair wise co-integration between Turkey and any European markets included in the sample stock markets. At the same time, co-integration tests are conducted at 5 % level. These results are also proving the same co-integration results. According to Max-Eigenvalue statistics, there is no co-integration between any country pairs. Therefore, overall results of these co-integration tests indicate that Turkey has no pair-wise co-integration with European markets.

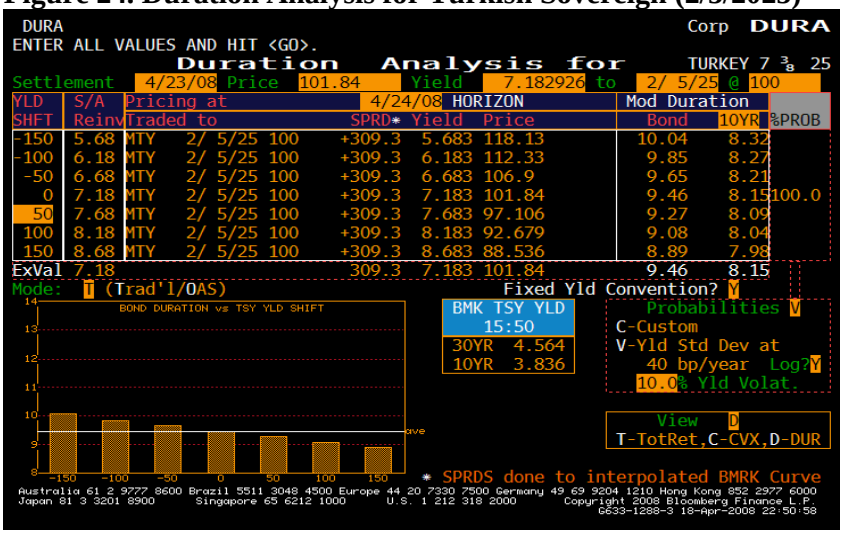
These results are in line with the findings of Kucukcolak (2008). She examines the integration level of Turkish equity market (ISE-100) with major EU market indices. However, to investigate the co-integration, she utilizes Engle-Granger method which is proposed in 1987. Considering the size of the markets, she selected France (CAC 40), Germany (DAX 30), and UK (FTSE 100) as representative countries for EU and selected Greece

(FTASE 20) for being the same scale market as Turkey. Furthermore, she used the daily data for January 2002-December 2005 period. Then she considered two series as pair (Turkey-Germany, Turkey-France, Turkey-UK, and Turkey-Greece) and performed a regression of one log price of Turkey equity market on the log price of one of EU equity markets. After that she tested the residual of each regression for stationarity and the residuals indicated that the error process is not stationary. Based on these results, she concluded that in the long run Turkish equity market is not co-integrated with major European stock markets except Greece.

To sum up, the results of these correlations and no co-integration between Turkey and European markets implies several conclusions. First, Turkey and European markets are seems to be segmented to a certain extend with no long-run co-movement. Second, there seems to be a limited contagion effect between Turkey and European markets. For example, if there is credit crunch in European market, this will affect Turkish Credit Market to some less extend. Finally, long-run international diversification across these markets can be an effective risk management strategy.

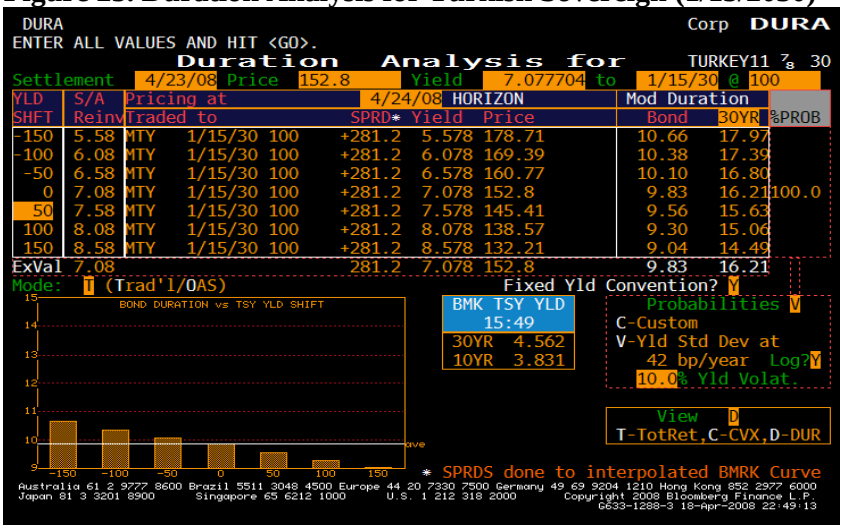
APPENDIX III. DURATION ANALYSIS FOR TURKISH SOVEREIGNS

Figure 24. Duration Analysis for Turkish Sovereign (2/5/2025)



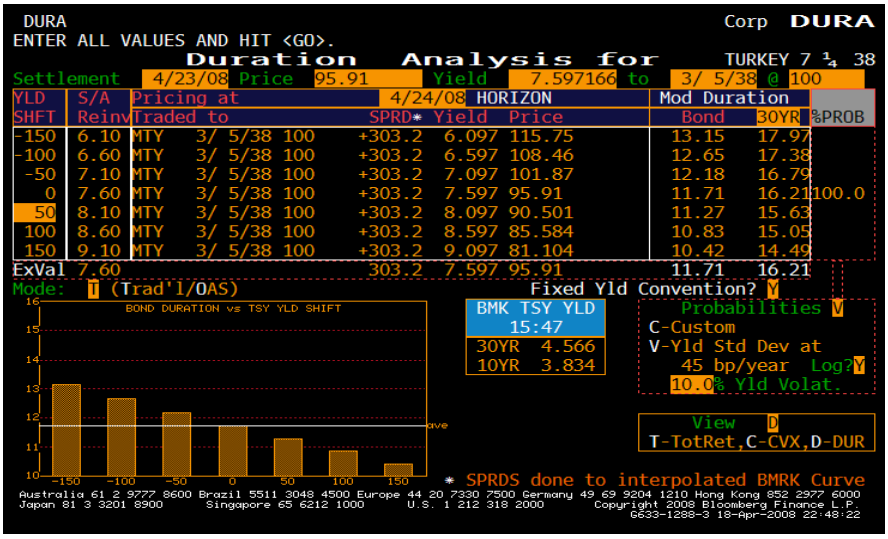
Source: *Used by permission from Bloomberg*

Figure 25. Duration Analysis for Turkish Sovereign (1/15/2030)



Source: *Used by permission from Bloomberg*

Figure 26. Duration Analysis for Turkish Sovereign (3/5/2038)



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