ΟΙΚΟΝΟΜΙΚΟ ΠΑΝΕΠΙΣΤΗΜΙΟ ΑΘΗΝΩΝ

ΤΜΗΜΑ ΛΟΓΙΣΤΙΚΗΣ & ΧΡΗΜΑΤΟΟΙΚΟΝΟΜΙΚΗΣ

ΠΡΟΓΡΑΜΜΑ ΜΕΤΑΠΤΥΧΙΑΚΩΝ ΣΠΟΥΔΩΝ

Investigation of the Credit Default Swap spreads and Asset Swap spreads behaviour in the long – run

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Εργασία υποβληθείσα στο

Τμήμα Λογιστικής & Χρηματοοικονομικής

του Οικονομικού Πανεπιστημίου Αθηνών

ως μέρος των απαιτήσεων για την απόκτηση

Μεταπτυχιακού Διπλώματος Ειδίκευσης

Αθήνα

Οκτώβριος 2005

Εγκρίνουμε την εργασία του

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ΗΜΕΡΟΜΗΝΙΑ

Θα επιθυμούσα να εκφράσω τις ευχαριστίες μου στον καθηγητή του Οικονομικού Πανεπιστημίου Αθηνών, κ. Καβουσανό Μανόλη για την επιλογή του θέματος και τις παρατηρήσεις του καθώς και στην υποψήφια διδάκτορα του Τμήματος Λογιστικής & Χρηματοοικονομικής, κ. Παλαμήδη Μάρα για την καθοδήγησή της στην εκπόνηση της εργασίας.

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Abstract

The aim of the present study is to investigate whether there is a long-term relationship between the credit default swap premia and asset swap spreads. Any discrepancies between the two markets can be exploited to lead to some profit. The basis is the difference between the credit default swap and asset swap spreads. In order to investigate whether there is a long-term relationship between the credit default swap premia and asset swap spreads, the basis is used in the analysis. An alternative way of calculating the basis is the difference between the credit default swap spreads and the yield spreads. Asset swap spreads seem to be volatile, whereas yield spreads appear to be mean reverting and reflect the default risk in a much better way. Moreover the asset swap spreads are affected by the bond's price and in that sense it is not an appropriate credit index to issuer.

To find out whether there is a long – run relationship between CDS premia and ASW spreads; Engle – Granger test should be conducted to the residuals of the process. If the residuals are proved to be stationary at the levels then we conclude that the time series are cointegrated. This finding means that the CDS and ASW spreads time series have the same long – term behaviour and therefore an investor cannot use the discrepancies between the two markets to speculate.

The data for the sample has been downloaded from the Bloomberg and the JP Morgan database. The sample period is chosen as from 15 May 2003 to 25 August 2005.

Using the ASW spreads in the basis calculation has proved to lead to insufficient results about the long – run relationship between the CDS premia and the ASW spreads. Therefore, an alternative method of calculating the basis is the difference between CDS premia and the yield spreads.. The outcome of the two models leads us to the conclusion that the CDS premia and asset swap spreads (or alternatively yield spreads) time series are cointegrated and consequently, an investor cannot use the discrepancies between the two markets (derivative market and cash market) to speculate in the long run.

1. Introduction

Credit derivatives are rapidly becoming one of the most successful financial innovations of the past decade. The British Bankers' Association estimates that from a total notional amount of $ 180bn in 1997, the credit – derivatives market grew more than tenfold to $ 2,0trillion by the end of 2002. Further more, the British Banker's Association forecasted that the total notional amount of credit derivatives would have reached $4,8 trillion by the end of 2004. In a November 19, 2002 speech before the Council on Foreign Relations, Federal Reserve Chairman Alan Greenspan praised the credit – derivatives market for its role in allowing banks and other financial institutions to hedge credit risk.

Credit derivatives are contingent claims with payoffs that are linked to the credit – worthiness of a given firm or sovereign entity. The purpose of these instruments is to allow market participants to trade the risk associated with certain debt – related events. Credit derivatives widely used in practice include total – return swaps, spread options, and credit – default swaps.[1] The simplest example of a single – name credit – default swap contract can be illustrated as follows. The first party to the contract, the protection buyer, wishes to insure against the possibility of default on a bond issued by a particular company. The company that has issued the bond is called the reference entity. The bond itself is designated the reference obligation. The second party to the contract, the protection seller, is willing to bear the risk associated with default by the reference entity. In the event of a default by the reference entity, the protection seller agrees to buy the reference issue at its face value from the protection buyer. In return, the protection seller receives a periodic fee from the protection buyer. This fee, typically quoted in basis points per $100 notional amount of the reference obligation, is called the default swap premium. Once there has been a default and the contract settled (exchange of the bond and the face value) the protection buyer discontinues the periodic payment. If a default does not occur over the life of the contract, then the contract expires at its maturity date.

[1] Credit – default swaps on a portfolio of bonds, sometimes called portfolio credit – default swaps, also exist. For example, see Fitch IBCA, Duff and Phelps (2001).

In the most general credit – default swap contract; the parties may agree that any of a set of bonds or loans may be delivered in the case of a physical settlement. In this case, the reference issue serves as a benchmark against which other possible deliverable bonds or loans might be considered eligible. In any case, the deliverable obligations are usually specified in the contract. It is also possible, however, that a reference obligation may not be specified. In this case, any senior unsecured obligation of the reference entity may be delivered. Cash settlement, rather than physical settlement, may be specified in the contract. The cash settlement amount would either be the difference between the notional and market value of the reference issue (which could be ascertained by polling bond dealers), or a predetermined fraction of the notional amount. Note that because the protection buyer generally has a choice of the bond or loan to deliver in the event of default, a credit default swap could include a delivery option similar to that in Treasury note and bond futures contracts.

Since credit – default swaps are OTC contracts, the maturity is negotiable, and maturities from a few months to ten years or more are possible, although five years is the most common or liquid tenor in the market.

The nearly – explosive growth of this market, however, has also been accompanied by controversy. In particular, concerns have been raised recently about whether credit protection is priced fairly in the credit – derivatives market.

We view credit derivatives as the most important new mechanism for transferring credit risk.

In simple terms, credit derivatives are a means of transferring credit risk between two parties by way of bilateral agreements. Contracts can refer to single credits or diverse pools of credits (such as in synthetic Collateralized Debt Obligations, CDOs, which transfer risk on entire credit portfolios). Credit derivative contracts are over – the – counter (OTC) and therefore can be tailored to individual requirements. However, in practice the vast majority of transactions in the market are quite standardized.

Within an economy a broad variety of entities have a natural need to assume, reduce or manage credit exposures. These include banks, insurance companies, fund managers, hedge funds, securities companies, pension funds, government agencies and corporates. Each type of player will have different economic or regulatory motives for wishing to take positive or negative credit positions at particular times. Credit derivatives enable users to:

- Hedge and / or mitigate credit exposure;
- Transfer credit risk;
- Generate leverage or yield enhancement;
- Decompose and separate risk embedded in securities (such as in convertible bond arbitrage);
- Synthetically create loan or bond substitutes for entities that have not issued in those markets at chosen maturities;
- Proactively manage credit risk on a portfolio basis;
- Use as an alternative vehicle to equity derivatives for expressing a directional or volatility view on a company; and
- Manage regulatory capital ratios.

Conventional credit instruments (such as bonds or loans) do not offer the same degree of structural flexibility or range of applications as credit derivatives.

A fundamental structural characteristic of credit derivatives is that they de – couple credit risk from funding. Thus players can radically alter their credit risk exposure without actually buying or selling bonds or loans in the primary or secondary markets.

Credit default swaps (CDS) are developing into an increasingly standardized means of transferring credit risk – not just between entities but between different markets for risk. The development of a deep and relatively liquid credit derivative market has the potential to play an important role in efficiently allocating credit risk within economies.

Arguably, the different capital adequacy requirements of different types of credit investor can distort this efficient credit allocation. If this is the case then an effective and standardized market for credit risk may tend to promote "capital efficient" in addition to "efficient" allocation of credit.

Credit Default Swaps (CDS) are the most important and widely used instrument in the credit derivative market. In essence a default swap is a bilateral OTC agreement, which transfers a defined credit risk from one party to another. The buyer of credit protection pays a periodic fee to an investor in return for protection against a Credit Event experienced by a Reference Entity (i.e. the underlying credit that is being transferred).

Credit default swaps are also known as "protection". Transactions in the market are usually referred to in terms of either buying or selling protection. This can be confusing since a seller of protection is assuming credit risk. In the underlying swap documentation, the fixed payer is the protection buyer (the fixed payment being the regular premium) and the floating payer is the protection seller (the floating payment being the underlying cash payment of the notional amount following a "Credit Event").

Under a typical default swap the buyer of protection pays to the seller a regular premium (usually quarterly), which is specified at the beginning of the transaction. If no Credit Event, such as default, occurs during the life of the swap, these premium payments are the only cash flows. Like many other swaps there is no exchange of underlying principal. Following a Credit Event the protection seller makes a payment to the protection buyer. Typically this payment takes the form of a physical exchange between the buyer and the seller. The protection buyer provides the seller any qualifying debt instrument (known as Deliverable Obligation) of the Reference Entity in return for a cash payment amounting to its full aggregate notional amount (i.e. par). The protection buyer stops paying the regular premium following the Credit Event. The net loss to the protection seller is therefore par less the recovery value on the delivered obligation.

Just because a Credit Event has occurred it does not necessarily mean that the claim on the Reference Entity will be worthless. Credit default contracts are structured to effectively replicate the experience of a cash market holder of an obligation of the Reference Entity. At least some payments may be made to creditors even if the company is wound up. As recovery values (or the market value of debt following default) are typically at a deep discount to par, the default swap buyer has effectively received protection on this price deterioration.

The transaction described above involves physical settlement. The market convention is for such physical settlement although it is possible to **cash settle**. In such cases, following a credit event, the protection seller would provide single cash payment reflecting the extent to which a market valuation of a specified debt obligation of the reference entity has fallen in value.

Interest Rate Swaps and Asset Swaps

The developing interest rate swap market of the 1980s made possible the asset swap market. In this way, an instrument designed to shift *interest rate risk* has facilitated the transfer of *credit risk* between distinct types of investor groups within the economy.

Asset swaps are hardly new. By simply combining a cash bond purchase with an interest rate swap, a fixed – rate bond can be transformed into a floating rate asset. As the cash flow profile of such an asset is essentially the same as term loan – with a higher yield for a given credit – asset swaps are typically bought by banks for long – term investment purposes. As this occurs there is a net transfer of credit risk from mainstream bond market investors to lending bank portfolios.

Market Participants

Banks are the dominant market users, and have particularly large market share as buyers of protection. While initially focused on regulatory capital relief and portfolio transactions, the focus is now arguably migrating to economic capital relief and single name transactions, becoming selective sellers of protection and using the process to facilitate primary market syndications. Perhaps more interesting on the bank side is that US data from the Office of the Comptroller of the Currency (OCC) suggest that (as with interest rate swaps) activity is concentrated in a small number of very large banks. Of the $634bn notional principal of outstanding contracts as of 31 December 2002, 91% was comprised by just 3 banking groups and the largest bank had 58% market share.

Although default swaps are in many ways similar to insurance policies there are important differences. For example, an insurance policy typically requires an underlying insurable interest and actual loss whereas credit protection can be bought whether or not the buyer has an underlying risk exposure, which needs hedging. In most countries insurance companies have regulatory constraints limiting direct usage of derivatives. For this reason, many of credit derivative transactions are structured into Credit Linked Notes (CLNs) or principal protected notes, which are collateralized by zero coupon bonds. Insurance companies are also significant investors in the various trenches of synthetic CDOs.

Transactions can also be booked through "transformer" captive offshore insurance companies, which sell credit protection in the market and buy an insurance policy with virtually identical terms and conditions from an insurance company. The advantage of such vehicles over CLNs is that they are capable of entering into policies that can be booked in the underwriting business.

The market share for hedge fund buying activity has tripled from 1999 to 2001. Strategies such as convertible bond arbitrage use default swaps to hedge the credit risk component of convertible bond positions and isolate exposure to cheap embedded equity options. Other uses involve combining either long or short CDS positions against offsetting equity or equity derivative positions in capital structure arbitrage opportunities.

Corporations are significant buyers of credit protection. Such activity is typically motivated by the need to reduce customer exposure through receivables or vendor financing.

Valuation of Credit Default Swaps

In terms of cash flow profile, a credit default swap is most readily comparable with a par floating rate note funded at Libor or an asset swapped fixed – rate bond financed in the repo market. Though default protection should logically trade at a spread relative to a risk – free asset, in practice it trades at a level that is benchmarked to the asset swap market. Most banks look at their funding costs relative to LIBOR and calculate the net spread they can earn on an asset relative to their funding costs. LIBOR represents the rate at which AA – rated banks fund each other in the interbank market for a period of 3 – 6 months. Although this is a useful pricing benchmark it is not a risk free rate.

Intuitively, the price of a credit default swap will reflect several factors. The key inputs would include the following:

- Probability of default of the reference entity and protection seller;
- Correlation between the reference entity and protection seller;
- Joint probability of default of the reference entity and protection seller;
- Maturity of the swap; and
- Expected recovery value of the reference asset.

Though several sophisticated pricing models exist in the market, default swaps are primarily valued relative to asset swap levels. This assumes that an investor would be satisfied with the same spread on a credit default swap as the spread earned by investing the cash in the asset (taking into account the funding cost of the institution for the particular asset).

Default swap pricing is based on arbitrage relationships between the derivative and cash instruments. Rather than using complicated pricing models to estimate default probability, we can use a simpler pricing mechanism, which assumes that the expected value of credit risk is already captured by the cash, market credit spreads.

A credit default swap is equivalent to a financed purchase of a bond with an interest rate hedge. It is an unfounded transaction requiring no initial cash outlay. As a result, the relative value of a credit default swap is compared to an asset swap rather than a bond's underlying spread over treasuries. An unfounded position in the bond would have to be financed in the repo market.

In a simplified model, the default swap should trade at the same level as an asset swap on the same bond. The asset swap provides a context for relative value because reference assets have transparent prices.

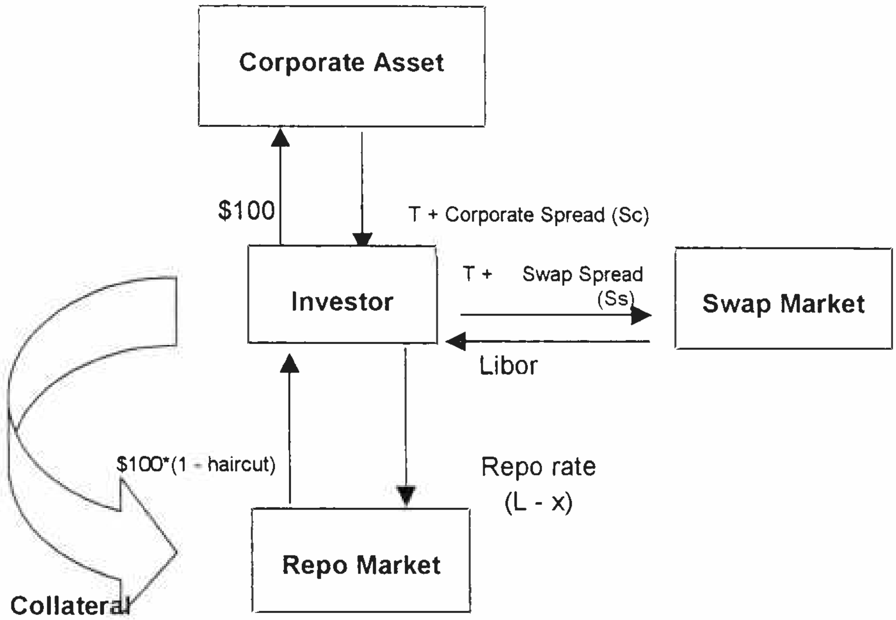
Default swap exposure can be replicated in the following way:

- Purchase a cash bond with a spread of $T + S_c$ for par.
- Pay fixed on a swap ($T + S_s$) with the maturity of the cash bond and receive Libor (L).
- Finance the bond purchase in the repo market. The repo rate is quoted at a spread to Libor ($L - x$).
- Pledge bond as collateral and is charged a haircut by the repo counterparty.

The interest rate swap component eliminates the duration and convexity exposure of the cash bond. Without this hedge, the trade would be equivalent to a leveraged long position in the fixed rate corporate asset ($T + S_c - (L - x)$).

Since a credit default swap is an unfounded transaction, the bond purchase needs to be financed. This financing is achieved with a bond repo. In a repo, collateral is traded for cash. The "collateral" seller borrows cash and lends collateral (a repo). The collateral "buyer" borrows the collateral and lends cash (a reverse repo). The repo bid/ offer refers to the rate at which the collateral can be bought. The bid is higher than the offer since it is the cost of buying cash and selling collateral (Figure 1.1).

Figure 1.1



Two important components of a repo trade are:

- Haircut: This is defined as the difference between the securities purchased and the money borrowed. The lender of cash charges a haircut for the loan in order to compensate for market risk of collateral as well as counterparty risk.
- Repo rate: This is the financing charge for the collateral. It varies according to the demand to borrow (or lend) the security. This rate has been denoted as L – x, since several liquid credits have repo rates that are usually, but not always, less than Libor.

Table 1.1

Investor Trade	Receive	Pay
buy cash bond	T+Sc	100
swap hedge	L	T+Ss
repo	100	L - x
total cash flows	T+Sc+L+100	100+T+Sc+L-x

The haircut represents the capital in the trade (Table 1.1). As a result, institutions with the cheapest cost of capital will be able to assume this credit exposure for the lowest net cost. If we assume a haircut of 0 for simplicity, then the net cash flow is: $(S_c - S_s) + x$. If the repo rate for the bond were Libor flat ($x = 0$) the exposure would simply be the asset's swap spread $(S_c - S_s)$.

This cash flow is similar to that received by a protection seller on a default swap, i.e., a simple annuity stream expressed in basis points for the life of the trade. If the bond defaulted, the repo would terminate and the investor would lose the difference between the purchase price and recovery price of the bond.

In efficient markets, arbitrage relationships should drive default swap levels towards the asset swap level. Any mispricing between the markets would be arbitraged away by market makers. For example, if the default premium is greater that the asset swap level, protection sellers would enter the market and drive the default swap premium down towards the asset swap level.

The present study aims to investigate whether there is a long – run relationship between the credit default swap spreads and the asset swap spreads. An investor might exploit any possible discrepancies between the two markets in order to speculate. The majority of the studies that have been published so far try to reflect the relationship between the cash market and the derivatives markets through the use of the basis. These studies define the basis as the difference between credit default swap spreads and yield spreads. 0n the contrary, the present study aims to investigate the differences between the two markets using the difference between the credit default swap spreads and the asset swap spreads as the basis definition.

The content of this study is as follows. Section 2 gives an overview of the theoretical and empirical literature. In Section 3 the Augmented Dickey – Fuller and the Engle – Granger methods are explained and the model is specified. Next, in Section 4, the data that are used to test the ADF and the Engle – Granger hypothesis are described. In Section 5, the results from the model implementation are shown. Finally, Section 6 summarizes.

2. Literature review

The literature on credit derivatives is growing rapidly. Important theoretical work in the area includes Jarrow and Thurnbull (1995, 2000), Longstaff and Schwartz (1995), Das (1995), Duffie (1998, 1999), Lando (1998), Duffie and Singleton (1999), Hull and White (2000, 2001), Jarrow and Yildirim (2001), Das, Sundaram and Sundaresan (2003), and many others. There are also several recent empirical studies of the pricing of credit – default swaps including Cossin, Hricko, Aunon – Nerin, and Huang (2002), Houwlling and Vorst (2002), and Zhang (2003).

Credit Default Swaps and Credit Spreads

Blanco, Brennan, and Marsh (2004) begin their analysis with a loose approximate arbitrage relationship. They assume an investor buys a T – year par bond with yield to maturity of y issued by the reference entity, and buys credit protection on that entity for T – years in the credit default swap market at a cost of p_{cds}. The investor has eliminated most of the default risk associated with the bond. If p_{cds} is expressed annually as a percentage of the notional principal, then the investor' s net annual return is $y - p_{cds}$. By arbitrage, this net return should approximately equal the T – year risk – free rate, denoted by x. If $y - p_{cds}$ is less than x, then shorting the risky bond, writing protection in the CDS market and buying the risk – free instrument would be a profitable arbitrage opportunity. Similarly, if $y - p_{cds}$ exceeds x, buying the risky bond, buying protection and shorting the risk – free bond would be profitable. This suggests that the price of the CDS, p_{cds}, should equal the credit spread $y - x$.

This is the relationship used in the empirical analysis that follows, although we recognize that the arbitrage is only perfect in some instances. Duffie (1999) shows that the spread on a par risky floating – rate note over a risk – free floating – rate note exactly equals the CDS price. Unfortunately, floating – rate notes are rare. The spread on a par fixed – coupon risky bond over the par fixed – coupon risk – free bond exactly equals the CDS price if the payment dates on the CDS and bond coincide and recovery on default is a constant fraction of face value (Houweling and Vorst, 2002).

Alternatively, with a flat risk – free curve and constant interest rates, the arbitrage is perfect if the payout from a CDS on default is the sum of the principal amount plus accrued interest on a risky par yield bond times one minus the recovery rate (Hull and White, 2000). As noted above, however, the payout from a CDS usually equals the principal amount minus the recovery rate times the sum of principal and accrued interest on the reference obligation. Nevertheless the referenced papers show that the arbitrage is reasonably accurate (within 5 – 10basis points) for assets trading close to par when interest rates are not high and yield curves are relatively flat.

Three other considerations are relevant. First, as noted above, physically – settled CDS prices, especially for European entities, might contain CTD options. Other things equal, this will lead to CDS prices being greater than the credit spread. Unfortunately, it is impossible to value this option analytically since there is no benchmark for the post – default behaviour of deliverable bonds, so we cannot simply subtract its value from the CDS price. Second, the arbitrage relationship that should keep the two prices together may rely on short selling the cash bond. This is not always costless and indeed is sometimes not even possible in illiquid corporate bond markets. If the repo cost of shorting the cash bond is significant, then the credit spread we have computed (bond yield minus risk – free rate) underestimates the true credit spread (bond yield minus risk – free rate plus repo cost). Quantifying these two factors is difficult in the absence of reliable repo cost data or a valuation model for the option. However, since both the repo cost and the option value are bounded at zero, we can say that the CDS price is an upper limit on the price of credit risk while the credit spread provides a lower limit. Third, liquidity premia exist in both the cash bond and CDS markets. The cash bond market is often described as relatively illiquid, particularly outside the United States. Movements in liquidity premia may explain a large proportion of the total variation in credit spreads (Collin – Dufresne, Goldstein and Martin, 2001). The CDS market is still relatively small despite its rapid recent growth and so demand / supply imbalances can often cause short – term price movements unrelated to default expectations.

If both CDS and cash bonds price default risk equally then, subject to the arbitrage imperfections noted above, the spread on the risky bond over a risk – free reference rate should equal the CDS price of the same maturity. Define the basis to be the difference between the time t CDS price, p_{cds}, and the credit spread, $p_{cs,t}$:

$$\text{Basis}_t^{\text{swaps}} = p_{cds\,t} - p_{cs,t}^{swaps} = p_{cds,t} - \left(\hat{y}_t - x_t^{swaps}\right)$$

$$\text{Basis}_t^{\text{swaps}} = p_{cds\,t} - p_{cs,t}^{govrt} = p_{cds,t} - \left(\hat{y}_t - x_t^{govt}\right)$$

Where $\hat{y}$ denotes the interpolated five –year yield on the risky bond, x^{swaps} denotes the five – year swap rate, and x^{govt} is the five – year government bond yield.

Jan Annaert and Marc Ceuster (1999) suggested risky bonds should offer higher yields than comparable risk – free bonds, to compensate investors for the probability of losing (part of) their invested funds. Consequently, a risky bond trades at a lower price than a risk free bond (given an identical maturity and coupon rate). The difference between the yield on the risky bond ('risky yield', YTM) and the yield of the comparable risk – free bond ('risk – free yield', i) is called the credit spread (sp).

Spreads

The spread should at least compensate the investors for the expected losses on the risky bond, but –to the extent that investors are risk averse- should also include a risk premium to reward investors for accepting the risk to assume higher than expected losses.

Z – spread: To calculate the Z – spread, all cash flows of a fixed rate corporate bond are discounted by the appropriate zero – coupon swap rate. The net present value of the cash flows of the corporate bond, discounted by the swap curve, is then compared to the market price of the bond. The zero coupon swap curve is the shifted (parallel) until the calculated PV of the cash flows equals the market price. The size of the shift needed to make the PV equal the market price is the z- spread. It provides a relatively clean way to compare the bond to the swap curve (excluding the premium adjustment), but for most bonds it would be extremely difficult to put on a trade that would replicate the z – spread. Accordingly, the z – spread is the best analytical tool, but significant dislocations in z – spreads cannot be cleanly arbitraged.

Asset swap spread: The bond's cash flows are discounted using the appropriate zero – coupon swap rates, and then an annuity is added or subtracted from the bond to force the calculated bond price to be equal to the market price. The size of this annuity, spread over the floating leg of the actual swap, is the asset swap spread. The key difference between z – spread and asset swap spread involves the discount rate (zero coupon swap rates in case of asset swaps and zero coupon swap rates plus the z – spread in case of the z – spread calculation) and the upfront payments for a par – asset swap.

There are some very positive attributes of the asset swap spreads. There is a live and active asset swap market. One could, therefore, realize the asset swap spreads. It is not just a theoretical construct like z- spreads.

But, as one would expect, there are several problems with the asset swap spread, as well. First, by adding in an annuity, one is introducing sensitivity to parts off the curve where there should be none. For example, a 10 – year zero – coupon corporate bond should not see any relative value change if the 10 – year zero – coupon swap rate is unchanged but the 3 – year zero – coupon swap rate rallies 10 bps, but its asset swap spread would change. In addition, the upfront payment equal to the PV of the annuity is essentially a loan at LIBOR, which might be significantly different from the financing cost of the corporate instrument.

If one actually needs to do an asset swap to realize the value of a trade, then one ought to use the asset swap spread to make relative value judgments, its faults notwithstanding. For example, if an investor were buying a fixed rate bond and a default swap as a package, he would be much better off using the asset swap spread rather than any other measure for relative value analysis because the basis can be locked in.

I – spread: The I –spread, also known as yield – yield or matched – maturity asset swap spread, is simply the difference between the corporate bond's yield – to –

maturity and the asset swap yield to the same maturity date. An interpolated rate is used if the bond's maturity does not line up perfectly with actively traded point on the swap curve (the 9 – and 10 – year swap rates would be interpolated to generate a 9 ¼ year rate).

The most attractive thing about I – spreads is that it is a very straightforward and simple calculation. Also, the I – spread works reasonably well for bonds trading near par that have a yield close to the swap yield. But, there will be large duration differences if the coupon on the bond is far away from the swap yield. If the yield curve were perfectly flat, the duration gap would cause less significant problems with relative value analysis. But, with a steep curve, using maturity instead of duration can cause serious distortions.

Some investors use the I – spread as their relative value measure because they do not want to make a separate premium adjustment. When the yield curve is upward sloping, the duration versus maturity issue means the I – spread on high coupon bonds should be wider, but the high dollar price of most high coupon bonds means the premium adjustment lowers the spread to LIBOR. Investors assume that these two factors will offset each other, but there is no reason to expect that the distortions will be of similar magnitudes. Accordingly, we think that investors are much better off using either the z – spread or asset swap spread, and then making a separate premium adjustment.

According to the Credit Suisse, the z- spread is largely a theoretical construct and should be used mostly as an analytical tool rather than an executable transaction. On the other hand, the asset swap spread is slightly more complicated and less accurate from a relative value perspective, but investors can actually execute trades that lock in the asset swap spread. So, investors trading corporates against LIBOR or the CDS markets (which uses LIBOR by default) should stick the asset swap calculation.

The credit spread, according to Annaert and Ceuster may therefore exhibit continuous changes as well as sudden jumps. Their study assumes that the risky bond is identical to the risk – free bond, save for its default risk. In practice, government bond markets are larger and more liquid than corporate bond markets. This implies that in addition to the credit spreads, investors will need to be rewarded for holding bonds less liquid than government bonds. The spread, sp, thus also contains a liquidity premium. Therefore, changes in the measured "credit" spread, sp, may also be due to time – varying liquidity premia.

Annaert and Ceuster suggested that to explain the credit spread one has to take into account not only the elements having an impact on expected default, but also the risk premium investors require assuming the risk of higher losses. This is quite complex as risk enters the picture in several ways. The four major sources of credit risk are default risk, credit migration risk, exposure uncertainty risk and recovery risk. Default risk refers to the fact that it is never certain if and when a firm will default on its obligations. Credit migration risk captures the changes in credit quality, which will affect the value of the portfolio held. Exposure uncertainty risk comprises all optionalities implied in loan and bond contracts. Recovery risk concerns the uncertainty about the value of the bond that is faced once the bond defaults.

The factors that are reported to have an impact on credit spreads are divided into two groups. The first series of factors are related to the bond or the issuing company. The second group refers to common time – varying determinants.

Annaert and Ceuster included credit rating, term to maturity, seniority and collateral, and coupon rate in the first group of the factors (specific factors) that are reported to have an impact on credit spreads. In the second group (common factors) they included liquidity effects, term structure of interest rates and business cycle.

Specific factors

1) Credit rating: As the credit spread compensates the holder of the debt instrument for expected losses, there should be a link between the credit spread and the credit rating class, given the fact that there exist ample evidence that rating categories indeed entail an identication of relative credit risk. Researchers have indeed shown that there exist a close relationship between credit rating classes and subsequent default experience. This is mirrored in empirical studies where it is always found that the credit spread widens at an increasing rate as the credit rating worsens.

2) Term to maturity: Theoretically, there is a relation between the term to maturity of bonds and its credit spread, which is also known as the term structure of credit spread curve (Merton, 1974; Jarrow, Lando and Turnbull, 1997; Longstaff and Schwartz, 1995; Tychon, 1998). This relationship is not necessarily upward sloping or humped – shaped. The intuition behind the latter is that highly related companies can hardly become better rated, but can get down – rated. The reverse applies to less – than – investment rated companies. The longer the term to maturity, the higher the probability that the credit rating of such a company increases. This explains that the credit spread can be lower for longer maturity bonds. Empirical evidence is available for this phenomenon (Saring and Warga, 1989; Fons, 1994; Van Horne, 1998). However, Helwege and Turner (1997) indicated that the downward sloping credit spread curve might be consequence of using average credit spreads of bonds in a given rating class. Moreover, the safer firms tend to issue the longer dated bonds[2]. Therefore, the credit spread is underestimated for the longer maturities, such that the downward sloping curves in fact only follow from using less risky bonds for the longer maturities.

In any case, many other authors also fail to find other than positively sloped credit spread curves. Litterman and Iben (1991) indicate that in their sample the credit spread curve is upward sloping, although they only study BBB or higher rated bonds, Ma, Rao and Peterson (1989) report a positive relation between yield spread and duration[3] and Duffee (1996) also finds (using investment – grade bonds) that for typical firms the term structure of yield spreads is upward sloping, with a slope which is positively related to the level of the spread. Fons (1994) computes credit spreads using historical default rates and assuming risk – neutrality. Although the credit spreads increase with term to maturity for investment – grade bonds, the credit spread curve for Ba – rated bonds is slightly humped, whereas the credit spread curve for B – rated bonds is negatively sloped. In contrast, Angbazo, Mei and Saunders (1998) find a positive relation between term to maturity and credit spreads on loans for highly

[2] This implies that term to maturity and credit risk are not independent. Term to maturity is determined endogenously in the firm's financing decisions. See e.g. Mitchell (1991).
[3] Duration is used as it is deemed more appropriate than term to maturity for high – yield bonds because of their high coupon rates. Chance (1990) elaborating Merton's (1974) model finds that risky bonds have a lower duration than riskless bonds with similar term to maturity.

leveraged transactions. It is remarkable that even for these highly risky loans no humped or downward sloping curve is found.

3) Seniority and collateral: Both the seniority of a bond or loan and the collateral attached as security to it, have an impact on the credit spread because, arguably, both kinds of provisions will increase the recovery rate in case of default. Indeed, Izvorski (1997) finds that for defaulted US bonds debt seniority is one of the most important determinants of the recovery ratio, thus implying a lower yield for senior issues.

In some papers, however, the reverse relationship is reported: within a rating class security covenants actually increase the issue' s yield. Roberts and Viscione (1984) explain this anomalous finding by differences in credit risk within the same rating category. Relatively risky bonds are more likely to have covenants, which in turn may lead to higher credit ratings for the issue than it would have without covenants. To eliminate this bias Roberts and Viscione (1984) study the yield difference between bonds issued by the same company, with similar features except for seniority / security covenants. In their sample, they do find lower yields for higher security bonds.

4) Coupon rates: in general, the credit spreads on coupon bonds are not equal to credit spreads on zero – coupon bonds because of either a non – flat term structure or a non – flat credit spread structure. To the extent that the credit – spread curve is upward sloping, higher coupon bonds will have lower credit spreads than lower coupon bonds with the same maturity (Litterman and Iben, 1991). Likewise, if the bond' s duration shortens, e.g. because of an interest rate level and credit spreads of zero coupon bonds, there still might be a relation between the former and the credit spread on coupon bonds.

5) Other factors: Of course, the spread between a risky and a riskless bond is not only due to credit risk if also other characteristics of the two bonds differ. Callability or other option features may be important to take into account. In efficient markets the value of these options is embedded in the bond' s price and thus in the credit spread. The results in Duffee (1998) clearly indicate that the callability feature can dramatically change spread behaviour. He finds that spreads are negatively related to

changes in risk – free rates. He finds that spreads are negatively related to changes in risk – free rates. However, the relationship is stronger for callable bonds as the call feature' s value is obviously related to interest rate level. If rates increase, the calls move further to the out – of – the – money range. This implies that prices of callable risky bonds do not drop as much as those of non – callable bonds, therefore lowering the credit spread stronger for callable bonds.

Also differences in liquidity may be important. To the extent that the riskless reference bond is more liquid than the risky bond, the spread between the two will also include a liquidity premium. When liquidity is measured as the issue' s size, many authors find a negative relation between spread and size: the larger the size, the larger the issue's liquidity, the lower the required yield and therefore the spread. Boardman and McEnally (1981) find a negative relation between size and yield for Baa or better – rated US corporate bonds. Also for highly levered transaction loans do Angbazo, Mei and Saunders (1998) find a negative relationship between size and their spread. This corroborated by Shulman, Bayless and Price (1993) who report a significantly negative relation between several spread and liquidity proxies for individual high – yield bonds.

Common factors

1) Liquidity effects: Of course, besides the liquidity of a specific issue market – wide 'liquidity events" may also impact credit spreads. Cornell (1992) e.g. reports large abnormal returns on low – grade bonds due to changes in liquidity in the junk bond market. First, the bonds experienced positive abnormal returns (resulting in higher prices and hence in lower spreads) when Drexel Burnham Lambert exponentially increased the issuance of low – grade bonds, and then abnormal negative returns (higher spreads) when the market collapsed after Drexel' s default in 1989. This is confirmed by Patel, Evans and Burnett (1998) and the same observation is made by Arak and Corcoran (1996) related to yield spreads on privately placed issues: investment grade issues had lower spreads than expected in late 1989 and early 1990, whereas sub – investment issues yielded less than expected according to economic conditions.

2) Term structure of interest rates: There are strong theoretical arguments to assume that there is a relation between credit spreads and the risk – free interest rate level. First, under the simplifying assumptions that investors are risk – neutral and the recovery rate given default is constant and known, there exist a purely mathematical relation between the two. Consider for simplicity a one period risky bond and assume that the recovery rate given default is zero.[4] If EDF denotes the expected default frequency (or the probability of default), market equilibrium implies

$$(1 + i) = (1 - EDF) * (1 + YTM) + EDF * 0,$$

where i is the risk – free one period rate and YTM the promised yield on the risky debt. This relation implies the following for the credit spread sp:

$$sp \equiv YTM - i = (1+i) * EDF/(1-EDF).$$

As long as EDF is a proper constant probability residing between 0 and 1, a positive relation exists between the risk – free rate i and the spread sp.

3) Business cycle: According to finance textbooks, credit spreads behave cyclically over time (e.g., Van Horne, 1998). During periods of economic downturn credit spreads are expected to increase, as investors are more concerned with safety. On the other hand, during periods of economic expansion, investors are likely to seek the highest – yielding investments, implying reduced risk premia. Liquidity and marketability aspects might have an additional effect on the cyclical nature of credit spreads: to the extent that investors want to hold more liquid instruments in periods of recession, the spread will increase. Moreover, business conditions are also likely to impact default risk: as debt – service becomes more difficult in periods of economic downturn, the required risk premium may increase.

