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iBoxx TRS Primer

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iBoxx TRS – which is an over-the-counter credit derivative that allows market participants to take a synthetic long or short position on iBoxx cash indices – has grown in recent years, as investors look for ways to gain exposure to bond market returns without incurring basis risk. We provide an introduction to TRS trading, including key concepts and calculations, and work through some trade examples. We also compare TRS to the CDS indices and ETFs and discuss the use-case for TRS and the factors that can affect TRS pricing.

iBoxx TRS: the newest member of the portfolio product family

The growth of credit portfolio products has accelerated in recent years, as investors have increasingly used them to manage the liquidity risk in their portfolios, tactically adjust beta exposure, and express cross-asset relative-value views. While the CDS indices (CDX and iTraxx) remain the most liquid portfolio products, iBoxx total returns swaps (TRS) have continued to gain traction as investors seek alternatives to the CDS indices and ETFs.

While the concept of TRS has existed for quite some time, its introduction on the iBoxx indices is a fairly recent development, with the product having been launched in 2012 and further standardised in 2016 to improve fungibility. Given that TRS is still a relatively new addition to credit investors' inventory of portfolio products, we review the basics of the product, including which cash indices are available to trade with Barclays. We also discuss the use-case for TRS versus the other portfolio products and provide some statistics on index composition and volume growth, as well as typical market technicals. We also include appendices with reference information on the underlying iBoxx cash indices.

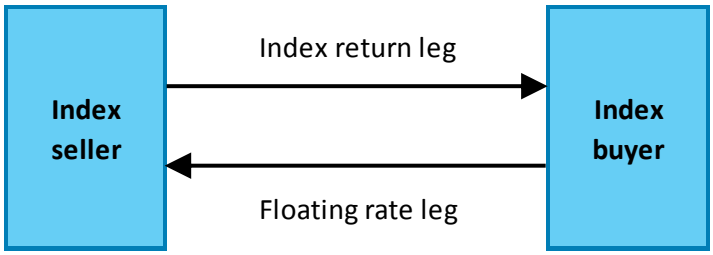
What is an iBoxx TRS?

TRS is an over-the-counter credit derivative that allows market participants to take a synthetic long or short position on iBoxx cash indices, such as the USD and EUR Investment Grade and High Yield indices. Conceptually, a long position is like buying the cash index funded at the 3m Libor rate. TRS trades are governed by the 2006 ISDA Definitions, and the standard terms and trade confirmation documents can be found on Markit's website.

A TRS trade involves two parties: an index buyer and an index seller. The index buyer is going long risk, while the index seller is going short risk; these parties essentially exchange cash flows that replicate the total rate of return of being long/short the index funded at the 3m Libor rate, which is Libor/Euribor flat (ie, there is no additional spread over the Libor rate). Figure 1 illustrates the cash flows of a TRS trade; the index buyer pays the floating leg every quarter and receives the index return leg at maturity.

The maturity for TRS contracts is standardised and falls on business day-adjusted IMM dates (20 Mar/Jun/Sep/Dec), which should be familiar to users of CDS products. The most commonly-traded TRS tenors are 3, 6, 9, and 12 months.

FIGURE 1
A standardised Total Return Swap on iBoxx indices



Note: This illustration does not show the initial payment amount to the index buyer.
Source: Markit, Barclays Research

The index return leg

The index return leg is determined by the total return relative to the "initial" level (also referred to as the "strike" level) of the trade. The dealer quotes bid-ask levels for the initial level and these will generally be different from the underlying index level. The investor can then buy/sell the index at the quoted levels. The difference between the mid-quote and the index level is driven by supply and demand technicals for TRS, which we will return to further below. The "final" level is the official index closing level on the maturity date, as determined by IHS Markit, the third-party index administrator. At the end of the trade, the index buyer will receive the total return of the index at maturity (potentially having to pay the index seller if the realised total return is negative).

The floating rate leg

The methodology for calculating and exchanging floating rate payments (which are based on 3m Libor flat) is similar to the "Full First Coupon" convention for CDS. At trade inception, the index seller will make an initial payment (assuming Libor is positive) to the index buyer for any accrued "coupon" from the prior IMM date to the trade-effective date. The reason for this is that the index buyer will subsequently make a full floating rate payment (again assuming Libor is positive) to the index seller at the next IMM date, regardless of when the trade was executed within the quarter (which is consistent with how coupon payments for CDS are exchanged). The initial payment from the index seller to the index buyer compensates the index buyer for the overpayment that the index buyer will make at the next IMM date. This process results in all trades within a given quarter referencing the same 3m Libor rate and having the same terminal coupon pay-out, which increases the fungibility of trades and simplifies the processing of floating rate payments.

Funding cost intuition

We can think of the funding cost (ie, the floating leg) of the TRS as akin to how an investor would fund a bond purchase via repo. In a repo transaction, an investor finances the ownership of a bond by borrowing funds on an overnight basis and then posting the bond as collateral. The investor receives the total return of the bond while incurring a financing cost. TRS works similarly in that an investor going long risk via TRS receives the total return of the underlying index and pays 3m Libor to finance the trade, but in the case of TRS, the investor does not have ownership of the underlying reference assets.

Which iBoxx cash indices are available to trade?

We expect TRS to be available to trade with Barclays on the seven iBoxx indices shown in Figure 2. Many investors will be familiar with cash indices like the ones referenced by the iBoxx TRS contracts, so we keep the treatment here brief and refer instead to the appendix for a summary of common index rules, inclusion criteria, and total return calculations.

FIGURE 2

Markit iBoxx indices expected to be quoted by Barclays at the time of publication

Index Name	ISIN	BBG Ticker
iBoxx EUR Corporates	DE0006301161	QW5A
iBoxx EUR Liquid High Yield	GB00B57G6H43	IBOXXMJA
iBoxx EUR Contingent Convertible Liquid Developed Market AT1	GB00BQY78372	IBXXC2D1
iBoxx USD Liquid Investment Grade	GB00B4K4X773	IBOXIG
iBoxx USD Liquid High Yield	GB00B4K07738	IBOXHY
iBoxx USD Contingent Convertible Liquid Developed Markets AT1	GB00BQY78F97	IBXXC1D1
iBoxx USD Liquid Leveraged Loans	GB00B4Q2XT74	IBXXLLTR

Source: Markit, Barclays Research

The cash indices that will be available to trade (Figure 2) are in the "Liquid" index series, with the exception of the EUR Corporates index. These are generally also the indices that ETFs that reference the iBoxx family of indices are tracking given the greater ease with which the constituent bonds can be sourced.

The Liquid indices are closely related to the broader IG/HY/CoCo/LL indices. Specifically, they are sub-indices of their broader counterparts, as they have additional restrictions on which bonds can be admitted. These restrictions vary from index to index but are generally based on deal size (including only larger issues), remaining time to maturity (excluding less-liquid tenors), as well as caps on issuer, sector and country exposure.

