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The Bond-CDS Funding Basis

The role of funding costs in negative basis trades and the relative value of bonds vs. CDS

- **This report develops a general framework for the funding costs of CDS and bond trades**. Both instruments provide attractive investment opportunities with similar risk return profiles. However, the costs of funding involved in entering these trades can greatly affect their overall P&L. We analyse these costs in detail, differentiating between investors with low and high funding costs (e.g. "banks" vs. "hedge funds").

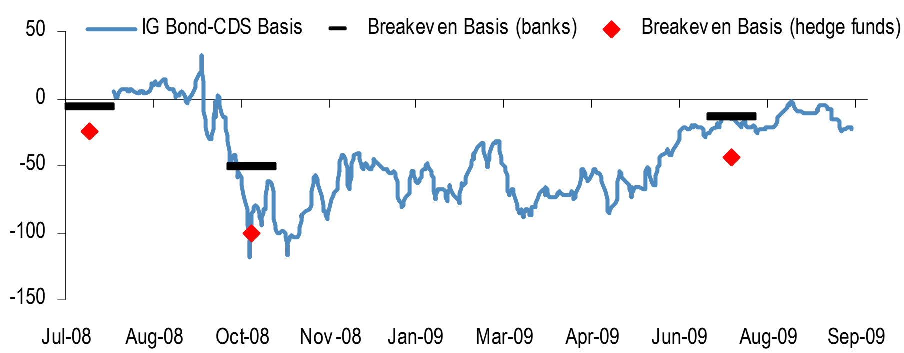
- **Identifying the funding costs allows us to calculate the profitability of negative basis trades**.

  We define the ***Breakeven Basis*** as the level at which the bond-CDS basis is negative enough for the trade to be "profitable", once funding costs are accounted for. We show that these funding costs are a primary driver of the average bond-CDS basis (Figure 1), and that the distribution of individual bonds around this average is a function of the liquidity and supply/demand dynamics around each bond.

- **We also compare the relative value of bonds and CDS to a long risk investor**.

  We define the ***Relative Value Basis*** as the level at which an investor is indifferent to investing in bonds or CDS once funding costs are taken into account. Using the distribution of investment grade basis, we believe that for 35-40% of our bond universe, banks would find it more attractive to sell CDS protection, rather than buying bonds. For hedge funds this proportion would be larger (around 55-60%).

Figure 1: IG Breakeven Basis levels for banks and hedge funds vs. average IG Bond-CDS basis (bp)



Source: J.P. Morgan.

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*We wish to recognise the extensive contribution of **Danny White** to the preparation of this report.*

Table 1: Current Breakeven Basis and Relative Value Basis levels

Breakeven Basis	
IG	Bp.
Banks	-14
Hedge funds	-44
Average bond-CDS basis	-25
HY	
Banks	-62
Hedge funds	-112
Average bond-CDS basis	-120

Relative Value Basis	
IG	Bp.
Banks	-14
Hedge funds	-32
Average bond-CDS basis	-25
HY	
Banks	-62
Hedge funds	-84
Average bond-CDS basis	-120

Source: J.P. Morgan estimates.

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Analysing and Quantifying the Role of Funding Costs

The focus of this publication is the role of funding costs on the level and attractiveness of negative basis trades, as well as on whether long credit risk positions are more attractive via bonds or CDS.

September 2008 saw the bond-CDS basis moving far into negative territory; investors who would have previously traded on a basis as small as -10bp now found themselves confronted by previously unseen basis levels all the way from -50bp to -500bp. The catalyst for this widening of the bond-CDS basis was the rapid decline not only in liquidity, but also in the availability (and cost) of funding. This caused bond spreads to widen far more than CDS spreads, resulting in the highly negative bond-CDS basis.

In the months after the collapse of Lehman Brothers, basis levels remained very negative but the high levels of funding required to purchase bonds or CDS protection inhibited many investors from taking advantage of this. In the market rally of the last few months bonds have outperformed CDS and this has caused the bond-CDS basis to become less negative, but there are still many cases for which significant differences exist in the valuation of bonds and CDS. The funding costs associated with entering a trade have also fallen, meaning that there are many attractive investment opportunities currently available in both bonds and CDS.

The bond-CDS basis has remained highly negative since September 2008 but has recently shown signs of normalisation.

Figure 2: Average Euro Investment Grade Bond-CDS Basis

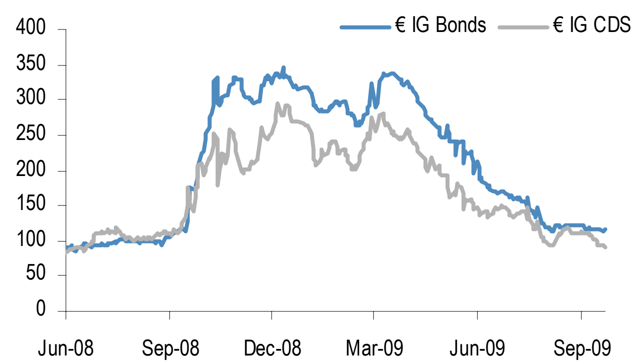
bp

Source: J.P. Morgan. Using the bonds in our Euro Basis Report universe.

Bond credit spreads have largely been the driver behind basis movement; the recent rally in bond prices has outperformed the tightening in CDS spreads.

Figure 3: CDS and Bond Spread levels

bp



Source: J.P. Morgan. Using the bonds in our Euro Basis Report universe.

Funding costs are a key determinant of the profitability of both outright long risk positions and of negative basis trades.[1] In this report we show, for example, that the average negative basis is mainly determined by funding costs, and that how much more negative (or positive) a negative basis is with respect to this average level is more a function of the liquidity and supply/demand dynamics around each bond.

[1] We have analysed the impact of funding costs on the level of negative basis in the recent past: *CMOS*, E Beinstein et al, 31 October 2008; *High Grade Bond and CDS 2009 Outlook*, E Beinstein et al, 5 December 2008; *Bond-CDS Basis Handbook*, A Elizalde, 5 Feb 2009.

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This report aims to investigate the funding costs associated with entering bond and CDS trades from two points of view:

- **Negative basis trades**: **Can we derive a "minimum" (negative) basis level which compensates investors for the funding cost of negative basis trades?** An investor can take advantage of a difference in the valuation of a bond and a CDS and receive an annual income. The funding costs of entering a negative basis trade must be taken into account when establishing whether the trade will be "profitable" or not. We leave aside the attractiveness of negative basis trades as short term MtM trades but focus on whether the basis is negative enough for investors to break even (after paying funding costs) if the trade is held until maturity and funding costs remain constant.

- **Expressing a long risk view with credit: Buy the bond or sell CDS protection?** An investor wishing to go long risk can do so in two different ways: buying bonds or selling CDS protection. If there is a difference in the valuation of the bonds and CDS once funding costs have been taking into account then one method represents a better investment than the other.

Investors can use this framework with their respective funding costs for each particular credit instrument to better gauge the attractiveness of negative basis trades and the relative value between bonds and CDS.

We develop a framework which allows us to quantify the importance of funding costs on negative basis trades and on outright long risk positions.[2] Funding costs are a function of the investor credit quality (e.g. banks vs. hedge funds) and of the credit quality of the underlying instrument (e.g. investment grade vs. high yield). As a consequence, the (numerical) conclusions of our analysis will vary by investor and credit instrument.

We derive a ***Breakeven Basis*** level such that for a negative basis trade to be "attractive" for an investor when funding costs are taken into account (and ignoring any short term mark-to-market P&L) the bond-CDS basis must be more negative than this Breakeven Basis. For example, our analysis shows that the Breakeven Basis for "banks" and "hedge funds" for a typical investment grade bond was:[3] -6 / -25bp before the crisis, -51 / -101bp during the crisis and -14 / -44bp after the liquidity crisis, respectively. These levels closely track our estimates for average investment grade basis before (10bp), during (-75bp) and after (-20bp) the liquidity crisis following the default of Lehman Brothers.

Similarly, we derive a ***Relative Value Basis*** level such that a bond-CDS basis less negative than the relative value basis implies that selling CDS protection is better for going long risk than buying a bond (and vice-versa). For example, with the Relative Value Basis for banks and hedge funds and the current distribution of basis in the investment grade space, we estimate that banks would find it more attractive to sell CDS protection (rather than buying bonds) approximately 35-40% of the time; for hedge funds, this proportion would be larger (around 55-60%).

In the rest of this section we provide an overview of our analysis and conclusions regarding the role of funding costs in both bond-CDS negative basis trades and in the relative value between bond and CDS outright long risk positions.

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[2] The following variables may affect funding costs: Libor, unsecured funding rates, secured (repo) funding rates and repo haircut levels (for bonds), CDS margins, CDS market spread, CDS coupon and CDS upfront.
[3] See assumptions in Table 2.

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The next two sections (*Negative Basis Trades: The Breakeven Basis* and *Expressing a View with Credit: The Relative Value Basis*) expand on the above two themes with a more detailed review, examples and with a historical analysis of funding costs before, during and after the liquidity crisis.

We leave the formal derivation of our framework for the last three sections of the report. We break down and analyse all the funding costs involved when buying bonds and buying/selling CDS protection in Section 4. We then use these funding costs to formally derive the expressions for the Breakeven Basis and Relative Value Basis levels in Sections 5 and 6 respectively.

The Bond-CDS Basis and Funding Costs: Introducing the "*Breakeven Basis*"

Bond-CDS Basis

CDS Spread

minus

Comparable Cash Bond Spread

The bond-CDS basis is defined as the difference in the full running CDS spread and a bond spread measure; usually the Z-spread, asset swap spread or par equivalent CDS spread (PECS)[4]. **The bond-CDS basis is often used to measure the attractiveness of a basis trade**; a negative basis suggests that buying equal notional of both bonds and CDS protection should, theoretically, return a profit on this single name trade if it is held until maturity or it is unwound when the basis becomes less negative. Furthermore, the bond-CDS basis can be used as a measure of the relative value of CDS and bonds; a negative basis implies that buying bonds is better value than selling CDS protection for a long risk investor.

However, in both cases the bond-CDS basis fails to include any of the funding costs involved in entering the trade. These funding costs can have a large impact on the P&L of any trade involving bonds or CDS. In order to ascertain the profitability of a negative basis trade or the relative value of a bond and CDS we must first take these funding costs into account.

For an investor entering a negative basis trade the bond-CDS basis represents the compensation (expressed in running spread per year) that is received when using equal notionals. For example, if the bond-CDS basis is -100bp, an investor can buy a bond and buy CDS protection and earn 100bp per year in a trade with seemingly little credit risk. Although basis trades are exposed to mark-to-market risk we will, in this report, concentrate on the income from the basis itself. Therefore in the above trade a negative basis investor would be "earning" 100bp per year before the costs of funding the trade are deducted; however, if the annual funding is more than 100bp the investor will make a loss every year.

This suggests that for each trade there is some critical level that the basis must exceed in order for the trade to be profitable; we will call this critical level the *Breakeven Basis*. For the trade to return a profit (again, ignoring any mark-to-market P&L) **the bond-CDS basis must be more negative than the *Breakeven Basis***.

The *Breakeven Basis* will be a function of the funding costs that an investor will encounter upon entering the trade, such as: Libor, unsecured funding rates, secured (repo) funding rates, repo haircut levels, CDS margins, CDS market spread, CDS coupon and CDS upfront.

[4] See *Bond-CDS Basis Handbook*, Elizalde, 5 Feb 2009.

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A negative basis trade is only profitable if its basis is more negative than the *Breakeven Basis*.

Table 2: Breakeven Basis – IG example

Bond priced at €90. In bp.

	Jul-08	Oct-08	Jul-09
IG Bond spread	100	300	150
Bank breakeven level	-6	-51	-14
Hedge fund breakeven level	-25	-101	-44
IG Bond-CDS basis	10	-75	-20

Source: J.P. Morgan estimates.

Importantly all these variables are readily available to an investor and so the *Breakeven Basis* should therefore be straightforward to calculate for each investor and for each trade. Table 2 shows an illustrative example of the Breakeven Basis for an IG bond at three different dates (July-08, October-08 and July-09). The *Breakeven Basis* is generally very close to the average bond-CDS basis. **Thus funding costs can be seen as the main driver of the "average" basis; however, as we have shown many times in the past, the dispersion around the average basis level can be very high**.

