BARCLAYS

Credit Research

12 June 2019

US CMBS

CMBX: Primer and recent trends

Update: This replaces the version published 7 June 2019, 00:00 GMT, to correct Figures 1 and 2. The update does not change any text or conclusions.

- **The use of portfolio products has increased recently, especially during periods of high volatility, when they provide an efficient way to manage liquidity and when the ability to short the index becomes all the more important. In line with the broader trend, CMBX trading volumes have also increased in recent years and even surpassed cash volumes during the sell-off in December 2018.**

- **With that background, we revisit the CMBX contract, discussing its benefits, possible use cases and characteristics of recent indices. CMBX is a synthetic tradable index referencing twenty-five conduit CMBS transactions. It is traded over the counter and allows investors to take synthetic exposure (long or short) across rating categories.**

- **The mechanics of a CMBX contract are very similar to those of a CDX. However, unlike CDX indices, there is generally no overlap between two CMBX series. Other key differences include the seller of the protection being liable for any interest shortfall on the underlying obligations and monthly payments in CMBX, compared with quarterly payments for CDX.**

- **The CMBX-cash basis has been stable recently and acts as an attractive liquid macro hedge for CMBS portfolios. The transaction costs for CMBX are significantly lower than for cash bonds.**

- **The bulk of the trading is concentrated in the AAA and BBB- tranches. With the risk more fungible in the AAA space and originators preferring to use on-the-run indices, liquidity in that tranche is concentrated in recent indices. As the risk profile of each index is different, lower-rated CMBX tranches can be used to put on macro trades or hedge specific risks. For example, a higher share of retail properties in CMBX.6 makes its BBB- and BB tranches ideal candidates for implementing views on the retail sector.**

- **CMBX generally captures the trends in the broader conduit market and, as such, can be used to put on relative value trades across indices. While LTV ratios have come down and DSCRs have improved in recent years, the use of interest-only loans has increased significantly, and we estimate that the share of pro forma underwriting has also risen. Coupled with lower CE levels for CMBX.11, that makes its lower-rated tranches relatively riskier among CMBX.8-12, in our view.**

Anuj Jain, CFA
+ 1 212 412 2099
anuj.jain2@barclays.com
BCI, US

www.barclays.com

Portfolio products have become more popular

The use of portfolio products has increased recently, especially during periods of high volatility, when they provide an efficient way to manage liquidity and when the ability to short the index becomes all the more important. As an example, in the recent sell-off, HY bond volumes barely increased, as investors instead used portfolio products, including the CDX.HY index, to manage exposure (see *Amid the Volatility, HY Portfolio Products Sub in for Bonds* for more details). In line with the broader trend, CMBX trading volumes have also increased in recent years and even surpassed cash volumes during the massive sell-off in December 2018. With that background, we revisit the CMBX contract, outlining its benefits and possible use cases. We also discuss the quotation conventions and mechanics of trading in Appendix A and index construction process in Appendix B. We summarize key CMBX terms, index eligibility rules and list deals for CMBX 6-12 in Appendix C: Figure 16-18.

History of CMBX

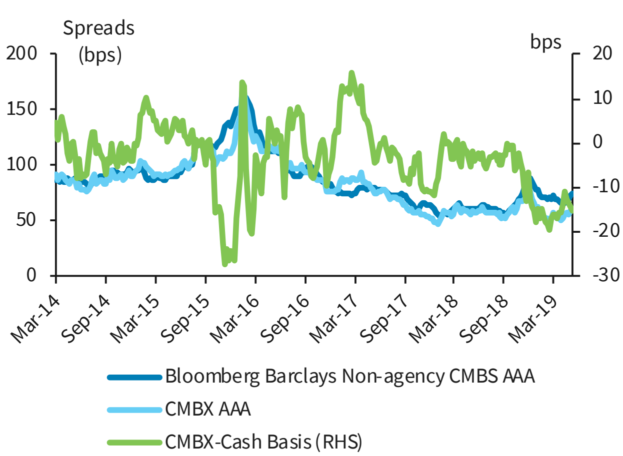
CMBX is a synthetic tradable index referencing twenty-five conduit CMBS transactions. The first series, CMBX.1, was launched on March 6, 2006; subsequently, CMBX.2-5 were launched every six to seven months, with CMBX.5 launched in May 2008. As the issuance in the sector dried up in the years after the GFC, no new CMBX series were launched until 2013. CMBX.6 was launched in January 2013 and since then, a new index is being launched every year, with the latest CMBX.12 launching in January 2019. The date for the launch of a new CMBX series is referred to as the roll date. Each CMBX series has multiple indices referencing different parts of the capital structure. CMBX.1-5 had 8 indices: AAA, AM, AJ, AA, A, BBB, BBB- and BB. CMBX.6 and onwards have only 6 indices: AAA, AS, AA, A, BBB- and BB.

Assessing the benefits of using CMBX as a hedge

The ability to short the CMBX indices makes it useful for a variety of market participants. For example, originators can sell CMBX to hedge pipeline risk, while CMBS dealers and investors can be short the index to hedge their existing inventory. On the long side, it can be used by investors who want to gain synthetic exposure to the market. Finally, differences across the different series of CMBX indices allow investors to implement more nuanced relative value views on the market.

FIGURE 1

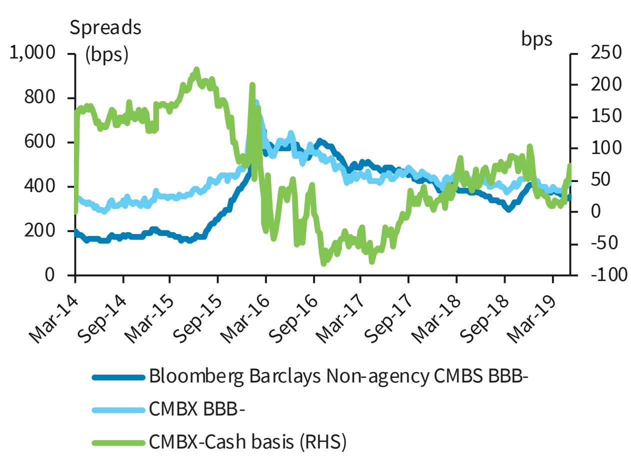
CMBX AAA generally trade in line or tighter to cash AAA



