

Recovery Swaps

Trading and hedging corporate bond recovery

- **Recovery swaps allow credit market participants to take explicit views on recovery levels**, which are determined through a CDS auction following a credit event. These contracts differ from standard CDS contracts, which incorporate exposures to both default probabilities and recovery rate expectations. Recovery swaps are most often quoted on high yield names, but are also traded on high grade names and on CDS indices.
- **Recovery swaps are a package of two separate CDS contracts: a standard CDS contract and a fixed recovery CDS contract.** The recovery swap package trades with zero upfront and has no net cashflows until a credit event occurs, at which point the only cashflow is the difference between the traded recovery level and the final auction-determined recovery level.
- **Investors can use recovery swaps to express a number of different credit views:**
 - Take outright views on recovery levels.
 - Use fixed recovery CDS to increase long risk returns.
 - Hedge assets which are expected to recover at different levels to deliverable obligations, including senior secured loans and UT2/T1 debt.
 - Use recovery swaps to floor the value of cash bonds in a credit event scenario.
- **Many recovery swaps are quoted at close to 40% recovery.** While this represents a good historical average for recovery rates, historically most names have recovered either far above or far below this level. For credit analysts with high conviction views on likely recovery rates under distressed scenarios, we believe that there are many attractive trading opportunities on offer.

European Credit Derivatives Strategy

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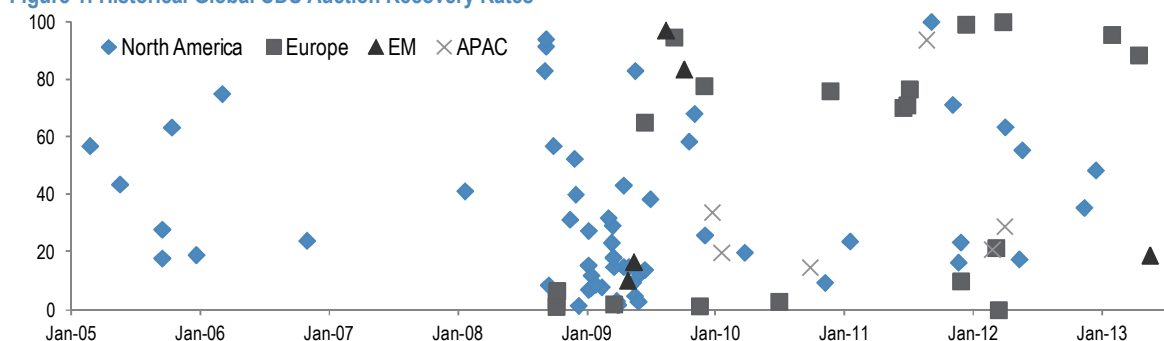
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Figure 1: Historical Global CDS Auction Recovery Rates



Source: J.P. Morgan, Credit Fixings. Senior unsecured 2.5y-5y Bucket.

See page 19 for analyst certification and important disclosures.

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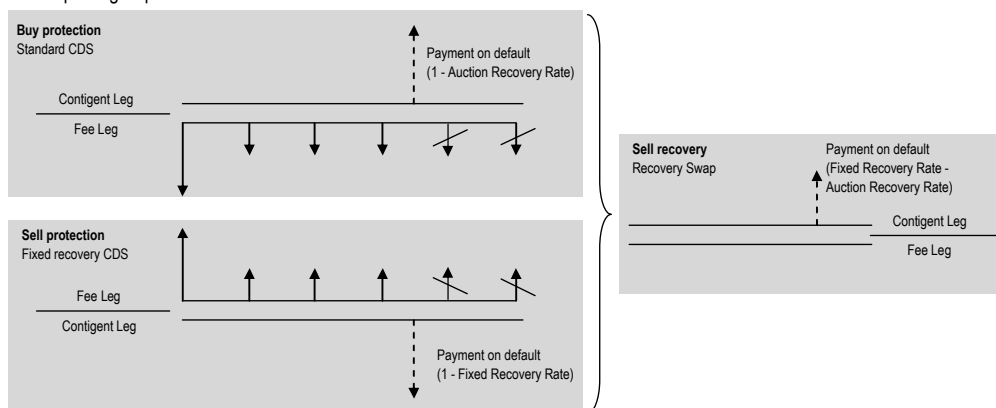
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Recovery Swap Mechanics

Recovery swaps are constructed from two separate swap contracts; a standard CDS contract and a fixed recovery CDS contract¹. The standard CDS contract will pay out par minus auction recovery in the event of default, while the fixed recovery contract will pay out par minus a fixed recovery level specified in the contract term. By combining these two swaps, the payout at maturity is equal to the difference in the auction recovery and the fixed recovery level. We illustrate the cashflows of this combined package in Figure 2

Figure 2: Recovery Swap cashflows

From the perspective of a seller of recovery, i.e. someone who thinks the realised recovery will be lower than current pricing implies



Source: J.P. Morgan.

An investor who believes that the auction recovery will be higher than the fixed recovery can buy a recovery swap. This position is equivalent to buying fixed recovery CDS protection and selling standard CDS protection.

Conversely, an investor who wishes to be short recovery will sell the recovery swap, effectively buying standard CDS protection and selling fixed recovery protection.

The only net cashflow is the one on default: auction – realised recovery

The only net cashflow in a recovery swap is the difference in auction recovery and fixed recovery following a credit event. The two CDS contracts have the same initial upfront costs (see the *Fixed Recovery CDS* section below) and also have the same fixed coupon, meaning that there are no net payments in a recovery swap prior to a credit event occurring. The cashflow of a recovery swap is shown in Equation 1.

Equation 1: Recovery swap cashflow post credit event for a buyer of recovery.

$$\text{Recovery Swap Payout} = \text{Notional} \times (R_{\text{Auction}} - R_{\text{Fixed}})$$

R_{Auction} = Auction recovery. R_{Fixed} = Recovery level specified by recovery swap.

¹ Fixed recovery CDS are also referred to as digital CDS

Recovery swaps return a final recovery of 100% if there are no deliverables

Recovery swaps do not knock out in the event that there are no deliverable obligations into a CDS auction. In this case, the auction recovery will be 100% and the net payout from standard CDS contracts will be zero. For holders of recovery swaps this will have a significant impact upon the value of the swap.

Recovery locks

In addition to recovery swaps, investors can also take views on recovery using *Recovery Locks*. Whereas recovery swaps trade as a package of two separate contracts, recovery locks are structured as a single contract. Underlying features of recovery locks mean that they are more commonly traded in the US than they are in Europe. We discuss recovery locks more in the Appendix.