As we show in the following sections, our main conclusions regarding the Breakeven Basis are as follows:

- **Banks and other investors paying lower funding costs will find that their Breakeven Basis is small enough to make a wide range of bond-CDS negative basis trades attractive in both the IG and HY spaces**. However, investors required to pay higher funding costs (such as hedge funds) will most likely find they are restricted to high-yield names and outliers in the investment grade space.
- **Hedge funds Breakeven Basis levels are more negative than banks since they are subject to higher funding costs**. The average investment grade bond-CDS basis tends to be mid-way between banks' and hedge funds' Breakeven Basis levels. As a consequence, the universe of "attractive" negative basis trades for banks is always larger, and hedge funds only find attractive trades where the negative basis is much more negative than the average basis.
- **According to our estimates, 60-65% of names in IG are currently attractive negative basis trade opportunities for banks, and 25-30% would be profitable for hedge funds.**
- The breakeven levels for banks and hedge funds in the HY space compare more favourably to the average Bond-CDS basis than they do in the IG space suggesting that a large number of HY names would provide an attractive opportunity for a negative basis trade for both banks and hedge funds.
- **The main drivers of the Breakeven Basis are the unsecured and repo funding rates as well as the bond price**. The repo haircut and the CDS margin have a non-negligible, although much lower, effect on the Breakeven Basis. Finally, Libor rates have a much smaller effect on the Breakeven Basis than any of the other factors.

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Bond vs. CDS as outright longs: Introducing the "*Relative Value Basis*"

The *Relative Value Basis* allows an investor to assess whether bonds or CDS are better to express a view on credit:

- Basis more negative than relative value basis: Buying bonds better value for long risk investor.
- Basis less negative than relative value basis: Selling CDS protection better value for long risk investor.

Table 3: Relative Value Basis – IG example

Bond priced at €90. In bp.

	Jul-08	Oct-08	Jul-09
IG Bond spread	100	300	150
Bank breakeven level	-6	-51	-14
Hedge fund breakeven level	-25	-83	-32
IG Bond-CDS basis	10	-75	-20

Source: J.P. Morgan estimates.

An investor wishing to express a long risk view on a single name company can do so either with bonds or with CDS. The bond-CDS basis will give this investor a signal as to whether CDS or bonds currently represents the better value investment; if the basis is negative then the bond spread is greater than the CDS spread and so a long risk investor will get a better return from buying bonds than from selling CDS protection.

However, once again this analysis does not include the funding costs involved in entering trades involving bonds or CDS. We shall go on to calculate a ***Relative Value Basis*** which takes these costs into account; a bond-CDS basis more negative than the relative value basis suggests that buying bonds is the best way for a long risk investor to express a credit view. A bond-CDS basis less negative than the relative value basis implies that selling CDS protection is the best method of going long risk.

Table 3**Error! Reference source not found.** shows an illustrative example of the *Relative Value Basis* for an IG bond at three different dates.

To derive the Breakeven Basis we consider the funding costs of an investor buying a bond and *buying* CDS protection. To derive the Relative Value Basis, we are concerned with the funding costs for an investor buying a bond vs. *selling* CDS protection. Because the bond funding costs are much greater than those of a CDS the relative value basis is usually at a similar level to the Breakeven Basis. In the investment grade space banks tend to have the Relative Value Basis slightly less negative than the average bond-CDS basis whereas for hedge funds the relative value basis is usually more negative than the actual bond-CDS basis.

Using the current distribution of the bond-CDS basis for Euro IG bonds we estimate that banks would find more attractive to sell CDS protection (rather than buying bonds) approximately 35-40% of the time; for hedge funds, this proportion would be larger (~55-60%).

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Negative Basis Trades: The Breakeven Basis

In this section:

- The Breakeven Basis - An overview.
- The Breakeven Basis over the past year.
- The Accuracy of the Breakeven Basis.
- Drivers of the Breakeven Basis.

We consider the case of an investor entering an equal notional negative basis trade. The investor **buys bonds** and also **buys** (equal notional) **CDS protection** on those bonds before going on to **enter into an asset swap** to hedge out any exposure to interest rates. Entering into this trade requires a number of initial payments; an investor unwilling or unable to use his own cash reserves must borrow enough to make these initial payments and will pay interest on this borrowed amount; we shall refer to this interest as the funding costs of the trade.

The investor will receive an annual income from this trade; however, if the funding costs are higher than this annual income then the trade will not be profitable.[5] We therefore define a critical level for the bond-CDS basis at which the annual income is exactly equal to the costs of funding the trade; this critical level is known as the Breakeven Basis: **The annual income from a negative basis trade is only positive when the bond-CDS basis is more negative than the Breakeven Basis.**

Since we are concerned with the real cash flows of the negative basis trade if it is held until maturity, the asset swap spread is the most relevant bond spread measure since, unlike the Z-spread and the PECS, it is a traded measure and will be a real determinant of the trade cash flows.

As we mentioned before, we leave the technical and formal derivation of our framework to compute the determinants of bonds and CDS funding costs as well as to compute the Breakeven Basis for later sections.[6]

By considering the structure of a negative basis trade it is possible to obtain an expression for the total funding and the net annual income of a negative basis trade. This derivation is demonstrated in a later section of the report; the end result is an equation for the Breakeven Basis in terms of the funding costs.

The most simple case is that of a negative basis trade in which the CDS trades on full running spread with no upfront payment; an expression for the Breakeven Basis in this case is shown in Equation 1. The grey box outlines the trade structure and the funding costs involved in the case the CDS trades on a full running format. We analyse them extensively in later sections.

[5] Throughout all this report we consider hold to maturity trades where the funding costs remain constant.
[6] See *Funding Costs for Bonds and CDS Contracts* and *Deriving the Breakeven Basis for Negative Basis Trades* later in this note.

Equation 1: Breakeven Basis for CDS with full running spread

$$Basis_{BREAKEVEN} = -F - mF + (1-h)(F-R)\, P/100$$

F = Unsecured funding rate   m = CDS margin   h =Repo haircut   R = Repo rate
P = Bond dirty price

Equation 1 assumes that the investor enters into a repo agreement to reduce the overall funding costs (since the secured repo funding rate should be lower than the unsecured funding rate).

Negative basis trade structure and funding costs involved: An illustrative example

Let's assume that an investor buys a bond and full running CDS protection with the same notional. Additionally, the investor enters into a par asset swap package, i.e. the investor pays par and receives Libor plus the asset swap spread on the bond notional.

CDS funding costs: For a full running CDS the investor needs to fund the margin ***m*** required by its counterparty, at Libor *L* plus the investor's unsecured funding rate ***F***. The investor is paid Libor on the posted margin. When the CDS trades with an upfront and a fixed coupon the funding/investment of the upfront would need to be taken into account.

Bond funding costs: The investor is able to fund part of the bond via a repo transaction. If the repo haircut is ***h***, the investor funds *(1-h)%* of the bond (dirty) price ***P*** at Libor *L* plus the repo (i.e. secured) funding rate ***R***, and the rest of the bond notional at Libor *L* plus the unsecured funding rate ***F***.

As we show later, if the CDS was to trade on a full upfront format, the Libor rate would not affect the Breakeven Basis. Even in the case where the CDS trades on an upfront plus fixed coupon format, the impact of Libor on the Breakeven Basis is very limited.[7]

Breakeven Basis example:[8]

Unsecured rate	*F* = 125bp
CDS margin	*m* = 10%
Repo haircut	*h* = 10%
Repo rate	*R* = 50bp
Bond dirty price	*P* = 90

Breakeven Basis = -125-0.1*125 +(1-0.1)*(125-50)*0.9

= -76.75bp

Example: If the CDS full running spread is 100bp and the asset swap spread is 200bp then the bond-CDS basis is -100bp[9] and so is more negative than the Breakeven Basis shown in the example on the left. The trade will therefore return an annual profit.

For a negative basis trade in which the CDS does involve an upfront payment the situation is more complex since, unlike the other initial payments, the CDS upfront is not returned back to the investor at default or maturity; it instead must be amortised from any annual income the investor makes. If the trade ends before the upfront has been fully amortised due to a default then the investor will make a loss. As such, for trades with a CDS upfront we define the Breakeven Basis as the level at which the investor makes zero P&L at the maturity of the trade; i.e. the accumulated income at maturity is exactly enough to cancel out the upfront amount.[10]

[7] See *Drivers of the Breakeven Basis* section.
[8] Funding rates *F* and *R* are given in addition to Libor. For example, if the standard unsecured funding rate was Libor + 125bp then *F* = 125bp. The haircut is the proportion of the bond dirty price that cannot be funded at the repo rate. For a detailed explanation of the structure of a negative basis trade see the section *Funding Costs for Bonds and CDS Contracts* later in this report.
[9] We choose to use the asset swap spread as our bond spread in this report as this is equal to the actual income that will be received from the asset swap on top of Libor.
[10] See Equation 23 for the Breakeven Basis for a negative basis trade with a non-zero CDS upfront.

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Evolution of the Breakeven Basis

To obtain an idea of how the Breakeven Basis may behave in the future it is useful to examine the behaviour of funding levels and the Breakeven Basis throughout the last year.

Table 4: Approximate unsecured funding levels ***F*** over the past year

In bp.

	Jul-08	Oct-08	Jul-09
Hedge fund	150	300	200
Bank	75	150	100

Source: J.P. Morgan estimates.

To compute a range of values for the Breakeven Basis we split investors into two broad categories; those who have access to cheap credit who we shall call "banks" and those investors who are required to pay higher levels of funding who we shall describe as "hedge funds".[11] Table 4 shows rough estimates of the unsecured funding levels *F* over the past year. Credit was at its least expensive before the collapse of Lehman Brothers, after which the cost of borrowing greatly increased as banks became very wary of lending to one another. However, in recent months funding costs have begun to decrease again but have some way to go before they reach their Summer 2008 levels. For the purposes of this report, we assume that the current funding costs remain at their July 2009 levels.

Table 5 and Table 6 show the Breakeven Basis levels for banks and hedge funds over the last year. As would be expected from the evolution of the funding levels the Breakeven Basis was at its least negative last summer, then became highly negative shortly after the onset of the liquidity crisis. The Breakeven Basis is now currently less negative than it was nine months ago but, like the funding levels, it has still not returned to 2008 levels.

Table 5: Example Breakeven Basis levels - Hedge funds

For a bond price of €90. In bp.

	Hedge funds		
Bond spread	Jul-08	Oct-08	Jul-09
0-100	-25	-73	-26
101-300	-29	-101	-44
301-600	-44	-142	-74
601-1200	-66	-202	-112
1201-2500	-104	-284	-171

Source: J.P. Morgan estimates.

Table 6: Example Breakeven Basis levels - Banks

For a bond price of €90. In bp.

	Banks		
Bond spread	Jul-08	Oct-08	Jul-09
0-100	-6	-34	-3
101-300	-9	-51	-14
301-600	-19	-76	-37
601-1200	-35	-109	-62
1201-2500	-58	-150	-100

Source: J.P. Morgan estimates.

Investment Grade

Figure 4 shows the historical Breakeven Basis levels from Table 5 and Table 6 compared with the average IG Bond-CDS basis. The black line denoting the breakeven level for banks is generally around the same levels as the average basis, suggesting that a sizeable proportion of the names in IG remain attractive to banks as a negative basis trade. Hedge funds however find their breakeven to be somewhat below the average IG basis and so only the most extreme outliers in the IG distribution will be profitable negative basis trades for hedge funds.

[11] The measures for the different funding costs (levels and margins) we use throughout the report are our estimates only. The numerical results we present are sensitive to funding cost levels.