Arak and Corcoran (1996) find some empirical corroboration of the anticipated credit spread behaviour. They study yield spreads on privately placed issues, both

[4] This analysis can be generalized to a multiperiod coupon bond, with similar qualitative conclusions, see Hurley and Johnson (1996). They also include a non – zero recovery rate.

investment – grated (a – rated) and sub – investment rated (Ba – rated) issues. They find that credit spreads are negatively correlated to economic activity as well as to the direction of change: when economic activity is high or expanding credit spreads tend to decrease.

Annaert and Ceuster also tried to investigate the relation between the risk – free term structure and credit spreads. This is an important aspect for credit risk management, as many pricing models require independence between credit risk and interest rates.

To study the relationship between credit spreads and the term structure, they follow the approach in Duffee (1998): changes in the credit spread are regressed upon a constant, changes in the short – term risk free rate and changes in the slope of the term structure:

$$\Delta sp_t = c_0 + c_1 \Delta i_t + c_2 \Delta slope_t$$

The results for the changes in the slope of the term structure are also comparable to those of Duffee (1998). In Annaert and Ceuster's sample, the effect is most visible at the longer maturities. For these series the relation is significantly negative. For the shorter term bond spreads no firm statistical relation has been found.

Longstaff, Mithal and Neis found that the cost of credit protection in the credit – default swap market is significantly less than the cost implied from the corporate bond prices. The fact that there is so much time – series and cross – sectional variation in the differences between implied and market premia, however, raises the possibility of additional factors affecting the cost of credit protection, (Longstaff).

Longstaff, Mithal and Neis (2002) found clear evidence that the implied cost of credit protection is significantly higher in the corporate bond market. A potential explanation for the higher cost of credit protection implied by corporate bonds may be that there are significant tax – related and liquidity components built into the spreads of these corporate bonds. In contrast, credit – default swap premia should only depend on the actual default risk of the underlying firm. An important implication of this is that these differences may provide direct measures of the size of the tax – related and liquidity components in corporate bond yields.

Evidence also showed that both changes in credit – default swap premia and stock returns often lead changes in corporate bond yields. This confirms the widely – held view that new information tends to appear in the credit – derivatives and equity markets before it arrives in the corporate bond market.

In financial markets, the return of a financial security should reflect the security's risk, based on the well – known risk and return relationship. For fixed income securities such as notes and bonds, the level of risk should be a function of the characteristics of the issuers and the issues, the level of volatility of interest rates, and the liquidity of the issues. The above relationships should be true in both primary and secondary markets. From both the investors' and issuers' perspective, it is important to understand how the determinants of bond risk are reflected in bond yields.

In the line of research that stems from Merton (1974), structural models of corporate bond yields view corporate liabilities as contingent claims on the value of the underlying firm. Various contingent claims models differ in the modeling of financial distress and/ or bankruptcy. For example, Merton (1974) models financial distress as an exogenously fixed absorbing barrier. Others have taken the approach of modeling an endogenous bankruptcy point. Anderson and Sundaresan (1996) adopt a game – theoretic model of bankruptcy, whereas Mella – Barral and Perraudin (1997) model liquidation as an option. Leland (1994), on the other hand, assumes that bankruptcy is triggered when the market price of equity reaches zero. Regardless of the assumptions of the bankruptcy barrier, these structural models propose that the value of perpetual coupon debt is a function of the coupon rate, risk – free interest rate, principal, probability of default, the recovery rate, cost of bankruptcy, and the default barrier. Subsequently, these models suggest that firm leverage and asset volatility are important factors related to default risk and are determinants of the yields on corporate bonds.

There are several potential candidates for these additional factors affecting the spread between corporate and Treasury yields. One important feature that could drive a wedge between the yields on corporate and Treasury bonds is that interest on

Treasury bonds is exempt from State and local income taxes, while interest on corporate bonds is not. In a recent paper, Elton, Gruber, Agrawal, and Mann (2001) argue that the difference in taxation between corporates and Treasuries might explain a significant portion of the yield spread. Since credit – default swaps are purely contractual in nature; the premium should reflect only the actual risk of default on the underlying bonds. Thus, if the spread between corporates and Treasuries includes a tax – related component in addition to the default – related component, then this portion of the spread should not incorporated into the credit – default swap premium. Of course, the size of any tax – related component in corporate spreads will depend on the marginal state and local tax rate of the marginal investor in the corporate bond market. The recent trend towards greater participation in the corporate bonds markets by pension, retirement, and other tax-exempt investors, however, raises the possibility that the marginal state and local tax rate could be very small or even zero. Note that any tax – related component in yield spreads would be linked to bond – specific features such as the coupon rate of the corporate bond.

Another possible candidate is the difference in the liquidity of corporate and Treasury bonds. If corporate bonds are less liquid than Treasury bonds and priced accordingly, then corporate bond spreads could also include a liquidity component. This implies that the yield spread on a corporate bond could be an upward biased measure of the actual risk of default for the firm. Thus, the liquidity of the corporate bonds should not affect the cost of credit protection in the credit – default swap market.[5] This means that if corporate bond yields include a liquidity component, then credit – default swap premia should be less than the premia implied from corporate bond prices.

There are two ways in which a liquidity component in corporate yield spreads could arise. If Treasury bonds trade at a premium because of their unique role in financial markets as highly – liquid havens during turbulent periods, then corporate spreads will contain a common Treasury liquidity component. On the other hand, if an individual corporate bond trades at a discount relative to other similar corporate bonds because of its illiquidity, then the spread on this bond will include an idiosyncratic

[5] Empirical studies documenting the presence of liquidity – related premia in Treasury bond prices include Amihud and Mendelson (1991), Kamara (1994), and Longstaff (2003).

liquidity component. Although both have the effect of increasing corporate yield spreads, it is important to observe that the two sources of the liquidity component have different empirical implications. In particular, if this component of the spread is due to Treasury liquidity or specialness, then this component should affect all corporate spreads equally. In this case, changes in Treasury liquidity could explain time variation in corporate spreads, and therefore, in the difference between implied and market credit spreads. Clearly, however, this common liquidity component could not account for the cross – sectional differences across firms. In contrast, if the liquidity component is due to the idiosyncratic illiquidity of individual bonds, it may then explain variation in average pricing differences across firms.

The empirical results provided by Longstaff, Mithal and Neis provide evidence that the pervasive differences between implied and market credit – default swap premia may be due the liquidity component of corporate bond yield spreads. It is important, however, to consider whether there might be alternative explanations for these results. Longstaff, Mithal and Neis examine a number of possibilities.

The Swap Curve.

Many practitioner articles on credit – default swaps relate the cost of credit protection to the spread between corporate yields and swap rates. Typically, the credit – default swap premium is related to the spread on a specific type of contract known as an asset swap, and the difference between the premium and the asset swap spread is referred to as the basis.[6]

This practitioner perspective is consistent with theory provided that the market views the swap curve as riskless. In other words, if the swap spread (the spread between swap and Treasury rates) is entirely an artifact of the large premium that market participants are willing to pay for Treasury bonds because of their high

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[6] Some practitioners use an "asset swap arbitrage" example to argue that the premium should equal the spread of a corporate over the swap curve. Besides not actually being an arbitrage, this example has several conceptual problems. Foremost among these is that it violates the Modigliani – Miller Theorem that the value of an asset should be independent of how it is financed. Also, the argument implies negative premia for high – credit – quality firms with yields below swap rates. Finally, the argument does not consider that a portfolio consisting of a corporate bond and credit protection should finance close government or agency repo rates.

liquidity. If the swap curve were to be used in calculating the implied cost of credit protection, the resulting implied cost would be lower by the swap spread and might match market credit – default swap premia more closely. Note, of course, that this would reduce all of the implied premia by about the same amount. Thus, this approach is unlikely to account for the cross – sectional variation in the differences between implied and market premia.

Counterparty Credit Risk.

Another possible explanation for why market credit – default swap premia are lower than those implied from corporate bonds is that the firm selling credit protection might enter financial distress itself and be unable to meet its contractual obligations. If there is a risk that the protection seller may not perform, the value of the promised protection is obviously not worth as mush to the buyer, and the premium the buyer would be willing to pay would be correspondingly less. Thus, counterparty credit risk could potentially explain the uniformly positive sign of the average differences.

The Cost of Shorting Corporate Bonds.

Another factor that could affect the pricing of credit protection is that protection sellers who hedge their risk by shorting the underlying corporate bonds incur shorting costs. In equilibrium, these costs may be passed along to protection buyers and be reflected in credit – default swap premia. It is important to observe, however, that the effect of this would be to increase the credit – default swap premium (see Duffie (1999)).

King and Khang (2002) collected pricing information on all publically offered bonds with a remaining maturity of two or more years from January 1985 to March 1998. They excluded bonds with nonstandard features such as call and put options, mortgages, floating rates, extensions, step – ups or step – downs, zero coupon, annual adjusting rates, etc.

To investigate the cross – sectional relation between bond yield spreads and issuer characteristics, King and Khang first examine the sample of bonds across rating categories at the end of each quarter during the sample period. Thy include several issuer characteristics including firm leverage, free cash flow, stock return volatility, return on equity, and the fixed assets over total assets ratio. Their results suggest that firm leverage has a strong and positive effect on yield spreads. The parameter estimate on the debt ratio is positive and significant in all sample groups. Stock return volatility is an important determinant of yield spreads in all samples except for utility bonds. Bond betas to equity market risk factors are not major determinants of yield spreads cross – sectionally. The fixed assets to total assets ratio is negatively and significantly related to yield spreads for financial bonds, but positively and significantly related to yield spreads for industrial bonds.

In sum King and Khang' s results suggest that debt ratio and stock return volatility are significant factors in explaining the cross – sectional variation of yield spreads, while free cash flow does not have a significant impact on yield spreads. Furthermore, the effects of debt ratio and stock volatility are larger and highly significant with the A – rated and BBB – rated bond sample, but smaller and insignificant in the AA – rated bond sample. This is consistent with AA – rated bonds having lower default risk to begin with, so the cross sectional variation in default risk is likely to be small. In other words, the AA – rated issues seem to be more homogeneous with respect to default risk. Regardless, the relation between issuer characteristics and yield spreads differs by rating category. Furthermore, sensitivities to equity market factors provide little additional explanatory power beyond the issuer and issue characteristics. Finally, yields on bonds within the same rating category reflect the differences in default risk as measured by firm leverage and equity return volatility.

Blanco, Brennan, and Marsh (2004) tested the validity of a theoretical arbitrage relationship equating credit default swap prices to credit spreads for a sample of 33 US and European investment – grade firms for which high – quality time series data are available. The existence of a reliable relationship between the bond and CDS markets is important if participants are to use the latter for hedging purposes. Blanco, Brennan, and Marsh (2004) find that this parity relationship holds on average over time for most companies, suggesting that the bond and CDS markets price credit risk equally. However, they also note two forms of deviation from parity. First, for three European firms, they find that CDS prices are substantially higher than credit spreads for long periods of time. They attribute these cases to combinations of imperfections in the contract specification of CDSs and measurement errors in computing the credit spread. Second, they find short – lived deviations from parity for all the other companies in the sample. They showed that these are due to clear lead for CDS prices over credit spreads in the price discovery process.

Default events for CDS might include some or all the following:

i. Bankruptcy
ii. Failure to pay
iii. Obligation default or acceleration
iv. Repudiation or moratorium (for sovereign entities)
v. Restructuring

The first four are not particularly contentious, although the evolving ISDA documentation has dropped events iii and iv in some jurisdictions since they have been deemed subsumed by events i and ii for non – sovereign credits. Restructuring has been and remains a source of controversy in the CDS market. The 1999 ISDA documentation defines restructuring to constitute a default event if either the interest rate or principal paid at maturity are reduced or delayed, if an obligation' s ranking in payment priority is lowered or if there is a change in currency or composition of any payment (excluding adoption of the euro by a member state of the European Union). The key problem is that not all deliverable assets necessarily become due and payable should restructuring occur and it is conceivable that some deliverable obligations will be cheaper than others. This is likely to be particularly acute where deliverable assets include very long – dated or convertible bonds that often trade at a discount to shorter – dated straight bonds. This means that where there is a non – negligible probability of a restructuring that falls short of making all debt due and payable and where some obligations trade at a substantial discount to others, then a physically – settled CDS price also contains a cheapest – to – delivery (CTD) and is not a pure measure of credit risk. European CDS traded on the basis of this definition throughout our data sample. US CDS have been subject to a Modified Restructuring definition since 11

May 2001 that, among other aspects, restricts the scope of deliverable assets and specifically prevents the delivery of very long – dated bonds. This reduces the value of the delivery option in US default swaps.

There is a large a large and growing literature on the pricing of credit risk, within which two approaches dominate. Structural models are based on the value of the firm and are usually derived from Merton (1974). In this class of models default occurs when the process describing the value of the firm hits a given boundary. Black and Cox (1976), Geske (1977) and Longstaff and Schwartz (1995) are three of many important references. Bas (1995) and Pierides (1997) apply structural models to the pricing of credit derivatives. The second approach, usually termed reduced – form or intensity – biased models, instead assume that the timing of default is specified in terms of a hazard rate. Leading reduced – form frameworks would include Jarrow and Turnbull (1995), Jarrow, Lando and Turnbull (1997) and Duffie and Singleton (1999). Das and Sundaram (1998), Duffie (1999), Houweling and Vorst (2002) and Hull and White (2000) apply reduced – form models to credit derivatives. Both structural and reduced – form approaches are very comprehensively surveyed by Lando (1997) and Schonbucher (2000).

Longstaff, Mithal and Neis found that for almost all firms in their sample, the cost of credit protection in the credit – default swap market is significantly less than the cost implied by the firm's bonds. There are several possible interpretations off this finding. Foremost among these is the possibility that corporate spreads may include credit, tax – related, and liquidity components. In pricing credit derivatives however, only the credit component of the corporate spread is relevant. Thus, the difference between the model and market values for the credit – default swap premium may represent the tax and liquidity components of corporate spreads. It was found that corporate spreads are affected by the differential State tax treatment of corporate bonds, the general liquidity or specialness of Treasury bonds, and the illiquidity of individual corporate bonds.

Valuation of bonds and CDSs

Since the 1970s there have been extensive studies on the pricing of credit risk. In general, measures of credit risk consist of three building blocks: probability of default (PD), loss given default (LGD) and correlation between PD and LGD[7]. The credit risk models can be divided into two major groups. The so – called structural – form models, which were pioneered by the Merton (1974) framework, model explicitly the firm value process and values corporate bonds using modern option theory. In Merton's world, a firm issues two types of assets: equities and bonds. A default happens if the total asset value falls below a default boundary[8]. By contrast, reduced form models (also known as intensity – based models), represented by Jarrow and Turnbull (1995), Duffie and Singleton (1999), Madan and Unal (1999) and Hull and White (2000), typically treat default as a random stopping time with a stochastic arrival intensity. The credit risk spread is determined by risk neutral valuation under the absence of arbitrage opportunities.

[7] The relationship between PD and LGD has attracted more attention recently among practitioners and bank regulators, particularly when they consider the time dimension of credit risk exposures. See Altman et al (2002) for an extensive discussion on this issue. In addition, for portfolio credit risk measurement, the default correlation is also an important factor that should be taken into account (see Lowe (2002)).

[8] There are five major ingredients in structural models: the risk –free interest rate process; firm value dynamics; the firm's leverage ratio; the default boundary; and the recovery ratio. At the early stage, structural models have often been based on some simplified assumption. For example, the risk – free rate is constant over time; the firm's leverage ratio is constant; a firms defaults if only and only if the asset value falls below the face value of its debt; and the recovery rate is constant. More recently, much effort has been devoted to relaxing some of these assumptions. Such extensions include the stochastic risk – free interest rate process proposed by Longstaff and Schwartz (1995); endogenously determined default boundaries by Anderson et al (1996), Leland and Toft (1996); and the mean – reverting leverage ratio process in Collin- Dufresne and Goldstein (2001).

Reduced – form representation provides a convenient framework to connect bond spreads with CDS premia. Using the risk – neutral default probability and no – arbitrage conditions, it is straightforward to establish the equivalence relationship between the two spreads.

No – arbitrage conditions suggest that this CDS can be replicated synthetically by shorting a par fixed coupon bond on the same reference entity with the same maturity date, and investing the proceeds in a par – fixed coupon risk –free note. Hence, the CDS premium should be equal to the credit spread of the par fixed coupon bond. The logic is as follows.

Define q(t) as the risk neutral default probability for the underlying asset at time t, and accordingly, $Q(t) = 1 - \int_0^t q(s)ds$ as the risk neutral survival probability until time t. A CDS buyer pays a regular CDS premium (ρ) at time t_1, t_2, ...t_N unless a default occurs, and similarly, a bondholder gets a regular coupon payment (c) at the same frequency. Based on these assumptions, the valuation of the CDS can be derived using the risk neutral valuation principle. In particular, the CDS premium satisfies the following condition: $\sum_{i=1}^{N} e^{-rt} Q(t_i)\rho = \int_0^N e^{-rt}(100 - M)q(t)dt$ **(1)** where r is the constant risk – free rate. The left hand – side of equation **(1)** represents the present value of premium payment in the risk neutral world. The protection buyer pays the prespecified premium rate so long as the credit event does not arise. The right hand of equation (1) is the present value of protection payment the buyer can receive if the credit event occurs. In equilibrium, the two values should be equalized to ensure that no arbitrage opportunity exists.

Using the same risk neutral valuation method, the current price of the defaultable bond (a par fixed coupon bond) can be derived as follows.

$$P = 100 = \sum_{i=1}^{N} e^{-rt_i} Q(t_i)c + e^{-rt_N} * 100q(t_N) + \int_0^N e^{-rt} Mq(t)dt \quad \textbf{(2)}$$

The valuation of defaultable bond consists of three parts: the value of coupon payments, the value of the principal repayment at maturity given that no default has occurred, and the market value of the bond if defaults.

Now assume that an investor shorts the defaultable bond and purchases a par fixed rate (with a coupon rate of r) risk – free note. Since the risk – free rate is constant, the risk – free note can always be sold at par whenever the risky bond defaults. As the initial net investment is zero, the no – arbitrage condition requires that

$$0 = -\sum_{i=1}^{N} e^{-rt_i} Q(t_i)c - e^{-rt_N} 100 * Q(t_N) - \int_0^N e^{-rt} M_t q(t)dt + \sum_{i=1}^{N} e^{-rt_i} r * Q(t_i) + \int_0^N e^{-rt} * 100q(t)dt + e^{-rt_N} * 100 * Q(t_N)$$

$$\Rightarrow \sum_{i=1}^{N} e^{-rt_i} Q(t_i)(c - r) = \int_0^N e^{-rt}(100 - M_t)q(t)dt$$

(3)

In the above equation, the first three items on the right – hand side represent the value of cash flows from shorting the risky bond and the last three items represent the value of cash flows from purchasing the par risk – free note. Comparing this equation with the pricing formula of credit default swaps, it is straightforward that the following condition holds:

$\rho = c - r$ **(4)**

That is, CDS spreads should be approximately equal to the credit spreads (yields minus risk – free rates) of the underlying bonds. If ρ is greater than $c - r$, an investor can sell the CDS in the derivatives market, buy a risk – free bond and short the corporate bond in the cash market, and make arbitrage profits. If ρ is less than $c - r$, a reverse strategy can generate arbitrage returns.

Equation **(4)** provides a cornerstone for the empirical analyses. However, this equivalence relationship may not hold exactly in practice for several reasons. Economists usually make simplified assumptions, implying that the above relationship is at best an approximation. For example, we have assumed that the risk – free interest rate is constant. In reality, it moves randomly. Further more, Duffie and Liu (2001) suggest that the equivalence relationship holds for par floating notes rather than for par fixed loans. In practice, due to data availability, most researchers use fixed coupon notes that are not priced at par. All these factors point to the deviation from the above equivalence relationship and therefore bond spreads may not equal CDS premia exactly.

Moreover, some institutional factors may also cause CDS premia to differ from bond spreads. First, the protection buyer usually needs to pay the accrued premium when a default occurs. Therefore the CDS premium tends to be lower after taking account of this accrued premium payment. Second, a CDS contract can usually be settled either by cash or by delivery of physical assets. When the latter method is chosen, the protection buyer can choose to deliver any valid assets from a large prespecified pool. The existence of delivery options implies that CDS premia would be higher. Third, the definition of credit events is a very controversial topic, yet it could play a significant role in determining the premium rate of a CDS contract. In the standardized definition of credit derivatives issued by ISDA (International Swap and Derivatives Association) in 1999, restructuring was included as one of the six major credit events. However, protection buyers and sellers often have an opposite understanding regarding whether a particular event should be included in this category. Such confusion makes it hard to predict the true value of a CDS contract. Fourth, CDSs are unfounded, contrary to the funding restriction in the cash market. This difference could cause the two spreads to react differently to changes in the underlying credit risk, generating price discrepancies between the two markets in the short run. Fifth, short – sale of bonds is practically not allowed. Therefore traders are not able to gain from the price differentials when the CDS premium is higher than the bond spread. The asymmetry in the ability to take on arbitrage opportunities may have important implications for the dynamic adjustment of credit spreads. Sixth, the existence of transaction costs will allow for the existence of small arbitrage opportunities between the two markets. Finally, the two spreads may include information other than credit risk, such as liquidity premia. The influence of these additional factors could be very different in the two markets.

Haibin Zhu (2004) has found that the credit risk tends to be priced equally in the two markets (derivatives market and cash market) in the long run. In other words, no arbitrage opportunity exists in the long run. Market participants seem to use swap rates rather than treasury rates as the proxy for risk – free rates. In the short run there is strong evidence of market inefficiency in that the two markets exhibit substantial price discrepancies. This is to a large extent due to their different responses to changes in the credit quality of reference entities. Overall, the derivatives market seems to lead the cash market in anticipating rating events and in price adjustment. The relative importance of the two markets in price discovery can vary substantially across entities. The existence of the delivery option in CDS contracts and the short – sale restriction in the cash market only has minor impacts on credit risk pricing.

The analysis confirms the theoretical prediction that the two prices should be on average equal to each other. However in the short run there are quite significant pricing discrepancies between the two markets. Zhu (2004) showed that the pricing discrepancies could be largely due to their different responses to changes in credit conditions and that the derivatives market tends to move ahead of the bond market.

Valuing the CDS Basis

The arbitrage relationship provides a fundamental linkage between default swap premiums and asset – swapped par bonds. However, the yields on the two instruments frequently do not correspond to what this arbitrage relationship tells us. The difference between the asset swap spread and the CDS premium is known as the CDS basis. If the CDS premium is higher than the asset swap yield, the basis is said to be **positive**. If the CDS is tighter the basis is **negative**.

CDS BASIS = CDS PREMIUM – ASSET SWAP SPREAD

An asset swap is a transaction that transforms the cash flow of a bond through the application of one or more swaps. For example, bond coupons can be swapped from fixed into floating rate or vice versa, interest and principal can be swapped into a different currency, or the yield from a security can be swapped to a cash flow based on an index in another asset class.

A fixed – floating asset swap is an over – the – counter package product consisting of two simultaneous trades:

- The asset swap buyer purchases a fixed – rate bond from the asset swap seller (usually a bank who has put the structure together).
- The asset swap buyer enters into an off – market interest rate swap with the asset swap seller. In the swap, the bond's coupons form the fixed leg payment, in return for receiving LIBOR plus (or minus) an agreed fixed spread on the floating leg. The maturity of the swap is the same as the maturity of the asset.

This structure enables investors to gain exposure to a bond's credit risk with minimal interest rate risk. Creating synthetic floating – rate assets may be desirable if higher yields are available than on the straight floating – rate debt of an issuer, or if the required maturity exposure is not available in floating – rate form. Banks, hedge funds and securities companies, which fund on a floating –rate basis, are natural buyers of such products.

As a result, if there is an active asset swap market, bond prices can never become too cheap relative to similar floating – rate issues. As a result, asset swaps tend to create a natural floor to bond prices and help reduce the price volatility of bonds. While there are many variations of asset swap structure – forward starting, cross-currency, callable, and others – there are two types of fixed – floating structure that the market uses, both of which can give different asset swap spreads.

The most frequently used is the "par in – par out" structure. Under a par structure, the asset swap buyer effectively buys the package from the asset swap seller at par, regardless of the cash price of the bond, and the notional amount of the swap is equal to the face value of the underlying bond.

Tax and accounting reasons may make it advantageous to buy and sell non – par assets at par through such an asset swap structure. If the bond is trading below par, the asset swap seller can be thought of as effectively having an upfront "profit". If the bond is trading above par, the asset – swap seller effectively has an upfront "loss".

At initiation, the PV of all the cash flows must be zero. As such, the asset swap spread satisfies the following equation (from the perspective of the asset swap seller):

$$0 = 100 - P + \sum_{i=1}^{M} C * d_i - \sum_{I=1}^{M} (L_I + A) * d_i * a_i$$

If P<100, seller has upfront "profit"
If P>100, seller has upfront "loss"

Fixed payments on IR swap

Floating payments on IR swap

P is the cash price of the bond,

A is the Par – ASW spread,

d_i is the ith discount factor (derived from swap market),

L_i is the ith LIBOR rate set at time t_{i-1} and paid at time t_i,

C is the bond's coupon,

α_i is the accrual factor in the appropriate day count basis.

Thus any upfront profit or loss will impact the spread that the asset swap buyer receives. If the bond is trading at 85c, for example, the remaining 15c can be thought of as "subsidizing" the floating rate spread over the life of the asset swap. As the swap progresses towards maturity, this deposit will decrease, and other things being equal, the bond's market price will accrete towards par.

Paying par to buy an asset swap on a discount bond results in the asset swap buyer having an immediate exposure to the asset swap seller equal to par minus the bond price (the opposite is true for a premium bond). Hence, under this structure, counterparty risk is greatest at initiation and falls to zero at maturity.

One of the disadvantages of asset swaps is that the credit performance of the underlying bond and the swap are not linked – if the bond defaults before maturity the interest rate swap component of the structure does not automatically stop. In this instance, the asset swap buyer has to continue paying the fixed leg of the swap – despite losing the ability to fund the leg with the coupon of the bond – or unwind the swap position incurring a Market-to-Market profit or loss. The asset swap buyer also loses the par redemption of the bond; receiving whatever recovery rate the bond issuer pays.

What Drives The Basis?

The yield of corporate bonds and premiums on default swaps are linked through the asset swap arbitrage relationship. In theory, the spreads should trade closely in line. In reality it is the exception rather than the norm for CDS to trade on a flat basis to the cash market. In fact, the relationship can be highly volatile and the levels can diverge greatly. The CDS basis can be negative or positive as an end result of a range of forces both structural and technical pulling the CDS in different directions.

Although the default swap and cash bond markets are essentially just different markets for credit risk, they are not necessarily used by the same participants. In fact certain flows in the protection market can lead to significant default – pricing volatility and substantial divergences in yields for the same underlying credits.

Fixed rate debt illiquid

The illiquidity of a company's fixed rate debt can have a distorting impact on the CDS basis. Illiquidity can weaken or strengthen the basis.

In the cash market, investors will typically favour large liquid benchmark bonds and demand additional spread on illiquid paper. Investors looking for exposure to credits that have illiquid debt outstanding can opt to sell protection on the credit instead. In this case, protection can be more liquid and this tends **to pull CDS spreads tighter.**

Sometimes, however, the illiquidity of an issue may not be due to its small size but due to its popularity with retail investors and its place as a core holding in domestic funds. In such cases, this debt can trade very tight even though volatile markets and the basis can be **positive.**

Convertible Bond (CB) Issuance

A typical situation where the CDS is driven wider by market flows is during and following the issuance of a convertible bond. In such circumstances CB investors may look to unlock "cheap" equity volatility by hedging credit risk – the credit derivative market typically offers the most effective means of doing this quickly in large size.

Negative Credit View

Default swaps offer a means of taking a generic credit view by either selling protection (long credit) or buying protection (short credit). This is probably most important when that view is negative, as buying protection is typically much more straightforward than arranging term borrowing of bonds for selling short. As a result, the protection buyer may be willing to pay more for protection than the bid side of the asset swap spread **driving the basis wider**.

With France Telecom, the basis widened to almost 300 in the middle of 2002 as the market worried about the company's liquidity and leverage. Interestingly as the markets started to turn more bullish on FRTEL in November 2002, this basis collapsed. In the case of Commerzbank, worries about the German banking system in September 2002 saw default swap levels blow out much more rapidly than bond spreads causing the basis to balloon wider (Merrill Lynch - Credit Derivatives Handbook).

Repo Market Optionality

An investor in a bond typically has alternative means of financing that position either as a normal on – balance sheet holding or in the repo market. The lowest cost option will typically be favoured.

Bonds can usually be funded in the repo market at or around Libor. If the bond becomes special, the investor would be able to roll over the funding at a cheaper level. However, the reverse is true if the bond is not special in the repo market, i.e. the funding could increase above Libor. However, this would be capped by the investor's own cost of funding. The cash bond investor, therefore, holds a repo market option that makes the bond more attractive than the default and would tend to **drive the basis wider.**

3. Methodology & Model Specification

The aim of the thesis is to investigate whether the CDS premium and ASW spread time series have a long – term relationship. Therefore, the model below is used:

$$basis_t = a_0 + a_1 * (CDS_t - ASW_t) + \varepsilon_t$$

Where, α_0 is the constant factor, α_1 is the independent variable coefficient, $CDS_t - ASW_t$ is the independent variable of the model and reflects the difference between the credit default swap premium (CDS) and the asset swap spreads (ASW) and ε_t depicts the residuals of the process.

All the data that refer to CDS premium, ASW spreads and the basis have been introduced to the E – views program. Unit root test implementation has been conducted to all variables of the model above. The unit root test results based on the ADF method are presented at tables 11 to 20. If a variable is not stationary at the levels, then the unit root test is conducted at the first differences. To find out whether there is a long run relationship between CDS premia and ASW spreads; Engle - Granger test should also be conducted to the residuals of the process. If the residuals are proved to be stationary at the levels then we conclude that the time series are cointegrated.

An alternative way of the basis calculation is the use of yield spreads instead of asset swap spreads. In this case, the model that can be used is: $basis_t = \alpha_0 + \alpha_1 * (CDS_t - Yieldspreads_t) + \varepsilon_{it}$.

The unit root test results, based on the above model, are presented at tables 23 to 26. Again, to find out whether there is a long – term relationship between CDS premia and yield spreads; the Engle – Granger test should also be conducted to the residuals of the process. If the residuals are proved to be stationary at the levels, then we conclude that the CDS premia and the yield spreads time series are cointegrated.

Unit root test theory

Let us assume that y_t is a first – order autoregressive process $y_t = \rho y_{t-1} + \varepsilon_t$, with $|\rho| \leq 1$, and ε_t is a white noise of variance σ^2_ε. We want to test the null hypothesis of a random walk $H_0 : (\rho = 1)$. $\hat{\rho}_T$ is a consistent estimator of ρ and gives the limit distribution of $T(1 - \hat{\rho}_T)$ under H_0

$\frac{1 - B^2(1)}{2\int_0^1 B^2(r)dr}$. Therefore, we can propose a test of asymptotic size a and with critical region $\left\{T\left(1 - \hat{\rho}_T\right)\right\} > c_a$, where c_α is determined on the basis of the limit distribution. This test was first proposed by Dickey and Fuller (1979, 1981) and the distribution of $T(1 - \hat{\rho}_T)$ has been tabulated by Fuller (1976). Thus for α = 1%, 5% and 10% the values of c_α are respectively, 13.8, 8.1, 5.7.

Another procedure is based on a Student' s t – ratio

$$\hat{t} = \frac{1 - \hat{\rho}_T}{\left(\hat{\sigma}^2_\varepsilon \Big/ \sum_{t=1}^{T} y^2_{t-1}\right)^{1/2}} = \frac{T\left(1 - \hat{\rho}_T\right)\left(\sum_{t=1}^{T} \left(y_{t-1}^2 / T^2\right)\right)^{1/2}}{\hat{\sigma}_\varepsilon}$$

With $\hat{\sigma}^2_\varepsilon = \frac{1}{T}\sum_{t=1}^{T}(y_t - y_{t-1})^2$, or $\frac{1}{T}\sum_{t=1}^{T}(y_t - \hat{\rho}_T y_{t-1})^2$ which under H_0 converges to σ^2. This statistic $\hat{t}$ is the opposite of the usual Student statistic to test the significance of the parameter a in the model $\Delta y_t = \alpha y_{t-1}$ with $\Delta y_t = y_t - y_{t-1}$.

This other way of computing $\hat{t}$ is interesting because it is done automatically in the regression programs of Δy_t on y_{t-1}.

Engle and Granger (1987) have derived an estimation procedure in two steps for the coefficients of an error correction representation. Let us assume, for example, that y_t satisfies not only $(1-L)y_t = HL\tilde{\varepsilon}_t$ where ε indicates an n – dimensional white noise (and $\tilde{\varepsilon}_t = \varepsilon_t$ if $t \geq 0$ and $\tilde{\varepsilon}_t = 0$ if $t<0$), but also an autoregressive relationship $\Phi(L)y_t = \tilde{\varepsilon}_t$ and that the subspace of the cointegrating vectors is of order 1. The corresponding error correction model can be written as $D\alpha' y_{t-1} + \tilde{\tilde{\Phi}}(L)\Delta y_t = \tilde{\varepsilon}_t$, with $\tilde{\tilde{\Phi}}(0) = \mathrm{I}$ and $\alpha' = (-1, \alpha_2, \ldots, \alpha_n)$. One equation of such a system can be written as $\Delta y_{1t} = (1-\phi_{11}(L))\Delta y1t - \ldots - \phi_{1n}(L)\Delta y_{nt} - D_1\alpha' y_{t-1} + \tilde{\varepsilon}_{1t}$, where $\phi_{1i}(L)$, I = 1,..., n are the elements of the first row of $\tilde{\tilde{\Phi}}(L)$ and D$_1$ is the first element of the vector **D**.

The first step of the Engle and Granger procedure consists of estimating a by minimizing $\sum_{t=1}^{T}(\alpha' y_t)^2$ that is, regressing by ordinary least squares $y_{1t}, \ldots, y_{nt}$. This regression is called a *cointegrating regression*.

The second step consists of replacing in $\Delta y_{1t} = (1-\phi_{11}(L))\Delta y1t - \ldots - \phi_{1n}(L)\Delta y_{nt} - D_1\alpha' y_{t-1} + \tilde{\varepsilon}_{1t}$ a with the estimator $\hat{\alpha}_{\mathrm{T}}$ obtained in the first step, in order to estimate the parameters in $\phi_{11}(L), \ldots, \phi_{1n}(L)$ and D$_1$ by OLS (Gourieroux, C, and Monfort, A., Cambridge University, 1997).

4. Data

The sample consists of 51 issues from two to forty four years to maturity. The issuers were chosen from the European market and they refer to the banking, industrial, utility and retailing sectors of economy. More specifically, the issuers who are included in the sample are: ABN –AMRO, Barclays, BNP – Paribas, Carrefour, Commerzbank, Daimlerchrysler, Deutsche Telecome, Electric de France, Fiat and France Telecome. The sample period is chosen as from 15 May 2003 to 25 August 2005. Both credit default swap premia and asset swap spreads are denominated in euro. Each issuer is involved in the asset swap and credit default swap markets. Both the JP Morgan and the Bloomberg database provide the data. The CDS premia time series are downloaded from the Bloomberg database. At each particular date, the average quote is found as the middle point of bid and ask. Then, the time remaining to the maturity of each bond is calculated. The fact that the CDS time series that are downloaded do not reflect exactly the maturity of the issues (e.g. CDs spreads might refer to 3, 5, 10 years to maturity whereas the bond maturity might refer to 6 years) makes difficult the basis calculation. Therefore, the interpolation method is used in order to match the credit default premia and asset swap spreads time series. According to the available data, the daily observations for the credit default swap spreads and asset swap spreads time series, range from 259 to 595 for each issuer.

The first aim is to find the basis, which is the difference between credit default swap spreads and asset swap spreads. CDS spreads need to be matched with ASW spreads. The interpolated CDS spreads are calculated based on the time remaining to the bonds' maturities. So, the basis can be defined as the difference between the interpolated CDS and the ASW spreads. In order to facilitate the analysis I have plotted each basis diagram that refers to each of maturity separately. The descriptive statistics are presented using the E – views program (tables 1 to 10) for all the bond issues as well.

Secondly, in order to investigate whether the ASW spreads and CDS spreads have a long – term relationship, all the gathered data have been introduced into the E –

views program and the Augmented Dickey – Fuller (ADF) method is implemented for each CDS premium, ASW spreads and the basis time series. Finally, the Engle – Granger method is developed on the residuals of each process. The same econometric method is followed if yield spreads are introduced into the model instead of asset swap spreads. Yield spreads are downloaded from the JP Morgan database and they refer to the period from 15 May 2003 to 25 August 2005. Again, E – views program is used for the ADF and the Engle – Granger methods implementation.

