

DBLCI MR Enhanced

Summary

The Deutsche Bank Liquid Commodity Index – Mean Reversion™ Enhanced (DBLCI MRE) is intended to reflect the performance of 12 commodities from 4 broad commodity sectors; energy, precious metals, base metals and agriculture. The weights of the commodities in the DBLCI MRE index are systematically adjusted depending on the relative richness or cheapness of the commodity. The commodities included and their target weights are detailed in Figure 1. Each commodity weight is a function to the ratio between a one-year and five-year moving average price. Relatively expensive commodities have lower weights; conversely, relatively cheap commodities have higher weights.

The index is calculated and published to Bloomberg in the following versions;

- DBLCI Mean Reversion Enhanced USD ER DBLCMREU
- DBLCI Mean Reversion Enhanced USD TR DBLCMRTU
- DB MR Enhanced 15 ER DBLCMTEU
- DBLCI Mean Reversion Enhanced EUR Hedged ER DBLCMREE
- DB MR Enhanced ERAC DBLCMREN
- DBLCI Mean Reversion Enhanced EUR Hedged TR DBLCMRTE
- DB MR Enhanced TV 15 EUR Hedged ER DBLCMTEE
- db Commodity Euro (Excess Return After Cost) Index DBLCMCEE
- DB Commodity USD Index DBLCMCTU
- DB Commodity EUR Index DBLCMCTE

DBLCI-OY Commodity Indices

All commodities except Natural Gas are represented by the relevant DBLCI OY individual commodity atom indices. The Deutsche Bank Liquid Commodities Indices Optimum Yield (DBLCI-OY) employs a rule based approach when it 'rolls' from one futures contract to another for each commodity in the index. Rather than select the new future based on a predefined schedule (e.g. monthly) the index rolls to that future (from the list of tradable futures which expire in the next thirteen months) which generates the maximum implied roll yield.

The index aims to maximize the potential roll benefits in backwardated markets and minimize the loss from rolling down the curve in contango markets. A market is said to be in contango (backwardation) if future prices are above (below) their respective spot prices.

For more information on DBLCI-OY indices please refer to the DBLCI-OY index description and index guide.

Natural Gas is represented by the DBLCI Natural Gas index. This index rolls contracts on a monthly basis. The index rolls into the 4th month contract. The roll takes place between the 2nd and 6th business day of each month.

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Index Rules and Calculations

The weight of each commodity in the Index is determined in a rule based and transparent manner by comparing the 1-year moving average price of a commodity with its 5-years moving average price. For determining the 1-year moving average price and the 5-years moving average price of each commodity in the Index, the price of the futures contract that had been included in the relevant sub index for the relevant period, is used. The Index seeks to overweight commodities that are cheaper on a historical price basis compared to other commodities. Similarly, the Index seeks to underweight commodities that are expensive on a historical price basis compared to other commodities. The rebalancing of the weight of various commodities in the Index (“Rebalancing Mechanism”) is determined on the 6th business day and implemented on the 8th business day of each calendar month. The commodities included in the index and the base weights are detailed in Figure 1.

Figure 1. DBLCI Mean Reversion Enhanced Target Weights

Commodity	Ticker	Exchange	Target Weight
Energy			40.00%
WTI Crude Oil	CL	NYMEX	35.00%
Natural Gas	NG	NYMEX	5.00%
Base Metals			18.00%
Aluminium	MAL	LME	3.60%
Copper	MCU	LME	3.60%
Zinc	MZN	LME	3.60%
Nickel	MNI	LME	3.60%
Lead	MPB	LME	3.60%
Precious Metals			17.00%
Gold	GC	COMEX	13.60%
Silver	SI	COMEX	3.40%
Agriculture			25.00%
Wheat Basket ¹	W	Multiple Exchanges	8.34%
Corn	C	CBOT	8.33%
Soybeans	S	CBOT	8.33%