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Table 7: IG Breakeven levels vs. Historical average IG Bond-CDS basis

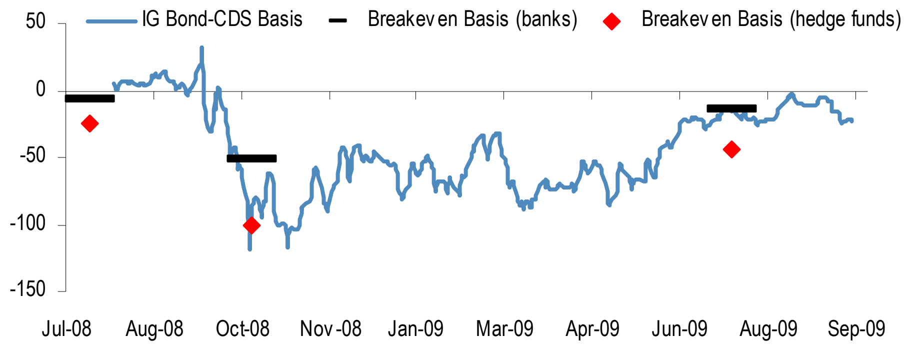
For a bond priced at €90. In bp.

	Jul 08	Oct 08	Jul 09
Bond spread	100	300	150
Bank breakeven level	-6	-51	-14
Hedge fund breakeven level	-25	-101	-44
IG Bond-CDS basis	10	-75	-20

Source: J.P. Morgan estimates.

Figure 4: IG Breakeven Basis levels compared to IG Bond-CDS basis

Breakeven Basis for a bond priced at €90. In bp.



Source: J.P. Morgan. Using the Euro IG bond universe in our basis reports.

Hedge funds Breakeven Basis levels are more negative than banks since they are subject to higher funding costs. The average investment grade bond-CDS basis tends to be mid-way between banks' and hedge funds' Breakeven Basis levels. As a consequence, the universe of "attractive" negative basis trades for banks is always larger, and hedge funds only find attractive trades where the negative basis is well below the average basis.

By examining the distribution of names within the IG space, we can estimate what proportion of IG names have a bond-CDS basis more negative than the Breakeven Basis and so would make profitable negative basis trades. This data is shown in Table 8.

Table 8: Proportion of IG bonds with bond-CDS basis more negative than breakeven basis

	Jul-08	Oct-08	Jul-09
Banks	22%	51%	57%
Hedge funds	12%	29%	29%

Source: J.P. Morgan estimates. Using the Euro IG bond universe in our basis reports.

Figure 5 shows the current distribution of the bond-CDS basis for Euro IG bonds together with banks' and hedge funds' investment grade Breakeven Basis levels. **We estimate that 60-65% of bonds in the IG that we consider are currently attractive negative basis trade opportunities for banks, and 25-30% would be profitable for hedge funds.**

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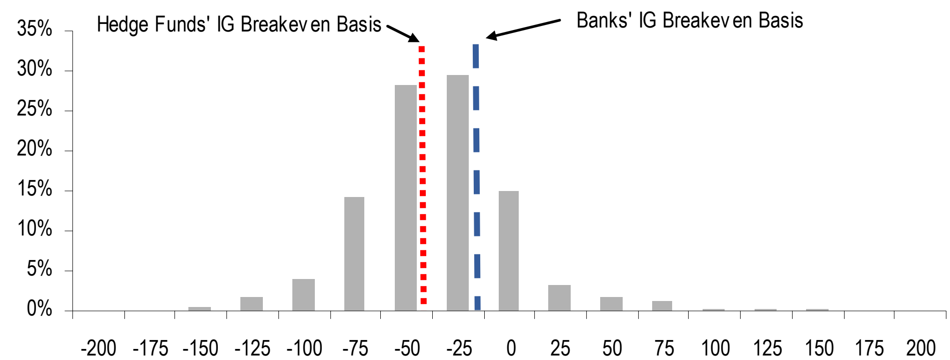
Figure 5: Current distribution of the bond-CDS basis for Euro IG bonds



Source: J.P. Morgan. Using the Euro IG bond universe in our basis reports.

Table 9: HY Breakeven levels vs. Historical average HY bond-CDS basis

For a bond priced at €90. In bp.

	Jul 08	Oct 08	Jul 09
HY Bond spread	670	1220	920
Bank breakeven level	-35	-150	-62
Hedge fund breakeven level	-66	-284	-112
HY Bond-CDS basis	-80	-440	-150

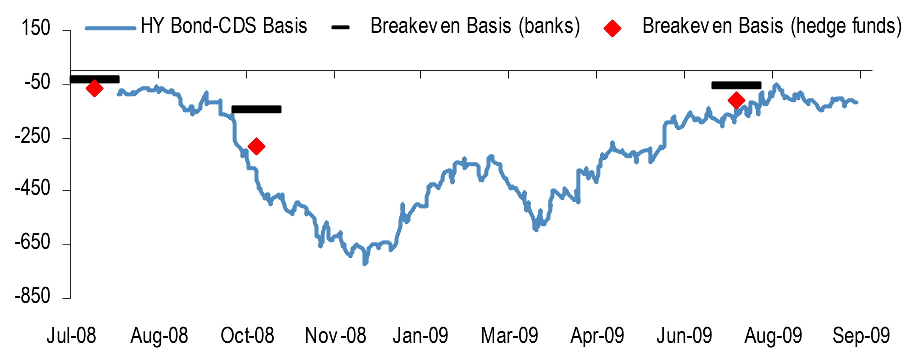
Source: J.P. Morgan estimates.

High Yield

We now examine the HY space; Figure 6 shows the same as Figure 4 but for the HY space instead of IG.[12] The breakeven levels for banks and hedge funds in the HY space compare more favourably to the average Bond-CDS basis than they do in the IG space suggesting that **a large number of HY bonds would provide an attractive opportunity for a negative basis trade for both banks and hedge funds.**

Figure 6: HY Breakeven Basis levels compared to HY bond-CDS basis

Breakeven basis for a bond priced at €90. In bp.



Source: J.P. Morgan. Using the average USD HY bond-CDS basis.

By examining the distribution of names in HY, we estimate that 65-70% of names in HY would currently be attractive negative basis trade opportunities for banks. 55-60% would be profitable for hedge funds.

In conclusion, banks and other investors paying lower funding costs will find that their Breakeven Basis is small enough to make a wide range of names attractive in both the IG and HY spaces. However, investors required to pay higher funding costs will most likely find they are restricted to high-yield names and outliers in the investment grade space.

[12] We use the average USD HY bond-CDS basis rather than the EUR one, due to the small universe of EUR HY bonds for which we track the bond-CDS basis.

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In theory the bond-CDS basis should move roughly in line with the Breakeven Basis as any large deviation will result in investors taking advantage via either positive or negative basis trades, thus causing the bond-CDS basis and Breakeven Basis to converge. Both Figure 4 and Figure 6 support this hypothesis.

Where next for the Breakeven Basis?

With the easing of the liquidity crisis funding levels are continuing to fall. Further reductions in the costs of funding will make the Breakeven Basis less negative and in doing so will make more negative basis trades available to a range of investors. Investors entering these trades would cause the bond-CDS basis to tighten further.

Even if funding levels now stabilise and do not return to their 2008 levels it seems highly unlikely that they will increase significantly without another banking crisis on the scale of the Lehman Brothers collapse.

The accuracy of the Breakeven Basis

In deriving the expression for the Breakeven Basis we make several generalisations in order to make the calculations much more straightforward. One factor that could affect the P&L of the trade that has not been accounted for are any future changes in funding rates; the derivation assumes that the trade can be funded at the initial costs for the entire duration of the trade. However in practice it is likely that an investor would have to renew their funding at regular intervals and so would be somewhat exposed to changes in the levels of funding.

In any case, the Breakeven Basis is still a very useful measure of the profitability of a negative basis trade as it takes into account all of the funding costs an investor will encounter when entering such a trade and makes it clearer which trades will be profitable; a buy-and-hold investor can look down a list of single name companies and immediately identify which names will not be profitable; the investor can then decide which of the remaining single names are best suited for negative basis trades.

Drivers of the Breakeven Basis

Drivers of the Breakeven Basis

Primary drivers:

- Unsecured funding rate F
- Repo rate R
- Bond dirty price P

Secondary drivers:

- CDS Margin m
- Repo haircut h

Minor drivers:

- Libor L

The Breakeven Basis greatly affects the number of attractive negative basis trades available to an investor and as such it is very useful to know how a change in one variable affects the Breakeven Basis.

The Effect of the Unsecured Funding Rate *F* on the Breakeven Basis

One of the main drivers of the Breakeven Basis is the standard unsecured funding rate that an investor must pay on any unsecured loan in addition to Libor. The effect of changing the unsecured funding rate F is shown in Figure 7 for three trades; one with a repo haircut h of 0%, one with h = 20% and one with h = 50%

As would be expected a higher unsecured funding rate results in higher funding costs and therefore a more negative Breakeven Basis. However, the repo haircut affects the linear relationship between the two; the higher the haircut the more of the bond is funded via the unsecured funding F and so the greater the negative effect of F on the Breakeven Basis. This can be observed in Figure 7; the curve with the smallest gradient has the smallest haircut. When the unsecured funding rate F is equal to the repo rate R of 50bps the haircut has no effect on the Breakeven Basis whatsoever.

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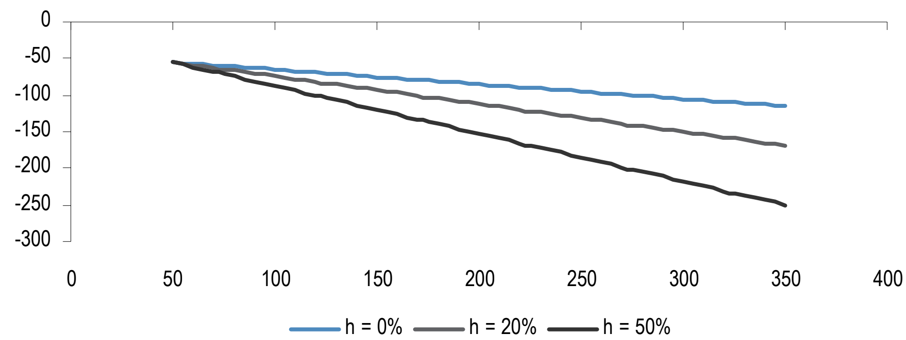
Figure 7: Breakeven Basis vs. Unsecured Funding Rate

Y-Axis: Breakeven Basis (bp). X-Axis: Unsecured Funding Rate *F* (bp).
Assumptions: Libor *L* = 100. CDS Margin *m* = 10%. Repo Rate *R* = 50bp. Bond dirty price *P* = 90.



Source: J.P. Morgan.

The role of the repo rate R

The investor funds, at Libor plus the secured repo rate *R*, the bond (dirty) price times one minus the repo haircut *h*. The rest is funded at Libor plus the investor's unsecured funding rate *F*.

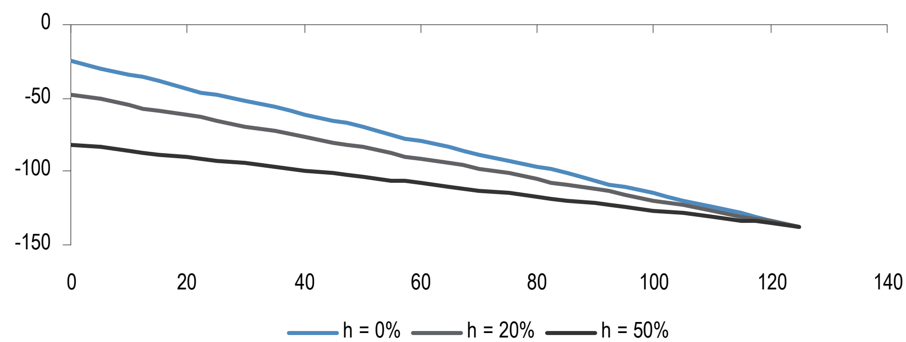
The Effect of the (Secured Funding) Repo Rate *R* on the Breakeven Basis

Similar to the unsecured funding rate a change in the repo rate also has a large effect on the Breakeven Basis; the higher the repo rate the higher the funding costs and the more negative the Breakeven Basis. The relationship between the Breakeven Basis and the repo rate is shown in Figure 8 for haircuts of 0, 20 and 50%. In this case, the greater the haircut the less of the bond price is funded at the repo rate and so the smaller the effect of the repo rate on the Breakeven Basis.

As above, the Breakeven Basis becomes independent of the haircut at the point where the repo rate is equal to the unsecured funding rate.