5. Results

1) Descriptive statistics results

The descriptive statistics of the interpolated CDS premia and ASW spreads of the bond issues for every issuer have been summarized in tables 1 to 10. The means of the interpolated CDS premia reflect discrepancies among the issues with short time to maturity and longer maturities. Table 7, for example, shows the differences between short maturities and longer maturities issues for Deutsche Telekom CDS premia. There is a rise of 9% between 11 – July – 2011 and 29 – May – 2012 issues but the rise in the CDS premia is even greater (54,2%) between 29 – May – 2012 and 29 – March – 2018 by 6 times. The rise is even greater between 29 – March – 2018 and 4 – January – 2033 issues (89,5%).

Electric de France CDS premia (table 8) rise from 27,6% to 116,30% among all the maturities. The rise of CDS premia for France Telecome (table 10) is 305%, for Commerzbank the rise is 74,81% approximately, for Carrefour (table 4), the rise is 30,82%. For BNP – Paribas CDS premia rise ranges from 9,70% to 396,70% (table 3). Barclays' CDS premia rise reaches 31,80% approximately (table 2), for the ABN – AMRO the rise is 52% (table 1) and for Daimlerchrysler (table 6) the CDS premia rise is 38,24%.

It can be concluded that the CDS premia become higher as the time to maturity approaches. But this is not actually a norm. As it is observed the reverse can also occurs. Table 9 shows that the CDS premia for FIAT have decreased from 442,63 bp to 419,15 bp (-5,30%). In general, the CDS premia rise as the time to maturity approaches. An explanation could be the existence of default risk that leads to higher premia. The deviations among the issuers may be attributed to liquidity effects. Less liquid bonds may compensate the holder with higher premia. More liquid bonds are related to lower premia observed for shorter maturities.

The asset swap spreads seem to be much more volatile among the maturities. The basis seems to behave in accordance with the credit default swap premia patterns rather than with the asset swap spreads patterns. For example, ABN – AMRO (table 1) basis spreads increase as the interpolated CDS premia become higher and decrease as the interpolated CDS premia become narrower. On the other hand, the impact of the asset swap spreads seems to be less influential on the basis pattern behaviour. This finding is relatively valid since there are cases where the asset swap spreads increase by a greater rate than interpolated CDS premia and therefore the basis decreases. This is obvious for BNP – Paribas (table 3); the asset swap spreads rise by a rate of 143,60% among the 08 – October – 2011 and 23 – October – 2011 maturities whereas the interpolated CDS premia decrease by 3,79%. The impact of these changes is reflected on the basis spread that changes by 79,20%. It is obvious that the change in asset swap spreads is offset by the change in credit default swap premia. The differences in the behaviour between CDS premia and ASW spreads among the issuers may be attributed to the cash market characteristics or to the firms' characteristics e.g. Commerzbank was subject to several restructure schemes that might lead to the default risk increase and this might be an explanation of the uneven behaviour of the basis among different maturities. Other factors that might have an impact on the basis may be bond liquidity and tax premium (Elton, Gruber, Agrwal and Mann 2001, Longstaff, Mithal and Neis, 2002).

CDS premia may depict the liquidity effects on the bond issues. Longer maturity bonds compensate investors with higher returns. In that sense, the issues that have been included in the sample provide low or high returns according to their liquidity. If the bond liquidity is high, then the returns will be low and that affects on the CDS premia. The sample consists of several bond maturities that provide different returns and consequently they result in diverse CDS premia. Consequently, higher liquidity bonds that might be connected to shorter maturities offer low returns and, therefore, the CDS premia are low as well. On the other hand lower liquidity bonds that might be connected to longer maturities offer high returns and, therefore, the CDS premia are high as well.

The impact of credit default swap premia on the basis has been depicted with charts 1 to 102. All the basis patterns follow the same path with credit default swap pattern for the same issuers. It is clear that if credit default swap premia are higher than asset swap spreads the basis is positive. The basis turns out to be negative if the opposite occurs. A negative basis means that the CDS market has valuated the specific issuers' credit risk with lower price than the cash market that is represented by the ASW. But this is a temporary trend. The two markets tend to equal each other in the long run theoretically, and every imbalance between them is eliminated. So, only temporarily an investor may exploit the discrepancies between the two markets to reach some profit.

Barclays, BNP –Paribas, Daimlerchrysler, Electric de France and Fiat show an even behaviour among their bond issues as far as the CDS and ASW markets are concerned (charts 15 - 18, 27 - 34, 59 - 60, 77 - 80, 83 - 84). In some cases, the basis patterns are not common for different maturities. Observing the ABN – AMRO, Carrefour, Commerzbank, Deutsche Telekom and France Telecome basis patterns, we may conclude this. By observing the diagrams, it's clear that credit default swap premia keep pace with asset swaps as the time to maturity approaches. The two markets seem to converge in the long run for some cases (charts 21 and 29, charts 37 – 40, carts 61 and 64, chart 81, 85 and 90). Implementing the cointegration analysis based on the ADF methodology these results can also be derived.

2) Unit root testing results

The ADF test requires the examination of unit root existence for a time series. If a variable has not unit root then the time series is stationary. Unit root existence leads to the conclusion that the time series is not stationary and therefore the process should be implemented to its first differences. Tables 11 to 20 exhibit the ADF test results. The first column shows the variables that consist of the time series of credit default swap premia, asset swap spreads and the basis spreads and their first differences for every maturity and every issuer separately. The second column shows the number of lags that refer to each variable. ADF test was conducted for lags 1 to 10 through the E – views program. The variable selection was based on the Schwarz criterion (the higher Schwarz price was chosen). The ADF test was implemented for constant and constant with trend separately, as it can be clear by observing the tables. The results of ADF test are presented in separate columns. The first differences of the time series are denoted with the letter 'd' (e.g. 'dasw $_{(25.Apr.2007)}$' denotes the first difference of the asset swap spread time series with maturity 25 – April – 2007). Tables 11 to 20 show the results from the ADF test. It's clear that few of the variables are statistically significant at level 5% or 10%.

3) Engle – Granger testing results

In order to investigate whether two time series are cointegrated, Engle - Granger test is developed on the residuals. The equation that is used is:

$CDS_t = c\ (1) + c\ (2)\ * ASW_t + e_i$, where CDS_t is the credit default premia time series, ASW is the asset swap spread time series, c (1) is a constant, c (2) is ASW_t coefficient and e_i depicts the residuals of the process. Again the Schwarz criterion is used to select the higher price for lags 1 to 10.

As it is concluded from the Engle - Granger test implementation, residuals are stationary for BNP –Paribas (bond maturities 08 – July – 2011, 16 – January – 2013 and 05 – October – 2049). Residuals are also stationary for Carrefour (bond maturities 26 – May – 2010 and 15 – June – 2011), for Deutschetelekom (bond maturities 07 – October – 2009 and 29 – May – 2012), for Fiat (bond maturity 24 – February – 2010) and finally for France Telecome (28 – September – 2007, 23 – December – 2009 and 28 – January – 2033).

The results of the Engle –Granger test on the residuals have shown that only eleven out of fifty – one time series of credit default swap premia and asset swap spreads are cointegrated (tables 21 and 22) and consequently, an investor cannot use the discrepancies between the two markets (derivative market and cash market) to speculate in the long run.

4) Alternative calculation of the basis

An alternative way of calculating the basis is the use of yield spreads instead of asset swap spreads. The yield spread can be defined as the difference between the yield to maturity on a corporate bond and the swap rate. Different swap rates need to be interpolated in order to be matched with the yield to maturity. The basis term is calculated as the difference between the interpolated CDS premia and the yield spread. The equation can be now written as:

$$basis_t = \alpha_0 + \alpha_1 * (CDS_t - YieldSpread_t) + \varepsilon_t$$

The same process is followed again by implementing the unit root test (ADF) and the Engle – Granger test on the residuals to investigate whether CDS premia and the yield spread time series are cointegrated.

This method is implemented on the ABN Amro, Barclays, Daimlerchrysler, and Electric de France issues. The basis has been plotted for each issue (chart 103 – 116). All the diagrams show that the basis, as the difference between interpolated CDS premia and the yield spreads follow an even pattern. On the contrary, all the diagrams that show the basis as the difference between the interpolated CDS premia and the asset swap spreads are much more volatile. The difference in the basis behaviour calculated with the two methods might be attributed to the discrepancies between the asset swap spreads and the yield spreads.

As noted by the Credit Suisse, the asset swap spread adds sensitivity to the basis calculation. On the other hand, yields on bonds within the same rating category reflect the differences in default risk as measured by firm leverage and equity return volatility (King and Khang, July 2002). Asset swap spread seems to be volatile instead of the yield spread that appears to be mean reverting and reflects the default risk in a much better way. Moreover the asset swap spreads are affected by the bond's price and in that sense it's not an appropriate credit index to issuer.

The ADF test is implemented as described before for the above issuers. The results derived from the test are described in tables 23 to 26. The variables consist of the CDS premia, yield spreads, the basis and their differences. The ADF test has shown that most of the variables are stationary in their first differences with the exception of Barclays yield spreads and basis time series that are stationary in their second differences.

In order to investigate the behaviour of CDS premia and yield spreads in the long run, Engle – Granger test is implemented as it was shown in the previous section. The equation that is used can now be written as: $CDS_t = c\,(1) + c\,(2) * Yield\ spread_t + e_t$. More specifically, the residuals are proved to be stationary for all the issuers except from Barclays (table 27) probably due to the fact that yield spreads are too low which restricts the basis. This outcome leads us to the conclusion that the CDS premia and yield spread time series are cointegrated, which means that an investor cannot use the discrepancies between the two markets to speculate.

5) Implications

It has been shown that there might be differences in CDS and ASW spreads behaviour among the issuers. These differences might be attributed to the cash market characteristics or to the firms' characteristics. As it is concluded by implementing the Augmented Dickey – Fuller and the Engle – Granger methods for the selected sample, only eleven out of fifty – one time series of credit default swap premia and asset swap spreads are cointegrated. So, there is strong evidence that investors might speculate exploiting the differences between the two markets. Practically, this is not an easy task due to the fact that many factors affect the CDS premia and ASW spreads (e.g. liquidity and default risk that have a different impact on a sample of issues). More over, as it has been said in efficient markets, any mispricing between the markets would be arbitraged away by market makers (Merrill Lynch, Credit Derivative Handbook, 2003).

6. Conclusion

This study examines whether there is a long – run relationship between the credit default swap premium and asset swap spread time series based on 4946 daily observations. The sample period is chosen as from 15 May 2003 to 25 August 2005. The first aim is to find the basis and then ADF and Engle – Granger methods are implemented to find out whether the time series are cointegrated.

Descriptive statistics show that in many cases CDS premia become higher as the time to maturity approaches. An explanation could be the existence of default risk that leads to higher premia. On the other hand, the asset swap spreads seem to be much more volatile among the maturities and the basis seem to behave in accordance with the credit default premia.

If CDS premia is higher than ASW spreads the basis is positive. A negative basis means that the CDS market has valuated the specific issuers' credit risk with lower price than the cash market.

Using the ASW spreads in the basis calculation has proved to lead to insufficient results about the long – run relationship between the CDS premia and the ASW spreads. Therefore, an alternative method of calculating the basis is the difference between CDS premia and the yield spreads. The yield spread is simply the difference between the yield to maturity on a corporate bond and the swap rate.

The difference in the basis behaviour calculated with the two methods might be attributed to the discrepancies between the asset swap spreads and the yield spreads. The same econometric methodology is implemented for both ways of the basis computation.

The outcome of the two models leads us to the conclusion that the CDS premia and asset swap spreads (or alternatively yield spreads) time series are cointegrated and consequently, an investor cannot use the discrepancies between the two markets (derivative market and cash market) to speculate in the long run.

Topics for further research

Yield spreads are used to investigate the basis behaviour for only four issuers. The alternative calculation of the basis as it is presented in this thesis, could be generalized for all the issuers of the sample to find out whether we can reach to the same conclusions.

Moreover, it could be useful to examine whether there is a short – term relationship between CDS premia and ASW spreads (or yield spreads). For this purpose a Vector Error Correction Model (VECM) should have been applied in the analysis.

References

Altman, E., Pesti, A. and Sironi, A., The link between default and recovery rates: effects on the procyclicality of regulatory capital ratio, Bank of International Settlements, Working papers, no 113, 2002.

Annaert, J., Ceuster, M., Modeling European Credit Spreads University of Antwerp, sponsored by Deloitte & Touche working papers, http:// fetew.rug.ac.be/fineco/jana.html, Sept. 1999.

Blanco, R., Bernnan, S., and Marsh, I., An empirical analysis of the dynamic relationship between investment – grade bonds and credit default swaps Bank of England working papers, March, 2004.

Chordia, T., Roll, R. and Subrahmanyan, A., Market liquidity and trading activity, Journal of Finance 56, 501 – 530, 2001.

Collin – Dufresne, Pierre Robert S. Goldstein and J. Spencer Martin, 2001, The determinants of credit spread changes, Journal of Finance 56, 2177 – 2207.

Collin – Dufresne, Pierre and Robert S. Goldstein, Do credit spreads reflect stationary leverage ratios?, Journal of Finance, vol. 56, pp 1929 – 57, 2001.

Credit Suisse First Boston, Credit Derivatives Handbook – Credit Default Swap Products and Evaluation, Credit Suisse, 20 May 2005.

Das, S. R., 1995, Credit Derivatives, Journal of Derivatives vol.2, 7 – 23.

Das, S. R. and Sundaram, R.K., 1998, A direct approach to arbitrage – free pricing of credit derivatives, NBER Working Paper No. 6635.

Duffee, G., The relation between Treasury yields and corporate bond yield spreads, 1998, Journal of Finance vol.54, p.2225 - 2241.

Duffie, Darrell, 1999, Credit swap valuation, Financial Analysts Journal 55, 73 – 87.

Duffie, Darrell, and Ken Singleton, 1999, Modeling term structures of defaultable bonds, Review of Financial Studies 12, 687 – 720.

Elton, E., Gruber, M. et, Explaining the rate spread on corporate bonds, Journal of Finance vol.56, p.247 - 277, Feb. 2001.

Elton, Edwin J. and Clifton, T., Tax and liquidity effects in pricing government bonds, Journal of Finance vol.53, 1533 - 1562, 1998.

Ericssson, J. and Renault, O., Liquidity and credit risk, working paper, Mc Gill University and Univerisitè Catholique de Louvain, 2001.

Fleming, M. J., Measuring Treasury market liquidity, Working papers, Federal Reserve of New York, 2001, http:// www.ny.frb.org/rmanghome.

Gourieroux, C., Monfort, A., Time series and Dynamic Models, Cambridge University Press, Cambridge, 1997.

Green, C. and Odegard, A., Tax effects in relative pricing of US government bonds, Journal of Finance vol.52, 609 - 633, 1997.

Hoong, G. and Warga, a., An empirical study of bond market transactions, Financial Analysis Journal, 56, 32 – 46, 2000.

Houweling, P., Mentink, A., Vorst, T., How to measure corporate bond liquidity? , University of Rotterdam working papers, Febr.2003.

J.P. Morgan, 2000, The J.P. Morgan Guide to Credit Derivatives.

Jarrow, Robert A., and Stuart Turnbull, 1995, Pricing derivatives on financial securities subject to credit risk, Journal of Finance 50, 53 – 86.

King, T., Khang, K., On the cross – sectional and time series relation between firm characteristics and corporate bond yield spreads, working paper, University of Wisconsin – Milwaukee, July, 2002.

Lando, David, 1997, Modelling bonds and derivatives with default risk, Mathematics of Derivative Securities (Cambridge University Press, Cambridge).

Longstaff, F., Mithal, S., Neis, E., The Credit Default Swap Market: is credit protection priced correctly?, August 2003, unpublished working paper.

Merrill Lynch, Credit Derivative Handbook, 16 April 2003.

Mills C. Terence, The econometric modeling of Financial Time Series, second edition, Cambridge University Press – UK, 2003.

Pierides, Y. A., 1997, The pricing of credit risk derivatives, Journal of Economic dynamics and Control 21, 1579 – 1611.

Sarig, O. and Warga, A. D., Bond price data and bond market liquidity, Journal of Financial and Quantitative Analysis, 24, 367, 1989.

Zhu Haibini, An empirical comparison of credit spreads between the bond market and the credit default swap market, Bank of International Settlements, 2004.

TABLE 1

ABN AMRO

	25-Apr-2007Par M-M Asset Swap	12-May-2009 Par M-M Asset Swap	24-Jun-2009 Par M-M Asset Swap	08-Sep-2009 Par M-M Asset Swap	28-Jun-2010 Par M-M Asset Swap
Mean	138,7159	29,0732	12,1306	11,4384	33,9246
Median	139,7400	29,3300	13,9700	11,8900	32,2600
Maximum	188,6300	52,0800	26,7600	26,5500	68,8800
Minimum	79,6300	8,5700	0.870000	-0.070000	13,6800
Std. Dev.	27,0439	10,0997	5,4559	6,1224	12,0491
Skewness	-0.144231	0.098609	-0.377961	-0.036202	0.442348
Kurtosis	1,8824	2,5134	2,4661	2,0124	2,6108
Jarque-Bera	27,2563	5,6408	17,5213	20,0612	19,1120
Probability	0.000001	0.059582	0.000157	0.000044	0.000071
Observations	491,0000	491,0000	491,0000	491,0000	491,0000
	interpolated cds	**interpolated cds**	**interpolated cds**	**interpolated cds**	**interpolated cds**
Mean	10,3180	15,3671	15,6653	16,1928	15,6931
Median	11,0300	16,1400	16,4400	16,9700	16,4800
Maximum	23,8300	32,1300	32,6000	33,4500	32,6500
Minimum	3,6500	7,0200	7,2300	7,6100	7,2500
Std. Dev.	4,1704	5,4095	5,4722	5,5835	5,4780
Skewness	0.512271	0.416049	0.417988	0.421992	0.418392
Kurtosis	3,4662	3,1750	3,1731	3,1728	3,1736
Jarque-Bera	26,5547	15,1528	15,2748	15,5544	15,3068
Probability	0.000002	0.000512	0.000482	0.000419	0.000474
Observations	491,0000	491,0000	491,0000	491,0000	491,0000
	basis	**basis**	**basis**	**basis**	**basis**
Mean	-128,3986	-13,6978	3,5434	4,7636	-18,2228
Median	-128,7600	-13,0100	3,3100	4,8800	-15,7600
Maximum	-68,3900	-1,3700	11,4600	13,8300	-6,0500
Minimum	-178,5400	-26,6900	-1,7800	-3,4400	-43,2700
Std. Dev.	29,3372	5,3601	2,0378	2,4674	7,1241
Skewness	0.118048	-0.163004	0.729748	0.110246	-0.484758
Kurtosis	1,8457	3,1322	4,2336	2,7741	2,4478
Jarque-Bera	28,3998	2,5320	74,7099	2,0389	25,4685
Probability	0.000001	0.281952	0.000000	0.360791	0.000003
Observations	491,0000	491,0000	491,0000	491,0000	491,0000

TABLE 2

Barclays

	5-Dec-2010 Par M-M Asset Swap	08-Mar-2011 Par M-M Asset Swap	08-Jul-2011 Par M-M Asset Swap	31-Mar-2013Par M-M Asset Swap
Mean	55,5680	25,3434	26,6284	27,0942
Median	51,6500	25,2400	27,1200	26,9800
Maximum	103,8300	42,7500	52,9300	43,8300
Minimum	25,4100	9,5000	9,8500	11,4800
Std. Dev.	18,4366	7,2702	9,8796	6,9250
Skewness	0.554588	0.093217	0.160887	-0.028304
Kurtosis	2,4096	2,6015	2,2318	2,6886
Jarque-Bera	36,3784	4,4603	15,9847	2,3075
Probability	0.000000	0.107515	0.000338	0.315454
Observations	553,0000	553,0000	553,0000	553,0000
	interpolated cds	**interpolated cds**	**interpolated cds**	**interpolated cds**
Mean	14,7802	15,2463	15,9306	19,4766
Median	14,1950	14,5800	15,2250	18,8150
Maximum	27,9300	28,7600	29,9800	36,3000
Minimum	9,0800	9,4200	9,7700	11,1200
Std. Dev.	4,4839	4,5808	4,7273	5,5388
Skewness	1,1931	1,2078	1,2250	1,2532
Kurtosis	3,9559	3,9981	4,0482	4,1427
Jarque-Bera	155,2764	160,5394	166,8768	178,3102
Probability	0.000000	0.000000	0.000000	0.000000
Observations	553,0000	553,0000	553,0000	553,0000
	basis	**basis**	**basis**	**basis**
Mean	-40,7634	-10,0712	-10,6696	-7,5777
Median	-37,6100	-10,6100	-12,6500	-7,5000
Maximum	-15,3000	0.840000	3,8600	2,9700
Minimum	-78,4600	-21,0100	-27,2900	-16,9000
Std. Dev.	14,7310	3,9649	6,8616	3,7155
Skewness	-0.462500	0.451843	0.244851	0.248748
Kurtosis	2,2590	3,4732	2,3054	3,2216
Jarque-Bera	32,3663	23,9773	16,6418	6,8348
Probability	0.000000	0.000006	0.000243	0.032798
Observations	553,0000	553,0000	553,0000	553,0000

TABLE 3

BNP Paribas

	07-Aug-2008 Par M-M Asset Swap	23-Jan-2009 Par M-M Asset Swap	08-Jul-2011 Par M-M Asset Swap	23-Oct-2011 Par M-M Asset Swap	24-Jan-2012 Par M-M Asset Swap	17-Dec-2012 Par M-M Asset Swap	16-Jan-2013 Par M-M Asset Swap	05-Oct-2049 Par M-M Asset Swap
Mean	22,6162	24,5260	27,7064	67,5750	67,3571	32,7090	92,0807	198,4410
Median	24,2700	22,1700	27,9700	61,6600	63,7500	31,7300	69,3000	185,4600
Maximum	58,2300	48,0600	52,9300	129,4300	126,0000	71,3500	221,7700	287,5500
Minimum	-17,7100	8,7200	9,8500	28,5800	32,4200	7,8600	34,8800	148,9800
Std. Dev.	15,1540	9,4038	10,4252	23,7244	21,2731	13,6570	51,8150	38,9140
Skewness	-0.658663	0.506888	0.091046	0.766802	0.842254	0.690420	1,3812	0.762448
Kurtosis	3,5100	2,2770	2,0338	2,9017	3,0674	2,9621	3,6169	2,3079
Jarque-Bera	49,4706	38,4399	23,9672	58,5483	70,4606	47,3064	198,6210	69,5243
Probability	0.000000	0.000000	0.000006	0.000000	0.000000	0.000000	0.000000	0.000000
Observations	595,0000	595,0000	595,0000	595,0000	595,0000	595,0000	595,0000	595,0000
	interpolated cds	**interpolated cds**	**interpolated cds**	**interpolated cds**	**interpolated cds**	**interpolated cds**	**interpolated cds**	**interpolated cds**
Mean	10,8389	11,8810	17,4069	18,0663	18,6400	20,6630	20,8480	103,5563
Median	10,5900	11,5200	16,4800	17,0450	17,5450	19,3600	19,5350	97,8900
Maximum	23,9100	25,5700	34,3400	35,3800	36,2900	39,5000	39,8000	173,1200
Minimum	5,3100	6,1800	10,2800	10,6600	10,9900	12,1600	12,2600	54,7900
Std. Dev.	4,0407	4,2656	5,5212	5,6763	5,8118	6,2937	6,3380	27,2549
Skewness	0.839483	0.833805	0.830110	0.831063	0.831855	0.835021	0.835511	0.882300
Kurtosis	3,0647	2,9865	2,7870	2,7775	2,7705	2,7532	2,7525	2,8766
Jarque-Bera	71,5190	70,4547	70,9764	7,1241	7,1456	7,2199	7,2290	79,2688
Probability	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Observations	595,0000	595,0000	595,0000	595,0000	595,0000	595,0000	595,0000	595,0000
	basis	**basis**	**basis**	**basis**	**basis**	**basis**	**basis**	**basis**
Mean	-11,7908	-12,6569	-10,3035	-49,5119	-48,7193	-12,0455	-71,2318	-94,7655
Median	-13,5200	-11,1800	-11,8000	-44,4100	-45,3900	-7,6900	-48,2800	-73,6000
Maximum	26,1000	-2,1300	1,8700	-16,8100	-20,8700	7,2100	-21,7900	-1,6200
Minimum	-35,3200	-26,7200	-25,9000	-9,7230	-91,8300	-53,5600	-204,3800	-203,0300
Std. Dev.	12,3414	5,7028	5,9712	18,5125	15,9298	13,5427	52,0198	54,0401
Skewness	1,1661	-0.557780	0.305404	-0.742480	-0.843101	-1,5994	-1,6235	-0.487935
Kurtosis	4,8042	2,5899	2,4236	2,9884	3,1919	4,3163	4,1236	1,8621
Jarque-Bera	215,5511	35,0216	17,4853	54,6716	71,4029	296,6310	292,6923	55,7081
Probability	0.000000	0.000000	0.000160	0.000000	0.000000	0.000000	0.000000	0.000000
Observations	595,0000	595,0000	595,0000	595,0000	595,0000	595,0000	595,0000	595,0000

TABLE 4

CARREFOUR

	18-Mar-2009 Par M-M Asset Swap	26-May-2010 Par M-M Asset Swap	15-Jun-2011 Par M-M Asset Swap
Mean	17,8985	20,3522	27,6501
Median	20,2600	19,7700	27,8400
Maximum	25,5700	31,0500	40,3900
Minimum	6,5200	14,6200	18,4500
Std. Dev.	5,6161	3,4026	3,2246
Skewness	-0.533715	0.208877	-0.172751
Kurtosis	1,9456	2,1187	3,7742
Jarque-Bera	24,2939	10,2654	7,7572
Probability	0.000005	0.005901	0.020680
Observations	259,0000	259,0000	259,0000
	interpolated cds	**interpolated cds**	**interpolated cds**
Mean	22,4548	26,4017	29,3769
Median	21,5800	26,1600	29,1300
Maximum	31,5500	35,0100	37,5800
Minimum	14,5300	19,4300	22,0900
Std. Dev.	4,8047	3,9568	3,4364
Skewness	0.152601	0.091992	-0.019166
Kurtosis	1,6066	1,9563	2,4580
Jarque-Bera	22,6354	12,4953	3,2844
Probability	0.000012	0.001935	0.193556
Observations	259,0000	259,0000	259,0000
	basis	**basis**	**basis**
Mean	4,5809	6,0663	1,7381
Median	4,8900	6,3300	1,8500
Maximum	14,1700	15,2800	9,7800
Minimum	-1,7200	-5,2200	-6,6000
Std. Dev.	3,2151	4,4012	2,6830
Skewness	-0.071077	-0.102163	0.257322
Kurtosis	2,5191	2,4461	3,5595
Jarque-Bera	2,7143	3,7619	6,2368
Probability	0.257393	0.152445	0.044229
Observations	259,0000	259,0000	259,0000

TABLE 5

commerzbank

	20-May-2008 Par M-M Asset Swap	21-Apr-2009 Par M-M Asset Swap	25-Oct-2009 Par M-M Asset Swap	05-Nov-2009 Par M-M Asset Swap	12-Jul-2010 Par M-M Asset Swap	25-Oct-2010 Par M-M Asset Swap	02-May-2011 Par M-M Asset Swap	25-Oct-2011 Par M-M Asset Swap
Mean	19,9634	58,9748	18,1171	30,1120	66,8685	25,9453	69,8381	28,1949
Median	17,9800	49,8150	15,5400	-2,9600	58,9150	22,8700	61,0300	26,2600
Maximum	74,7400	172,5300	70,2000	203,4100	180,1300	78,1500	229,3400	88,9300
Minimum	-3,0400	19,7600	-4,9400	-24,3600	24,8800	4,4200	23,8000	6,6900
Std. Dev.	17,6945	35,7105	14,5096	59,2238	36,6772	13,5470	39,3906	14,1452
Skewness	1,5658	1,3573	1,3057	1,1816	1,3628	1,3995	1,6258	1,2932
Kurtosis	5,4361	4,1401	4,4539	2,9990	4,2306	4,6049	5,5019	4,5970
Jarque-Bera	379,1176	208,7698	215,5090	134,7363	215,3888	251,1447	406,0904	222,9142
Probability	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Observations	578,0000	578,0000	579,0000	579,0000	578,0000	579,0000	579,0000	579,0000
	interpolated CDS	interpolated CDS	interpolated CDS	interpolated CDS	interpolated CDS	interpolated CDS	interpolated CDS	interpolated CDS
Mean	25,6503	29,8150	32,1353	32,2718	35,3613	36,6642	39,0090	44,8364
Median	22,0350	25,7750	27,6700	27,7850	30,6000	31,9050	34,1600	37,1800
Maximum	97,6700	103,9400	109,4600	109,8200	118,1600	121,6900	128,0500	204,2200
Minimum	9,8500	12,4900	13,9400	14,0300	15,9700	16,7800	18,2500	14,4200
Std. Dev.	17,8580	18,9063	19,5037	19,5390	20,3508	20,6974	21,3287	32,6813
Skewness	1,9234	1,9376	1,9449	1,9452	1,9539	1,9572	1,9627	2,3663
Kurtosis	6,7258	6,8393	6,9103	6,9143	7,0119	7,0534	7,1277	9,7339
Jarque-Bera	705,0292	731,5116	747,8401	748,7434	771,0841	780,5664	797,6197	1665,3680
Probability	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Observations	578,0000	578,0000	578,0000	578,0000	578,0000	578,0000	578,0000	578,0000
	basis	basis	basis	basis	basis	basis	basis	basis
Mean	5,7025	-29,1453	13,8930	2,0344	-31,4941	10,5874	-30,9639	16,4108
Median	4,6050	-22,0350	12,3800	21,4100	-27,2500	8,6700	-25,5700	11,6200
Maximum	40,0700	-4,9100	62,9400	123,8800	-7,5100	66,1900	-0.870000	136,9800
Minimum	-19,9200	-96,4400	1,1700	-116,3100	-105,8400	-4,3900	-117,0000	-9,9700
Std. Dev.	8,8965	18,3768	7,5398	49,3445	17,6188	9,1210	20,8236	19,5972
Skewness	0.910106	-1,0293	3,8289	-0.629810	-1,1267	3,0494	-1,6748	3,0494
Kurtosis	5,9213	3,2964	22,5146	2,2986	3,9640	17,0310	5,9766	15,1626
Jarque-Bera	285,3244	104,1726	10601.98	50,1455	144,6609	5646,8180	484,4243	4466,1510
Probability	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Observations	578,0000	578,0000	579,0000	579,0000	578,0000	579,0000	579,0000	579,0000

TABLE 6

Daimlerchrysler

	23-Jan-2009 Par M-M Asset Swap	21-Mar-2011 Par M-M Asset Swap
Mean	50,7769	65,89
Median	44,9900	63,57
Maximum	137,1900	154,12
Minimum	25,5200	43,25
Std. Dev.	15,8517	16,11
Skewness	1,2781	1,82
Kurtosis	5,9911	7,61
Jarque-Bera	257,3647	573,16
Probability	0.000000	0.000000
Observations	399,0000	399,00
	interpolated cds	**interpolated cds**
Mean	71,3287	98,6115
Median	66,2450	94,1100
Maximum	144,2200	192,6100
Minimum	40,1100	63,1000
Std. Dev.	19,4015	21,1293
Skewness	0.624120	0.937484
Kurtosis	2,9918	4,4861
Jarque-Bera	26,4889	97,3100
Probability	0.000002	0.000000
Observations	399,0000	399,0000
	basis	**basis**
Mean	20,5337	32,7230
Median	21,7800	32,4300
Maximum	39,2800	60,5600
Minimum	-8,3100	30,7000
Std. Dev.	9,6939	11,7954
Skewness	-0.101701	0.040811
Kurtosis	2,1142	1,6806
Jarque-Bera	13,7333	29,0540
Probability	0.001042	0.000000
Observations	399,0000	399,0000

TABLE 7

Deutsche Telecom

	07-Oct-2009 Par M M Asset Swap	06-Jul-2010 Par M-M Asset Swap	11-Jul-2011 Par M-M Asset Swap	29-May-2012 Par M-M Asset Swap	29-Mar-2018 Par M-M Asset Swap	24-Jan-2033 Par M-M Asset Swap
Mean	53,6008	70,2409	82,6192	68,6633	78,2150	113,0721
Median	47,6750	70,5550	78,8300	64,5300	74,7350	111,6150
Maximum	13,7290	173,1000	171,5300	154,1100	170,3000	178,2900
Minimum	18,3200	-21,0100	28,4300	32,5100	39,2800	69,0700
Std. Dev.	27,6069	37,0774	28,1814	26,4585	22,9704	20,6506
Skewness	1,0264	0.049124	0.817424	1,0931	1,4679	0.821602
Kurtosis	3,5024	4,0406	4,1502	3,6337	5,2544	3,7300
Jarque-Bera	104,9604	25,6722	93,9011	121,7498	321,9688	75,9759
Probability	0.000000	0.000003	0.000000	0.000000	0.000000	0.000000
Observations	564,0000	564,0000	564,0000	564,0000	564,0000	564,0000
	interpolated CDS	**interpolated CDS**	**interpolated CDS**	**interpolated CDS**	**interpolated CDS**	**interpolated CDS**
Mean	54,5414	59,5780	66,3930	72,3424	111,5743	211,3123
Median	54,6600	59,8800	66,7200	72,1100	108,2600	210,0000
Maximum	136,4000	142,6800	151,1800	158,6100	207,5900	332,1000
Minimum	21,4700	25,5600	31,1100	35,9600	55,7400	39,7100
Std. Dev.	23,4935	23,2393	22,9568	22,7709	23,0146	32,9189
Skewness	1,0723	1,0714	1,0641	1,0515	0.819941	0.036555
Kurtosis	3,9620	4,0284	4,1034	4,1519	4,0327	3,8482
Jarque-Bera	132,3617	135,3516	137,6870	137,7535	89,9783	17,3667
Probability	0.000000	0.000000	0.000000	0.000000	0.000000	0.000169
Observations	564,0000	564,0000	564,0000	564,0000	564,0000	564,0000
	basis	**basis**	**basis**	**basis**	**basis**	**basis**
Mean	1,0900	-10,5090	-16,0664	3,8443	33,5590	98,5280
Median	2,0700	-11,3900	-16,0650	5,4200	33,5400	98,6650
Maximum	19,5000	57,7200	15,0700	25,4900	79,6200	216,1300
Minimum	-18,5600	-46,4000	-47,4100	-36,3200	-46,4500	-99,2000
Std. Dev.	6,8787	18,6784	10,8342	7,6738	12,5641	30,8651
Skewness	-0.322724	1,9514	0.329736	-1,0253	-0.484738	-0.469516
Kurtosis	2,7190	8,1227	3,3325	4,4687	5,6940	5,3259
Jarque-Bera	11,6460	974,6345	12,8175	149,5116	192,6429	147,8514
Probability	0.002959	0.000000	0.001647	0.000000	0.000000	0.000000
Observations	564,0000	564,0000	564,0000	564,0000	564,0000	564,0000

TABLE 8

Electric de France

	28-Jan-2009 Par M-M Asset Swap	25-Oct-2010 Par M-M Asset Swap	25-Oct-2016 Par M-M Asset Swap	21-Feb-2033 Par M-M Asset Swap
Mean	15,0390	13,4944	36,8957	50,7692
Median	17,6450	14,9550	34,8250	47,0600
Maximum	33,9100	34,8500	81,8600	90,6600
Minimum	-8,3700	-10,5200	10,5200	31,7400
Std. Dev.	9,6067	10,1340	13,3428	14,0585
Skewness	-0.417711	-0.270802	1,5064	0.633683
Kurtosis	2,7826	2,8868	5,0257	2,3635
Jarque-Bera	17,5117	7,1944	309,7442	47,2672
Probability	0.000158	0.027401	0.000000	0.000000
Observations	564,0000	564,0000	564,0000	564,0000
	interpolated cds	**interpolated cds**	**interpolated cds**	**interpolated cds**
Mean	25,9011	33,0527	57,7388	124,8936
Median	21,0500	28,9000	55,7500	120,5200
Maximum	58,9500	70,6100	110,8500	220,3000
Minimum	11,5100	18,0300	28,0900	44,6500
Std. Dev.	12,4113	13,5062	18,0401	32,6843
Skewness	0.983802	1,0409	0.966629	0.544650
Kurtosis	2,8614	2,9979	3,1283	3,1128
Jarque-Bera	93,2144	103,8419	89,9382	28,7335
Probability	0.000000	0.000000	0.000000	0.000001
Observations	564,0000	564,0000	564,0000	564,0000
	basis	**basis**	**basis**	**basis**
Mean	10,9145	19,6119	20,9011	74,1947
Median	9,2950	19,6500	22,3900	74,4250
Maximum	31,8300	41,5900	72,0200	136,2800
Minimum	-3,2000	2,6300	-36,4800	-9,6800
Std. Dev.	6,8315	7,8774	21,5877	25,0091
Skewness	0.913285	0.360124	-0.299358	-0.492847
Kurtosis	3,3566	2,9832	3,2663	4,2602
Jarque-Bera	81,3921	12,1975	10,0908	60,1504
Probability	0.000000	0.002246	0.006439	0.000000
Observations	564,0000	564,0000	564,0000	564,0000

