FINM3405 Derivatives and Risk Management

Week 9: Credit default swaps (CDS)

Dr Godfrey Smith

September 14, 2024

Contents

Mechanics

This week we turn to the next section of the course covering credit default swaps, interest rate swaps (along with FRN), and currency swaps. All these instruments are negotiated and originated OTC and dominate global financial markets on most measures of market size and activity. This week we cover credit default swaps (CDS) and the material will be very useful for your Team Project on Bill Ackman and Pershing Square.

- Readings: Chapters 25.1-7 of Hull.

I also highly recommend Chapter 42 Credit Default Swaps (CDS) of Cuthbertson, Nitzsche and O'Sullivan, Derivatives: Theory and Practice.

- I'd also mention that the International Swaps and Derivatives Association (ISDA) plays a very strong role in this space.

Mechanics

A **credit default swap** (**CDS**) is like an insurance contract in which:

- The CDS buyer "takes out insurance" against a credit event (e.g. default) of a company or sovereign state and in return pays the CDS seller a regular, fixed "insurance" premium for the insurance.
- The CDS seller receives the CDS premium and agrees to pay the buyer a compensation amount upon occurrence of the credit event.
- If the credit event occurs, the compensation is paid, the CDS buyer pays the period's accrued premium, and the CDS ceases to exist.
- If no credit event occurs, the CDS buyer keeps paying the periodic premium until the CDS maturity date.

We now go into the details of CDS terminology, mechanics and pricing:

Mechanics

- The CDS buyer is called the **protection buyer**.
- The CDS seller is called the **protection seller** or **swap writer**.
- The company or sovereign in the CDS is the **reference entity**.
- The particular debt securities (bonds, loans, floating rate notes, etc) of the reference entity over which the CDS is written are called **reference assets** or **bonds** or **securities** or **obligations**.
- The credit events relating to the reference entity's reference assets as specified and defined in the CDS are called **reference events**.
- The "insurance" or compensation amount paid upon the occurrence of a reference event is called the CDS **payout**.

Mechanics

The CDS can be single-name or multi-name:

- Above we're referring to **single-name** CDS, which are written over the reference assets of one single reference entity.
- **Multi-name** CDS, sometimes called **basket** CDS, are written over the reference assets of multiple reference entities, and the nature of their payouts can differ (add-up basket, k^{th}-to-default basket, etc).

There's also **CDS indices** (see wiki), which are effectively basket CDS:

- The CDX range (also see Investopedia and the CDS Indices Primer).
- The iTraxx range (also see Investopedia and wiki).

They're important for your Team Project and we cover them later.

Mechanics

Reference events specified in a CDS include, but are not limited to:

- **Default**: Failure of the reference entity to pay interest/loan/coupon payments or the principal or face value of the reference asset.
- **Bankruptcy**: Official or legal/judicial administration, liquidation or winding up of the reference entity rendering it unable to meet, either partially or wholly, its obligations of the reference asset.
- **Restructuring**: Corporate or debt restructuring that changes the nature of the reference asset in terms of its original structure and the original agreement between the reference entity and its creditors.

Mechanics

Reference events continued:

- **Repudiation/moratorium**: The reference entity disputing aspects of or failing to recognise the reference asset and its obligations, thereby disputing, delaying or refusing payment (common when the reference entity is a sovereign or sovereign state).
- **Covenants**: The reference entity's breaching or noncompliance with debt covenants, including due to deterioration in financial position or the devaluation or writing off of assets used as security/collateral.
- **Ratings downgrade**: The downgrading of a reference entity by a credit ratings agency (such as S&P, Moody's, Fitch, etc).

Mechanics

Remark

An intuitive way to think about reference events is they could potentially be anything that materially changes the ability of the reference entity to meet its original obligations of the reference assets, and which therefore would materially or significantly reduce the market value of the reference assets.

- It makes sense that creditors/lenders and other debt investors/holders may want to protect themselves against reference events, and they do this with CDS.