Note: We use OTR CMBX index. Source: IHS Markit, Bloomberg, Barclays Research

FIGURE 2

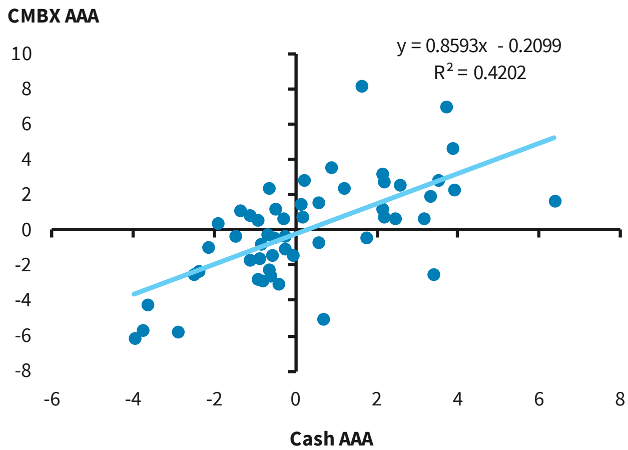
BBB- CMBX-cash basis has compressed



Note: We use OTR CMBX index. Source: IHS Markit, Bloomberg, Barclays Research

FIGURE 3

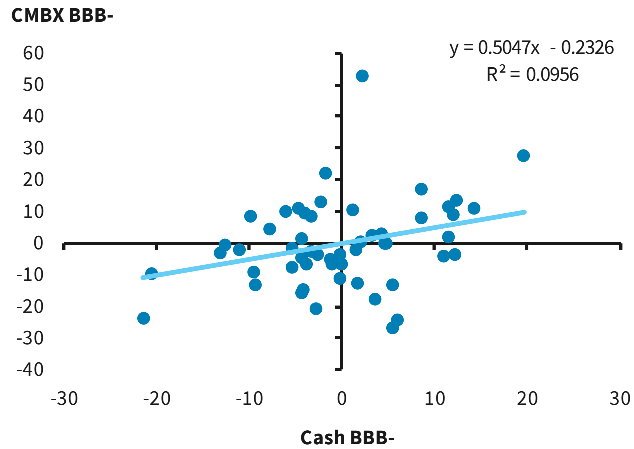
CMBX AAA is an attractive hedge for cash CMBS…



Note: We use OTR CMBX index. Chart uses last 1 year of data. Source: IHS Markit, Bloomberg, Barclays Research

FIGURE 4

…but CMBX BBB- has very weak correlation



Note: We use OTR CMBX index. Chart uses last 1 year of data. Source: IHS Markit, Bloomberg, Barclays Research

CMBX-cash basis has been stable recently

To measure the effectiveness of using CMBX as a hedge, we look at the history of the basis between the CMBX and cash bonds. Since it is difficult to define a particular spread for each specific vintage, especially for lower-rated tranches, we compare CMBX spreads with the spreads on the Bloomberg Barclays non-agency CMBS index. Given that most of the trading in CMBX is in AAA and BBB- tranches, we use those spreads in our comparison. Since 2014, AAA CMBX has generally traded in line with to slightly tighter than cash spreads of similar rating (Figure 1). At the lower end of capital structure, BBB- CMBX spreads generally traded much wider than the BBB- cash index until the beginning of 2016. However, as we discuss below, it was likely driven by wider spreads on CMBX 6-7, due to a higher share of retail properties. More recently, the same trends generally hold, but the difference in spreads at the BBB- level has compressed considerably, to under 100bp from 150-200bp earlier (Figure 2), likely because of the same reason.

AAA index can be used an attractive hedge

In terms of attractiveness of the hedge, the CMBX AAA has a correlation of 0.42 and a beta of 0.9 , and as such can be used as an attractive hedge (Figure 3). However, both metrics are weak for BBB- index, likely due to idiosyncratic nature of each index (Figure 4).

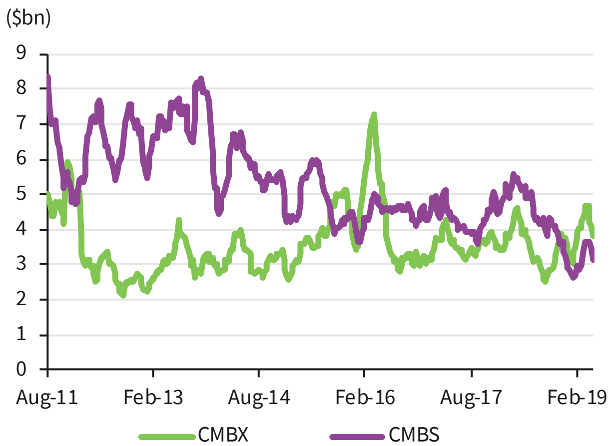
However, there are some risks. Multiple factors can drive the spreads between the CMBX index and generic cash CMBS spreads, including liquidity and funding costs. While liquidity has improved for CMBX, older series and tranches other than AAA and BBB- are relatively illiquid. Even for most liquid tranches, there is lack of intraday transparency, even though dealers sometimes send out multiple runs during a day.

In addition, given that CMBX is traded over the counter and is still not centrally cleared, a variation margin needs to be posted on a daily basis, which started September 1, 2017[1]. As background, five agencies – CFTC, Federal Reserve, FDIC, OCC and SEC – adopted rules in late 2015 requiring the posting of variation margin on a daily basis for uncleared swaps. The other disadvantages are typical of any other OTC instrument: the requirement of an ISDA, counterparty risk and restrictions on certain funds from holding OTC instruments.

[1] *Margin requirements for Uncleared CMBX, CREFC*

FIGURE 5

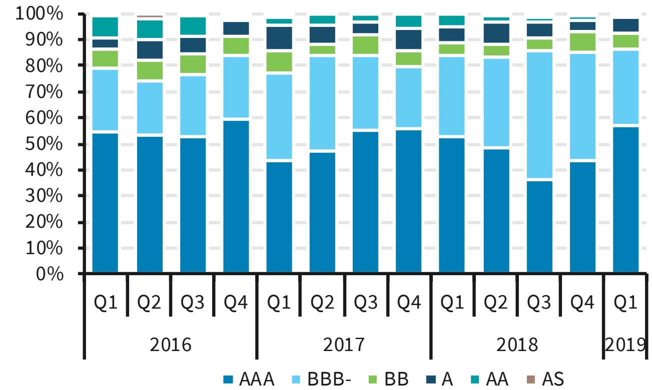
CMBX trading volumes are now comparable with cash CMBS bonds



Note: 3m average of weekly trading volumes. Source: DTCC, SIFMA, Barclays Research

FIGURE 6

Most of the trading is concentrated in AAA and BBB- tranches



Source: DTCC, Barclays Research

Increased liquidity in recent years, with lower bid-ask

While the liquidity in CMBX was much lower than cash CMBS until 2014, since then, both have more or less converged. While part of the this is due to the decline in volumes for cash CMBS, CMBX volumes have also improved (Figure 5). Moreover, unlike cash bonds, CMBX volumes jump significantly during times of heightened volatility, such as during early 2016 and late 2018. In fact, CMBX volumes are generally higher than cash bonds during such times. While each series has six tranches, most of the trading (80-85%) is concentrated in AAA and BBB- tranches (Figure 6). As such, we will focus our attention mostly on those two tranches.