TABLE 9

FIAT

	24-Feb-2010 Par M-M Asset Swap	25-May-2011 Par M-M Asset Swap
	335,0122	348,7717
Median	327,2050	342,1350
Maximum	594,5900	590,4300
Minimum	258,2800	275,1800
Std. Dev.	48,8270	4,8974
Skewness	2,1621	1,9152
Kurtosis	10,0667	8,6130
Jarque-Bera	1612,9710	1085,1890
Probability	0.000000	0.000000
Observations	564,0000	564,0000
	interpolated cds	**interpolated cds**
Mean	442,6307	419,1529
Median	409,5400	392,0900
Maximum	741,5100	794,9500
Minimum	276,7700	253,5400
Std. Dev.	116,3798	136,6492
Skewness	0.985975	1,0885
Kurtosis	2,9464	3,2166
Jarque-Bera	93,2331	114,6689
Probability	0.000000	0.000000
Observations	564,0000	564,0000
	basis	**basis**
Mean	108,1764	71,1019
Median	86,6200	40,8050
Maximum	390,6500	412,3400
Minimum	-33,3600	-92,7300
Std. Dev.	100,1484	125,2030
Skewness	1,1709	1,1229
Kurtosis	3,4971	3,3232
Jarque-Bera	134,6868	120,9749
Probability	0.000000	0.000000
Observations	564,0000	564,0000

TABLE 10

France Telecome

	28-Sep-2007 Par M-M Asset Swap	14-Mar-2008 Par M-M Asset Swap	26-Apr-2008 Par M-M Asset Swap	15-May-2008 Par M-M Asset Swap	01-Aug-2008 Par M-M Asset Swap	23-Dec-2009 Par M-M Asset Swap	10-Nov-2010 Par M-M Asset Swap	28-Jan-2013 Par M-M Asset Swap	28-Jan-2033 Par M-M Asset Swap
Mean	31,2103	88,4324	205,3263	-640,2786	377,1924	49,0851	53,1157	69,3573	124,7539
Median	33,6800	80,9200	266,9500	-643,7300	373,7600	52,6900	5,7250	72,5800	125,1300
Maximum	58,8000	135,2800	275,3800	-583,9300	434,5800	74,5600	87,7900	103,3700	156,7900
Minimum	6,9800	30,8000	116,7800	-684,9800	285,3600	19,3000	22,0300	33,6800	79,9500
Std. Dev.	12,6952	24,5049	74,6480	21,2595	34,2736	13,0492	14,7105	13,9876	13,8628
Skewness	-0.012263	0.453284	-0.280161	0.548946	0.021844	-0.444966	-0.152895	-0.408351	-0.886090
Kurtosis	2,1674	2,3286	1,0832	2,9402	1,7225	2,3471	2,4625	2,9905	4,3693
Jarque-Bera	10,9563	20,0963	62,9778	19,0912	25,8022	19,2393	6,0398	10,5345	79,2036
Probability	0.004177	0.000043	0.000000	0.000072	0.000002	0.000066	0.048807	0.005158	0.000000
Observations	379,0000	379,0000	379,0000	379,0000	379,0000	379,0000	379,0000	379,0000	379,0000
	interpolated cds	interpolated cds	interpolated cds	interpolated cds	interpolated cds	interpolated cds	interpolated cds	interpolated cds	interpolated cds
Mean	41,3700	47,1109	47,8002	48,0654	49,5097	55,8434	60,1100	70,8424	167,6348
Median	44,5100	51,3500	51,9100	52,1700	53,6100	60,0200	64,6200	74,8450	169,0600
Maximum	71,9700	72,0800	72,5400	72,7600	73,9600	79,2100	83,4400	95,0500	202,2700
Minimum	11,9500	16,0200	16,6200	16,9100	18,4600	25,0700	28,9300	38,1500	121,2700
Std. Dev.	15,8179	13,1648	12,8806	12,8621	12,7632	12,3538	12,1028	11,5701	14,2101
Skewness	-0.154723	-0.637925	-0.604112	-0.607103	-0.623093	-0.695530	-0.745741	-0.870976	-0.525690
Kurtosis	1,7813	2,4700	2,4290	2,4360	2,4743	2,6625	2,8078	3,2273	3,2988
Jarque-Bera	25,5599	30,8579	28,8706	28,9777	29,5752	33,1242	36,5601	49,8911	19,3138
Probability	0.000003	0.000000	0.000001	0.000001	0.000000	0.000000	0.000000	0.000000	0.000064
Observations	379,0000	379,0000	379,0000	379,0000	379,0000	379,0000	379,0000	379,0000	379,0000
	basis	basis	basis	basis	basis	basis	basis	basis	basis
Mean	10,2857	-41,1889	-157,4001	688,4701	-327,5565	6,8852	7,1217	1,6137	43,0203
Median	10,6600	-35,4900	-205,0900	688,6900	-320,2500	7,2200	8,0600	23,6000	42,2300
Maximum	20,1400	-7,2500	-5,7630	730,4800	-227,6900	24,8800	29,2100	17,5600	85,2200
Minimum	-4,2200	-78,1600	-255,8000	641,0700	-406,8200	-22,1900	-12,4300	-20,5300	-4,4600
Std. Dev.	4,4952	16,8061	77,1489	17,2523	45,1663	4,2220	6,0717	5,4385	14,5536
Skewness	-0.215575	-0.610644	0.205148	-0.132678	-0.236367	-2,2630	-0.532318	-0.581688	0.000621
Kurtosis	2,3105	2,2502	1,1937	3,0398	1,6320	18,6180	3,5890	3,6145	3,0515
Jarque-Bera	10,4420	32,4313	54,1821	1,1369	33,0834	4175,4320	23,3770	27,3365	0.041944
Probability	0.005402	0.000000	0.000000	0.566397	0.000000	0.000000	0.000008	0.000001	0.979247
Observations	379,0000	379,0000	379,0000	379,0000	379,0000	379,0000	379,0000	379,0000	379,0000

TABLE 11 ABN - AMRO					
variable	n	ADF test			
		constant	critical values	constant and trend	critical values
asw(25.Apr.2007)	10	-1,523110		-2,136523	
dasw(25.Apr.2007)	10	-5,958335*	-3,4495	-5,990382*	-3,9859
asw(12.May.2009)	7	1,614687		-2,948390	
dasw(12.May.2009)	7	-7,676241*	-3,4485	-7,648989*	-3,9846
asw(24.Jan.2009)	7	-0,881863		-1,780303	
dasw(24.Jan.2009)	7	-8,823121*	-8,8231	-8,783865*	-3,9846
asw(08.Sep.2009)	7	-0,780384		-3,911989**	-3,4224
dasw(08.Sep.2009)	4	-11,88474*	-3,4476	-11,88021*	-3,9883
asw(28.Jan.2010)	7	-1,680458		-2,747879	
dasw(28.Jan.2010)	10	-6,947126*	-3,4495	-7,018896*	-3,9859
cds(25.Apr.2007)	8	-3,238331**	-2,8677	-3,909520**	-3,4208
dcds(25.Apr.2007)	8	-6,726289*	-3,4459	-6,937263*	-3,9809
cds(12.May.2009)	4	-2,554988		-3,465316**	-3,4208
dcds(12.May.2009)	8	-6,320674*	-3,4459	-6,556449*	-3,9809
cds(24.Jun.2009)	4	-2,519401+	-2,5700	-3,46925**	-3,4208
dcds(24.Jun.2009)	8	-6,365216*	-3,4459	-6,599545*	-3,9809
cds(08.Sep.2009)	4	-2,470687		-3,483159**	-3,4208
dcds(08.Sep.2009)	4	-8,302149*	-3,4458	-8,391088*	-3,9808
cds(28.Jun.2010)	4	-2,516851		-3,470800**	-3,4208
dcds(28.Jun.2010)	8	-6,364557*	-3,4459	-6,598810*	-3,9809
basis(25.Apr.2007)	8	-1,483148		-2,261255*	-3,9846
dbasis(25.Apr.2007)	8	-6,560591*	-3,4488	-6,580037*	-3,9850
basis(12.May.2009)	8	-1,126666		-1,852714	
dbasis(12.May.2009)	3	-12,18526*	-3,4473	-12,17620*	-3,9829
basis(24.Jun.2009)	8	-0,857583		-0,868437	
dbasis(24.Jun.2009)	8	-8,485771*	-3,4488	-8,517450*	-3,9850
basis(08.Sep.2009)	8	-1,470354		-1,777547	
dbasis(08.Sep.2009)	8	-9,424246*	-9,424246	-9,443447*	-3,9850
basis(28.Jun.2010)	3	-2,344716		–4,250202*	-3,9825
dbasis(28.Jun.2010)	8	-9,916136*	-9,916136	—	

*	Statistically significant at 1%
**	Statistically significant at 5%
+	Statistically significant at 10%

TABLE 12 BARCLAYS					
variable	n	ADF test			
		constant	critical values	constant and trend	critical values
asw(05 Dec 2010)	10	-0,932755		-3,393597**	-3,9824
dasw(05 Dec 2010)	10	-6,666869*	-3,4472	-6,670631*	-3,9828
asw(08 Mar 2011)	10	-1,317275		-2,467430	
dasw(08 Mar 2011)	10	-6,688410*	-3,4472	-6,680244*	-3,9828
asw(08 Jul 2011)	10	-0,912600		-2,172577	
dasw(08 Jul 2011)	10	-8,658327*	-3,4472	-8,6491171*	-3,9828
asw(31 Mar 2013)	10	-1,426758		-2,246324	
dasw(31 Mar 2013)	10	-5,923023*	-3,4472	-5,913638*	-3,9828
cds(05 Dec 2010)	10	-2,573599+	-2,5697	-2,376989	
dcds(05 Dec 2010)	10	-6,775758*	-3,4446	-6,932829*	-3,9791
cds(08 Mar 2011)	10	-2,580395+	-2,5697	-2,370786	
dcds(08 Mar 2011)	10	-6,943518*	-3,4446	-7,098932*	-3,9791
cds(08 Jul 2011)	10	-2,590537+	-2,5697	-2,365779	
dcds(08 Jul 2011)	10	-7,181830*	-3,4446	-7,334570*	-3,9791
cds(31 Mar 2013)	10	-2,603175+	-2,5697	-2,357593	
dcds(31 Mar 2013)	10	-8,032664*	-3,4446	-8,166117*	-3,9791
basis(05 Dec 2010)	8	-1,020966		-3,141017+	-3,1331
dbasis(05 Dec 2010)	8	-8,654051*	-3,4467	-8,654465*	-8,654465
basis(08 Mar 2011)	8	-1,673700		-2,446136	
dbasis(08 Mar 2011)	8	-9,148213*	-3,4467	-9,138630*	-3,9821
basis(08 Jul 2011)	8	-1,209735		-2,572047	
dbasis(08 Jul 2011)	8	-11,98761*	-3,4467	-11,97584*	-3,9821
basis(31 Mar 2013)	10	-1,921892		-2,187703	
dbasis(31 Mar 2013)	10	-7,803449*	-3,4472	-7,808562*	-3,9828

*	Statistically significant at 1%
**	Statistically significant at 5%
+	Statistically significant at 10%

TABLE 13 BNP - PARIBAS

variable	n	ADF test			
		constant	critical values	constant and trend	critical values
asw(07 Aug 2008)	8	-2,806205		-3,528957 **	-3,4208
dasw(07 Aug 2008)	8	-8,921786*	-3,4461	-8,960552*	
asw(23 Jan 2009)	8	-1,735077		-3,288956+	-3,1328
dasw(23 Jan 2009)	8	-7,517601*	-3,4461	-7,511141*	-3,9812
asw(08 Jul 2011)	8	-0,811200		-2,848585	
dasw(08 Jul 2011)	8	-12,20044*	-3,4461	-12,18851*	-3,9812
asw(23 Oct 2011)	8	-2,266658		-2,370726	
dasw(23 Oct 2011)	8	-8,038923*	-3,4461	-8,156281*	-3,9812
asw(24 Jan 2012)	8	-2,476991		-2,659126	
dasw(24 Jan 2012)	2	-15,19466*	-3,4446	-15,33840*	-3,9791
asw(17 Dec 2012)	8	-1,566560		-1,670389	
dasw(17 Dec 2012)	8	-8,123088*	-3,4461	-8,159361*	-3,9812
asw(16 Jan 2013)	8	-0,458530		-1,079963	
dasw(16 Jan 2013)	8	-6,855837*	-3,4461	-7,075674*	-3,9812
asw(05 Oct 2049)	8	-0,141455		-1,881332	
dasw(05 Oct 2049)	10	-7,262609*	-7,262609	-7,476699*	-3,9819
cds(07 Aug 2008)	10	-2,480557		-3,431486**	-3,4194
dcds(07 Aug 2008)	6	-8,206642*	-3,4431	-8,358272*	-3,9779
cds(23 Jan 2009)	10	-2,478607		-3,424247**	-3,4194
dcds(23 Jan 2009)	6	-7,770797*	-3,4437	-7,904610*	-3,9779
cds(08 Jul 2011)	10	-2,537638		-3,234015	
dcds(08 Jul 2011)	6	-8,154051*	-3,4437	-8,251897*	-3,1320
cds(23 Oct 2011)	10	-2,531400		-3,214895+	-3,1320
dcds(23 Oct 2011)	6	-8,261627*	-3,4437	-8,355749*	-3,9779
cds(24 Jan 2012)	10	-2,526293		-3,199713+	-3,1320
dcds(24 Jan 2012)	6	-8,354849*	-3,4437	-8,445788*	-3,9779
cds(17 Dec 2012)	10	-2,509036		-3,154801+	-3,1320
dcds(17 Dec 2012)	6	-8,632055*	-3,4437	-8,713169*	-3,9779
cds(16 Jan 2013)	10	-2,507120		-3,151649+	-3,1320
dcds(16 Jan 2013)	4	-12,26170*	-3,4436	-12,31119*	-3,1319
cds(05 Oct 2049)	10	-2,472547		-2,987074	
dcds(05 Oct 2049)	6	-10,13868*	-3,4437	-10,16179*	-3,9779
basis(07 Aug 2008)	7	-2,560828		-3,241087+	-3,1327
dbasis(07 Aug 2008)	6	-10,99575*	-3,4455	-11,00082*	-3,9805
basis(23 Jan 2009)	6	-1,573875		-2,714195	
dbasis(23 Jan 2009)	6	-8,703653*	-3,4455	-8,685568*	-3,9805
basis(08 Jul 2011)	6	-1,353820		-3,484565**	-3,1326
dbasis(08 Jul 2011)	6	-12,38284*	-3,4455	-12,38424*	-3,9805
basis(23 Oct 2011)	6	-2,418254		-2,239413	
dbasis(23 Oct 2011)	6	-9,599645*	-9,599645	-9,702881*	-3,9805
basis(24 Jan 2012)	2	-2,401890		-2,259841	
dbasis(24 Jan 2012)	6	-9,494302*	-3,4455	-9,607033*	-3,9805
basis(17 Dec 2012)	6	-1,015770		-1,489074	
dbasis(17 Dec 2012)	6	-9,754491*	-3,4455	-9,771236*	-3,9805
basis(16 Jan 2013)	6	-0,184140		-1,000779	
dbasis(16 Jan 2013)	4	-9,961921*	-3,4455	-10,11705*	-3,9798
basis(05 Oct 2049)	6	-0,605479		-2,227994	
dbasis(05 Oct 2049)	6	-10,28496*	-3,4446	-10,24333*	-3,9805

*	Statistically significant at 1%
**	Statistically significant at 5%
+	Statistically significant at 10%

TABLE 14 CARREFOUR					
variable	n	ADF test			
		constant	critical values	constant and trend	critical values
asw(18.Mar.2009)	5	-0,449908		-2,330343	
dasw(18.Mar.2009)	2	-10,46231*	-3,4597	-10,47935*	-4,0002
asw(26.May.2010)	2	-1,921891		-2,057431	
dasw(26.May.2010)	2	-10,67929*	-3,4597	-10,71205*	-4,0002
asw(15.Jun.2011)	2	-2,329873		-2,441321	
dasw(15.Jun.2011)	2	-8,916612*	-3,4597	-8,825898*	-4,0002
cds(18.Mar.2009)	10	-1,726336		-2,838128	
dcds(18.Mar.2009)	10	-4,193974*	-3,4576	-4,208729*	-3,9973
cds(26.May.2010)	10	-2,357223		-3,136267	
dcds(26.May.2010)	10	-4,369177*	-3,4576	-4,382870*	-4,0002
cds(15.Jun.2011)	10	-2,992410**	-2,8729	-3,223695 +	-3,9974
dcds(15.Jun.2011)	10	-4,419787*	-3,4576	-4,456163*	-4,0002
basis(18.Mar.2009)	5	-2,111244		-2,395296	
dbasis(18.Mar.2009)	2	-11,37941*	-3,4597	-11,45503*	-4,0002
basis(26.May.2010)	2	-2,662469		-2,431926	
dbasis(26.May.2010)	2	-10,21724*	-3,4597	-10,24268*	-4,0002
basis(15.Jun.2011)	10	-3,513735*	-3,4650	-3,495940 **	-3,4337

*	Statistically significant at 1%
**	Statistically significant at 5%
+	Statistically significant at 10%

TABLE 15 - COMMERZBANK

variable	n	ADF test			
		constant	critical values	constant and trend	critical values
asw(20.May.2008)	10	-2,578253		-4,150949*	-3,9817
dasw(20.May.2008)	10	-7,231591*	-3,4467	—	
asw(21.Apr.2009)	2	-1,651065		-2,101026	
dasw(21.Apr.20090	10	-8,289121*	-3,4467	-8,472701	-3,9821
asw(25.Oct.2009)	10	-2,544080		-2,519808	
dasw(25.Oct.2009)	10	-5,654394*	-3,4446	-5,740346	-3,9819
asw(05.Nov.2009)	2	-3,787641*	-3,4446	-4,514558	-3,9792
asw(12.Jul.2010)	2	-2,114406		-2,872531	
dasw(12.Jul.2010)	10	-7,275292*	-3,4467	-7,506522	-3,9821
asw(25.Oct.2010)	2	-3,491988*	-3,4446	-4,067924	-3,9792
asw(02.May.2011)	3	-4,016647*	-3,4448	-4,091111	-3,9795
asw(25.Oct.2011)	2	-2,119760		-3,396341+	-3,1323
dasw(25.Oct.2011)	3	-19,10975*	-3,4450	-19,05294	-3,9798
cds(20.May.2008)	2	-4,051307*	-3,4439	-3,994578	-3,9782
cds(21.Apr.2009)	3	-4,087176*	-3,4439	-4,335099	-3,9782
cds(25.Oct.2009)	3	-3,975148*	-3,4439	-4,247225	-3,9782
cds(05.Nov.2009)	3	-3,968156*	-3,968156	-4,242223	-3,9782
cds(12.Jul.2010)	3	-3,826424*	-3,826424	-4,149680	-3,9782
cds(25.Oct.2010)	3	-3,774174*	-3,774174	-4,120746	-3,9782
cds(02.May.2011)	3	-3,682836*	-3,4439	-4,080810	-3,9782
cds(25.Oct.2011)	2	-5,380304*	-3,4439	-5,446403	-3,9782
basis(20.May.2008)	10	-5,7183964*	-3,4465	-5,687064	-3,9817
basis(21.Apr.2009)	2	-1,929981		-4,017878	-3,9792
dbasis(21.Apr.2009)	7	-12,46039*	-3,4460	—	
basis(25.Oct.20090	2	-7,423265*	-3,4446	-7,160702	-3,9792
basis(05.Nov.20090	2	-5,227742*	-3,4446	-5,560754	-3,9792
basis(12.Jul.2010)	2	-2,213977		-4,786440	-3,9792
dbasis(12.Jul.2010)	2	-17,51588*	-3,4449	—	
basis(25.Oct.2010)	2	-6,876486*	-6,876486	-6,850571	-3,9792
basis(02.May.2011)	7	-3,312551**	-2,8676	-5,670267	-3,9807
dbasis(02.May.2011)	2	-12,69189		—	
basis(25.Oct.2011)	10	-4,322203*	-3,4448	-3,985768	-3,9816

*	Statistically significant at 1%
**	Statistically significant at 5%
+	Statistically significant at 10%

TABLE 16 DAIMLERCHRYSLER

variable	n	ADF test			
		constant	critical values	constant and trend	critical values
asw(23.Jan.2009)	8	-2,263849		-2,290568	
dasw(23.Jan.2009)	6	-9,081881*	-3,4513	-9,068154*	-3,9886
asw(21.Mar.2011)	8	-2,656087		-2,642613	
dasw(21.Mar.2011)	6	-8,621577*	-3,4513	-8,607787*	-3,9886
cds(23.Jan.2009)	10	-2,263754		-2,488793	
dcds(23.Jan.2009)	10	-5,800429*	-3,4489	-5,785784*	-3,9852
cds(21.Mar.2011)	10	-2,379824		-2,503676	
dcds(21.Mar.2011)	10	-6,139221*	-3,4489	-6,119097*	-3,9852
basis(23.Jan.2009)	8	-1,684184		-3,061689	
dbasis(23.Jan.2009)	6	-7,997254*	-3,4513	-7,983819*	-3,9886
basis(21.Mar.2011)	10	-1,224506		-2,722165	
dbasis(21.Mar.2011)	8	-7,107524*	-3,4521	-7,095649*	-3,9896

*	Statistically significant at 1%
**	Statistically significant at 5%
+	Statistically significant at 10%

TABLE 17 DEUTSCHETELEKOM					
variable	n	ADF test			
		constant	critical values	constant and trend	critical values
asw(07.Oct.2009)	10	-3,138323**	-2,8680	-3,689924**	-3,4214
dasw(07.Oct.2009)	10	-6,149703*	-3,4469	-6,417937*	-3,9823
asw(06.Jul.2010)	10	-0,814029		-2,259021	
dasw(06.Jul.2010)	10	-7,520840*	-3,4469	-7,508968*	-3,9823
asw(11.Jul.2011)	10	-2,106798		-3,317448+	-3,1331
dasw(11.Jul.2011)	10	-7,818251*	-3,4469	-7,816316	-3,1332
asw(29.May.2012)	8	-2,437164		-3,149865+	-3,1329
dasw(29.May.2012)	8	-7,772991*	-3,4464	-7,873784*	-3,1330
asw(29.Mar.2018)	2	-3,551998*	-3,4449	-3,846616**	-3,4202
asw(24.Jan.2033)	8	-2,871957+	-2,5701	-2,531355	
dasw(24.Jan.2033)	8	-8,809425*	-3,4464	-9,012088*	-3,9816
cds(07.Oct.2009)	2	-3,058254**	-2,8669	-3,522036**	-3,4197
dcds(07.Oct.2009)	10	-7,795535*	-3,4443	-8,061328*	-3,9788
cds(06.Jul.2010)	2	-2,966933**	-2,5669	-3,583074**	-3,9785
dcds(06.Jul.2010)	10	-7,774034*	-3,4443	-7,999559*	-3,9788
cds(11.Jul.2011)	2	-2,896032**	-2,8669	-3,680326**	-3,4197
dcds(11.Jul.2011)	10	-7,818949*	-3,4443	-7,997593*	-3,9788
cds(29.May.2012)	2	-2,872508**	-2,8669	-3,7755102**	-3,4197
dcds(29.May.2012)	10	-7,880877*	-3,4443	-8,026191*	-3,9788
cds(29.Mar.2018)	2	-3,283604**	-2,8669	-4,272716*	-3,9785
dcds(29.Mar.2018)	2	-18,55480*	-3,4442	—	
cds(24.Jan.2033)	2	-4,376152*	-3,4442	-4,523681*	-3,9785
basis(07.Oct.2009)	10	-2,207233		-2,899731	
dbasis(07.Oct.2009)	10	-8,736626*	-3,4469	-8,726791*	-3,9823
basis(06.Jul.2010)	10	0,183899		-0,945463	
dbasis(06.Jul.2010)	10	-7,862680*	-3,4469	-7,947690*	-3,9823
basis(11.Jul.2011)	8	-2,197975		-2,535674	
dbasis(11.Jul.2011)	10	-7,653347*	-3,4469	-7,676708*	-3,9823
basis(29.May.2012)	10	-2,097210		-2,518504	
dbasis(29.May.2012)	10	-8,328396*	-3,4469	-8,313111*	-3,9823
basis(29.Mar.2018)	10	-2,486155		-2,373304	
dbasis(29.Mar.2018)	10	-8,120518*	-3,4469	-8,127720*	-3,9823
basis(24.Jan.2033)	10	-2,151017		-1,945810	
dbasis(24.Jan.2033)	10	-7,982635*	-3,4469	-8,022157*	-3,9823

*	Statistically significant at 1%
**	Statistically significant at 5%
+	Statistically significant at 10%

TABLE 18 ELECTRIC DE FRANCE

variable	n	ADF test			
		constant	critical values	constant and trend	critical values
asw(28 Jan 2009)	8	-1,400198		-3,544244**	-3,4228
dasw(28 Jan 2009)	8	-7,194360*	-3,4491	-7,207620*	-3,9854
asw(25 Oct 2010)	10	-2,444540		-3,923521**	-3,4232
dasw(25 Oct 2010)	10	-5,18986*	-3,4498	-5,202187*	-3,9864
asw(25 Oct 2016)	10	-2,164636		-3,229172+	-3,1342
dasw(25 Oct 2016)	10	-7,290440*	-3,4498	-7,294413*	-3,9864
asw(21 Feb 2033)	8	-1,788995		-0,304278	
dasw(21 Feb 2033)	8	-7,099406*	-3,4491	-7,365688*	-3,9854
cds(28 Jan 2009)	6	-2,819680		-1,625399	
dcds(28 Jan 2009)	6	-8,251611*	-3,4464	-8,633969*	-3,9816
cds(25 Oct 2010)	10	-2,374720		-1,559292	
dcds(25 Oct 2010)	6	-8,782574*	-3,4464	-9,125341*	-3,9816
cds(25 Oct 2016)	10	-2,217485		-1,532211	
dcds(25 Oct 2016)	10	-6,508130*	-3,4465	-6,702467*	-3,9818
cds(21 Feb 2033)	10	-2,151754		-1,604800	
dcds(21 Feb 2033)	10	-7,033472*	-3,4465	-7,178145*	-3,9818
basis(28 Jan 2009)	4	-1,789810		-1,294523	
dbasis(28 Jan 2009)	10	-6,318500*	-3,4498	-6,368834*	-3,9864
basis(25 Oct 2010)	10	-1,686279		-2,228426	
dbasis(25 Oct 2010)	10	-4,959291*	-3,4498	-4,889949*	-3,9864
basis(25 Oct 2016)	10	-1,603267		-1,619004	
dbasis(25 Oct 2016)	10	-6,703180*	-6,703180	-6,795272*	-3,9864
basis(21 Feb 2033)	10	-2,039565		-2,255473	
dbasis(21 Feb 2033)	10	-5,735218*	-5,735218	-5,726401*	-3,9864

*	**Statistically significant at 1%**
**	**Statistically significant at 5%**
+	**Statistically significant at 10%**

TABLE 19 FIAT

variable	n	ADF test			
		constant	critical values	constant and trend	critical values
asw(24.Feb.2010)	5	-2,473017		-2,646650	
dasw(24.Feb.2010)	5	-8,150974*	-3,4457	-8,189800*	-3,9807
asw(25.May.2011)	5	-1,739182		-2,382103	
dasw(25.May.2011)	5	-8,294927*	-3,4457	-8,407356*	-3,9807
cds(24.Feb.2010)	10	-2,932730		-2,789899	
dcds(24.Feb.2010)	10	-6,623905*	-3,4443	-6,714939*	-3,9807
cds(25.May.2011)	10	-3,032108		-2,750778	
dcds(25.May.2011)	10	-6,512577*	-3,4443	-6,644436*	-3,9788
basis(24.Feb.2010)	5	-3,202666		-3,343907+	-3,1327
dbasis(24.Feb.2010)	5	-9,315579*	-3,4457	-9,305625*	-3,9807
basis(25.May.2011)	5	-2,602252		-2,957921	
dbasis(25.May.2011)	5	-8,499334*	-3,4457	-8,494534*	-3,9807

*	**Statistically significant at 1%**
**	**Statistically significant at 5%**
+	**Statistically significant at 10%**

TABLE 20 FRANCE TELECOME

variable	n	ADF test			
		constant	critical values	constant and trend	critical values
asw(28.Sep.2007)	10	-2,137204		-3,567182**	-3,4260
dasw(28.Sep.2007)	10	-5,633678*	-3,4540	-5,807639*	-3,9923
asw(14.Mar.2008)	10	-1,562172		-2,498293	
dasw(14.Mar.2008)	10	-4,398396*	-3,4540	-4,375988*	-3,9923
asw(25.Apr.2008)	10	-1,644031		-1,500244	
dasw(25.Apr.2008)	10	-7,464279*	-3,4540	-7,509273*	-3,9923
asw(15.May.2008)	10	-1,089014		-1,423456	
dasw(15.May.2008)	10	-5,590543*	-3,4540	-5,547114*	-3,9923
asw(01.Aug.2008)	10	-0,992463		-2,252998	
dasw(01.Aug.2008)	10	-5,481227*	-3,4540	-5,450099*	-3,9923
asw(23.Dec.2009)	10	-1,412867		-2,461475	
dasw(23.Dec.2009)	10	-6,608398*	-3,4540	-6,603823*	-3,9923
asw(10.Nov.2010)	10	-1,688605		-2,540796	
dasw(10.Nov.2010)	10	-5,330988*	-3,4540	-5,415064*	-3,9923
asw(28.Jan.2013)	10	-2,164293		-2,898818	
dasw(28.Jan.2013)	10	-5,531807*	-3,4540	-5,605406*	-3,9923
asw(28.Jan.2033)	10	-1,978134		-2,164039	
dasw(28.Jan.2033)	10	-5,465760*	-3,4540	-5,491944*	-3,9923
cds(28.Sep.2007)	10	-1,008144		-3,003559	
dcds(28.Sep.2007)	10	-6,565446*	-3,4498	-6,565539*	-3,9864
cds(14.Mar.2008)	10	-0,371758		-2,312862	
dcds(14.Mar.2008)	10	-7,048232*	-3,4498	-7,068630*	-3,9864
cds(25.Apr.2008)	10	-0,950192		-2,616180	
dcds(25.Apr.2008)	10	-6,859106*	-3,4498	-6,849907*	-3,9864
cds(15.May.2008)	10	-0,950578		-2,612783	
dcds(15.May.2008)	10	-6,842526*	-3,4498	-6,833344*	-3,9864
cds(01.Aug.2008)	10	-0,957031		-2,599069	
dcds(01.Aug.2008)	10	-6,755617*	-3,4498	-6,746641*	-3,9864
cds(23.Dec.2009)	10	-1,002724		-2,578876	
dcds(23.Dec.2009)	10	-6,299122*	-3,4498	-6,290904*	-3,9864
cds(10.Nov.2010)	10	-1,073055		-2,605258	
dcds(10.Nov.2010)	10	-6,004657*	-3,4498	-5,996685*	-3,9864
cds(28.Jan.2013)	10	-1,287360		-2,639321	
dcds(28.Jan.2013)	10	-5,694358*	-3,4498	-5,686917*	-3,9864
cds(28.Jan.2033)	10	-2,963649**		-2,967512	
dcds(28.Jan.2033)	10	-7,319994*	-3,4498	-7,309911*	-3,9864
basis(28.Sep.2007)	10	-2,019817		-3,514269	
dbasis(28.Sep.2007)	10	-6,302321*	-3,4540	-6,339989*	-3,9923
basis(14.Mar.2008)	10	-2,512348		-2,702418	
dbasis(14.Mar.2008)	10	-4,770338*	-3,4540	-4,746171*	-3,9923
basis(25.Apr.2008)	10	-1,398826		-1,392017	
dbasis(25.Apr.2008)	10	-7,486798*	-3,4540	-7,536025*	-3,9923
basis(15.May.2008)	10	-1,320657		-1,319064	
dbasis(15.May.2008)	10	-6,071673*	-3,4540	-6,012572*	-3,9923
basis(01.Aug.2008)	10	-0,639023		-2,096344	
dbasis(01.Aug.2008)	10	-5,985272*	-3,4540	-5,955390*	-3,9923
basis(23.Dec.2009)	10	-3,269425**	-2,8712	-3,125635	
dbasis(23.Dec.2009)	10	-8,096404*	-3,4540	-8,142410*	-3,9923
basis(10.Nov.2010)	10	-2,860996+	-2,5719	-2,594252	
dbasis(10.Nov.2010)	10	-5,451891	-3,4540	-5,5845588*	-3,9923
basis(28.Jan.2013)	10	-2,992439**	-2,8712	-2,151431	
dbasis(28.Jan.2013)	10	-5,834873*	-3,4540	-6,135361*	-3,9923
basis(28.Jan.2033)	10	-2,643958		-2,868572	
dbasis(28.Jan.2033)	10	-7,560170*	-3,4540	-7,617557*	-3,9923

*	**Statistically significant at 1%**
**	**Statistically significant at 5%**
+	**Statistically significant at 10%**

TABLE 21 COINTEGRATION TESTING RESULTS (ENGLE - GRANGER TEST)

	constant	asw	$\bar{R}$	D.W.	A.D.F.(n)	n
ABN - AMRO						
cds25.Apr.2007	20,94657 (24,66035)	-0,076626 (-12,74893)	0,249465	0,025015	-2,244964	10
cds12.May.2009	0,789019 (3,103281)	0,501712 (60,72587)	0,882920	0,163066	-1,565552	7
cds24.Jun.2009	4,389880 (19,89419)	0,930216 (56,06200)	0,865362	0,283253	-0,886935	8
cds08.Sep.2009	6,682055 (31,08620)	0,832284 (50,22268)	0,837613	0,238461	-1,740887	8
cds28.Jun.2010	1,184149 (4,868652)	0,427938 (63,33526)	0,891342	0,306523	-2,517105	10
BARCLAYS						
cds05.Dec.2010	3,095131 (9,983065)	0,210724 (39,78887)	0,741818	0,107861	-2,205381	8
cds08.Mar.2011	1,278331 (3,657043)	0,552172 (41,64548)	0,758899	0,244815	-2,285550	10
cds08.Jul.2011	5,982415 (16,364620	0,374653 (29,10450)	0,605886	0,229998	-2,024059	8
cds31.Mar.2013	1,107156 (2,159994)	0,679458 (37,06807)	0,713772	0,245550	-2,072919	8
BNP PARIBAS						
cds07.Aug.2008	6,215731 (32,46479)	0,203823 (28,97406)	0,586037	0,127782	-2,269122	7
cds23.Jan.2009	1,597425 (8,555153)	0,418806 (58,90926)	0,854060	0,193419	-1,563716	8
cds08.Jul.2011	4,203496 (14,89522)	0,476401 (49,96858)	0,808082	0,461583	**-3,165255 ****	10
cds23.Oct.2011	2,911264 (11,78169)	0,224223 (64,98203)	0,876860	0,201398	-2,051329	10
cds24.Jan.2012	1,325857 (4,897010)	0,257016 (67,04879)	0,883464	0,206591	-1,991117	10
cds17.Dec.2012	16,90961 (25,99974)	0,114768 (6,254106	0,061878	0,026093	-2,114707	10
cds16.Jan.2013	20,52305 (38,64786)	0,003539 (0,703980)	0,000835	0,022725	**-2,744597+**	10
cds05.Oct.2049	146,9517 (26,53486)	-0,218081 (-7,962905)	0,096598	0,109970	**-3,011586 ****	10
CARREFOUR						
cds18.Mar.2009	9,842788 (17,12671)	0,706014 (23,04097)	0,673811	0,111844	-2,547042	2
cds26.May.2010	19,27265 (13,38236)	0,351111 (5,030496)	0,089640	0,042051	**-2,671083+**	7
cds15.Jun.2011	9,126377 (6,670251)	0,732793 (14,90885)	0,463772	0,159979	**-3,371952****	10
DAIMLERCHRYSLER						
cds23.Jan.2009	17,36212 (10,69153)	1,062461 (34,79859)	0,753101	0,143574	-1,713676	8
cds21.Mar.2011	26,56129 (10,74433)	1,093513 (30,00273)	0,693948	0,086660	-1,036763	10

