Fitting the Bloomberg #23 yield curve: Notes

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Bloomberg's popular #23 LIBOR/swap-based yield curve is constructed by splicing together data from different segments of the market at different maturities (see Ron, 2000), specifically

- 3-month LIBOR at the short end.
- Eurodollar futures for intermediate maturities.
- Swap rates for longer maturities.

In their fitting algorithm 1 — piecewise-linear simple rates (Bloomberg, 2021) — simple interest rates are assumed to be a piecewise linear, continuous function of maturity, $r_s(t)$, with kinks at the input instruments' maturity dates. The simple interest rate and the discount factor for date d are related via:

$$DF(d_0, d) = \frac{1}{1 + r_s(\tau) \times \tau}. \tag{1}$$

Here d_0 is the settlement date, d is some future date, $DF(d_0, d)$ is the date-d_0 discount factor for date d, and $\tau = \tau(d_0, d)$ is the time interval between the two dates in years, which Bloomberg calculates using the ACT/360 convention. Outside the range of the input instruments' maturity dates, $r_s(t)$ is assumed constant, i.e.,

$$r_s(d) = \begin{cases} r_s(d_{\min}) & \text{if } d \le d_{\min}, \\ r_s(d_{\max}) & \text{if } d \ge d_{\max}. \end{cases}$$

Input data

Short maturities: cash rates

At the short end of the yield curve, Bloomberg uses 3-month LIBOR, quoted as a simple interest rate with the ACT/360 day-count convention.

Medium maturities: futures

The starting date of the period covered by the 3-month Eurodollar futures contracts in the input data is the third Wednesday of either a March, June, September or December. The ending date is the third Wednesday of the month three months later.

The quoted futures price is converted to an interest rate by subtracting it from 100.[1] This futures rate is then converted to a forward rate by subtracting a *convexity adjustment*.[2] Quoted forward rates use the ACT/360 day-count convention and simple interest. I.e.,

$$\text{Interest} = \text{quoted rate} \times \frac{\text{(actual) days in interest period}}{360}. \tag{2}$$

Long maturities: swaps

Payment dates By default, fixed (floating) swap payments occur every 6 (3) months on the same day of the month as the settlement date. E.g., if the settlement date is January 15, the fixed payment dates are July 15, the following January 15, etc., with some exceptions:

- When the settlement date is the last day of a month, all payments occur on the last day of their month. Thus, for a settlement date of February 28, 2019, the first floating payment is on May *31*, 2019, not May 28.[3]
- If a payment date calculated as above is a weekend or holiday, it is adjusted using the *modified-following* convention: it moves to the following working day if this is in the same month; otherwise, it moves back to the preceding working day.
- Holidays on which payments cannot be made include: New Year's Day, Martin Luther King, Jr. Day, Presidents Day, Good Friday, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Christmas, UK Spring/Summer bank holidays, Easter Monday and Boxing Day.

Payment amounts The size of the "fixed" payment on a swap is *not* actually fixed! Rather, it depends on the length of the relevant period:

$$\text{Fixed payment} = \$100 \times \text{swap rate} \times \frac{\text{days in payment period (30I/360)}}{360}. \tag{3}$$

[1] For an overview of Eurodollar futures contracts, see Bixby et al. (2019).

[2] Bloomberg (2017) describes how this adjustment is calculated, using the Hull and White (1990) model with a mean-reversion parameter of 0.03.

[3] This only applies to the last *calendar* day of the month. It would not apply to settlement dates of February 26, 2021 or even February 28, 2020, even though both are the last *working* day of the month.

Output data

Zero rates

Pre-2020, Bloomberg quoted zero rates as semi-annually compounded using the 30I/360 day-count convention, and interest calculations were done using compound interest:

$$1 + \text{interest} = \left(1 + \frac{\text{quoted rate}}{2}\right)^{2 \times \frac{\text{(30I/360) days in interest period}}{360}}.$$

Forward rates

- The output forward rates are quoted as simple rates (see Equation (2)) and use the ACT/360 day-count convention.
- Successive forward rates start on successive output dates. However, the forward rates do not necessarily end on the next output date. The end date of each forward period is 3 months after the start date, adjusted for weekends and holidays as necessary using the modified-following convention.

References

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