Comparing credit indices: are CDS indices a better investment than corporate bonds?

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Executive Summary

Credit default swap (CDS) indices, such as the iTraxx and CDX families, have grown considerably in volumes since their inception in the early 2000s. Average daily volumes approached $100bn in 2020, more than ten times the volumes in the single name CDS market. However, despite some progress in recent years, CDS indices still attract relatively little attention compared to the corporate bond market, with most industry and academic studies continuing to focus on bonds.

In this paper we use more than 15 years of data to assess how successful using the most liquid CDS indices has been to take long risk exposure to credit markets, both compared to corporate bonds and in the context of cross-asset portfolios. We find that:

- CDS index spreads have over-compensated investors relative to the actual realised defaults in the indices since the launch of the iTraxx and CDX families, supporting the notion that a “credit risk premium” is present in CDS markets as well as in corporate bonds.
- Investable strategies that go long risk through on-the-run 5y CDS indices and roll to the new series every six months have shown excess returns that *outperform* the implied carry of such strategies; the opposite is true in corporate bond space. This can be attributed to the greater impact of slide in CDS indices as well as technicals such as a lesser impact of downgrades from investment grade and the positive benefit of CDS orphaning events.
- As a result, rolling CDS index strategies have shown considerably higher risk-adjusted excess returns across Europe, North America, IG and HY than their corporate bond index equivalents, in each case showing an improved Sharpe ratio and a Sortino ratio that is more than double that of corporate bond excess returns.
- In a cross-asset portfolio context, previous studies have shown that replacing treasury allocations in equity/bond portfolios with corporate bonds leads to lower risk-adjusted returns; however we find that if a rolling CDS index strategy is used as an overlay to government bonds in a 60/40 equity-bond portfolio, then this can lead to higher absolute returns while maintaining or even increasing risk-adjusted returns.
- On a forward-looking basis, CDS indices receive sizeable allocations in cross-asset portfolios that are optimised for a variety of forward-looking scenarios that take the current levels of credit spreads and bond yields into account.

1. Introduction to CDS indices

CDS indices are baskets of single name CDS; an investor selling protection on iTraxx Europe (an equally weighted basket of 125 European investment grade corporates, also known as iTraxx Main) has a position economically equivalent to individually selling protection on all 125 single name CDS contracts within the index.

CDS indices originated in the early 2000s, with the benchmark CDX and iTraxx families launching in late-2003 and mid-2004 respectively. Since then, daily volumes in CDS indices have grown significantly and averaged $99bn per day in 2020. Four indices – iTraxx Main, iTraxx Crossover, CDX IG and CDX HY – account for approximately 94% of this total volume. CDS indices now have significantly higher volumes than single name CDS ($9bn per day ADV in 2020) and even to corporate bonds (CDX IG ADV of $29bn in 2020 compared to $21bn for USD IG corporate bonds).

Unlike equity and bond indices, where portfolio rebalancings are incorporated into a single evergreen index, CDS indices trade in "series". Each series has a fixed composition and maturity and a new series of each index launches every six months with an updated composition and maturity. The latest series is known as the "on-the-run" series; investors can either continue to hold a position in an off-the-run series or "roll" their position to a newer series.

For the purposes of this paper, we will focus on the four most liquid CDS indices (as described above) and the five-year tenor, which is by far the most liquid and commonly traded maturity.

2. The credit risk premium in CDS indices

In the period from late 2003 to the end of 2020 a total of 24 and 25 different series of the 5-year iTraxx and CDX index families have been launched and matured, respectively; this period covers several bouts of significant financial stress (including the 2008-09 global financial crisis, the 2010-12 European sovereign crisis and the 2020 Covid-19 outbreak) and so gives a useful "through-the-cycle" sample for testing whether there is clear evidence of a "credit risk premium" within CDS indices.

Table 1 shows the average implied and realised default loss rates for each of the four in-scope CDS indices over this period; only series that have matured by 20 December 2020 are included and the implied default loss rate is equal to the CDS index spread at launch date.

For each index, the implied default loss rates have greatly exceeded the realised default loss rate. In CDX HY – the index that has seen the highest realised default loss rates – an average 64.8% of the credit spread that investors would have received at launch is an excess risk premium over realised losses, while for iTraxx Main more than 99% of the credit spread is excess risk premium.

Table 1: Average Annualised Implied and Realised Default Losses in CDS Indices – matured series

Index	Annual Implied Loss	Annual Realised Loss	Annual Risk Premium	Risk Premium / Implied Loss
iTraxx Main	0.84%	0.01%	0.83%	99.2%
CDX IG	0.84%	0.10%	0.73%	87.6%
iTraxx XO	4.29%	1.01%	3.28%	76.5%
CDX HY	5.11%	1.80%	3.31%	64.8%

Source: Tabula Capital, Markit, J.P. Morgan, creditfixings.com.

This analysis does not take into account the effect of many high yield defaults that occurred in 2020 as in most cases the CDS indices that contained these names have not yet matured; if they were included (as shown in Table 2) the ratio of the credit risk premium to implied loss drops from 64.8% to 50.5% and from 76.5% to 69.7% for CDX HY and iTraxx Xover respectively. For the investment grade indices this ratio actually increases once outstanding indices are included, given that no defaults occurred in 2020 or early 2021 in an outstanding series of iTraxx Main or CDX IG.

Table 2: Average Annualised Implied and Realised Default Losses in CDS Indices – all series

Index	Annual Implied Loss	Annual Realised Loss	Annual Risk Premium	Risk Premium / Implied Loss
iTraxx Main	0.79%	0.00%	0.79%	99.4%
CDX IG	0.80%	0.07%	0.73%	91.0%
iTraxx XO	3.94%	1.19%	2.74%	69.7%
CDX HY	4.80%	2.38%	2.42%	50.5%

Source: Tabula Capital, Markit, J.P. Morgan, creditfixings.com.

In addition to the CDS index credit risk premium being positive when averaged across series, it also has been positive for each individual matured series – i.e. even in environments where default losses have risen, the excess credit risk premium at the launch of the series has been enough to compensate investors for this risk. Figure 1 to Figure 4 plot the implied and realised default loss for each of the issued series for iTraxx Main, CDX IG, iTraxx Crossover and CDX HY respectively.

Figure 1: Annualised Implied and Realised Default Losses for matured series of iTraxx Main 5y

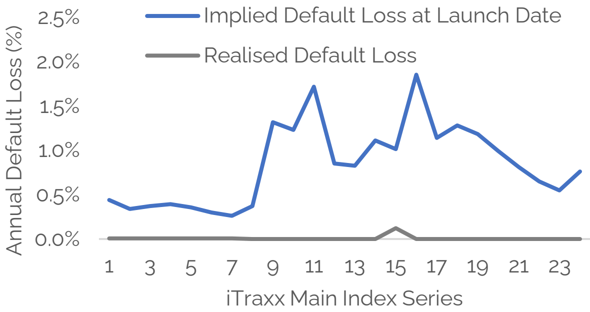


Figure 2: Annualised Implied and Realised Default Losses for matured series of CDX IG 5y

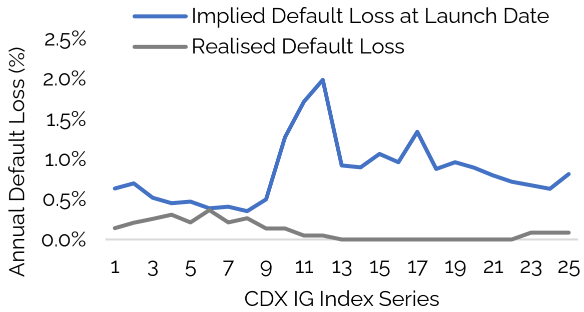


Figure 3: Annualised Implied and Realised Default Losses for matured series of iTraxx Xover 5y