TABLE 22 COINTEGRATION TESTING RESULTS (ENGLE - GRANGER TEST)

	constant	asw	$\bar{R}$	D.W.	A.D.F.(n)	n
DEUTSCHETELEKOM						
cds07.Oct.2009	9,944985	0,834798	0,952450	0,176055	**-3,248580****	10
	(20,96792)	(106,1000)				
cds06.Jul.2010	19,58583	0,57141549	0,823093	0,151775	-1,742152	10
	(22,06627)	(51,13520)				
cds11.Jul.2011	3,659461	0,761244	0,864547	0,151550	-2,444801	10
	(3,298522)	(59,89182)				
cds29.May.2012	15,38292	0,831953	0,925300	0,287320	**-2,898613****	10
	(20,96767)	(83,43488)				
cds29.Mar.2018	44,80592	0,856205	0,724692	0,377482	-2,387912	10
	(24,69270)	(38,46233)				
cds24.Jan.2033	137,3760	0,656432	0,169194	0,369345	-2,161277	10
	(19,478930	(10,69821)				
ELECTRIC DE FRANCE						
cds28.Jan.2009	1,182478	1,503950	0,777371	0,121512	-2,151641	2
	(1,653008)	(40,51094)				
cds25.Oct.2010	10,94599	14,76525	0,736555	0,151780	-2,532660	10
	(14,78550)	(36,24987)				
cds25.Oct.2016	-4,898969	2,004690	0,402479	0,119130	-2,000978	10
	(-1,336751)	(17,79280)				
cds21.Feb..2033	35,91040	1,709013	0,502581	0,165703	-2,363119	10
	(8,461701)	(21,79170)				
FIAT						
cds24.Feb.2010	19,14964	1,265742	0,279188	0,033800	**-3,056768****	4
	(0,659331)	(14,75384)				
cds25.May.2011	14,19073	1,163176	0,172088	0,019135	-2,459332	4
	(0,374401)	(10,80815)				
FRANCE TELECOME						
cds28.Sep.2007	3,500915	1,217387	0,949929	0,364157	**-3,602472***	10
	(7,219555)	(84,57115)				
cds14.Mar.2008	11,09515	0,408768	0,580394	0,077660	-1,93483	10
	(6,755120)	(22,83555)				
cds25.Apr.2008	51,86603	-0,019188	0,012374	0,020940	-0,786269	10
	(26,89408)	(-2,173379)				
cds15.May.2008	274,5994	0,353608	0,341855	0,034905	-0,883321	10
	(16,96290)	(13,99364)				
cds01.Au.2008	162,4301	-0,299036	0,645306	0,098958	-2,346740	10
	(37,56003)	(-26,18949)				
cds23.Dec.2009	12,01763	0,895439	0,895321	0,427041	**-2,640171+**	10
	(15,00625)	(56,78452)				
cds10.Nov.2010	20,24060	0,753012	0,838320	0,225551	-2,183148	8
	(21,56443)	(44,21267)				
cds28.Jan.2013	17,81514	0,766406	0,858763	0,196315	-1,677969	10
	(15,73025)	(47,87759)				
cds28.Jan.2033	107,6210	0,482175	0,217996	0,462697	**-2,790608+**	10
	(18,22934)	(10,25156)				

* Statistically significant at 1%

** Statistically significant at 5%

\+ Statistically significant at 10%

TABLE 23 ABN AMRO

variable	n	ADF test			
		constant	critical values	constant and trend	critical values
cds(12.May.2009)	10	-3,168507 **	-2,8678	-5,245681*	-3,9814
dcds(12.May.2009)	10	-7,038386	-3,4463	___________	
cds((24.Jun.2009)	10	-3,187208**	-2,8678	-5,268736*	-3,9814
dcds((24.Jun.2009)	10	-7,129580	-3,4463	___________	
cds(08.Sept 20090	10	-3,210374**	-2,8678	-5,301229*	-3,9814
dcds(08.Sept.2009)	10	-7,26044*	-3,4463	___________	
cds(28.Jun.2010)	10	-3,188177**	-2,8678	-5,271197*	-3,9814
dcds(28.Jun.2010)	10	-7,136038*	-3,4463	___________	
ys(12.May.2009)	10	-1,066959		-3,381941+	-3,1330
dys(12.May.2009)	10	-7,215656*	-3,4463	-7,216304*	-3,9814
ys(24.Jun.2009)	10	-0,561210		-2,080313	
dys(24.Jun.2009)	10	-8,499529*	-3,4463	-8,487631*	-3,9814
ys(08.Sept.2009)	10	-0,912344		-3,978289**	-3,4211
dys(08.sept.2009)	10	-8,710221*	-3,4463	-8,703542	-3,9814
ys(28.Jun.2010)	10	-1,752910		-3,583079**	-3,9814
dys(28.Jun.2010)	10	-7,019901*	-3,4463	-7,066071*	-3,9814
basis(12.May.2009)	10	-3,362307**	-2,8678	-5,153035*	-3,9814
dbasis(12.May.2009)	10	-6,368738*	-3,4463	___________	
basis(24.Jun.2009)	10	-3,343732**	-2,8678	-5,145943*	-3,9814
dbasis(24.Jun.2009)	10	-6,435314*	-3,4463	___________	
basis(08.Sept. 2009)	10	-3,345013**	-2,8678	-5,13363*	-3,9814
dbasis(08.Sept.2009)	10	-6,435974*	-3,4463	___________	
basis(28.Jun.2010)	10	-3,341534**	-2,8678	-5,111463*	-3,9814
dbasis(28.jun.2010)	10	-6,424480*	-3,4463	___________	

*	**Statistically significant at 1%**
**	**Statistically significant at 5%**
+	**Statistically significant at 10%**

TABLE 24 Barclays

variable	n	ADF test			
		constant	critical values	constant and trend	critical values
cds(05.Dec.2010)	10	-2,573599		-2,376989	
dcds(05.Dec.2010)	10	-6,775758*	-3,4446	-6,932829*	-3,9791
cds(08.Mar.2011)	10	-2,580295		-2,370786	
dcds(08.Mar.2011)	10	-6,943518*	-3,4446	-7,098932*	-3,9791
cds(08.Jul.2011)	10	-2,590537		-2,365779	
dcds(08.Jul.2011)	10	-7,181830*	-3,4446	-7,334570*	-3,9791
cds(31.Mar.2013)	10	-2,603175		-2,357593	
dcds(31.Mar.2013)	10	-8,032664*	-3,4446	-8,166117*	-3,9791
ys(05.Dec.2010)	4	-0,495076		-1,887356	
dys(05.Dec.2010)	4	-3,888502*	-3,5572	-4,019576**	-3,4952
ys(08.Mar.2011)	6	0,518076		-2,043964	
dys(08.Mar.2011)	6	-3,980101*	-3,5625	-4,270175*	-4,1458
ys(08.Jul.2011)	10	0,519909		-1,351723	
dys(08.Jul.2011)	10	-2,304073		-2,512635	
ddys(08.Jul.20110	10	-3,707791*	-3,5778	-3,642629**	-3,5088
ys(31.Mar.2013)	10	1,296314		-0,905108	
dys(31.Mar.2013)	10	-2,156812		-2,744724	
ddys(31.Mar.2013)	10	-3,735557*	-3,5778	-3,692143**	-3,5088
basis(05.Dec.2010)	10	-0,593911		-2,231075	
dbasis(05.Dec.2010)	10	-2,191891		-2,052368	
ddbasis(05.Dec.2010)	10	-3,447392**	-2,9256	-3,420542+	-3,1840
basis(08.Mar.20110	10	-0,538405		-2,204578	
dbasis(08.Mar.2011)	10	-2,159645		-2,007984	
ddbasis(08.Mar.2011)	10	-3,540503**	-2,9256	-3,526414**	-3,5088
basis(08.Jul.2011)	10	-0,511168		-2,152927	
dbasis(08.Jul.2011)	10	-2,147812		-1,988083	
ddbasis(08.Jul.2011)	10	-3,574147**	-2,9256	-3,566958**	-3,5088
basis(31.Mar.2013)	10	-0,378485		-1,994425	
dbasis(31.Mar.2013)	10	-2,078426		-1,848172	
ddbasis(31.Mar.2013)	10	-3,811793*	-3,5778	-3,843267**	-3,5088

*	**Statistically significant at 1%**
**	**Statistically significant at 5%**
+	**Statistically significant at 10%**

TABLE 25 DAIMLERCHRYSLER

variable	n	ADF test			
		constant	critical values	constant and trend	critical values
cds(23.Jan.2009)	8	-1,892135		-2,13779	
dcds(23.Jan.2009	8	-6,227624*	-2,8690	-6,218102*	-3,9851
cds(21.Mar.2011)	8	-2,050977		-2,212265	
dcds(21.Mar.2011)	8	-6,711505*	-3,4489	-6,700614*	-3,9851
ys(23.Jan.2009)	8	-1,722382		-1,843826	
dys(23.Jan.2009)	4	-5,364317*	-3,5572	-5,398904*	-4,1383
ys(21.Mar.2011)	8	-2,506128		-2,500204	
dys(21.Mar.2011)	4	-4,329791*	-3,5572	-4,268390	-4,1383
basis(23.Jan.2009)	4	-2,920851		-2,840529	
dbasis(23.Jan.2009)	4	-4,384095*	-3,5572	-4,397638	-4,1383
basis(21.Mar.2011)	4	-3,336044**	-2,9157	-3,133976*	-4,1348
dbasis(21.mar.2011)	4	-4,416437*	-3,5572		

*	**Statistically significant at 1%**
**	**Statistically significant at 5%**
+	**Statistically significant at 10%**

TABLE 26 ELECTRIC DE FRANCE					
variable	n	ADF test			
		constant	critical values	constant and trend	critical values
cds(28.Jan.2009)	10	-2,506542		-1,609085	
dcds(28.Jan.2009)	10	-5,500658*	-3,4465	-5,812039*	-3,9818
cds(25.Oct.2010)	10	-2,374720		-1,559292	
dcds(25.Oct.2010)	10	-5,765541*	-3,4465	-6,037352*	-3,9818
cds(25.Oct.2016)	10	-2,217485		-1,532211	
dcds(25.Oct.2016)	10	-6,508130*	-3,4465	-6,702467*	-3,9818
cds(21.Feb.20033)	10	-2,151754		-1,604800	
dcds(21.Feb.2033)	10	-7,033472*	-3,4465	-7,178145*	-3,9818
ys(28.Jan.2009)	8	0,545795		0,237605	
dys(28.Jan.2009)	4	-3,765180**	-2,9069	-4,238735*	-4,1059
ys(25.Oct.2010)	8	-0,692879		-0,780656	
dys(25.Oct.2010)	4	-4,102718*	-3,5345	-4,274244*	-4,1059
ys(25.Oct.2016)	8	-2,791750		-3,929468**	-3,4838
dys(25.Oct.2016)	4	-4,833622*	-3,5345	-4,851106*	-4,1059
ys(21.Feb.2033)	8	-2,001341		-2,456763	
dys(21.Feb.2033)	4	-3,187902*	-3,5345	-3,418887+	-3,1675
basis(28.Jan.2009)	8	-2,424877		-2,127649	
dbasis(28.Jan.2009)	8	-3,576192*	-3,5417	-3,804745+	-3,1703
basis(25.Oct.2010)	8	-2,618587+	-2,5919	-2,324830	
dbasis(25.Oct.2010)	4	-4,236419*	-3,5345	-3,337099+	-3,1703
basis(25.Oct.2016)	8	-2,475202		-2,421607	
dbasis(25.Oct.2016)	4	-4,399580*	-3,5345	-4,387326*	-4,1059
basis(21.Feb.2033)	8	-2,190953		-2,423602	
dbasis(21.Feb.2033)	4	-4,474451*	-3,5345	-4,439055*	-4,1059

*	Statistically significant at 1%
**	Statistically significant at 5%
+	Statistically significant at 10%

TABLE 27 COINTEGRATION TESTING RESULTS (ENGLE - GRANGER TEST)

	constant	yield spread	R^2	D.W.	ADF (n)	n
ABN AMRRO						
cds(12.May.2009)	4,131524 (-21,3666)	39,37915 (-64,5193)	0,894878	0,149519	**-5,075700***	10
cds(24.Jun.2009)	7,9829 (-52,86208)	64,40492 (-62,01402)	0,88719	0,232645	**-4,620933**	10
cds(08.Sept.2009)	9,243818 (-52,25566)	60,8808 (-49,34125)	0,832738	0,162856	**-4,103641***	10
cds(28.Jun.2010)	-1,871393 (-7,145054)	35,95374 (-70,51336)	0,910458	0,281989	**-4,203396***	10
BARCLAYS						
cds(05.Dec.2010)	23,59470 (69,78320)	-9,370519 (-5,661900)	0,359961	1,068860	-1,210548	10
cds(08.Mar.20110	19,11721 (21,883060	-11,02760 (-8,015978)	0,529920	1,541652	-1,411509	10
cds(08.Jul.2011)	21,05795 (29,51083)	-10,73648 (-8,626552)	0,566267	1,593615	-1,148069	10
cds(31.Mar.2013)	24,96115 (23,29224)	-11,47064 (-7,258702)	0,480348	1,614731	-1,443363	10
DAIMLERCHRYSLER						
cds(23.Jan.2009)	72,53712 (10,80260)	26,15480 (2,502233)	0,098973	0,277591	**-4,800895***	10
cds(21.Mar.2011)	2,655962 (0,169645)	154,0398 (6,9525170	0,458882	0,522378	**-3,952693***	10
ELECTRIC DE FRANCE						
cds(28.Jan.2009)	54,27149 (15,35216)	5,658555 (0,828234)	0,009987	0,172726	**-3,083532****	2
cds(25.Oct.2010)	66,48076 (27,83950)	20,66992 (2,323593)	0,073558	0,304498	**-2,628719+**	10
cds(25.Oct.2016)	96,02179 (8,263761)	-5,489848 (-0,143036)	0,000301	0,466429	**-2,280433***	10
cds(21.Feb.2033)	147.7336 (7,178763)	56,78988 (1,822710)	0,046581	0,558307	**-3,083532****	10

* **Statistically significant at 1%**
** **Statistically significant at 5%**
\+ **Statistically significant at 10%**

chart 1 abn-asw/cds25.04.2007

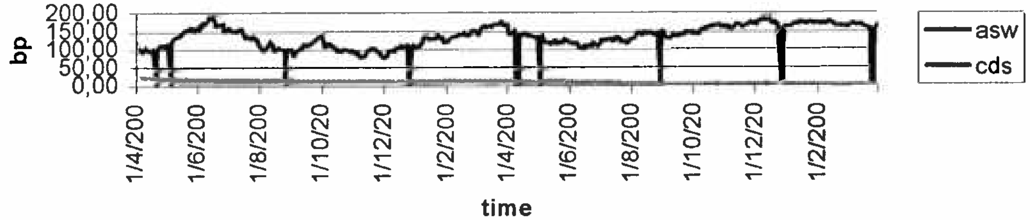


chart 2 abn-asw/cds12.05.2009

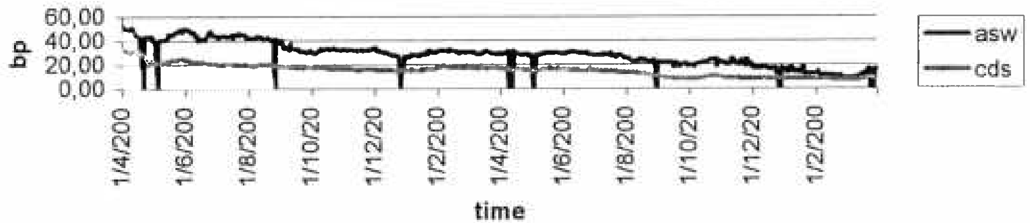


chart 3 abn-asw/cds24.06.2009

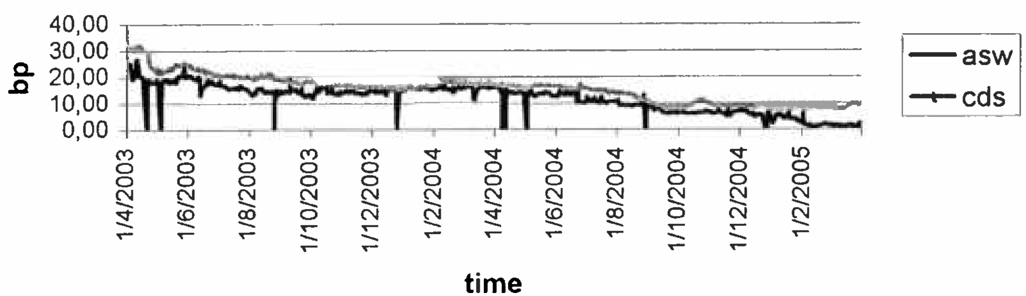


chart 6 abn-basis25.04.2007

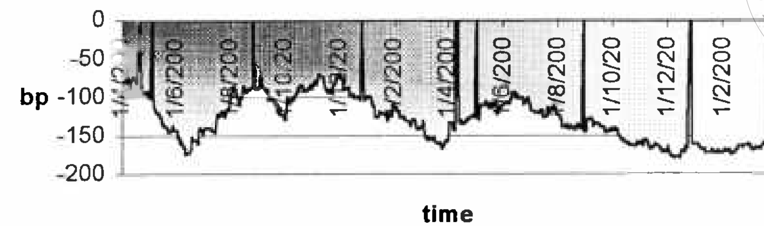


chart 7 abn-basis12.05.2009

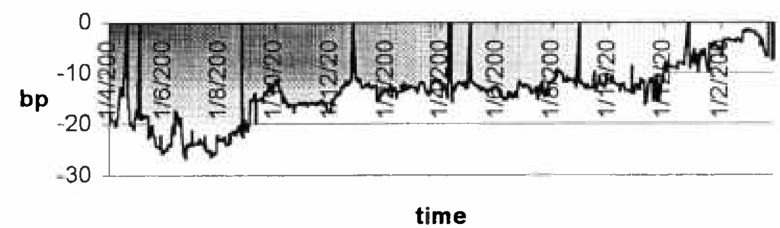


chart 8 abn-basis24.06.2009

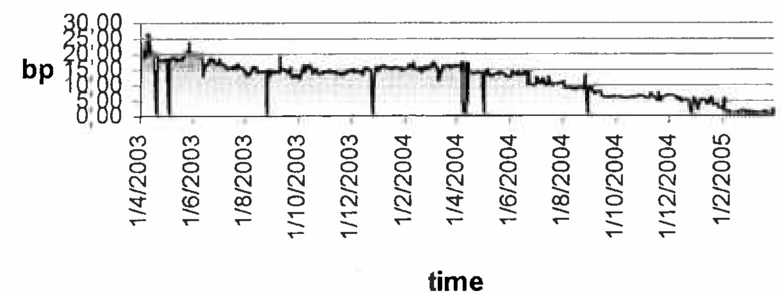


chart 4 abn-asw/cds08.09.2009

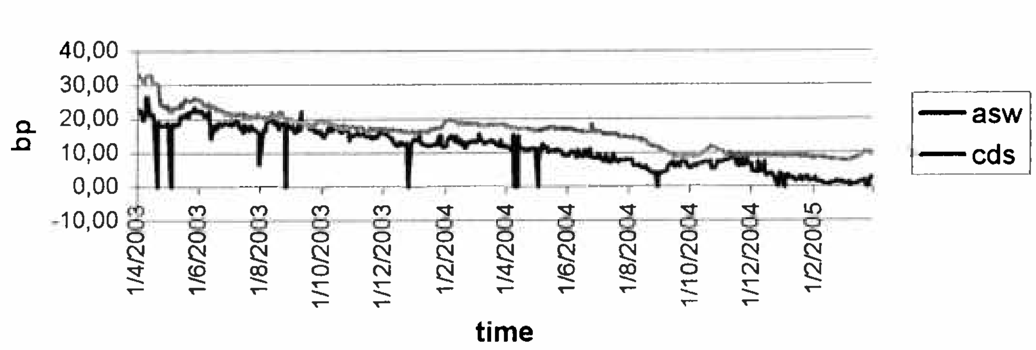


chart 9 abn-basis08.09.2009

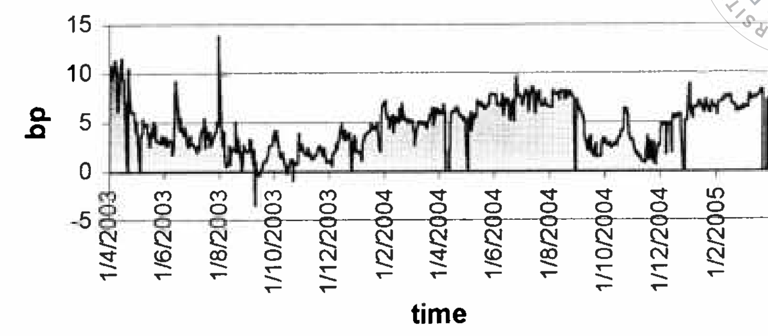


chart 5 abn-asw/cds28.06.2010

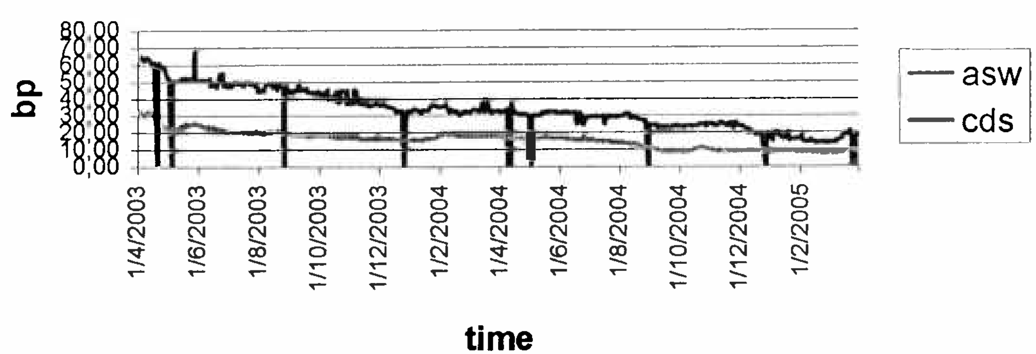


chart 10 abn-basis28.06.2010

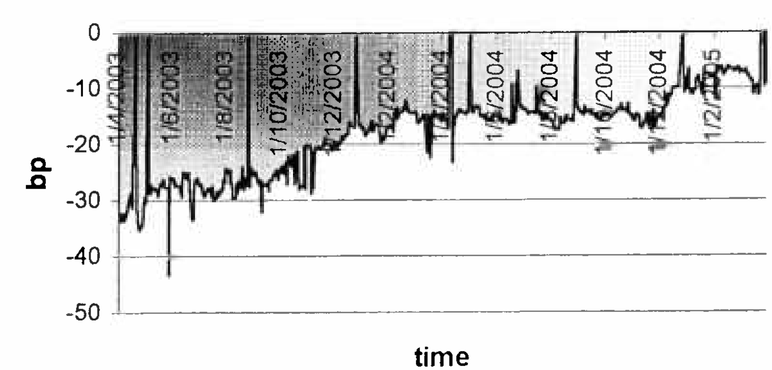


chart 11 bacr-asw/cds15.12.2010

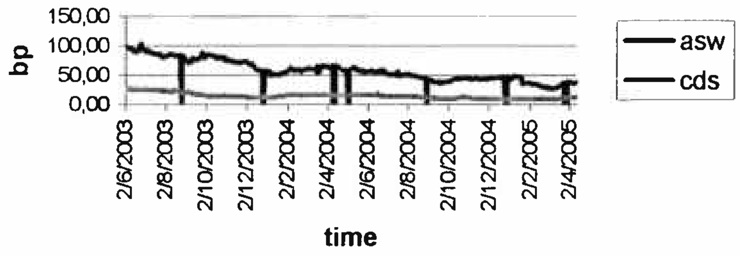


chart 15 bacr-basis15.12.2010

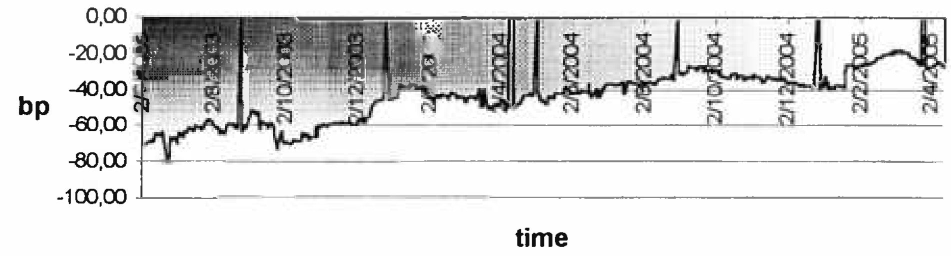


chart 12 bacr-asw/cds08.03.2011

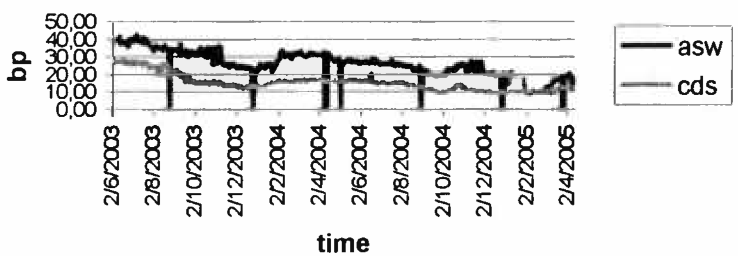


chart 16 bacr-basis08.03.2011

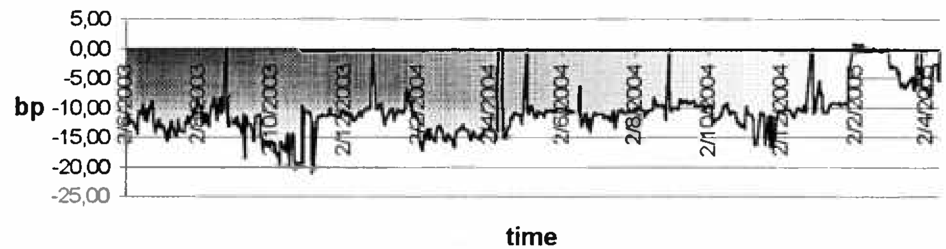


chart 13 bacr-asw/cds08.07.2011

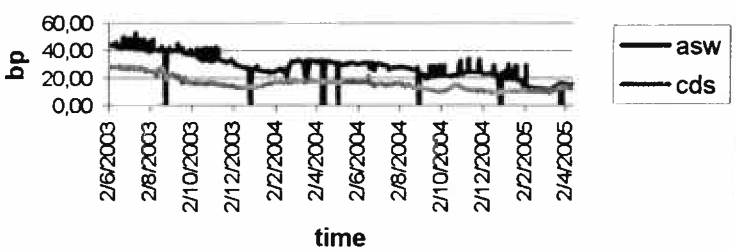
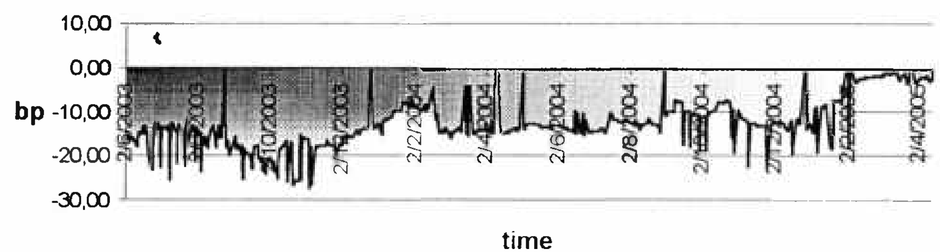


chart 17 bacr-basis08.07.2011



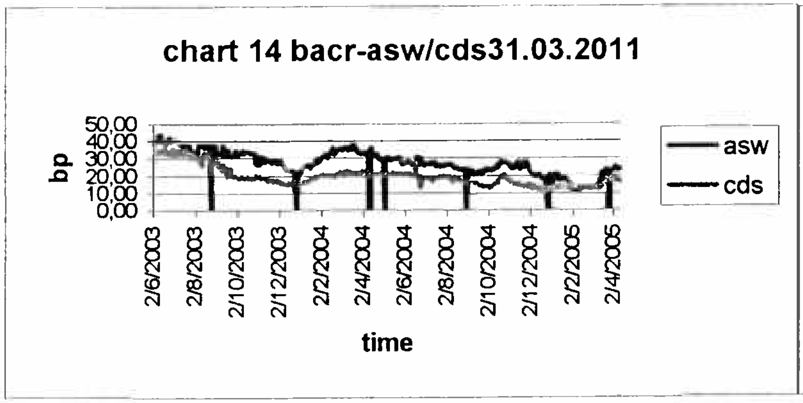


chart 14 bacr-asw/cds31.03.2011
bp
50,00
40,00
30,00
20,00
10,00
0,00
2/6/2003
2/8/2003
2/10/2003
2/12/2003
2/2/2004
2/4/2004
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2/8/2004
2/10/2004
2/12/2004
2/2/2005
2/4/2005
time
asw
cds