Figure 8: Breakeven Basis vs. Repo Rate

Y-Axis: Breakeven Basis (bp). X-Axis: Repo Rate *R* (bp).
Assumptions: Libor *L* = 100. CDS Margin *m* = 10%. Unsecured Funding Rate *F* = 125bp. Bond dirty price *P* = 90.



Source: J.P. Morgan.

The Effect of the Bond Dirty Price *P* on the Breakeven Basis

The bond price also greatly affects the Breakeven Basis. Counter-intuitively a higher bond price actually results in lower funding costs and a less negative Breakeven Basis as more of the notional can now be funded at the lower repo rate *R*. The haircut amplifies this effect and so the bond price has a greater effect on the Breakeven Basis for larger haircuts, as can be seen in Figure 9.

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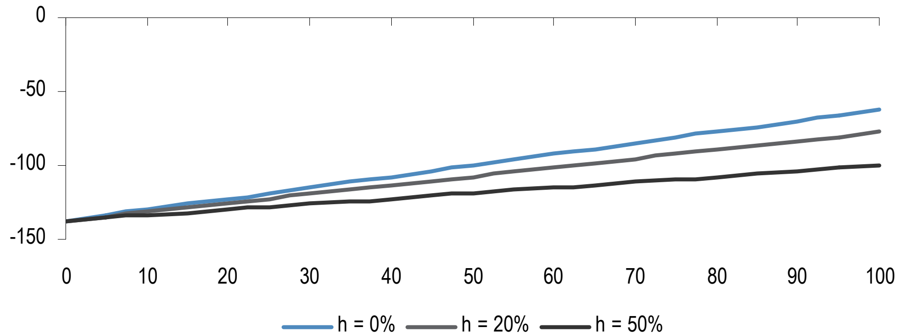
Figure 9: Breakeven Basis vs. Bond Dirty Price

Y-Axis: Breakeven Basis (bp). X-Axis: Bond Dirty Price *P* ($).
Assumptions: Libor *L* = 100bp. CDS Margin *m* = 10%. Unsecured Funding Rate *F* = 125bp. Repo Rate = 50bp.



Source: J.P. Morgan.

We assume that the investor is entering into a par asset swap package and paying par. As a consequence, the investor has to fund the bond notional, irrespective of the price. Assuming the bond price is below par, a higher price increases the part that is funded at the secured repo rate *R* and decreases the part that is funded at the unsecured funding rate *F*. Since the repo rate is lower than the unsecured funding rate, a higher price reduces the overall funding costs of the transaction and makes the trade more attractive.

The Effect of the CDS Margin *m* on the Breakeven Basis

The CDS margin essentially amplifies the effect that the unsecured funding rate *F* has on the Breakeven Basis. A larger margin will not only increase the total funding costs and make the Breakeven Basis more negative, it will result in the unsecured funding rate having a greater effect on the Breakeven Basis as well.

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Libor has a very small effect on the Breakeven Basis

The Effect of Libor L on the Breakeven Basis

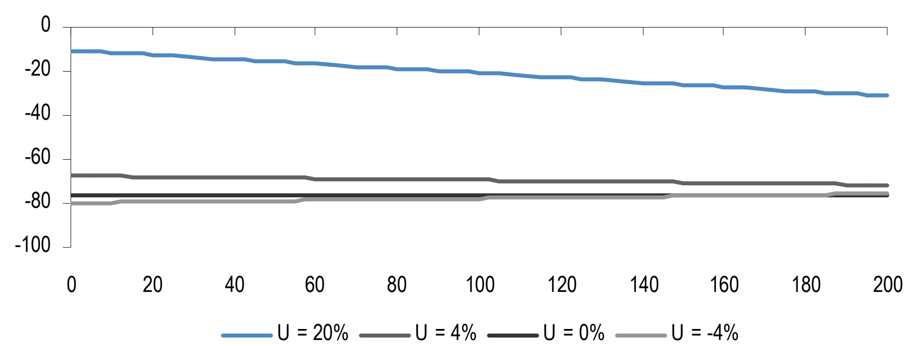
The Libor rate *L* does not appear in Equation 1 as for a trade with zero CDS upfront the Libor received from the asset swap completely cancels out any Libor paid as part of funding costs. However, for trades with a CDS upfront an investor must pay Libor plus the unsecured funding rate *F* on this upfront and so the Breakeven Basis does have some Libor dependency when there is a CDS upfront.

The relationship between the Breakeven Basis and Libor is shown in Figure 10 for negative basis trades in the case where there is zero upfront (U = 0%), the case where the investor pays an upfront (U = 4%) and the case where the investor receives an upfront (U = -4%)

The conclusion is that the value of Libor has a very small effect on the Breakeven Basis; e.g. for a reasonably sized upfront of 4% a 200bp change in Libor only resulted in a 4bp change in the Breakeven Basis. Even for very high upfronts the change is relatively small compared to that of other drivers; e.g. for a large 20% upfront a 200bp in Libor results in a 21bp change in the Breakeven Basis. The same change in the unsecured funding rate *F* would cause a 130bp change in the Breakeven Basis.

Figure 10: Breakeven Basis vs. Libor

Y-Axis: Breakeven Basis (bp). X-Axis: Libor L (bp).
Assumptions: Libor *L* = 100. CDS Margin *m* = 10%. Unsecured Funding Rate *F* = 125bp. Bond Dirty Price *P* = 90. CDS Coupon *C* = 100bp. Time to maturity *T* = 5 years. Repo Haircut *h* = 10%.



Source: J.P. Morgan.

The Effect of the CDS Coupon *C* on the Breakeven Basis

For trades in which the CDS does trade with an upfront the Breakeven Basis is dependent on the CDS coupon[13]. The relationship between the Breakeven Basis and the CDS coupon is shown in Figure 11. The smaller the coupon the less negative the Breakeven Basis making more trades attractive. As we reduce the coupon (for a given full running CDS spread), the upfront becomes more negative (less positive) for a CDS protection buyer. However, a larger upfront also has the disadvantage of making the investor more exposed to the risk of an early default[14].

[13] See Equation 23.
[14] For the effects of the CDS coupons and upfronts on the P&L profile of the trade see the *P&L and the Breakeven Basis for CDS Contracts with an Upfront* chapter.

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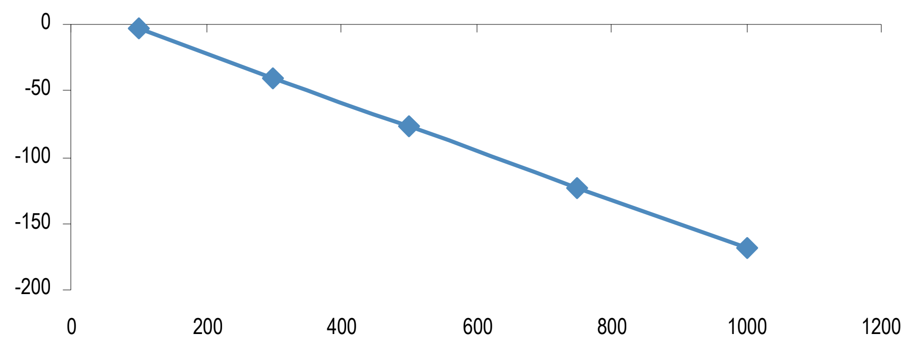
Only certain coupon values are commonly traded; Figure 11 shows coupon values of 100, 300, 500, 750 and 1000bp. As this is a variable that the investor has some degree of control over it is not a driver of the Breakeven Basis in the usual sense but is instead a way for the investor to manipulate the P&L profile of the trade; investors may however find that they are restricted to certain coupon values.

Figure 11: Breakeven Basis vs. CDS Coupon

Y-Axis: Breakeven Basis (bp). X-Axis: CDS Coupon C (bp).

Assumptions: Libor L = 100. CDS Margin m = 10%. Unsecured Funding Rate F = 125bp. Bond dirty price P = 90. CDS full running spread S_{CDS} = 500bp. Repo Haircut h = 10%. Time to maturity T = 5 years.



Source: J.P. Morgan

Conclusion

In conclusion, the main drivers of the Breakeven Basis are the unsecured and repo funding rates F and R as well as the bond price P; changes in these three variables have the greatest effect on the Breakeven Basis.

The repo haircut h and the CDS margin m have a non-negligible effect on the Breakeven Basis but their effect is to amplify or reduce the effects of the three main drivers F, R and P; as such, whilst remaining important drivers they are not as crucial to the Breakeven Basis as the three primary drivers.

Libor has a much smaller effect on the Breakeven Basis than any of the other factors as it is only paid on the CDS upfront, which itself is a fraction of the total notional. It would take a very large change in Libor to have a noticeable effect on the Breakeven Basis.

Finally, although the CDS coupon used has a significant effect on the Breakeven Basis it is not a driver in the same sense as the other factors; the investor may be able to choose the coupon used for example. Furthermore, any reduction in the Breakeven Basis due to the choice of coupon will be offset by a higher exposure to an early default[15].

[15] See the *Effect of coupon size on breakeven time and final P&L* chapter later in this report.

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Expressing a View with Credit: The Relative Value Basis

An investor wishing to express a view on a single name company with credit can do so either by trading CDS or with bonds:

- A long risk investor can either buy bonds or sell CDS protection.
- A short risk investor can either sell bonds or buy CDS protection

A different pricing between the bonds and CDS should imply that one method will represent a better investment for each investor. This valuation must include the funding costs required to enter CDS or bond trades.

Due to the complications associated with short selling bonds we shall concentrate on long risk investors; for these investors both selling CDS protection and buying bonds represent viable options. To ascertain which method is a better value investment we compare the CDS spread minus any CDS funding costs and the bond compensation[16] minus any bond funding costs.

The *Relative Value Basis* allows an investor to assess which of bonds and CDS is better to express a view on credit.

- Basis more negative than relative value basis: Buying bonds better value for long risk investor.
- Basis less negative than relative value basis: Selling CDS protection better value for long risk investor.

Since we are using the bond-CDS basis as our reference measure, we will define the **Relative Value Basis** as the point where selling CDS protection and buying bonds are of equal value to a long risk investor. A bond-CDS basis more negative than the relative value basis implies that buying bonds is a better investment than selling CDS protection for a long risk investor; the bond gives a better return than the CDS whilst being exposed to the same credit risk. Similarly, if the bond-CDS basis is less negative than the Relative Value Basis then selling CDS protection is the more attractive option.

In the previous section we were interested in the funding costs of an investor buying a bond and *buying* CDS protection. Here, we are concerned with the funding costs for an investor buying a bond vs. *selling* CDS protection. Because the bond funding costs are much greater than those of a CDS the relative value basis is usually at a similar level to the Breakeven Basis.

We derive an equation for the Relative Value Basis in the *Deriving the Relative Value Basis* section; the expression we obtain in the case that there is no CDS upfront is shown in Equation 2.

Equation 2: Relative Value Basis for CDS with full running spread

$$Basis_{RELATIVEVALUE} = -F + mF + (1-h)(F-R)\, P/100$$

F = Unsecured funding rate h =Repo haircut R = Repo rate P = Bond dirty price
m = CDS margin

Relative Value Basis Example:

Unsecured rate	*F* = 125bp
CDS margin	*m* = 10%
Repo haircut	*h* = 10%
Repo rate	*R* = 50bp
Bond dirty price	*P* = 90

Relative Value Basis =
-125+0.1*125+(1-0.1)*(125-50)*0.9

= -51.75bp

[16] Libor plus asset swap spread, in our analysis.

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Evolution of the Relative Value Basis

By plugging historical funding levels into Equation 2 we can track the behaviour of the relative value basis over the past year. As would be expected the relative value basis behaves in a similar fashion to the Breakeven Basis. Table 10 and Table 11 show the relative value basis for Hedge Funds and Banks for a range of bond spreads; from comparing these to Table 5 and Table 6 it can be seen that the breakeven and relative value bases are strongly correlated.

Table 10: Example Relative Value Basis Levels - Hedge Funds

For a bond priced at €90. In bp.

