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Fixing floaters

How the 10y10y rate can save FRNs

Experts from Crédit Agricole's rates team explain how use of a forward euro fixing can bring positive carry and improve coupons

For some time now, floating rate notes have compared poorly to their fixed rate cousins in Europe due to the shape of the yield curve. The forward curve is structurally steeper than the spot version, and since pricing is based largely on the former, it means the coupon available on a floating note suffers.

But the problem isn't the rates environment in Europe; it is the indexation that is used.

Typically, a floating rate note will reference three-month Euribor or the 10-year constant maturity swap (CMS) rate, known as the Ice swap rate. When purchasing a floating rate note, the investor is effectively buying the expensive forward rate at maturity, and receiving the cheaper spot rate. With the forwards on these rates much higher than spot, this results in very low coupons. Put another way, pricing takes into account the high forward rates and reduces the coupon accordingly.

Using a different floating rate based solely on forward rates can solve this problem. The forward 10-year Ice swap rate has a characteristic where the 10-year point is generally always the maximum level, after which it slopes downwards. If this 10-year/10-year rate is used as the spot and a lower, future point as the forward, this creates positive carry and better coupons.

Since the first issuance in November 2018, more than €1 billion ($1.12 billion) has been linked to the 10-year/10-year Ice swap rate from a range of issuers (see table A), and all the signs show this is set to continue.

A. Selected 10-year/10-year issuance

Issuer	Arranger	Size (€)	Maturity	ISIN
CA-CIB	CA-CIB	6,000,000	12Y	FR7271CA2629
EBRD	CA-CIB	100,000,000	20Y	XS1917955715
CA-CIB	CA-CIB	80,000,000	12Y	FR7271CA2678
CA-CIB	CA-CIB	5,000,000	12Y	FR7271CA2678
CA-CIB	CA-CIB	30,000,000	10Y	FR7271CA2702
Natixis	Natixis	20,000,000	12Y	FR0013401270
NBC	DB	40,000,000	12Y	XS1953930283
CA-CIB	CA-CIB	75,000,000	15Y	FR7271CA2736
JP Morgan	JP Morgan	75,000,000	15Y	XS1879185533
Premium Green	CA-CIB	30,000,000	22Y	XS1961829428
Goldman Sachs	Goldman Sachs	24,000,000	16Y	XS1948751695
CA-CIB	CA-CIB	194,500,000	12Y	FR7271CA2769
NBC	HSBC	50,000,000	15Y	XS1964559576
Barclays	Barclays	130,000,000	20Y	XS1931227521
Natixis	Natixis	20,600,000	13Y	FR0013413416
Morgan Stanley	Morgan Stanley	75,000,000	20Y	XS1414108495
JP Morgan	JP Morgan	30,000,000	15Y	XS1879181979

Source: Crédit Agricole Corporate & Investment Bank

The market expectations curve

To fully understand how the product works entails going back to basics. Fundamentally, regardless of the asset class, the price of a derivatives product is based on market expectations. In the case of a single indexation to an underlying asset, the present value is based on an estimate of the future value of the underlying asset, while the current cashflow depends on the underlying asset's current value. Pricing depends on a set of market expectations of the underlying asset, represented by the curve, which reflects supply and demand.

The market expectations curve is derived from the information contained in tradeable asset prices, which establishes a fundamental relationship between traded prices and market expectations. These future estimations lead to market expectations curves that can be normal, steep, inverted or flat. A current cashflow depends on the front part of the curve; a future cashflow depends on points farther out.

Market expectations are also used for decision-making. For example, the European five-year forward, five-year inflation swap rate is monitored by central banks and fuelled discussions about the implementation of quantitative easing in 2014. Historical data on five-year/five-year inflation shows that inflation market expectations have been relatively stable over the past five years, even though actual inflation has been particularly volatile.

Expectations versus realisation

One well-known investment strategy, the carry trade, takes advantage of the shape of the market expectations curve by buying an underlying with a downward curve or selling an underlying with an upward curve. This strategy establishes a link between valuation and realisation because its return depends on the non-realisation of market expectations. Indeed, the investor will buy or

sell a given point of the curve (the expectation), and will receive or pay the initial point (realisation) at the expiry of the strategy.

Since market-expected rates diverge from realised rates, are tradeable and may be used by policy-makers, indexing to such rates becomes a strong investment proposition. It is possible to take advantage of the market expectations curve by buying or selling certain points of the curve and fixing on a previous point of choice. This fundamental approach of extracting value from the shape of the curve (the price of the instrument based on market expectations versus actual cashflows based on market expectations) generalises the standard case (the price of the instrument based on market expectations versus actual cashflows based on realisation).