The idea of a reference event leading to a significant decline in the market value V of the reference entity's reference assets leads to:

Mechanics

The **payout** upon the occurrence of a reference event is defined as:

- A CDS is written over a **notional principal** or **face value** F.
  - The protection buyer is taking out protection ("insurance") over a holding of the reference entity's reference assets of total face value F.
- CDS can be physically deliverable or cash settled upon the occurrence of a reference event (after which the CDS vanishes):
  - **Physical delivery**: The protection seller agrees to buy the reference asset holding from the protection buyer at its total face value F.
  - **Cash settled**: The protection seller agrees to pay the protection buyer the difference $F - V$ between the face value F and the market value V of the reference asset.

Mechanics

Remark

Most CDS are cash settled. Also, in the theoretical treatment of pricing and hedging/speculating with CDS, there is no difference between a CDS being cash settled or physically delivered.

- So for simplicity we assume that CDS are always cash settled.

We define the important concept of the **recovery rate** R:

- It is the market value V of the reference asset expressed as a percent of the notional principal F after a reference event:

$$V = RF.$$

Mechanics

- From another perspective, R tells us "how much we would recover" if we held a portfolio of the reference asset of total face value F and then sold it after a reference event occurred: We receive $V = RF$.

It also follows then that the **payout** $F - V$ for a cash settled CDS is

$$\text{CDS payout} = (1 - R)F.$$

Remark

This payout $(1 - R)F$ is sometimes called the **loss given default** since it's how much we'd lose on a holding of the reference asset.

Mechanics

The above illustrates one way in which CDS are used for hedging:

- Suppose you hold a portfolio of the reference entity's reference assets (say bonds) of a total face value of F.
  - Suppose it's roughly trading at par value, so $V \approx F$.
- Upon the occurrence of a reference event (say a default), the market value of the reference asset falls to $V = RF$
  - It falls by an amount of $F - V = (1 - R)F$.
- The CDS then pays out this amount $(1 - R)F$.
  - It covers your loss upon the default of the reference entity.

Mechanics

The regular, fixed "insurance premium" paid by the protection buyer to the protection seller is called the **CDS coupon** or **spread** or **premium**.

- The premium C is given as a percent k of the notional principal:

$$\boxed{\text{premium} = kFd,}$$

  with $d = \frac{1}{2}$ if semiannual premiums, $d = \frac{1}{4}$ if quarterly premiums, etc. The market convention is premiums are usually paid quarterly.

- Here, k is also called the **CDS spread**.

Question: Why is k called the CDS "spread"?

Mechanics

Remark

Answer: Let r be the risk-free rate, or a reference rate such as Term SOFR or Euribor which are effectively risk-free rates. Also let y be the yield on the reference entity's reference asset.

- Then $y - r$ is the reference asset's **risk premium** or **spread**.
- Below we use arbitrage arguments to show that k should approximately equal this risk spread $y - r$ of the reference asset over the risk-free rate, hence the terminology.

Furthermore, we will indeed show that the CDS spread k reflects the perceived credit risk of the reference entity's reference asset:

- k rises (falls) when this perceived credit risk rises (falls).

Mechanics

Remark (Continued)

So CDS spreads k reflect the market's assessment of the credit or default risk of the reference entity.

- In fact, we can use CDS spreads trading in the market to deduce the implied probability of default of the reference entity (numerically, like deducing option implied vols).

In the light, the World Sovereign Bonds website gives CDS spreads for sovereigns and their implied probability of default.