Transactions costs in CMBX are much lower than for cash bonds

The typical bid-ask for the CMBX AAA tranche is about 2bp, while it is about 8bp for the BBB- tranche. In comparison, for a 10y AAA cash bond, it is 4-5 bp, while it is generally 10-15bp for BBB- bonds.

Due to fungibility, AAA volumes are usually concentrated in recent indices…

At an aggregate level, most of the trading is usually concentrated within two to three recent indices. However, activity for AAA tranches tends to be concentrated in recent indices, while volumes for BBB- tranches can remain high for some time (Figure 7). We think the trend in the AAA tranches is likely reflective of the fact that the risk there is more fungible; as such, it makes more sense to use the most liquid contract. Additionally, originators, who typically use AAA tranches, are more likely to use recent indices, as they are more reflective of their pipeline.

FIGURE 7

Volumes for AAA tranches are concentrated more in recent indices

Index Tranche	CMBX	Annual volumes ($bn) 2019	2018	2017	2016	2015	2014	2013
AAA	12	**11**						
	11	**13**	**33**					
	10	**8**	**25**	**38**				
	9	2	**9**	**22**	**27**			
	8	2	7	**12**	**52**	45		
	7	3	4	5	10	38	35	
	6	3	6	14	**18**	12	19	25
BBB-	12	0						
	11	**3**	8					
	10	**5**	**12**	**10**				
	9	2	**10**	9	**9**			
	8	3	7	4	8	8		
	7	2	8	**12**	**21**	19	9	
	6	**7**	**24**	**20**	**10**	**10**	11	11
BB	6	2	5	8	12	6	8	4

Note: For years 2016 and beyond, the top three indices by trading volumes are shown in bold. 2019 numbers are until May 10. Source: DTCC, Barclays Research

…but lower-rated tranches are more unique

Since each CMBX series references deals issued in a specific year, the risk profile of each series is different, so investors looking to hedge the credit risk in their portfolios are likely to use specific indices. Unlike the CDX indices, there is generally no overlap between two CMBX series (with the exception of CMBX 4 and 5).

FIGURE 8

Summary of key collateral and underwriting characteristics for the conduit market

Issue Year/CMBX	WAC (%)	DSCR	LTV	Full IO%	Partial IO%	Property Type: Office	Retail	Multifamily	Hotel	Other	Debt Yield (%)
2012 (6)	5.03	1.67	63.3	13	22	26	41	6	10	17	10.5
2013 (7)	4.54	1.83	63.0	17	34	21	36	10	11	22	10.4
2014 (8)	4.68	1.73	65.1	19	45	23	29	14	14	20	10.1
2015 (9)	4.38	1.83	64.1	25	43	24	26	15	17	19	10.1
2016 (10)	4.47	2.02	59.7	33	34	28	28	9	15	20	10.5
2017 (11)	4.45	2.19	56.9	47	28	33	22	7	15	23	10.8
2018 (12)	4.72	2.06	57.7	51	25	29	26	10	14	21	10.8

Source: Trepp, Barclays Research

FIGURE 9
CMBX IO and property details

Index	%Full IO	%Partial IO	Partial IO length (yrs)	Property Type				
				Office	Retail	Multifamily	Hotel	Others
CMBX.6	12%	24%	2.5	26%	35%	6%	13%	19%
CMBX.7	16%	35%	2.8	18%	31%	14%	14%	23%
CMBX.8	21%	48%	3.3	25%	26%	16%	14%	20%
CMBX.9	21%	44%	3.4	23%	24%	16%	17%	20%
CMBX.10	37%	28%	2.9	29%	31%	8%	15%	18%
CMBX.11	48%	28%	3.3	29%	22%	8%	16%	25%
CMBX.12	54%	24%	3.4	28%	24%	11%	14%	23%

Source: IHS Markit,Trepp, Barclays Research

CMBX metrics are generally in line with the broader conduit market

For investors looking to get synthetic exposure to the CMBS market or hedging their portfolios, it is important for the CMBX indices to reflect the trends in the broader market. One of these is the increased use of interest-only loans (Figure 8). The same trend is reflected in the CMBX indices, with 54% of loans referenced in CMBX.12 being interest-only. Similarly, the decline in retail and multifamily exposure in the broader market is reflected in the CMBX indices (Figure 9). In terms of collateral performance, CMBX and the broader market are reasonably aligned, except for CMBX.7, where the index has slightly higher bond losses and interest shortfall (Figure 10).

Differences in collateral and underwriting standards also create relative value opportunities

As mentioned above, the use of interest-only loans has increased. While LTV ratios have declined and DSCRs have improved, we estimate that the share of pro forma underwriting has also increased with CMBX.11 and CMBX 12 at 17-19%. In addition, credit enhancement levels have also come down recently. CE levels for single A tranches of recent indices are now in line with CMBX.6, while they are lower for BB tranches. At the BBB- level, they are modestly up compared with CMBX.6 but lower than the highs in CMBX.9. Given these trends, the BBB-

FIGURE 10
CMBX track conduit performance reasonably well

	Int. Shortfall (per $10000)		Cum Bond Loss (bps)	
	CMBX	Conduit	CMBX	Conduit
CMBX 6 (2012)	2.8	2.9	12	12
CMBX 7 (2013)	4.1	3.3	30	17
CMBX.8 (2014)	4.5	4.9	11	10
CMBX.9 (2015)	1.3	1.3	0	2
CMBX. 10 (2016)	0.3	0.4	2	1
CMBX.11 (2017)	0.4	0.3	0	0
CMBX. 12 (2018)	0.0	0.0	0	0

