



Does Interbank Funding Stress Predict Treasury Bill Yield Risk in Nigeria? Evidence from Volatility Persistence, Quantile Regression and Out-of-Sample Forecasts.

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Abstract: Treasury bills carry no default risk in naira, but their yields can move sharply, and a holder who needs to sell before maturity bears that risk. A common view among market practitioners is that turbulence in the interbank market, where banks fund themselves overnight, spills over into the bill market. This paper tests that view with monthly Central Bank of Nigeria data for February 2006 to March 2026. The risk measure is the absolute monthly change in the Treasury bill rate, and the funding-stress measure is the absolute monthly change in the interbank call rate. Across 241 months, bill-yield risk is clearly persistent: a one-point absolute change this month is followed by a 0.31-point absolute change next month (HAC $p = 0.004$). Interbank movements add nothing. Their coefficient is close to zero and insignificant in ordinary least squares, before and after 2021, with or without policy-rate and inflation controls, and at the median, 75th and 90th percentiles in quantile regressions. Months with the largest interbank moves are followed, if anything, by slightly smaller bill-yield changes. Out of sample, over February 2021 to March 2026, adding interbank information does not improve forecasts, and none of the models beats the historical mean significantly. The paper also shows that the positive interbank effect suggested by the published data arises from two zero entries in the bill-rate series. In Nigeria, bill-yield risk is driven by the bill market's own dynamics rather than by spillovers from overnight funding conditions.

Keywords: Treasury bills; funding liquidity; interest-rate risk; quantile regression; volatility; Nigeria

JEL classification: G12; G21; G17; C22

1. INTRODUCTION

Treasury bills are usually described as safe assets, and in one sense they are: the federal government has never failed to redeem a naira bill. But safety from default is not the same as safety from price changes. A bank, pension fund or money-market fund that buys a 364-day bill and has to sell it after three months will receive a price that depends on the yields prevailing at that time, and in Nigeria those yields can move a long way. In February 2024, the month the Central Bank of Nigeria (CBN) raised the monetary policy rate (MPR) by 400 basis points, the average Treasury bill rate rose from 4.3 to 17.0 per cent. A holder of bills bought at January yields would have suffered a substantial mark-to-market loss.

What drives such moves? An intuitive answer, often heard on Nigerian treasury desks, is that problems in bank funding markets spill over into the bill market. When the interbank call rate jumps, banks short of liquidity may sell bills to raise cash, and banks with surplus liquidity may demand higher yields before committing funds to term instruments. Brunnermeier and Pedersen (2009) provide a theoretical basis for this view: funding liquidity and market liquidity reinforce one another, so that tighter funding conditions reduce the willingness of intermediaries to hold securities and make their prices more volatile. If this mechanism operates in Nigeria, large movements in the interbank rate should be followed by large movements in bill yields.

There are also reasons to doubt it. The Nigerian interbank market is volatile for reasons that have little to do with the bill market, including large and irregular government flows, cash reserve debits and the timing of foreign-exchange auctions. Bill yields, in turn, are set at fortnightly primary auctions whose results depend on the Debt Management Office's borrowing needs and the CBN's liquidity management. The two markets may simply move to different drummers. A volatility series also tends to be highly persistent on its own, as the ARCH literature shows (Engle, 1982; Bollerslev, 1986), and any spillover from interbank stress has to be measured over and above that persistence.



This paper tests whether interbank funding stress helps to predict bill-yield risk in Nigeria. It makes three contributions. First, it defines a transparent, observable measure of bill-yield risk and estimates its persistence over twenty years of monthly data. Second, it tests whether interbank movements add to that persistence, not only for the average month but also in the upper tail of the risk distribution, using quantile regression (Koenker & Bassett, 1978). Third, it evaluates the question out of sample, which is the relevant test for anyone who would use interbank stress as an early-warning signal. It also documents how two zero entries in the published bill-rate series create a spurious funding effect.

The rest of the paper is organised as follows. Section 2 reviews the literature. Section 3 describes the data and Section 4 the methods. Section 5 presents the results, Section 6 discusses them and Section 7 concludes.