Figure 3 shows summary statistics for each of the indices. The total return index level (which forms the reference point of a TRS trade) has been accumulating since the index "base date", ie, the date on which the index was created.

FIGURE 3

iBoxx index statistics

	EUR Corporates	EUR Liquid HY	EUR CoCo Liquid DM AT1	USD Liquid IG	USD Liquid HY	USD CoCo Liquid DM	USD Liquid Lev Loans
Number of Bonds	2,486	456	46	1,910	947	65	100
Market Value (bn)	2,115	248	47	2,818	855	99	229
Notional Amount (bn)	2,005	245	45	2,702	849	96	235
Modified Duration	5.1	2.8	3.3	8.4	3.3	3.3	-
Yield (%)	1.1%	3.7%	5.3%	4.1%	6.3%	6.6%	-
OAS (bp)	134	405	574	144	381	419	-
Total Return Index Level	230.96	196.13	143.87	289.04	286.91	142.85	172.45
Base Date	31-Dec-98	31-Dec-05	31-Dec-13	31-Oct-06	31-Oct-06	31-Dec-13	31-Mar-08
YTD TR (%)	3.3%	5.5%	7.4%	6.2%	8.2%	7.6%	5.9%
3YR TR (%)	6.3%	13.4%	35.6%	10.8%	26.0%	33.2%	14.2%
5YR TR (%)	14.7%	16.8%	36.4%	21.0%	23.2%	37.1%	14.4%

Note: Data as of 10 April 2019. Market value and notional amounts in local currency terms. No data available for modified duration, yield and OAS for the USD Liquid Lev Loans index. Source: Markit, Barclays Research

Understanding the use-case for TRS

TRS is essentially a type of portfolio product comparable to CDS indices and credit ETFs. As previously mentioned, TRS provides a way for investors to express a long or short view on specific parts of the credit market, which is similar to ETFs and CDS indices, but with some key differences.

FIGURE 4
Stylised characteristics of credit portfolio products

Instrument	Funding	Rates risk	Basis risk	Term	Liquidity
CDS index	Unfunded	No	Large	5 year	High
ETF	Funded	Yes	Small	Perpetual	Low (EU) / High (US)
TRS	Unfunded	Yes	None*	3-12m	Low-Medium

Note: *There is no basis or tracking error away from the quoted level versus NAV. Source: Barclays Research

Namely, we can broadly think of portfolio products as characterised by their need for funding, their rates risk, and their basis versus the underlying cash index (Figure 4).

A CDS index is an unfunded product that provides exposure to the credit spread (ie, no rates risk) with substantial basis risk (see for example *CDS-cash basis: IG down, HY up*, 2 November 2018). Unfunded products allow investors to gain exposure to an asset class without having to post or exchange the notional amount of the exposure.

In contrast, a credit ETF is a funded product that gives exposure to the total return (ie, includes rates risk) with significantly less basis risk than a CDS index. As the ETF is a physical share, expressing short-risk views can at times be expensive as it requires borrowing the shares.

TRS is similar to ETFs in that it gives exposure to the total return, but is different in that it is unfunded and does not require borrowing shares in order to express short-risk views. Moreover, in Europe, the liquidity for TRS is already approaching that of comparable ETFs. However, in the US, credit ETFs tend to be far more liquid than TRS, although TRS activity has been increasing.

An alternative portfolio product with better tracking

While the CDS indices remain the most liquid portfolio products, investors have at times been frustrated with the tracking error between CDX/iTraxx and the relevant benchmark cash indices. In some cases, the CDS indices are significantly different than their related cash markets. For example, on-the-run CDX.IG has a duration between 4.5 and 5.0 and does not have any of the "Big Six" US banks among its constituents. In contrast, the Bloomberg Barclays US Corporate Index has a duration of 7.4, and the Big Six banks account for approximately 11% of the index.

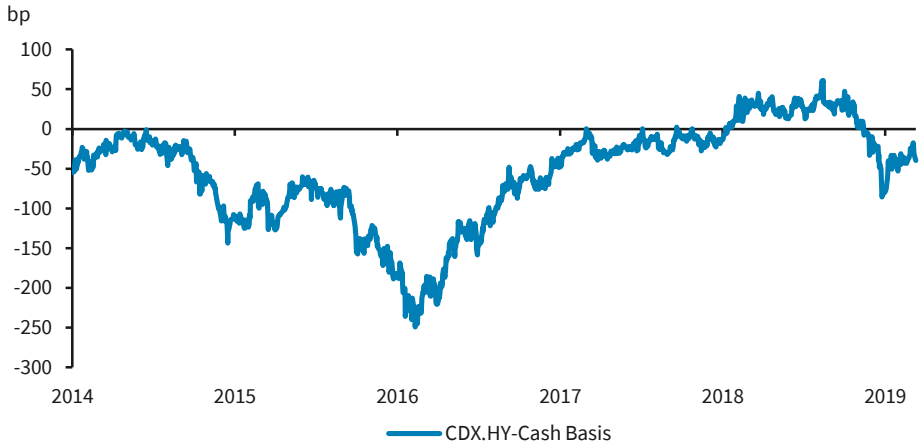
In Europe, although iTraxx Main does have many banks among its constituents, with financials accounting for 24% of the index, that number actually pales in comparison to the 40% weight of financials in the European investment grade bond market. We provide a more detailed comparison of the sector weights and ratings of the US and European CDS and iBoxx indices in the appendix.

Aside from compositional differences, other concerns about the CDS indices are that they may not always reflect the various technicals affecting cash market performance, including bond supply, call constraints, fund flows, and changes in funding conditions, and that they do not have direct rates exposure. TRS, on the other hand, provides a direct way to gain exposure to the performance of the relevant bond market without incurring basis risk (aside from the initial bid-offer, which we will discuss in more detail).

The CDS indices have proven to be effective instruments for expressing long/short views over short timeframes, but we have seen periods of extended under/outperformance versus the cash market. For example, investors who hedged their US high yield exposure with CDX.HY would have meaningfully underperformed during the energy-driven selloff from 2015 to early-2016 (as CDX.HY widened less than the cash market), while investors who went long risk in CDX.HY would have underperformed in the subsequent rally (Figure 5). While the large moves in the basis at the time were partly attributable to the relative underweight of the energy sector in CDX.HY (which has since been largely corrected), the basis can still experience sharp moves, with December 2018 being the most recent example. See also *Positively negative CDS-cash basis*, 1 February 2019 for a discussion of a recent increase in 'wrong way' CDS-cash performance for European IG credit.

FIGURE 5

Changes in the CDS-cash basis can lead to meaningful tracking error



Source: Barclays Research

ETFs and TRS are more alike in that they both provide exposure to the cash market, and therefore they are affected by similar technicals. However, one advantage that TRS offers is that it does not require locating shares to borrow in order to go short. In addition, some funds may not be able to own ETFs because they are equity instruments, or they may be hesitant to use them because of the management fees, and therefore TRS could be more attractive.