Mechanics

Remark (Continued)

		Rating	5 Years Credit Default Swaps				
	Country	S&P	5Y CDS	Var 1m	Var 6m	PD (*)▲	Date
	Switzerland	AAA	6.00	-7.26 %	-20.00 %	0.10 %	11 Sep
	Denmark	AAA	9.31	-3.62 %	-0.96 %	0.16 %	12 Sep
	Germany	AAA	9.57	+6.45 %	-16.13 %	0.16 %	12 Sep
	Netherlands	AAA	9.69	-5.65 %	-4.81 %	0.16 %	12 Sep
	Sweden	AAA	10.55	-11.34 %	-21.79 %	0.18 %	12 Sep
	Australia	AAA	13.10	-0.30 %	-18.68 %	0.22 %	12 Sep
	Austria	AA+	13.83	+3.60 %	-14.47 %	0.23 %	12 Sep
	Ireland	AA	17.84	-5.71 %	-15.81 %	0.30 %	12 Sep
	Finland	AA+	19.56	-0.76 %	-4.45 %	0.33 %	12 Sep
	Japan	A+	19.78	-10.13 %	+2.75 %	0.33 %	12 Sep
	Belgium	AA	19.83	+4.31 %	+2.06 %	0.33 %	12 Sep
	United Kingdom	AA	21.21	-8.81 %	-28.66 %	0.35 %	11 Sep
	France	AA-	29.98	-14.22 %	+27.57 %	0.50 %	11 Sep
	United States	AA+	32.37	-0.03 %	-7.70 %	0.54 %	12 Sep
	South Korea	AA	33.12	-15.38 %	+3.11 %	0.55 %	11 Sep
	Portugal	A-	33.38	-3.64 %	-4.49 %	0.56 %	12 Sep
	Spain	A	34.78	-9.29 %	-9.17 %	0.58 %	11 Sep
	Canada	AAA	39.60	0.00 %	0.00 %	0.66 %	11 Sep
	Italy	BBB	61.79	-12.06 %	-6.08 %	1.03 %	12 Sep
	Greece	BBB-	62.78	-10.58 %	+6.68 %	1.05 %	11 Sep
	China	A+	62.84	-5.00 %	-4.57 %	1.05 %	12 Sep

Pricing

We now turn to CDS **pricing** which involves determining the fair or theoretical CDS spread k. The general principal is:

> The CDS spread k is set so that the CDS has 0 initial value to both the protection buyer and seller (like futures and forwards) so no initial exchange of money takes place at origination.

Here k is called the **breakeven CDS spread**. However, note that after the GFC, even though CDS are originated and traded OTC, their terms and specifications have been standardised, and in particular CDS indices are originated with a fixed CDS spread k and an initial exchange of money usually occurs between buyer and seller (as per the Team Project).

Pricing

So far we have the following CDS notation and terminology:

- F is the **notional principal** or **face value**.
- R is the **recovery rate**.
- k is the **CDS spread**.
- kFd is the **CDS premium**, where d is the time between premium payments in years (say $d = \frac{1}{4}$ for quarterly).
- $(1 - R)F$ is the **payout** upon occurrence of a reference event.

For simplicity, we assume that the payout occurs at the end of the premium period in which a reference event occurs.

Pricing

Also define the following notation and terminology:

- $t_1, \ldots, t_N$ is the premium payment and payout dates.
- $r_1, \ldots, r_N$ is the risk-free rate yield curve for these dates.
- q_i is the (risk-neutral) **probability of default** in period i.
  - Probability of a reference event occurring in period i.
- s_i is the **survival probability** up to time t_i.
  - Probability that no reference event occurred up to time t_i.

Pricing

Example

Consider a 5 year CDS with quarterly premiums. Then:

- There is $N = 4 \times 5 = 20$ quarters.
- Times t_1 is the end of the first quarter, t_2 is the end of the first year, and so on to t_N being the CDS maturity date.
- q_i is the probability of default in quarter i.
- s_i is the probability of surviving up to the end of quarter i.

Pricing

Risk-neutral law of finance: The price of a derivative security, including a CDS, is the present value of its (risk-neutral) expected future cashflows discounted at the risk-free rate.

From the perspective of the protection buyer:

- The regular premium payments kFd are cash outflows.
- The payout $(1-R)F$ is a cash inflow.