	Hedge funds		
Bond Spread	Jul-08	Oct-08	Jul-09
0-100	-25	-64	-22
101-300	-28	-83	-32
301-600	-40	-112	-58
601-1200	-59	-148	-84
1201-2500	-89	-200	-129

Source: J.P. Morgan estimates.

Table 11: Example Relative Value Basis Levels - Banks

For a bond priced at €90. In bp.

	Banks		
Bond Spread	Jul-08	Oct-08	Jul-09
0-100	-6	-34	-3
101-300	-9	-51	-14
301-600	-19	-76	-37
601-1200	-35	-109	-62
1201-2500	-58	-150	-100

Source: J.P. Morgan estimates.

In the investment grade space banks tend to have the Relative Value Basis slightly less negative than the average bond-CDS basis whereas for hedge funds the relative value basis is usually more negative than the actual bond-CDS basis; this data can be observed in Table 12. By examining the distribution of names within IG we can also establish the proportion of names for which CDS is a better value investment than bonds; this data is shown in Table 13.

We discover that prior to the liquidity crisis CDS were of better value than bonds for around 80% of single names in IG. Since the crisis the value of bonds has improved compared to CDS; currently CDS is a better value long-risk investment for around half the names in IG.

Table 12: IG Relative value levels vs. Historical average IG Bond-CDS basis

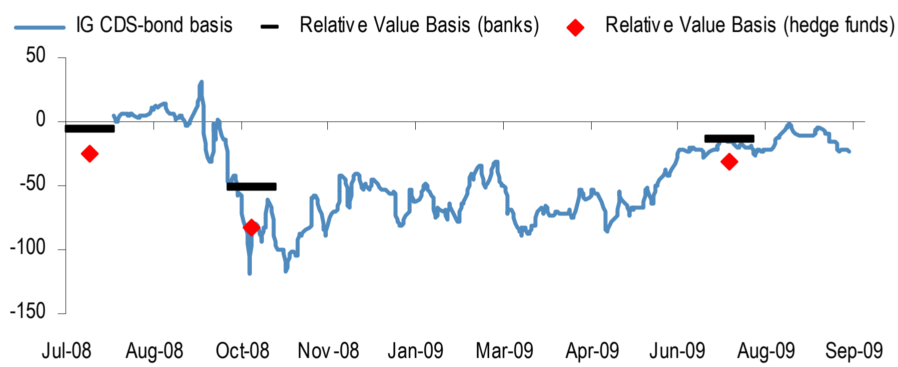
For a bond priced at €90. In bp.

	Jul 08	Oct 08	Jul 09
Bond spread	100	300	150
Bank relative value level	-6	-51	-14
Hedge relative value level	-25	-83	-32
IG Bond-CDS basis	10	-75	-20

Source: J.P. Morgan estimates.

Figure 12: IG Relative Value Basis compared to IG bond-CDS basis

Relative Value Basis for a bond priced at €90. In bp.



Source: J.P. Morgan. Using the Euro IG bond universe in our basis reports.

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Table 13: Proportion of IG bonds for which CDS is better value than bonds for long-risk investors

	Jul-08	Oct-08	Jul-09
Banks	78%	49%	43%
Hedge funds	88%	62%	60%

Source: J.P. Morgan estimates. Using the Euro IG bond universe in our basis reports.

Figure 5 showed the current distribution of the bond-CDS basis for Euro IG bonds. Using banks' and hedge funds' investment grade Relative Value Basis levels, **we estimate that banks would find more attractive to sell CDS protection (rather than buying bonds) 35-40% of the time in the IG space. For hedge funds, this proportion would be larger (55-60%).** As funding costs maintain their downward trend and we move closer to pre-crisis conditions, we expect CDS to increase their attractiveness (relative to bonds) for long credit investors going forward.[17]

We come to a different conclusion when examining the behaviour of the Relative Value Basis in the HY space over the past year. In this case the Relative Value Basis is noticeably less negative than the average HY basis for both banks and hedge funds as shown in Figure 13. We estimate that in HY, CDS are better value than bonds in 30-35% of the cases for both banks and hedge funds.[18]

Table 14: HY Relative value levels vs. Historical average HY bond-CDS basis

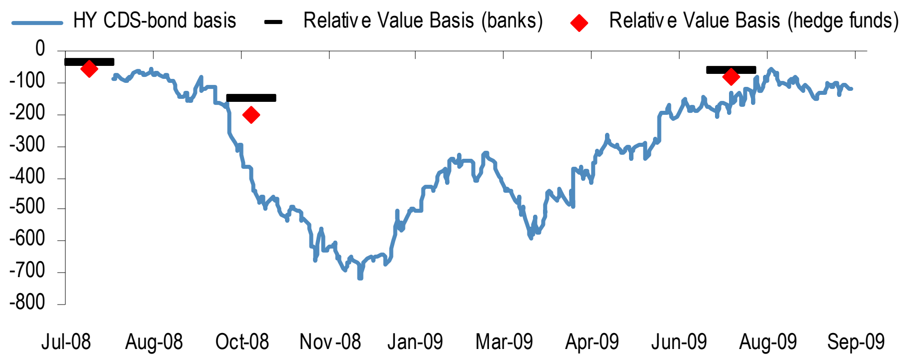
For a bond priced at €90. In bp.

	Jul 08	Oct 08	Jul 09
HY Bond spread	670	1220	920
Bank relative value level	-35	-150	-62
Hedge fund relative value level	-59	-200	-84
HY Bond-CDS basis	-80	-440	-150

Source: J.P. Morgan estimates.

Figure 13: HY Relative Value Basis compared to HY bond-CDS Basis

Relative Value Basis for a bond priced at €90. In bp.



Source: J.P. Morgan. Using the average USD HY bond-CDS basis.

Drivers of the Relative Value Basis

The drivers of the relative value basis are very similar to those of the Breakeven Basis, the only notable exception being the CDS margin; the sensitivities of which are reversed. As the CDS margin increases, the CDS becomes less attractive; as a consequence, the Relative Value Basis becomes less negative.

[17] While we expect the average bond-CDS basis level and the relative value basis to stay around the current levels, we do expect the left tail of bond-CDS basis distribution to be thinner, and the right tail to be thicker. This should increase the proportion of bonds with basis above the Relative Value Basis and, as a consequence, make it more attractive for investors to sell CDS protection.

[18] We use the average USD HY bond-CDS basis rather than the EUR one, due to the small universe of EUR HY bonds for which we track the bond-CDS basis.

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Funding Costs for Bonds and CDS Contracts

In this section:

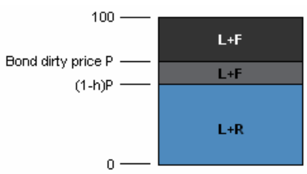
- Funding a bond.
- Funding a CDS.
- Total funding and annual income for a negative basis trade.

When entering trades involving bonds and CDS contracts there are a number of upfront payments that the investor is required to make in order to enter the trade. Many investors prefer to minimise the capital required to enter these trades and so instead borrow the amount needed to make these payments. However, the investor must pay the funding costs associated with this borrowing.

In this section we aim to establish the funding costs required to enter into bond and CDS trades. Using these funding levels we can then go on to calculate the total funding for a negative basis trade, as well as comparing the different funding levels of bond and CDS trades

Bond Funding - Repo Agreements and Asset Swaps

Figure 14: Bond funding diagram



L = Libor
F = Unsecured funding rate
R = Repo rate
h = Repo haircut

We consider the case of an investor wishing to buy a bond; the process of short selling a bond is complicated and does not represent a cheap way of going short risk so we shall concentrate on the long risk case.

We make two assumptions about an investor purchasing a bond:

- The investor will repo the bond in order to reduce the funding costs by as much as possible.
- The investor will also enter into a par asset swap in order to remove any Libor exposure and to convert the bond's cash flows into a regular flow of payments.

The asset swap and bond together are priced at €100. We split this amount into two parts; the bond dirty price *P* and the remaining €100-*P* amount required to enter the par asset swap. The funding for each part will be considered separately.

Funding the bond dirty price *P*
The cheapest form of funding available to an investor will most likely be **secured (repo) funding**; the repo counterparty will lend to the investor at a reduced rate of Libor (*L*) plus the repo rate *(R)* but will also hold the bonds as collateral in case the investor defaults. Typically, the counterparty will only lend the investor a proportion of the bond dirty price; the proportion of the bond price that is left unfunded is known as the "haircut" (*h*). [19] The funding for the repo is shown in Equation 3.

Equation 3: Repo funding

$$Funding_{REPO} = (1-h)(L+R)\,{}^{P}\!/_{100}$$

L = Libor *R* = Repo rate *h* = Haircut *P* = Bond dirty price

Repo funding example:

Libor	*L* = 100bp
Repo rate	*R* = 50bp
Repo haircut	*h* = 10%
Bon dirty price	*P* = 90

$Funding_{REPO}$=(100+50)*(1-0.1)*0.9

=121.5bp

An investor cannot fund the "haircut" at the repo rate; this haircut must be funded at the higher rate of Libor plus a standard **unsecured funding rate** (*F*). As this type of funding is more expensive than repo funding an investor will prefer the haircut to be as small as possible. The funding of the haircut is given in Equation 4.

[19] For more information on repurchase (repo) agreements see *Bond-CDS Basis Handbook*, Elizalde, 5 Feb 2009.

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Haircut funding example:

Repo haircut	h = 10%
Libor	L = 100bp
Unsecured rate	F = 125bp
Bond dirty price	P = 90

$Funding_{HAIRCUT}$ = 0.1*(100+125)*0.9

=20.25bp

Equation 4: Haircut funding

$$Funding_{HAIRCUT} = h(L+F)\,{}^{P}\!/_{100}$$

h = Haircut L = Libor F = Unsecured funding rate P = Bond dirty price

Funding the asset swap

Now we have accounted for the funding of the entire cost of the bond P. However, we also wish to enter into a par asset swap. The initial payment required to enter into this asset swap is €100 – P; this must be funded at the same rate as the haircut. The funding cost for the asset swap is shown in Equation 5.

Asset swap funding example:

Libor	L = 100bp
Unsecured rate	F = 125bp
Bond dirty price	P = 90

$Funding_{ASW}$ = (100+125)*(1-0.9)

= 22.5bp

Equation 5: Asset swap funding

$$Funding_{ASW} = (L+F)(1-{}^{P}\!/_{100})$$

L = Libor F = Unsecured funding rate P = Bond dirty price

Total bond/asset swap funding

We have now accounted for all the funding required to purchase the bond and the asset swap; the total funding for these assets is obtained by combining Equation 3, Equation 4 and Equation 5.

Total bond/asset swap funding example:

Repo haircut	h = 10%
Libor	L = 100bp
Repo rate	R = 50bp
Unsecured rate	F = 125bp
Bond dirty price	P = 90

$Funding_{BOND+ASW}$ = 100+125-(1-0.1)*(125-50)*0.9

= 164.25bp

Equation 6: Total bond/asset swap funding

$$Funding_{BOND+ASW} = \underbrace{(1-h)(L+R)\,{}^{P}\!/_{100}}_{\text{Repo funding}} + \underbrace{h(L+F)\,{}^{P}\!/_{100}}_{\text{Haircut funding}} + \underbrace{(L+F)(1-{}^{P}\!/_{100})}_{\text{ASW funding}}$$

h = Repo haircut R = Repo rate L = Libor P = Bond dirty price F = Unsecured funding rate

Equation 6 can be greatly simplified by collecting the coefficients of P together, yielding Equation 7. The overall coefficient of the bond price is negative; this means that **a higher bond price will result in lower funding costs** (due to the investor being able to fund more of the par amount at the reduced repo rate).

Equation 7: Total bond/asset swap funding

$$Funding_{BOND+ASW} = L+F-(1-h)(F-R)\,{}^{P}\!/_{100}$$

L = Libor F = Unsecured funding rate P = Bond dirty price R = Repo rate
h = Repo haircut

Table 15 shows examples of bond funding levels assuming Libor of 136p and unsecured funding of 125bp. As noted above the funding costs decrease as the bond price increases. These funding costs are all relatively high compared to CDS funding costs (see Table 16).

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Table 15: Example bond funding levels

Assuming Libor L = 136bp and unsecured funding rate F = 125bp. Bp referencing bond notional bought.