TRS also offers better tracking of index returns over time as ETF returns can be impacted by the premium/discount to NAV, transaction costs from portfolio turnover, and the challenge with replicating bond index returns.

For investors looking to gain exposure for a specific period of time, TRS allows them to avoid having to pay bid-offer twice as the position can be held to maturity (in contrast to ETFs and CDS indices).

One tracking error-related difference between ETFs and TRS is that when a TRS matures, the payout will be linked to the index net asset value on that date with no uncertainty, whereas the ETF position would be exposed to the Price-NAV basis.

Potential drawbacks: liquidity, still OTC, and limited intraday transparency

We think that the main drawback of TRS currently is that it is the least liquid of the portfolio products, and therefore the most expensive to utilize for short-term trades that would incur roundtrip transaction costs. Trade sizes could also be limited, especially relative to the CDS indices. Aside from liquidity considerations, another drawback is that it is an over-the-counter (OTC) product that requires an ISDA. As TRS is not yet cleared, there is some counterparty risk, and some funds may be precluded from holding OTC instruments. The

CDS indices, on the other hand, are generally cleared, and the ETFs are listed securities. That said, as previously mentioned, some investors are precluded from holding equities, which rules out ETFs.

Another potential disadvantage is the lack of intraday transparency. Although dealers send out runs multiple times a day, it can be difficult to accurately calculate the NAV, especially when volatility is high or updated pricing is not available for all of the bonds in the index.

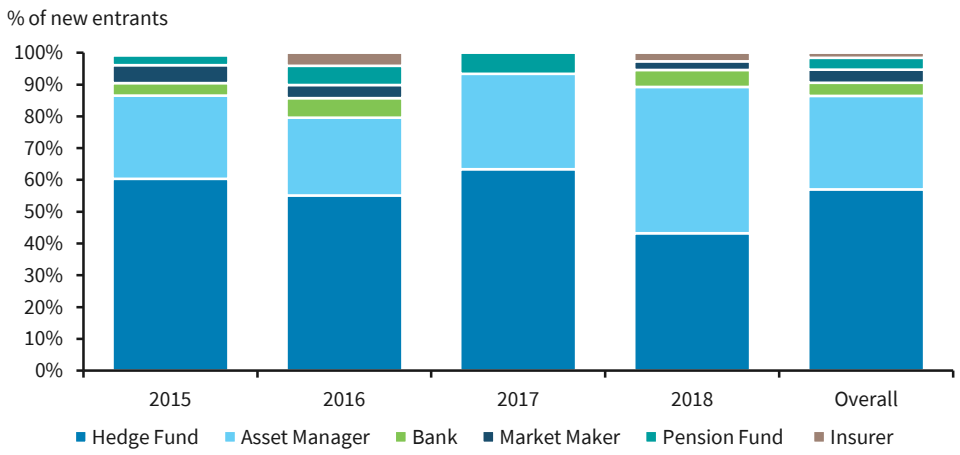
Ways to utilise TRS

The potential uses of TRS include both portfolio hedging and going outright long/short risk. For example, an asset manager could use TRS as a liquidity buffer, ie, go long without needing the funding on day one, whereas an ETF would require deploying cash balances. Similarly, asset allocators can use TRS to gain "beta" exposure to the underlying asset class in size. Hedge funds could use TRS to express opportunistic or tactical views on cash indices. A CDS index would be the obvious alternative, but as previously discussed is subject to a much larger basis versus cash. Some accounts might also be interested in exploring convergence trades between TRS, ETFs, and CDS.

An evolving user base

Hedge funds have been quick to adopt iBoxx TRS and made up a majority of the new entrants into the iBoxx TRS market from 2015-17 (Figure 6). However, there was a meaningful shift in 2018 as other types of investors, led by asset managers, accounted for a majority of new users for the first time. We think this could be a sign of the broadening appeal of TRS as real-money investors seek out alternatives to the CDS indices and ETFs.

FIGURE 6
Annual distribution of new market entrants for iBoxx TRS



Source: MarkitSERV, Barclays Research

Historical volumes – absolute and relative to CDS and ETFs

TRS activity has varied by market and asset class, with US and European high yield and US leveraged loans being the most active to date (Figure 7). The prevalence of hedge funds in those markets has likely aided liquidity, along with a focus by high yield investors to keep a portion of their assets in portfolio products in order to manage the liquidity risk of their portfolios.

FIGURE 7
Average weekly TRS volumes by year ($mn)

Year	USD HY	EUR HY	USD LL	USD IG	EUR IG	EUR COCO	USD COCO
2016	771	272	85	191	111	-	-
2017	1,204	360	241	251	139	7	2
2018	1,567	451	282	298	174	72	17
2019*	1,161	572	464	428	261	24	23

*2019 volumes as of March 29, 2019. Source: DTCC, Barclays Research

While the volume numbers appear small in absolute terms, they are not far behind ETF volumes in Europe (Figure 8). Institutional investors have been slow to adopt ETFs in the European markets and, as a result, TRS is already a relatively liquid way to obtain cash-like returns in the form of a portfolio product in the region, in particular for HY.

It is a different story in the US, as US ETFs are quite liquid and have seen their activity levels increase over time. But, given the potential benefits of TRS relative to ETFs that were previously discussed, we think there is scope for TRS activity to increase over time.

Leveraged loans is the US market that could perhaps benefit most from increased TRS activity as there is no CDS index that is directly tied to the asset class. The other markets have very liquid CDS indices, with volumes for most of them many times greater than either ETF or TRS volumes. But, given the tracking error concerns for CDS, we think investor interest in these products that track the cash indices should continue to grow.

FIGURE 8
2019 average weekly volume comparison ($mn)

	US IG	US HY	US LL	EU IG	EU HY
CDS Index	181,562	45,079	-	117,257	23,978
ETF*	5,346	9,395	887	847	709
TRS	428	1,161	464	261	572

Note: Volumes as of March 29, 2019. *For ETF volumes, we used the largest ETF in each market: LQD (US IG), HYG (US HY), BKLN (US LL), IEAC (EU IG), and IHYG (EU HY). Source: DTCC, Bloomberg, Barclays Research

Interpreting the 'Mid-NAV' basis

In a frictionless world, TRS quotes would be completely in line with the current index level, just as in a steady state an ETF's price 'should' be equal to its underlying NAV, and a CDS index spread 'should' be equal to the intrinsic spreads of its underlying constituents.

But, just as an ETF's price is rarely equal to its NAV, and a CDS index spread is rarely equal to its intrinsic spread, the TRS mid-price is rarely equal to the current index level ('NAV').