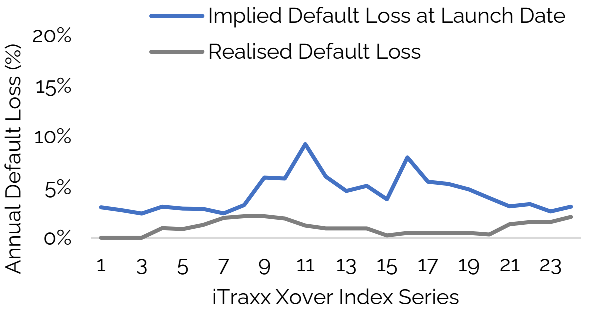
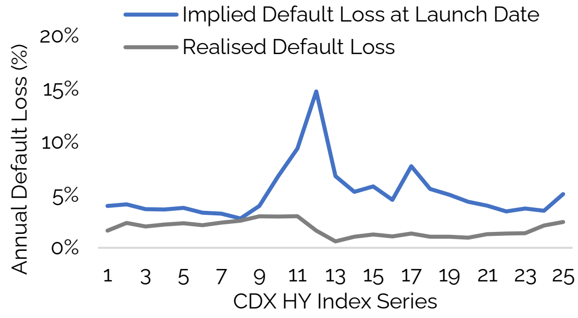


Figure 4: Annualised Implied and Realised Default Losses for matured series of CDX HY 5y



Source: Tabula Capital, Markit, J.P. Morgan

3. Comparing returns for CDS indices and corporate bond indices

The most direct way of taking exposure to the credit risk premium is to invest in one or more credit instruments and hold them to maturity; the long-term return of such a strategy (ignoring features such as embedded call options) is a function of the spread or yield at which the instruments were entered and the realised default losses over time, with pull-to-par effects constraining the impact of changing market prices. For this type of hold-to-maturity strategy, the primary driver of the difference between the excess returns of issuer and maturity matched portfolios of corporate bonds and credit default swaps is the bond-CDS basis (i.e. the CDS spread minus the bond spread), with the level of the bond-CDS basis at entry determining the difference in hold-to-maturity returns of each portfolio.

However, in practice most credit investors and indices do not follow purely "hold-to-maturity" strategies and instead follow strategies that include periodic rebalancings:

- In the corporate bond space, most corporate bond indices will remove bonds if they drop below a certain time to maturity (usually one year) or if they are downgraded below a certain cutoff; this is typically seen in investment grade indices where bonds that are downgraded to BB+/Ba1 or below are removed from the index.
- In CDS indices, arguably the most common "evergreen" strategy is a rolling position in the current on-the-run series where the position is rolled to the new series every six months; this involves both a change in the composition as well as the maturity of the portfolio.

In each case, these rebalancings introduce additional return contributions that can cause the long-term return to diverge from the difference in implied and realised default rates. Removing downgraded names from a portfolio is a commonly used example of this; it is likely that credit spreads will widen in conjunction with a ratings downgrade and so removing that name from portfolio will usually crystallise a mark-to-market loss, even if that instrument does not later default. This impact has been previously highlighted in a number of academic studies for corporate bonds, including Ng and Phelps (2011) and Ilmanen (2012).

However, these previous studies have not investigated whether the same effect exists in CDS indices. As a starting point for examining this we can obtain a rough approximation for the impact of portfolio rebalancings on both CDS and corporate bond indices by comparing the average spread of the portfolio to the actual realised excess return over the same period; the residual difference between the two terms will include both the impact of defaults within the portfolio as well as the impact of any change in spread of the portfolio.

Table 3 below shows the results of this analysis for four corporate bond and four CDS indices between December 2004 and February 2021. For the corporate bond indices we use the excess returns over treasuries of broadly tracked ICE BofA benchmark indices, whereas for CDS indices we use the unfunded return of strategies that track the performance of selling protection on the on-the-run series of the 5y tenor of iTraxx Main, iTraxx Crossover, CDX IG and CDX HY.

Table 3: Average Spreads compared to Excess Returns for Corporate Bond and CDS Indices

Index	Annual Excess Return	Average Spread	Residual	Initial Spread	Final Spread
EUR IG Corp Bonds	0.87%	1.35%	-0.48%	0.46%	0.89%
USD IG Corp Bonds	0.87%	1.65%	-0.78%	0.83%	0.95%
EUR HY Corp Bonds	3.67%	5.18%	-1.51%	2.78%	3.24%
USD HY Corp Bonds	2.85%	5.36%	-2.50%	3.03%	3.51%
iTraxx Main	1.14%	0.79%	0.35%	0.36%	0.51%
CDX IG	0.86%	0.81%	0.05%	0.44%	0.56%
iTraxx XO	5.76%	3.89%	1.86%	2.10%	2.65%
CDX HY	5.18%	4.67%	0.51%	2.96%	3.10%

Source: Tabula Capital, ICE, from 31 December 2004 to 26 February 2021. See Appendix 3 for explanatory comments.

The residual term in the third column of Table 3 is equal to the annualised excess return minus the average spread; in line with previous studies we see that this residual term is negative for corporate bond indices; i.e. corporate bond excess returns have underperformed their average spreads, which is intuitive given the expected impact of downgrades and defaults. However, for a rolling long risk strategy in CDS indices the opposite is true; CDS index returns are higher than the returns implied by average spreads, in some cases (such as iTraxx Crossover) considerably so.

While these portfolios are not composition or maturity matched, this still provides an immediately striking contrast between corporate bond and CDS investment strategies. Despite optically wider spreads in bond space, CDS indices have shown higher excess returns in every sector except for US investment grade (where the excess returns are roughly equivalent for CDX IG and the ICE US Corp Index despite the bond index having an average spread more than double that of the CDX IG index). This result is consistent with the findings set out in Israelov (2019), who shows that US corporate bonds underperformed a liquid replicating basket of equities, rates futures and options while CDS indices outperformed their replicating basket.

This outperformance of CDS indices relative to their projected carry cannot be explained by differences in changes in on-the-run market spreads over the period; while on-the-run corporate bond index spreads have optically increased more over the period this change can only be responsible for up to 0.11% of annual underperformance across the four markets based on an assumed average duration of five years over the period[1]. Similarly, while the excess returns shown in Table 3 do not include the impact of transaction costs for either the bond indices or the

[1] In reality quoted spreads are not directly comparable across different periods due to changes in composition and, in the case of corporate bond indices, maturities and so it is possible that some of the perceived change in spreads is due to differences in composition and maturity between 2004 and 2021.

CDS indices we believe that their inclusion is highly unlikely to change this picture, and if anything would increase the apparent relative outperformance of CDS indices relative to bond indices given the high liquidity and low roll costs in the CDS index market.

Instead, we believe this CDS outperformance can be largely attributed to three main factors.

The first is related to **curve slide** (also known as rolldown): a strategy that unwinds short-dated instruments and adds new longer dated instruments introduces an inherent bias related to the steepness of credit curves; if credit curves are upwards sloping this maturity extension introduces a positive contribution over time. We can approximate the impact on long-term returns from slide as follows:

$$SlideImpact = \Delta S \times D_{Exit} \quad (1)$$

where ΔS is the change in spreads per year due to rolldown and D_{Exit} is the duration at which positions exit from the portfolio; i.e. the impact of slide on long term portfolio returns is equal to the average annualised rolldown multiplied by the duration at which positions exit the portfolio. A rolling CDS index strategy has sizeable benefits over corporate bond indices here:

- A rolling 5y CDS index strategy enters positions when they have 5.25 years to maturity and exits at 4.75 years to maturity, while most benchmark corporate bond indices hold positions until they have one year to maturity. This results in a much higher D_{Exit} term for CDS indices.
- Spread curves tend to be steepest – in both corporate bonds and CDS – for maturities less than 5 years.

