Supply, habitat and the price of liquidity in less-liquid sovereign bond markets.

Evidence from Poland.

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Motivation and contribution

RESEARCH QUESTION

- The low-frequency liquidity-estimator literature is calibrated on deep markets; the supply-and-habitat literature (Greenwood–Vayanos 2014, Vayanos–Vila 2021) is estimated almost exclusively on US Treasuries. Both remain largely untested on the middle tier of sovereign curves.
- This paper treats liquidity as the dependent variable: what prices into bond-level spreads, into the segment-level supply channel, and into the aggregate term premium.
- Contribution: a bond-level and segment-level liquidity panel for the Polish sovereign curve over 2005–2026, five hypotheses spanning issue size, supply stocks, holder structure, monetary events and the primary-auction cycle, and a supply-block regression of the price of liquidity.

Setting: the less-liquid market (LLM) cohort

INSTITUTIONAL ENVIRONMENT

- Middle tier of sovereign curves: liquidity is priced by every dealer, yet tick-data estimators built for the deepest curves do not transfer. Daily venue fixings and monthly turnover are the highest-frequency public record, which dictates the low-frequency estimator set.
- Poland is arguably the best-instrumented cohort member: daily BondSpot fixings with quoted bid and ask, Ministry of Finance holdings by investor class, and a regulated venue with published quoting obligations (Annex G caps).
- Comparable markets: Brazil, Chile, Czechia, Hungary, India, Indonesia, Israel, Korea, Malaysia, Mexico, Singapore, South Africa, Thailand, Türkiye.

Hypotheses

TESTABLE PREDICTIONS AND EXPECTED SIGNS

- **H1 (issue size).** Outstanding amount enters negatively in all bond-level liquidity measures.
- **H2 (stocks versus flow).** Segment liquidity responds to stock variables (segment stock, residual-maturity concentration), while monthly gross issuance flow is uninformative conditional on them.
- **H3 (holder structure).** The post-2019 foreign buy-side retreat loads on Amihud, while the venue-capped quoted spread is unresponsive.
- **H4 (monetary transmission).** The liquidity response to MPC rate-change days differs pre- versus post-COVID.
- **H5 (auction cycle).** Primary Dealers absorb auctions at a concession; secondary yields revert over the following week, increasing in maturity.

Liquidity measures

LOW-FREQUENCY ESTIMATORS ON DAILY FIXINGS

For bond i in month t, from daily closing fixings (price p, bid b, ask a, turnover V, modified duration MD):

$$BAS_{it} = 10^4 \overline{\left(\frac{|a-b|}{p \cdot MD}\right)}, \qquad Amihud_{it} = \overline{\left(\frac{|r_d|}{V_d}\right)}, \qquad Roll_{it} = 2\sqrt{-\widehat{\mathrm{Cov}}(\Delta p_d, \Delta p_{d-1})}$$

- Duration scaling converts the quoted price spread into a yield-equivalent object, comparable across maturities.
- Completed by the Bao–Pan–Wang γ, the Corwin–Schultz high-low estimator, the zero-trading-days share, and an equal-weight composite z-score of the standardised measures.

Estimating equations

THREE LAYERS

Bond-month panel (H1–H3), bond fixed effects, Driscoll–Kraay SE:

$$L_{it} \;=\; \alpha_i + \beta' X_{it} + \gamma' M_t + \varepsilon_{it}$$

Aggregate monthly supply block (Result 4), Newey–West SE:

$$TP_t^{(\tau)} \;=\; \alpha + \beta_D\, Debt_t + \beta_F\, Foreign_t + \beta_N\, NBP_t + \beta_G\, \frac{Debt_t}{GDP_t} + \delta' M_t + u_t$$

Auction event study (H5), normalised yield path by segment s:

$$\Delta y_{s,k} \;=\; y_{s,\,t_e+k} - y_{s,\,t_e}, \qquad k \in [-5,\, +10] \text{ business days}$$

Result 1: issue size (H1)

BOND-MONTH PANEL, BOND FE, DRISCOLL-KRAAY SE

- Coefficient on log(outstanding) for the quoted spread: -3.5 bp, $p < 0.01$; on the composite z-score: -0.123, $p < 0.01$; the zero-trading-days share carries the same sign and significance.
- The sign is uniform across all six low-frequency estimators and survives the macro block and the post-2020 regime controls.
- Economically, outstanding amount is the single most robust bond-level covariate of liquidity in the panel, consistent with the H1 prediction and with the deep-market evidence on issue size.

Result 2: supply operates through stock variables (H2)

SEGMENT-MONTH PANEL, SEGMENT FE, DRISCOLL-KRAAY SE

- Monthly gross issuance is insignificant for segment liquidity once stock variables enter the specification.
- Trailing twelve-month issuance and log segment stock load monotonically; the residual-maturity concentration share loads positively on Amihud and on the zero-trading-days share.
- The supply margins priced into segment liquidity are therefore the level and the maturity composition of the outstanding stock; gross issuance flow is statistically irrelevant once stocks enter.