Spot and forward rates

In the case of a yield or swap rate curve, the construction is based on bond prices in the bond market, or swap prices in the swap market. These curves are generally upward and concave, with asymptotic behaviour.

Beyond the law of supply and demand, which sets prices, the form of a yield curve depends on three fundamental factors: market expectations of the central bank's economic policy; the risk premium; and the convexity bias (*Ilmanen, Antti. 1995. "Understanding the Yield Curve", Salomon Brothers*). We will see that the opposition between risk premium and convexity leads to significant opportunities.

The spot bond yield curve or swap rate curve is used to derive the corresponding forward curves. The forward rates are determined by applying the non-arbitrage assumption, establishing a mathematical link between rates on the spot rate curve.

The forward rate curve generally has a maximum, which implies that interest rate market expectations rise and then fall.

This maximum is explained by the opposition of the risk premium and convexity factors. The risk premium increases the required yield for longer maturities, while convexity reduces it.

The convexity of a bond is the second derivative of the bond price, defined as the change in the rate of change of prices due to interest rate moves. Positive convexity is beneficial to bondholders; it reduces the loss in the event of a rate increase and increases the gain in the event of a rate decrease.

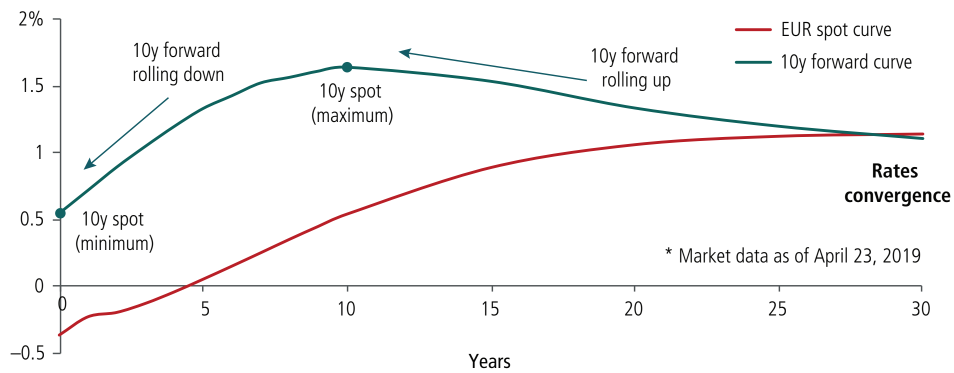
Convexity is higher for longer-term bonds. For example, a 50-year, €50 million nominal value bond is more convex than the 20-year, €100 million nominal equivalent.

This convexity, considered as protection, tends to reduce very long-term bond yields. Investors value the higher convexity of very long-term bonds, especially if high volatility is anticipated, and bid up their prices, thus reducing their yields.

This opposition between risk premium and convexity results in a concave and decreasing long-term yield curve, which mathematically leads to a market expectations curve with a maximum, as in the 10-year forward curve in figure 1.

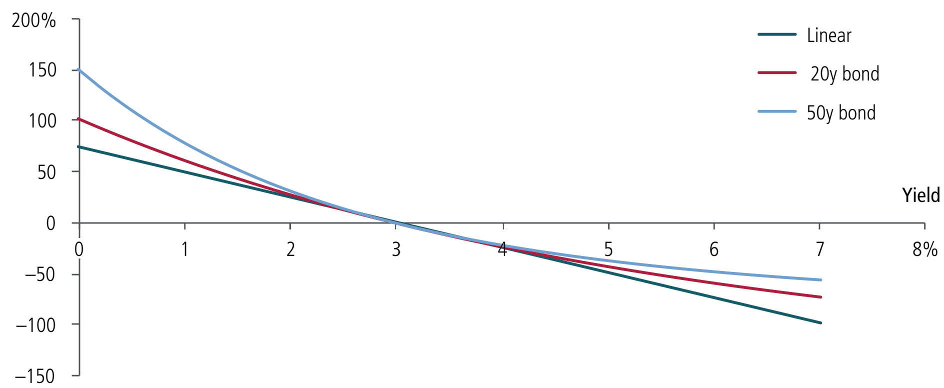
An investment strategy can be implemented to benefit from this.

1 Spot and forward curve*



Source: Crédit Agricole Corporate & Investment Bank

2 Convexity effect



Source: Crédit Agricole Corporate & Investment Bank

Focus on the swap rate

Let us now focus on the swap rate fixings published daily at 11:00 Frankfurt time by Ice Benchmark Administration. Each swap rate is equal to the at-the-money swap rate for the respective maturity prevalent at this specific time – we denote it as the relevant CMS rate.

