# Floating above it all

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*If you are interested in learning more about Turnleaf Analytics inflation forecasts and would be interested in a trial, please contact us*

## Trading DM IRS with Turnleaf Analytics inflation forecasts

*In this paper, we examine the relationship between inflation forecasts and interest rate swaps in developed markets. We create trading rules based upon inflation forecasts both in terms of where inflation will likely move compared to current levels and also by looking at the inflation forecast curve. We create systematic trading rules for developed market interest rate swaps using metrics based on our inflation forecasts. Our portfolio of various inflation forecast based trading rules for interest rate swaps has historical risk adjusted returns of 1.37 and annualised returns of 7.8% since 2018, which outperforms trend over the same period on the same assets.*

### Introduction

Interest rate swaps allow market participants to exchange fixed rate interest payments for floating payments and vice versa. The receiver in the swap, receives a fixed interest rate payment, funding it via a floating rate. If interest rates fall, they will profit. Conversely, a rise in interest rates, means they will lose money. The payer in the swap, meanwhile, pays the fixed interest rate, in exchange for a floating payment. The payer benefits from rising interest rates and loses during periods of falling interest rates. Thus intuitively it seems reasonable to expect that inflation forecasts are likely to be useful for trading interest rate swaps, given the link between inflation and rates. In Figure 1, we present the historical returns of a trading strategy on interest rates swaps which uses Turnleaf Analytics inflation forecasts as an input.

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| **Figure 1: Historical returns of an IRS trading strategy based on our inflation forecasts** |
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| *Source: Turnleaf Analytics, Bloomberg* |

Later in the paper, we shall go into detail into how the trading rules behind this portfolio are constructed. Furthermore, we will delve more deeply into the intuition behind the relationship between inflation and interest rates.

### Background on interest rate swaps

Before we discuss any trading rules, we give some background on interest rate swaps. We use our reference for interest rates swaps (Dynkin et. Al, 2007)[[1]](#footnote-1), which provides a very detailed summary. In the introduction, we noted the dynamics of P&L for interest rate swaps, namely that:

* a **receiver** receives fixed interest rates in exchange for floating rates
* a **payer** pays fixed interest rates in exchange for floating rates

If we consider the P&L for a receiver, it is akin to holding a fixed rate bond, and funding the position via a floating rate. If interest rates rise, then their fixed rate bond loses value, whilst you need pay more to fund it. If we want to construct a total return index for the P&L of a receiver, we need to understand the P&L for both the fixed leg P&L and the floating leg.

Rather than constructing the total returns index ourselves, we shall be using the Bloomberg Bellwether Total Return Indices for USD, EUR, GBP and CAD inflation swaps to measure the P&L from the perspective of a payer, across 2Y, 5Y and 10Y. The construction of the Bloomberg Bellwether Total Return indices[[2]](#footnote-2) is discussed at length in (Dynkin et. Al, 2007). We note that funding costs are not included in these indices, but given that our trading strategies we use later are not systematically long or short, it should not impact the P&L significantly, in particular given that funding rates were low during much of the historical sample. If funding rates were consistently high in the sample, and we were continually receiving fixed rates, this would not be the case.

We can illustrate the point about the similarity between being a receiver and holding a fixed income bond, funded by a floating rate if we examine fixed income futures returns. In Figure 2, we plot the returns for holding a US 10Y Treasury future which is rolled (and adjusting on rolls by the ratio) and the US 10Y Bellwether Total Returns Index. The swap rate is the fixed interest rate, which reflects the market expectation for what the floating rate (historically LIBOR, but now SOFR) will be over the lifetime of the swap.

We can see that the two indices are highly correlated, but not identical. Indeed, we typically observe a spread between the swap rate and the US 10Y Treasury yield, given the greater credit risk associated with banks versus the sovereign. At times of market stress, swap spreads tend to widen, and tighten during more benign periods.

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| **Figure 2: Total returns of swaps versus futures for US 10Y** |
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| *Source: Turnleaf Analytics, Bloomberg* |

### The intuition behind using inflation to understand interest rate swaps

Consider that rising inflation tends to be accompanied by central bank hiking. Conversely, falling inflation is often a signal for a more dovish central bank. This suggests that rising inflation is likely to be negative for receivers (given the impact on higher interest rates), whereas falling inflation is a positive (given that interest rates are likely to fall).