Table 4 below shows numerical examples of this methodology applied to the US investment grade market, using average levels of ΔS from December 2004 to February 2021. We can see that for maturities less than five years the bond spread slide has been approximately 12bp per year on average. This is identical to the average slide of 12bp per year for CDS curves between the 4.75y and 5.25y point. However, a "classic" corporate bond benchmark that includes bonds longer than five years and holds bonds until they reach one year to maturity suffers from both the flatter levels of curves beyond the 5y point as well as the short duration at which bonds are eventually unwound; this results in a notable difference in the slide impact on a rolling 5y CDX IG strategy and a broad- maturity corporate bond index. This difference would become greater still if bonds longer than 10y were to be included in this analysis.

In theory it is possible to construct a corporate bond strategy that also benefits from the same technical that the rolling CDX IG strategy is benefiting from; e.g. buying 5y bonds and rolling them between six and twelve months later. However, in practice this strategy would require a large degree of active management and would also likely encounter large transaction costs due to high turnover required in single corporate bond positions.

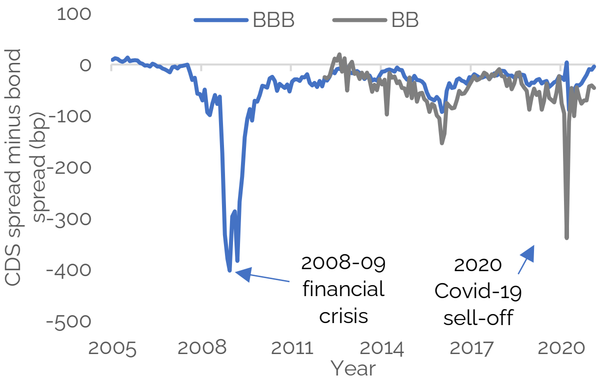
Table 4: Curve Slide Impact by Maturity Range

Sector	Maturity Range	Average ΔS (per year)	Approx D_{Exit} (years)	Slide Impact (per year)
USD IG Corp Bonds	1-3y	0.12%	1	0.12%
	3-5y	0.11%	2.7	0.31%
	5-7y	0.07%	4.5	0.33%
	7-10y	0.02%	6.3	0.15%
	1-10y	0.08%	1	0.08%
CDX IG	4.75-5.25y	0.12%	4.3	0.51%

Source: Tabula Capital, ICE, Markit, J.P. Morgan.

The second reason is linked to **the impact of downgrades**. Investment grade indices will exclude names that are downgraded to sub-investment grade for both CDS and corporate bond indices and we would expect that some negative return impact from downgrades would exist in both markets. However, downgrades tend to increase during periods of market and economic stress, which has historically coincided with periods where the bond-CDS basis (i.e. CDS minus bond spread) has become more negative (see Figure 5). This implies that the mark-to-market impact of downgrades is likely to be greater for bond portfolios than CDS indices.

Figure 5: Bond-CDS Basis for USD BBB and BB rated bonds



Source: J.P. Morgan. From 31-Dec-2004 to 26-Feb-2021.

The third reason relates to the differing **impact of call options and buybacks** on bonds and CDS. For corporate bonds, the exercise of a call or the buyback of a bond (for example as a result of M&A events) is often an unremarkable event from a return perspective; a buyback will usually occur at or slightly above market levels while call option features are known in advance and as a result bond prices are unlikely to greatly exceed a call price. However, for a CDS referencing an issuer, for which all deliverable debt suddenly disappears, it is a very different outcome – CDS has no embedded call features and with no debt left to default upon the spread of the CDS will usually tighten rapidly; this is known as CDS "orphaning". For high yield CDS indices, where call options (and arguably M&A events) are more common this can have a large impact on long term returns. J.P. Morgan (2014) previously published on this impact on the iTraxx Crossover and CDX HY, finding that this effect was especially large for iTraxx Crossover where 8.4% of the composition was either orphaned or upgraded on average each year over eight series covering a period from September 2005 to May 2014 (the comparable rate for CDX HY was 2.5%). This, in our view, at least partly explains the large excess performance of iTraxx Crossover relative to its projected carry as shown in Table 3.

Helpfully, the standardised nature of CDS indices and the availability of different tenors of each series of a CDS index means that it is much more straightforward to accurately calculate the impact of factors such as curve rolldown or changes in portfolio composition than for a corporate bond index. To do this, we look at the period from 31 December 2004 to 26 February 2021 (the same period as used for the analysis in Table 3) and break this period up into 32 shorter periods that each represents the period that a given series of each CDS index is "on-the-run"; with the exception of the first and last periods these periods are approximately six months in length and typically run from September to March or vice versa.

The trading convention for CDS indices is that a CDS index contract trades with a "fixed coupon"[2]; any difference between the quoted spread of the CDS index contract and this fixed coupon is compensated for through the exchange of an upfront amount which is calculated using an industry standard pricing model (available at www.cdsmodel.com) applied to the quoted spread of the index[3]. For each of the 32 periods described above, the P&L of a long risk position in the on-the-run series of a CDS index can be expressed as a function of the change in upfronts calculated using this model as shown in Equation 2:

$$P\&L(t_0, t_{End}) = C + U\left(S_{t_0}^{5.25y}, t_0, 5.25y\right) - U\left(S_{t_{End}}^{4.75y}, t_{End}, 4.75y\right) - L \qquad (2)$$

where C is the aggregate coupon amounts received plus the net change in accrued interest over the period, $U\left(S_{t_0}^{5.25y}, t_0, 5.25y\right)$ is the upfront of the CDS index contract at the start of the period for which that series of the CDS index is on-the-run[4], $U\left(S_{t_{End}}^{4.75y}, t_{End}, 4.75y\right)$ is the upfront of the same CDS index contract (ignoring credit event settlement amounts) at the end of the six month period and L is the credit event settlement amounts in the on-the-run series over the period.

We then attribute this P&L into four different categories: carry, slide, default loss, and spread change ex-slide as follows:

1. "**Carry**"; equal to the coupon received plus the change in upfront purely due to the time to maturity decreasing over the period, keeping spreads constant as shown in Equation 3:

[2] Currently 100bp for iTraxx Main/CDX IG and 500bp for iTraxx Crossover/CDX HY.

[3] This model uses a standard discount curve as an input; here we do not attribute P&L from any changes in this discount curve as the impact of these changes is usually small; instead any P&L from changing interest rates will show up in the carry term.

[4] i.e. the upfront calculated at t_0 for a contract with 5.25 years remaining and a current spread equal to $S_{t_0}^{5.25y}$, where $S_{t_0}^{5.25y}$ is the 5.25y spread at t_0 of the series that is on-the-run during the period.

$$Carry(t_0, t_{End}) = C + U(S_{t_0}^{5.25y}, t_0, 5.25y) - U(S_{t_0}^{5.25y}, t_{End}, 4.75y) \quad (3)$$

2. "**Default Loss**", equal to credit event settlement amounts over the period, including any payment of accrued interest on default.
3. "**Slide**", equal to the change in upfront that would have resulted from spreads "rolling down"[5] the spread curve as implied on the launch date of the series as shown in Equation 4:

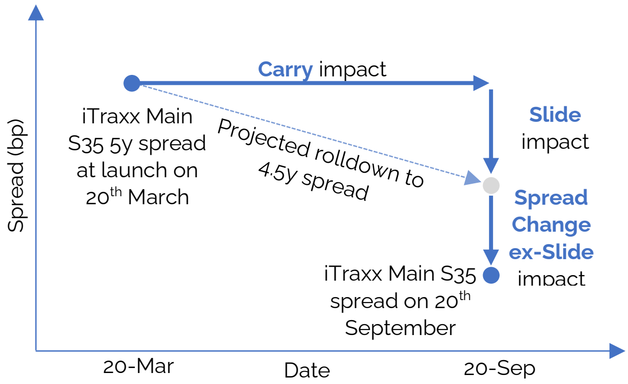
$$Slide(t_0, t_{End}) = U(S_{t_0}^{5.25y}, t_{End}, 4.75y) - U(S_{t_0}^{4.75y}, t_{End}, 4.75y) \quad (4)$$

4. "**Spread Change ex-Slide"**, equal to the change in upfronts between the spread level implied by curve rolldown and the actual spread at the end of the period, as shown in Equation 5. Conceptually this term will include both the impact from changes in the spread in the remaining on-the-run names as well as the impact from spread changes in all the names in the index that were subsequently removed from the on-the-run version of the index (e.g. downgrades from iTraxx Main and CDX IG as well as orphaning events).

$$Spread\ Change\ Attribution(t_0, t_{End}) = U(S_{t_0}^{4.75y}, t_{End}, 4.75y) - U(S_{End}^{4.75y}, t_{End}, 4.75y) \quad (5)$$

Figure 6 shows a visual representation of the attribution between the Carry, Slide and Spread Change ex-Slide components

Figure 6: Performance attribution for Carry, Slide and Spread Change ex-Slide components



Source: Tabula Capital.