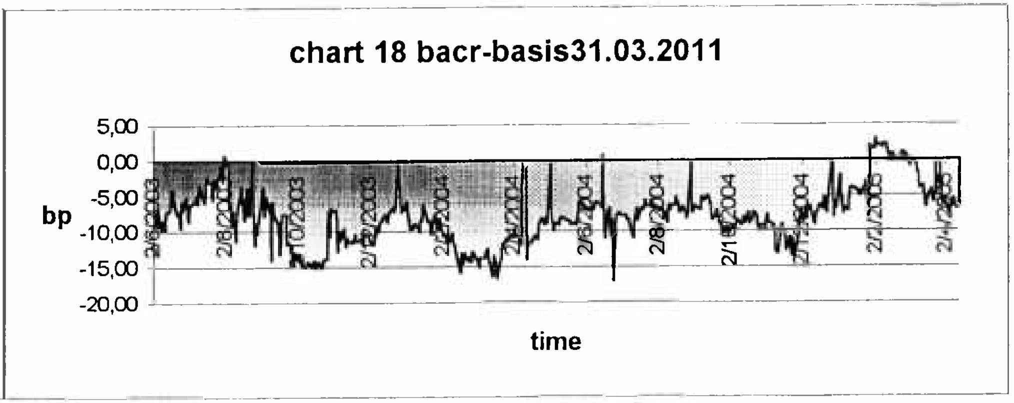


chart 18 bacr-basis31.03.2011
bp
5,00
0,00
-5,00
-10,00
-15,00
-20,00
time

chart 19 bnp-asw/cds07.08.2008

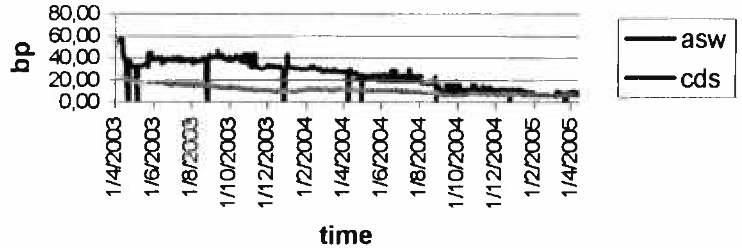


chart 27 bnp-basis07.08.2008

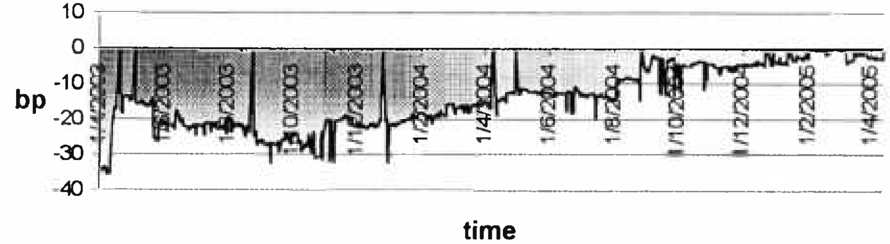


chart 20 bnp-asw/cds23.01.2009

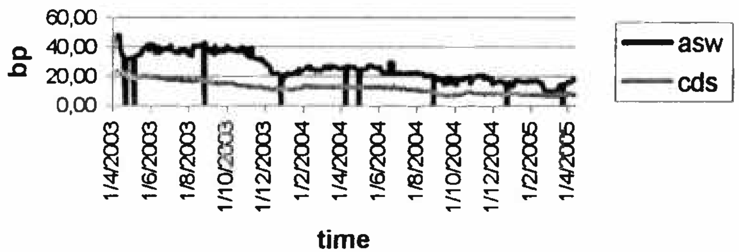


chart 28 basis23.01.2009

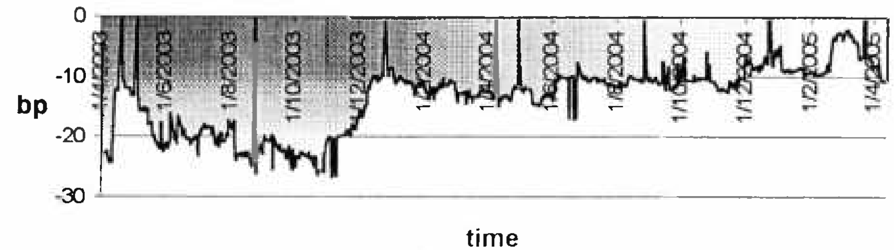


chart 21 bnp-asw/cds08.07.2011

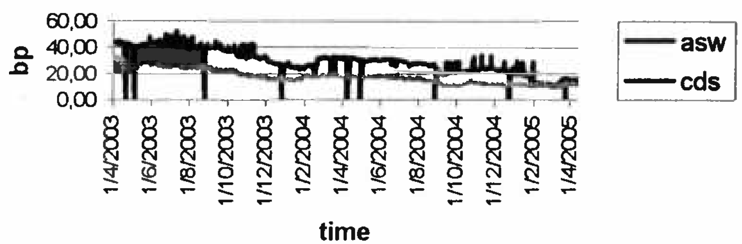


chart 29 bnp-basis08.07.2011

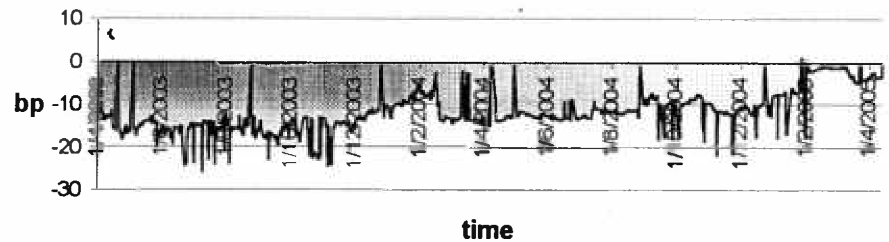


chart 22 bnp-asw/cds23.10.2011

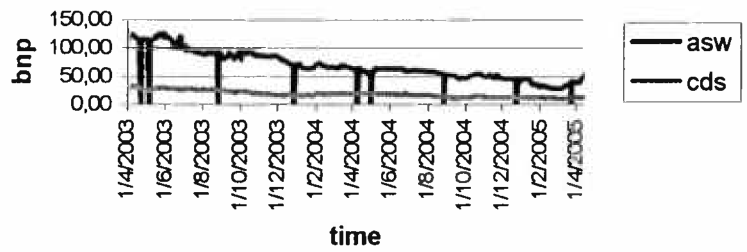


chart 30 bnp-basis23.10.2011

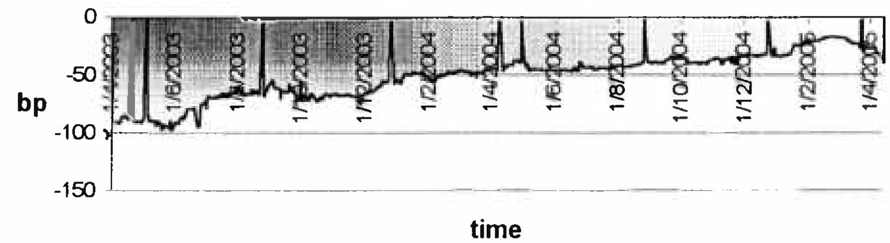


chart 23 bnp-asw/cds24.01.2012

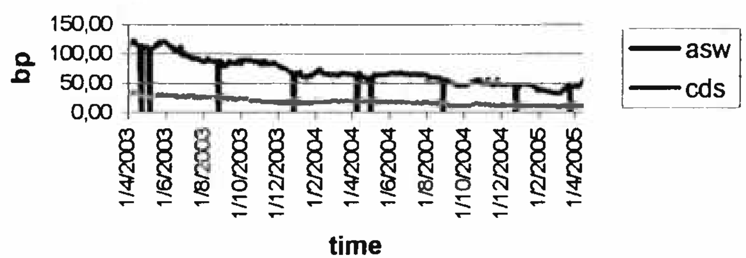


chart 31 bnp-basis24.01.2012

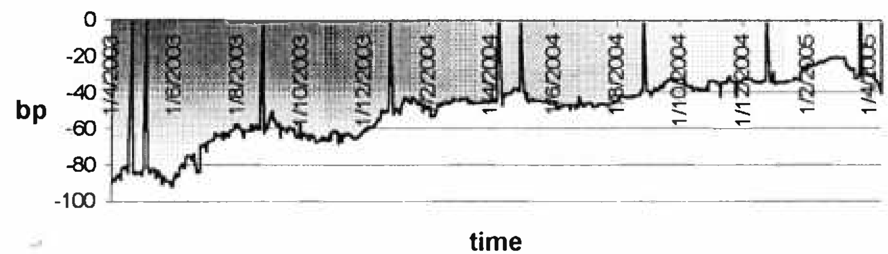


chart 24 bnp-asw/cds17.12.2012

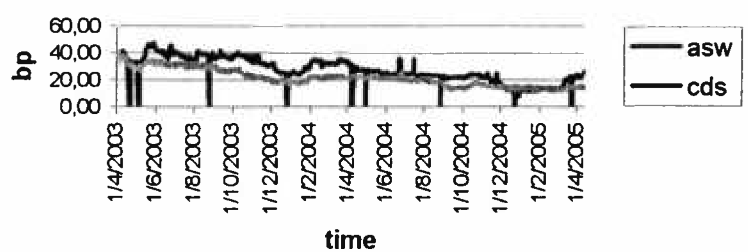


chart 32 bnp-basis17.12.2012

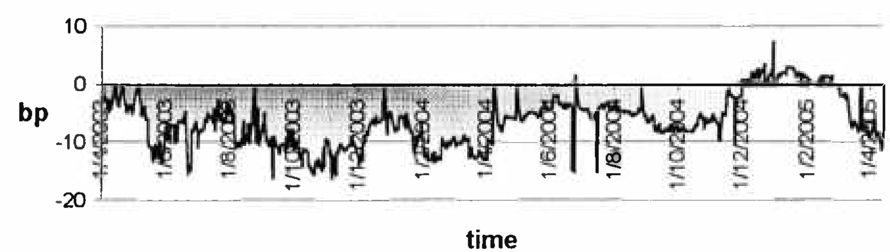


chart 25 bnp-asw/cds16.01.2013

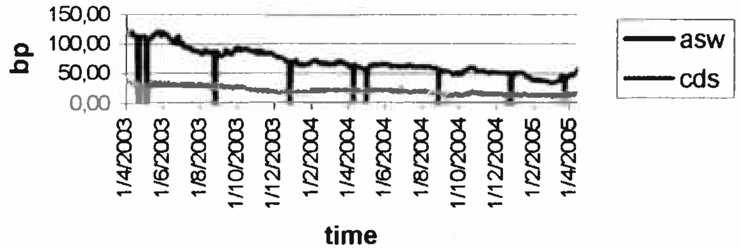


chart 33 bnp-basis16.01.2013

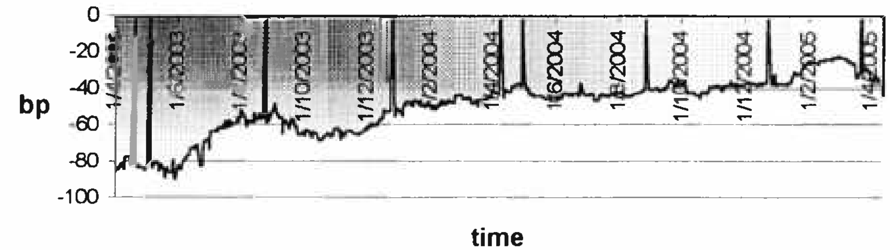


chart 26 bnp-asw/cds05.10.2049

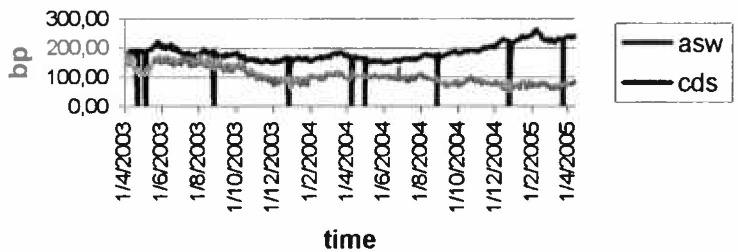


chart 34 bnp-basis05.10.2049

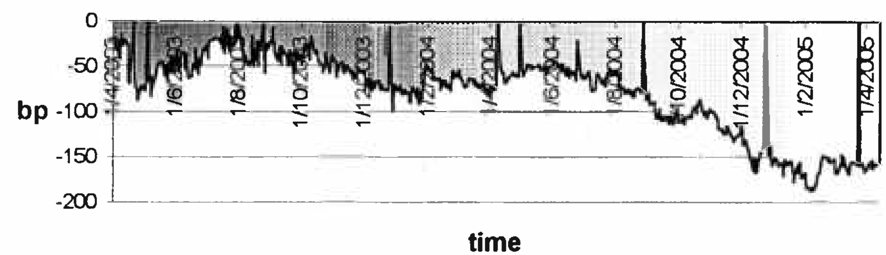


chart 35 carrefour-asw/cds18.03.2009

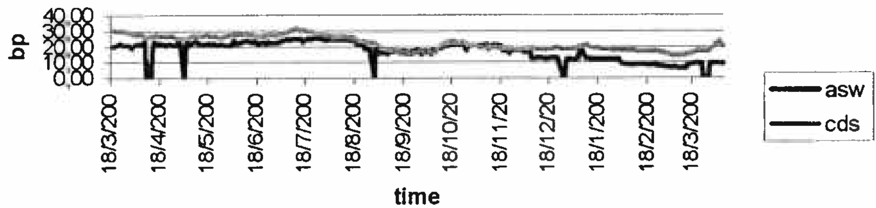


chart 36 carrefour-asw/cds26.05.2010

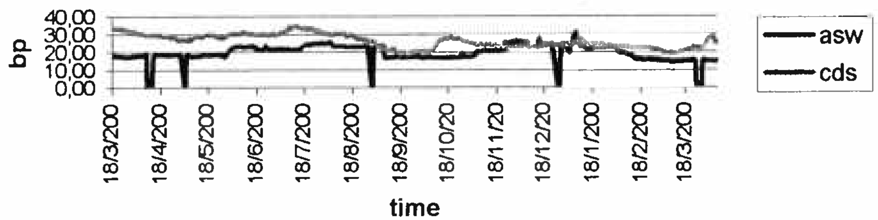
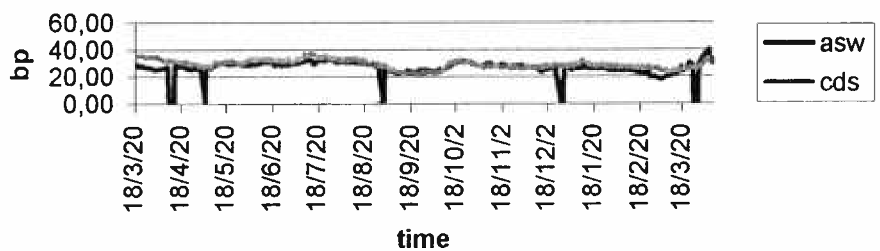


chart 37 carrefour-asw/cds15.01.2011



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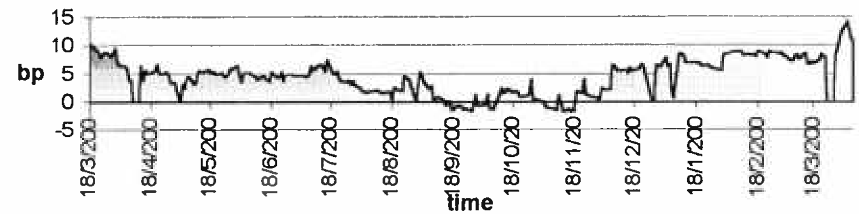

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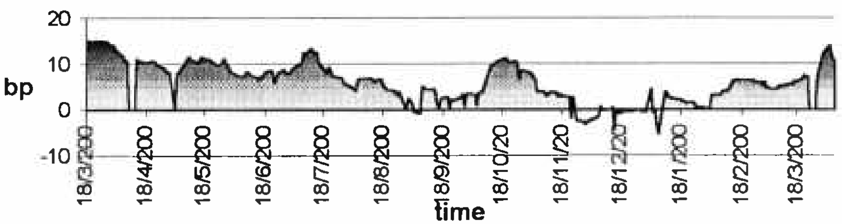

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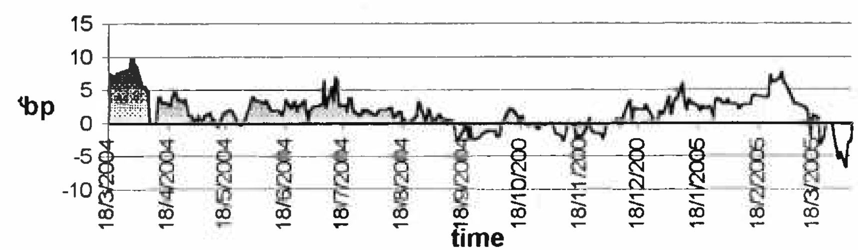

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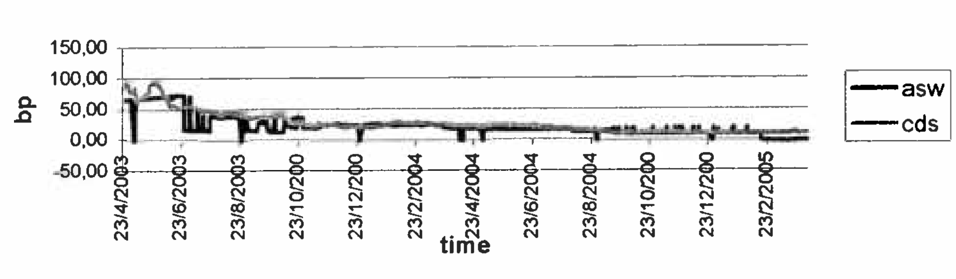


chart 42 cmzb-asw/cds21.4.2009

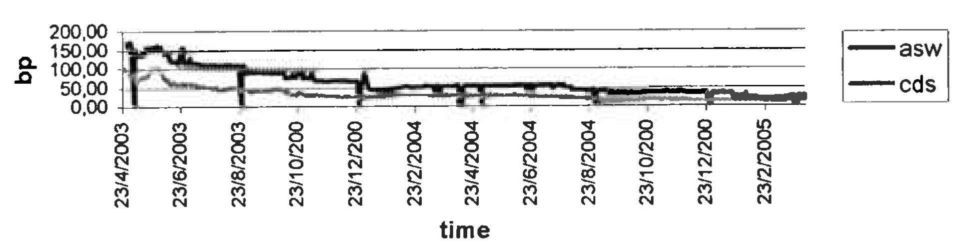
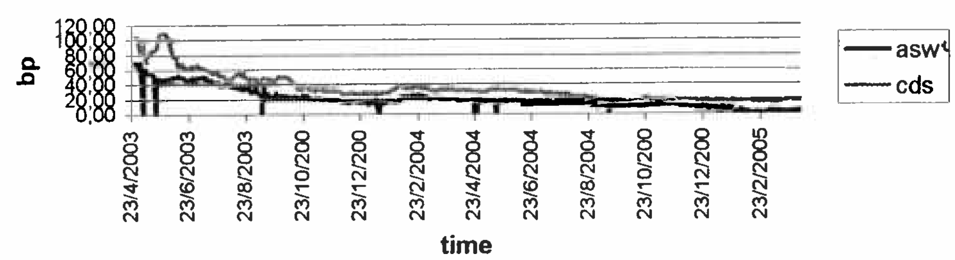


chart 43 cmzb-asw/cds25.10.2009



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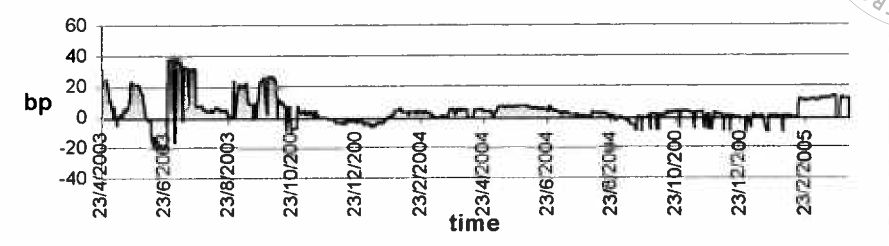

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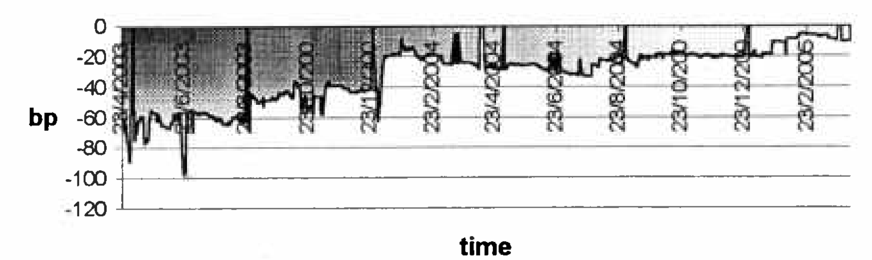

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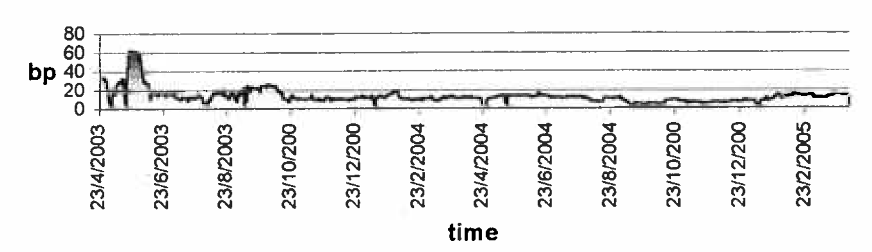

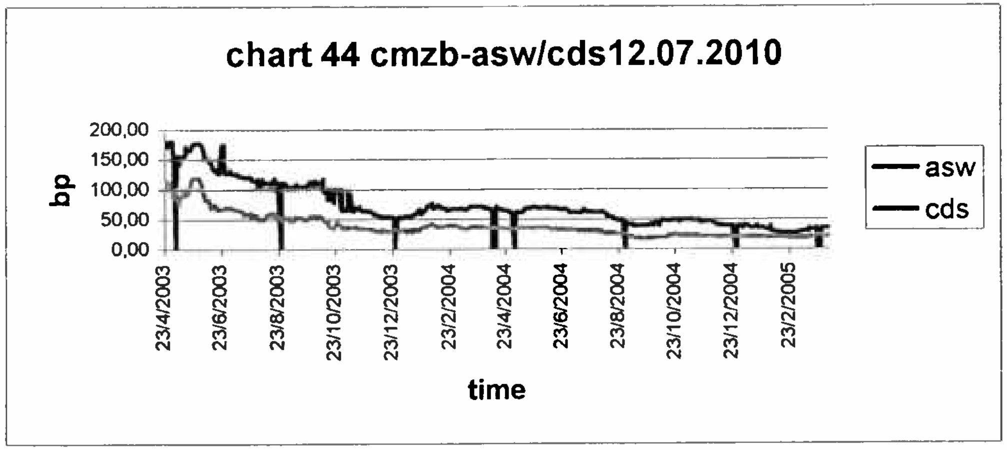
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50,00
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23/4/2003
23/6/2003
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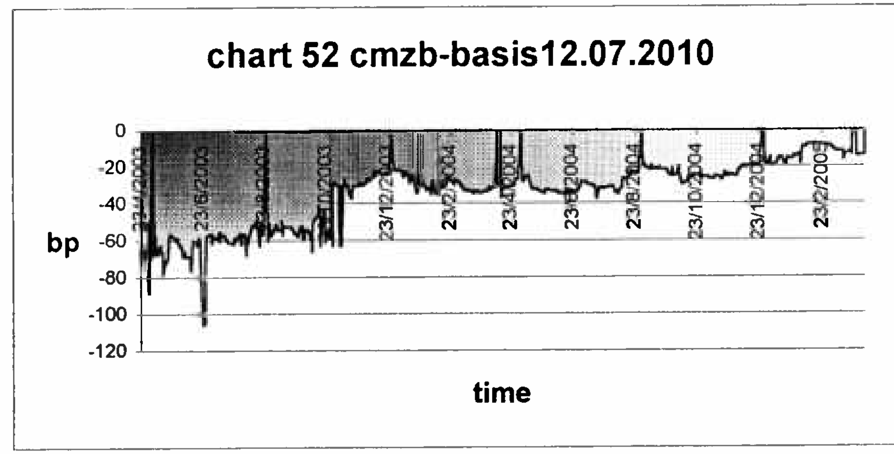
time
asw
cds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bp
0
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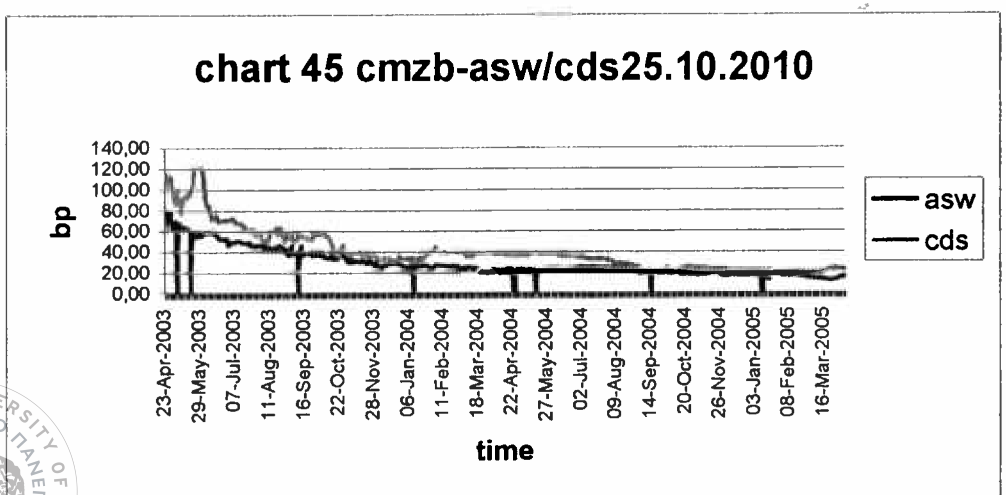
-100
-120
time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23-Apr-2003
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07-Jul-2003
11-Aug-2003
16-Sep-2003
22-Oct-2003
28-Nov-2003
06-Jan-2004
11-Feb-2004
18-Mar-2004
22-Apr-2004
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time
asw
cds

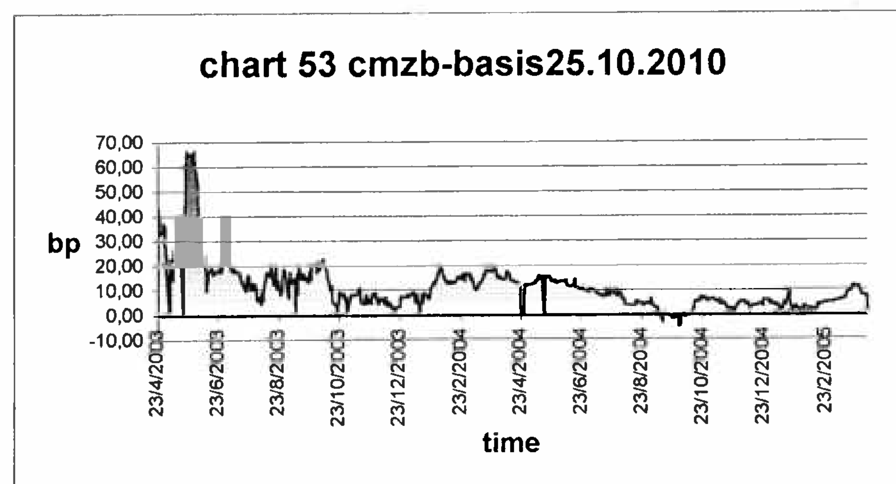
chart 53 cmzb-basis25.10.2010
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10,00
0,00
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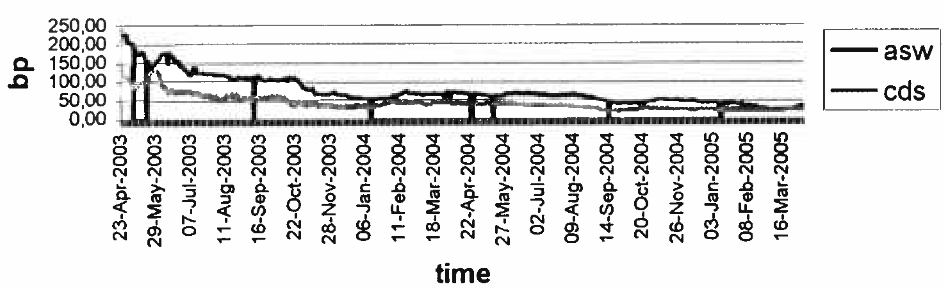
23/6/2003
23/8/2003
23/10/2003
23/12/2003
23/2/2004
23/4/2004
23/6/2004
23/10/2004
23/12/2004
23/2/2005
time

chart 46 cmzb-asw/cds02.05.2011



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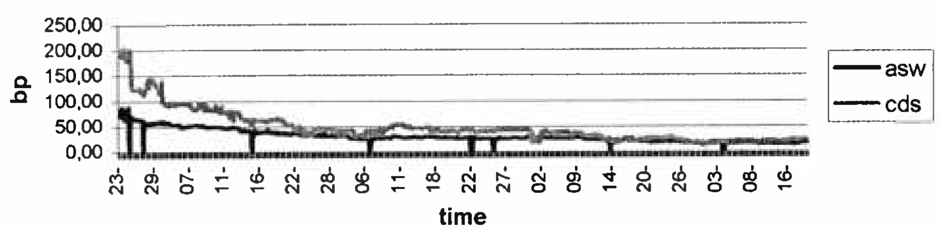

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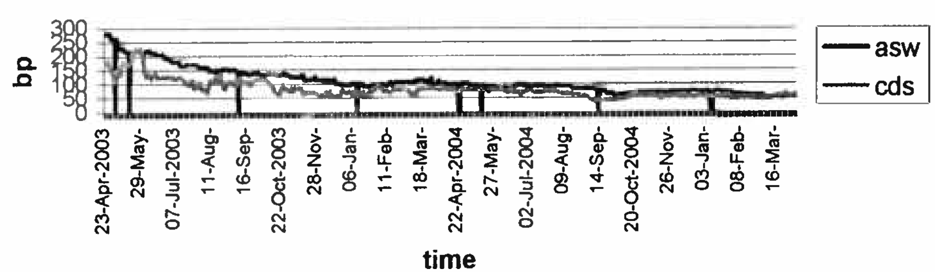

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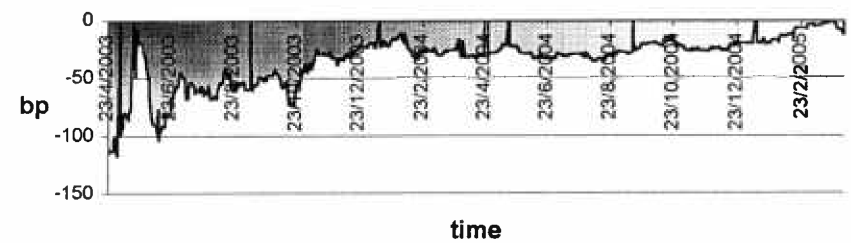

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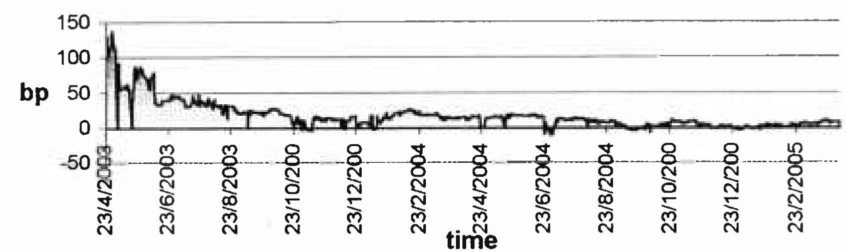

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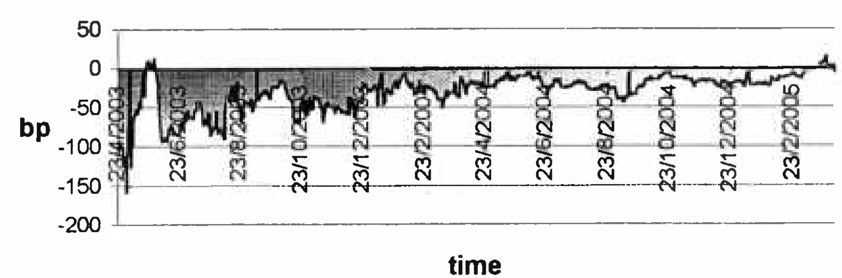

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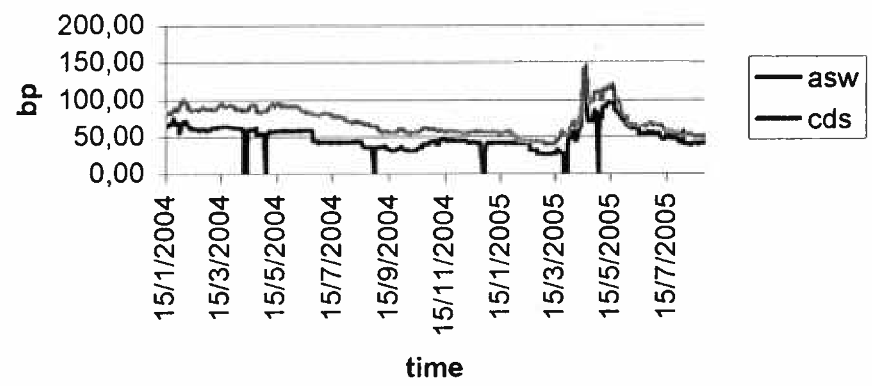

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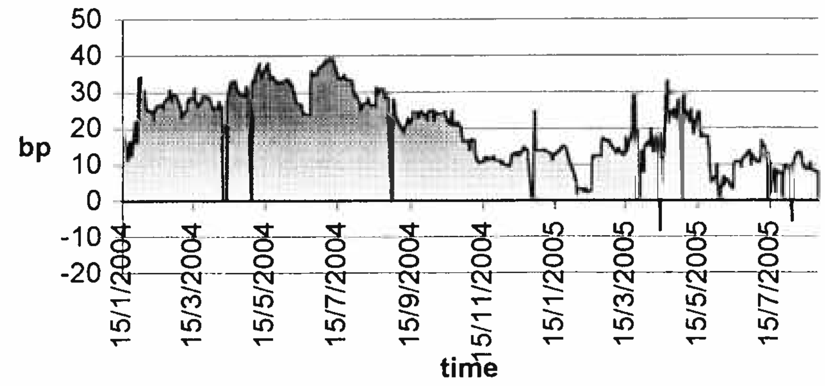

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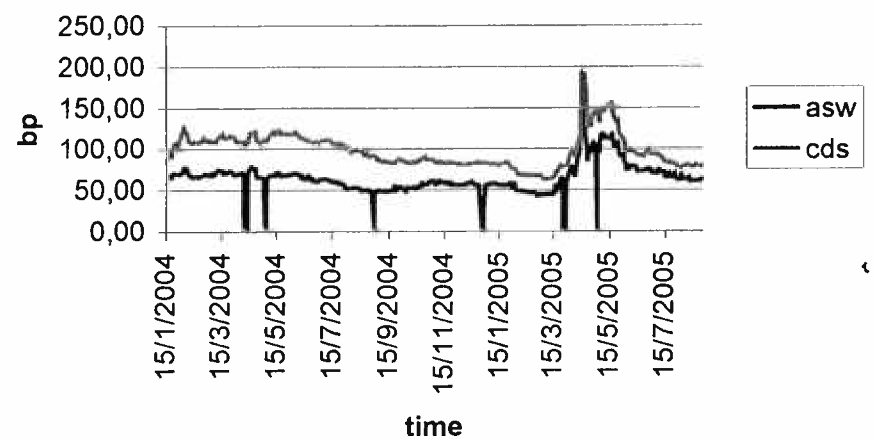

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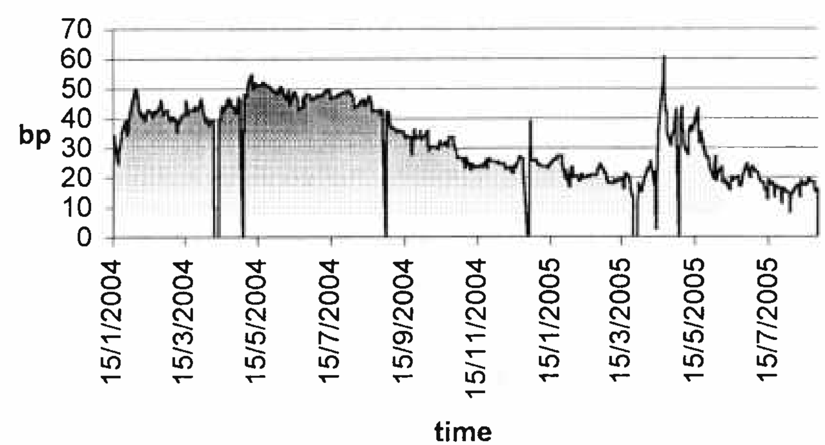

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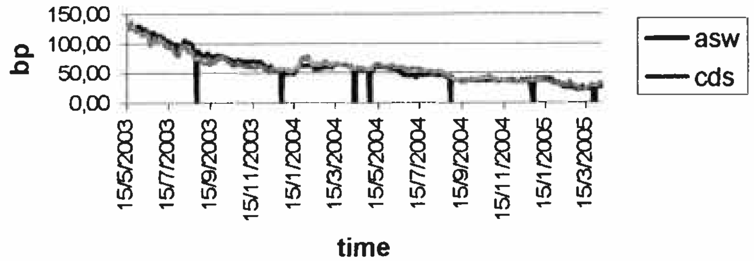

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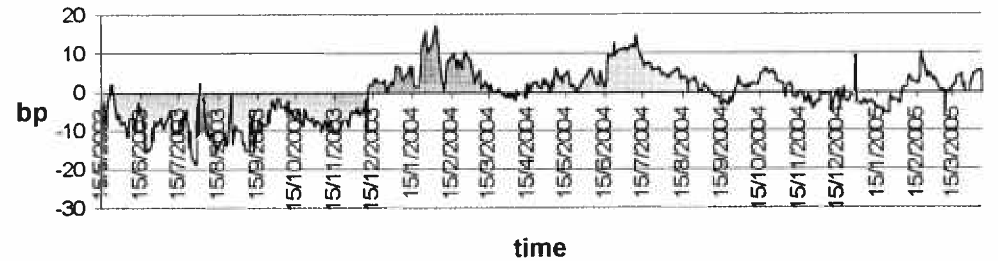

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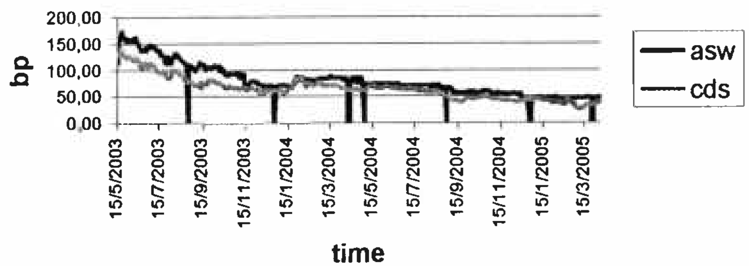

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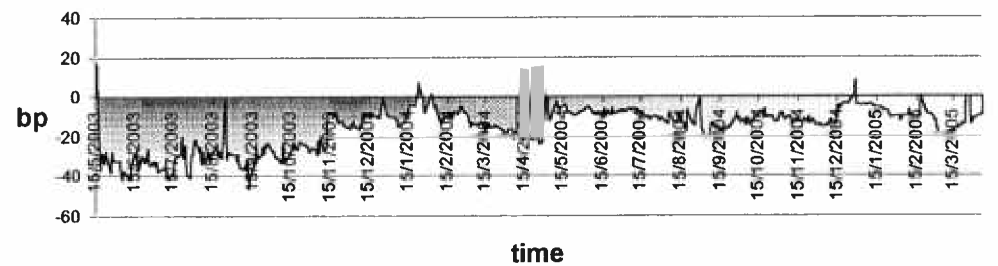
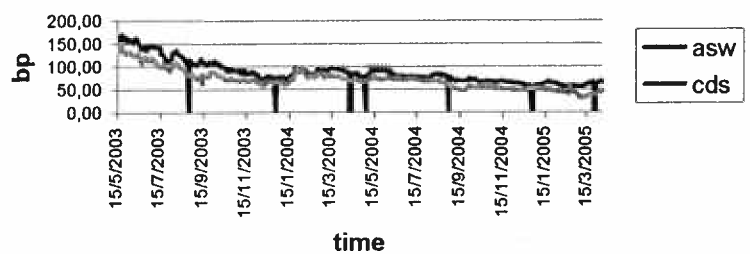


chart 63 dt-asw/cds11.07.2011



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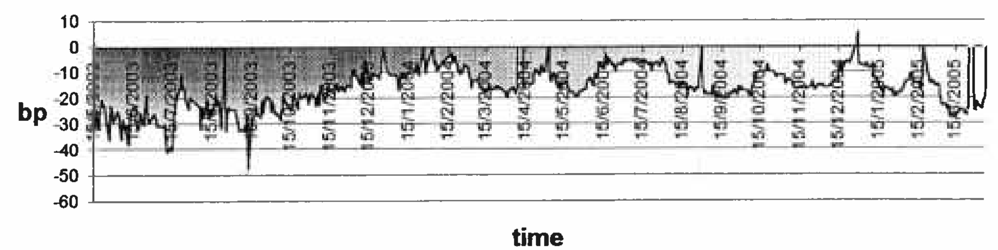

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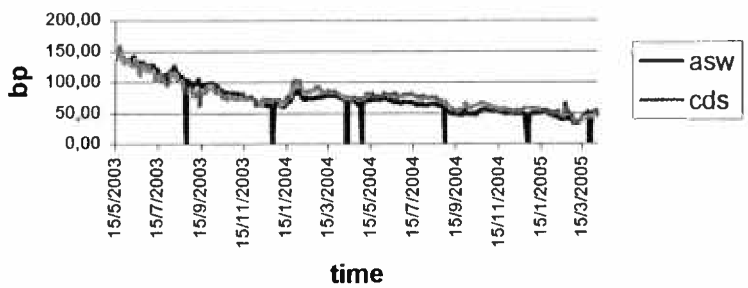

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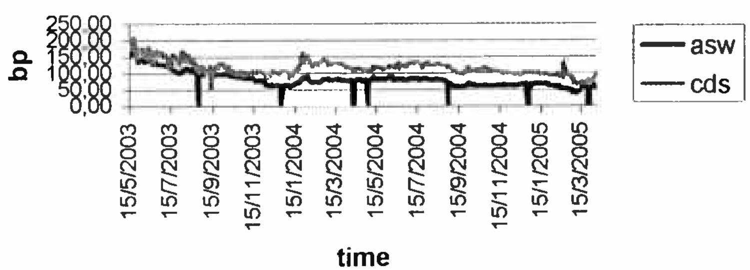
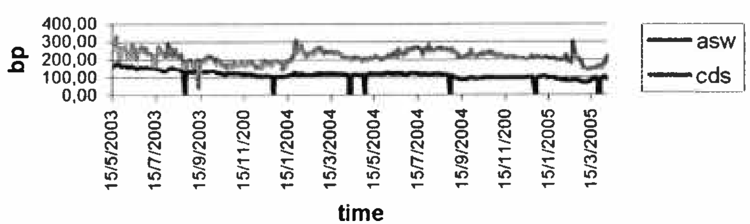


chart 66 dt-asw/cds24.01.2033



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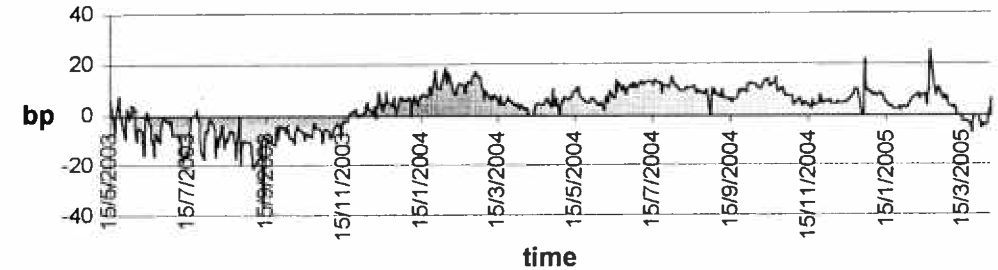