Source : DBIQ

Index Calculation

DBLCI MR Enhanced Excess Return Calculation

The DBLCI MR Enhanced Excess Return Index is calculated on valid DBLCI business days². The index return is equal to the change in current atoms index levels multiplied by the relevant holdings.

$$ILB(t) = ILB(t-1) + \sum_i (ILa(t,i) - ILa(t-1,i)) * Ua(t,i)$$

Where, ILB(t) = DBLCI MR Enhanced Excess Return Index level on day t

ILa(t,i) = Commodity atom i index level on day t

Ua(t,i) = Commodity atom i index holding on day t

¹ From 12th March 2012, **Wheat Basket** is based on the DBLCI-OY Wheat Basket of three contracts covering Chicago Wheat, Kansas Wheat and Minneapolis Wheat (Bloomberg ticker DBLCOWUE). The details of this calculation can be found on page 10. Prior to 12th March 2012 wheat is represented by DBLCI OY Wheat Index (Bloomberg ticker DBLCOWTE)

² Prior to 1 January 2010, “**DBLCI Business Day**” means a day (other than a Saturday or Sunday) on which Commercial banks and foreign exchange markets settle payments and are open for general business in New York City. Since 1 January 2010, “**DBLCI Business Day**” means a day (other than a Saturday or Sunday) which is not a holiday in the CME Group New York Floor holiday calendar for the relevant year as published on the CME Group website.

The weights for the commodity atoms are defined by the divergence ticks (see below). The index is re-weighted on the 8th business day of each month. The target weights are based on divergence tick data on the 6th business day of each month. Based on the atom index weights the new holdings for each atom are calculated.

$$Ua(t+1, i) = \frac{ILB(t) * W(t, i)}{ILa(t, i)}$$

For all other days the holding remains constant.

$$Ua(t+1, i) = Ua(t, i)$$

DBLCI MR Enhanced Total Return Calculation

The total return index level in USD is expressed as

$$ILBtr(t) = \left(\frac{ILB(t)}{ILB(t-1)} + (1 + Rt(t))^{d(t,t-1)} - 1 \right) * ILBtr(t-1)$$

$$Rt(t) = \left(1 - \frac{91}{360} y(t-1) \right)^{-\left(\frac{1}{91}\right)} - 1$$

Where:

- ILBtr(t) = DBLCI MR Enhanced Total Return Index level on day t
- ILBtr(t-1) = DBLCI MR Enhanced Total Return Index level on index calculation day t-1
- Rt(t) = T-bill return on day t
- d(t,t-1) = Number of calendar days between day t and index calculation day t-1 including day t
- y(t-1) = 3-month benchmark T-bill yield on index calculation day t-1

Mean Reverting Weight Strategy

The mean reverting weight strategy is based on the commodity divergence ticks. The divergence tick is a measure of the ratio of the 5yr and 1yr commodity moving average. The divergence tick is expressed as:

$$dk(t, i) = trunc\left(\frac{MA1(t, i) / MA5(t, i) - 1}{f}\right)$$

where:

- dk(t,i) = Divergence tick of commodity i on day t
- MA1(t,i) = One-year moving average of commodity i on day t
- MA5(t,i) = Five-year moving average of commodity i on day t
- f = 0.05

The moving average calculations (except for wheat basket³) are based on the price of the contracts included in each commodity atom during the relevant (one year or five year) period. During roll periods the price of the old contract being rolled out of the index is used. The one year average is based on price data from the 6th business day of the month to the first business day succeeding the date 12 months prior to the 6th business day of the month. The five year average is based on price data from the 6th business day of the month to the first business day succeeding the date 60 months prior to the 6th business day of the month.

³ For wheat basket, the moving average calculation is done in the same way as described above for all 3 wheat commodities. The moving average for wheat basket is average of Chicago wheat, Kansas wheat and Minneapolis wheat commodity moving average.

The historical calculations for MCU, MNI, MPB and MZN up to and including 09-Jul-02 underlying commodity future prices for the full 5 years was not available for the calculation. During this period spot pricing was used to calculate the 5 year and 1 year moving averages. The historical calculation for MAL up to and including 08-Aug-02 underlying commodity future prices for the full 5 years was not available for the calculation. During this period spot pricing was used to calculate the 5 year and 1 year moving averages.

