Internet Appendix

A Liquidity Measures

In this section, we briefly describe our monthly illiquidity measures. Following Roll (1984), we get *Roll* measure which captures the negative auto-covariance of trade price changes. Specially, we compute the monthly *Roll* measure for an individual bond i as:

$$\text{Roll}_{i,\tau} = 2\sqrt{-cov(R_{i,u-1,\tau}, R_{i,u,\tau})} \tag{A1}$$

where $R_{i,u-1,\tau}$ and $R_{i,u,\tau}$ are daily returns of two consecutive trading days, u-1 and u, within the same month, τ, and the covariance is computed for bond i in the same month τ. *Roll* is set to be missing when the monthly covariance is positive.

Following Amihud (2002), we utilize bond returns and trading dollar volume to construct *Amihud* illiquidity ratio. Specially, the monthly *Amihud* measure is:

$$\text{Amihud}_{i,\tau} = \frac{1}{N}\sum_{u=1}^{N}\frac{|R_{i,u}|}{Q_{i,u}} \tag{A2}$$

where N is the number of positive-volume trading days for bond i in a given month τ. $R_{i,u}$ and $Q_{i,u}$ are the return and dollar trading volume, per million dollars, for bond i when there is at least one trade on day u of month τ. The return $R_{i,\tau}$ is calculated from daily closing prices on day u and its most recent trading day.

The third measure is the spread between the high and low daily transaction prices. Corwin and Schultz (2012) propose that daily high prices correspond to buy orders and low prices are likely from sell orders. They utilize the *Highlow* ratio on consecutive days to separate the security variance and the bid-ask spread. Because the variance component is proportional to time while the bid-ask spread should be constant, we construct $Highlow_{i,u}$ as:

$$\text{Highlow}_{i,u} = \frac{2\cdot(e^{\alpha_{i,u}}-1)}{1+e^{\alpha_{i,u}}} \tag{A3}$$

where

$$\alpha_{i,u} = \frac{\sqrt{2\cdot\beta_{i,u}}-\sqrt{\beta_{i,u}}}{3-2\cdot\sqrt{2}} - \sqrt{\frac{\gamma_{i,u}}{3-2\cdot\sqrt{2}}}, \tag{A4}$$

$$\beta_{i.u} = \sum_{s=0}^{1} \left(log \left(\frac{H_{i,u+s}}{L_{i,u+s}} \right) \right)^2, \tag{A5}$$

$$\gamma_{i,u} = \left(log \left(\frac{H_{i,u,u+1}}{L_{i,u,u+1}} \right) \right)^2 \tag{A6}$$

$H_{i,u}$ and $L_{i,u}$ are the highest and lowest price for bond i on day u. $H_{i,u,u+1}$ and $L_{i,u,u+1}$ are the highest and lowest price for bond i on two consecutive days u and $u+1$. We use the mean value of daily *Highlow* values in a month to get a monthly *Highlow* illiquidity measure for each bond.

B Dealer Inventory Cycle

A dealer inventory cycle counts the number of consecutive trading days that aggregate dealer inventory of an individual bond stays positive or negative. On each trading day, dealers' aggregate trading of a bond shall equate to the aggregate trading of customers (non-dealers). A positive inventory cycle for a bond means that dealers' overall inventory of the bond is positive. Conversely, a negative inventory cycle occurs when customers purchase the bond and dealers thus have a negative aggregate inventory on it.

We follow Anand et al. (2021) to define bond inventories and construct bond dealers' inventory cycles for all bonds traded in the secondary market using the enhanced version of the TRACE dataset. The following filters are applied: i) inter-dealer transactions are excluded, thus all in sample observations are transactions among dealers and customers (the dealer buy-sell indicator is B or S); ii) transactions for bonds with a zero recorded par value reported in FISD are deleted; and iii) bonds with reported trading size exceeding recorded par value are excluded. After imposing the filters above, the sample contains 54.9 million transactions for 15,618 unique bonds.

We then estimate the daily dealer inventory change of an individual bond by aggregating net trading dollar amounts across all dealers for each sample bond on each day. We set dealer inventory on the first trading day in the sample period to be zero and a new cycle begins when aggregated dealers' cumulative inventory crosses zero, and the cycle ends if it crosses zero again from the opposite direction. We exclude cycles with less than 5 trading day lengths.

We follow Anand et al. (2021) to use 63 trading days (three calendar months) as the threshold to separate cycles into short cycles and long cycles. Within the first 63 trading days for a bond cycle, we calculate the cumulative changes in dealer inventories from the beginning of the cycle. Alternatively, when a cycle goes beyond 63 trading days, we calculate a bond's dealer *inventory* using a 63-day rolling imbalance. In both cases, the current cycle ends when the inventory crosses zero. We only consider cycles with more than $10 million peak inventory as qualified cycles. Our final sample consists of 164,980 valid dealer inventory cycles for 14,065 bonds. The average cycle length is over 60 calendar days and the average peak inventory is around 25 million, which is comparable to Anand et al. (2021).