The results of this performance attribution, expressed in average annualised terms, are shown in Table 5 below.

Table 5: Annualised Performance Attribution for Rolling Long Risk CDS Index Strategies

	iTraxx Main	CDX IG	iTraxx Crossover	CDX HY
Excess Return	1.16%	0.92%	5.97%	5.17%
Carry	0.84%	0.85%	4.18%	4.79%
Default Loss	0.00%	0.00%	-0.18%	-1.76%
Slide	0.51%	0.52%	1.25%	1.38%
Spread Change ex-Slide	-0.19%	-0.45%	0.72%	0.76%
Residual (= Excess Return – Carry)	0.33%	0.08%	1.78%	0.38%

Source: Tabula Capital, Markit, J.P. Morgan. From 31-Dec-2004 to 26-Feb-2021 with rolls occurring each six months (usually in September and March or shortly thereafter depending on the specific roll date for that year and index).

Reviewing each term in turn, the **Carry** terms are close to those shown in Table 3 with an average difference of only 4bp in carry for the investment grade indices and 21bp for the high yield indices, which suggests that while the average spread over a period is a reasonable (if not perfect) measure of the actual carry of a CDS index position.

Next, the **Default Loss** term is zero for the investment grade indices. This is intuitive given that no on-the-run series of iTraxx Main or CDX IG have experienced defaults (the defaults that have occurred in these indices have been after those names have exited the on-the-run series). For CDX HY, the historical average default loss impact for on-the-run indices is equal to -1.76%, which is coincidentally very close to the 1.80% realised loss shown for all matured series (both on and off-the-run) in Table 1. For iTraxx Crossover, the average loss impact of negative 0.18% per annum looks optically low compared to the average annual default loss of 1.01% shown in Table 1. However, this can be explained by the fact that the rules governing the composition of new Crossover series explicitly restrict CDS contracts trading at distressed levels, defined as 50pts upfront or more. This effectively means that many names

[5] Or "rolling up" if the spread curve is inverted.

that go on to default are removed from the on-the-run series prior to the default date, and so this instead shows up in the attribution in the spread change ex-slide term.

The **Slide** term has been a large contributor to historical returns for each index. The relative impact of slide is especially large for the investment grade indices with the slide term making up 46% and 60% of the total excess return for iTraxx Main and CDX IG respectively, with the slide contribution higher than the loss due to the spread change ex-slide term in both cases. The 0.51% and 0.52% slide contribution of these indices is also very close to the approximate calculation set out for slide returns in Table 4, which gave a predicted slide contribution of 0.51% per year based on the historical average level of CDX IG curves. The contribution from slide for the high yield indices is higher in absolute terms that for the investment grade indices, but makes up a smaller percentage of the overall excess return in each case.

The **Spread Change ex-Slide** contribution is negative for investment grade indices and positive for high yield indices. Given that on-the-run spreads have not dramatically moved over the period (as shown in Table 3) we believe that the majority of this term can be explained by spread movements in constituents that were later removed from the indices; for example downgrades from the investment grade indices or upgrades/orphanings in the high yield indices, both of which are consistent with a negative contribution for iTraxx Main/CDX IG and a positive contribution for iTraxx Crossover/CDX HY.

For the investment grade indices, we also note that the spread change ex-slide term is less negative than the residual shown for the equivalent corporate bond indices in Table 3. Assuming that the majority of the spread change ex-slide term for iTraxx Main and CDX IG comes from the impact of downgraded names that subsequently left the index; this supports our hypothesis that the impact of downgrades is lower in CDS indices than in the corporate bond space (especially given it is fair to assume that slide still makes some positive, if small, contribution to the corporate bond index residuals shown in Table 3).

We also believe that the iTraxx Crossover term is notable, given that the impact of any names being removed from the index after widening to more than 50pts upfront is included in this term rather than the default loss term – to us this corroborates the view that the upgrade/orphaning technical in iTraxx Crossover must have been especially large over this historical period in order to cancel out this impact and bring the overall spread change ex-slide term in line with CDX HY (which does not include near default contributions).

Finally, we also show a **Residual** term which is equal to the excess return minus carry (and so matches the definition of the residual term shown in Table 3). Similar to the results in Table 3 we see that this residual term is positive for all four CDS indices and has a similar magnitude to the residual term from that table, with iTraxx Crossover once again showing the most positive residual term.

Overall, we believe that the results shown in Table 5 broadly corroborate the more approximate approach used in Table 3 and give us a detailed insight into the outperformance of CDS indices relative to their carry implied returns. However, this analysis does not take into account the historical volatility or drawdowns of CDS indices relative to corporate bond indices.

To address this point, Figures 7 to 10 and Tables 6 to 9 summarise the broad performance differences between corporate bond and CDS indices since the end of 2004 for each of the USD IG, USD HY, EUR IG and EUR HY markets using time series plots and several key performance metrics. For the corporate bond index performance we use the excess return versus government bonds[6] of maturity restricted indices to better match the 5y maturity of the CDS indices (whereas the figures shown in Table 3 use the full bond indices unrestricted by maturity). This brings the rolldown and duration profile of the bond indices more in line with that of the rolling CDS indices. While these universes are not composition matched, we still consider them to be a useful comparison of the overall performance that investors in each respective market track.

In each of the four cases shown below, rolling CDS strategies have outperformed their corporate bond indices on a risk-adjusted basis, with Sortino ratios for the CDS index strategies more than double that of the corporate bond indices in each of the four markets. In most markets this is driven by the CDS strategies showing lower volatilities

[6] We use the ICE BofA calculated excess returns, which compare index returns against US and German government bonds respectively for USD and EUR indices.

and drawdowns than their corporate bond equivalents, while also (in all markets except USD IG) also showing higher excess returns overall.

In summary, CDS indices have historically had lower spreads than their corporate bond index equivalents, but a variety of technical factors have meant that rolling strategies in 5y CDS indices have greatly outperformed corporate bond excess returns since the end of 2004 on a risk-adjusted (and in many cases outright) basis, with considerably lower maximum drawdowns. In addition, while some performance difference can be expected due to composition differences, we believe that a large part of this can be explained by the higher contribution of curve rolldown in a rolling CDS index strategy, the lesser impact of downgrades and the impact of CDS orphaning events.