So the **value** of a CDS to the protection buyer is

$$\text{CDS value} = \text{PV}(\mathbb{E}[\text{payouts}]) - \text{PV}(\mathbb{E}[\text{premiums}]).$$

Pricing

PV of expected payouts: At time t_i there is a payout of:

- $(1 - R)F$ with probability q_i.
- 0 otherwise.

Hence, the expected payout at time t_i is

$$\mathbb{E}[\text{payout}_i] = q_i(1 - R)F$$

and the present value of all of the expected payouts is

$$\boxed{\text{PV}(\mathbb{E}[\text{payouts}]) = \sum_{i=1}^{N} e^{-r_i t_i} q_i (1 - R)F.}$$

Pricing

PV of expected premiums: At time t_i there is a premium of:

- kFd with probability s_i.
- 0 otherwise (note that we're ignoring any accrued premium).

Hence, the expected premium at time t_i is

$$\mathbb{E}[\text{premium}_i] = s_i kFd$$

and the present value of all of the expected premiums is

$$\boxed{\text{PV}(\mathbb{E}[\text{premiums}]) = \sum_{i=1}^{N} e^{-r_i t_i} s_i kFd.}$$

Pricing

The **breakeven CDS spread** k that which gives the CDS 0 initial value:

$$\mathrm{PV}(\mathbb{E}[\text{payouts}]) = \mathrm{PV}(\mathbb{E}[\text{premiums}]),$$

which we rearrange to get

$$\boxed{k = \frac{\mathrm{PV}(\mathbb{E}[\text{payouts}])}{\sum_{i=1}^{N} e^{-r_i t_i} s_i F d}.}$$

We now give an example showing how the calculate the CDS spread k.

Pricing

Example

Consider a 2 year CDS over $F = 10,000,000$ with premiums paid quarterly, and yield curve and default and survival probabilities:

time	survival probability	default probability	risk-free rate
t1	0.9876	0.0124	4.0%
t2	0.9753	0.0123	4.2%
t3	0.9632	0.0121	4.4%
t4	0.9512	0.0120	4.6%
t5	0.9394	0.0118	4.8%
t6	0.9277	0.0117	5.0%
t7	0.9162	0.0115	5.2%
t8	0.9048	0.0114	5.4%

Pricing

Example (Continued)

Suppose we model the recovery rate to be $R = 50\%$. I get:

time	default probability	recovery rate	payout upon default	expected payout	PV of expected payouts
t1	0.0124	50%	$ 5,000,000.00	$ 62,111.00	$ 61,492.98
t2	0.0123	50%	$ 5,000,000.00	$ 61,339.44	$ 60,064.75
t3	0.0121	50%	$ 5,000,000.00	$ 60,577.47	$ 58,611.04
t4	0.0120	50%	$ 5,000,000.00	$ 59,824.97	$ 57,135.35
t5	0.0118	50%	$ 5,000,000.00	$ 59,081.81	$ 55,641.15
t6	0.0117	50%	$ 5,000,000.00	$ 58,347.88	$ 54,131.87
t7	0.0115	50%	$ 5,000,000.00	$ 57,623.07	$ 52,610.89
t8	0.0114	50%	$ 5,000,000.00	$ 56,907.27	$ 51,081.53
				PV(E[payouts])	$ 450,769.56

This is the numerator of $k = \dfrac{\mathrm{PV}(\mathbb{E}[\text{payouts}])}{\sum_{i=1}^{N} e^{-r_i t_i} s_i F d}$. The denominator:

Pricing

Example (Continued)

time	survival probability	d	F x d	s_i x F x d	PV of s_i x F x d
t1	0.9876	0.25	$ 2,500,000.00	$ 2,468,944.50	$ 2,444,378.09
t2	0.9753	0.25	$ 2,500,000.00	$ 2,438,274.78	$ 2,387,604.91
t3	0.9632	0.25	$ 2,500,000.00	$ 2,407,986.04	$ 2,329,819.35
t4	0.9512	0.25	$ 2,500,000.00	$ 2,378,073.56	$ 2,271,160.04
t5	0.9394	0.25	$ 2,500,000.00	$ 2,348,532.66	$ 2,211,764.76
t6	0.9277	0.25	$ 2,500,000.00	$ 2,319,358.72	$ 2,151,769.94
t7	0.9162	0.25	$ 2,500,000.00	$ 2,290,547.18	$ 2,091,310.14
t8	0.9048	0.25	$ 2,500,000.00	$ 2,262,093.55	$ 2,030,517.59
				denominator	$ 17,918,324.82

So we calculate the **breakeven CDS spread** to be

$$k = \frac{\mathrm{PV}(\mathbb{E}[\text{payouts}])}{\sum_{i=1}^{N} e^{-r_i t_i} s_i F d} = 2.52\%$$

(252 basis points). The quarterly premium paid is $Fdk = 62,892$.

Pricing

We now present an example of CDS pricing in which the CDS spread is set to $k = 1\%$ (100 basis points), a common market convention. We calculate the upfront cashflow needed between the protection buyer and seller at the initiation of the CDS. I'll use the same figures as above.

Example

Recall that the value of a CDS to the protection buyer is

$$\text{CDS value} = \text{PV}(\mathbb{E}[\text{payouts}]) - \text{PV}(\mathbb{E}[\text{premiums}]).$$

In the previous example we saw that $\text{PV}(\mathbb{E}[\text{payouts}]) = 450,770$.

Pricing

Example (Continued)

The quarterly premium is $kFd = 25,000$ if $k = 1\%$. We get:

time	survival probability	premium	expected premium	PV of expected premiums
t1	0.9875778	$ 25,000.00	$ 24,689.45	$ 24,443.78
t2	0.975309912	$ 25,000.00	$ 24,382.75	$ 23,876.05
t3	0.963194418	$ 25,000.00	$ 24,079.86	$ 23,298.19
t4	0.951229425	$ 25,000.00	$ 23,780.74	$ 22,711.60
t5	0.939413063	$ 25,000.00	$ 23,485.33	$ 22,117.65
t6	0.927743486	$ 25,000.00	$ 23,193.59	$ 21,517.70
t7	0.916218872	$ 25,000.00	$ 22,905.47	$ 20,913.10
t8	0.904837418	$ 25,000.00	$ 22,620.94	$ 20,305.18
			PV(E[premiums])	$ 179,183.25

The protection buyer would need to pay the protection seller the CDS value upfront of $450,770 - 191,183 = 271,581$.

Speculation and hedging

We already mentioned an example of hedging with CDS:

- You hold a portfolio of debt securities, buy CDS protection on it, and upon the occurrence of a reference event the CDS gives you a payout to offset the reduction in your portfolio's value.

CDS can also provide a hedge against, or enable you to speculate on, macroeconomic or political events that impact market-wide credit risk perceptions, as in the case study of Bill Ackman and Pershing Square.

- We give an example of this that may assist with the Team Project.

Speculation and hedging

Example

Consider with the last example of entering into a CDS with a fixed CDS spread of $k = 1\%$. There, the protection buyer had to pay the CDS value of $271,581$ to the protection seller.

- Suppose a large macroeconomic shock occurs at the end of the 1$^{\text{st}}$ quarter, such as a pandemic like COVID19, which causes default probabilities to spike and the survival probabilities to fall to the following:

Speculation and hedging

Example

time	survival probability	default probability	risk-free rate
t2	0.9048	0.0464	0.042
t3	0.8607	0.0441	0.044
t4	0.8187	0.0420	0.046
t5	0.7788	0.0399	0.048
t6	0.7408	0.0380	0.05
t7	0.7047	0.0361	0.052
t8	0.6703	0.0344	0.054