The forward rate for that same maturity can be defined, assuming no arbitrage, using the relevant CMS rates and their durations or annuity terms (sum of the relevant discount factors), also referred to as 'Physical Annuity' below.

For instance, the 10-year euro swap value, at the Ice fixing time, is defined by:

$$\text{Swap(10y,ICEfixing)} = 0$$

$$= \sum_{i=1}^{20} \mathrm{DF}(0, t_i) \cdot \delta \cdot \mathrm{Eur6m}_{ti} - \sum_{j=1}^{10} \mathrm{DF}(0, t_j) \cdot \mathrm{CMS10y}$$

$$\Downarrow$$

$$\sum_{i=1}^{20} \mathrm{DF}(0, t_i) \cdot \delta \cdot \mathrm{Eur6m}_{ti} = \mathrm{PhysicalAnnuity10y} \cdot \mathrm{CMS10y} \qquad (*)$$

With:

$$\sum_{j=1}^{10} \mathrm{DF}(0, t_j) = \mathrm{PhysicalAnnuity10y}$$

The 20-year euro swap value is defined by:

$$\text{Swap(20y,ICEfixing)} = 0$$

$$= \sum_{i=1}^{40} \mathrm{DF}(0, t_i) \cdot \delta \cdot \mathrm{Eur6m}_{ti} - \sum_{j=1}^{20} \mathrm{DF}(0, t_j) \cdot \mathrm{CMS20y}$$

$$\Downarrow$$

$$\sum_{i=1}^{40} \mathrm{DF}(0, t_i) \cdot \delta \cdot \mathrm{Eur6m}_{ti} = \mathrm{PhysicalAnnuity20y} \cdot \mathrm{CMS10y} \qquad (**)$$

With:

$$\sum_{j=1}^{20} \mathrm{DF}(0, t_j) = \mathrm{PhysicalAnnuity20y}$$

The 10-year forward, 10-year euro swap value is defined by:

$$\text{Swap(10y10y,ICEfixing)} = 0$$

$$= \sum_{i=21}^{40} \mathrm{DF}(0, t_i) \cdot \delta \cdot \mathrm{Eur6m}_{ti} - \sum_{j=11}^{20} \mathrm{DF}(0, t_j) \cdot \mathrm{Forward10y10y}$$

By using (*) and (**) we derive the following barycentric formula:

$$\text{Forward10y10y} = \frac{\text{PhysicalAnnuity20y} \cdot \text{CMS20y} - \text{PhysicalAnnuity10y} \cdot \text{CMS10y}}{\text{PhysicalAnnuity20y} - \text{PhysicalAnnuity10y}}$$

The forward rate is not observable since the annuity depends on the unobservable discount factors and the calibration model.

Cash settlement annuity and forward swap rate

In order to avoid this obstacle, we use the assumption that swaptions can be cash settled, using a cash-settled annuity instead of a physical version. This assumption has been used in the swaption market for nearly 20 years. We set:

$$\text{CashAnnuity10y} = \sum_{i=1}^{10} \frac{1}{(1+\text{CMS10y})^i}$$

$$\text{CashAnnuity20y} = \sum_{i=1}^{20} \frac{1}{(1+\text{CMS20y})^i}$$

By setting a lower boundary to this ratio (such as 125%, for example), any discrepancies are ruled out in extreme scenarios.

Thus, the cash-settled forward CMS is defined by:

$$\text{CMS10y10y} = \frac{\text{CA20y} \cdot \text{CMS20y} - \text{CA10y} \cdot \text{CMS10y}}{\text{CA20y} - \text{CA10y}}$$

$$\Updownarrow$$

$$\text{CMS10y10y} = \frac{(\text{CA20y} - \text{CA10y} + \text{CA10y}) \cdot \text{CMS20y} - \text{CA10y} \cdot \text{CMS10y}}{\text{CA20y} - \text{CA10y}}$$

$$\Updownarrow$$

$$\text{CMS10y10y} = \frac{(\text{CA20y} - \text{CA10y}) \cdot \text{CMS20y} + \text{CA10y} \cdot (\text{CMS20y} - \text{CMS10y})}{\text{CA20y} - \text{CA10y}}$$

$$\Updownarrow$$

$$\text{CMS10y10y} = \text{CMS20y} + \frac{\text{CA10y}}{\text{CA20y} - \text{CA10y}} \cdot (\text{CMS20y} - \text{CMS10y})$$

$$\Updownarrow$$

$$\text{CMS10y10y} = \text{CMS20y} + \frac{1}{(\text{CA20y}/\text{CA10y}) - 1} \cdot (\text{CMS20y} - \text{CMS10y})$$

where CashAnnuity has been abbreviated to CA. In reality, we approximate the ratio of durations:

$$\frac{\text{CashAnnuity20y}}{\text{CashAnnuity10y}}$$

By setting a lower boundary to this ratio (such as 125%, for example), any discrepancies are ruled out in extreme scenarios.