2. LITERATURE REVIEW

2.1 Funding liquidity and market liquidity

Brunnermeier and Pedersen (2009) model speculators who provide market liquidity but face margin constraints that depend on their funding conditions. When funding becomes scarce, speculators reduce their positions, market liquidity falls, prices become more volatile and margins rise further, producing a liquidity spiral. Gorton and Metrick (2012) document a version of this mechanism in the 2007–2008 run on the US repo market, where rising haircuts forced banks to sell assets. The theory implies that stress in funding markets should precede, or at least coincide with, greater price volatility in securities markets. For government securities specifically, Amihud and Mendelson (1991) show that differences in liquidity alone produce significant differences in yields between otherwise identical US Treasury notes and bills, which underlines how much liquidity conditions matter for the pricing of even the safest assets.

2.2 Measuring and predicting risk

Financial volatility is persistent. Engle (1982) introduced the autoregressive conditional heteroskedasticity (ARCH) model to capture this, and Bollerslev (1986) generalised it into the GARCH model. The practical implication for this paper is that any test of whether interbank stress predicts bill-yield risk must control for the bill market's own recent volatility. Risk is also about tails. Koenker and Bassett (1978) introduced quantile regression, which allows the effect of a predictor to differ across the conditional distribution of the outcome. Adrian and Brunnermeier (2016) use quantile methods to measure systemic risk (CoVaR), and Adrian et al. (2019) show that financial conditions predict the lower tail of GDP growth much better than its centre. The same logic suggests that interbank stress might matter for extreme bill-yield movements even if it has no effect on the average.

2.3 Nigerian evidence

Nigerian studies have examined volatility and spillovers between money and foreign-exchange markets. Atoi and Nwambeke (2020) use multivariate GARCH models for 2007–2019 and find a negative dynamic correlation between the bureau-de-change exchange rate and the interbank call rate, with volatility spillovers running from the foreign-exchange market to the money market. Oyinlola (2018) finds highly persistent volatility in the naira-dollar rate. On transmission within the money market, Tule (2014) finds that pass-through from the policy stance is stronger to lending rates than to Treasury bill rates, and Eleam et al. (2021) conclude that retail and money-market rates adjust slowly to changes in the CBN's standing-facility corridor. Mishra et al. (2012) note that thin and segmented markets weaken the links between short-term rates in low-income countries. None of these studies examines whether interbank stress predicts bill-yield risk.

2.4 Hypotheses

H1: The absolute change in the interbank rate in month t is unrelated to the absolute change in the Treasury bill rate in month $t + 1$, after controlling for the bill market's own recent volatility.

H2: The same holds in the upper quantiles of the distribution of bill-yield changes.

H3: Adding interbank movements to a model of bill-yield risk does not reduce out-of-sample forecast errors.

3. DATA

3.1 Sources and definitions

The Treasury bill rate, the interbank call rate and the MPR are monthly averages from the CBN money-market indicators (Central Bank of Nigeria, 2026b), and inflation is year-on-year headline inflation (Central Bank of Nigeria, 2026a). The sample runs from January 2006 to March 2026. The policy rate is the minimum rediscount rate until November 2006 and the MPR from December 2006.

The published bill-rate series records a value of exactly zero in December 2017 and December 2018, when yields were above 10 per cent, and the interbank series records zeros in four months between 2020 and 2022. These entries represent months without a reported rate and are replaced by linear interpolation. The correction matters a great deal for this paper because the risk measure is built from absolute changes: each zero creates two artificial bill-yield moves of more than ten points.

Let TB_t and IB_t denote the bill and interbank rates. The measures are

$$A^{TB}_t = |TB_t - TB_{t-1}|, A^{IB}_t = |IB_t - IB_{t-1}|,$$

and the target is next month's bill-yield risk, $Y_{t+1} = A^{TB}_{t+1}$. These are changes in quoted yields in percentage points, not portfolio returns. They are a simple and transparent proxy for the risk of holding bills, closely related to the realised volatility used in the volatility-forecasting literature. The estimation sample contains 241 predictor months from February 2006 to February 2026, with targets from March 2006 to March 2026.