		Bond Price			
Haircut	Repo Rate(bp)	70	80	90	100
0%	0	173.5	161.0	148.5	136.0
2%	5	178.7	166.9	155.2	143.4
10%	30	201.2	192.6	184.1	175.5
30%	100	248.8	247.0	245.3	243.5

Source: J.P. Morgan estimates.

Now that we have accounted for the bond funding, we will now examine the funding costs involved in buying and selling CDS protection in order to compare the relative value of bonds and CDS and to establish the net annual income from a negative basis trade.

CDS Funding Costs for Buyers of Protection

CDS: From upfront plus coupon to full-running

Equation 8 shows how to compute the full running equivalent spread (S_{CDS}) on a contract trading with upfront (U) plus a running coupon (C), using the CDS risky annuity (RA) and accrued interest (AI).

Equation 8

$$S_{CDS} = \frac{U - AI}{RA} + C$$

Before the 2008-2009 liquidity crisis a buyer of CDS protection on a single name would make regular payments of the CDS full running spread to the protection seller. However, over the last year it has become common practice for CDS protection to be bought with an **upfront payment**, followed by a standard fixed coupon. Buyers of protection are also required to give a proportion of the notional, known as the **margin,** to the dealer to act as collateral.

CDS upfronts

We assume that the inventor pays (or receives) an upfront amount U for the protection bought, followed by a standard coupon C. We shall treat the zero-upfront scenario as a special case of this. The upfront is a function of the market spread and coupon as given in Equation 8.

Although the investor could either pay an upfront (U>0), or receive one (U<0). If the upfront is positive and so represents another initial payment that must be funded; the investor will pay Libor plus the standard unsecured funding rate F on this amount. However, it makes no difference to the analysis if the buyer of protection receives an upfront, we simply assume that it is invested a rate of Libor plus the unsecured funding rate F. The funding required for the upfront is given in Equation 9.

CDS upfront funding example:

CDS upfront	U = 5%
Unsecured rate	F = 125bp
Libor	L = 100bp

$Funding_{UPFRONT}$ = 0.05*(100+125)

= 11.25bp

Equation 9: CDS upfront funding for buyers of protection

$$Funding_{UPFRONT} = U(L+F)$$

U = CDS upfront L = Libor F = Unsecured funding rate

CDS margins

In addition to the CDS upfront it is general practice for dealers to require buyers of CDS protection to post a margin (m) for the notional at risk (i.e. the total notional minus any upfront). This margin protects the investment bank in the event of the protection buyer defaulting; the investment bank will return the margin at default[20], maturity or unwind. We assume that the investor receives Libor on the posted margin. In any case, the protection buyer must still fund the margin at Libor plus the unsecured funding rate F and so this margin represents an additional burden. The total funding for the CDS margin, including the Libor received back from the protection seller, is given in Equation 10.

[20] Of the CDS reference entity.

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Equation 10: CDS margin funding for buyers of protection

$$Funding_{MARGIN} = m(1-U)(L+F) - m(1-U)L$$
$$= m(1-U)F$$

m = CDS margin *U* = CDS upfront *L* = Libor *F* = Unsecured funding rate

CDS margin funding example:

CDS upfront	*U* = 5%
CDS margin	*m* = 10%
Libor	*L* = 100bp
Unsecured rate	*F* = 125bp

$Funding_{MARGIN}$ = 0.1*(1-0.05)*(100+125)-0.1*(1-0.05)*100

= 11.88bp

Total CDS funding

By combining the funding for the CDS upfront and the CDS margin we can obtain an expression for the total funding required into the CDS contract; this is given in Equation 11.

Equation 11: Total CDS funding for buyers of protection

$$Funding_{CDS} = U(L+F) + m(1-U)F$$

U = CDS upfront *L* = Libor *m* = CDS margin *F* = Unsecured funding rate

Total CDS funding example:

CDS upfront	*U* = 5%
CDS margin	*m*= 10%
Libor	*L* = 100bp
Unsecured rate	*F* = 125bp

$Funding_{CDS}$ = 11.25 + 11.88

= 23.13bp

Table 16 shows some example CDS funding levels for a coupon of 100bp, Libor of 136bp and unsecured funding of 125bp. The CDS funding costs are noticeably smaller than the bond funding costs, because both the CDS margin and upfront is a fraction of the notional.

Table 16: Example CDS funding for buyers of protection

Assuming Libor *L* = 136bp, unsecured funding rate *F* = 125bp and CDS Coupon = 100bp. In bp.

	CDS full running spread: (Upfront)	50 -2.4%	100 0.0%	150 2.3%	200 4.5%	250 6.6%
CDS Margin	0%	-6.2	0.0	6.0	11.7	17.3
	3%	-2.4	3.8	9.6	15.3	20.8
	5%	0.2	6.3	12.1	17.7	23.1
	10%	6.6	12.5	18.2	23.7	28.9
	20%	19.4	25.0	30.4	35.6	40.6

Source: J. P. Morgan estimates.

CDS Funding Costs for Sellers of Protection

In the case that the investor wishes to sell CDS protection and go long risk the situation is reversed.

CDS upfront

A seller of protection will receive an upfront payment *U* from the buyer if the CDS full running spread is greater than the CDS coupon. We assume that the seller of protection invests this upfront at the Libor rate *L*. The funding for the CDS upfront for a seller of protection is shown in Equation 11. In this case a positive value (U>0) represents the seller receiving an upfront and a negative value (U<0) denotes the seller making an initial payment to the buyer. In the latter case the investor will in fact have to fund the upfront payment as above and so will pay the unsecured funding rate *F* on top of Libor. However, as it tends to be more common to use a CDS coupon below the full running spread we shall assume the seller receives an upfront payment.

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Equation 12: CDS upfront funding for sellers of protection

$$Funding_{UPFRONT} = -UL$$

U = CDS upfront L = Libor

CDS margin

An investor wishing to sell protection will also have to pay an initial margin; as with the previous case this margin must be funded at Libor plus the unsecured funding rate F, but will also receive Libor payments back on the margin.

Equation 13: CDS margin funding for sellers of protection

$$\begin{aligned} Funding_{MARGIN} &= m(1-U)(L+F) - m(1-U)L \\ &= m(1-U)F \end{aligned}$$

m = CDS margin U = CDS upfront L = Libor
F = Unsecured funding rate

The total CDS funding for a seller of protection is therefore equal to any funding paid on the upfront as shown in Equation 14. If the seller receives an upfront then the total CDS funding is negative; this is the compensation that the seller receives for the CDS coupon being lower than the CDS full running spread.

Equation 14: Total CDS funding for sellers of protection

$$Funding_{CDS} = -UL + m(1-U)F$$

U = CDS upfront L = Libor m = CDS margin
F = Unsecured funding rate

Negative Basis Trades: Funding Costs and Income

Now that we have identified the funding costs required to buy bonds and CDS protection we can calculate the total funding costs for a negative basis trade. We can then go on to calculate the net annual income from the trade.

We assume that in order to be protected from defaults the investor uses equal notionals of bonds and CDS. The income from a negative basis trade is the income from the asset swap (which is equal to Libor L plus the asset swap spread S_{ASW}) minus the CDS coupon C as shown in Equation 15.

Equation 15: Basis income

$$Income_{BASIS} = L + S_{ASW} - C$$

L = Libor S_{ASW} = Asset swap spread C = CDS coupon

In the case where there is no upfront, the CDS coupon C is equal to the full running CDS spread S_{CDS}.

In the case that an investor funds a negative basis trade using their own cash then the annual net income from the trade is equal to the basis income. However, as most investors will be required to completely fund the trade the net annual income must take the total funding costs into account.

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Total Funding Costs for a Negative Basis Trade

In order to calculate the total funding costs for a negative basis trade, we add together the total bond funding cost (Equation 7) and the funding costs required to buy CDS protection (Equation 11). The result is shown in Equation 16.

Total funding example:

Libor	L = 100bp
Unsecured rate	F = 125bp
CDS upfront	U = 5%
CDS margin	m = 10%
Repo haircut	h = 10%
Repo rate	R = 50bp
Bond dirty price	P = 90

$Funding_{TOTAL}$ =
100 + 125 + (1-0.1)*125*0.1+0.05*(100+125)-(1-0.1)*(125-50)*0.9

= 186.75bp

Equation 16: Total Funding for a Negative Basis Trade

$$Funding_{TOTAL} = L + F + m(1-U)F + U(L+F) - (1-h)(F-R)\frac{P}{100}$$

L = Libor F = Unsecured funding rate U = CDS upfront m = CDS margin h = Repo haircut
R = Repo rate P = Bond dirty price

Net Annual Income from a Negative Basis Trade

By subtracting this total funding from the basis income as defined in Equation 15, we can obtain an expression for the net annual income from a basis package; this is shown in Equation 17. This is the net cash flow that the investor receives each year from the trade if funding costs remain constant.

Equation 17: Net Annual Income from a Negative Basis Trade

$$Income_{net} = (L + S_{ASW} - C) - \underbrace{\left(L + F - (1-h)(F-R)\frac{P}{100}\right)}_{\text{Bond funding}} - \underbrace{\left(m(1-U)F + U(L+F)\right)}_{\text{CDS funding}}$$

S_{ASW} = Asset swap spread C = CDS coupon F = Unsecured funding rate U = CDS upfront
m = CDS margin L = Libor h = repo haircut R = repo rate
P = bond dirty price

Net annual income example:

Asset swap spread	S_{ASW} = 350bp
CDS coupon	C = 100bp
Unsecured rate	F = 125bp
CDS upfront	U = 5%
CDS margin	m = 10%
Libor	L = 100bp
Repo haircut	h = 10%
Repo rate	R = 50bp
Bond dirty price	P = 90

Net annual income =
350-100-125-(1-0.05)*125*0.1-0.05*(100+125) +(1-0.1)*(125-50)*0.9

= 162.63bp

Equation 17 can be simplified by cancelling out the Libor on the notional amount; the result is shown in Equation 18. Note that the Libor dependency that remains is very small as it is paid on the CDS upfront which itself is a fraction of the entire notional.

Equation 18: Net annual income from a negative basis trade

$$Income_{net} = S_{ASW} - C - F - m(1-U)F - U(L+F) + (1-h)(F-R)\frac{P}{100}$$

S_{ASW} = Asset swap spread C = CDS coupon F = Unsecured funding rate U = CDS upfront
M = CDS margin L = Libor h = repo haircut R = repo rate
P = bond dirty price

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Table 17 summarises the trade structure, income and funding costs of a negative basis trade.

Notation:

P	Bond dirty price (€)
S_{ASW}	Bond asset swap spread (bp)
L	Libor (bp)
F	Unsecured funding rate (bp)
R	Repo funding rate (bp)
h	Repo haircut (%)
U	CDS upfront (%)
M	CDS margin (%)
S_{CDS}	CDS full running spread (bp)
C	CDS coupon (bp)

Table 17: Trade structure

Trade	Running annual income (bp)
• Buy bond at dirty price *P* • Enter repo agreement with repo rate *R* and haircut *h* • Buy asset swap for €100-*P*	$L+S_{ASW}$
• Buy CDS protection for full running spread S_{CDS}, upfront *U*, coupon *C* and margin *m*[21]	$-C$
Total running income	$L+S_{ASW}-C$

Initial (upfront) payments	Annual cost of funding (bp)
• Cost of the bond *P*	$(1-h)(L+R)P+h(L+F)P$
• Cost of the asset swap 100-*P*	$(L+F)(100-P)$
• CDS upfront cost *U*	$U(L+F)$
• CDS required margin *m*	$m(1-U)(L+F)-m(1-U)L$
Total funding	$L+F+m(1-U)F+U(L+F)-(1-h)(F-R)P$
Total net income	$S_{ASW}-C-F-m(1-U)F-U(L+F)+(1-h)(F-R)\frac{P}{100}$

Source: J.P. Morgan.

For a negative basis trade with zero CDS upfront, the profit at time *t* is simply the total net income multiplied by the number of years *t*[22]. However, if a CDS upfront does exist the situation is more complicated as the upfront represents a sunk cost that must be paid back from the annual income cash flow before a profit can be made. The next section covers the P&L and breakevens of each case in detail.