Interest in the forward CMS

This cash-settled forward CMS formula allows for observable forward rates on the basis of Ice swap rate fixings. This transparency opens up a wide range of investment and decision-making possibilities.

For a given forward rate curve, the 'first' rate is the spot rate. Subsequent rates represent market expectations for the relevant rate in the future. The cash-settled forward CMS formula makes it possible for investors to buy or sell the market-expected rate and receive or pay the market-expected rate, which is cheaper than buying or selling the market-expected rate and receiving or paying the realised rate.

Indexing to – that is, receiving or paying – interest rate market expectations, therefore, improves the profitability of the rate curve investment strategy.

Problem of floating rate indexation

One fundamental application of forward rate indexation is to solve the problem of the negative carry of floating rate indexation, which consists of buying a bond with a floating rate coupon. Investors find this too expensive, and therefore problematic, especially in an environment of low interest rates, positive curve slopes and tight credit spreads.

The cost of floating rate indexation is defined by comparing the equivalent fixed rate and the spot floating rate (yield curve unchanged). The cost is high if the equivalent fixed rate is higher than the floating rate. High cost or high carry are equivalent concepts.

A 20-year euro bond issued by an AAA-rated issuer will offer a positive fixed rate but a zero coupon if linked to three-month Euribor, for example. In the current environment of the euro swap rate curve, this cost is roughly the value of the swap rate.

This carry cost phenomenon is linked to the shape of the swap rate curve and the choice of indexation, and reflects the difference between the forward and spot rates. The cost of the floating index will be higher if the swap rate curve is steep and lower if the yield curve is flat.

In an environment where risk premiums are high – meaning interest rate market expectations increase with time – but the spot curve doesn't change, market expectations lose value over time and floating rate indexation is expensive. In this case, the investor gives up higher returns for the opportunity of receiving higher floating rates in the future, which do not materialise.

As a result, for a structurally increasing swap rate curve, forward rates converge over time towards the spot rate, which is lower than all forward rates. In summary, the high cost of carry of floating rate indexation is due to (a) the shape of the yield curve and (b) buying interest rate market expectations and receiving a realised rate, which is the minimum rate of the market expectation curve.

The solution to this carry problem uses the concavity of the curve and changes the indexation from a spot rate to a forward rate.

As we have seen, a concave swap rate curve implies that there is a maximum on the forward swap curve. This maximum allows us to distinguish two types of market expectation rates: forward rates with a forward time horizon before the maximum point, which have negative carry for floating rate instruments; and forward rates with a forward time horizon after the maximum point, which have positive carry.

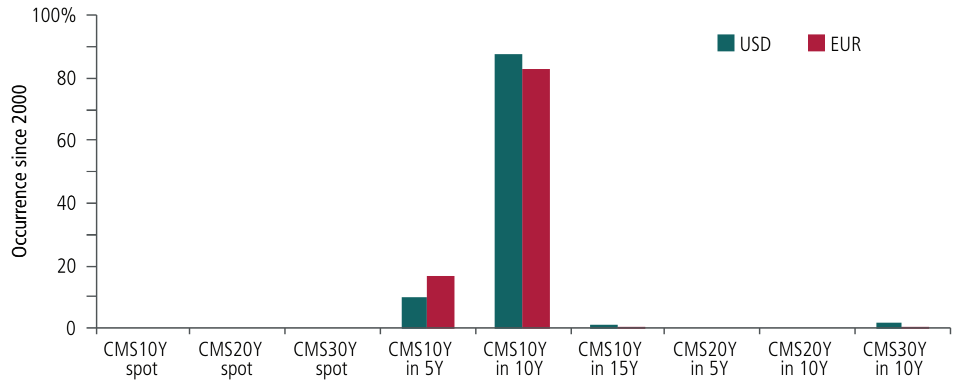
Therefore, an indexation to this maximum point on the forward curve solves the problem of floating rate negative carry. The market expectations of this maximum rate (unknown char) which are used to price (unknown char) are by construction lower than the realisation since they exist at a time horizon after this maximum. So, for example, pricing a 10-year floating rate bond using 10-year/10-year as the index, you would effectively use the strip from 10-year to 20-year on the 10-year forward curve – that is, 11-year/10-year, 12-year/10-year … 20-year/10-year – which mechanically are all lower than 10-year/10-year. This therefore results in better pricing and return.