Figure 7: USD IG Corp Bonds versus CDX IG 5y

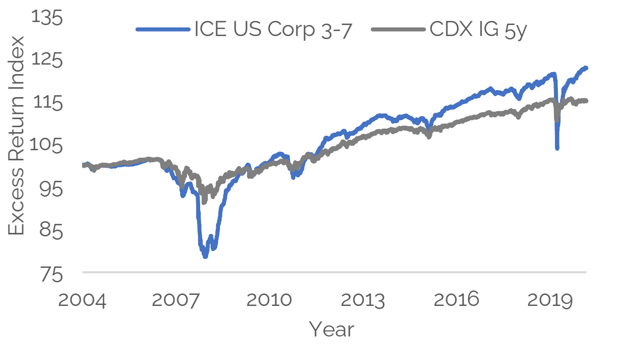


Table 6: Performance statistics for USD IG

	ICE US Corp 3-7	CDX IG 5y
Excess Return p.a.	1.27%	0.86%
Volatility	4.76%	2.05%
Sharpe ratio	0.27	0.42
Sortino ratio	0.23	0.49
Max drawdown	21.90%	8.34%

Figure 8: USD HY Corp Bonds versus CDX HY 5y

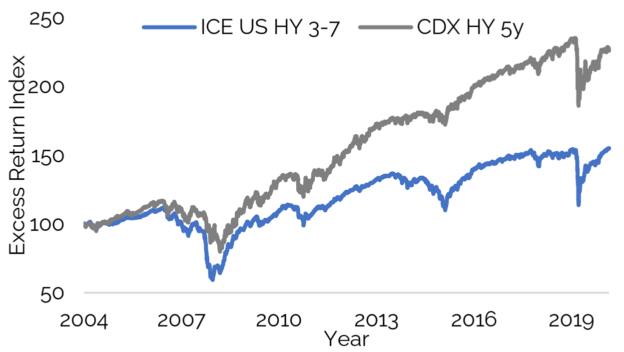


Table 7: Performance statistics for USD HY

	ICE US HY 3-7	CDX HY 5y
Excess Return p.a.	2.74%	5.18%
Volatility	10.38%	9.22%
Sharpe ratio	0.26	0.56
Sortino ratio	0.25	0.70
Max drawdown	44.41%	29.29%

Figure 9: EUR IG Corp Bonds versus iTraxx Main 5y

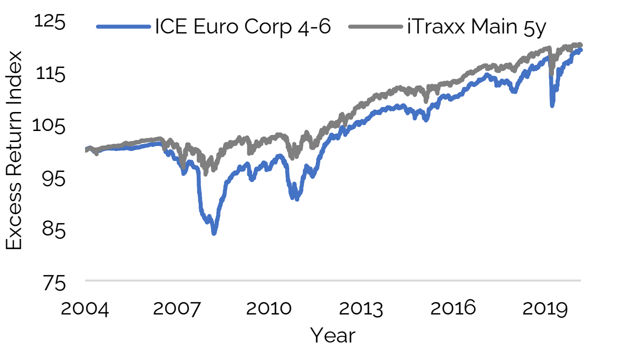


Table 8: Performance statistics for EUR IG

	ICE Euro Corp 4-6	iTraxx Main 5y
Excess Return p.a.	1.09%	1.14%
Volatility	3.83%	2.15%
Sharpe ratio	0.29	0.53
Sortino ratio	0.27	0.69
Max drawdown	16.29%	5.36%

Figure 10: EUR HY Corp Bonds versus iTraxx XO 5y

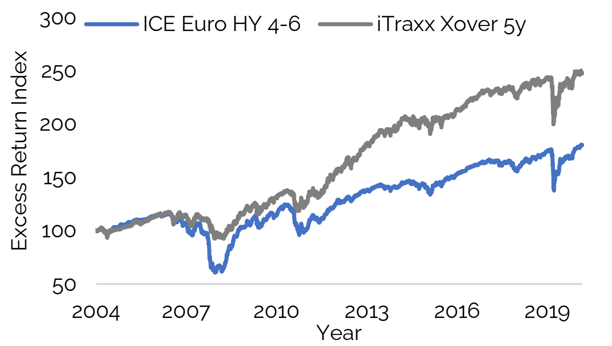


Table 9: Performance statistics for EUR HY

	ICE Euro HY 4-6	iTraxx Xover 5y
Excess Return p.a.	3.70%	5.75%
Volatility	12.03%	8.01%
Sharpe ratio	0.31	0.72
Sortino ratio	0.30	0.93
Max drawdown	46.93%	20.78%

Source for Figures 7-10 and Tables 6-9: Tabula Capital, ICE, Markit, J.P. Morgan. From 31 December 2004 to 26 February 2021 using monthly observations.

4. CDS indices in a cross-asset portfolio since 2004

Previous studies have investigated the benefits of including credit allocations in a cross-asset portfolio, usually consisting of equity and treasury allocations. Norges Bank IM (2017) looked at a specific cross-asset case of replacing treasury allocations with corporate bond allocations, finding that a corporate bond allocation adds value (lowering volatility and increasing return) to a treasury-only portfolio, but replacing treasuries with corporate bonds in a portfolio that already has sizeable equity allocations is not worthwhile given the high correlation between credit excess returns and equity excess returns.

We find a similar result for an equity-bond portfolio when applied to our shorter sample period of December 2004 to February 2021, as shown in Table 10; adding global IG corporate bond excess return exposure to the treasury component of a portfolio consist of 60% global equities and 40% US treasuries does increase returns, but at the expense of a lower Sharpe ratio. This also applies to high yield corporate bond excess returns, as shown in Table 12.

By comparison, if a rolling strategy in 5y global IG CDS indices (consisting of 50% CDX IG and 50% iTraxx Main) is used as an overlay then we observe an improved IRR with no degradation in Sharpe ratio, as shown in Table 11.

This is even more pronounced when global HY CDS indices (50% CDX HY and 50% iTraxx Crossover) are used as an overlay (Table 13), with the addition of the credit overlay increasing both absolute and risk-adjusted return.

In addition to overlaying treasury risk with credit risk, Asvanunt & Richardson (2017) considered a broader case of optimising cross-asset portfolio allocations to include credit exposure, allowing credit risk to replace equity risk in the portfolio in addition to credit risk being solely allowed to act as an overlay or replacement for treasury risk as discussed above.

In this case, Asvanunt & Richardson found that US investment grade corporate bond excess returns would have added to value to a bond/equity portfolio over a longer period from 1936 to 2014, as well as finding a similar result for CDS indices over a shorter period from 2004 to 2014; in both cases the added value mostly comes from the credit risk premium being used as a replacement for equity risk premium.

However, Asvanunt & Richardson do not directly compare optimal CDS and corporate bond allocations over the same period; to address this we repeat our analysis from Tables 10 to 13 over the period for which we have data for CDS indices (December 2004 to February 2021) and instead of overlaying the balanced portfolio with credit risk we replace equity risk with credit risk; these results are shown in Tables 14 to 17.

Table 10: Impact of overlaying a 60% global equities/40% treasury portfolio with global IG corporate bond excess return exposure.

Credit Overlay	IRR	Volatility	Sharpe	Sortino
0%	5.28%	8.93%	0.59	0.73
10%	5.35%	9.26%	0.58	0.70
20%	5.42%	9.61%	0.56	0.68
30%	5.48%	9.97%	0.55	0.65
40%	5.54%	10.33%	0.54	0.63

Table 11: Impact of overlaying a 60% global equities/40% treasury portfolio with a rolling strategy in 5y global IG CDS indices.

Credit Overlay	IRR	Volatility	Sharpe	Sortino
0%	5.28%	8.93%	0.59	0.73
10%	5.37%	9.08%	0.59	0.73
20%	5.46%	9.24%	0.59	0.73
30%	5.55%	9.40%	0.59	0.73
40%	5.64%	9.56%	0.59	0.73

Table 12: Impact of overlaying a 60% global equities/40% treasury portfolio with global HY corporate bond excess return exposure.

Credit Overlay	IRR	Volatility	Sharpe	Sortino
0%	5.28%	8.93%	0.59	0.73
10%	5.60%	9.77%	0.57	0.69
20%	5.91%	10.66%	0.55	0.65
30%	6.20%	11.59%	0.54	0.61
40%	6.48%	12.54%	0.52	0.58

Table 13: Impact of overlaying a 60% global equities/40% treasury portfolio with a rolling strategy in 5y global HY CDS indices.