Fixed recovery CDS

In a fixed recovery CDS, the payout from a seller to a buyer of protection following a credit event is mutually agreed between the two counterparties at trade inception and is equal to $(1 - R_{\text{Fixed}}) \times \text{Notional}$, where R_{Fixed} is the agreed upon recovery rate. By comparison, the payout in a standard CDS contract is uncertain, only being determined at the auction following a credit event. All the other features of a fixed recovery CDS contract are the same as a standard contract.

The quoted upfront cost of a fixed recovery CDS depends upon the default probabilities of the underlying reference entity as well as the specified fixed recovery rate. The lower the fixed recovery rate, the higher the payout following a credit event and so the higher the cost to buy protection.

At a certain recovery level, the quoted upfront of the fixed recovery contract will be equal to the upfront for the standard CDS contract. This recovery level represents the *market-implied recovery level*; recovery swaps are struck at this level and thus trade with zero upfront cost.

A special type of fixed recovery CDS is the *zero recovery swap*. These contracts use a fixed recovery of 0% and so the payout following a credit event is equal to the notional of the contract. As a result of this higher payout, *zero recovery swaps* are more costly to buy protection on than standard credit default swaps or fixed recovery swaps with higher recovery levels.

Recovery assumptions in the ISDA Standard Model

In senior CDS contracts quoted on a spread basis, the ISDA Standard Model assumes a standard recovery of 40% in order to calculate the upfront value that is exchanged upon initiation of the contract. This does not mean that the market implied recovery level is equal to 40%. For example, market consensus could be that recovery will be lower than 40%, but that the likelihood of default is less than that implied by the ISDA Standard Model and as a result the upfront exchanged is ultimately the same.

High yield CDS contracts are usually quoted on upfront terms, rather than on spread terms, which sidesteps the need to assume a recovery in order to convert a quoted spread to an upfront amount through the ISDA Standard Model.

CDS index recovery swaps

In addition to recovery swaps on single names, there is also a market in index-based recovery swaps. These contracts are constructed in the same way as a single name recovery swap; a standard index CDS contract and a fixed recovery contract. Recovery swaps on CDS indices in Europe are primarily quoted on iTraxx Main and Crossover.

Following a credit event, the index recovery swap cashflow is equal to the difference in the fixed recovery and the final auction recovery for the defaulted single name, multiplied by the weighting of that single name in the index.

Equation 2: Index Recovery swap cashflow post single name credit event for a buyer of recovery

$$\text{Recovery Swap Payout} = \text{Notional} \times (R_{\text{SingleName}} - R_{\text{Fixed}}) \times \text{Weighting}$$

$R_{\text{SingleName}}$ = Auction recovery for defaulted single name credit. R_{Fixed} = Recovery level specified by recovery swap. Weighting = % weighting of name within index.

For example, if we trade a €10mm recovery swap at a level of 40% on iTraxx Crossover S19 (an index of 50 names) and there is a single default in the index with a recovery of 10%, a seller of recovery will receive €60,000 $(=(40\% - 10\%) \times 1/50 \times €10\text{mm})$ from the recovery buyer.

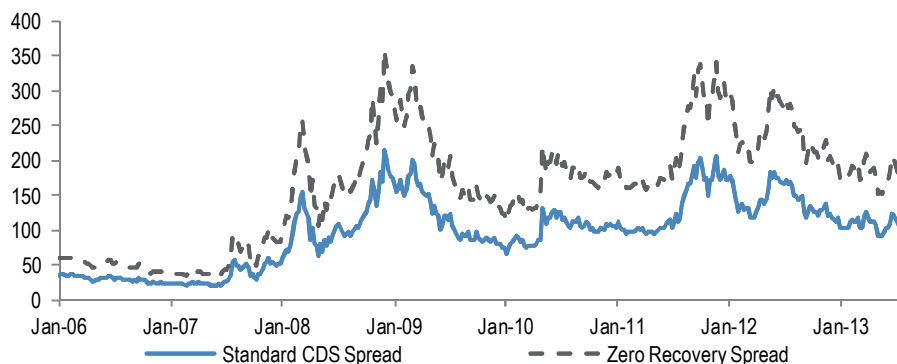
Fixed Recovery Index CDS

Most users of index recovery swaps are looking to take exposure to fixed recovery CDS rather than to express direct views on recovery. Investors looking to increase yield can sell protection on zero recovery index CDS, which pays a higher spread than the conventional contract due to the higher payout that the seller protection must pay if a credit occurs.

The historical difference between the spread of a standard iTraxx Main contract and that of a zero recovery contract is shown in Figure 3. As of COB on 2nd August 2013 the standard 5y spread for iTraxx Main S19 was 96bp and the spread for the zero recovery contract was 160bp; we discuss the calculation of spreads for fixed recovery contracts more in the next chapter.

Figure 3: iTraxx Main Standard and Zero Recovery Spreads

Y-Axis: Spread (bp). Zero recovery spread is calculated using ISDA Standard Model with recovery of 0%.



Source: J.P. Morgan.

Trading Recovery Swaps

Recovery swaps allow investors to take views which are not possible to execute through conventional CDS contracts. In particular, the views investors can express with recovery swaps fall into three main categories:

1. Taking direct views on recovery levels.

Investors can use recovery swaps to take views on the recovery level generated by an auction, simply by buying or selling recovery swaps. This view can be based on fundamental reasoning - for example if an investor believes that at default the company's debt will be trading at a lower level than that implied by the market.

2. Using recovery swaps to gain access to fixed recovery CDS.

Given that a recovery swap consists of two separate contracts (a fixed recovery and standard CDS), investors can use a recovery swap and overlay standard CDS protection to gain access to a fixed recovery CDS contract. For example, an investor can sell a recovery swap and sell standard CDS protection, effectively selling protection on fixed recovery CDS. We highlight two main uses for fixed recovery CDS:

- a. Long risk investors can use fixed recovery CDS to increase the spread they receive by selling protection on contracts with fixed recoveries lower than the current market level.
- b. Investors can hedge assets which are either not deliverable into an auction (e.g. UT2/T1 debt) or are expected to recover higher than a senior unsecured auction by buying protection on fixed recovery CDS. Investors can size the notional of this trade such that the payout from the fixed recovery contract in a credit event matches the expected loss of the asset.

3. Using recovery swaps to limit cash bond losses

Investors who hold cash bonds can sell recovery swaps in order to limit their cash bond losses if a credit event does occur.