Result 3: the quote cap separates BAS from Amihud (H3)

IDENTIFICATION FROM THE VENUE RULEBOOK

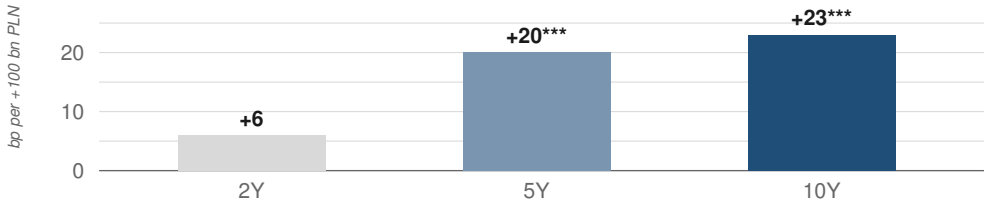
The foreign buy-side share of zloty-denominated sovereign debt fell from ∼33% to under 15% over 2019–2024. The two estimator families respond asymmetrically:

Under a binding quote cap, quote-based and volume-scaled estimators identify different objects; treating them as substitutes discards the identifying variation.

Result 4: the supply gradient on the term premium

MONTHLY TIME SERIES, NEWEY-WEST SE, ANDREWS BANDWIDTH

Coefficient on the total State Treasury debt level (per +100 bn PLN) in monthly regressions of ACM term premia on the supply block and macro controls, $n = 167$:



The supply block is jointly significant at 1% for all term-premium maturities ($F = 4.3$–9.5), insignificant for the venue-capped BAS ($F = 0.65$). Debt-to-GDP adds +3.3/+5.4/+8.1 bp at 2/5/10Y per pp; a COVID interaction triples the 10Y debt sensitivity post-2020. The tenor-increasing gradient is the preferred-habitat implication of Vayanos–Vila (2021).

Result 5: a mark-to-market counterfactual

THREE-CURVE PRESENT-VALUE SCENARIO, VALUATION DATE 2026-04-21

The outstanding fixed-cash-flow universe (951.9 bn PLN face; PS/DS/WS fixed-coupon plus OK zero-coupon issues) is repriced under three zero curves, discrete annual compounding, act/365.25:

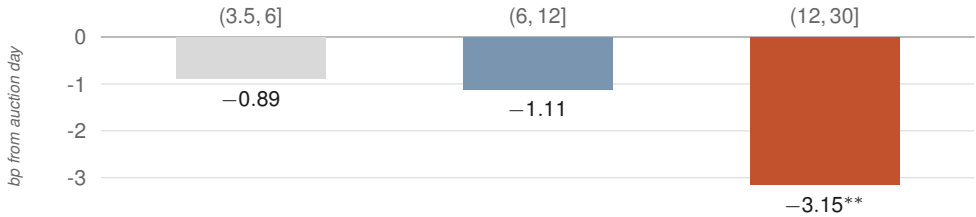
	curve	PV (bn PLN)	vs (A)
(A)	contemporaneous NSS	949.8	—
(B)	BRW risk-neutral (y^{rf} leg)	997.2	+4.99%
(C)	NSS net of the supply wedge	972.7	+2.41%

The wedge in (C) applies the Result-4 coefficients (23/81/92 bp at 2/5/10Y) to the 400 bn PLN debt rise of 2019–2025. The +22.9 bn PLN difference between (A) and (C) is the cumulated supply-attributable term-premium component of present value. First-order calculation; convexity effects are second order at these magnitudes.

Result 6: auction-cycle reversion (H5)

EVENT STUDY ON THE YIELD PATH, PRE-2022 SUB-SAMPLE

Segment-mean $\Delta y_{s,k}$ around auction trade dates at k = +5 business days; the macro-confounded 2022–23 hiking cycle is excluded:



Post-event yield drift is negative and increasing in maturity, consistent with an inventory risk premium; magnitudes match the US estimates of Lou–Yan–Chang (2013) and Sigaux (2018).

Interpretation

WHAT THE FIVE RESULTS ADD UP TO

- **Measurement.** Under a binding venue quote cap, quote-based and volume-scaled liquidity estimators carry distinct information sets; their divergence identifies the buy-side retreat that the quote conceals.
- **Pricing.** Supply prices into the term structure through stocks and maturity composition with a tenor-increasing gradient, the observable implication of preferred-habitat demand curves in a market without a deep arbitrage sector.
- **Magnitude.** The implied wedge is macro-relevant: roughly 2.4% of the sovereign universe's present value over one debt expansion, and about 23 bp at 10Y per 100 bn PLN of debt through the level channel alone.

Data and econometrics

SPECIFICATION SUMMARY

- **Panel.** Daily BondSpot closing fixings and turnover, 91 PLN-denominated sovereign bonds, 2005–2026; Ministry of Finance outstanding amounts, holdings by investor class, and a monthly macro block.
- **Measures.** Quoted bid-ask, Amihud, Roll, Bao–Pan–Wang γ, Corwin–Schultz, an equal-weight composite z-score, and the zero-trading-days share.
- **Estimation.** Bond-month and segment-month fixed-effects panels with Driscoll–Kraay (Bartlett kernel) standard errors; MPC and auction event studies (AAR/CAAR and normalised yield paths); aggregate monthly time-series regressions with Newey–West errors, Andrews (1991) bandwidth ($L \in [10, 14]$); joint F-tests on the supply block; first-difference robustness.
- **Valuation.** Three-curve present-value counterfactual on the fixed-cash-flow universe.

Companion data and replication

YIELDCARTOGRAPHY.COM

- The six measures and the composite are recomputed on the full BondSpot panel with every site build; normalisation constants are frozen on the paper sample, so the live series is directly comparable with the published one: `yieldcartography.com/liquidity`.
- The ACM–BRW term premia behind the supply regressions update daily on `/term-premia/`.
- Underlying CSVs are downloadable from the dashboards; the paper is open access.

Thank you.

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