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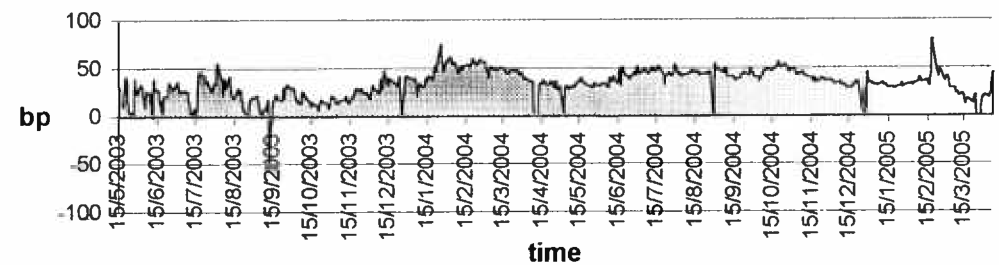

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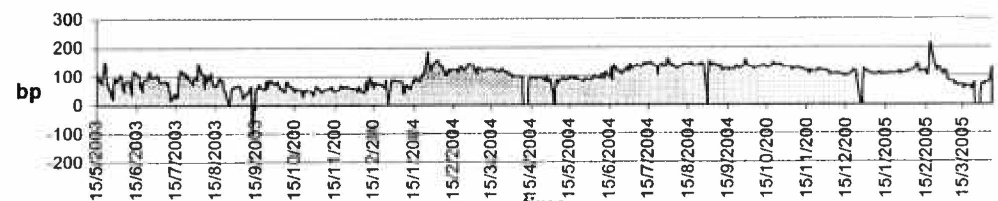

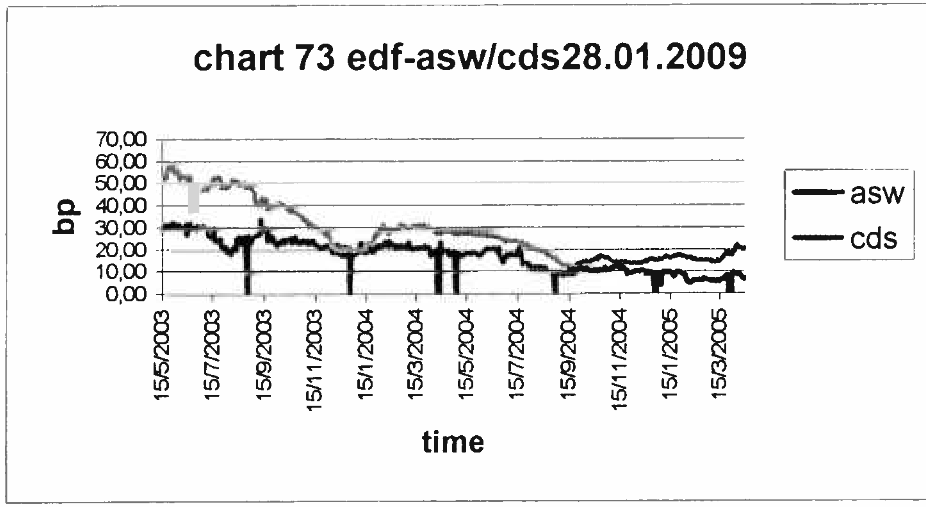
chart 73 edf-asw/cds28.01.2009
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40,00
30,00
20,00
10,00
0,00
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15/11/2003
15/1/2004
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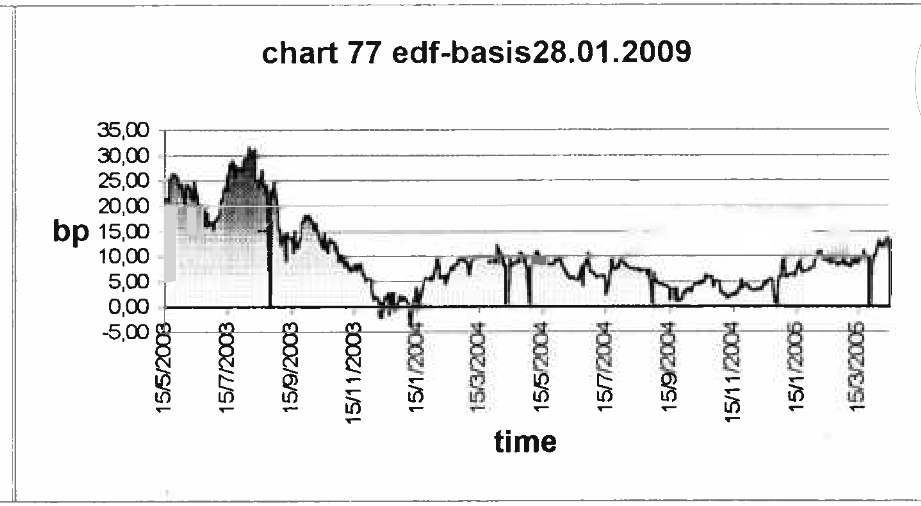
time
asw
cds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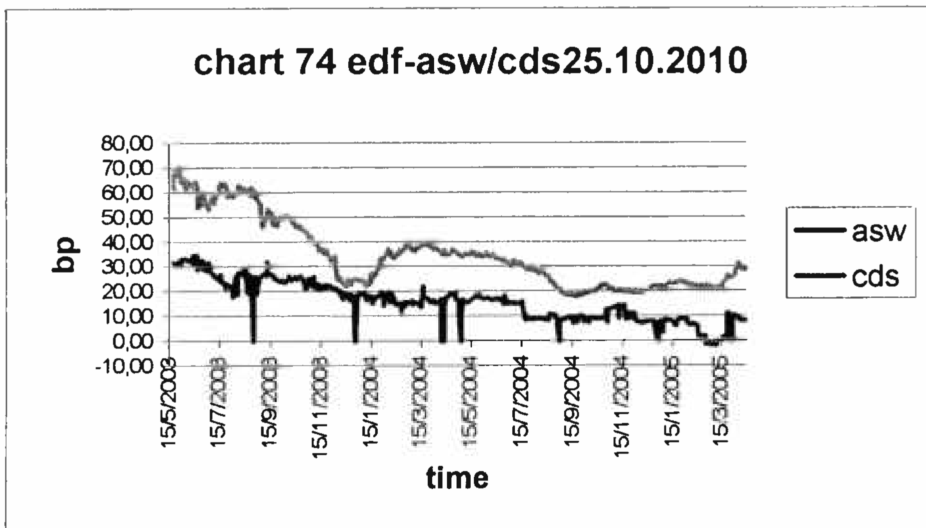
15/1/2005
15/3/2005
time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50,00
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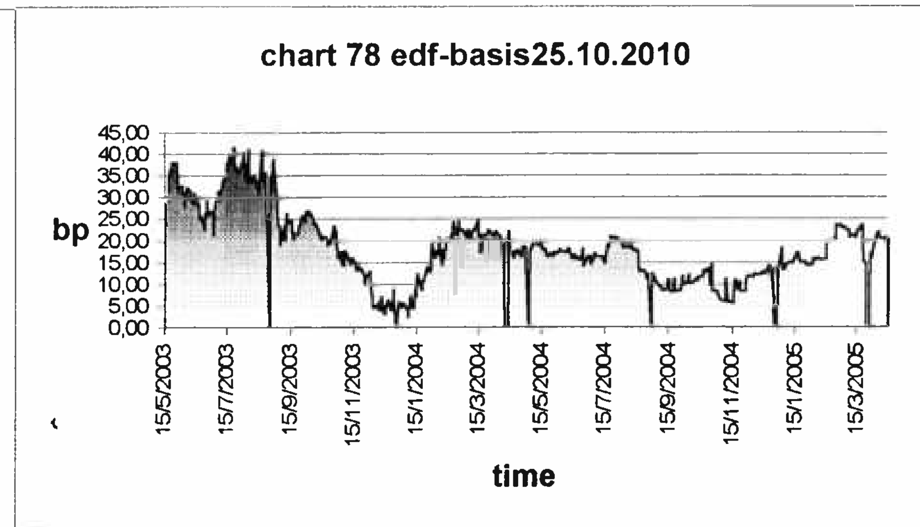
time
asw
cds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15/9/2003
15/11/2003
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15/3/2004
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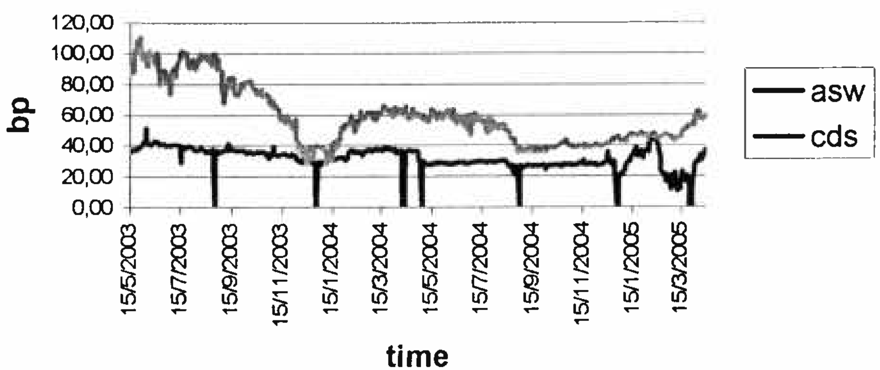
time

chart 75 edf-asw/cds25.10.2016



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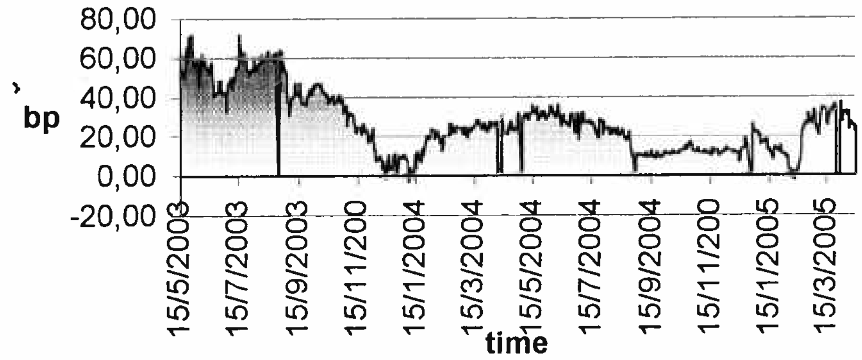

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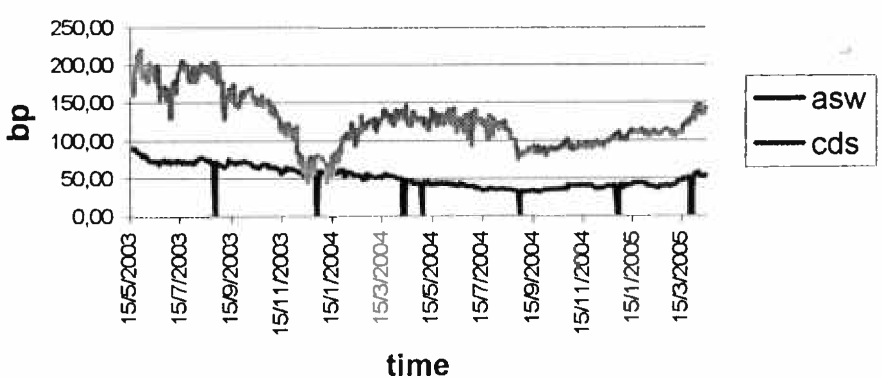

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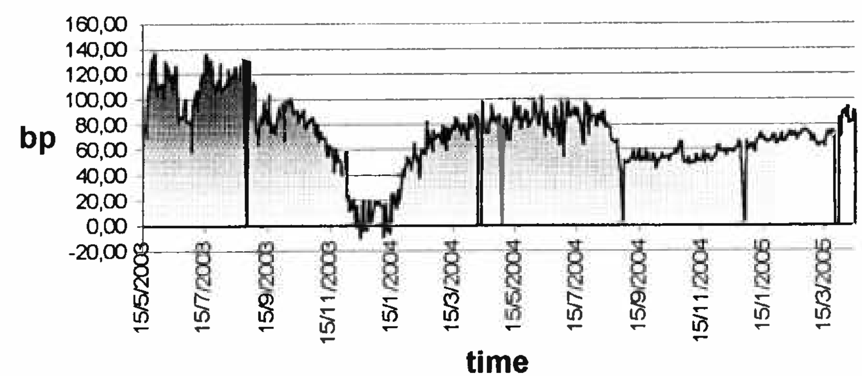

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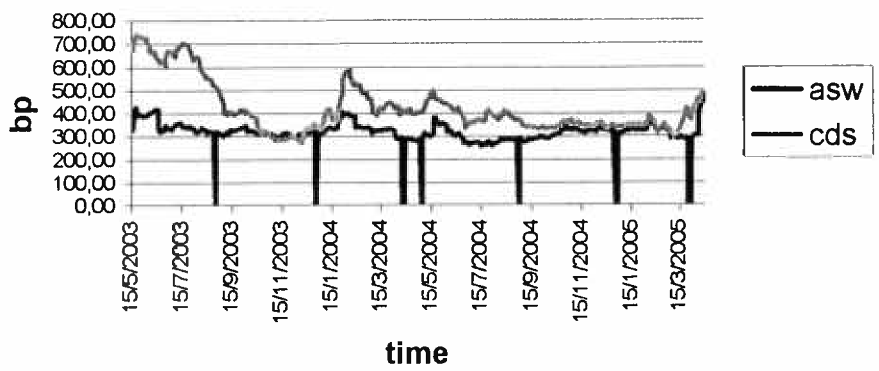

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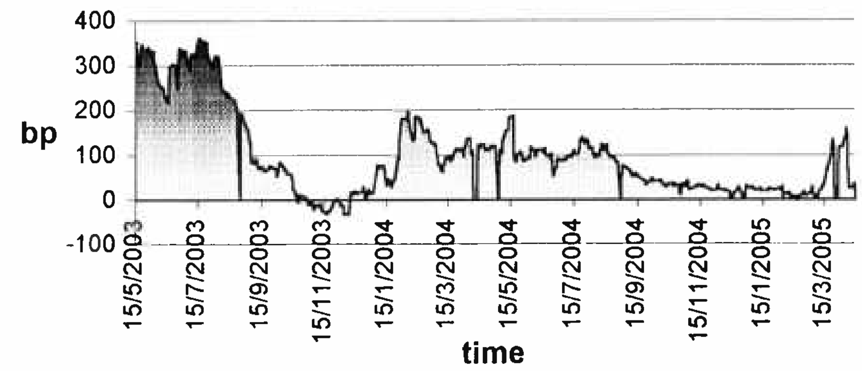
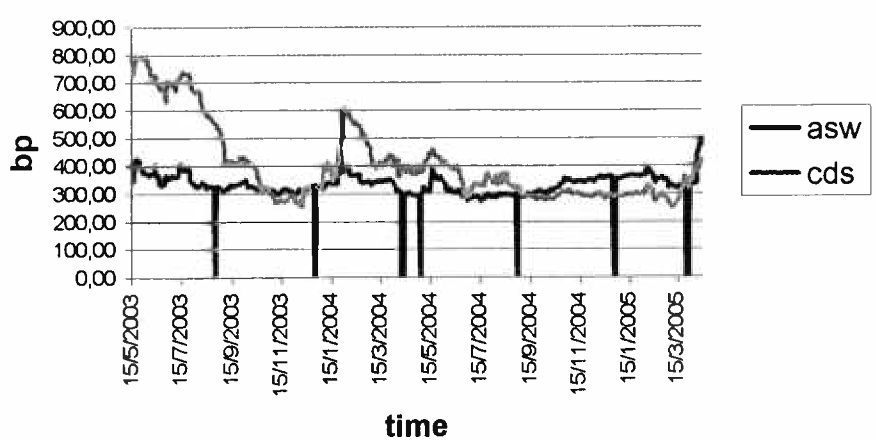


chart 82 fiat-asw/cds25.05.2011



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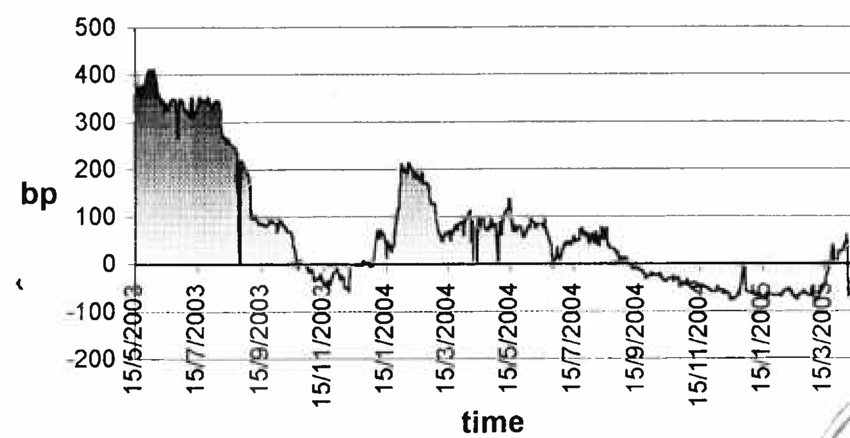


chart 85 frtel-asw/cds28.09.2007

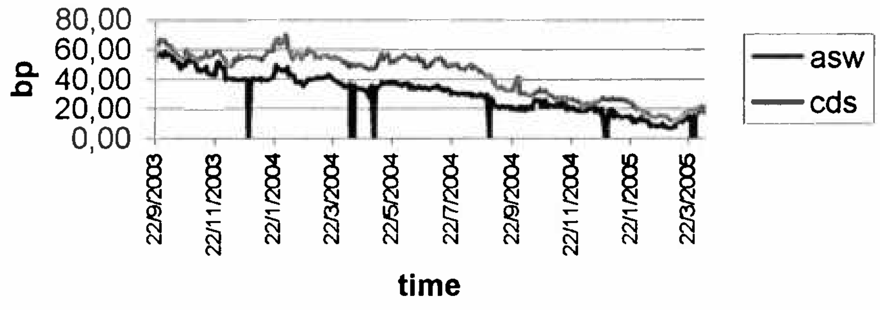


chart 94 frtel-basis 28.09.2007

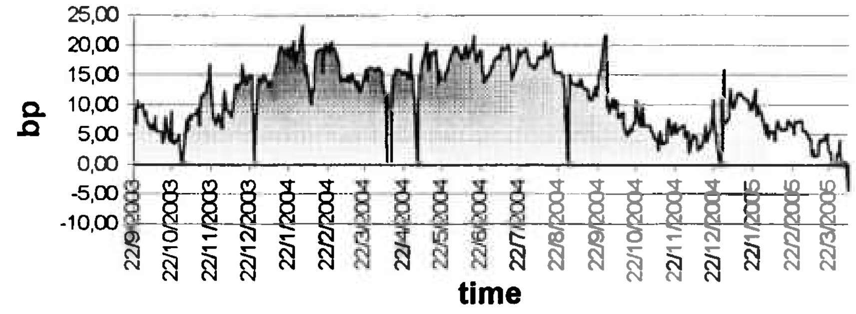


chart 86 frtel-asw/cds14.03.2008

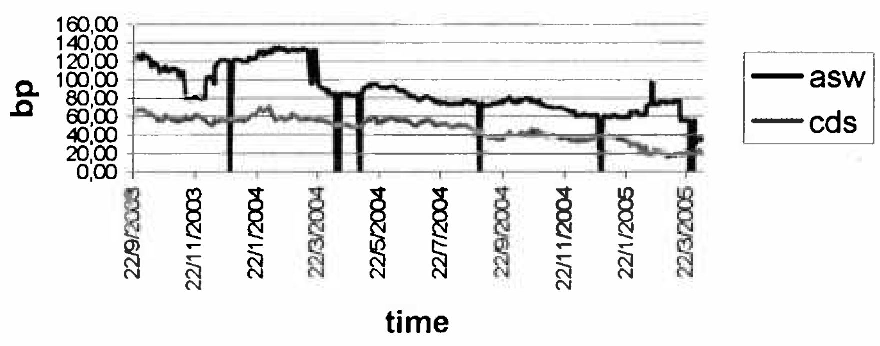
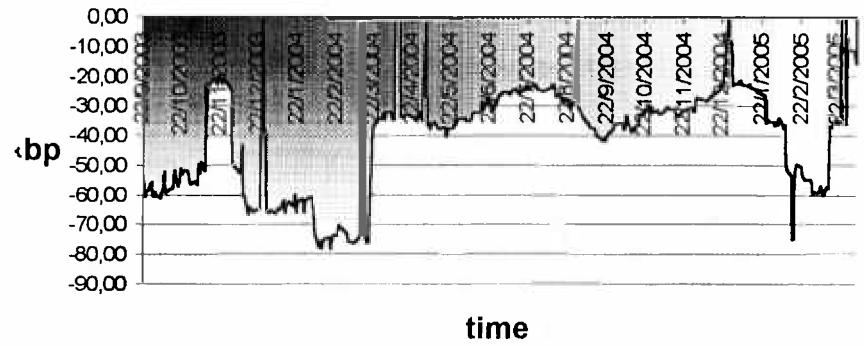
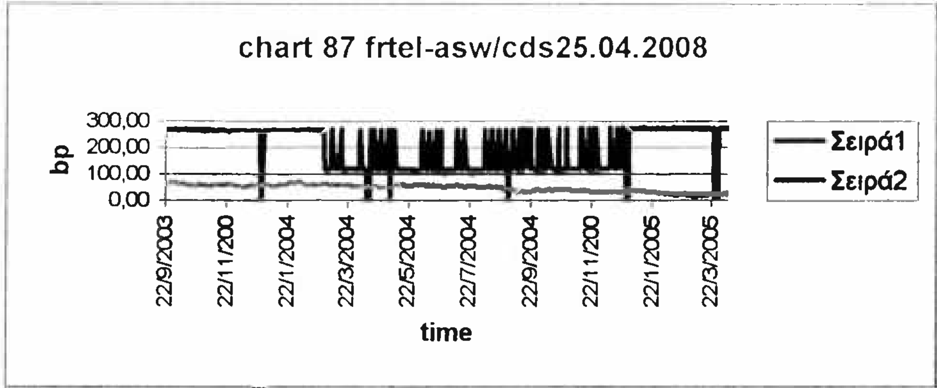


chart 95 fterl-basis14.03.2008

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300,00
200,00
100,00
0,00
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22/1/2004
22/3/2004
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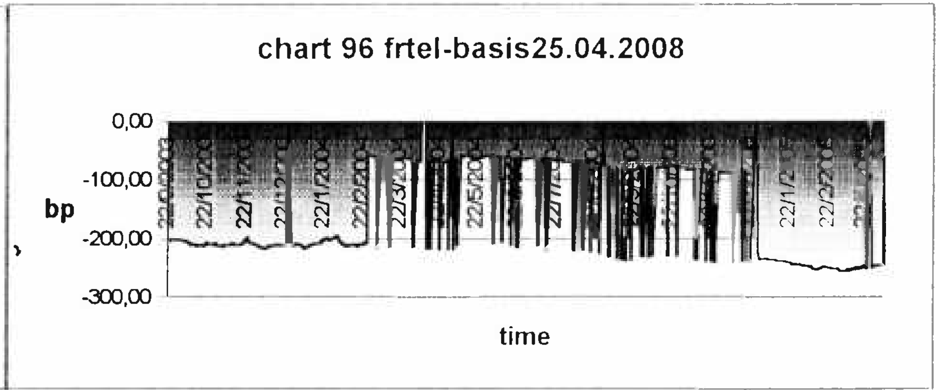
22/1/2005
22/3/2005
time
Σειρά1
Σειρά2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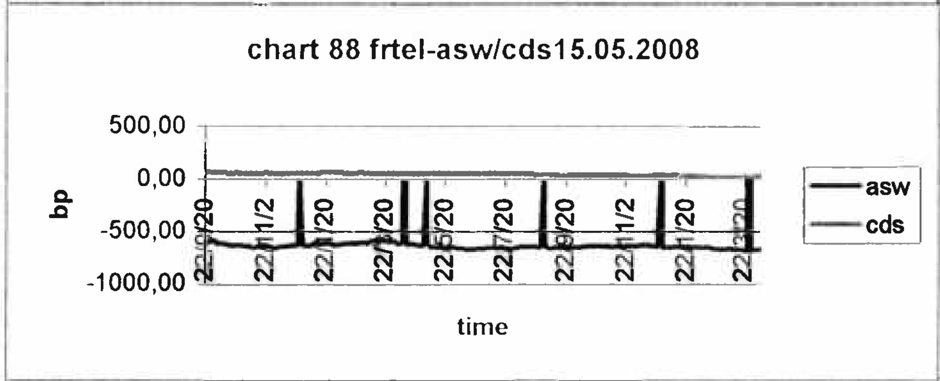
bp
time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bp
time
asw
cds

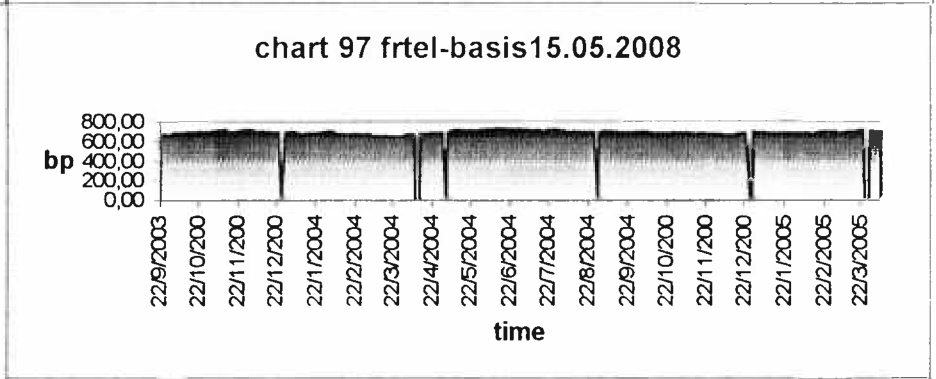
chart 97 frtel-basis15.05.2008
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22/9/2003
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22/3/2004
22/4/2004
22/5/2004
22/6/2004
22/7/2004
22/8/2004
22/9/2004
22/10/200
22/11/200
22/12/200
22/1/2005
22/2/2005
22/3/2005
time

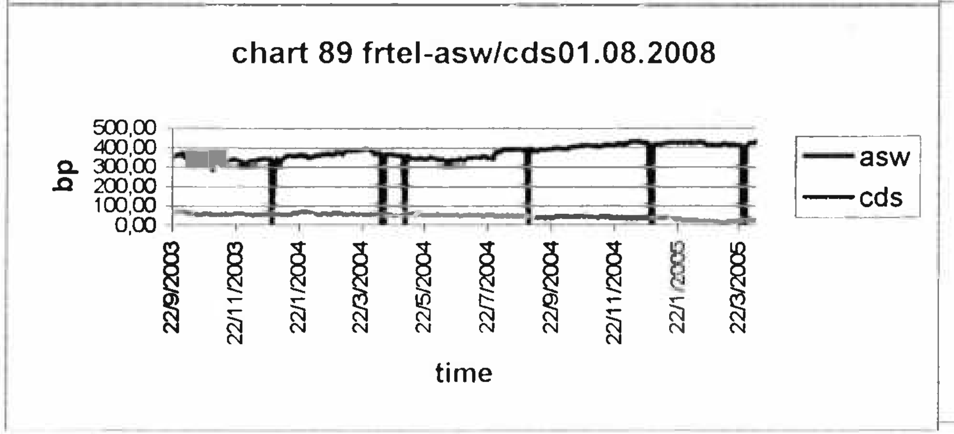
chart 89 frtel-asw/cds01.08.2008
500,00
400,00
300,00
200,00
100,00
0,00
bp
22/9/2003
22/11/2003
22/1/2004
22/3/2004
22/5/2004
22/7/2004
22/9/2004
22/11/2004
22/3/2005
time
asw
cds

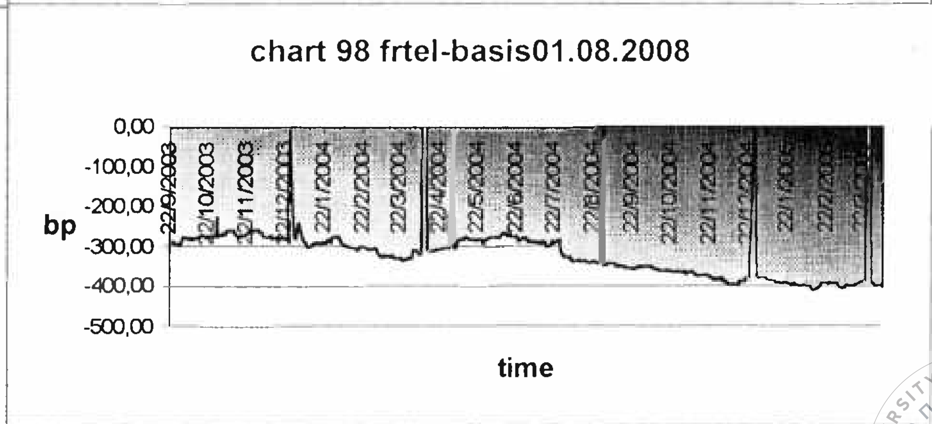
chart 98 frtel-basis01.08.2008
0,00
-100,00
-200,00
-300,00
-400,00
-500,00
bp
time

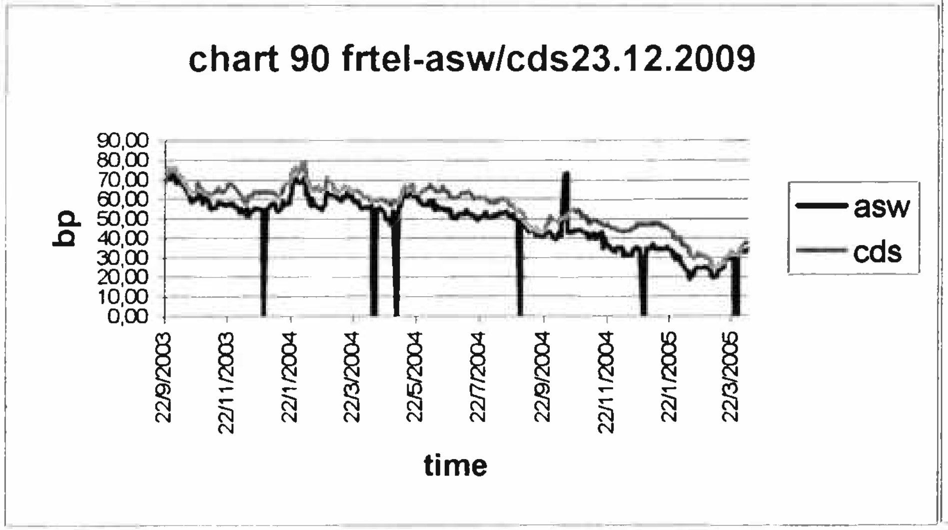
chart 90 frtel-asw/cds23.12.2009
90,00
80,00
70,00
60,00
50,00
40,00
30,00
20,00
10,00
0,00
bp
22/9/2003
22/11/2003
22/1/2004
22/3/2004
22/5/2004
22/7/2004
22/9/2004
22/11/2004
22/1/2005
22/3/2005
time
asw
cds

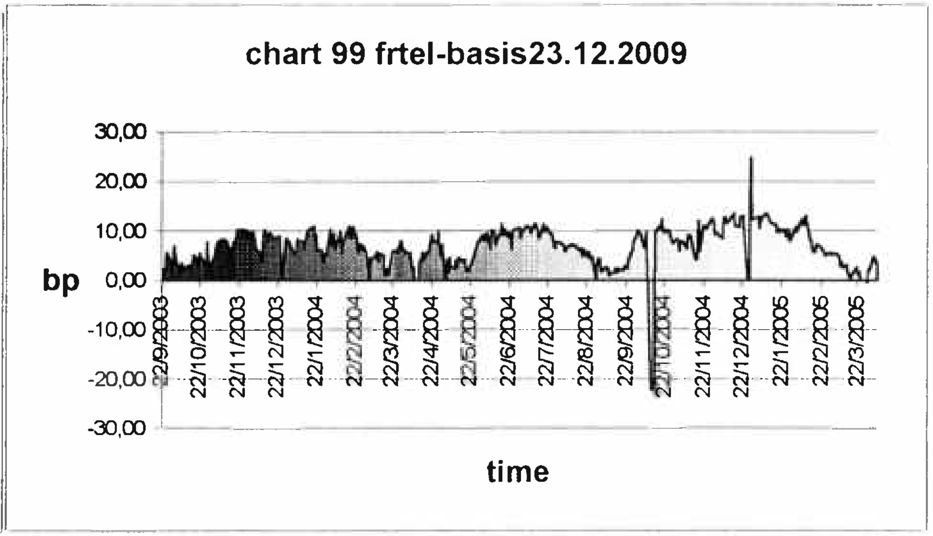
chart 99 frtel-basis23.12.2009
30,00
20,00
10,00
0,00
-10,00
-20,00
-30,00
bp
22/9/2003
22/10/2003
22/11/2003
22/12/2003
22/1/2004
22/2/2004
22/3/2004
22/4/2004
22/5/2004
22/6/2004
22/7/2004
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22/2/2005
22/3/2005
time

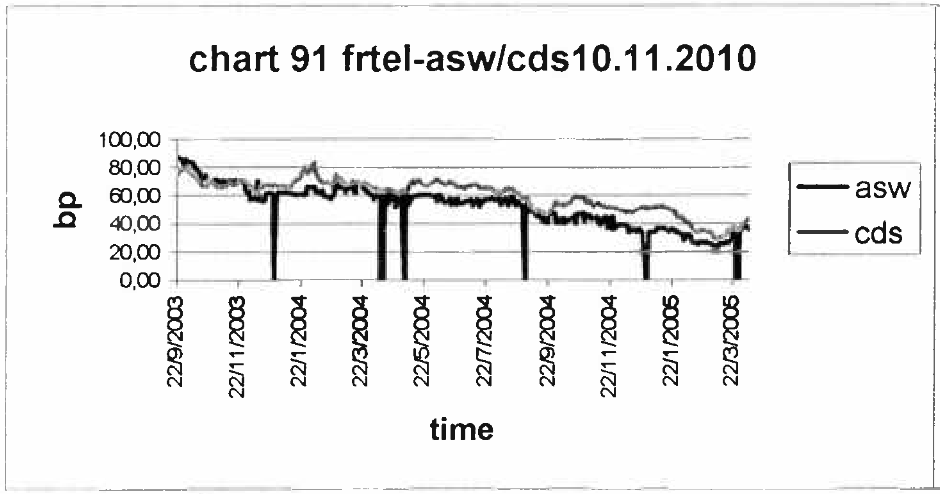
chart 91 frtel-asw/cds10.11.2010
100,00
80,00
60,00
40,00
20,00
0,00
bp
22/9/2003
22/11/2003
22/1/2004
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22/1/2005
22/3/2005
time
asw
cds

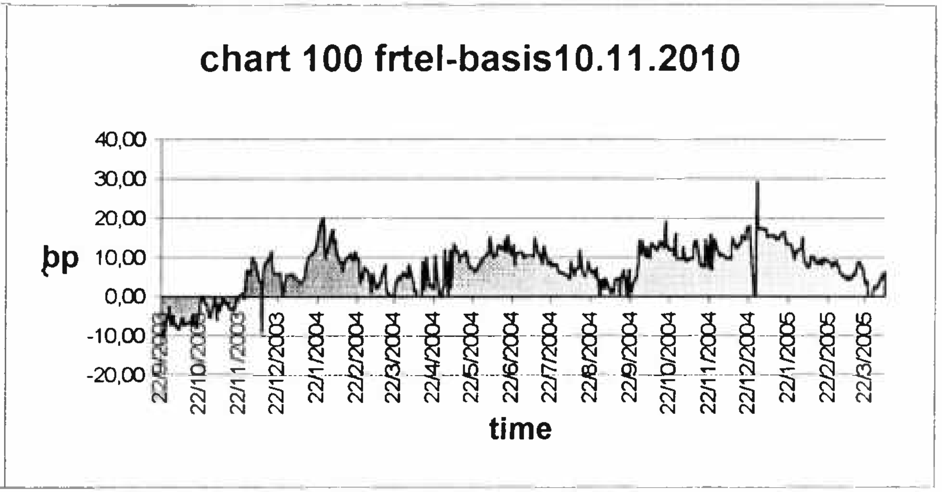
chart 100 frtel-basis10.11.2010
40,00
30,00
20,00
10,00
0,00
-10,00
-20,00
bp
22/9/2003
22/10/2003
22/11/2003
22/12/2003
22/1/2004
22/2/2004
22/3/2004
22/4/2004
22/5/2004
22/6/2004
22/7/2004
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22/2/2005
22/3/2005
time