Taking outright views on recovery

Credit analysts will regularly have views about where a company's debt is likely to recover under a credit event, whether it be a restructuring, bankruptcy or failure to pay. Recovery swaps offer a direct way to play these views. Compared to conventional CDS contracts, recovery swaps have no carry costs associated with them and require no upfront cashflows to enter.

We believe that for investors looking to take views on recovery, there are two scenarios which make good entry points for recovery swap trades:

- Companies which are already distressed and so have a high probability of a credit event occurring in the near future. These names are obvious candidates for recovery views given the high likelihood that any difference in expected and eventual recovery will be realised.
- Companies which are currently not distressed, but for which the investor has a negative view and believes could become distressed in the near future. Widening

spreads increase the size of any mark-to-market and the fact that investors pay more attention to likely recovery levels as companies become more distressed means that there are likely good entry opportunities for recovery swaps at tighter level. As the name widens, recovery receives greater attention and analysts who do early work on likely recovery levels for tight names can benefit from this.

Many high-yield corporates trading at non-distressed levels currently have mid recovery swap levels of 40% (see Table 1). While 40% might represent a good historical average of recovery levels, dispersion among names can be very high (see the *Historical CDS Auction Recovery Rates* chapter). Investors who have strongly held views on these names and likely recovery levels can take advantage of the relatively small focus on recovery levels of non-distressed names and enter recovery swaps at these levels, positioning for a greater focus on recovery should these names become distressed over the duration of the contract.

Table 1: Current 5y recovery swap levels on common HY names

Ticker	Recovery	
	Bid	Ask
ALUFP	35	45
COLTLN	40	50
CWCLN	35	45
NOKIA	37	47
OTE	37	47
PORTEL	35	45
SUNCOM	35	45
WINDIM	35	45
HAVAS	35	45
PROSIE	35	45
IFX	35	45
VNU	35	45
ITVLN	35	45
NXP	35	45
EMI	55	65
CODERE	40	45
RNK	35	45
DXNSLN	37	47
RALFP	35	45
KABEGR	35	45
ONOSM	35	45
UNITY	35	45
UPCB	35	45
VMED	35	45
AFFP	35	45
IAGLN	35	45
SAS	37	57

Source: J.P. Morgan. Prices as of 5th August 2013.

An OTE example

For example, we can sell OTE recovery at 37% today. If the probability of an OTE default increases in the near future and recovery expectations fall, potentially due to the possibility of a Greece exit from the Eurozone and a depreciation of post-Euro currency, then the seller of recovery will profit from the combination of falling recovery levels and widening spreads. If OTE begins to trade at 50pts upfront (equal to the wides seen in 2012) and recovery expectations fall to 20%, the original recovery swap struck at 37% would have a positive MtM of 13.4% of notional.

While this is not as profitable as buying CDS protection outright, expressing this view through recovery swaps has the upside that there is no cost of holding the protection and no negative MtM if the spread tightens, rather than widens.

Taking views with fixed recovery CDS

As explained above, investors can combine recovery CDS and standard CDS contracts to construct outright positions in fixed recovery CDS. Investors will in some cases prefer to use fixed recovery CDS rather than standard floating-recovery CDS contracts.

One of the most common uses of fixed recovery CDS is as a yield enhancer for long risk investors. Investors can do this by selling protection on zero recovery CDS; sellers of protection will be paid a higher spread for a zero recovery contract than they will for a standard contract in order to compensate the protection seller for the higher payout they would have to make if a credit event did occur.

The spread for a zero recovery CDS contract can be calculate by dividing the standard CDS contact spread by one minus the market recovery. For example, if the quoted standard CDS spread is 100bp based on a 40% recovery, the zero recovery CDS spread will be equal to 167bp ($=100\text{bp}/(1-0.4)$).

The spread of a general fixed recovery CDS can be calculated using the standard spread, the market recovery and the fixed recovery, as shown in Equation 3.

Equation 3: Spread for fixed recovery CDS based on standard CDS spread.²

$$\text{Fixed Recovery CDS Spread} = \text{Standard CDS Spread} \times \frac{1 - R_{\text{Fixed}}}{1 - R_{\text{Standard}}}$$

² This quoted spread for a fixed recovery CDS contract assumes conversion from upfront to spread in the ISDA Standard Model uses the fixed recovery rather than the market recovery. Using the market recovery rather than the fixed recovery will result in a slightly higher spread.

R_{Fixed} = Recovery specified by fixed recovery contract. R_{Standard} = Recovery associated with standard CDS spread.

Hedging with fixed recovery CDS

Fixed recovery CDS can be used to hedge instruments which are likely to have a different recovery rate to that of a CDS auction.

Senior secured debt and loans.

Debt at the senior secured level is likely to recover higher than the senior unsecured debt referenced by the majority of CDS contracts. Investors looking to hedge their senior secured debt with CDS can size the notional of fixed recovery CDS contracts to match the expected difference between senior secured recovery and par.

For example, if we own €10mm of senior secured loans and expect them to recover at 70% and fixed recovery CDS trades at a recovery of 40%, we can buy €5million notional of fixed recovery CDS protection to hedge the €3million ($= €10\text{mm} \times (1 - 70\%)$) we expect to lose if a credit event does occur.

T1 and UT2

Very little CDS is traded on debt below the LT2 level and UT2/T1 debt is not deliverable in LT2-level auctions. For investors looking to hedge these instruments using CDS, fixed recovery CDS allows the investor to pre-define the payout they will receive if a credit event does occur. If recovery is currently trading at 40%, an investor who owns €10million of T1 bonds and expects them to recover at 0%, the investor can buy €16.7mm of fixed recovery CDS protection ($= €10\text{mm} / (1 - 40\%)$) and will receive a payout of €10million if a credit event does occur.

Hedging cash bond recovery with recovery swaps

Holders of cash bonds can use recovery swaps to guarantee a minimum price for their bonds at recovery. For example, if cash bonds are currently trading at 60pts, and recovery is trading at 40%, the holder of cash bonds can sell recovery at 40%, effectively guaranteeing a minimum price of 40pts for their cash bonds if a credit event does occur. If there is no credit event, then the investor receives the full upside in any rally in the bond price. This differs from the case where an investor buys CDS protection to hedge a bond; in this case most of the upside will be counteracted by a fall in the value of the CDS protection.

In this case, if the auction recovery was 30% then the investor would receive 10pts from their short recovery swap position. The investor can also place a market order to sell their bonds in the auction, guaranteeing that they will receive the eventual recovery rate as payment for their bonds. Overall, combining the 30pt value of the bonds with the 10pt value of the recovery swap position gives a total position value of 40pts. This is only an option for investors whose cash bonds are deliverable into the relevant CDS contract.