On the 6th business day of each month the pre-capped target weight is expressed as:

$$PW(t, i) = \frac{CW(i) * e^{-dk(t,i)*k}}{\sum_j CW(j) * e^{-dk(t,j)*k}}$$

where:

$CW(i)$ = Target weight for commodity i

$PW(t,i)$ = Pre capped target weight of commodity atom i on day t

k = 0.3

The final index weights $W(t,i)$ are capped to ensure UCITS III guidelines are met.

The pre-capped target weights are ordered by the highest to lowest weight. If two pre-capped target weights are identical the commodity with the highest current weight is ordered first. The agriculture commodities are not considered for rank calculations.

If the highest ranked pre-capped target weight is above 32% it is capped to 32%. All other weights including agriculture commodities are capped to 18%.⁴

The difference between the capped weights and pre-capped weights are distributed pro-rata between the remaining commodities. In the event any commodities apart from the highest ranked commodity have a weight above 18% after the redistribution they are capped to 18%. The redistribution is repeated, with the weight of those commodities having a weight below 18% being increased on a pro-rata basis. This process is repeated iteratively until only the highest ranked commodity has a weight above 18% (in the event the highest ranked commodity had a weight below 18% no commodities will have a weight above 18%). These weights are the final index weights.

DBLCI Mean Reversion Enhanced TR USD Calculation

The total return index level in USD is expressed as

$$ILBtr(t) = \left(\frac{ILB(t)}{ILB(t-1)} + (1 + Rt(t))^{d(t,t-1)} - 1 \right) * ILBtr(t-1)$$

$$Rt(t) = \left(1 - \frac{91}{360} y(t-1) \right)^{\left(\frac{1}{91} \right)} - 1$$

Where:

$ILBtr(t)$ = DBLCI Mean Reversion Enhanced Total Return Index level on day t

$ILBtr(t-1)$ = DBLCI Mean Reversion Enhanced Total Return Index level on index calculation day t-1

$Rt(t)$ = T-bill return on day t

$d(t,t-1)$ = Number of calendar days between day t and index calculation day t-1 including day t

$y(t-1)$ = 3-month benchmark T-bill yield on index calculation day t-1

DBLCI Mean Reversion Enhanced EUR Hedged TR Calculation

⁴ Prior to 12th March 2012, the cap used for highest weight was 35% and the cap for all other commodities was 20%. Also, agriculture commodities were also considered for rank calculation before 12th March 2012.

The total return hedged EUR index levels are calculated based on WM FX data. The return from the FX hedge is accrued over the month on an ACT/ACT basis. The hedged index is expressed as

$$ILh(t) = [1 + RetIL(t) + RetIL(t) * FXr(t) + FXhr(t)] * ILh(r)$$

Where:

ILh(t) = Hedged total return index level on day t

ILh(r) = Hedged total return index level on last business day of last month r

ILuh(t) = Un-hedged total return index level on day t

ILuh(r) = Un-hedged total return index level on last business day of last month r

$$RetIL(t) = \frac{ILBtr(t)}{ILBtr(r)} - 1$$

$$FXr(t) = \frac{FX(t)}{FX(r)} - 1$$

FX(t) = FX rate on day t quoted Index Currency: Hedge Currency

FX(r) = FX rate on last business day of last month r quoted Index Currency:
Hedge Currency

$$FXhr(t) = \left(\frac{FXh(r)}{FX(r)} - 1 \right) * \frac{dy(t)}{TD}$$

FXh(r) = One-month FX forward rate on last business day of last month r quoted Index Currency: Hedge Currency

dy(t) = Number of calendar days between t and last business day of last month r

TD = Number of calendar days from last business day of immediately preceding month up to but excluding last business day in current month

DBLCI Mean Reversion Enhanced EUR Hedged ER Calculation

Excess return EUR index levels are calculated based on WM FX data. The excess return hedged index levels represent the returns of the USD excess returns converted into the target currency. Excess return un-hedged index levels are not calculated.