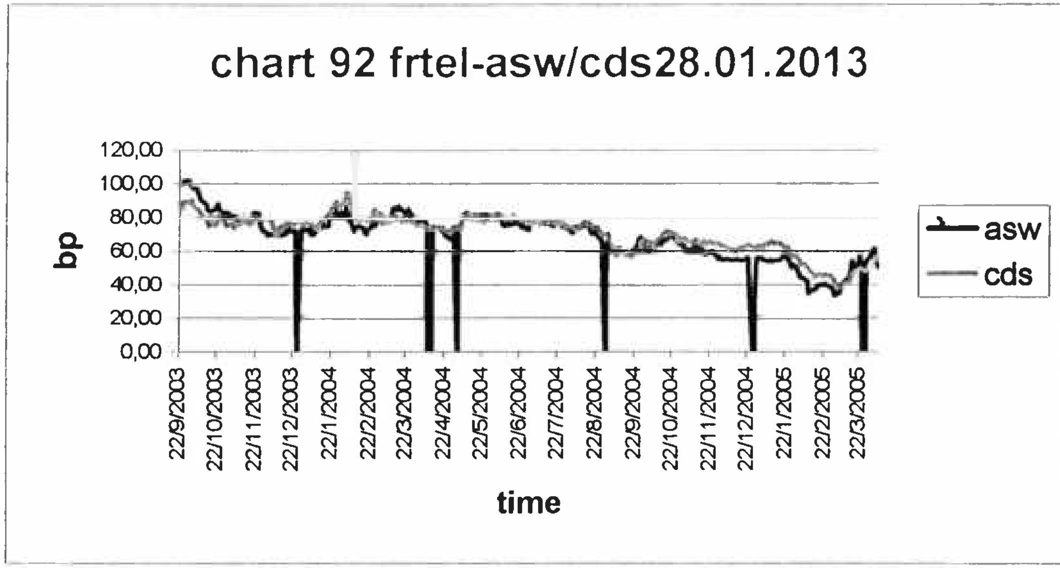
chart 92 frtel-asw/cds28.01.2013
120,00
100,00
80,00
60,00
40,00
20,00
0,00
bp
asw
cds
22/9/2003
22/10/2003
22/11/2003
22/12/2003
22/1/2004
22/2/2004
22/3/2004
22/4/2004
22/5/2004
22/6/2004
22/7/2004
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22/2/2005
22/3/2005
time

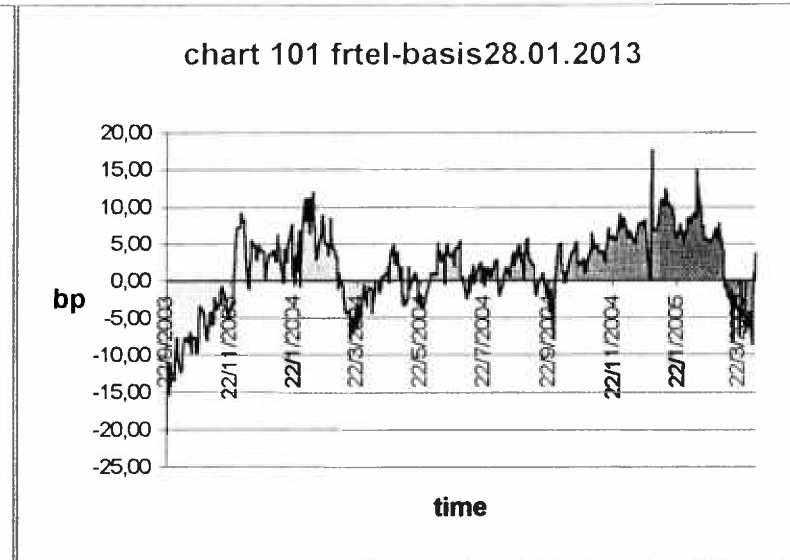
chart 101 frtel-basis28.01.2013
20,00
15,00
10,00
5,00
0,00
-5,00
-10,00
-15,00
-20,00
-25,00
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22/11/2004
22/1/2005
time

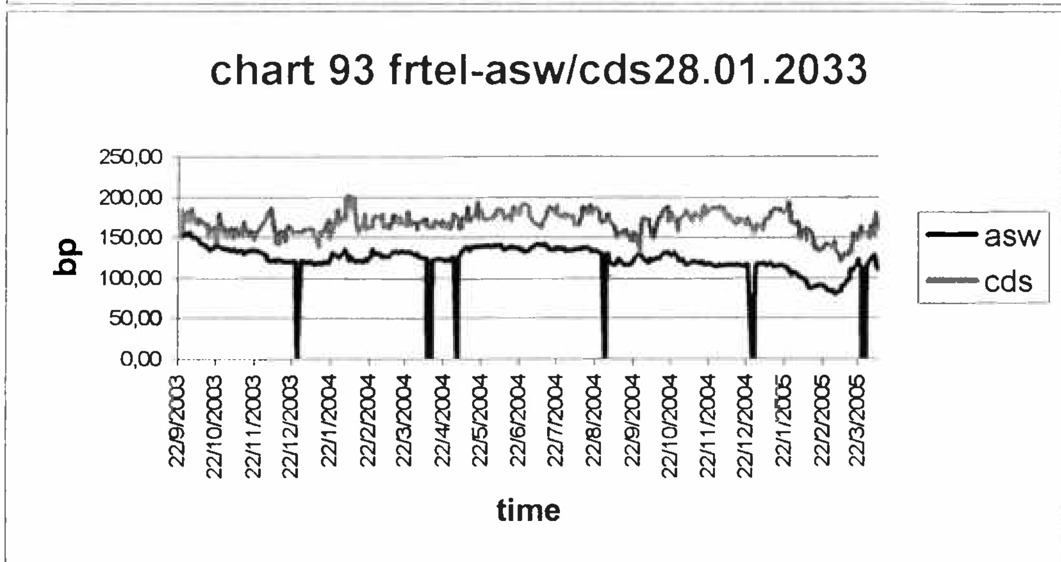
chart 93 frtel-asw/cds28.01.2033
250,00
200,00
150,00
100,00
50,00
0,00
bp
asw
cds
22/9/2003
22/10/2003
22/11/2003
22/12/2003
22/1/2004
22/2/2004
22/3/2004
22/4/2004
22/5/2004
22/6/2004
22/7/2004
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22/2/2005
22/3/2005
time

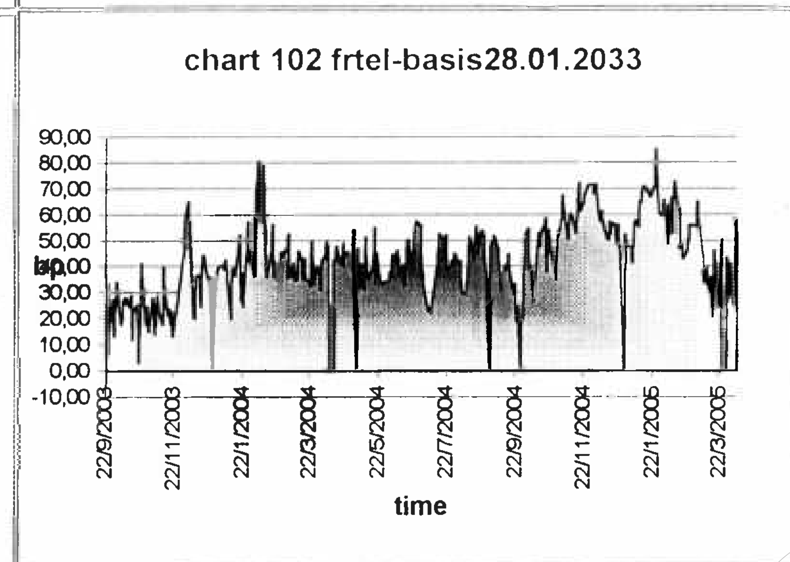


chart 102 frtel-basis28.01.2033
90,00
80,00
70,00
60,00
50,00
30,00
20,00
10,00
0,00
-10,00
bp
22/9/2003
22/11/2003
22/1/2004
22/3/2004
22/5/2004
22/7/2004
22/9/2004
22/11/2004
22/1/2005
22/3/2005
time

chart 103 basis(cds-yield spread)12-May-2009 abn amro

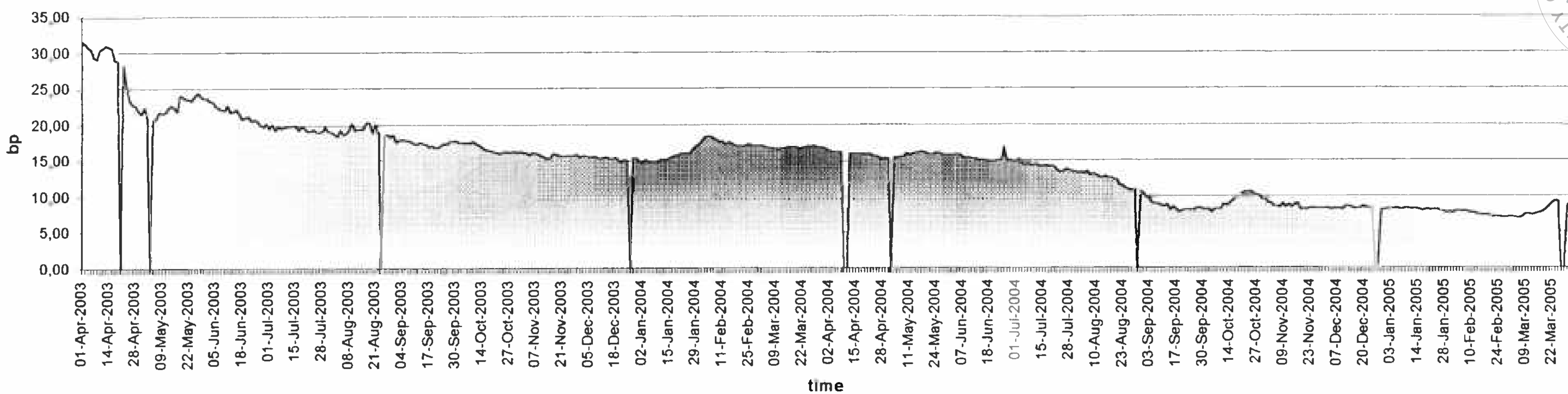


chart 104 basis(cds-yield spread)24-Jun-2009 abn amro

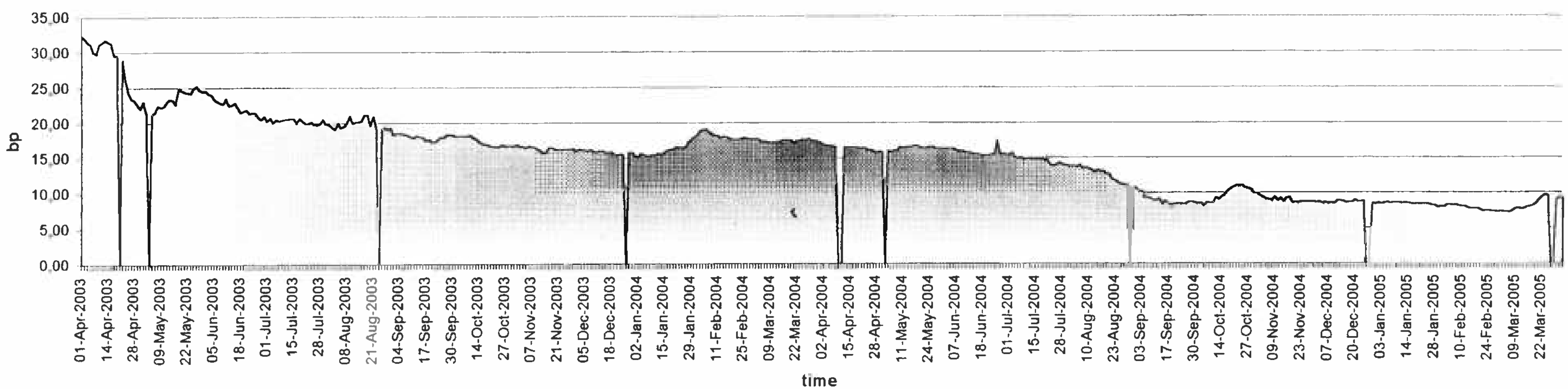


chart 105 basis(cds-yield spread) 08-Sep-2009 abn amro

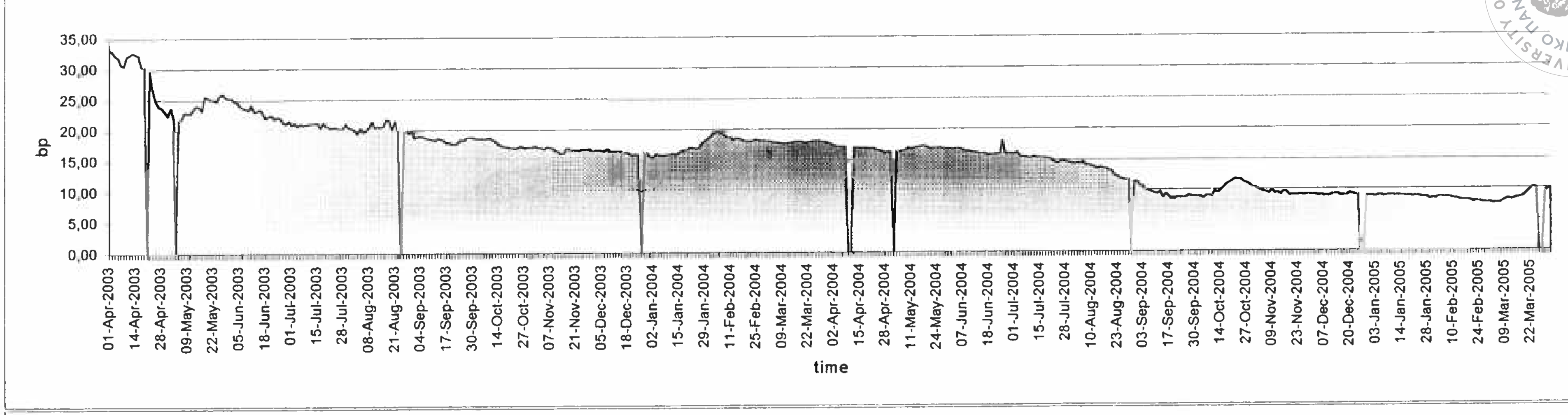


chart 106 basis(cds-yield spread)28-Jun-2010 abn amro

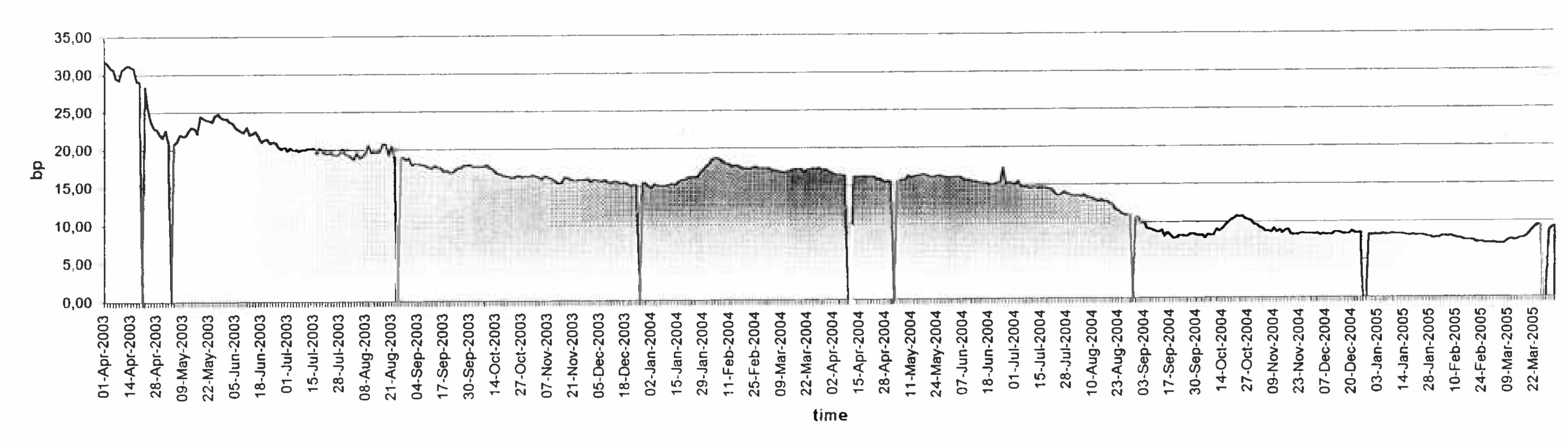


chart 107 basis(cds-yield spread)15-Dec-2010 bacr

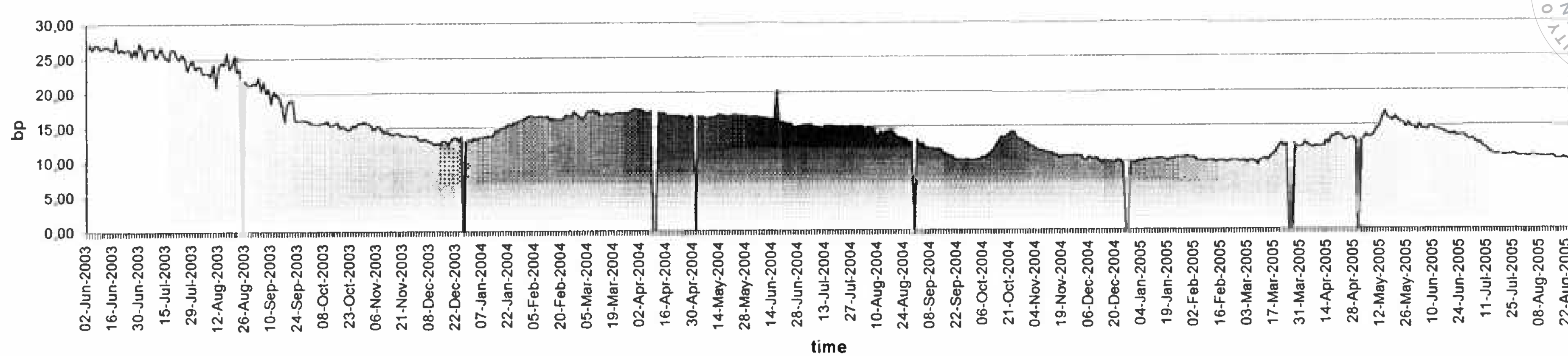


chart 108 basis(cds-yield spread) 08-Mar-2011 bacr

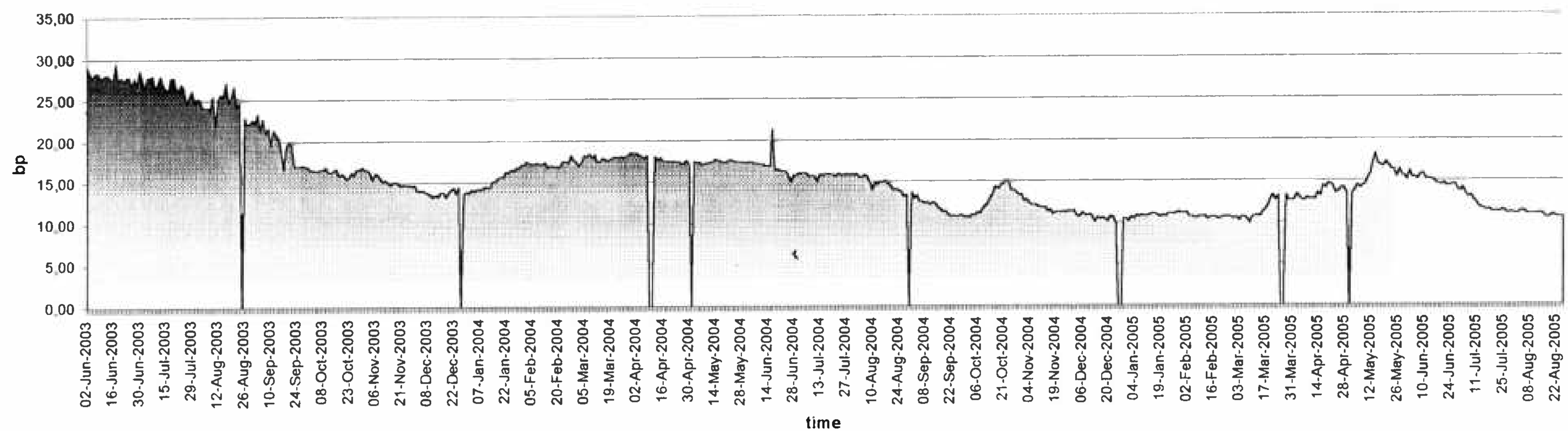


chart 109 basis(cds-yield spread)08-Jul-2011 bacr

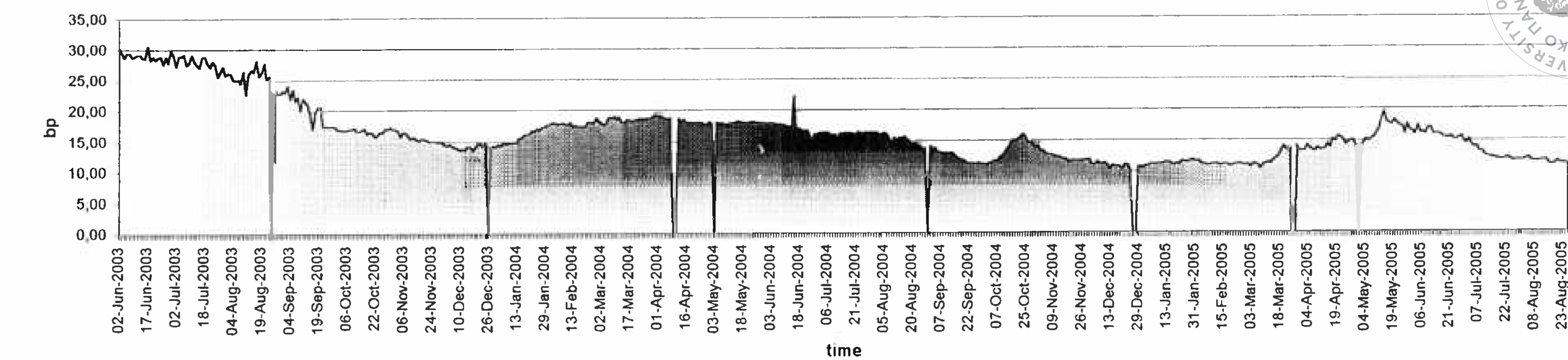


chart 110 basis(cds-yield spread)31-Mar-2013 bacr

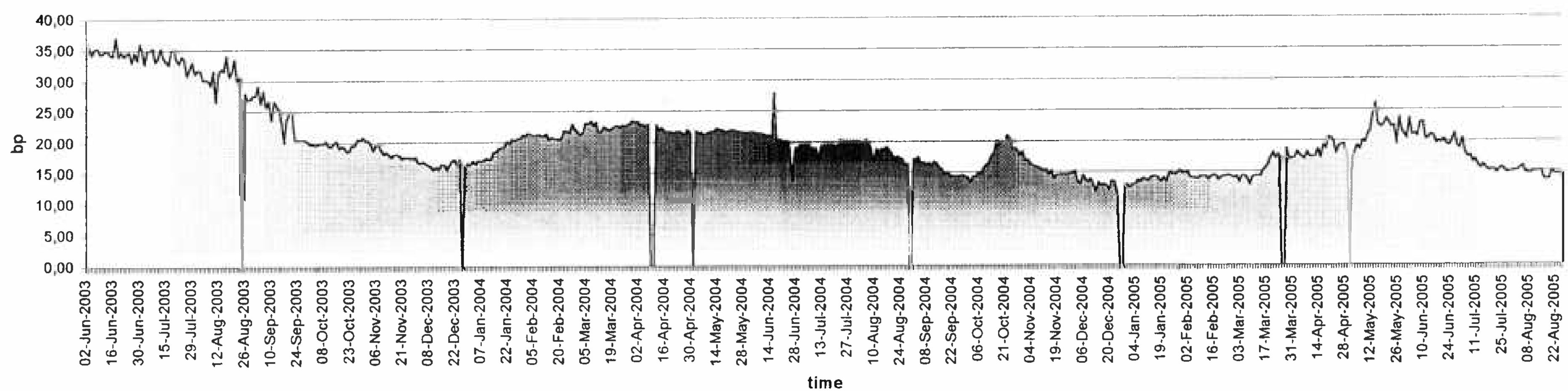


chart 111 basis(cds-yield spread) 23-Jan-2009 dcx

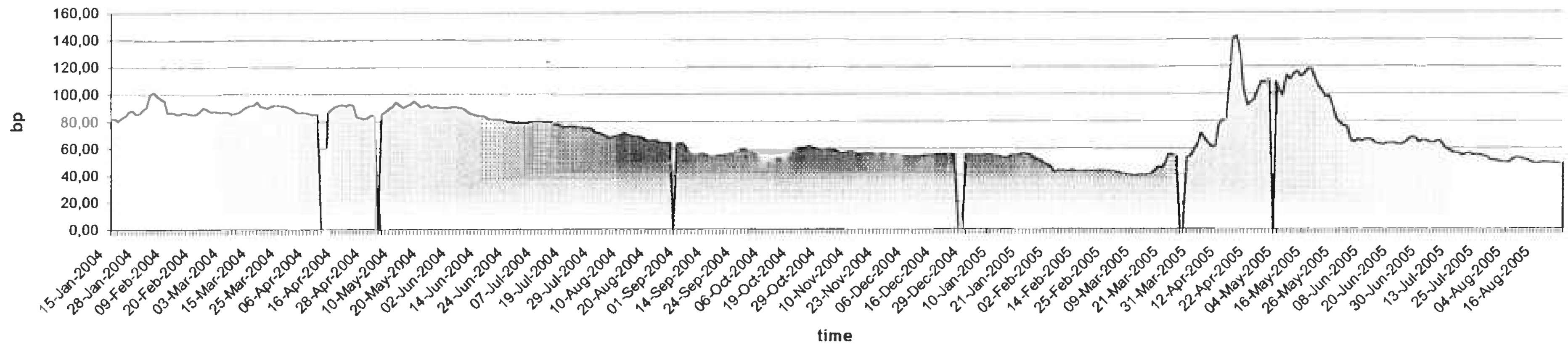


chart 112 basis(cds-yield spread) 21-Mar-2011 dcx

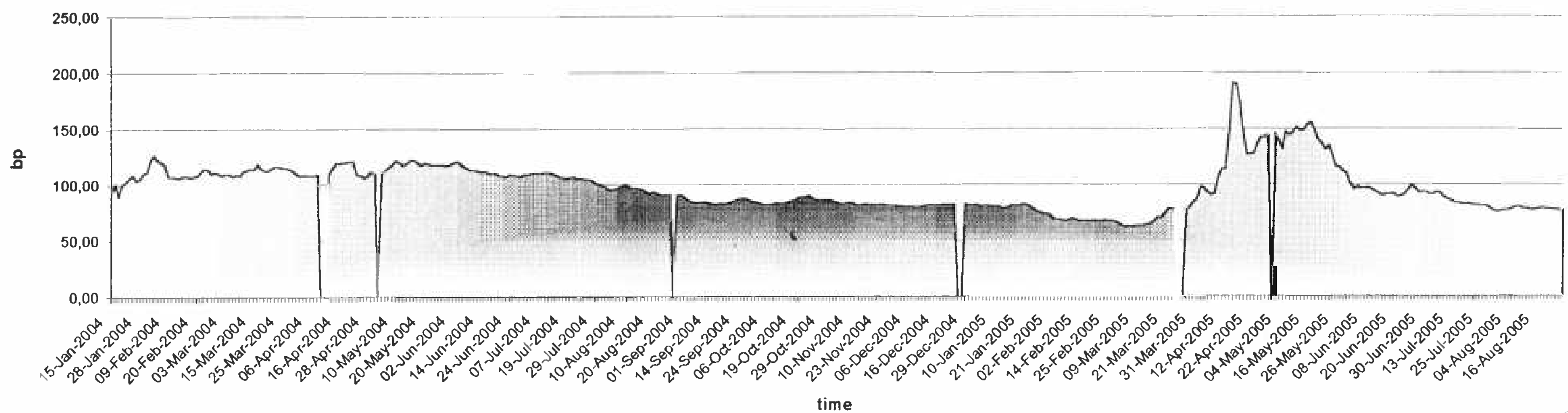


chart 113 basis (cds-yield spread) 28-Jan-2009
edf

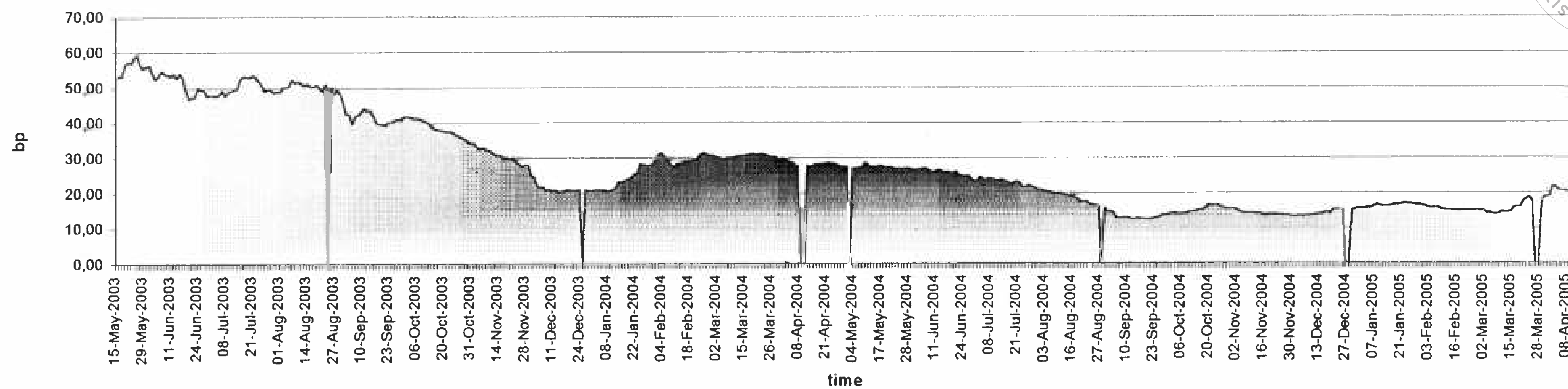
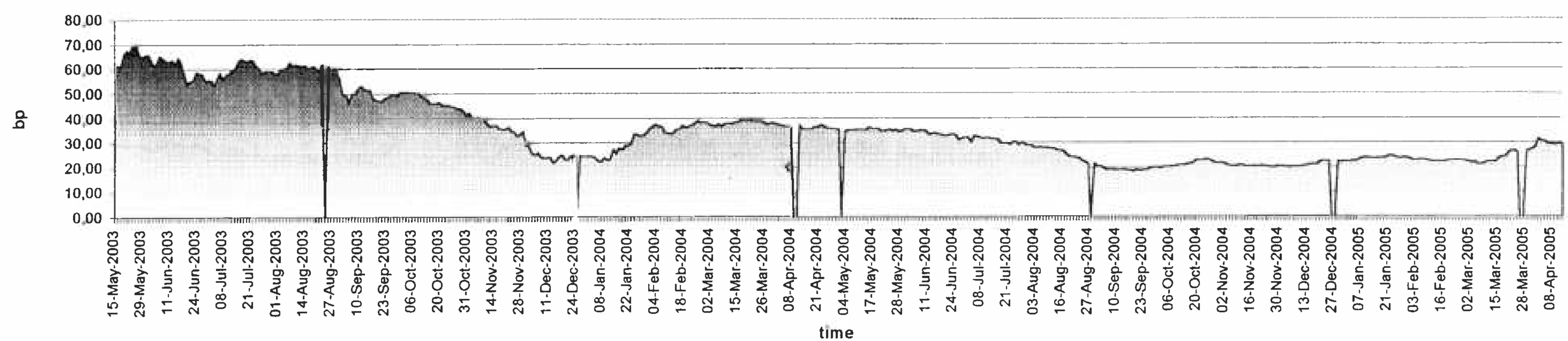


chart 114 basis(cds-yield spread) 25-Oct-2010
edf



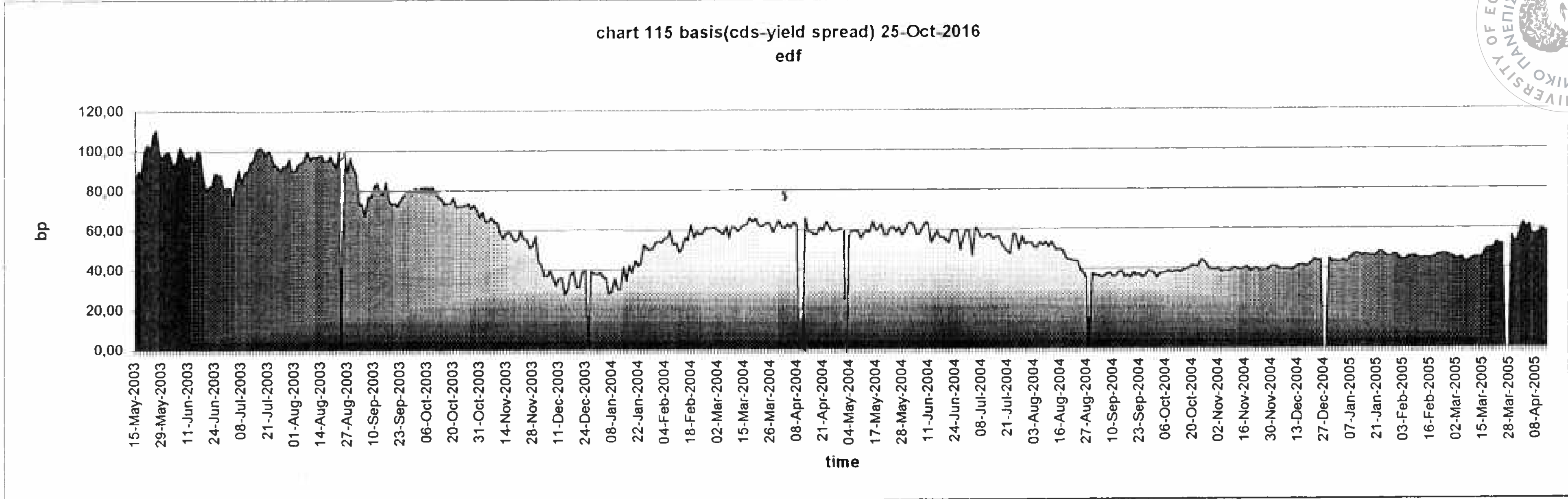


chart 115 basis(cds-yield spread) 25-Oct-2016
edf
bp
time

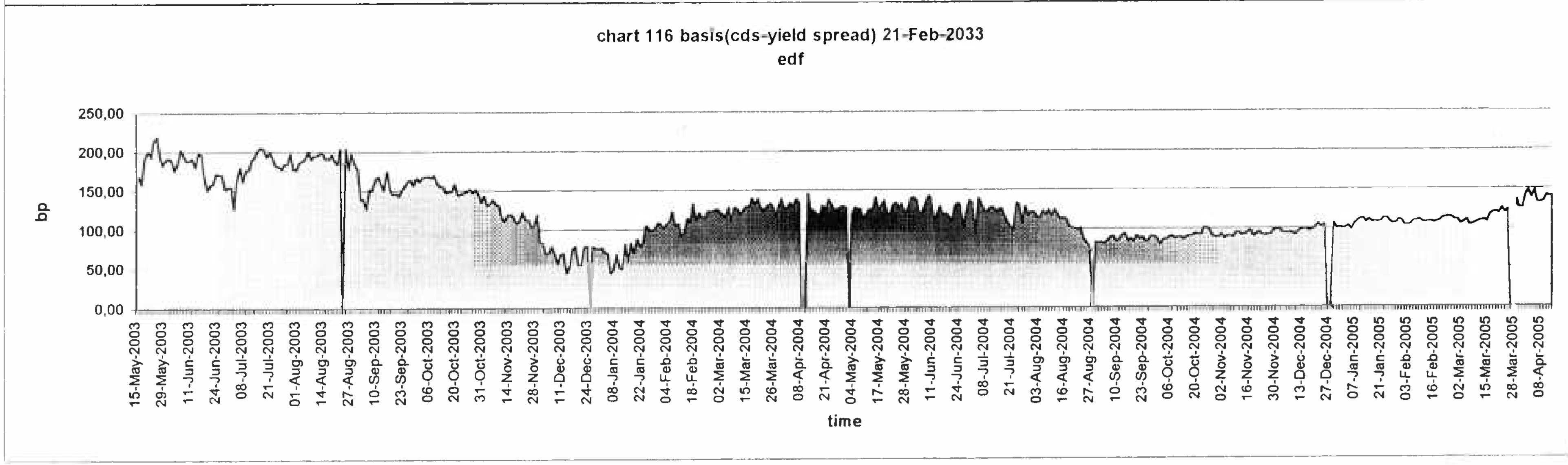


chart 116 basis(cds-yield spread) 21-Feb-2033
edf
bp
time