Hence, if we have an understanding of where inflation is likely to be heading, intuitively, we would expect inflation forecasts to be a useful input for trading interest rate swaps, and we can use this as a signal to switch between paying fixed rates and receiving. We shall later discuss how to create trading rules using these inflation forecasts for developed markets interest rate swaps.

### Background on Turnleaf Analytics inflation and growth (ISM) forecasts

In this section, we give some background on how Turnleaf Analytics inflation and growth (ISM) forecasts are constructed. Turnleaf Analytics uses several types of data to construct our forecasts. This data is drawn from many sources, including central banks, official statistical organisations, data vendors etc. which we list below:

* Macroeconomic data
  + This includes what we would traditionally expect to be used for inflation, such as unemployment data and growth data
* Market data
  + This includes FX, rates and commodities data
* Benchmark data
  + Benchmark/consensus inflation forecasts are used as an input
* Alternative data
  + This includes, for example, time series on pollution, which can be used as a proxy for industrial activity, and is available on a high frequency basis

This data is collected and then pre-processed. This pre-processing includes steps like checking for outliers, cleaning the data etc. As with other data science problems, the steps involving the collection and preparation of the data is the most time consuming.

The pre-processed data is then fed into a machine learning model. We have opted for a machine learning model, which:

* captures the non-linearities in the data (which for example an OLS cannot do effectively)
* is sufficiently simple, so it isn’t very data greedy like deep neural net

Our inflation model generates forecasts from 1 month out to 12 months, and is updated for each country once a month, a short time after the inflation release for that country. We also update our forecasts closer to the CPI release for many countries, i.e., we publish short term forecasts/nowcasts.

There are many potential use cases for inflation forecasts. In this paper, we shall explore a specific use case, looking at trading interest rates swaps, using Turnleaf Analytics’ CPI YoY NSA forecasts for inflation for several developed markets.

### Creating measures for inflation forecasts

Here, we create metrics based upon the inflation forecast curve, as well as the front-end forecasts. We shall look at two different metrics. First, we compare the inflation forecast for coming period against the latest print. In other words, is inflation forecast to go higher or lower over the next period? If we expect inflation to go lower, we’d be long the associated interest rate swap (ie. we’d be the receiver of fixed rates). Conversely, if inflation was going higher, we’d be short the interest rate swap (ie. we’d be the payer of fixed rates).

Second, we examine the inflation forecast curve, comparing the 3M forecast against the 1M forecast. If the 3 month inflation forecast is above the 1 month inflation forecast (ie. there’s a steepening of the inflation forecast curve), we’d be short the interest rate swap (ie. we should be a payer of fixed rates, expecting yields to go higher). If the 1 month inflation forecast is above the 3 month inflation forecast, then inflation curve is likely to flatten, we’d be long the interest rate swap (ie. we should be a receiver of fixed rates, expecting yields to go lower).

Below we define these metrics. In both cases, a rising metric is associated with higher inflation and yields, and a falling metric is indicative of falling inflation and yields.

* Inflation front-end forecasts metric = Turnleaf Analytics US CPI YoY NSA 3M forecast – last US CPI YoY NSA realised
* Inflation forecast curve metric = Turnleaf Analytics US CPI YoY NSA 1M forecast – Turnleaf Analytics US CPI YoY NSA 3M forecast

In Figure 3, we illustrate the relationship between the inflation forecast and interest rate swaps P&L, from the perspective of the payer. We plot the Bloomberg Bellwether Total Returns Index of US 10Y swaps one month in the future, versus the change in the inflation forecast compared to the last print. In this stylized example, we see how an increase in the inflation, is typically accompanied by a drop in P&L (and a fall in inflation is beneficial for P&L).

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| **Figure 3: Inflation forecast curve against IRS swaps 1 month into the future** |
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| *Source: Turnleaf Analytics, Bloomberg* |

### Trading rules for interest rate swaps using inflation forecasts

We have already discussed the intuition behind the relationship between interest rates swaps, yields and inflation. Here, we do a backtest of several trading strategies on interest rate swaps based on Turnleaf Analytics inflation forecasts to assess whether these relationships are reflected in the data.