Credit Overlay	IRR	Volatility	Sharpe	Sortino
0%	5.28%	8.93%	0.59	0.73
10%	5.80%	9.58%	0.61	0.75
20%	6.33%	10.27%	0.62	0.77
30%	6.85%	10.97%	0.62	0.78
40%	7.36%	11.68%	0.63	0.79

Source: Tabula Capital. From 31-Dec-2004 to 26-Feb-2021.

For global IG corporate bonds (Table 14) we see that replacing global equity exposure with corporate bond excess return exposure over this recent period results in a minor increase in risk-adjusted returns (as measured by the Sortino ratio), with an allocation of 20% IG corporate bonds, 40% equities and 40% government bonds showing a Sortino ratio of 0.74 versus a ratio of 0.73 for the starting 60/40 equity-bond portfolio; however in our view this minor pickup in risk-adjusted returns is unlikely to justify a switch from equities to corporate bonds given the lower liquidity of credit as an asset class and that the absolute returns of the portfolio are lower once credit is included. For global HY corporate bonds (Table 16) we do not see any improvement in Sortino ratios at all for switching equity allocations into HY corporate bond excess returns.

By comparison, re-allocating from equities into CDS indices shows a far larger improvement in Sharpe and Sortino ratios over the same period (Tables 15 and 17); in this case replacing global equity exposure with CDS index exposure increases risk-adjusted returns, although absolute returns are still lower. This is, of course, caused by the lower volatility of credit exposures but can easily be addressed by increasing the credit leverage in the unfunded CDS component.

In summary, these results show that including CDS index allocations in a traditional cross-asset portfolio would have increased returns (either on an outright or risk-adjusted basis depending on which asset they replaced) since 2004. This is not the case for corporate bond allocations.

Table 14: Impact of replacing equity allocation with global IG corporate bond excess returns in a 60% equity/40% US treasuries portfolio.

Credit allocation	Equity allocation	IRR	Volatility	Sharpe	Sortino
0%	60%	5.28%	8.93%	0.59	0.73
10%	50%	4.69%	7.74%	0.61	0.73
20%	40%	4.08%	6.57%	0.62	0.74
30%	30%	3.46%	5.43%	0.64	0.73
40%	20%	2.83%	4.35%	0.65	0.72
50%	10%	2.19%	3.39%	0.65	0.68
60%	0%	1.54%	2.66%	0.58	0.60

Table 15: Impact of replacing equity allocation with a rolling strategy of 5y global IG CDS indices in a 60% equity/40% US treasuries portfolio

Credit allocation	Equity allocation	IRR	Volatility	Sharpe	Sortino
0%	60%	5.28%	8.93%	0.59	0.73
10%	50%	4.70%	7.56%	0.62	0.77
20%	40%	4.11%	6.20%	0.66	0.82
30%	30%	3.50%	4.87%	0.72	0.90
40%	20%	2.87%	3.58%	0.80	1.03
50%	10%	2.23%	2.42%	0.92	1.28
60%	0%	1.57%	1.68%	0.94	1.65

Table 16: Impact of replacing equity allocation with global HY corporate bond excess returns in a 60% equity/40% US treasuries portfolio.

Credit allocation	Equity allocation	IRR	Volatility	Sharpe	Sortino
0%	60%	5.28%	8.93%	0.59	0.73
10%	50%	4.94%	8.24%	0.60	0.72
20%	40%	4.60%	7.61%	0.60	0.69
30%	30%	4.25%	7.06%	0.60	0.65
40%	20%	3.89%	6.60%	0.59	0.60
50%	10%	3.52%	6.24%	0.56	0.53
60%	0%	3.15%	6.02%	0.52	0.47

Table 17: Impact of replacing equity allocation with a rolling strategy of 5y global HY CDS indices in a 60% equity/40% US treasuries portfolio.

Credit allocation	Equity allocation	IRR	Volatility	Sharpe	Sortino
0%	60%	5.28%	8.93%	0.59	0.73
10%	50%	5.15%	8.06%	0.64	0.79
20%	40%	5.00%	7.22%	0.69	0.87
30%	30%	4.85%	6.43%	0.75	0.95
40%	20%	4.69%	5.71%	0.82	1.05
50%	10%	4.52%	5.08%	0.89	1.16
60%	0%	4.33%	4.58%	0.95	1.27

Source for Table 14 to 17: Tabula Capital. From 31-Dec-2004 to 26-Feb-2021

5. CDS indices within cross-asset portfolios for forward-looking scenarios

Section 4 suggests that CDS indices would have warranted inclusion in cross-asset portfolios, either as an overlay to government bonds or as a replacement for equity risk, whereas corporate bonds would have not.

Because this analysis is highly dependent on a reasonably short historical period, we extend this analysis by constructing four forward-looking market scenarios, each of which portrays a different outcome for financial markets:

- **Scenario 1 ("Repeat"):** expected returns for different assets are the same as their IRRs from 31-Dec-2004 to 26-Feb-2021. This implies a continuing fall in bond yields and increase in equity valuations, while credit spreads remain broadly unchanged over the period. Given the current low levels of bond yields it could be argued that this scenario is unrealistic, but we still find it to be a useful benchmark.

- **Scenario 2 ("Carry implied")**: credit spreads, bond yields and equity P/E ratios remain constant at levels as of 26-Feb-2021. Expected returns for this scenario for credit and government bond assets are calculated using current yield/spread levels, adjusted by the average residual seen between carry and actual performance as shown in Table 3; this implies that corporate bonds will continue to underperform their carry while CDS indices outperform. For government bonds we calculate the residual in a similar way over the same period (equal to +0.34% for US treasuries and +0.41% for German government bonds, which implies a reasonable slide contribution in the government bond markets). For equities, the long-term expected return is taken as the excess performance vs. Fed Funds since December 2004, adjusted downwards to reflect the change in the price-to-earnings ratio over that period. This is similar to the method outlined in Asness (2021)[7].
- **Scenario 3 ("Reflation")**: the next 16 years is effectively an unwind of the previous 16 years, with bond yields and equity valuations returning to their levels as of 31 December 2004 in what is effectively a rewind of market moves since that date. This scenario acts as a negative drag on government bonds (and by extension corporate bond total returns) given the large fall in yields over that time; equities experience a drag as the increase in P/E ratios since 2004 is reverted. This scenario also assumes that the average of bond yields and credit spreads over the next sixteen years is the same as the average over the last sixteen.
- **Scenario 4 ("Round trip")**: in this scenario the average level of credit spreads and bond yields over the next sixteen years is the same as the past sixteen (implying that both yields and spreads spend a significant amount of time over the next sixteen years at higher levels than they are currently) but eventually return to their current levels, implying no net market impact over the full period but much higher levels of carry than in Scenario 2.

Table 18 shows the expected returns and Sharpe ratios for global equities, global government bonds, global corporate bonds (both unhedged and treasury hedged) and global CDS indices in each of the four scenarios discussed above.

In each case, the expected returns are shown in USD in excess of Fed Funds, which is assumed to be equal to 1.35% (the average rate from 31-Dec-2004 to 26-Feb-2021) for all scenarios except scenario 2, where the assumed Fed Funds rate is 0.07% (the level as of 26-Feb-2021). FX hedging costs for EUR investments hedged into USD are assumed to be equal to 0.87% (i.e. a benefit), equal to the average level from 31-Dec-2004 to 26-Feb-2021, for all scenarios except for scenario 2 for which a level of 0.79% (correct as of 26-Feb-2021) is used.

