

## Inflation (CPI) futures

There is currently not such a thing as exchanged traded futures on inflation or inflation linked bonds. However, there is a growing market on inflation-linked instruments that are the subject of this article.

What is inflation?

Inflation is an index measuring the economic evolution of prices. These prices are usually defined by a basket of representative goods used commonly by households. The most common inflation indexes used by economists and financial markets are the retail price indices RPI and the consumer price indices CPI. Because the tobacco plays a special role, inflation index can be with or without tobacco. There are also product specific inflation index like the Producer price index (production goods) or the retail price index excluding mortgage interest payment (RPIX)

Target market for inflation

Inflation is a natural risk exposure for many market participants. Usually, one targets the inflation market into two groups, according to their inflation risk.

- The first group referred to as the *natural payer of inflation* consists in the companies whose revenues are positively and strongly correlated to inflation. Most of the utility companies like gas, water, transportation or other infrastructure company which in a monopoly situation have their prices indexed to inflation. Retail companies are also indirectly exposed

positively to inflation as they increase their prices with inflation. Last but not least, governments, counties and municipalities are benefiting from rising inflation via tax revenues.

- The second group referred to as the *natural receiver of inflation* consists in the companies whose revenues are negatively and strongly correlated to inflation. Most of the pension funds and insurance companies have part of their liabilities indexed to inflation. Industrial companies like oil companies and many other commodities based companies experience additional cost with rising inflation. Some financial institutions are also sensitive to buying protection against inflation.

Inflation linked structure:

There are three major categories of inflation products:

- Inflation linked bonds: this is a growing market with some government bond issue of more than 10 to 15 billion dollars. The most liquid markets are France: with the OATi, CADESi bonds, the US with the TIPS bonds, the UK with I/L Gilts and the Eurozone inflation bond market OATie. Various utilities and banks have also issued inflation linked corporate bonds. Typical inflation linked bonds pay a regular fixed coupon paid on a notional that accretes at the inflation rates. The final notional is also accreting at the inflation rate, although it is additionally floored at par. Because of the delay in publication of inflation numbers by the various statistics agencies, the inflation number is lagged by some months (typically, 3 months for French OATi, and 8 months for UK I/L Gilts).

Although liquidity and ability to repo and asset swap inflation bonds have been growing, the inflation-linked bond market is still relatively small and suffers from its illiquidity. In reaction, governments have been increasing outstanding amount of their issue like for instance the French government on recent OATi (2009) issues. Pension funds and insurers (especially in the UK) have swallowed some of the issues, narrowing considerably the market. In addition, risk appetite for asset swaps on inflation-linked bond is still low.

Inflation linked bonds enjoy great popularity as they offer natural protection against inflation accreting assets. This also explains that the inflation linked bond paying a coupon indexed on the inflation looks much less attractive to investors clients as they bear the risk that the final notional is not adjusted for the increase due to inflation.

- Inflation swap: the inflation market is still not completely unified as it is still at the early development stage. Inflation swap can exist many in three forms:
  - Zero coupon inflation swaps: consisting in a stream of exchange at maturity between a fixed payment and the notional accreted over the whole period at the inflation rate. At maturity, pays therefore  $CPI(T-lag)/CPI(0)-100\%$ , versus a fixed payment of the form  $(100\% + Infl)^T - 100\%$ , where the zero coupon swap rate  $Infl$  is such that the swap has zero NPV.
  - Revenue inflation swap: this would be the equivalent of a swap as at each period, there is an exchange of payment between inflation linked

cashflows, that have accreted at the inflation rate:  $CPI(T-lag)/CPI(0)-100%$ , and a fixed payment accreting at the swap rate  $(100% + Infl)^T - 100%$ . A revenue inflation swap is therefore nothing more than a series of zero coupon inflation swap.

- Year-On-Year inflation swap: at each period (every year), there is an exchange of payment between an inflation linked payment but accreting only for the last year  $CPI(T-lag)/CPI(T-lag-1year)-100%$  versus a fixed cashflow paying  $Infl$ .

Inflation swaps are very attractive to client as they are highly customisable: ability to specify the appropriate inflation index, ability to match the risk profile in term of the structure, and great accounting benefit as this can easily qualify as an hedging trade. Zero coupon inflation swaps bear a substantial credit risk exposure compared to revenue inflation and year on year inflation swaps as it pays a single payment at maturity.

- Inflation structured products: these are tailor-made products addressing specific clients' preoccupations. For instance, common structures are:
  - Standard vanilla like caps, floors and swaptions on inflation.
  - Event-trigger structures on inflation: like right to enter into an inflation linked note depending on a third party asset like price of oil or a commodity index. Useful for utility companies and cheaper than standard structures.
  - Yield enhancement or financing cost reducing inflation structure: for investors that issue an inflation-linked note, selling the option to enter

into a payer inflation swap can offer substantially lower financing cost (on the liability side) or increase the yield (asset side) on the structure.

Useful for inflation-linked issuer or for inflation-linked investors.

- Callable inflation structures: Callable inflation bonds offering to an investor the right to call back the inflation-linked issue at a set of early redemption dates to protect him against an inflation surge. As a matter, this can just be seen as a Bermudan inflation swap.
- Spread option on inflation paying the spread between two inflation indexes, for instance Spanish inflation and harmonized European inflation, with some capped and/or floor. Useful as a hedge against the inflation rates differential between different countries. Other slight variations of the inflation spread options are structures paying the maximum of two inflation rates.
- And many more exotics like quanto inflation structure, where the US inflation is paid in Euro, Best-Of, Worst-Of and all the standards correlation hybrids products structured on inflation and other assets, like equity stock, foreign exchange, fixed income, commodity and credit indexes, real capital guaranteed products, where the real notional is protected.

### Pricing and modeling

There are two types of approaches for modeling the inflation:

- Macro-economic based models describing and quantifying the impact of economic variables like the level of nominal interest rates, the output gap, the unemployment to describe the fundamentals that may affect the

inflation level. These models are extremely useful at forecasting the inflation level and are widely used by central banks. Typical example is a stochastic model based on the Taylor rules.

- Option pricing based models that ignore any fundamental impact but rather takes the dynamic of the inflation for granted and aim at providing option prices based on the assumed dynamics. These models are widely used by banks to price complex derivatives and to offer hedging solutions for them. For instance, proper modeling of inflation forecast and dynamics can be done using a multi-factor models that:
  - Calibrates easily market instruments
  - Is consistent with inflation forecast
  - Is linked against some general pricing engine like a Monte Carlo or a PDE engine to allow pricing of complex structures.

Entry category: Futures.

Key words:

Related articles: futures markets, inflation-protected securities.

Eric Benhamou<sup>1</sup>

Swaps Strategy, London, FICC,

Goldman Sachs International

---

<sup>1</sup> The views and opinions expressed herein are the ones of the author's and do not necessarily reflect those of Goldman Sachs

## Appendix: inflation market profile