Our trading rule for all interest rate swaps based on these metrics is straightforward:

* if the inflation metric is negative => go long interest rate swaps (ie. a receiver of fixed rates in exchange for floating rates, expecting inflation and hence yields to fall)
* if the inflation metric is positive => go short interest rate swap (ie a payer of fixed rates in exchange for floating rates, expecting inflation and hence yields to rise)

Our trading rule is triggered when the monthly Turnleaf Analytics forecast is updated (within 3 working days of the CPI release for that country). As discussed earlier, we shall be using the Bloomberg Bellwether Interest Rate Swap Total Return Indices and we’ll be applying a volatility target of 10% on each contract with max leverage of 5 in our trading rules. We also include transaction costs.

The reweighting of each interest rate swaps based on the volatility target will be applied at month end. It is important to apply volatility targeting for each interest rate swap given their associated levels of volatility can be vastly different.

### Historical backtest for the inflation forecast trading rules

In Figure 4, we show the historical results for our various inflation and trading based trading rule for a historical sample from 2018 across several developed markets (USD, EUR, GBP and CAD) and across several tenors. We also add a generic trend following rule for comparison.

We see that the inflation front end is generally the top performer, across most of the assets, with the exception of USD. Whilst, both inflation curve and trend based trading rules are also historically profitable, although in general less than the inflation front end trading rule.

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| **Figure 4: Historical returns for the inflation forecast based trading rules** |
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| *Source: Turnleaf Analytics, Bloomberg* |

In Figure 5, we create a trading basket based on each trading rule. We also create a portfolio which has both the inflation rules. We see that the best performer is the inflation front end strategy on a risk adjusted basis. The inflation curve and trend strategies have similar risk adjusted returns and annualised returns. However, the drawdown of the trend model is more than the inflation curve model.

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| **Figure 5: Baskets for the various inflation trading rules** |
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| *Source: Turnleaf Analytics, Bloomberg* |

We combine both the inflation trading rules into an equally weighted portfolio in Figure 6, This has risk adjusted returns of 1.37 and returns of 7.8%. We also note that our portfolio has higher risk adjusted returns compared to every individual basket (other than inflation back end). In particular, we see that the portfolio outperforms the trend basket.

The outperformance of the inflation forecast based portfolio against trend, suggests that we are capturing additional information looking at inflation forecasts which isn’t fully present in the underlying trend of the asset.

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| **Figure 6: Combining all inflation forecast trading rules into a portfolio** |
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| *Source: Turnleaf Analytics, Bloomberg* |

We decompose the returns for the various trading rules in Figure 7, on a year on year basis. We see that trend lost money in 2018 and 2023, but the inflation based trading rules were profitable in every year of our historical sample.

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| **Figure 7: Year on year returns of the inflation trading rules** |
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| *Source: Turnleaf Analytics* |

### Conclusion

In this note, we began by giving some background on interest rate swaps, notably, that a receiver in the swap, has similar exposure to an investor holding a fixed rate bond, funding it via a floating rate. Conversely, the payer, will be funding their floating exposure via a fixed leg.

Hence, the receiver’s P&L is likely to benefit from falling inflation (and hence falling yields), whereas the payers would be positively exposed to rising inflation (and thus yields to rise). We discussed the intuition of why inflation should be correlated to rates.

We also talked about how Turnleaf Analytics inflation forecasts are constructed and we created various metrics using these inflation forecasts. These inflation forecast metrics were used in various trading rules for interest rate swaps. A portfolio of inflation forecast trading rules for interest rate swaps has risk adjusted returns of 1.37 and annualised returns of 7.8% outperforming trend based strategies on the same assets using historical data since 2018.

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1. Lev Dynkin, Anthony Gould, Jay Hyman, Vadim Konstantinovsky & Bruce Phelps - Quantitative Management of Bond Portfolios (2007), Princeton University Press [↑](#footnote-ref-1)
2. Originally the Lehman Brothers Bellwether Indices [↑](#footnote-ref-2)