3.2 Descriptive statistics

Table 1 summarises the data. The bill rate averaged 8.76 per cent and the interbank rate 12.98 per cent. Absolute monthly changes in the interbank rate (mean 4.33 points, median 1.93) were about six times as large as those in the bill rate (mean 0.71, median 0.41). Both distributions are extremely skewed. The bill-rate series has a kurtosis of almost 55, driven by a handful of very large moves such as the 12.7-point rise in February 2024.

Table 1 Descriptive statistics, February 2006 – February 2026

Variable	Mean	SD	Min	Median	Max	Skewness	Kurtosis
Treasury bill rate (%)	8.76	4.70	0.03	9.08	19.07	0.08	2.11
Interbank call rate (%)	12.98	8.61	0.77	11.10	64.58	1.64	8.11
$ \Delta T\text{-bill} $ (pp)	0.71	1.14	0.00	0.41	12.70	5.87	54.82
$ \Delta \text{Interbank} $ (pp)	4.33	6.79	0.00	1.93	51.47	3.32	17.57

Note. $N = 241$. pp = percentage points. Jarque–Bera tests reject normality for every series at the 5 per cent level.

Figure 1 shows the two rates. The interbank rate swings around the bill rate with far greater amplitude, particularly in 2008–2009, 2015–2018 and 2023–2024. The bill rate moves more smoothly, apart from a few abrupt shifts.

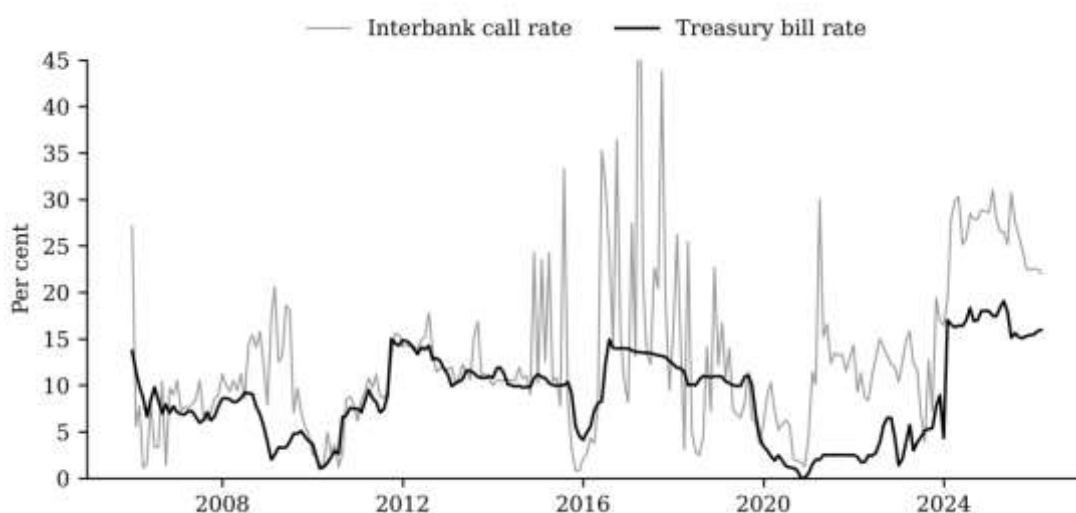


Figure 1. Treasury bill rate and interbank call rate, January 2006 – March 2026. The vertical axis is truncated at 45 per cent. Source: Central Bank of Nigeria.

The simple correlation between this month's interbank movement and next month's bill-yield movement is -0.06 . Figure 2 plots the two against each other. There is no visible relationship. The largest bill-yield moves occurred after months of modest interbank movement, and the largest interbank moves were mostly followed by small bill-yield changes.