C Insurer Attributes Related to Liquidity Provision

The capital ratio, abbreviated as *CR*, is the ratio of an insurer's total adjusted capital to the authorized control level risk-based capital. Total adjusted capital is the amount of capital confirmed by insurance regulators. The authorized control level risk-based capital is the threshold level of capital for an insurer to avoid regulator control. It is the 100% of the number determined under the risk-based capital formula (NAIC, 2012).

Operational cash flow, abbreviated as *CF*, is a life insurer's underwriting cash flow reported in the cash flow statement in million USD.

Investment in BBB-rated bonds, abbreviated as *%BBB*, is the holding amount of bonds rated between BBB- and BBB+ in a year scaled by all holding bonds in the year.

Holding horizon, abbreviated as *HR*, is the average holding horizon of an insurer's corporate bond portfolio. It is estimated following Cremers and Pareek (2016) for an insurer's holding horizon of an individual corporate bond first then averaging across all bonds held by the insurer.

$$\text{HR}_{i,j,t} = \sum_{i=1}^{n_{j,t}} \sum_{\tau=1}^{t} \frac{(t-\tau) * \alpha_{i,j,\tau}}{H_{i,j,t}} \tag{C1}$$

where τ is any specific month between 1, the first month for insurer j to hold bond i and maintain the current month t. $\alpha_{i,j,\tau}$ is the amount of bond i purchased or sold by insurer j in month τ scaled by the par value of bond i; $H_{i,j,t-1}$ is insurer j's holding of bond i in month $t-1$; $n_{j,t}$ is the number of bonds held by insurer j in month t.

D Procedure to Estimate Bond-Monthly Net Purchase

We obtain the predicted value of an insurer's corporate bond net purchase in year t, $\widehat{INP_{j,t}}$ based on the first-stage regression.

$$\widehat{\text{INP}_{j,t}} = \widehat{\beta}\text{UWE}_{j,t} + \widehat{\boldsymbol{\gamma}'}\boldsymbol{c_{j,t}} \tag{D1}$$

Subsequently, in the second stage, we analyze the impact of insurer net purchases on bond liquidity. This analysis is more intricate than a typical second-stage regression for two main reasons. First, bond liquidity is measured on a monthly frequency, distinct from the annual frequency at which the predicted values of insurer net purchases are observed. Second, performed for individual bonds, it deviates from the insurer-level regression conducted in the first stage.

To deal with the first issue, we estimate the expected $\widehat{INP_{j,\tau}}$ of individual months of an insurer j using the estimated seasonality factor based on aggregated net purchases (scaled by the insurer's total assets) across all insurers. To quantify the seasonality factor, we aggregate all life insurers' net purchases in dollars across all bonds in the sample in each month and regress them on month-of-year indicators:

$$\text{Buy}_\tau - \text{Sell}_\tau = \gamma_m + \zeta_t + \epsilon_\tau \tag{D2}$$

where Buy_τ ($Sell_\tau$) is the aggregate dollar bond purchase amount (sales amount) of all sample insurers in the month τ; γ_m represents the effect of a calendar month in a year (m = 1, ..., 12) and ζ_t represents the year fixed effect.

γ_m from Eq. (D2) is used to estimate the proportion of an insurer's net purchase in m, a given calendar month of the year, as $f_m = \frac{\gamma_m}{\sum_{\tau=1}^{12} \gamma_m}$. Subsequently, using f_m, we estimate net purchases of a specific insurer j in month τ of year t by distributing the insurer's net purchase in year t:

$$\widehat{\text{INP}}_{j,\tau} = \widehat{\text{INP}}_{j,t} * f_m \tag{D3}$$

Next, to address the second concern that the second-stage regressor is not the same as the predicted value based on the first-stage regression, we first apply an allocation rule to distribute $\widehat{INP}_{j,\tau}$ to individual bonds, $\widehat{INP}_{i,j,\tau}$, based on insurer j's holding of bond i in month τ, $H_{i,j,\tau}$, in the insurer's aggregate bond holding.

$$\widehat{\text{INP}}_{i,j,\tau} = \widehat{\text{INP}}_{j,\tau} * \frac{H_{i,j,\tau}}{H_{j,\tau}} \tag{D4}$$

Finally, recognizing that *INP* is scaled by individual insurers' lagged total assets in Eq. (D4) but net purchase used in the second stage regression is scaled by an individual bond's par value, we further adjust $\widehat{INP}_{i,j,\tau}$ using $\frac{TA_{j,\tau-1}}{Par_{i,\tau-1}}$:

$$\widehat{\text{NP}}_{i,j,\tau} = \widehat{\text{INP}}_{i,j,\tau} \frac{TA_{j,\tau-1}}{Par_{i,\tau-1}} \tag{D5}$$

where $TA_{j,\tau-1}$ is insurer j's total assets at the beginning of month τ, and $\text{Par}_{i,\tau-1}$ is the par value of bond i at the beginning of month τ. This gives us the expression of the aggregate net purchase of bond i across all individual insurers as below:

$$\widehat{\text{NP}}_{i,\tau} = \sum_j \widehat{\text{NP}}_{i,j,\tau} \tag{D6}$$