Table 18: Performance projections for different asset classes in forward looking scenarios

Asset Class		Repeat		Carry Implied		Reflation		Round Trip	
		Expected Return	Sharpe	Expected Return	Sharpe	Expected Return	Sharpe	Expected Return	Sharpe
Global Equities		6.73%	0.43	7.10%	0.46	4.91%	0.32	5.82%	0.38
Global Government Bonds		2.76%	0.72	0.97%	0.25	-0.49%	-0.13	1.31%	0.34
Corporate Bonds	Global IG Corp Bonds	3.53%	0.78	1.62%	0.36	1.13%	0.25	2.44%	0.54
	Global HY Corp Bonds	5.94%	0.61	3.06%	0.31	4.49%	0.46	5.21%	0.53
Corporate Bonds (Treasury Hedged)	Global IG Corp Bonds (vs. Govts)	0.87%	0.18	0.29%	0.06	0.97%	0.21	0.87%	0.18
	Global HY Corp Bonds (vs. Govt)	3.26%	0.30	1.37%	0.12	3.37%	0.31	3.26%	0.30
Credit Default Swaps	Global IG CDS Indices	1.00%	0.49	0.74%	0.36	1.04%	0.51	1.00%	0.49
	Global HY CDS Indices	5.47%	0.66	4.06%	0.49	5.58%	0.68	5.47%	0.66

Source: Tabula Capital. Returns are in excess of Fed Funds.

[7] The price-to-earnings ratio, based on Bloomberg Estimates, for the MSCI World index increased from 17.98x on 31-Dec-2004 to 20.62x on 26-Feb-2021. We calculated the "Carry Implied" IRR for equities by assuming an instantaneous fall at the end of the period to bring the P/E ratio of the index back to its December 2004 level, and then calculate the full IRR over the period taking that drop into account.

Using these projected expected returns as well as the historical volatilities and covariances of each asset class from December 2004 until February 2021 we run an optimisation process to identify the optimal portfolio for each scenario. We define the optimisation problem to maximise the Sharpe ratio of the portfolio, subject to the following constraints and initial conditions:

- The minimum USD IRR of the portfolio, in excess of Fed Funds, must be greater than or equal to 5%. This constraint is designed to avoid the second issue highlighted in Section 4 where the optimal portfolio has a very high Sharpe ratio but a very low absolute return.
- The allocation to equities must be between 40% and 80% while the allocation to government bonds is constrained to between 20% and 60%; i.e. the optimised portfolio should not stray too far from a traditional 60/40 equity-bond portfolio.
- The aggregate weight of the "funded" assets – i.e. equities, government bonds and unhedged corporate bonds – cannot exceed 100%, while the individual weight of "unfunded" assets (hedged corporate bonds and CDS indices) can be up to 200% for high yield credit and 800% for investment grade credit to reflect the leverage that can be applied to these unfunded products.

First, we apply this optimisation to equities and government bonds only, with the results shown in Table 19. For the "repeat" scenario we see that an allocation of 56.4% equities, 43.6% government bonds would have produced an optimal Sharpe ratio from December 2004 to February 2021. This is very close to the stereotypical portfolio of 60% equities, 40% bonds. However, in any of the other scenarios the optimal equity/bonds allocation would be more weighted towards equities.

Table 19: Portfolio optimisation in different scenarios – equities and government bonds only.

Asset	Repeat	Carry Implied	Reflation	Round Trip
Equities	56.4%	65.8%	80.0%	80.0%
Govt bonds	43.6%	34.2%	20.0%	20.0%
Return	5.00%	5.00%	3.83%	4.92%
Sharpe	0.60	0.51	0.32	0.41

Source: Tabula Capital. Returns are in excess of Fed Funds.

Next, Table 20 shows the result of this optimisation if the range of investable assets is expanded to include investment grade credit. In each of the four scenarios, the optimal portfolio now includes a significant allocation to investment grade CDS indices as well as a lower equity allocation and a higher government bond allocation relative to the allocations shown in Table 19[8]. Investment grade corporate bonds do not feature in the optimal allocation in any of the four scenarios.

Table 20: Portfolio optimisation in different scenarios – equities, government bonds and IG credit only.

Asset	Repeat	Carry Implied	Reflation	Round Trip
Equities	40.0%	40.0%	40.0%	40.0%
Govt bonds	60.0%	60.0%	60.0%	60.0%
IG Corps	0.0%	0.0%	0.0%	0.0%
IG Corps ER	0.0%	0.0%	0.0%	0.0%
IG CDS	65.3%	214.3%	800.0%	188.7%
Return	5.00%	5.00%	10.00%	5.00%
Sharpe	0.74	0.54	0.48	0.56

Source: Tabula Capital. Returns are in excess of Fed Funds.

Our interpretation of the higher allocation to government bonds compared to that shown in Table 19 is that the diversifying impact of government bonds (in particular their negative correlation versus credit and equity returns) is valuable but only if the allocation to credit/equities generates sufficient returns to offset the lower returns associated with government bonds; the higher risk-adjusted expected returns of CDS indices compared to equities mean that an optimised portfolio can "afford" a higher allocation to government bonds.

The "**repeat**" scenario matches the result shown in Table 15 where replacing equity risk with IG CDS risk would have increased the risk-adjusted return of the portfolio, but now the ability to apply leverage to the CDS position means that this has not resulted in a lower absolute return. In this scenario, adding the ability to include investment grade CDS indices in the portfolio has increased the potential Sharpe ratio from 0.60 to 0.74 with the same absolute excess return of 5%.

For the "**carry implied**" scenario, adding investment grade CDS to the portfolio also increases the potential Sharpe, albeit to a lesser extent from 0.51 to 0.54. This smaller increase compared to the "repeat" scenario can be explained by our projected return framework for equities not depending on a "carry" field and so

[8] Relaxing the maximum allocations to equities, treasuries or combined "funded" assets would result in an even higher weight to treasuries in Tables 20 and 21, with no increase in the equity allocation.

the projected equity performance in this scenario sees a smaller relative reduction than in the fixed income assets (and in fact the expected return of equities over Fed Funds actually increases in the "carry implied" scenario versus the "repeat" scenario given the lower assumed level of Fed Funds in the "carry implied" scenario).

In the "**reflation**" scenario, the optimal portfolio for an equity/government bond only mix was the maximum allocation to equities (80%) and the minimum to government bonds (20%). When investment grade CDS is added to the universe of investable assets means that optimal portfolio radically shifts to 40% equities (the minimum allocation), 60% in government bonds (the maximum allocation) and a leveraged 800% long risk position in investment grade CDS indices, achieving a projected Sharpe ratio increase from 0.32 to 0.48. This reflation scenario is the clearest example of the higher risk-adjusted expected return of CDS indices compared to equities meaning that a portfolio that generates income through CDS indices can "afford" a much higher allocation to diversifying government bond exposures while still achieving return targets.

The "**round trip**" scenario shows a similar picture to the "reflation" scenario; a substantially higher government bond allocation and investment grade CDS indices replacing a large portion of the equity exposure, with an increase in the projected Sharpe ratio from 0.41 to 0.56.

As an additional step, in Table 21 we also allow high yield credit investments to be included in the portfolio. The results are similar to those shown in Table 20 but with allocations being switched from equities into high yield CDS indices rather than investment grade CDS indices, with corresponding increases in Sharpe ratio for each scenario versus those in Table 20.

Table 21: Portfolio optimisation in different scenarios – equities, government bonds and IG/HY yield credit.

Asset	Repeat	Carry Implied	Reflation	Round Trip
Equities	40.0%	40.0%	40.0%	40.0%
Govt bonds	60.0%	60.0%	60.0%	60.0%
IG Corps	0.0%	0.0%	0.0%	0.0%
IG Corps ER	0.0%	0.0%	0.0%	0.0%
IG CDS	0.0%	0.0%	0.0%	0.0%
HY Corps	0.0%	0.0%	0.0%	0.0%
HY Corps ER	0.0%	0.0%	0.0%	0.0%
HY CDS	28.9%	38.9%	200.0%	173.0%
Return	5.92%	5.00%	12.82%	12.57%
Sharpe	0.77	0.60	0.61	0.67

Source: Tabula Capital. Returns are in excess of Fed Funds.