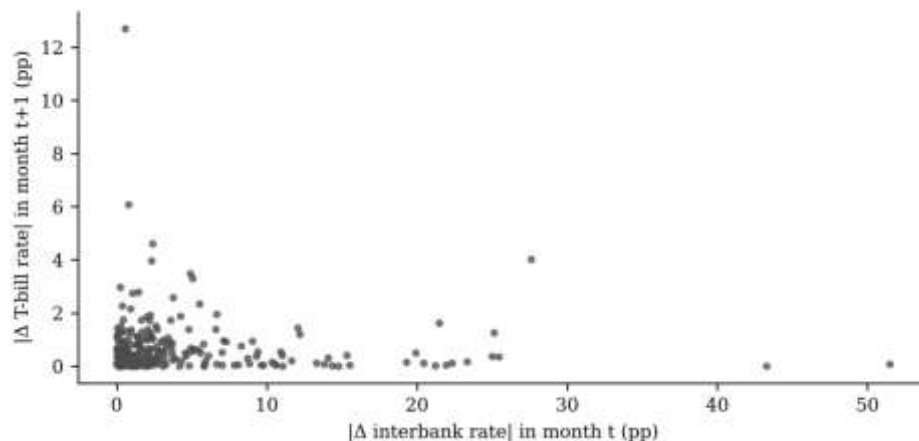


Figure 2. Absolute change in the interbank rate in month t against the absolute change in the Treasury bill rate in month $t + 1$, March 2006 – March 2026. Source: author's calculations.

4. METHODOLOGY

4.1 Mean regressions

The baseline model is

$$Y_{t+1} = \alpha + \beta_1 A^{TB}_t + \beta_2 A^{IB}_t + \varepsilon_{t+1},$$

and the full model adds the policy rate, inflation and a dummy for the January 2025 rebasing of the consumer price index. H1 implies $\beta_2 = 0$, and the funding-liquidity view predicts $\beta_2 > 0$. The models are estimated by ordinary least squares with Newey and West (1987) standard errors using three lags. A subsample estimate for 2006–2020 checks whether the result depends on the volatile post-2021 period.

4.2 Quantile regressions

To test H2, the baseline model is estimated as a quantile regression at the 50th, 75th and 90th percentiles of Y_{t+1} (Koenker & Bassett, 1978). If interbank stress matters mainly for extreme bill-yield moves, β_2 should be larger and more significant at the upper quantiles.

4.3 Forecast evaluation

Four forecasts of Y_{t+1} are compared: the historical mean; a model using only the bill market's own lagged volatility, A^{TB}_t (the "bill-yield history" model); that model plus A^{IB}_t ; and the full model with policy rate and inflation. The first 180 observations form the initial estimation window. Each model is then re-estimated every month with an expanding window and used to forecast the next month, giving 61 forecasts for targets from February 2021 to March 2026. Accuracy is measured by the root mean squared error (RMSE) and mean absolute error (MAE). Models are compared with the bill-yield history model using the Diebold and Mariano (1995) test with the Harvey et al. (1997) correction, and the nested comparison of the interbank-augmented model against it uses the Clark and West (2007) test.

5. RESULTS

5.1 Persistence of bill-yield risk

Table 2 reports the mean regressions. Bill-yield risk is persistent. In the reduced model, a one-point absolute change in the bill rate this month is followed by an expected absolute change of 0.31 points next month, over and above the unconditional mean ($p = 0.004$). The coefficient is almost identical before 2021 (0.30, $p = 0.001$) and in the full model with policy and inflation controls (0.28, $p = 0.005$). Persistence alone explains about 10 per cent of the variation in next month's bill-yield risk.

Table 2 Mean regressions for next month's absolute change in the Treasury bill rate

Regressor	Reduced model	Full model	2006–2020
Intercept	0.513*** (0.099)	0.385 (0.235)	0.447*** (0.093)
$ \Delta T\text{-bill} (t)$	0.308*** (0.108)	0.284*** (0.102)	0.304*** (0.094)
$ \Delta \text{Interbank} (t)$	−0.006 (0.009)	−0.007 (0.010)	−0.002 (0.010)
Policy rate (t)		−0.025 (0.023)	
Inflation (t)		0.034 (0.024)	
CPI rebasing dummy		−0.033 (0.291)	
Observations	241	241	179
R ²	0.099	0.118	0.096

Note. Dependent variable: absolute change in the Treasury bill rate in month $t + 1$ (percentage points). Newey–West HAC standard errors with three lags in parentheses. *** $p < 0.01$.