Generally speaking, the ETF price-NAV and CDS index-intrinsic bases (or 'skew') are driven by supply and demand for the ETFs, CDS, and their underlying products – and TRS is no different. Marginal interest in buying/selling the TRS drives TRS mid quotes higher or lower than NAV.

Theory: understanding implied funding spreads

At first glance, it seems as if TRS mids should trade above the index level, since both ETFs and CDS indices tend to trade at a premium to their NAVs. Portfolio products are often more liquid than their underlying products and may provide a leveraged way to be long risk, which helps explain why it should be more expensive to be long risk via portfolio products.

For TRS in particular, there is a funding advantage over cash bonds and ETFs in that it is possible to receive the return of an index without having to fund the purchase of the bonds above the relevant Libor rate. But, for TRS, it is also common to consider bid-ask as part of the funding cost of the trade (since an investor is typically not getting long at NAV), and therefore the difference between the initial mid (or quoted) level and the index NAV is commonly referred to as an 'implied funding spread'.

The implied funding spread represents the premium/discount between the initial quoted level and the current index level at trade inception. The initial quoted level is determined by the current index level, the funding spread, and the time to maturity, and can be calculated as follows:

$$Initial\ Level = Current\ Index\ Level \times (1 + Implied\ Funding\ Spread \times Maturity)$$

In the above equation, the initial (quoted) level is known, along with the current index level and the maturity of the TRS (in years).

We can rearrange the formula and calculate the implied funding spread directly:

$$Implied\ Funding\ Spread = \left(\frac{Initial\ Level}{Current\ Index\ Level} - 1\right) \times \frac{1}{Maturity}$$

Assuming that the initial mid-level is above the current index level, we can interpret this as the break-even funding spread that would make an investor indifferent between owning TRS or buying and funding the bonds for the TRS term at this particular funding spread, absent transaction costs.

Considering the total return leg in isolation, we can also think of this implied funding spread as a return break-even. Suppose a TRS price is above NAV. For an investor who goes long risk by buying TRS, how high of a total return (including carry earned, on an annualised basis) is needed before the total return leg breaks even? Or conversely, suppose an investor wants to go short risk and the price is above NAV: how much can the index return for the trade to still break even?

The reality: mids can be below NAV

The reality is that presently, for most iBoxx indices and tenors, the mid-levels are *below* the current index levels – ie, implied funding spreads are *negative*. As a result, for investors seeking to go long risk (buying TRS), there is a small 'buffer' in terms of returns being able to be modestly negative before suffering a loss on the total return leg of the position.

Anecdotal evidence suggests that hedge funds have generally been biased to be short risk via TRS, thereby lowering TRS prices (ie., the demand for shorts can drive prices below NAV). And a general interpretation is that given the basis risk observed between the CDS indices and cash bonds, investors are concerned with hedging with CDS indices, preferring CDS instead as a way to go long risk (see for example *CDS index positioning*, 27 Mar 2019). Consequently, they are willing to pay a premium to hedge with TRS in order to minimise tracking error.

In the US, given the liquidity of credit ETFs, the premium to hedge via TRS is also related to the borrow cost incurred by hedging with ETFs. Given that TRS most directly competes with ETFs that reference the same benchmark indices, the economics of going long or short risk in both products tend to be related. For example, the cost to go short via TRS will be tied to the borrow cost of the ETF as large divergences between the two would cause investors to favour one product over the other (all else being equal). TRS market-makers also use the

relevant ETFs to hedge their risk. As a result, ETF borrow costs (and the demand for shorts) will be reflected in TRS pricing and can cause TRS mids to be below NAV.

We can also explain the relationship between TRS and ETFs in the US market by considering the perspective of an investor looking to go long risk. Instead of going long via TRS, the investor has the option of buying an ETF and earning the total return of the ETF less a management fee. The investor may also have the ability to earn an additional return by lending out the ETF shares, particularly when the demand for shares is high. As a result, in order for TRS to offer a comparable return to the ETF, it would need to account for any additional carry that can be earned from lending out the ETF shares, which can cause TRS to be quoted inside of NAV.

Examples of TRS mids and funding spreads

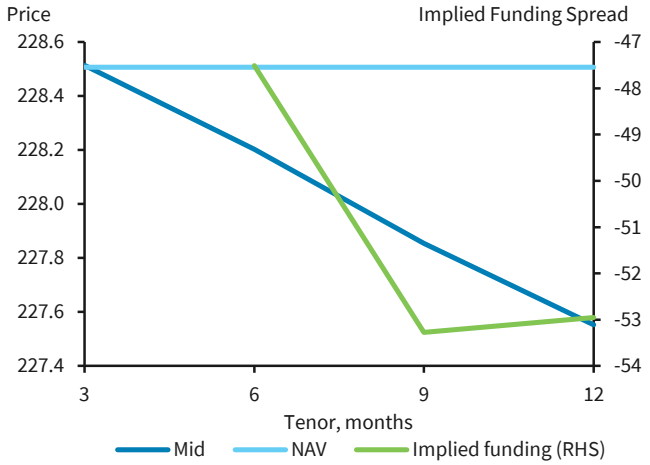
So what does the term structure of TRS mids/funding spreads look like? Using data from mid-March for TRS on the iBoxx EUR IG Corporates index (Figure 9), we find that TRS prices across tenors are below NAV, and that the longer the tenor, the lower the price. If we calculate implied funding spreads, the spread for the 6-month tenor (which was June at the time of our analysis) is around -48bp, whereas for the 9- and 12-month tenors, the implied funding spreads are similar, at about -53bp.

By converting the Mid-NAV differences into a spread, it is easier to compare TRS prices across tenors, because by just looking at Mid-NAV price differences in this example, we could conclude that a 12-month TRS has a meaningfully lower price than a 9-month TRS, but in spread terms they are actually very similar.

In contrast, for TRS on the iBoxx USD Liquid IG index (Figure 10), Mid-NAV is consistently positive, and thereby the implied funding spread is also positive. TRS prices are dropping for longer tenors, and so are the implied funding spreads: although it is expensive to be long risk in this TRS, it is less expensive for longer tenors.