Source: IHS Markit, Trepp, Barclays Research

FIGURE 11
Geo exposure has been stable over time

	California	New York	Texas	Florida	Illinois
CMBX.6	13%	15%	9%	5%	4%
CMBX.7	12%	11%	8%	5%	5%
CMBX.8	15%	12%	10%	7%	3%
CMBX.9	15%	10%	8%	7%	5%
CMBX.10	16%	12%	5%	5%	4%
CMBX.11	18%	18%	6%	3%	2%
CMBX. 12	16%	12%	7%	7%	3%

Source: IHS Markit,Trepp, Barclays Research

FIGURE 12
Credit enhancement and ratings across CMBX series

	Original CE (%)			Original Thickness (%)			Deal rating agencies	BBB- tranche rating agencies
Index	A	BBB-	BB	A	BBB-	BB		
CMBX.6	11.9	6.8	5.3	3.5	4.1	1.6	Moody's(92%), Fitch (76%), Kroll (52%)	Moody's (92%), Fitch (76%), Kroll(48%)
CMBX.7	11.8	7.1	5.1	4.0	4.8	1.9	Moody's(84%), Fitch (76%), Kroll (68%)	Fitch (76%), Kroll (68%), Moody's and DBRS (28% each)
CMBX.8	13.8	7.6	5.4	4.1	6.2	2.1	Moody's (96%),Fitch (72%),DBRS (68%)	DBRS (68%), Kroll (60%) and Fitch (56%)
CMBX.9	13.2	8.0	5.5	4.9	5.2	2.4	Moody's (100%),Fitch (84%),Kroll (68%)	Fitch (80%), Kroll (68%) and MSTAR (36%)
CMBX.10	12.9	7.6	5.1	4.6	5.3	2.5	Moody's (100%), Fitch (100%),Kroll (76%)	Fitch (100%), Kroll (76%), MSTAR (12%)
CMBX.11	11.7	6.9	4.7	4.3	4.0	2.1	Fitch (100%), Moody's (92%), Kroll (68%)	Fitch (100%), Kroll (76%), DBRS (36%)
CMBX.12	12.0	7.3	4.8	4.5	3.2	2.0	Fitch (100%), Kroll (60%), S&P (56%)	Fitch (100%), Kroll (54%), DBRS (46%)

Source: IHS Markit, Trepp, Barclays Research

and BB tranches of CMBX.11, with their high share of interest-only loans and pro forma underwriting and lower CE levels and thickness, are the riskiest among CMBX 8-12, in our view. However, as discussed above, one positive in most of the recent series compared with CMBX.6 and 7 is the decline in the share of retail properties, which makes them less sensitive to the risks in that sector. We think these key differences makes these indices good candidates for index swap trades.

Geo exposure has generally been stable

In terms of geographical exposure, five states (California, New York, Florida, Texas and Illinois) represent close to 60% of the exposure. Across series, the exposure has been relatively unchanged, except for CMBX.11, where the exposure to California increased marginally, while the share of New York properties increased to 18% (Figure 11).

Rating structure has undergone multiple changes over the years

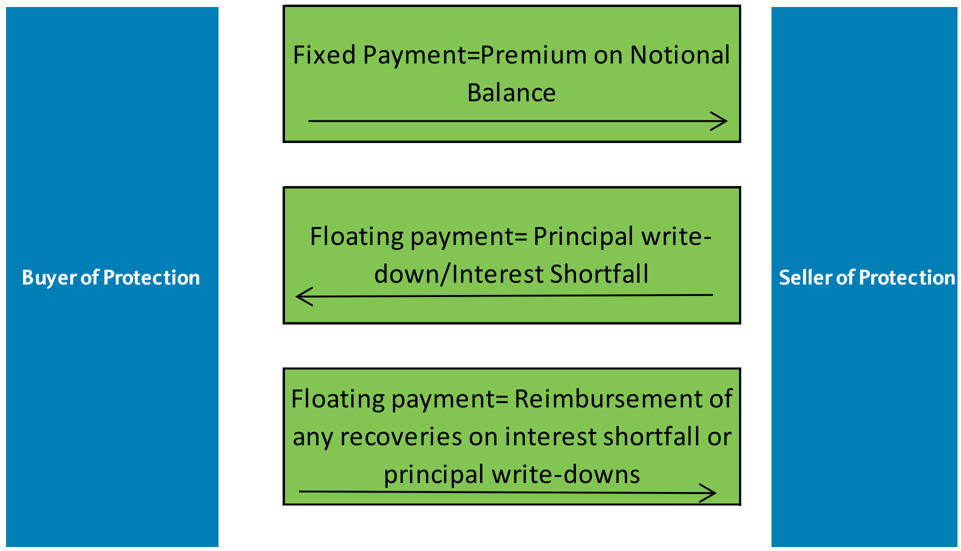
As we show in the appendix C, CMBX index rules were modified, starting with CMBX.8, to include DBRS as one of the accepted ratings agencies required on a tranche (Moody's, Fitch, S&P are the others). This was necessary for BBB- tranches, which on many deals no longer had a Moody's, Fitch or S&P rating. As a result, while Moody's, Fitch and Kroll were the top three rating agencies for CMBX. 6 and 7 BBB- tranches, that shifted to Fitch, Kroll and DBRS in most cases (Figure 12). However, at the deal level, the composition has generally been consistent, with Fitch, Moody's and Kroll generally the top three agencies, except for CMBX. 12 where S&P replaced Moody's.

Appendix A: Mechanics of a CMBX contract

A CMBX index references twenty-five conduit CMBS transactions. The weight of each transaction is equal to 4% at initiation. As the deals pay down, the weights can change. Since a CMBX contract can essentially be thought of as a combination of twenty-five CDS, the basic mechanics of a CMBX trade are similar to those of a CDX contract. Similar to a CDX trade, there are two primary parties involved: a buyer of protection, who is short the credit risk, and a seller of protection, who is long the credit risk. One key difference, as we discuss below, is that the seller of CMBX is also liable for covering the interest shortfall (up to a fixed cap) on any of the underlying reference obligations. Another difference is that the payments are monthly in CMBX, compared with quarterly for CDX.

There are three types of cash flows for CMBX, one fixed and two floating. The fixed payment, equal to a premium on the notional balance, is from the buyer of the protection to the seller every month until the termination date. The fixed premium that the buyer pays is determined on the fixed rate determination date prior to the roll date for the CMBX index (Figure 13).

