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Understanding Convexity Bias

To understand the convexity bias, you must understand the parallels between the Eurodollar futures market and the forward rate agreement (FRA) market. Both of these markets are large, liquid and have a vast influence on short-term interest rate pricing.

FRAs are an over the counter (OTC) bilateral agreement that allows the buyer/seller to notionally borrow/lend a specified amount at a ICE LIBOR-based linked rate over a forward period.

What is Convexity Bias?

Convexity bias appears in short-term interest rate instruments because of the payoff differences in the futures market versus the OTC FRA market (aka forward market).

For example, as Eurodollar futures (the underlying interest rate for Eurodollar futures) moves up and down, the payoff for the Eurodollar futures contract remains the same. If rates move up one basis point, the futures will change by $25.00 per contract. If rates move down one basis point, futures will also change by $25.00 per contract. Whether you profit or book a loss depends on if you are long or short on the futures.

With FRA agreements there is a convex payoff. Increases and decreases in rates produce differing payoffs. Its market value rises more for a given decline in rates than it would for a decline for the same size in the forward rate.

As rates decrease 10 basis points from 2.00 to 1.90, notice the Eurodollar (ED) futures lose $250,000, but the FRA payoff is 250,062. The same thing happens for an increase in rates. ED futures gain $250,000 but the FRA loses $62.00 less.

Remember ED futures move inversely with interest rates.

The table shows the convexity bias between a position of short 1000 Eurodollar (ED) futures and an offsetting short $1005m 3-month FRA (slightly more than $1000m to compensate for discounting methodology), both instigated at a rate of 2%.

- An increase in underlying rates from 2% to 2.10% would result in a credit to the variation margin account of short 1000 ED STIR position of $250,000 and a debit of slightly less than that in the discounted equivalent of $1005m-3M FRA collateral account (assuming zero threshold – zero threshold means every dollar of value change has to be made good.).
- A decrease in underlying rates of 10 basis points to 1.9% would result in a debit to the variation margin account of a short 1000 ED STIR position of $250,000 and a credit of slightly more than in the $1005m 3-month FRA collateral account (assuming zero threshold).

Source: STIR Futures—Trading Euribor and Eurodollar futures, by Stephen Aikin

The amount of the convexity is small at the short end of the curve. The example is using a three-month FRA and Eurodollar futures. Further out on the curve the convexity increases and sometimes dramatically.

Why is Convexity Important?

Although changes in the market have diminished the convexity phenomenon, fixed income traders have to be aware of the bias because of the effects on larger OTC transactions, like FRAs, that are further out on the yield curve. While the change might only be a few hundred dollars on a short term FRA, the changes in a 5-year FRA could be orders of magnitude higher, costing portfolio managers valuable capital.

Still the Eurodollar futures markets and the underlying FRA market closely track each other as spreading and arbitrage opportunities keep them from getting too far out of line.

What Contributes to Convexity Bias?

It is thought that the Convexity bias is due to the following:

- The way Eurodollar futures are margined versus an FRA instrument
- The cash flows paid out over the life of a futures contract versus an FRA. Futures are marked-to-market each day by the clearinghouse, while cash flows in an FRA are paid off differently.
- Volatility in the interest rate markets, generally increasing volatility could cause margin changes.

Final Considerations

Over the years since the financial crisis, the convexity bias has significantly declined. Since many OTC swaps/FRAs etc. have migrated to central counterparty clearing models such as the exchanges, the margining similarities have contributed to a decline in the convexity bias.

Uncleared margin rules also have impacted funding on OTC trading such as swaps and forward rate agreements. Higher funding rates should, in theory, drive such transactions to the exchanges, such as CME Group, where margin benefits and margin offsets can be realized.

Test your knowledge

Convexity bias is more pronounced

- Longer term instruments usually exhibit greater convexity bias
- Medium term FRA instruments
- Shorter term FRA instruments

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