FIGURE 9

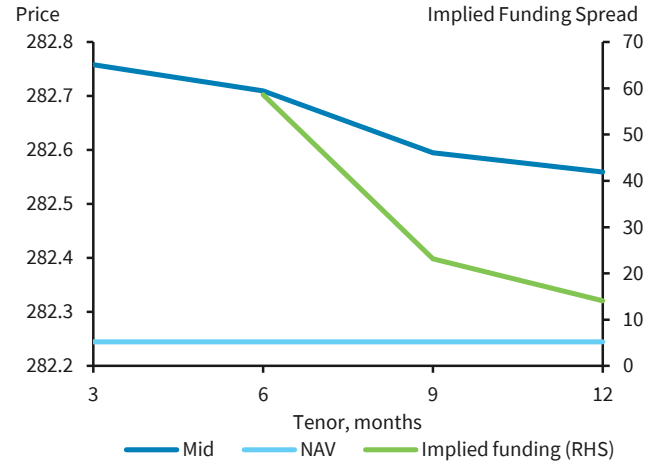
iBoxx EUR IG Corporates term structure: mid prices, NAV and implied funding spreads



Source: Markit, Barclays Research

FIGURE 10

iBoxx USD Liquid IG: mid prices, NAV and implied funding spreads



Source: Markit, Barclays Research

The anatomy and lifecycle of a TRS trade

How to read a TRS run

Market-makers will send out TRS quotes using Bloomberg messaging, and we show a sample TRS run in Figure 11. The top of the run shows the reference index for the TRS, and below that the previous day's closing NAV for the reference index, along with some characteristics (yield, duration, and spread) of the index.

The next section has quotes for the different TRS maturities. The quotes are based on the level of the total return index. For each maturity, both a bid and offer are shown, along with the change on the day and the standard size that can be transacted at the quoted level. For example, an investor that wants to go long risk in the Jun-19 iBoxx USD Liquid High Yield TRS would get long at the offer-side level of 285.48. This compares to the previous day's NAV of 285.02.

Below the TRS quotes is a roll matrix, which shows how much it costs to roll a TRS from one maturity to another. A roll trade involves unwinding an existing trade at the current dealer quote and then entering a new trade at the quoted level adjusted for the roll spread. For example, the roll spread for rolling from Jun-19 to Sep-19 is -0.9/-0.7. An investor that wanted to roll a long in the Jun-19 TRS to Sep-19 would roll at the offer side of the quote, which is this case is -0.7 index points. The investor and the dealer would unwind the Jun-19 TRS at the bid quote of 284.48 and then strike a new long with the same notional in the Sep-19 TRS at 283.78 (ie, 0.7 less than the agreed upon level for unwinding the Jun-19 TRS).

Note that this price is below the outright Sep-19 TRS offer of 284.69: rolling a TRS is less costly than separately unwinding an existing TRS trade and executing a new one.

FIGURE 11

Sample run for iBoxx USD Liquid High Yield TRS as of April 1, 2019

Ticker		IBOXHY / IBOXX USD LIQUID HIGH YIELD			
EOD NAV		285.02			
Yield	6.30%	G-Spread	399.98	Duration	3.59
Maturity		Mark		COD	SIZE
19-Jun		284.48/285.48		0.00	50x50
19-Sep		283.69/284.69		0.00	50x50
19-Dec		282.56/284.06		0.00	50x50
20-Mar		281.35/282.85		0.00	50x50
Roll		19-Jun	19-Sep	19-Dec	20-Mar
19-Jun		-	-0.9/-0.7	-1.78/-1.58	-2.98/-2.78
19-Sep		-	-	-0.98/-0.78	-2.19/-1.99
19-Dec		-	-	-	-1.31/-1.11

Source: Barclays Research

Rolling TRS

As mentioned above, the process of rolling an existing TRS trade to a new maturity involves settling or closing out the existing trade and then entering into a new trade. If we refer back to the above example of a long investor rolling from Jun-19 to Sep-19, the investor and the dealer agree on a final settlement price for the original Jun-19 swap, and then a close-out amount is calculated for both the asset leg and the funding leg. The investor and the dealer

then enter into a new trade on the Sep-19 swap. The quoted roll markets quantify how much it costs to roll from one contract to another in terms of index points.

Closing out a TRS

There are a number of ways an investor can close an existing TRS trade. They can roll the trade (as explained above), unwind or novate the trade, or alternatively offset the trade by entering into an opposite position.

While investors can unwind their TRS with their existing counterparty, the standardisation of iBoxx TRS allows them to unwind with a different dealer. The process by which a new counterparty can replace an existing counterparty in a swap contract is referred to as "novation", and this process should be familiar to investors that have traded CDS. The investor would transfer or novate its contractual obligation from the original trade to a new dealer in exchange for cash, and then the two dealers would face each other on the original trade. The investor and the new dealer would then proceed with an unwind transaction as previously described. This process enables investors to take advantage of potentially better pricing offered by another dealer without having to worry about being tied to the dealer that originated the trade.

Finally, in the case where the investor offsets the trade with an opposite position, they will face a residual exposure on either the index return leg or the floating rate leg (depending on the notional of the offsetting trade), given that the levels at which the trades are entered are unlikely to offset perfectly.

Bloomberg tools: TRSW

Bloomberg provides a calculator under the function TRSW for valuing total return swaps. Figure 12 shows a screenshot of the Main tab of the calculator with a sample trade for the iBoxx EUR Liquid High Yield Index, which can be accessed on Bloomberg by typing "IBOXXMJA Index TRSW".

On the left-hand side, starting in the Swap section, the "Leg 1: Asset" is set to Receive, which indicates that the investor is going long the TRS. The "Notional" defaults to 10MM but can be changed if necessary. The Effective date of the trade is T+1, and in our example, the TRS matures on June 20, 2019, which is the next IMM date. The "Asset" field shows the index for the TRS, and below that we have entered the strike price for the trade, which for our example is 194.50. The "Latest Value" is populated automatically by Bloomberg and based on the prior day's closing level for the index.

On the right-hand side of the Swap section are the characteristics for the Floating rate leg, which is set to Pay. When accessing the TRSW screen via "[Index ticker] Index TRSW," the correct floating leg parameters should be populated by default.

In the Market section, the tool calculates the accrued value of the asset leg, which is simply:

$$\frac{Current\ Index\ Level - Initial\ Level}{Initial\ Level} \times Notional$$

Using the levels from our example, we get: (194.7819 – 194.50) / 194.50 × 10MM = 14,493.57.

It also calculates the accrued value of the floating leg, which is determined as follows:

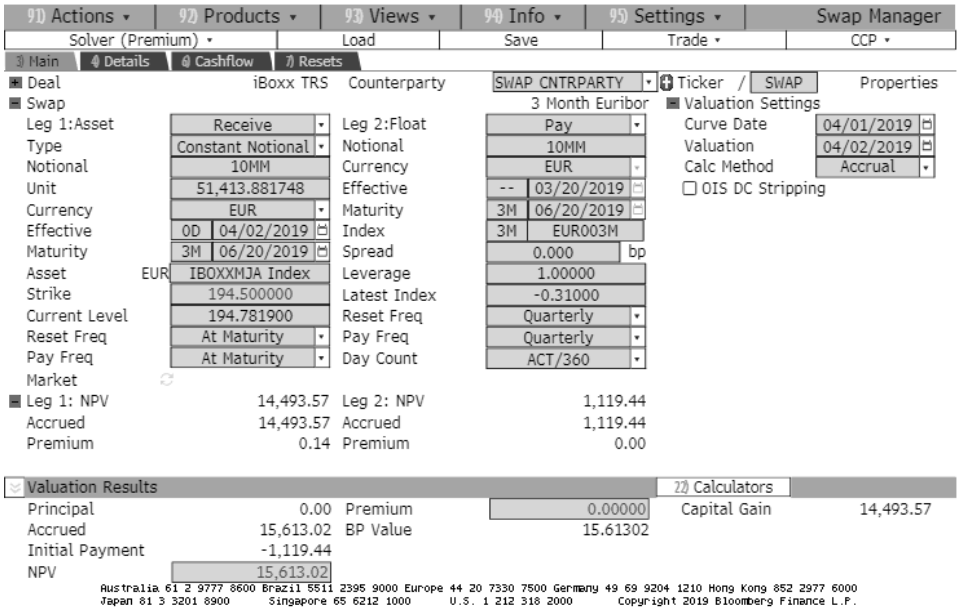
$$-\frac{Floating\ Rate}{100} \times \frac{ACT}{360} \times Notional$$