If the investor holds a bond that is more expensive than the cheapest-to-deliver bond, they may prefer to sell this bond outside the auction. If the bond is not the cheapest to deliver, then the eventual price of the package after selling a recovery swap will be worth the fixed recovery level plus any premium in the bond price over the auction recovery level.

Valuation of Recovery Swaps

The fixed recovery within a recovery swap is struck at a level which gives a recovery swap a zero upfront cost. As time passes, the market's expectations around recovery on a certain name can change, which means that the fixed recovery level that the recovery swap was struck at is no longer "on-market" and so the recovery swap has a mark-to-market associated with it.

This means that buyers and sellers of recovery swaps can realise gains (and losses) on their trades by exiting them early, without needing to wait for a credit event to occur.

Marking recovery swaps to market

The mark-to-market of a recovery swap broadly depends on two separate factors: the recovery swap cashflow we expect to receive following a credit event, and the probability of a credit event occurring.

1. Expected Recovery Swap Cashflow

Following a credit event, the recovery buyer will receive the auction recovery minus the fixed recovery rate specified by the swap. Our current best estimation for the auction recovery is the level that zero upfront recovery swaps are now quoted at in the market. This means that our expectation for the recovery swap cashflow prior to a credit event occurring is equal to $(R_{Market} - R_{Fixed})$, where R_{Market} is the current level that recovery swaps are being traded in the market and R_{Fixed} is the level that our recovery swap was struck at.

2. Probability of Default

The recovery swap cashflow is only paid if a credit event actually occurs. The mark-to-market of a recovery swap must therefore take into account the probability that a credit event occurs; for tight spread names with little chance of an actual default, the actual P&L implications of the market's expectations of recovery changing are tiny as the chance of actually realising that cashflow are so small. Current default probabilities can be backed out from traded upfronts using the recovery level that recovery swaps are currently trading at.

Qualitatively, the impact of recovery levels and default probabilities on recovery buyers and sellers can be summarised as:

- If market traded recovery increases, recovery buyers benefit and recovery sellers lose out.
- If default probability increases, the magnitude of the P&L (whether negative or positives) increases.

The mark-to-market of a recovery swap contract can be expressed as the expected cashflow multiplied by the cumulative probability of a default over the lifetime of the contract, while also taking present value effects into account as well.

Equation 4: Recovery swap mark-to-market for recovery buyer.

$$MTM = \text{Notional} \times PV(R_{Market} - R_{Fixed}) \times \text{Cumulative Prob of Default}$$

R_{Market} = Current recovery swap trading level. R_{Fixed} = Recovery level specified by initial recovery swap.

It is also possible to express mark-to-market in terms of the standard CDS flat spread and the contract risky annuity, as shown in Equation 5

Equation 5: Recovery swap mark-to-market for recovery buyer.

$$MTM = \text{Notional} \times (R_{\text{Market}} - R_{\text{Fixed}}) \times \frac{\text{Spread}}{1 - R_{\text{Market}}} \times \text{Risky Annuity}$$

R_{Market} = Current recovery swap trading level. R_{Fixed} = Recovery level specified by initial recovery swap. Spread = Flat Spread for standard CDS contract based on R_{Market} .

A worked example

An investor believes that recovery on Portugal Telecom will be higher than expected and buys a 5y recovery swap at 45 on a notional of €10mm. One month later, the traded level of recovery swaps has increased to 70. The current spread on the 5y Portel standard CDS contract is 400bp, and the current risky annuity of the contract is 3.7. The MTM of the recovery swap is equal to

$$MTM = €10\text{mm} \times (70\% - 45\%) \times \frac{400\text{bp}}{1 - 70\%} \times 3.7 = €1.23\text{mm}$$

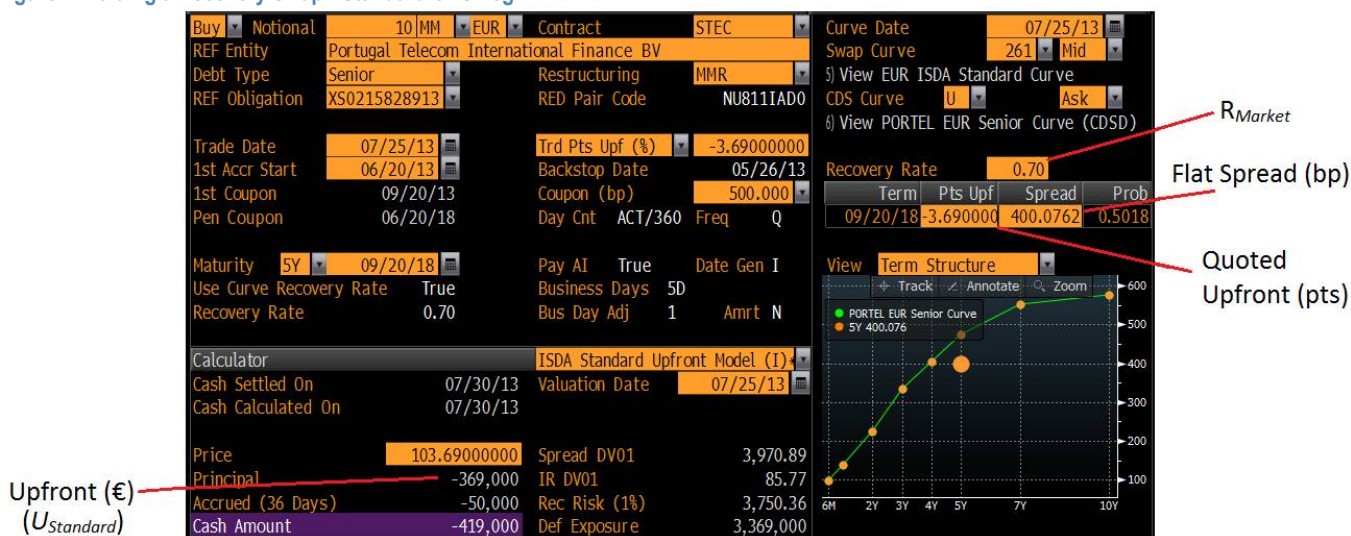
Marking recovery swaps to market with CDSW

It is also possible to use the CDSW function on Bloomberg to calculate the mark-to-market of a recovery swap. To do this we value both the standard CDS and fixed recovery CDS legs, and calculate the net difference in the upfront of the two contracts.