The hedged index is expressed as

$$ILher(t) = (1 + RetIL(t) + RetILer(t) * FXr(t)) * ILher(r)$$

Where:

ILher(t) = Hedged excess return index level on day t

ILher(r) = Hedged excess return index level on last business day of last month r

$$RetILer(t) = \frac{ILB(t)}{ILB(r)} - 1$$

ILler(t) = Local excess return index level on day t

ILler(r) = Local excess return index level on last business day of last month r

$$FXr(t) = \frac{FX(t)}{FX(r)} - 1$$

FX(t) = FX rate on day t quoted Index Currency: Hedge Currency

FX(r) = FX rate on last business day of last month r quoted Index Currency:

Hedge Currency

After Cost Index Calculation

The following indices are calculated using the after cost method;

- DB MR Enhanced ERAC DBLCMREN
- db Commodity Euro (Excess Return After Cost) Index DBLCMCEE
- DB Commodity USD Index DBLCMCTU
- DB Commodity EUR Index DBLCMCTE

•*DB MR Enhanced ERAC - Core Index Information*

Component 1	DBLCI Mean Reversion Enhanced USD ER
Calculation Calendar	DBLCI (see legal documentation for definition)
Rebalancing Calendar	DBLCI (see legal documentation for definition)
Rebalancing Frequency	Last business day of each year
Selection Frequency	Fixed weight so no selection
Currency	USD
Return Type	ER
FX Exposure	None
Running Cost	1.1%
Rebalancing Cost	None
Leverage	None
Target Volatility	None

•*db Commodity Euro (Excess Return After Cost) Index - Core Index Information*

Component 1	DBLCI Mean Reversion Enhanced EUR Hedged ER
Calculation Calendar	DBLCI (see legal documentation for definition)
Rebalancing Calendar	DBLCI (see legal documentation for definition)
Rebalancing Frequency	Last business day of each year
Selection Frequency	Fixed weight so no selection
Currency	EUR
Return Type	ER
FX Exposure	None
Running Cost	1.1%
Rebalancing Cost	None
Leverage	None
Target Volatility	None

DB Commodity USD Index- Core Index Information

Component 1	DBLCI Mean Reversion Enhanced USD TR
Calculation Calendar	DBLCI (see legal documentation for definition)
Rebalancing Calendar	DBLCI (see legal documentation for definition)
Rebalancing Frequency	Last business day of each year
Selection Frequency	Fixed weight so no selection
Currency	USD
Return Type	TR

FX Exposure	None
Running Cost	1%
Rebalancing Cost	None
Leverage	None
Target Volatility	None

DB Commodity EUR Index- Core Index Information

Component 1	DBLCI Mean Reversion Enhanced EUR Hedged TR
Calculation Calendar	DBLCI (see legal documentation for definition)
Rebalancing Calendar	DBLCI (see legal documentation for definition)
Rebalancing Frequency	Last business day of each year
Selection Frequency	Fixed weight so no selection
Currency	EUR
Return Type	TR
FX Exposure	None
Running Cost	1.1%
Rebalancing Cost	None
Leverage	None
Target Volatility	None

Daily Calculation

The return of the After Cost index is equal to the change in the Component Index multiplied by the relevant holding subject to the cost adjustment.

$$ILac(t) = [ILac(r) + (ILu(t) - ILu(r)) * Uu(t)] * \left(1 - RC * \frac{d(r,t)}{DC}\right)$$

where

ILac (t) = Index level on day t

ILu(t) = Component Index level on day t

Uu(t) = Component index holding on day t

t = Calculation date t

r = Last rebalancing date, which is last index business day of previous year

RC = Running Cost

DC = Number of calendar days from and excluding last index business day of previous year to and including last index business day of current year

d(r,t) = Number of calendar days from and excluding r to and including t

Unit Holding Calculation

The index is re-weighted on the last business day of each year. The new holding is expressed as;

$$Uu(t+1) = \frac{ILac(t)}{ILu(t)}$$

For all other days the holding remains constant.