FIGURE 13
Basic mechanics of a CMBX contract



Source: Barclays Research

In case of a credit event on any of the referenced obligations in the CMBX index, the seller makes a floating payment to the buyer. Markit relies on trustee reports to capture credit events. However, in practice, because the buyer continues to pay the fixed premium, only a net payment is made. Credit events, discussed below, include interest shortfall, principal write-down and failure to pay the principal. In case any of these amounts are recovered following a payment from the seller, the buyer makes a subsequent payment back to the seller. Since CMBX also uses a pay-as-you-go (PAUG) structure, the contract is not terminated following a credit event on a reference obligation. However, unlike CDX, a reference obligation may not fall out of the index after a credit event.

Quotation and trading mechanics

The CMBX indices trade on spread terms, similar to corporate CDX. Market-makers send out quotes on different indices via Bloomberg messaging. Two useful Bloomberg functions are IMGR (to see quotes from different market makers) and MEMC (to see the constituents of a CMBX index). While the indices can trade at different spreads than the initial coupon, the seller of protection receives only the initial coupon on the payment dates. However, if the market spread is tighter than the initial coupon, an upfront payment is made from the seller to the buyer, and the other way around if the spread is wider. We discuss the methodology of calculating upfront payments below. The seller of protection also needs to make a payment for any accrued fixed payment, since the buyer makes the full fixed payment amount to the seller on the payment date.

Payment dates

The upfront payment, including any accrued payment, is exchanged on the settlement date, which is three business days after the trade date. The accrued fixed payment is calculated until the trade date. Following the first payment, contractual payments for CMBX occur on the 25th of each month or the next business day if 25th is not one. The fixed payment amount accrues from the 25th day of each month to the 25th day of the following month. Following the initial payment, the cash flows (for a given notional) for a CMBX trade are the same for all investors, irrespective of the trade date, and are published monthly by Markit on its public website.

One consequence of a standardized payment structure is that the potential reimbursement of write-downs and outstanding shortfalls does not depend on the trade date. As such, a seller of protection will be entitled to recoveries that accrued before the trade was effective.

Trade confirmation and settlement

Trades in CMBX confirm over DTCC for all inter-dealer trades and with enabled customers. Trades are documented using two-page confirms, referencing a standard terms supplement and annex posted on Markit's website.

Unwinding a trade

Investors can unwind a CMBX position in one of three ways:

- **Assignment/novation**: An investor may assign his position in an existing trade to a third party, who either makes or receives an upfront payment, depending upon the market value of the position. The investor is no longer associated with the trade.
- **Termination**: An investor may terminate a contract with its counterparty for an agreed payment, typically the market value of the contract. Additionally, the buyer will have to pay the accrued fixed payment from the end of last accrual.
- **Offsetting trade**: Since CMBX contracts are standardized with the same payments, irrespective of the trade date, an investor can enter into an offsetting trade with another counterparty to eliminate any exposure. However, this leads to the investor facing counterparty risks on both of the trades.

Calculation of upfront payment

The upfront payment is calculated using a market standard methodology. The basic assumption is that the market spread is a measure of default risk, and a spread of 100bp implies a loss of 100bp per year on the reference obligations. This loss rate is applied to 0 CPY cash flows to arrive at the default-adjusted schedule for the notional. The upfront payment is then simply the net present value of the fixed and floating payments. The initial fixed spread for CMBX 6-12 ranges from 50bp to 500bp, depending on the tranche. The CMBX model does not comply with the ISDA CDS standard model, with the major difference being the use of flat par spreads in the CMBX model and a flat default intensity rate in the CDS model.

Credit events and their treatment

1. **Interest shortfall:** If any of the reference obligations in an index faces an interest shortfall, a floating payment from the seller to buyer is triggered. The amount is the interest shortfall on the tranche multiplied by the weight of the tranche in the index. However, CMBX uses a fixed cap method, under which any payment from the seller due to the shortfall is capped at the fixed rate of the CMBX index.

   Take, for example, CMBX. NA. BB.12 (with a fixed spread of 500bp) and assume that one of the reference obligations with a coupon of 6% and a current weight of 4% in the index is facing a complete shortfall; the payment from the seller on a $100mn trade will be capped at $16.7k, even though the total interest shortfall is $20k. Netting out the payments will result in a payment of ~400k from the buyer to the seller.

$$\begin{aligned} Fixed\ \ payment &= Notional * coupon * 30/360 \\ &= \$100m * 5\% * \frac{30}{360} = \$416.7k \end{aligned}$$

$$Interest\ \ shortfall = Notional * tranche\ \ weight * 6\% * \frac{30}{360} = \$20k$$

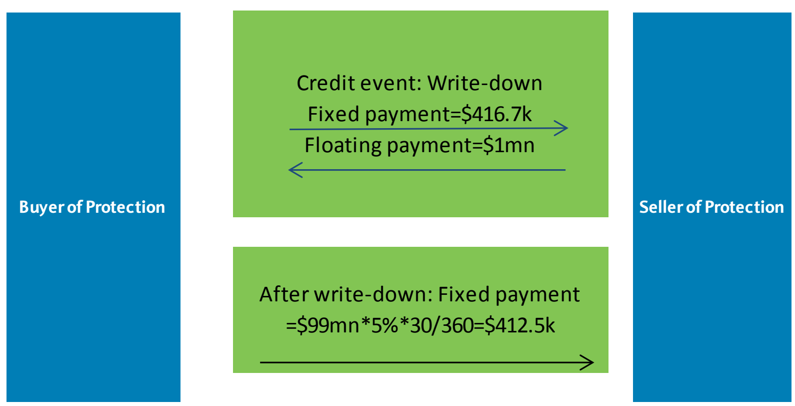
$$Capped\ \ Amount = \$100mn * 4\% * 5\% * \frac{30}{360} = \$16.7k$$

$$Floating\ \ payment = \min(capped\ \ amount, interest\ \ shortfall) = \$16.7k$$

$$Net\ \ payment = Fixed - floating = \$400k$$

2. **Principal write-down:** If any of the reference obligations in an index suffers a principal write-down, the notional balance of the index will also be written down. This will be calculated by multiplying the write-down in the tranche with the current weight of the tranche in the index. So if a tranche with a 4% weight suffers a 25% write-down, the notional amount of the index will be reduced by 1%. Such a write-down will also lead to a payment of 1% of the notional amount from the seller to the buyer. For a \$100mn notional trade on a CMBX.NA.BB.12 with a 500bp coupon, such a write-down will result into a payment of \$1mn from the seller, while the buyer will owe approximately \$417k, as calculated above. After the write-down, as the notional has decreased to \$99mn, the payment from the buyer will decrease to \$412.5k (Figure 14).