We use the same example as in the previous section; a 5y recovery swap on Portugal Telecom. The investor bought recovery at 45, and the current traded level is now 70. The standard CDS contract trades with an upfront of -3.69%.

The first step of marking a recovery swap to market is to value the standard CDS leg, as shown in Figure 4. We enter the upfront of -3.69% and the current R_{Market} of 70% as shown. The current cash upfront, U_{Standard} for this contract is -€369,000 and the equivalent flat spread, based on a 70% recovery, is 400bp.

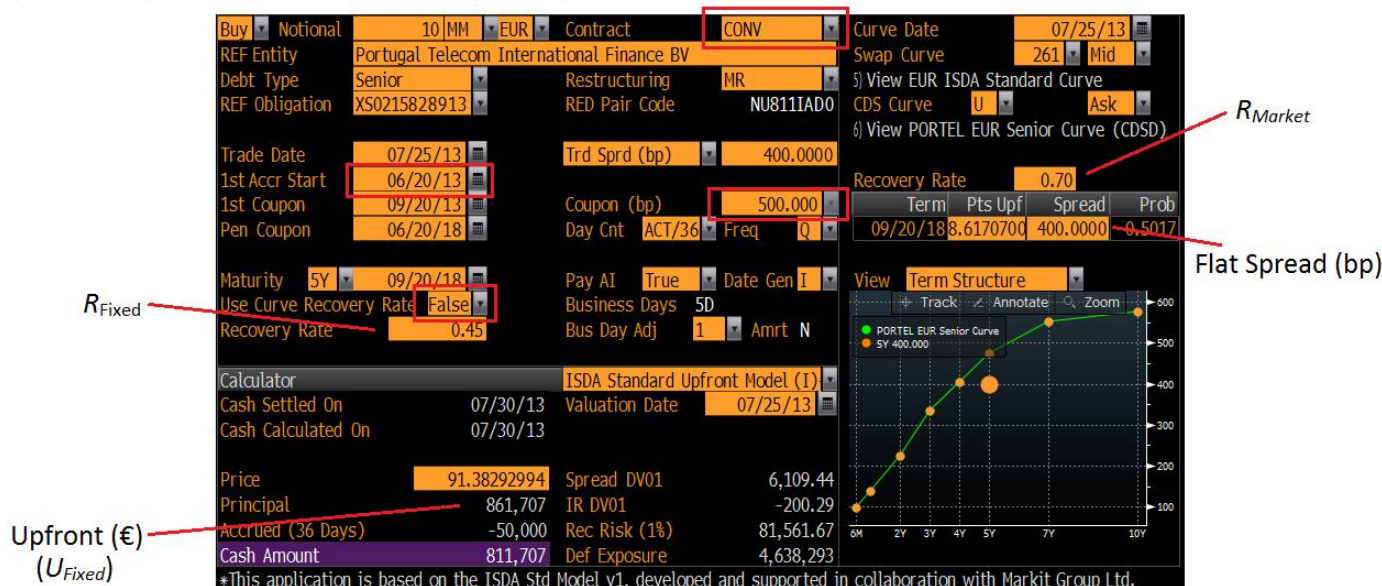
Figure 4: Valuing a Recovery Swap - Standard CDS Leg



Next, we value the fixed recovery leg. To do this, the contract type should be changed to "CONV" as shown below. As a result of this change, the 1st Accr Start date and Coupon will also need to be reset to match the values used in the standard CDS valuation shown above. The Flat Spread should be changed to the number we produced in the valuation of the standard CDS contract above - 400bp in this case. R_{Market} should then be changed to the current recovery level of 70%. Finally, the "Use Curve Recovery Rate" field should be changed to "False" and this recovery level set to R_{Fixed} (45% in this case). These instructions are highlighted in Figure 5.

The current clean upfront for the fixed recovery CDS contract is shown under "Principal" in the bottom half of the screen. The recovery rate on the right hand side of the screen is the current market-implied rate (R_{Market}) and the recovery on the left hand side is the recovery specified in the fixed recovery CDS contract (R_{Fixed})

Figure 5: Valuing a Recovery Swap - Fixed Recovery CDS Leg



Source: J.P. Morgan.

The mark-to-market of the recovery swap is equal to the difference in the clean upfronts of the two contracts. For a recovery buyer, the mark-to-market is equal to $U_{Fixed} - U_{Standard}$. In this example, the difference is equal to $€861,707 - (-€369,000) = €1,230,707$. This matches the answer shown in the previous section.

Sensitivities of recovery swaps

Users of standard CDS contracts often use concepts such as Spread DV01 to measure the exposure of their contracts to changing market conditions. We can extend these principles to recovery swaps as well in order to gain a better idea of how the mark-to-market of a contract depends upon changing spreads and recovery expectations.

Recovery sensitivity - recovery buyers profit from rising recovery

The current traded recovery rate is obviously a key driver of recovery swap P&L. Qualitatively, the impact of a recovery rate change depends on how high the probability of default is; for higher probabilities of default the impact is larger as the recovery payout is more likely to be realised.

Equation 6 shows the MTM effects for a 1% change in traded recovery for a buyer of recovery.

Equation 6: Recovery sensitivity - MTM change for a 1% change in traded recovery level

$$\text{Recovery sensitivity} = 1\% \times \text{Notional} \times \frac{\text{Spread}}{1 - R_{\text{Market}}} \times \text{Risky Annuity}$$

R_{Market} = Current recovery swap trading level. Spread = Flat Spread for standard CDS contract based on R_{Market} .

Using our Portel example, the current market spread is 400bp, the risky annuity is 3.7 and current market recovery is 70%. On a notional of €10mm, a buyer of recovery would expect to make €49,333 for a 1% change in recovery ($= 1\% \times €10\text{mm} \times 4\% / (1 - 0.7) \times 3.7$).

If the probability of default increased, causing spreads to widen to 1000bp (resulting in a new risky annuity of 2.4), the impact from a 1% change in recovery would rise to €80,000.

Spread sensitivity - MtM magnitude increases as spreads widen.

As probabilities of default increase the magnitude of the existing P&L increases, no matter whether the current MTM is positive or negative.

Equation 6 shows the MTM effects for a 1bp widening in the standard CDS contract spread for a buyer of recovery.

Equation 7: Spread sensitivity - MTM change for a 1bp change in flat spread for recovery buyer

$$\text{Spread sensitivity} = 1\text{bp} \times \text{Notional} \times \frac{R_{\text{Market}} - R_{\text{Fixed}}}{1 - R_{\text{Market}}} \times \text{Risky Annuity}$$

R_{Market} = Current recovery swap trading level. R_{Fixed} = Recovery level specified by initial recovery swap.