Here, consider yourself to be standing at time t_1, so the end of the 1^{st} quarter, and this is the new data you're presented with for the remaining 7 quarters of the CDS's life. I get the new calculations:

Speculation and hedging

Example

time	default probability	recovery rate	payout upon default	expected payout	PV of expected payouts
t2	0.0464	50%	$ 5,000,000.00	$ 231,960.03	$ 227,139.66
t3	0.0441	50%	$ 5,000,000.00	$ 220,647.21	$ 213,484.68
t4	0.0420	50%	$ 5,000,000.00	$ 209,886.12	$ 200,450.05
t5	0.0399	50%	$ 5,000,000.00	$ 199,649.85	$ 188,023.15
t6	0.0380	50%	$ 5,000,000.00	$ 189,912.81	$ 176,190.37
t7	0.0361	50%	$ 5,000,000.00	$ 180,650.65	$ 164,937.25
t8	0.0344	50%	$ 5,000,000.00	$ 171,840.22	$ 154,248.52
				PV(E[payouts])	$ 1,324,473.69

Here, the present value of the expected payoffs went from 450,770 when we entered into the CDS to now 1,324,474 after the macroeconomic shock and spike in default probabilities.

- The present value of the expected premiums fall a bit due to the survival probabilities (and 1 premium has been paid):

Speculation and hedging

Example

time	survival probability	premium	expected premium	PV of expected premiums
t2	0.9048	$ 25,000.00	$ 22,620.94	$ 22,150.85
t3	0.8607	$ 25,000.00	$ 21,517.70	$ 20,819.20
t4	0.8187	$ 25,000.00	$ 20,468.27	$ 19,548.06
t5	0.7788	$ 25,000.00	$ 19,470.02	$ 18,336.17
t6	0.7408	$ 25,000.00	$ 18,520.46	$ 17,182.23
t7	0.7047	$ 25,000.00	$ 17,617.20	$ 16,084.82
t8	0.6703	$ 25,000.00	$ 16,758.00	$ 15,042.44
			PV(E[premiums])	$ 129,163.78

The new CDS value is $1,324,474 - 129,164 = 1,195,310$.

- A large increase over the original CDS value of 271,581.
  - Protection buyer could close out their position in the market.
- Also, the new breakeven CDS spread is $k = 10.25\%$.

Speculation and hedging

So the point of this example is:

- There was a large macroeconomic shock.
- Default probabilities, consequently breakeven CDS spreads, spiked.
  - CDS spreads went from 252 basis points to 1025 basis points.
- The buyer made a large profit upon closing out the CDS position.
- This profit could be used to offset losses on say a share portfolio, like Bill Ackman did at Pershing Square (using CDS index).
- Alternatively, this is an example of how CDS can be used to speculate, like Michael Burry did during the GFC:

Speculation and hedging

Remark

Now possibly revisit Michael Burry's GFC CDS trade, in which he purchased CDS on mortgage backed bonds. "*On May 19, 2005, Mike Burry did his first subprime-mortgage deals. He bought $60 million of credit-default swaps from Deutsche Bank—$10 million each on six different bonds.*" The rest is history and was made into the movie The Big Short, and here's the scene of Michael Burry negotiating to purchase CDS of various banks.

Legendary stuff.

CDS spreads and risk premiums

We now provide a simple, intuitive argument for why the CDS spread k on the reference asset of a reference entity should approximately equal the reference entity's risk premium over the risk-free rate r. Suppose you:

- Purchase a portfolio of the reference asset (say bond) for total face value F, receiving a YTM of y, and approximately at par value.
  - At par means the coupon rate is also y.
- Purchase CDS protection over the reference asset for a notional principal of F and paying a breakeven CDS spread of k.

We also assume that (i) the reference asset coupon payments and CDS premiums occur on the same dates (both semiannual, or quarterly, etc) and (ii) the maturity dates of the reference asset and CDS align.