Again using the levels from our example, we get 0.31/100 × 13/360 × 10MM = 1,119.44. Note that for non-negative rates, this would be a negative number.

Finally, the Valuation Results section at the bottom is simply the sum of the Asset Leg and the Floating rate leg, which in our example is 15,613.02. While the calculations for TRS are fairly simple, we think the tool can be useful for quickly conducting what-if analysis at different levels and for different maturities.

FIGURE 12

Sample trade characteristics in the TRSW calculator on Bloomberg



Source: Bloomberg

Example trades

In order to see the key concepts and calculations presented above in action, we provide a few examples of specific TRS trades. We also collate the key concepts and calculations in the appendix – it may be useful to refer to these while going through the examples.

The first example is a short-term, long-risk position, which consists only of an initial payment and final payments since it is so short dated.

Example: a short-term, long-risk position using iBoxx TRS

On 2 July 2018, an investor wants to enter into a short-term, long-risk position in the USD Liquid IG index using the TRS that matures in September 2018. The trade is struck with an initial level of 270.57 (dealer's ask quote), and with a notional of $10mn. The lifecycle of this trade is as follows:

1. **Trade is struck.** The trade is struck on 2 July (the trade date) and becomes effective on 3 July (the effective date).
2. **Initial payment.** The index buyer, ie, the investor, receives an initial payment of $8,394.71 on 5 July (the initial payment date). This payment corresponds to the accrued coupon between 20 June (the initial IMM date) and 3 July (the effective date) at a 3m $ Libor rate of 2.3247% as of 18 June (the initial floating rate fixing date).

3. **Trade matures.** Since the TRS matures on 20 September 2018 (the final fixing date), there are no floating rate payments before maturity. The final payments are exchanged three business days after the maturity date, ie, on 25 September 18.

    a. **Index return payment.** On 20 September 2018, the final index level was 272.81, ie, the index generated a total return of c.0.83% relative to the initial level. As a result, the investor receives a total return of $82,788.19 from the index seller.

    b. **Final floating rate payment.** The investor pays the full 3m $ Libor coupon of $60,054.49 to the index seller. The floating rate payment corresponds to the accrued coupon from 20 June (the initial IMM date) to and including 20 September (the final fixing date) at a 3m $ Libor rate of 2.3247% as of 18 June (the initial floating rate fixing date).

The investor has paid a net total of $51,659.78 on the floating leg and has received a total of $82,788.19 on the index return leg.

A similar short-term, short-risk position consists of the same floating rate payments, but a different index return payment, reflecting the bid-ask spread in the initial levels.

Example: a short-term, short-risk position using iBoxx TRS

Consider the above example, but assuming the investor had wanted to enter into a short-risk position instead.

In this case, the investor would have struck the trade at an initial level of 269.95 (the dealer bid quote), paid the initial payment of $8,394.71 on 5 July, received the full 3m $ Libor coupon of $60,054.49 on 25 September, while also having to pay $105,945.55 on this date (corresponding to paying the total return of c.1.06% vs the initial level).

The investor has received a net total of $51,659.78 on the floating leg and has paid a total of $105,945.55 on the index return leg.

Trades, however, can be longer term and involve multiple floating rate payments. Below we go through an example of a trade that has a single floating rate payment before the maturity date.

Example: a long-term, long-risk position using iBoxx TRS

On 18 June 2018, an investor wants to enter into a long-term, long-risk position in the USD Liquid IG index using the TRS that matures in September 2018. The trade is struck with an initial level of 270.45 (dealer's ask quote), and with a notional of $10mn.

The life cycle of this trade is as follows:

1. **Trade is struck.** The trade is struck on 18 June (the trade date) and becomes effective on 19 June (the effective date).

2. **Initial payment.** The index buyer, ie, the investor, receives an initial payment of $55,655.35 on 21 June (the initial payment date). This payment corresponds to the accrued coupon between 20 March (the initial IMM date) and 19 June (the effective date) at a 3m $ Libor rate of 2.2018% as of 16 March (the fixing date).

3. **Floating rate payment.** The index buyer pays a floating rate payment of $56,266.94 on 20 June (the floating rate payment date). This payment

corresponds to the accrued coupon between 20 March (the initial IMM date) and 20 June (the second IMM date) at a 3m $ Libor rate of 2.2018% as of 16 March (initial floating rate fixing date).

4. **Trade matures.** The final payments are exchanged three business days after the maturity date, ie, on 25 September.

    a. **Index return payment.** On 20 September 2018, the final index level was 272.81, ie, the index has generated a total return of c.0.87% relative to the initial level. As a result, the investor receives a total return of $87,261.97.

    b. **Final floating rate payment.** The investor pays the 3m $ Libor coupon of $60,054.49. Here the floating rate payment corresponds to the accrued coupon between 20 June (the second IMM date) and 20 September (the final fixing date) at a 3m $ Libor rate of 2.3247% as of 18 June (the second floating rate fixing date).

The investor has paid a net total of $60,666.09 on the floating leg and has received a total of $87,261.97 on the index return leg.

Often, however, investors will not want to hold a TRS position until maturity, either by rolling into a new, longer tenor, or unwinding the trade altogether. We go through an example of how to roll a position below.

Example: rolling a TRS position

On 10 August 2018, instead of holding the position in the previous example to maturity, the investor decides to roll it to the December 2018 maturity. The dealer is quoting the roll at 0.15/0.25 index points.

The steps to roll the trade would be as follows:

1. **Agree on final price.** The investor and the dealer settle the September 2018 TRS trade at the dealer's bid for the September 2018 contract, which was 273.25 on 10 August (based on composite pricing).