$$Uu(t+1) = Uu(t)$$

Target Volatility Index Calculation

The following indices are calculated using the target volatility method;

- DB MR Enhanced 15 ER
- DB MR Enhanced TV 15 EUR Hedged ER

DB MR Enhanced 15 ER Calculation - Core Index Information

Component 1	DBLCI MR Enhanced USD ER Index
Calculation Calendar	DBLCI (see legal documentation for definition)
Rebalancing Calendar	DBLCI (see legal documentation for definition)
Rebalancing Frequency	Last business day of each month
Selection Frequency	Two business days prior to rebalance
Currency	USD
Return Type	ER
FX Exposure	None
Running Cost	None
Rebalancing Cost	None
Leverage	None
Target Volatility	15%
Maximum Allocation	300%
Volatility Look back	3 months

DB MR Enhanced TV 15 EUR Hedged ER Calculation - Core Index Information

Component 1	DBLCI Mean Reversion Enhanced EUR Hedged ER Index
Calculation Calendar	DBLCI (see legal documentation for definition)
Rebalancing Calendar	DBLCI (see legal documentation for definition)
Rebalancing Frequency	Last business day of each month
Selection Frequency	Two business days prior to rebalance
Currency	USD
Return Type	ER
FX Exposure	None
Running Cost	None
Rebalancing Cost	None
Leverage	None
Target Volatility	15%
Maximum Allocation	300%
Volatility Look back	3 months

Daily Calculation

The return of the Index is equal to the change in the component index multiplied by the relevant holding.

$$IL(t) = IL(t-1) + (ILa(t) - ILa(t-1)) * Ua(t)$$

where

IL (t) = Index level on day t

$ILa(t)$ = Component Index level on day t
 $Ua(t)$ = Component index holding on day t
 t = Calculation date t
 $t-1$ = Previous calculation date

Unit Holding Calculation

The exposure to the index is based on the target weight calculated above. The index is re-weighted on the last business day of each month. The new holding is expressed as;

$$Ua(t+1) = \frac{IL(t) * TW(t)}{ILa(t)}$$

For all other days the holding remains constant.

$$Ua(t+1) = Ua(t)$$

Selection Logic - Target Volatility Calculation

The target volatility is based on the ratio of the target volatility and the historical realised volatility of the index. A maximum weight limits the allocation. The historic lognormal returns are based on the range from the selection date to the selection date falling in the month that is equal to the current selection month minus the volatility lookback period.

The target weight is expressed as;

$$TW_t = MIN\left(\frac{TV}{V_t}, MaxTW\right)$$

where

V_t = Volatility on t, rounded to 1dp

TW_t = Target weight on t

TV = Target Volatility

$MaxTW$ = Maximum Allocation

DBLCI-OY Wheat Basket Calculation

The DBLCI-OY Wheat Basket is based on the performance of the DBLCI-OY Chicago Wheat, Kansas Wheat and Minneapolis Wheat indices. It is calculated in USD ER from 08-NOV-1990 on valid DBLCI business days. The index return is equal to the change in current atoms index levels multiplied by the relevant holdings.

$$ILB(t) = ILB(t - 1) + \sum_i (ILa(t, i) - ILa(t - 1, i)) * Ua(t, i)$$

where

ILB(t) = DBLCI-OY Wheat Basket Index level on day t

ILa(t, i) = Wheat atom i index level on day t

Ua(t, i) = Wheat atom i index holding on day t

Unit Holding Calculation

The weights for the wheat atoms are fixed at thirty three percent and one third each. The index is re-weighted on the 6th business day of November. The new holdings for each atom are calculated.

$$Ua(t + 1, i) = \frac{ILB(t) * \frac{1}{3}}{ILa(t, i)}$$

For all other days the holding remains constant.

$$Ua(t + 1, i) = Ua(t, i)$$

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