CDS spreads and risk premiums

Then your "net YTM" is the reference asset's YTM y you receive minus the CDS spread k you pay. Consider the two possible scenarios:

- **No reference event**: If there's no reference event over the life of the reference asset/CDS, then you realise the "net YTM" of $y - k$.
- **Reference event occurs**: If a reference event occurs at some point over the life of the reference asset/CDS, the CDS payout enables you to recover the full face value F, which you can then invest at the risk-free rate r for the remaining time to maturity.

Hence, the CDS turns the reference asset into a risk-free investment.

- The "net YTM" should equal the risk free rate, that is, $y - k = r$ and thus $k = y - r$, or else there is an obvious arbitrage opportunity.

CDS Indices

We now turn to CDS indices, which are useful for your Team Project.

CDS Indices

A **CDS index** such as those in the CDX or iTraxx families are tradable baskets of single-name CDS. They have specific rules/features:

- Number, country, credit rating, etc, of constituent reference entities.
- Various maturities, but 5 years is the most common.
- Typically a fixed CDS spread of $k = 1\%$ (100 basis points).
- Usually quoted as a breakeven CDS spread in basis points.
  - It's roughly an average of the constituent breakeven CDS spreads.
- Constituent CDS are typically evenly weighted.
  - Typically all have same notional principal in the CDS index.
- Premiums typically paid quarterly.
- Index constituents usually updated semiannually.
- Precisely defined reference events leading to payouts.

CDS Indices

An important aspect of CDS indices is how payouts occur:

- If a reference entity of a single-name CDS constituent in the CDS index experiences a reference event, the CDS index protection buyer receives the payout as per usual from that single-name CDS.
- This single-name CDS then ceases to exist as per normal for a single-name CDS, and is removed form the CDS index.
- The CDS index continues to exist, just with 1 less constituent.

Remark

When buying a CDS index you're buying protection against the specified reference events for the reference assets of all reference entities underlying the index's constituent single-name CDS.

CDS Indices

Example

A CDS on the EUR iTraxx™ with a notional value of €ten million, bearing a contractual fixed coupon (spread) of 60 bps is equivalent to an evenly weighted basket composed of 125 single-name CDSs, each of them having a nominal of €80,000, and hence bears an overall annual coupon of €60,000. In case one of the single-name CDS experiences a credit event, the protection seller pays a compensation equal to the actual recovery (€80,000 $\times$ (1 $-$ α)). This single-name CDS is removed from the index which resumes trading and the subsequent coupon payments are reduced to €59,520 per year (€80,000 $\times$ 124 $\times$ 60 bps).

Of interest to you for the Team Project, Bill Ackman at Pershing Square purchased the CDX NA Investment Grade, CDX NA High Yield and iTraxx Europe CDS indices to hedge his portfolio exposure.

CDS Indices

Differences between iTraxx and CDX

	iTraxx	CDX
Region	Europe, Asia and Australia	North America and Emerging Markets
Credit Events	Bankruptcy, Failure to Pay, Modified Restructuring	Bankruptcy, Failure to Pay
Currency	Europe – EUR, USD Japan – JPY Asia ex-Japan – USD Australia – USD	USD, EUR
Reference Entities	iTraxx Europe – 125 iTraxx Crossover – 75 iTraxx Asia ex-Japan – 40 iTraxx Japan – 40 iTraxx Australia – 25 iTraxx MSCI ESG Screened Europe – Variable	CDX.NA.IG – 125 CDX.NA.HY – 100 CDX.EM – 18

CDS Indices

ICE OTC

Markit CDX.NA.IG

Description

One hundred twenty five (125) of the most liquid North American entities with investment grade credit ratings as published by Markit ® from time to time

ICE OTC

Markit CDX.NA.HY

Description

One hundred (100) liquid North American entities with high yield credit ratings as published by Markit® from time to time

ICE OTC

Markit iTraxx Europe Main

Description

One hundred twenty five (125) of the most liquid European entities with investment grade credit ratings as published by Markit® from time to time

Summary