2. **Exchange cash flows to unwind the September 2018 TRS**

    a. **Index return payment.** The investor receives the total return of the index from the initial strike level of 270.45 to the final settlement price of 273.25, which is $103,531.15.

    b. **Floating rate payment.** The investor pays the 3m $ Libor coupon of 2.324% for the period from 20 June to 10 August, which is $33,578.86.

    c. **Net cashflows.** The investor receives a net total of $69,728.92 for the unwind of the September 2018 TRS trade.

3. **Enter new trade.** The investor then enters into a new TRS that matures in December 2018 with an initial level of 273.50, which is 0.25 index points more than the final settlement price of the September 2018 contract (this is from the dealer roll market, see Figure 11 for an example).

4. **Initial payment.** The investor receives the accrued 3m $ Libor coupon of 2.324% for the period from 20 June to 4 Sept, which is $33,578.86. Note that this amount is identical to the coupon that the investor paid as part of unwinding the September 2018 TRS.

5. **Lifecycle of trade.** The rest of the trade works in an identical manner to the previous examples, with the investor making full coupon payments on 20 September and 20 December (with the latter payment based on a floating rate fixing date of 18 September) and then receiving the total return of the index from the initial level to the final level.

Note that we do not have a separate example for unwinding a TRS position prior to maturity as it is similar to the above but without entering a new contract. Please refer to steps 1 and 2 above.

Appendix: key concepts and calculations for a TRS trade

Figure 13 lists the key concepts when entering a TRS trade. Below, we also show the relevant calculations for determining the floating rate and index return legs.

FIGURE 13
Key concepts for a TRS trade

Concept	Explanation
Trade date	Date on which trade is agreed
Initial level	The index level at which the trade is agreed (dealer's bid/ask quote)
Notional amount	The notional amount of the trade
Floating rate	Relevant 3m Libor rate for IMM quarter, ie, Euribor for EUR and Libor for USD
Day count convention	ACT/360 for EUR and USD
Adjusted quaterly IMM dates	20 Dec/Mar/Jun/Sep (business day adjusted)
Initial floating rate fixing date	Date on which the initial floating rate is fixed (the Initial IMM date -2 business days)
Effective date	Date on which the trade is effective (trade date +1 calendar day)
Initial payment amount	Amount paid to index buyer to compensate for the floating rate overpayment that the index buyer will make at the end of the initial period
Initial payment date	The date on which the initial payment amount is paid (3 business days after the trade date)
Floating rate payment dates	The dates on which the floating rate payments are paid (the last day in each IMM quarter, unless it is the final floating rate payment, in which case it is on the index return amount payment date)
Final fixing date (Maturity date)	The maturity date; the IMM date on which the index return, ie, trade pay-out, is determined
Final index level	The closing index level on the final fixing date
Index return amount payment date	The date on which the final payments are exchanged (3 business days after the final fixing date)

Source: Markit, Barclays Research

The initial floating rate is relative to the IMM date that precedes the trade date. For long-dated trades, meaning trades that exceed one IMM quarter, the floating rate resets at each IMM date. Determination of the applicable rate follows the fixing convention outlined in the 2006 ISDA Definitions: for EUR and USD trades, the floating rate fixing date is the IMM date minus two business days.

We show how to calculate the index return payment in the box below.

Index return leg payment

The index return is calculated via

$$Index\ Return\ Amount = Notional * Index\ Return$$

Where the index return is calculated via

$$Index\ Return = \frac{Final\ Index\ Level - Initial\ Index\ Level}{Initial\ Index\ Level}$$

Source: Markit, Barclays Research

Similarly, we show how to calculate the initial and floating rate payments in the box below.

Floating leg payments

The initial rate payment is calculated via

$$Initial\ Payment\ Amount = Floating\ Rate * Notional * \frac{Initial\ Quarter\ IMM\ Date - Effective\ Date}{Day\ Count\ Convention}$$

The floating rate payments prior to the final payment are calculated via

$$Floating\ Rate\ Accrued = Floating\ Rate * Notional * \frac{IMM\ Quarter\ End\ Date - IMM\ Quarter\ Start\ Date}{Day\ Count\ Convention}$$

The final floating rate payment is calculated via

$$Floating\ Rate\ Accrued = Floating\ Rate * Notional * \frac{IMM\ Quarter\ End\ Date - IMM\ Quarter\ Start\ Date + 1}{Day\ Count\ Convention}$$

Source: Markit, Barclays Research

Appendix: Markit iBoxx index methodology

Although many investors will have some familiarity with cash indices like the ones referenced by the iBoxx TRS contracts, we outline some common index rules and inclusion criteria for the indices listed in Figure 2. Markit makes the exact iBoxx index methodology available on an index-by-index basis on its website, which should be consulted for specific questions; the following is intended as a general outline of the underlying principles.

Index criteria

Like the Bloomberg Barclays indices, the central design of the Markit iBoxx indices starts with an evaluation of security-level attributes to determine whether a given bond will be eligible for index inclusion. While the inclusion criteria vary from index to index, most revolve around a core set of common attributes; generally, each index consists of criteria on:

- **Currency:** the denomination of a bond's principal and interest payments. The EUR indices only admit EUR-denominated securities; same principle for the USD indices.
- **Amount outstanding:** the amount outstanding in index currency terms after accounting for partial buybacks. For the EUR-denominated indices, the minimum amount is €500mn for IG and AT1 CoCos, and €250mn for HY. For the USD indices, the threshold is $750mn for IG and AT1 CoCos, $400mn for HY, and $500mn for Lev Loans.
- **Bond type:** structural features and subordination. The HY and IG indices admit a range of standard bond structures, such as fixed coupon bonds, callable bonds, bonds with step-ups, and perpetuals (eg, corporate hybrids) to mention a few. However, the IG and HY indices specifically exclude CoCos. The AT1 CoCo indices, on the other hand, include only these securities, denominated respectively in EUR and USD (we could potentially also see TRS on the RT1 CoCo indices once this market matures). The Lev Loans index allows fully funded term loans (both fixed and floating), as well as defaulted loans.
- **Credit rating:** all bonds in the IG and HY indices must be rated investment grade and sub-investment grade, respectively, according to Markit's rating methodology. Markit's methodology considers ratings from Fitch, Moody's and S&P that are then consolidated into a single "iBoxx rating", which is used to determine eligibility. Roughly speaking, the iBoxx rating corresponds to the average rating (in contrast to the Bloomberg Barclays index rating, which corresponds to the median). The AT1 CoCo indices admit both IG and HY-rated instruments, while the Lev Loans index admits only sub-investment grade loans.
- **Time to maturity:** the remaining time to maturity, where maturity denotes either the final maturity or the workout date (usually first call date, if applicable). This criterion varies substantially across the indices. Instruments with residual maturity in excess of

one year are typically eligible, although we note this is not a hard rule, eg, the USD IG Liquid index requires at least three years remaining. Additionally, the criterion also depends on whether the instrument is already in the index, or is about to enter.