6. Summary

This research paper shows that CDS indices are a highly compelling way of investing in credit markets, comparing well against more traditional credit instruments such as corporate bonds in both standalone and cross-asset contexts.

Firstly, CDS indices are now highly liquid instruments with average daily volumes approaching $100bn in 2020, which is considerably higher than the current single name CDS market and even compares well to the most liquid corporate bond markets.

Secondly, we demonstrated that the credit risk premium – defined as the compensation from credit spreads in excess of realised losses from credit events – has been (a) positive and (b) consistent for the most liquid CDS indices since their launch in 2004; this is consistent with previous established research finding that a credit risk premium exists in the corporate bond market.

Thirdly, we compare returns of benchmark corporate bond indices and a rolling long risk strategy in 5y CDS indices. Our initial results, shown in Table 3, showed that the returns of a rolling long risk strategy in CDS indices would have been *higher* than the implied carry of the strategy over the period. This is a highly significant result given that the opposite is true for corporate bond indices. We explain this outperformance as a function of three factors: the higher impact of slide in a rolling CDS strategy, a lower impact from downgrades and the positive returns from CDS orphaning events. This outperformance, combined with the lower historical volatility and drawdowns of CDS positions compared to corporate bonds, has meant that the risk-adjusted returns (as measured by the Sortino ratio) of a rolling CDS index strategy is more than double that of comparable corporate bond indices

Next, we extended this analysis to cross-asset portfolios and examined whether including CDS index allocations would have added value to a classic cross-asset portfolio (60% equities and 40% government bonds) in the period from December 2004 to February 2021. We found that using CDS indices as an overlay to government bonds would have increased absolute returns without sacrificing Sharpe ratio (while switching from government bond to corporate bonds would have led to worse risk-adjusted returns, as per Norges Bank IM (2017)) and also found that CDS would have meaningfully improved risk-adjusted returns if used as a replacement for equity risk over this period (again unlike corporate bonds).

Finally, in Section 5, we examined whether CDS indices could add value in cross-asset portfolios with a 5% return threshold for a variety of forward-looking scenarios using an optimisation approach. In each case, CDS indices warranted inclusion in the portfolio and led to higher risk-adjusted returns, while corporate bonds did not.

References

Asness, Cliff, The Long Run is Lying To You (March 2021), *Cliff's Perspectives*.

Asvanunt, Attakrit and Richardson, Scott Anthony, The Credit Risk Premium (June 21, 2016). Later published in *Journal of Fixed Income Winter 2017*.

IHS Markit, CDX and iTraxx 2020 Review (January 28, 2021).

Ilmanen, Antti S., Expected Returns on Major Asset Classes (June 1, 2012). *CFA Institute Research Foundation 2012 – 1*.

Israelov, Roni, Give Credit Where Credit is Due: What Explains Corporate Bond Returns? (April 10, 2019).

J.P. Morgan, Angels and Demons: Single name trends for iTraxx Crossover and CDX HY (May 1, 2014). *CD Player*.

J.P. Morgan, Liquidity in Credit Derivatives (November 19, 2020). *CD Player*.

Ng, Kwok-Yuen and Phelps, Bruce D., Capturing Credit Spread Premium (June 9, 2011). *Financial Analysts Journal, Vol. 67, No. 3, 2011*.

Norges Bank Investment Management, Corporate Bonds in a Multi-Asset Portfolio (April 9, 2017). *Discussion Note*.

Appendix 1

In section 1 we use market volumes from several sources:

- iTraxx and CDX volumes are based on IHS Markit data (see 2020 volume reviews https://ihsmarkit.com/research-analysis/cdxitraxx-2020-annual-review--indices-tranches-and-swaptions.html and https://ihsmarkit.com/research-analysis/ihs-markit-credit-indices--2020-volumes-review.html).
- Single name CDS volumes are based on J.P. Morgan data (*CD Player*, 19 November 2020).
- USD IG corporate bond volumes are based on TRACE data.

Appendix 2

In section 2, annual implied loss rates are equal to the iTraxx or CDX index spread on the day that the CDS index begins trading, using end-of-day spreads from IHS Markit from 2005 and J.P. Morgan data for earlier start dates. Realised loss information is calculated using data from www.creditfixings.com based on the recoveries determined by CDS auctions.

Appendix 3

In section 3, spreads and excess returns for corporate bonds are based on ICE BofA corporate bond index data, in particular the ICE BofA Euro Corporate (ER00) Index, ICE BofA US Corporate (C0A0) Index, ICE BofA Euro High Yield (HE00) Index and the ICE BofA US Cash Pay High Yield (J0A0) Index. Spreads are equal to the government option adjusted spread and excess returns are quoted against treasuries. Figures shown in Table 4 are based on the sub-indices of the C0A0 Index, namely the C1A0, C2A0, C3A0, C4A0 and C5A0 indices. More information on the ICE BofA indices is available at https://www.theice.com/market-data/indices/fixed-income-indices.

CDS index spreads are based on data from IHS Markit, with several gaps in early data prior to 2006 being filled in with data from J.P. Morgan. With the exception of the data shown in Table 5, CDS index excess returns are calculated based on a rolling strategy that sells protection on the 5y tenor and on-the-run series of the relevant CDS index and automatically rolls into the new series at each roll date. The notional of the CDS index position is scaled such that the notional of the CDS index position multiplied by the CDS "bond-equivalent price" is equal to the index level from the previous business day. The excess returns shown in Table 5 are calculated as described in section 3, and so show a slight difference versus other data in this section as a result of the lack of daily scaling of notional based on the "bond-equivalent price". We do not include transaction costs in these time series in order to make them comparable to the ICE bond index time series (which are gross of transaction costs), but our estimates of historical transaction costs from Markit data suggest that the impact of transaction costs on rolling CDS index strategies would be minimal (0.01% on average per annum for the investment grade indices and 0.07% for the high yield indices).

Bond-CDS basis data shown in Figure 5 is sourced from J.P. Morgan and is calculated using an equally weighted universe of corporate bonds that have liquid CDS trading.

In Figure 7 and Figure 8 we combine the excess returns over treasuries of the ICE BofA 3-5y and 5-7y year indices (C2A0 and C3A0 for IG, J2A0 and J3A0 for HY) together using an equal weighting with a monthly re-weighting. For Figure 9 and Figure 10, ICE already publishes a 4-6 year index for European credit (ER0C for IG, HE0D for HY) so we use the excess returns over German government bonds for these indices rather than constructing a 3-7y composite index.

Appendix 4

In sections 4 and 5, all returns of funded assets (i.e. equities, government bonds and unhedged corporate bonds) are calculated in excess of Fed Funds and, in the case of non-USD assets, are converted into USD by adjusting returns by the Bloomberg EURUSD 3 Month Hedging Cost (FXHCEUUS Index).

In each section, references to different asset classes mean the following:

- Global equities means MSCI World (M2WO).
- US treasuries means the ICE BofA US Treasury Index (G0Q0).
- Global investment grade corporate bonds means a 50/50 basket of the ICE BofA US Corporate Index (C0A0) and ICE BofA Euro Corporate Index (ER00) rebalanced on a monthly basis.
- Global high yield corporate bonds means a 50/50 basket of the ICE BofA US Cash Pay High Yield Index (J0A0) and ICE BofA Euro High Yield Index (HE00) rebalanced on a monthly basis.
- Global IG CDS indices means a 50/50 basket to a rolling long risk strategy in the on-the-run series and 5y tenor of each of iTraxx Main and CDX IG, calculated using the same methodology as in section 3.
- Global HY CDS indices means a 50/50 basket to a rolling long risk strategy in the on-the-run series and 5y tenor of each of iTraxx Crossover and CDX HY, calculated using the same methodology as in section 3.

About the authors

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About Tabula Capital

Tabula Capital believes that credit investors should not have to compromise on fees, liquidity or default risk. Higher quality returns can be found by investing in liquid credit index instruments, using a core systematic approach combined with an active management overlay.

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