In our Portel example, the current market spread is 400bp, the risky annuity is 3.7, current market recovery is 70% and the fixed recovery level is 45%. A 1bp change in spread would therefore result in a €3,083 increase in P&L ($= 1\text{bp} \times €10\text{mm} \times (0.7 - 0.45) / (1 - 0.7) \times 3.7$).

Time value - MtM magnitude decreases as time passes

As time passes without a credit event in the reference entity, the cumulative probability of default decreases. This reduces the magnitude of the current MTM, causing it to tend to zero as maturity approaches. The decline is not completely linear, as shown in Figure 6, but it is close enough so that we can use a linear approximation to gain a rough idea of the likely time value of holding a recovery swap, as shown in Equation 8

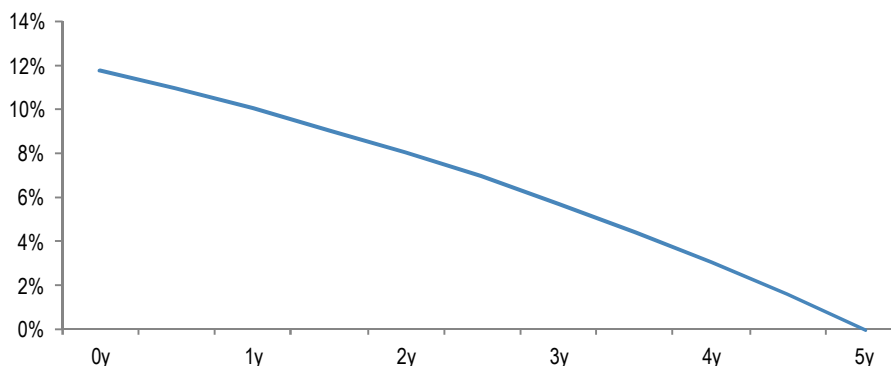
Equation 8: Time value of recovery swap, based on current mark-to-market.

$$\text{Time Value} = -\text{Current MtM} \times \frac{\text{Time shift}}{\text{Current time to maturity}}$$

For example, for a 5y year recovery swap with a current MtM of +12%, we would expect that the passage of one year would result in a time value of -2.4% ($= -12\% \times 1/5$). Taking this into account, we would expect our total MtM in one year's time to be 9.6% ($= 12\% - 2.4\%$) if recoveries and spreads are otherwise unchanged.

Figure 6: Evolution of Recovery Swap MtM with time

Y-Axis: MtM of 5y Recovery Swap (% of Notional). X-Axis: Years from now. Assumes constant spreads, recovery levels and an initial MtM of +12%.



Source: J.P. Morgan.

Recovery swap bid-offer costs

This framework for marking recovery swaps to market can also be used to ascertain the bid-offer of a recovery swap in cash terms. Equation 9 uses the same principles as Equation 5 to calculate the cash bid-offer for a recovery swap trade.

Equation 9: Cash bid-offer for a recovery swap.

$$Bid/Offer = Notional \times (R_{Offer} - R_{Bid}) \times \frac{Spread}{1 - R_{Market}} \times Risky Annuity$$

R_{Market} = Current recovery swap trading level. R_{Fixed} = Recovery level specified by initial recovery swap. Spread = Flat Spread for standard CDS contract based on R_{Market} .

For the Portel example used above, if the initial market on recovery swaps was 40-45 then our bid-offer costs on a €10mm trade would be roughly equal to €129,000 ($=€10mm \times (0.45 - 0.40) \times 0.04/(1-0.425) \times 3.7$), equivalent to 1.3pts in upfront terms or 35bp in running spread terms.

Historical CDS Auction Recovery Rates

Since the introduction of the standardised CDS auction process there have been a total of 90 auctions worldwide at the senior unsecured level (excluding LCDS contracts). The average recovery rate over the universe of historical credit events is 37.3%; close to the often quoted 40% assumption. However, there is a large amount of dispersion in the underlying recoveries and a large proportion of names have recovered either well above or well below this 40% level.

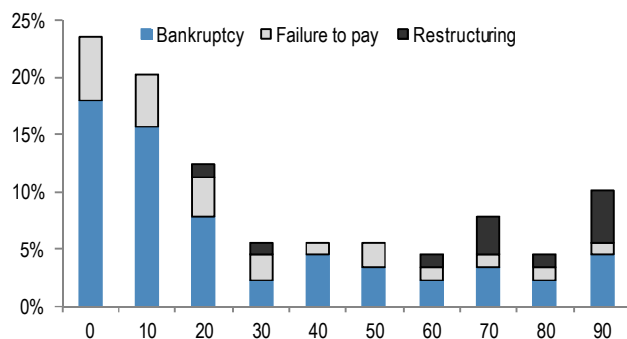
This distribution of historical recoveries is shown in Figure 7; from this we can see that relatively few credit events have resulted in a recovery level close to 40%; only 17% of historical auctions have resulted in a recovery of between 30% and 60%. 56% of auctions have given a recovery of less than 30% and 27% of auctions produce a recovery of higher than 60%.

The historical distribution of recovery rates is shown in Figure 8; recoveries have generally been higher in 2011-2013 than in 2008-2009, which has largely been driven by the higher number of restructuring events in European banks pushing up recovery rates.

We believe that this dearth of credits recovering close to 40% demonstrates that credit market participants with high conviction views concerning the likely final recovery values of CDS contracts can take advantage of the high number of recovery swaps trading close to the 40% level, as shown in Table 1.

Figure 7: Distribution of CDS Auction Recovery Rates by Type of Event

Y-Axis: Proportion (%). X-Axis: Recovery rate (%).

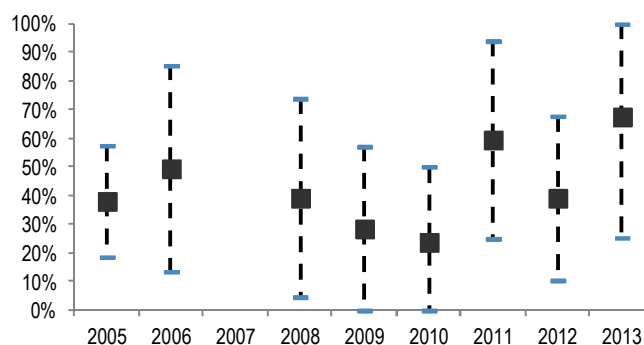


Source: J.P. Morgan, Credit Fixings, ISDA. Senior unsecured 2.5y-5y bucket only.