- **Classification/Sector:** all bonds are classified based on the principal activities of the issuer and the main sources of the cash flows used to pay coupons and redemptions. The iBoxx indices in Figure 2 consist of corporate issuers (as opposed to sovereigns, for example), which includes both non-financials and financials.
- **Liquidity:** most of the iBoxx indices in Figure 2 are denoted "Liquid"; these are sub-indices intended to reduce the replication costs by limiting the number of constituents. This is done by adding additional restrictions on which bonds can be admitted to the index. These restrictions vary from index to index but are generally based on deal size (including only larger issues), remaining time to maturity (excluding less liquid tenors), as well as caps on issuer, sector and country exposure.

Index mechanics

In addition to the index eligibility criteria, each index is also defined by its rebalancing frequency, treatment of repayments (reinvestments) and index weights.

- **Rebalancing:** the indices are usually rebalanced monthly on the last business day of the month after the close of business. Changes to outstanding amounts and ratings must be known respectively two or three days before rebalancing. New bonds that satisfy the relevant index criteria (and have settled before the end of the month) will enter the index, while bonds that no longer satisfy the relevant criteria will leave the index.
- **Reinvestment:** payments from coupons and scheduled partial and unscheduled full redemptions are held as cash (without interest) until the next rebalancing, at which point the cash is reinvested in the index. Markit accounts for costs associated with reinvestment via its "cost factor".
- **Weights:** generally, each instrument is assigned an index weight corresponding to its market value as a share of the overall index market value on the last business day of the month. However, some indices impose caps on these weights, eg, at the issuer, country, or loan facility level. There is some variation across indices, but we note that most of the "Liquid" indices impose a 3% issuer cap.

Total return calculations

As described above, all iBoxx indices are essentially monthly-rebalanced, market value-weighted baskets of bonds that satisfy certain index criteria. The composition of each index is adjusted at the beginning of each period (ie, the end of the preceding month), and so the total return of the index for any given month corresponds intuitively to the total return of its constituents during the month (adjusted for reinvestments at month-end). The total return index is then calculated by cumulating the monthly total returns since inception.

For specific formulas on how to calculate the total returns and other index analytics, we refer to the comprehensive Markit iBoxx Bond Calculus document, which is available on the Markit iBoxx Rules page, as well as the methodology documents for each index.

Appendix: sector and ratings comparisons

One of the concerns about CDS indices is that they may not reflect the composition of their related bond markets from a sectoral and quality perspective. Figure 14 and Figure 15 compare the sector weights of the CDS indices and the comparable iBoxx indices, while Figure 16 and Figure 17 compare them by quality distribution. We think investors can use these tables to understand where the CDS indices may have under/over weights versus the bond market.

FIGURE 14

Sector weight comparison: European CDS and iBoxx indices

EUR Investment Grade				EUR High Yield			
Sector	**ITX.EU s31**	**iBoxx EUR IG**	**Difference**	**Sector**	**ITX.XO s31**	**iBoxx EUR HY**	**Difference**
Basic Mat	6.4%	3.0%	3.4%	Basic Mat	9.3%	6.1%	3.3%
Cons Goods	18.4%	14.2%	4.2%	Cons Goods	10.7%	16.8%	-6.1%
Cons Svcs	12.8%	3.4%	9.4%	Cons Svcs	32.0%	11.0%	21.0%
Energy	4.8%	4.7%	0.1%	Energy	4.0%	1.8%	2.2%
Fin	24.0%	40.0%	-16.0%	Fin	4.0%	17.0%	-13.0%
Health	2.4%	5.2%	-2.8%	Health	4.0%	7.1%	-3.1%
Ind	10.4%	8.9%	1.5%	Ind	17.3%	20.4%	-3.0%
Tech	0.8%	2.3%	-1.5%	Tech	4.0%	4.1%	-0.1%
Telco	8.8%	7.2%	1.6%	Telco	12.0%	13.9%	-1.9%
Util	11.2%	11.2%	0.0%	Util	2.7%	2.0%	0.7%

Note: iTraxx sector weights based on the DTCC classification of index constituents. Source: Markit, DTCC, Barclays Research

FIGURE 15

Sector weight comparison: US CDS and iBoxx indices

USD Investment Grade				USD High Yield			
Sector	**CDX.IG s32**	**iBoxx USD IG**	**Difference**	**Sector**	**CDX.HY s32**	**iBoxx USD HY**	**Difference**
Basic Mat	6.4%	1.5%	4.9%	Basic Mat	8.0%	5.3%	2.7%
Cons Goods	12.8%	8.8%	4.0%	Cons Goods	13.0%	6.9%	6.1%
Cons Svcs	19.2%	11.5%	7.7%	Cons Svcs	22.0%	21.4%	0.6%
Energy	12.0%	10.2%	1.8%	Energy	10.0%	14.4%	-4.4%
Fin	15.2%	33.3%	-18.1%	Fin	12.0%	8.4%	3.6%
Health	8.0%	11.2%	-3.2%	Health	7.0%	12.0%	-5.0%
Ind	15.2%	5.7%	9.5%	Ind	13.0%	12.4%	0.6%
Tech	4.8%	9.0%	-4.2%	Tech	7.0%	5.4%	1.6%
Telco	1.6%	6.8%	-5.2%	Telco	4.0%	11.0%	-7.0%
Util	4.8%	1.9%	2.9%	Util	4.0%	2.7%	1.3%

Note: CDX sector weights based on the DTCC classification of index constituents. Source: Markit, DTCC, Barclays Research

FIGURE 16

Ratings comparison: European CDS and iBoxx indices

EUR Investment Grade				EUR High Yield			
Rating	**ITX.EU s31**	**iBoxx EUR IG**	**Difference**	**Rating**	**ITX.XO s31**	**iBoxx EUR HY**	**Difference**
AAA	0.0%	0.5%	-0.5%	BBB	8.0%	0.0%	8.0%
AA	6.4%	11.0%	-4.6%	BB	41.3%	72.0%	-30.6%
A	31.2%	39.1%	-7.9%	B	36.0%	25.9%	10.1%
BBB	62.4%	49.4%	13.0%	CCC	4.0%	2.2%	1.8%
				NR	10.7%	0.0%	10.7%

Source: Markit, DTCC, Barclays Research

FIGURE 17

Ratings comparison: US CDS and iBoxx indices

USD Investment Grade				USD High Yield			
Rating	**CDX.IG s32**	**iBoxx USD IG**	**Difference**	**Rating**	**CDX.HY s32**	**iBoxx USD HY**	**Difference**
AAA	0.8%	2.5%	-1.7%	BB	60.0%	54.0%	6.0%
AA	3.2%	8.9%	-5.7%	B	32.0%	36.7%	-4.7%
A	27.2%	39.2%	-12.0%	CCC	8.0%	9.3%	-1.3%
BBB	68.8%	49.4%	19.4%				

Source: Markit, DTCC, Barclays Research

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