[21] If the CDS trades on a full running basis, then the upfront *U* is zero and the coupon *C* is equal to the full running spread S_{CDS}.

[22] Ignoring any accrued interest.

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Deriving the Breakeven Basis for Negative Basis Trades

In this section:

- P&L and the Breakeven Basis for CDS contracts with full running spread.
- P&L and the Breakeven Basis for CDS contracts with an upfront.

In this section, we theoretically derive breakeven levels for basis trades to be profitable when funding costs are taken into account. By subtracting the total funding from the basis income (Equation 15) we obtain the net annual income (Equation 18). This is the cash flow that the investor receives each year from the trade. The majority of the Libor dependency cancels out (and only the Libor paid on the CDS upfront remains).

Equation 18 is a very useful equation since, as we will show, it can be expressed as a function of the basis $S_{CDS}-S_{ASW}$[23]. Our objective is to derive a **Breakeven Basis** level which makes the trade net income positive, i.e. one which guarantees that the trade compensation is enough to cover its funding costs. We first analyse the case where the CDS trades on a full running format (i.e. no upfront), where we will be able to derive a very simple and intuitive Breakeven Basis level. We then tackle the more general case where the CDS has a positive upfront and a fixed coupon.

Annual net income (zero upfront) example:

Asset swap spread	S_{ASW} = 450bp
CDS spread	S_{CDS} = 300bp
Unsecured rate	F = 125bp
CDS margin	m = 10%
Repo haircut	h = 10%
Repo rate	R = 50bp
Bond dirty price	P = 90

Net income = 450-300-125-0.1*125+(1-0.1)*(125-50)*0.9

= 73.25bp

P&L and the Breakeven Basis for CDS Contracts with Full Running Spread

In the special case that there is no upfront and the CDS trades on a full running spread we set $U = 0$ and $C = S_{CDS}$ and so Equation 18 is greatly simplified, yielding Equation 19.

Equation 19: Net income for full running CDS spread case

$$Income_{net;U=0} = S_{ASW} - S_{CDS} - F - mF + (1-h)(F-R)\,{}^{P}\!/_{100}$$

S_{ASW} = Asset swap spread
M = CDS margin
P = Bond dirty price
S_{CDS} = CDS full running spread
h = Repo haircut
F = Unsecured funding rate
R = Repo rate

Trade with full running CDS spread:

If the basis S_{CDS}-S_{ASW} is more negative than $Basis_{BREAKEVEN}$ then the trade will return a constant annual profit.

In the case of default the investor keeps any profit that has accumulated but no further P&L is made.

Importantly **in the full running spread case the annual net income is totally independent of Libor.**

By setting the annual net income in Equation 19 to zero we can obtain an expression for the Breakeven Basis, as given in Equation 20. This expression is not only independent of Libor, but of the CDS full running spread as well.

Equation 20: Breakeven Basis for full running CDS spread case

$$BreakevenBasis = -F - mF + (1-h)(F-R)\,{}^{P}\!/_{100}$$

F = Unsecured funding rate
M = CDS margin
h =Repo haircut
R = Repo rate
P = Bond dirty price

Breakeven Basis (zero upfront) example:

Unsecured rate	F = 125bp
CDS margin	m = 10%
Repo haircut	h = 10%
Repo rate	R = 50bp
Bond dirty price	P =90

Breakeven Basis = -125-0.1*125+(1-0.1)(125-50)*0.9

= -76.75bp

[23] The income from the asset swap is $L + S_{ASW}$; as such it is appropriate to use the asset swap spread S_{ASW} as the bond spread in the bond-CDS basis.

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If the actual Bond-CDS Basis is more negative than this Breakeven Basis, the trade will be attractive and will return a constant positive annual income; the costs of funding the trade are not large enough to counteract the income received from the Bond-CDS Basis. In the event of a default the investor keeps any profit that has been accumulated but receives no further income; the cash flow of the trade ends at default.

We assume for mathematical simplicity that the asset swap is a "**perfect asset swap**" and so the future cash flows disappear upon default. In practice however, the asset swap spread plus Libor tends to be greater than the bond coupon and so in the event of a default the investor will usually continue to receive a small annual income from the trade.

Example 1 (CDS full running spread): Valeo 3.75% €13s

We construct a negative basis trade on Valeo 3.75% EUR bonds. The bonds have a maturity date of 24-Jun-13. As before we divide investors into two categories: those able to obtain cheap credit ("banks") and those who may be required to pay higher costs of funding ("hedge funds").

Table 18: Example negative basis trade with CDS full running spread

		Hedge Fund	Bank
Notional		100	100
Basis			
CDS full running spread (bp)	S_{CDS}	226	226
Asset swap spread (bp)	S_{ASW}	392	392
Basis (bp)		-166	-166
Borrowing cost			
Libor (bp)	L	136	136
Unsecured funding rate (bp)	F	200	100
Bond funding			
Bond price	P	89.79	89.79
Haircut	h	4%	4%
Repo rate (bp)	R	12	0
Total bond funding (bp) (Equation 7)		162	141
CDS funding			
CDS margin	m	4%	0%
CDS funding (bp) (Equation 11)		13	0
Breakeven Basis		-45.9	-13.8
Net income			
Basis income (bp)		166	166
Libor from asset swap (bp)		136	136
Total funding (bp) (Equation 16)		182	150
Annual net income (bp)		120	152

Source: J. P. Morgan estimates. Data as of 23 July 2009.

Table 18 shows an illustrative example with the calculations for the net income for trades with full running spread. The table shows the calculations from the point of view of both a bank and a hedge fund to demonstrate the differences in funding costs.

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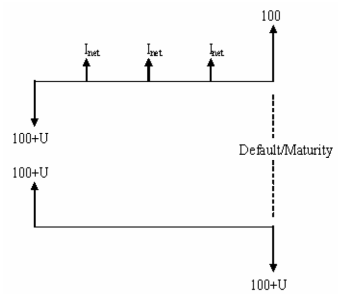
The trade is profitable for both banks and hedge funds but due to the increased funding that the hedge fund is required to pay the bank makes an extra 25bp profit every year.

P&L and the Breakeven Basis for CDS contracts with an upfront

Figure 15: Trade cash flows

Upper: trade cash flow.

Lower: borrowing cash flow



I_{net} = Net annual income
U = CDS upfront

Now that we have considered the special case in which the CDS contract trades on full running spread, we now turn our attention to the general case in which the CDS contact trades with an upfront and a standard coupon. This is more complicated than the previous case; to see why we must examine the cash flows at the end of the trade.

When the trade ends (due to either unwind, default or maturity) the investor will receive a lump sum which will then be used to pay off the money borrowed to enter the trade. The exception to this is the upfront; if the trade matures or the bond defaults then the upfront is not returned and it must be deducted from the sum of the net income the investor has accumulated. This can be seen in Figure 15 at maturity the investor receives 100 from the trade cash flow but owes 100+U due to the borrowing cash flow.

As a consequence, when the CDS has an upfront, this represents a sunk cost which we have to “amortise”. At some point during the trade the profit accumulated from the annual income must be used to pay back the money borrowed for the CDS upfront. If the trade ends (due to default or maturity) before the accumulated income is large enough to pay off the upfront then the trade will generate a negative final P&L.

In this section we aim to derive the **Breakeven Basis** for a negative basis trade with a CDS upfront. This will represent the basis which results in zero P&L at the maturity of the trade; if the actual basis is more negative than this breakeven then a profit will be made if and when the trade reaches maturity.

In addition to this we will derive a **Breakeven Time**. This is the time at which the accumulated income is exactly equal to the CDS upfront. A default before the breakeven time will result in a negative final P&L whereas a default after this time will generate a profit.

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P&L at default/maturity example:

Income = 200bp

Libor	L = 100bp
Unsecured rate	F = 125bp
Time of default	t = 3 years
CDS upfront	U = 5%

P&L =

$$\left(\frac{200}{100+125}\right)\left(\exp\left(\frac{100+125}{10000}\times 3\right)-1\right)-0.05$$

= 1.21%

P&L at maturity/default

To calculate the Breakeven Basis we first need an expression for the P&L of the trade as a function of time t, but due to the mark-to-market exposure of the trade we cannot simply calculate the final P&L when the trade is unwound at some time in the future. However, at default or maturity the mark-to-market exposure is nullified, meaning that we can obtain expression for the P&L of the trade at maturity, or if the trade defaults at time t.

By considering how the income accumulates over time we can obtain an expression for the P&L of the trade for a default or maturity at time t. This expression is derived from first principles in Appendix I; the resulting equation is Equation 21. The main assumption in this derivation is that as profit is made it is invested at a rate of Libor plus the unsecured funding cost F[24].

Equation 21: P&L at default/maturity

$$P(t)=\left(\frac{Income}{L+F}\right)\left(e^{(L+F)t}-1\right)-U$$

$$= Income\cdot e^{(L+F)t}\cdot Annuity_{L+F}(t)-U$$

P(t) = P&L at default/maturity at time t *Income* = Net annual income as defined in Equation 18
L = Libor F = Unsecured funding rate U = CDS upfront
$Annuity_{L+F}$ = The value of 1bp for an investor in can invest at a risk free rate of L+F

Breakeven Income example:

CDS upfront	U = 5%
Libor	L = 100bp
Unsecured rate	F = 125bp
Time to maturity	T = 3 years

Breakeven Income =

$$\frac{0.05*(100+125)}{\exp\left(\frac{100+125}{10000}\times 3\right)-1}$$

= 28.59bp

Breakeven Income

For the trade to breakeven at maturity the accumulated income (including any accrued interest) at maturity must be equal to the value of the initial CDS upfront. As an intermediate step to calculating the Breakeven Basis we define the Breakeven Income; the annual net income that results in the accumulated income at maturity being exactly equal to the upfront amount such that the overall P&L is zero. We obtain an expression for this breakeven income by setting P(t) = 0 and t equal to the time of maturity T in Equation 21. The resulting equation is Equation 22.

Equation 22: Breakeven Income

$$BreakevenIncome=\frac{U(L+F)}{e^{(L+F)T}-1}=U\left(\frac{L+F}{1-e^{-(L+F)T}}\right)e^{-(L+F)T}=\frac{Ue^{-(L+F)T}}{Annuity_{L+F}}$$

Income = Annual net income as defined in U = CDS upfront L = Libor
F = Unsecured funding rate T = Time to maturity (in years)
$Annuity_{Ll+F}$ = The value of 1bp for an investor who can invest at a risk free rate of L+F

[24] Without this assumption the manner in which the investor pays back money borrowed to pay the upfront has a large effect on the overall P&L; assuming that the profit accumulates interest at a rate of $L + F$ means that the way that the upfront is repaid is irrelevant. Furthermore, this assumption is equivalent to the upfront being continuously paid off by the accumulating income.

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Breakeven Basis example:

CDS spread	S_{CDS} = 210bp
CDS coupon	C = 100bp
CDS upfront	U = 5%
Libor	L = 100bp
Unsecured rate	F = 125bp
Time to maturity	T = 3 years
CDS margin	m = 10%
Repo haircut	h = 10%
Repo rate	R = 50bp

Breakeven Basis =

$$210-100-\frac{0.05\times(100+125)}{\exp\left(\frac{100+125}{10000}\times 3\right)-1}$$
$$-125-125\times 0.1\times(1-0.05)-0.05\times(100+125)$$
$$+(1-0.1)\times(125-50)\times 0.9$$

=-138.5bp

Trade with CDS upfront:

If the basis S_{CDS}-S_{ASW} is more negative than the Breakeven Basis then the trade will return a profit at maturity.

However, in the event of a default before maturity the trade may not be profitable.

Breakeven time example:

Income = 200bp

Libor	L = 100bp
Unsecured rate	F = 125bp
CDS upfront	U = 5%

$t_{BREAKEVEN}$ =

$$\frac{10000}{100+125}\ln\left[1+\frac{100+125}{200}\times 0.05\right]$$

= 2.43 years

Breakeven Basis

By substituting in the expression for the income from Equation 18 into Equation 22 we can obtain an expression for the Breakeven Basis as shown in Equation 23.[25] Intuitively, the income from the asset swap spread minus the CDS coupon must be large enough to cancel out the total funding for the trade as well as the upfront discounted by $Annuity_{L+F}$ (defined as the value of 1 basis point for an investor who can invest at a risk-free rate of L+F, see Equation 21). If the Bond-CDS Basis is more negative than this Breakeven Basis then this trade will be profitable at maturity.