Source: J.P. Morgan, Credit Fixings, ISDA. Senior unsecured 2.5y-5y bucket only.

Figure 8: Average CDS recoveries through time.

Y-Axis: Recovery Rate (%). X-Axis: Year. There were no unsecured CDS credit events in 2007. Square markers show average level for each year, error bars show average plus/minus standard deviation.

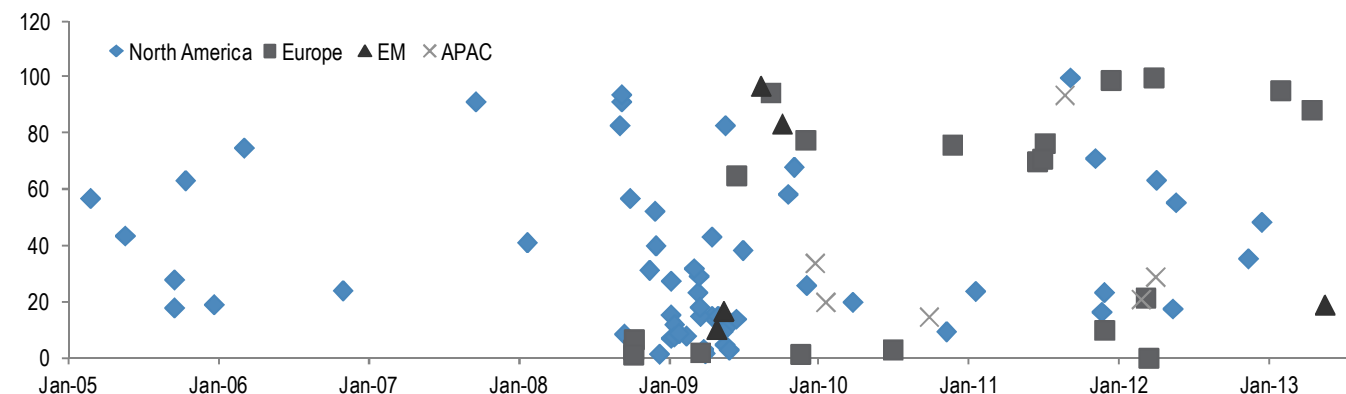


Source: J.P. Morgan, Credit Fixings, ISDA. Senior unsecured 2.5y-5y bucket only.

The historical distribution of recovery rates by region is shown in Figure 9. The universe of historical auction events for the senior unsecured 2.5-5y bucket is shown in Table 2 and Table 3.

Figure 9: Historical Recovery Rates from CDS Auctions - Global

Y-Axis: Recovery rate (%). X-Axis: Date of Credit Event.



Source: J.P. Morgan, Credit Fixings, ISDA. Senior unsecured 2.5y-5y bucket only.

Table 2: Historical Recovery Rates - Global CDS Auction

Reference Entity	Date of Credit Event	Final Recovery Rate	Type of event	Region	Sector
Winn-Dixie Stores Inc/Old	21-Feb-05	57	Bankruptcy	North America	Corporate
Collins & Aikman	17-May-05	43.625	Bankruptcy	North America	Corporate
Delta Airlines Corp	14-Sep-05	18	Bankruptcy	North America	Corporate
Northwest Airlines	14-Sep-05	28	Bankruptcy	North America	Corporate
Delphi Corp	11-Oct-05	63.375	Bankruptcy	North America	Corporate
Calpine Corp	20-Dec-05	19.125	Bankruptcy	North America	Corporate
Dana Corp	03-Mar-06	75	Bankruptcy	North America	Corporate
Dura	30-Oct-06	24.125	Bankruptcy	North America	Corporate
Quebecor	22-Jan-08	41.25	Bankruptcy	North America	Corporate
Tembec	04-Sep-08	83	Bankruptcy	North America	Corporate
Fannie Mae	08-Sep-08	91.51	Bankruptcy	North America	Financial
Freddie Mac	08-Sep-08	94	Bankruptcy	North America	Financial
Lehman	15-Sep-08	8.625	Bankruptcy	North America	Financial
Washington Mutual	29-Sep-08	57	Bankruptcy	North America	Financial
Glitnir	07-Oct-08	3	Bankruptcy	Europe	Financial
Landsbanki	07-Oct-08	1.25	Bankruptcy	Europe	Financial
Kaupthing	09-Oct-08	6.625	Bankruptcy	Europe	Financial
Ecuador	15-Nov-08	31.375	Failure to pay	North America	Sovereign
Masonite	28-Nov-08	52.5	Failure to pay	North America	Corporate
Hawaiian Telcom	01-Dec-08	40.125	Failure to pay	North America	Corporate
Tribune	09-Dec-08	1.5	Bankruptcy	North America	Corporate
Lyondell	06-Jan-09	15.5	Bankruptcy	North America	Corporate
Millenium America Inc	07-Jan-09	7.125	Bankruptcy	North America	Corporate
Equistar	07-Jan-09	27.5	Bankruptcy	North America	Corporate
Nortel Networks Limited	14-Jan-09	7.625	Bankruptcy	North America	Corporate
Nortel Networks Corporation	15-Jan-09	12	Bankruptcy	North America	Corporate
Smurfit-Stone Container	26-Jan-09	8.875	Bankruptcy	North America	Corporate
Aleris International, Inc	13-Feb-09	8	Bankruptcy	North America	Corporate
Station Casinos	04-Mar-09	32	Failure to pay	North America	Corporate
Capmark	13-Mar-09	23.375	Failure to pay	North America	Corporate
Rouse	16-Mar-09	29.25	Failure to pay	North America	Corporate
Great Lakes	18-Mar-09	18.25	Bankruptcy	North America	Corporate
LyondellBasell	19-Mar-09	2	Failure to pay	Europe	Corporate
Chemtura Corporation	19-Mar-09	15	Bankruptcy	North America	Corporate
Charter Comm Holdings	27-Mar-09	2.375	Bankruptcy	North America	Corporate
Abitibi Consol Inc.	27-Mar-09	3.25	Failure to pay	North America	Corporate
Idearc	31-Mar-09	1.75	Bankruptcy	North America	Corporate
Gen Growth Pptys Inc	16-Apr-09	43.25	Bankruptcy	North America	Corporate
Bowater Incorporated	16-Apr-09	15	Bankruptcy	North America	Corporate
JSC BTA	28-Apr-09	10.25	Failure to pay	EM	Financial
Syncora	01-May-09	15	Failure to pay	North America	Corporate
Hayes Lemmerz Intl Inc	13-May-09	9.5	Bankruptcy	North America	Corporate

Source: J.P. Morgan, Credit Fixings, ISDA. Senior unsecured 2.5y-5y bucket only.