Indexation to the maximum point on the forward curve means the investor pays the low convexity premium, which dominates the area after the maximum point, to receive the higher risk premium, which dominates the area before the maximum point.

In a way, it is about taking advantage of long-term market expectations at a lower cost.

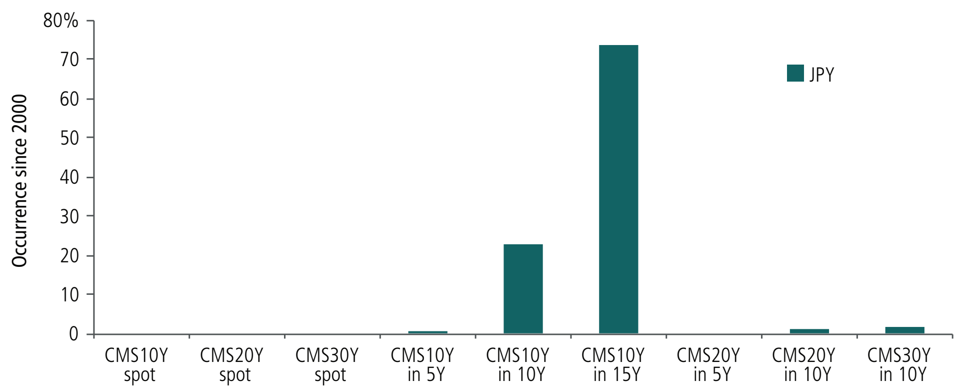
So, to solve the problem of negative carry, we take advantage of the concavity of the curve. And the introduction of the cash-settled forward CMS offers a transparent and observable implementation.

3 Highest long-term rate on curve (USD, EUR)



Source: Crédit Agricole Corporate & Investment Bank

4 Highest long-term rate on curve (JPY)



Source: Crédit Agricole Corporate & Investment Bank

From a purely quantitative point of view, the choice of indexation is based mainly on two factors: the optimisation of the carry cost and the empirical robustness. We now know that indexation to the maximum rate of a market expectation curve allows for positive carry. To optimise the choice of the maximum forward rate, it is sufficient to look at the drop-off in interest rate expectations after this maximum point.

More precisely, the steeper the negative slope, the more positive the carry; alternatively, the higher the convexity, the more positive the carry.

From an empirical point of view, the robustness of the maximum depends on the stability of the border between the risk premium and the convexity effects.

Choice of the maximum forward rate

In euro and US dollar, historical observations show that the CMS 10-year/10-year rate is the highest in 80–90% of cases among a set of liquid long-term rates (spot and forward).

This was in a sample of nine long-term rates: CMS 10-year; 20-year; 30-year; 10-year in five-year; 20-year in five-year; 10-year in 10-year; 20-year in 10-year; 30-year in 10-year; and 10-year in 15-year.

Since 2000, CMS 10-year/10-year outperforms 10-year by 1% on average both in euro and US dollar, and is below for approximately 20 days. This is because the 10-year and 20-year rates are in the risk premia-dominated area of the curve, so 20-year is above 10-year.

In yen, historical observation shows that CMS 15-year/10-year is the highest rate in 70% of cases among the same set of rates (CMS 10-year/10-year being 30% of the cases).

On average, 15-year/10-year outperforms the 10-year by 1.4% in yen, implying the border between risk premia and convexity is the 25-year point.

In euro, dollar or yen, the highest rate is always a 10-year forward rate, with maturities from five to 15 years.

This is because the structural shape of the curve is upward sloping and then concave, which implies that there is a forward rate higher than the spot rate; and also the border between the risk premium and the convexity areas of the curve is approximately the 20-year rate.

So, in order to solve the problem of negative carry in floating rate indexation, the solution is to buy rates in the convexity area, which is used for pricing, and fix them in the risk premium area. And this optimisation is achieved with the CMS 10-year/10-year. ■

Samy Ben Aoun is head of euro structured trading at Crédit Agricole Corporate & Investment Bank, Christophe Viard is macro structurer at Crédit Agricole CIB, and Pascal Ardelet is head of France and Benelux financial institution solutions sales at Crédit Agricole CIB.