5.2 Does interbank stress add anything?

It does not. The coefficient on the absolute interbank change is −0.006 in the reduced model ($p = 0.498$), −0.007 in the full model ($p = 0.471$) and −0.002 before 2021 ($p = 0.849$). The point estimates are small and slightly negative, and the standard errors are small enough to rule out economically meaningful positive effects: even at the upper end of the 95 per cent confidence interval in the reduced model, a ten-point interbank move would add only about 0.1 points to next month's expected bill-yield change. Neither the policy rate nor inflation is significant either. H1 cannot be rejected.

A simple comparison makes the same point. In the 61 months in which the absolute interbank change was in its top quartile (at least 4.82 points), the following month's absolute bill-yield change averaged 0.60 points, against 0.74 points in other months. The medians were 0.32 and 0.45. The difference goes in the opposite direction to the funding-stress hypothesis, although it is not significant (Welch $p = 0.304$; Mann–Whitney $p = 0.077$). Large bill moves of more than two points followed 6.6 per cent of the high-stress months and 5.6 per cent of other months.

5.3 The upper tail

Table 3 reports the quantile regressions. The persistence of bill-yield risk grows sharply in the upper tail. The coefficient on lagged bill-yield risk is 0.28 at the median, 0.51 at the 75th percentile and 0.98 at the 90th percentile, all highly significant. A large bill move this month is followed by a much higher probability of another large move next month. Interbank movements, by contrast, have no effect at any quantile. The coefficients are −0.008, −0.010 and 0.002, and none is close to significance. H2 cannot be rejected. Funding stress does not show up even in the tail of the bill-risk distribution, where the funding-liquidity mechanism would be expected to bite hardest.

Table 3 Quantile regressions for next month's absolute change in the Treasury bill rate

Quantile	$ \Delta T\text{-bill} (t)$	p	$ \Delta \text{Interbank} (t)$	p
0.50	0.278	0.000	−0.008	0.176
0.75	0.505	0.000	−0.010	0.339
0.90	0.980	0.000	0.002	0.901

Note. $N = 241$. Each row is a separate quantile regression of the absolute change in the bill rate in month $t + 1$ on its own lag and the absolute change in the interbank rate in month t .

5.4 Out-of-sample forecasts

Table 4 reports the forecasting results. Over February 2021 to March 2026, the historical mean has the lowest RMSE (1.794) and MAE (0.842). The bill-yield history model and the interbank-augmented model are almost identical (RMSE 1.880 and 1.877), and the full model is slightly worse. None of the differences is statistically significant. The Clark–West test of the interbank-augmented model against the bill-history model gives a one-sided p -value of 0.155. H3 cannot be rejected.

Table 4 Out-of-sample forecasts of bill-yield risk, February 2021 – March 2026 (61 forecasts)

Model	RMSE	MAE	DM vs bill	
			history	p
Historical mean	1.794	0.842	0.293	0.771
Bill-yield history	1.880	0.889	–	–
Bill history + interbank	1.877	0.892	0.982	0.330
Full model	1.895	0.931	−0.342	0.734



Note. Percentage points. DM = Diebold–Mariano statistic with the Harvey et al. (1997) correction; positive values favour the model in the row over the bill-yield history model. Clark–West test of bill history + interbank against bill history: statistic 1.01, one-sided $p = 0.155$.

The fact that the historical mean does best out of sample, despite the clear in-sample persistence, reflects the nature of the evaluation period. It contains a few enormous bill-yield moves, especially in early 2024, that no model anticipated. After such a move, the persistence models predict another large move; when it does not come, they incur a large error. The historical mean is not affected in this way. This is a common feature of volatility forecasting in samples dominated by rare jumps.

5.5 The effect of the zero entries

If the bill-rate series is used as published, the conclusions change. The coefficient on interbank movements becomes positive (0.027), the coefficient on lagged bill risk rises to 0.385 and the R^2 rises from 0.099 to 0.162. In addition, months in the top quartile of interbank movement appear to be followed by much larger bill-yield moves (an average of 1.33 points against 0.75 in other months). These results arise because each zero entry creates two bill-yield changes of more than ten points, one down and one back up, in a series whose median absolute change is 0.41 points. A handful of such outliers is enough to drive both the measured persistence and the apparent funding effect. Once the two entries are corrected, the interbank effect disappears.