FIGURE 14
Treatment of principal write-down



Note: Assuming a trade notional of \$100mn and the fixed spread of 500bps. Source: Barclays Research

Errors in reporting can be corrected retroactively

To the extent that a servicer or the trustee corrects any information in previous servicer reports and those corrections impact calculations, adjustments will be made retroactively. However, no amount in respect of interest shall be payable and the calculation agent will assume in calculation that no interest has accrued on any adjusted amount. The calculation agent shall promptly notify both parties of any corrected payments required by either party. The calculation agent has to be a licensee of the index and if both the parties are a licensee, then it will be the seller.

As an example, the loss reimbursement amount in the CWCI 2006-C1 deal in January 2014 was initially reported as an "interest adjustment", rather than the loss reimbursement and the CMBX.3 A index did not reflect it. However, Markit announced a correction payment the next month to handle the loss recoupment payout. Please refer to *CWCI 2006-C1 loss recoupment payout not reflected in CMBX.A.3 index*, January 24, 2014 and *Markit corrects CWCI 2006-C1 loss recoupment payout in CMBX.A.3*, February 24, 2014. The calculation agent may rely on calculations provided by Markit.

Appendix B: Index eligibility and the construction process

Index construction process

This is primarily rules-based. Each CMBS series references twenty-five eligible commercial mortgage-backed securities offerings. Each CMBX index within a series will similarly be composed of twenty-five reference obligations, each being an applicable qualified tranche of offerings underlying the CMBX series. We summarize the qualification criteria for the offerings and the tranches in Figure 15.

Proposed offerings list

The CMBX index construction process begins on the solicitation date, which is at least 10 business days prior to the roll date. On the solicitation date, Markit compiles a list of the twenty-five most recent CMBS offerings that meet the selection criteria. If two or more CMBS offerings are identical in terms of eligibility and inclusion of each one of them will cause the number of offerings in the proposed list to become more than 25, Markit will select the offerings with the largest principal amount at issuance so that the list contains only 25 offerings. The administrator will then circulate the proposed list (including qualified tranches) to CMBX members and publish to the public.

Voting from CMBX members

Markit will solicit from each eligible CMBX members a vote as to which offerings, if any, should be removed from the list. This will occur if at least 75% of the eligible members vote to remove it. Markit will inform the eligible CMBX members and publish to the public the offerings that have been eliminated. In the case that offerings were removed, Markit, no later than six days prior to the roll date, will determine additional offerings and qualified tranches required to be added. The voting process will start again and be repeated until a final list of twenty-five offerings for the CMBX series is created. No later than four days prior to the roll date, Markit will inform the public the composition of each CMBX index in the series. No later than three days prior to the roll date, it will publish to the eligible members and the public a draft of the annex for each CMBX Index. At present, nine dealers are eligible CMBX members. The roll date will be moved to another date if 75% of the eligible members vote to change it.

Fixed Rate Determination

At or about 1:00 pm on the fixed rate determination date, which is one business day prior to the roll date (unless 75% of the eligible members vote to change), Markit will determine the fixed rate for each new CMBX index by soliciting from each eligible CMBX members a spread for each such index until at least 75% of the eligible members have submitted. Markit will then rank the spreads for each index from lowest to highest, eliminate the top and bottom quartiles, and average the remaining spreads (rounded to the nearest basis point). These average spreads are the fixed rates (capped at 500bp) for each CMBX index. These rates are not disseminated to anyone, including eligible members, until after 5:00 pm on the fixed rate determination date. At that time, they are made available publicly. The trading date starts on the roll date. The fixed rates for each tranche have been unchanged since CMBX.6 (Figure 15).

FIGURE 15

Fixed rate for each tranche has been unchanged since CMBX 6

Index	Tranche	Coupon (bps)
CMBX 6-12	AAA	50
	AS	100
	AA	150
	A	200
	BBB-	300
	BB	500

Source: IHS Markit, Barclays Research

Appendix C: Summary of key CMBX terms, index eligibility rules and a list of deals referenced in CMBX 6-12

FIGURE 16

Summary of key CMBX concepts

Concept	Explanation
Roll Date	First trading date for the index
Fixed Rate	Annual payment in bp that the buyer makes to the seller. This is commonly referred to as the default swap premium
Fixed rate determination date	The day fixed rates for each new CMBX index is determined. One business day before the roll date
Fixed Rate Payer	Buyer of the protection
Floating Rate Payer	Seller of the protection
Credit Event	Includes writedown, interest shortfall and failure to pay principal
Pay-as-you-go	Similar to CDX, the contract is not terminated following a credit event. However, unlike CDX, a reference obligation may not fall out of the index following a credit event
Floating payment	Payments from the seller to the buyer for any credit events.
Fixed cap	Floating payment for interest shortfall are capped at the fixed rate
Trade date	The date that the trade occurs
Settlement date	Three business days after the trade date.
Payment dates	25th of each month (business day adjusted)
Day count convention	ACT/360
Upfront payment	Amount paid to either the seller or the buyer to compensate for the difference in current spread and the fixed rate. Also account for any accrued fixed rate payment from the seller to the buyer

