

Parsimonious yield curve modeling in less-liquid markets.

The liquidity-weighted Nelson-Siegel-Svensson framework (LW-NSS).

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Motivation

HETEROSKEDASTIC OBSERVATION NOISE ACROSS BONDS

- On a less-liquid sovereign curve, bond-level observation noise is strongly heterogeneous: daily turnover varies across issues by orders of magnitude, and a fixing on a rarely traded bond is a far noisier signal of the fundamental yield than one on a benchmark issue.
- Practitioners have long weighted parametric curve fits by turnover on intuition; the weighting scheme itself has lacked a microstructure foundation.
- Contribution: an explicit derivation of the efficient weight matrix for the Nelson–Siegel–Svensson fit from a dealer-market model of the fixing, and its empirical validation on the 21-year Polish panel.

The estimator

WEIGHTED NSS IN YIELD SPACE

The zero curve follows Svensson (1994):

$$y(\tau; \theta) = \beta_0 + \beta_1 \frac{1 - e^{-\tau/\tau_1}}{\tau/\tau_1} + \beta_2 \left(\frac{1 - e^{-\tau/\tau_1}}{\tau/\tau_1} - e^{-\tau/\tau_1} \right) + \beta_3 \left(\frac{1 - e^{-\tau/\tau_2}}{\tau/\tau_2} - e^{-\tau/\tau_2} \right)$$

fitted by weighted least squares on the observed bond-level yields:

$$\hat{\theta}_t = \arg \min_{\theta} \sum_i w_i (y_{it}^{obs} - y(\tau_{it}; \theta))^2$$

- The open question is the choice of w_i : equal weights, duration weights and ad-hoc turnover weights coexist in practice.

Microfoundation: a yield-space dealer market

GLOSTEN-MILGROM (1985) ADAPTED TO THE FIXING

- The fixing on bond i is modelled as a dealer's posterior over the fundamental yield after a Glosten–Milgrom quoting process run in yield space; in the active-trading regime the posterior variance is proportional to κ/μ_i , with μ_i the bond's turnover intensity.
- The efficient GLS weight is the inverse noise variance, hence $w_i = \mu_i$: turnover weighting is the information-matrix optimum, up to the common constant κ .
- Modified duration does not enter the noise process of a yield quote; it appears only as the Jacobian of the price-to-yield transformation in price-space implementations.

Monte Carlo evidence

EFFICIENCY UNDER THE CALIBRATED NOISE PROCESS

- Simulation experiments generate bond panels under the turnover-dependent noise process calibrated to the Polish market and compare equal-weight, duration-weight and turnover-weight NSS fits.
- The turnover-weighted estimator attains the lowest parameter and curve RMSE across the designs, including configurations with near-degenerate curvature (β_3 close to redundant), where parameter identification is weakest.

Empirical validation: the 21-year Polish panel

REFIT OF THE FULL HISTORY

- Refitting the daily Polish sovereign panel (BondSpot fixings, monthly Ministry of Finance turnover as the empirical μ_i) reduces the 21-year mean absolute fit error by 1.6 bp relative to the equal-weight NSS, while preserving the fitted curvature.
- The improvement concentrates where the theory predicts: on dates and segments where the turnover distribution across bonds is most uneven, i.e. where heteroskedasticity is strongest.

Downstream consequences

WEIGHTS PROPAGATE

- The fitted curve is an input to everything downstream: forwards, carry and roll-down computations, and affine term-structure estimation.
- The choice of weighting scheme therefore propagates into ACM term-premium estimates; the paper quantifies the wedge between weighting schemes at the standard tenors.
- For markets in the LLM cohort the message is methodological: curve-fitting weights are an identification choice with economically visible consequences, and they admit a derivation in place of a convention.

Companion data and replication

YIELDCARTOGRAPHY.COM

- Every curve on the site is an LW-NSS fit: daily since 2005, weights from BondSpot turnover and outstanding amounts, on yieldcartography.com/curves.
- Fit diagnostics (bond count, MAE) are published per date on the curves tab and on the cockpit's vintage row.
- The ACM-BRW term premia built on these curves update daily on [/term-premia/](https://yieldcartography.com/term-premia/).

Thank you.

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