Equation 23: Breakeven Basis for trade with CDS upfront

$$BreakevenBasis$$
$$= S_{CDS} - C - \frac{U(L+F)}{e^{(L+F)T}-1} - F - mF(1-U) - U(L+F) + (1-h)(F-R)\,{}^{P}\!/_{100}$$
$$= S_{CDS} - C - \frac{U}{Annuity_{L+F}} - F - mF(1-U) + (1-h)(F-R)\,{}^{P}\!/_{100}$$

S_{CDS} = CDS full running spread	C = Coupon	L = Libor	F = Unsecured funding rate
m = CDS margin	h = Repo haircut	R = Repo rate	U = CDS upfront
P = bond dirty price	$Annuity_{L+F}$ = The value of 1bp for an investor who can invest at a risk free rate of L+F		

By setting U = 0 and $S_{CDS} = C$ in Equation 23 we recover Equation 20 for the Breakeven Basis for a CDS contract with zero upfront.

Breakeven Time

For a negative basis trade in which the investor pays a CDS upfront, an immediate default will result in the investor losing that entire upfront. As time goes on and the investor accumulates income the exposure to default is reduced; it follows that if the investor stands to lose the upfront in the case of an immediate default but makes a profit should the trade reach maturity then there must be an intermediate time at which the investor breaks even should the bond default. At this time the accumulated income has exactly cancelled out the initial upfront payment; we call this time the Breakeven Time.

We can obtain an expression for the breakeven time by setting P(t) to zero in Equation 21 and solving for t; the result is shown in Equation 24.

Equation 24: Breakeven Time

$$BreakevenTime = \frac{1}{L+F}\ln\left[1+\frac{(L+F)U}{Income}\right]$$

L = Libor	F = Unsecured funding	U = CDS upfront
$Income$ = Annual net income as defined in Equation 18		

[25] Equation 23 is obtained by setting the net annual income equal from Equation 18 equal to the breakeven income in Equation 22. The resulting expression is then rearranged such that the left hand side is equal to -S_{ASW}. The CDS full running spread S_{CDS} is then added to both sides.

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A default occurring before the breakeven time will result in the trade making a loss, a default after the breakeven time will generate a positive final P&L.

Effect of coupon size on Breakeven Time and final P&L

The CDS upfront has a significant effect on the Breakeven Time and final P&L. If an investor can exact some control over the size of the CDS coupon then he can indirectly control the size of the CDS upfront involved in the trade and in doing so change the P&L profile of the trade.

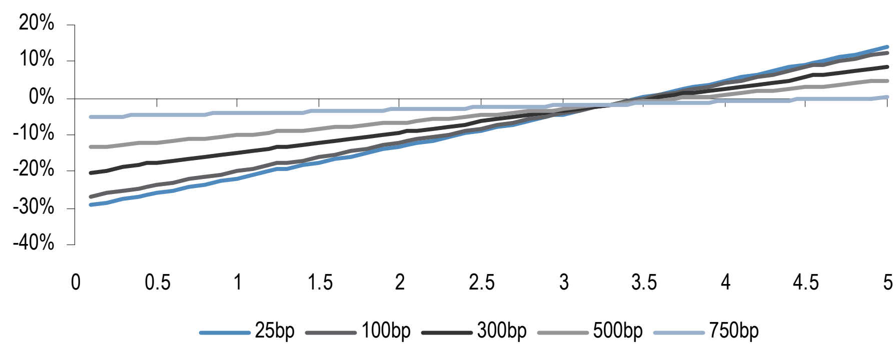
The P&L profiles of the same negative basis trade with different CDS coupons are shown in Figure 16.

Figure 16: Effect of coupon size on P&L at maturity/default

Libor = 136bp   Unsecured funding rate = 125bp   Annual income = 100bp

CDS running spread = 900bp   Maturity = 5 years

X-axis: Time in years. Y-axis: % P&L



Source: J.P. Morgan.

Lower coupon:
More exposure to an early default, more profit at maturity.

Higher coupon:
Less exposure to an early default, less profit at maturity.

The size of the coupon affects the profit at maturity and the breakeven date; **the higher the coupon the shorter the Breakeven Time but the lower the profit at maturity**. Effectively the reduced exposure to default is offset by the lower profit should the bond survive until maturity.[26]

If an investor believes the trade will reach maturity then as small a coupon as possible should be chosen. Likewise an investor who believes there is a significant possibility of an early default should select a large coupon. In practice however investors may be restricted in their choice of coupons.

[26] The expected P&L of the trade is the same independent of the coupon; the P&L for each trade intersects at the expected time to default of the trade (which is equal to the risky annuity).

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Example 2 (CDS upfront): GMAC 5.375% €11s

In this example we construct a negative basis trade from the point of view of a bank and a hedge fund on GMAC 5.375% EUR bonds with a maturity date of 6-Jun-11. In this case we assume the CDS trades with an upfront amount.

As with the previous example this trade is potentially profitable for both investors; the bank makes a profit of 4.8% at maturity, breaking even after 0.65 years. The hedge fund makes a smaller profit of 3.6% and maturity and can expect to break even after 0.79 years.

Table 19: Example negative basis trade with CDS upfront

		Hedge Fund	Bank
Notional		100	100
Maturity		6-Jun-11	6-Jun-11
Years to maturity	T	1.85	1.85
Basis			
CDS full running spread (bp)	S_{CDS}	913	913
Asset swap spread (bp)	S_{ASW}	1246	1246
Basis (bp)		-333	-333
Coupon (bp)	C	750	750
Borrowing cost			
Libor (bp)	L	136	136
Unsecured Funding (bp)	F	200	100
Bond funding			
Bond dirty price	P	84	84
Repo funding rate (bp)	R	120	100
Repo haircut	h	30%	30%
€ covered by repo		58.8	58.8
€ covered by unsecured funding		41.2	41.2
Total bond funding (bp) (Equation 7)		289	236
CDS funding			
CDS full running spread (bp)	S_{CDS}	913	913
CDS upfront	U	2.57%	2.57%
CDS upfront funding (bp)		6.1	6.1
Notional covered by margin		97.43	97.43
CDS margin %	m	10.50%	0%
CDS margin		10.23	0
CDS margin funding (bp)		34	0
CDS margin Libor income (bp)		14	0
Total CDS funding (bp) (Equation 11)		20	6
Breakeven Basis		-153.7	-79.0
Net income			
Coupon basis (bp)		496	496
Libor from asset swap (bp)		136	136
Total funding (bp) (Equation 16)		309	242
Annual net income (bp)		323	390
Breakeven time (years)		0.785	0.654
Profit at maturity (bp)		3.60%	4.80%

Source: J.P. Morgan estimates. Data as of 17 July 2009.

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Deriving the Relative Value Basis

To compare the relative value of a CDS contract and of bonds for a long risk investor we must compare the separate spreads whilst also taking the funding costs of each trade into account. The different assets will be of equal value when:

CDS full running spread[27] - CDS funding = Bond (full) spread[28] - Bond funding

If the left hand side of the equation is greater than the right then selling CDS protection is the best strategy for a long risk investor; if the right hand side is greater then buying bonds is the better option.

We shall use the asset swap spread as the bond spread once more as the asset swap converts the bond cash flows into a regular stream of payments, hence making it easier to compare to the CDS contract.

For illustration purposes, we consider the case that the CDS trades with full running spread. The bond funding costs are given by Equation 7, and the CDS funding costs by Equation 13 (assuming $U=0$). By substituting these values into the above equation and re-arranging the result we obtain Equation 25 for the relative value basis. The equation is identical to that for the Breakeven Basis (Equation 1) except that the sign of the CDS margin is reversed.

Relative Value Basis Example:

Unsecured rate	F = 125bp
CDS margin	m = 10%
Repo haircut	h = 10%
Repo rate	R = 50bp
Bond dirty price	P = 90

Relative value basis =
-125+125*0.1+(1-0.1)*(125-50)*0.9

= -51.75bp

Equation 25: Relative value basis

$$RelativeValueBasis = -F + mF + (1-h)(F-R)\,{}^{P}\!/_{100}$$

F = Unsecured funding rate h = Repo haircut R = Repo rate P = Bond dirty price

If the actual bond-CDS basis is more negative than the relative value basis then buying bonds is the best long risk strategy; less negative and selling CDS protection will be the preferable method of going long risk.

[27] Here we only consider the CDS full running spread; this gives a very good measure of the overall worth of the contract even when the CDS does trade with an upfront.
[28] Libor plus asset swap spread in our analysis.

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Appendix I: P&L for Basis Trades with Upfront

To calculate the breakeven time (the time at which the accrued revenue from the basis equals the upfront plus any interest it has accrued) we first create a discrete time model of the growth the basis revenue.

The most simple model is to consider the revenue at the start and end of each year. When we enter the trade we initially have zero revenue and so $r_0 = 0$. At the end of the first year we receive the annual revenue a and so $r_1 = a$. From this point on we accrue interest on the revenue we have already earned and so the revenue at the end of the second year $r_2 = (1+\lambda)r_1 + a$; we receive a interest rate of λ on the revenue already built up in addition to the annual revenue a

In general $r_t = (1+\lambda)r_{t-1} + a$. However, as we know that $r_0 = 0$ we can express r_t in terms of a and λ:

$$r_t = a + a(1+\lambda) + a(1+\lambda)^2 + ... + a(1+\lambda)^{t-1} = a\sum_{j=1}^{t}(1+\lambda)^{j-1}$$

To make this more accurate we can change the time steps from one year to a smaller period; if we divide the year into n equal periods then we must make the transforms $a \to \frac{a}{n}$ and $\lambda \to \frac{\lambda}{n}$ and also change the upper limit of the summation from t to tn.

$$r_t = \frac{a}{n}\sum_{j=1}^{tn}\left(1+\frac{\lambda}{n}\right)^{j-1}$$

This is a geometric series and so can be expressed in the form

$$r_t = \frac{a}{n}\left[\frac{1-\left(1+\frac{\lambda}{n}\right)^{tn}}{1-\left(1+\frac{\lambda}{n}\right)}\right]$$

This is equal to $r_t = \frac{a}{\lambda}\left[\left(1+\frac{\lambda}{n}\right)^{tn} - 1\right]$

To consider the continuous time limit we take $n \to \infty$ which implies:

$$r(t) = \frac{a}{\lambda}\left(e^{\lambda t} - 1\right)$$ using the $\lim_{n\to\infty}\left(1+\frac{x}{n}\right)^n = e^x$ identity

To obtain the profit $P(t)$ after time *t* we subtract the upfront U from the revenue $r(t)$:

$$P(t) = r(t) - U = \frac{a}{\lambda}\left(e^{\lambda t} - 1\right) - U$$

$$P(t) = \frac{a}{\lambda}e^{\lambda t} - \frac{a}{\lambda} - U$$

(We assume that any interest or funding on *U* is already included in *a*).

We now substitute $a = Income$ and $\lambda = L + F$ (we assume that any profit is invested at a rate of $L + F$).

$$P(t) = \left(\frac{Income}{L+F}\right)e^{(L+F)t} - \frac{Income}{L+F} - U$$

$$P(t) = Income \cdot \frac{e^{(L+F)t} - 1}{L+F} - U$$

$$P(t) = Income \cdot \left(\frac{1 - e^{-(L+F)t}}{L+F}\right) \cdot e^{(L+F)t} - U$$

$$P(t) = Income \cdot Annuity_{L+F}(t) \cdot e^{(L+F)t} - U$$

Where $Annuity_{L+F}(t)$ represents the value of 1 basis point for an investor who invests it at a risk-free rate of $L+F$ for a length of time *t*.

Furthermore, we can set $P(t) = 0$ to obtain the breakeven time:

$$e^{(L+F)t} = 1 + \frac{(L+F)U}{Income}$$

$$t_{BREAKEVEN} = \frac{1}{L+F}\ln\left[1 + \frac{(L+F)U}{Income}\right]$$

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