Source: IHS Markit, Barclays Research

FIGURE17

Summary of key CMBX eligibility rules

<table>
<tr><th>Guidelines</th><th>CMBX 1-5</th><th>CMBX 6 & 7</th><th>CMBX 8</th><th>CMBX 9</th><th>CMBX 10</th><th>CMBX 11</th><th>CMBX 12</th></tr>
<tr><td>CMBS offerings must include tranches with applicable ratings of:</td><td>AAA, AA, A, BBB, BBB- and BB.
Atleast two tranches rated AAA with differing credit enhancements</td><td>AAA, AA, A, BBB- and BB
Atleast two tranches rated AAA with differing credit enhancements</td><td>AAA, AA+, AA, A, BBB- and BB
Atleast two tranches rated AAA with differing credit enhancements</td><td colspan="4">Same as CMBX 8</td></tr>
<tr><td>Rating Agencies</td><td>Atleast 2 of the 3 rating agencies: Fitch, S&P, Moody's</td><td>At least 1 of the 3 rating agencies: Fitch, S&P, Moody's
At least 2 of the 6 rating agencies: Fitch, S&P, Moody's, DBRS, Kroll, Morningstar</td><td>At least 1 of the 3 rating agencies: Fitch, S&P, Moody's, DBRS
At least 2 of the 6 rating agencies: Fitch, S&P, Moody's, DBRS, Kroll, Morningstar</td><td colspan="4">Same as CMBX 8</td></tr>
<tr><td>Applicable rating</td><td colspan="3">Lowest of all the ratings</td><td colspan="4">Based on average of numerical scores assigned to each rating</td></tr>
<tr><td>Disclosures</td><td colspan="7">Each required tranche must disclose ratings from at least two agencies</td></tr>
<tr><td>Issuance Date</td><td>No restriction</td><td>Jan 1 2011-Dec 31, 2013</td><td>After Jan 1, 2014</td><td>After Jan 1, 2015</td><td>After Jan 1, 2016</td><td>After Jan 1, 2017</td><td>After Jan 1, 2018</td></tr>
<tr><td>Collateral guidelines for the CMBS offering</td><td>1. At least 50 separate mortgages.
2. At least 10 independent borrowers who are not affiliates of the issuer.
3. No state concentration > 40%.
4. No single real estate property type > 60%.
5. All properties should be located in United States.
6. Transaction size > $700mn</td><td colspan="6">1. At least 10 separate mortgages underlying the transaction.
2. At least 2 independent borrowers who are not affiliates of the issuer.
3. Atleast 95% of the properties are located in United States.</td></tr>
<tr><td>Issuer specific guidelines for CMBS offerings</td><td colspan="4">None</td><td>Limt of 5 deals per issuer</td><td colspan="2">Max of 4 deals per risk retention holding CMBX participants.
Exclude deals with horizontal risk retention unless if it makes number of eligible offerings less than 25</td></tr>
<tr><td>Tranche Guidelines</td><td colspan="7">Each tranche should be USD denominated
For AAA tranche: Principal amount > $100mn.
No single real estate property type can represent 100% of the tranche</td></tr>
<tr><td>Tranche Selection</td><td colspan="7">If there are two tranches with same credit rating, the one with the highest credit enhancement.
Among tranches with same CE, the one with longest average life</td></tr>
<tr><td>Average life guidelines (only applies to CMBX.NA.AAA Index)</td><td colspan="7">Expected average life of 8-12 years from issuance date, at 0% CPY.
Expected AL cannot decreased by >1yr in 100% CPP scenario and >2yr in 100% CPY scenario</td></tr>
</table>

Source: IHS Markit, Barclays Research

FIGURE 18

List of deals referenced in CMBX 6-12

	CMBX.6	CMBX.7	CMBX.8	CMBX.9	CMBX.10	CMBX.11	CMBX.12
Referenced Deals	CGCMT 2012-GC8	CGCMT 2013-GC15	CGCMT 2014-GC23	BACM 2015-UBS7	CD 2016-CD1	BANK 2017-BNK7	BANK 2018-BN10
	COMM 2012-CR1	CGCMT 2013-GC17	CGCMT 2014-GC25	CGCMT 2015-GC33	CD 2016-CD2	BANK 2017-BNK9	BANK 2018-BN11
	COMM 2012-CR2	COMM 2013-CR10	COMM 2014-CR18	CGCMT 2015-GC35	CFCRE 2016-C6	CCUBS 2017-C1	BANK 2018-BN12
	COMM 2012-CR3	COMM 2013-CR11	COMM 2014-CR19	CGCMT 2015-P1	CGCMT 2016-C1	CD 2017-CD4	BANK 2018-BN13
	COMM 2012-CR4	COMM 2013-CR12	COMM 2014-CR20	COMM 2015-CR24	CGCMT 2016-C3	CD 2017-CD5	BBCMS 2018-C2
	COMM 2012-CR5	COMM 2013-CR13	COMM 2014-LC17	COMM 2015-CR25	CGCMT 2016-P4	CD 2017-CD6	BMARK 2018-B4
	GSMS 2012-GCJ7	COMM 2013-CR9	COMM 2014-UBS4	COMM 2015-CR26	CGCMT 2016-P5	CFCRE 2017-C8	BMARK 2018-B5
	GSMS 2012-GCJ9	COMM 2013-LC13	COMM 2014-UBS6	COMM 2015-CR27	CGCMT 2016-P6	CGCMT 2017-B1	BMARK 2018-B6
	JPMCC 2012-C6	GSMS 2013-GC13	GSMS 2014-GC22	CSAIL 2015-C3	COMM 2016-COR1	CGCMT 2017-P8	BMARK 2018-B7
	JPMCC 2012-C8	GSMS 2013-GC14	GSMS 2014-GC26	GSMS 2015-GC32	GSMS 2016-GS2	COMM 2017-COR2	BMARK 2018-B8
	JPMCC 2012-CBX	GSMS 2013-GC16	JPMBB 2014-C21	GSMS 2015-GC34	GSMS 2016-GS3	CSAIL 2017-C8	CGCMT 2018-C5
	JPMCC 2012-LC9	JPMBB 2013-C14	JPMBB 2014-C22	GSMS 2015-GS1	GSMS 2016-GS4	CSAIL 2017-CX10	CGCMT 2018-C6
	MSBAM 2012-C5	JPMBB 2013-C15	JPMBB 2014-C23	JPMBB 2015-C30	JPMCC 2016-JP4	CSAIL 2017-CX9	COMM 2018-COR3
	MSBAM 2012-C6	JPMBB 2013-C17	JPMBB 2014-C24	JPMBB 2015-C31	JPMDB 2016-C4	DBJPM 2017-C6	CSAIL 2018-C14
	MSC 2012-C4	JPMCC 2013-C13	JPMBB 2014-C25	JPMBB 2015-C32	MSBAM 2016-C30	GSMS 2017-GS6	CSAIL 2018-CX11
	UBSBB 2012-C2	JPMCC 2013-C16	JPMBB 2014-C26	JPMBB 2015-C33	MSBAM 2016-C31	GSMS 2017-GS8	DBGS 2018-C1
	UBSBB 2012-C3	MSBAM 2013-C11	JPMCC 2014-C20	MSBAM 2015-C25	MSC 2016-BNK2	JPMDB 2017-C7	GSMS 2018-GS10
	UBSBB 2012-C4	MSBAM 2013-C12	MSBAM 2014-C17	MSBAM 2015-C26	MSC 2016-UB11	MSBAM 2017-C34	GSMS 2018-GS9
	UBSCM 2012-C1	MSBAM 2013-C13	MSBAM 2014-C18	WFCM 2015-C30	MSC 2016-UB12	MSC 2017-HR2	JPMDB 2018-C8
	WFCM 2012-LC5	WFCM 2013-LC12	WFCM 2014-LC18	WFCM 2015-C31	SGCMS 2016-C5	UBSCM 2017-C4	MSC 2018-H3
	WFRBS 2012-C10	WFRBS 2013-C15	WFRBS 2014-C21	WFCM 2015-LC22	WFCM 2016-BNK1	UBSCM 2017-C5	MSC 2018-H4
	WFRBS 2012-C6	WFRBS 2013-C16	WFRBS 2014-C22	WFCM 2015-NXS2	WFCM 2016-C35	UBSCM 2017-C7	UBSCM 2018-C11
	WFRBS 2012-C7	WFRBS 2013-C17	WFRBS 2014-C23	WFCM 2015-NXS3	WFCM 2016-C36	WFCM 2017-C38	UBSCM 2018-C14
	WFRBS 2012-C8	WFRBS 2013-C18	WFRBS 2014-C24	WFCM 2015-P2	WFCM 2016-LC24	WFCM 2017-C40	UBSCM 2018-C15
	WFRBS 2012-C9	WFRBS 2013-UBS1	WFRBS 2014-C25	WFCM 2015-SG1	WFCM 2016-NXS6	WFCM 2017-C41	UBSCM 2018-C8