Table 3: Historical Recovery Rates - Global CDS Auction - continued.

Reference Entity	Date of Credit Event	Final Recovery Rate	Type of event	Region	Sector
JSC Alliance Bank	15-May-09	16.75	Failure to pay	EM	Financial
RH Donnelley Corp	18-May-09	4.875	Failure to pay	North America	Corporate
Georgia Gulf Corp	19-May-09	83	Bankruptcy	North America	Corporate
Visteon Corporation	28-May-09	3	Bankruptcy	North America	Corporate
General Motors	01-Jun-09	12.5	Bankruptcy	North America	Corporate
Thomson	15-Jun-09	65.125	Restructuring	Europe	Corporate
Six Flags Inc	15-Jun-09	14	Bankruptcy	North America	Corporate
Lear Corp	01-Jul-09	38.5	Bankruptcy	North America	Corporate
Cemex	14-Aug-09	97	Restructuring	EM	Corporate
Bradford & Bingley	07-Sep-09	94.625	Failure to pay	Europe	Financial
NJSC Naftogaz of Ukraine	05-Oct-09	83.5	Failure to pay	EM	Corporate
Metro-Goldwyn Mayer Inc	19-Oct-09	58.5	Failure to pay	North America	Corporate
CIT Group Inc.	03-Nov-09	68.125	Bankruptcy	North America	Financial
Hellas Telecom	18-Nov-09	1.375	Bankruptcy	Europe	Corporate
Thomson	01-Dec-09	77.75	Bankruptcy	Europe	Corporate
Financi Guaranty Ins Co(FGIC)	03-Dec-09	26	Failure to pay	North America	Financial
AIFUL	24-Dec-09	33.875	Restructuring	APAC	Corporate
Japan Airlines	19-Jan-10	20	Bankruptcy	APAC	Corporate
AMBAC Assurance Corp	26-Mar-10	20	Bankruptcy	North America	Financial
Truvo	02-Jul-10	3	Bankruptcy	Europe	Corporate
Takefuji Corp	28-Sep-10	14.75	Bankruptcy	APAC	Corporate
Ambac Financial Group	09-Nov-10	9.5	Bankruptcy	North America	Financial
Anglo	24-Nov-10	76	Restructuring	Europe	Financial
Eastman Kodak	19-Jan-11	23.875	Bankruptcy	North America	Corporate
Allied Irish	19-Jun-11	70.125	Failure to Pay	Europe	Financial
Irish Life	01-Jul-11	71	Restructuring	Europe	Financial
BKIR	07-Jul-11	76.625	Restructuring	Europe	Financial
Victor Company of Japan	25-Aug-11	93.75	Restructuring	APAC	Corporate
NewPage Corp	07-Sep-11	100	Bankruptcy	North America	Corporate
Dynegy Holdings Inc.	07-Nov-11	71.25	Bankruptcy	North America	Corporate
PMI Group	23-Nov-11	16.5	Bankruptcy	North America	Corporate
AMR Corp	29-Nov-11	23.5	Bankruptcy	North America	Corporate
Seat Pagine	30-Nov-11	10	Failure to pay	Europe	Corporate
Northern Rock	15-Dec-11	99.125	Restructuring	Europe	Financial
Elpida Memory	27-Feb-12	21	Bankruptcy	APAC	Corporate
Greece	09-Mar-12	21.5	Restructuring	Europe	Sovereign
ERC	16-Mar-12	0	Failure to pay	Europe	Corporate
Eircom	29-Mar-12	100	Bankruptcy	Europe	Corporate
Sino Forest Corp	02-Apr-12	29	Bankruptcy	APAC	Corporate
Hawker Beechcraft Acquisition	04-Apr-12	63.5	Failure to pay	North America	Corporate
Residential Capital Corporation	14-May-12	17.625	Bankruptcy	North America	Corporate
Houghton Mifflin Company	22-May-12	55.5	Bankruptcy	North America	Corporate
Overseas Shipholding Group Inc	14-Nov-12	35.5	Bankruptcy	North America	Corporate
Edison Mission Energy	17-Dec-12	48.5	Bankruptcy	North America	Corporate
SNS	01-Feb-13	95.5	Restructuring	Europe	Financial
Bankia	18-Apr-13	88.5	Restructuring	Europe	Financial
Urbi Desarrollos Urbanos S A Bursatil	20-May-13	19	Failure to pay	EM	Corporate

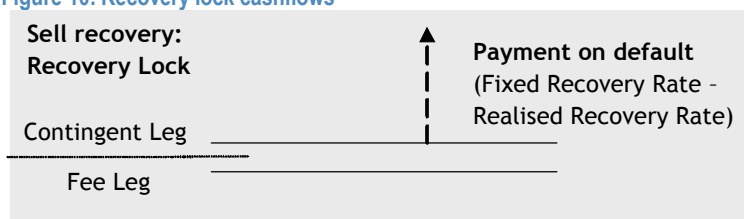
Source: J.P. Morgan, Credit Fixings, ISDA. Senior unsecured 2.5y-5y bucket only.

Appendix: Recovery Locks

Along with the recovery swap package discussed in this package, investors have historically also been able to trade recovery levels through *recovery locks*. The introduction of recovery locks stemmed from the desire to trade recovery through a single contract, rather than as a package of two separate contracts as is the case for recovery swaps.

Recovery lock cashflows are very similar to those for a recovery swap, as shown in Figure 10. The only cashflow in the lock is a single payment following a credit event, equal to the difference in the realised auction recovery rate and the fixed recovery specified under the terms of the lock.

Figure 10: Recovery lock cashflows



Source: J.P. Morgan.

Under current documentation, recovery locks do not knock out if there are no deliverable obligations into an auction and will return a realised recovery rate of 100% if this is the case. The behaviour of recovery locks in this case is the same as that of recovery swaps.

Recovery locks are primarily traded in North America on names with large volumes in the underlying single name CDS. For the most part, recovery locks are not traded on European names given the possibility for restructuring events; in this case the process for determining a single realised recovery rate is more involved and less straight forward than it would be for Failure To Pay or Bankruptcy events due to the possibility of buyer/seller triggers and the impact of bucketing.

If the outstanding single name CDS notional is too small for an auction to take place but there are deliverable obligations outstanding then there is a standard process to physically settle a recovery lock.

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