5.6 Alternative measures of funding stress and risk

The absolute change in the interbank rate is only one way to measure funding stress. Two alternatives give the same answer. The absolute gap between the interbank rate and the MPR, which measures how far the overnight rate has moved from the policy corridor, has a coefficient of 0.009 ($p = 0.517$) when added to the bill-history model. The standard deviation of interbank changes over the previous three months has a coefficient of essentially zero ($p = 0.962$). Changing the target to the average absolute bill-yield change over the next three months, which smooths out single-month jumps, also leaves interbank movements insignificant (-0.003 , $p = 0.736$), while the bill market's own persistence remains significant (0.16, $p = 0.019$). Whichever way funding stress or bill risk is measured, the interbank market carries no predictive information about bill-yield risk.

6. DISCUSSION

The evidence on interbank spillovers is uniformly negative. Across mean and quantile regressions, different sample periods, with and without controls, and in and out of sample, interbank movements do not help to predict the size of the next month's bill-yield change. What does predict it is the bill market's own recent behaviour, especially in the tail: a large bill move is likely to be followed by another.

There are several reasons why the funding-liquidity mechanism may be weak in Nigeria at a monthly frequency. First, much of the volatility in the interbank rate reflects temporary liquidity swings, such as the timing of federal allocations to states, cash reserve debits and foreign-exchange auction settlements, which reverse within days and do not change banks' willingness to hold bills over a month. Second, bills are largely held to maturity by banks that use them to meet liquidity ratio requirements, so there is less forced selling in response to funding pressure than the Brunnermeier–Pedersen mechanism assumes. Third, bill yields are set at primary auctions whose outcome depends heavily on the Debt Management Office's borrowing programme and the CBN's own liquidity operations. When the CBN tightens, it often does so through open market operations and reserve requirements that move both markets at once, but the timing of these moves is not well captured by the previous month's interbank volatility. Finally, monthly averages smooth out the daily spikes in which a funding squeeze would be most visible.

The strong persistence in the tail has a practical meaning. The 90th-percentile coefficient of almost one suggests that after a large repricing, the market remains unsettled for at least another month. For risk management, this is more useful information than the interbank rate.

6.1 Implications

For bank treasurers and fund managers holding Treasury bills, the results suggest that a sudden jump in the interbank rate is not, by itself, a reason to expect a large move in bill yields the following month. The bill market's own recent volatility is a better guide, especially to the risk of extreme moves. For the CBN, the weak link between the two markets is consistent with the slow and partial transmission found in other Nigerian studies and suggests that interbank volatility is not a major channel through which the bill market is destabilised. For researchers, the paper is a further example of how two recording errors in a widely used series can produce a statistically significant but spurious result.

6.2 Limitations

The risk measure is the absolute change in a monthly average yield, which understates intramonth volatility and does not correspond to the return on a specific bill. The interbank measure is similarly coarse. Daily data on bill yields,



interbank rates and open-buy-back rates would allow a sharper test. The analysis does not identify exogenous funding shocks; it tests only whether observed interbank movements carry predictive information. The evaluation period is dominated by a few large moves, so the out-of-sample comparison has limited power. Finally, the analysis does not consider other possible measures of funding stress, such as the spread between the interbank rate and the policy rate, the use of the standing lending facility or banks' net positions with the CBN.

7. CONCLUSION

This paper has asked whether turbulence in Nigeria's interbank market helps to predict the risk of holding Treasury bills. It does not. Over 2006–2026, absolute changes in the bill rate were persistent, especially in the upper tail, but absolute changes in the interbank rate added nothing to that persistence in mean regressions, in quantile regressions or out of sample. An apparent spillover in the published data is caused by two zero entries in the bill-rate series. Bill-yield risk in Nigeria is driven by the bill market's own dynamics, and investors should look there, rather than to the overnight funding market, for warning signs.

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