Source: IHS Markit, Barclays Research

Analyst Certification

I, Anuj Jain, CFA, hereby certify (1) that the views expressed in this research report accurately reflect my personal views about any or all of the subject securities or issuers referred to in this research report and (2) no part of my compensation was, is or will be directly or indirectly related to the specific recommendations or views expressed in this research report.

Important Disclosures:

Barclays Research is produced by the Investment Bank of Barclays Bank PLC and its affiliates (collectively and each individually, "Barclays").
All authors contributing to this research report are Research Analysts unless otherwise indicated. The publication date at the top of the report reflects the local time where the report was produced and may differ from the release date provided in GMT.

Availability of Disclosures:

For current important disclosures regarding any issuers which are the subject of this research report please refer to https://publicresearch.barclays.com or alternatively send a written request to: Barclays Research Compliance, 745 Seventh Avenue, 13th Floor, New York, NY 10019 or call +1-212-526-1072.

Barclays Capital Inc. and/or one of its affiliates does and seeks to do business with companies covered in its research reports. As a result, investors should be aware that Barclays may have a conflict of interest that could affect the objectivity of this report. Barclays Capital Inc. and/or one of its affiliates regularly trades, generally deals as principal and generally provides liquidity (as market maker or otherwise) in the debt securities that are the subject of this research report (and related derivatives thereof). Barclays trading desks may have either a long and / or short position in such securities, other financial instruments and / or derivatives, which may pose a conflict with the interests of investing customers. Where permitted and subject to appropriate information barrier restrictions, Barclays fixed income research analysts regularly interact with its trading desk personnel regarding current market conditions and prices. Barclays fixed income research analysts receive compensation based on various factors including, but not limited to, the quality of their work, the overall performance of the firm (including the profitability of the Investment Banking Department), the profitability and revenues of the Markets business and the potential interest of the firm's investing clients in research with respect to the asset class covered by the analyst. To the extent that any historical pricing information was obtained from Barclays trading desks, the firm makes no representation that it is accurate or complete. All levels, prices and spreads are historical and do not necessarily represent current market levels, prices or spreads, some or all of which may have changed since the publication of this document. Barclays Research Department produces various types of research including, but not limited to, fundamental analysis, equity-linked analysis, quantitative analysis, and trade ideas. Recommendations and trade ideas contained in one type of Barclays Research may differ from those contained in other types of Barclays Research, whether as a result of differing time horizons, methodologies, or otherwise.
In order to access Barclays Statement regarding Research Dissemination Policies and Procedures, please refer to *https://publicresearch.barcap.com/S/RD.htm*. In order to access Barclays Research Conflict Management Policy Statement, please refer to: *https://publicresearch.barcap.com/S/CM.htm*.

All pricing information is indicative only. Prices are sourced from Refinitiv as of the last available closing price at the time of production of the research report, unless another time and source is indicated.

Types of investment recommendations produced by Barclays FICC Research:

In addition to any ratings assigned under Barclays' formal rating systems, this publication may contain investment recommendations in the form of trade ideas, thematic screens, scorecards or portfolio recommendations that have been produced by analysts in FICC Research. Any such investment recommendations produced by non-Credit Research teams shall remain open until they are subsequently amended, rebalanced or closed in a future research report. Any such investment recommendations produced by the Credit Research teams are valid at current market conditions and may not be otherwise relied upon.

Disclosure of other investment recommendations produced by Barclays FICC Research:

Barclays FICC Research may have published other investment recommendations in respect of the same securities/instruments recommended in this research report during the preceding 12 months. To view all investment recommendations published by Barclays FICC Research in the preceding 12 months please refer to *https://live.barcap.com/go/research/Recommendations*.

Legal entities involved in producing Barclays Research:

Barclays Bank PLC (Barclays, UK)
Barclays Capital Inc. (BCI, US)
Barclays Bank Ireland PLC, Frankfurt Branch (BBI, Frankfurt)
Barclays Bank Ireland PLC, Paris Branch (BBI, Paris)
Barclays Bank Ireland PLC, Milan Branch (BBI, Milan)
Barclays Securities Japan Limited (BSJL, Japan)
Barclays Bank PLC, Hong Kong branch (Barclays Bank, Hong Kong)
Barclays Capital Canada Inc. (BCCI, Canada)
Barclays Bank Mexico, S.A. (BBMX, Mexico)
Barclays Securities (India) Private Limited (BSIPL, India)
Barclays Bank PLC, India branch (Barclays Bank, India)
Barclays Bank PLC, Singapore branch (Barclays Bank, Singapore)

Disclaimer:

This publication has been produced by Barclays Research Department in the Investment Bank of Barclays Bank PLC and/or one or more of its affiliates (collectively and each individually, "Barclays"). It has been prepared for institutional investors only and not for retail investors. It has been distributed by one or more Barclays affiliated legal entities listed below. It is provided to our clients for information purposes only, and Barclays makes no express or implied