Table A1: Insurer Bond Net Purchase and Bond Liquidity: Using Quarterly Rolling *NP*

This table reports panel regression results for monthly bond illiquidity. Panel A presents the results for all corporate bonds and Panel B presents the results for BBB bonds with a 5-year or longer maturity. The dependent variable is bond illiquidity measured by *Roll*, *Amihud*, or *Highlow* in month τ respectively. Key explanatory variables are i) $\Sigma_j NP^3_{i,j,\tau-1}$, the sum of 3-month rolling average net purchases across insurers; ii) $\Sigma_j NP^3_{i,j,\tau-1} X_{\tau-1}$, the sum of the 3-month rolling net purchase in rainy days; iii) $\Sigma_j NP^3_{i,j,\tau-1} HLS_{j,\tau-1}$, the sum of the 3-month rolling net purchase by high *LS* insurers; and iv) $\Sigma_j NP^3_{i,j,\tau-1} HLS_{j,\tau-1} X_{\tau-1}$, the sum of the 3-month rolling net purchase by high *LS* insurers in *RD* periods. $NP^3_{i,j,\tau-1}$ is the rolling 3-month net purchase of bond i by insurer j from month $\tau-3$ to $\tau-1$. $LS_{j,\tau-1}$ is the liquidity supply score of insurer j; $HLS_{j,\tau-1}$ is an indicator variable for high *LS* insurer equal to 1 if $LS_{j,\tau-1}$ is in the above-median group of month $\tau-1$ and zero otherwise. $X_{\tau-1}$ is a binary indicator that identifies the "rainy day" periods. It equals 1 when the difference in the proportions of bonds in positive and negative dealer inventory cycles exceeds the median of these fractional differences observed from the beginning of the sample to month τ-1, and equals zero otherwise. Control variables include *BondSize*, *Maturity*, *BondAge*, and bond rating dummies. The coefficients on control variables are not reported. The t-statistics reported in the parentheses are based on standard errors of two-way clustered (by month and by the bond issuer). *, **, and *** indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: All Bonds

	Roll (1)	Amihud (2)	Highlow (3)	Roll (4)	Amihud (5)	Highlow (6)	Roll (7)	Amihud (8)	Highlow (9)
$\Sigma_j NP^3_{i,j}$	-2.15***	-0.68***	-1.12***	-1.44***	-0.67***	-0.86***	-3.16***	-0.86***	-1.47***
	(-6.77)	(-7.39)	(-9.06)	(-3.65)	(-4.99)	(-5.18)	(-6.17)	(-4.63)	(-6.79)
$\Sigma_j NP^3_{i,j} X$				-1.56***	-0.03	-0.57**	2.54***	0.64***	0.73**
				(-3.03)	(-0.19)	(-2.42)	(3.56)	(2.61)	(2.43)
$\Sigma_j NP^3_{i,j} HLS_j$							4.60***	0.51	1.65***
							(3.96)	(1.60)	(3.19)
$\Sigma_j NP^3_{i,j} HLS_j X$							-10.77***	-1.73***	-3.42***
							(-5.52)	(-3.30)	(-4.46)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj R^2	0.19	0.19	0.13	0.19	0.19	0.13	0.19	0.19	0.13
N	496,516	549,154	549,373	496,516	549,154	549,373	496,516	549,154	549,373

Panel B: Bonds of BBB Ratings with a 5-year or Longer Maturity

	Roll (1)	Amihud (2)	Highlow (3)	Roll (4)	Amihud (5)	Highlow (6)	Roll (7)	Amihud (8)	Highlow (9)
$\Sigma_j NP^3_{i,j}$	-2.70***	-0.79***	-1.54***	-1.35***	-0.62***	-1.14***	-2.66***	-0.61**	-1.95***
	(-5.61)	(-5.30)	(-8.35)	(-2.74)	(-3.17)	(-5.21)	(-4.06)	(-2.55)	(-6.31)
$\Sigma_j NP^3_{i,j} X$				-2.99***	-0.37*	-0.86***	0.61	0.24	0.43
				(-4.09)	(-1.70)	(-2.64)	(0.67)	(0.82)	(1.04)
$\Sigma_j NP^3_{i,j} HLS_j$							3.34**	-0.03	2.10***
							(2.39)	(-0.06)	(3.19)
$\Sigma_j NP^3_{i,j} HLS_j X$							-8.86***	-1.48**	-3.28***
							(-4.44)	(-2.37)	(-3.99)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj R^2	0.14	0.18	0.07	0.14	0.18	0.07	0.14	0.18	0.07
N	109,973	124,243	124,311	109,973	124,243	124,311	109,973	124,243	124,311

Table A2: Insurer Bond Net Purchase and Bond Liquidity: Sub-Period Analysis

This table reports the results of panel regressions for monthly bond illiquidity in three subsample periods: i) pre-crisis, ii) crisis, and iii) post-crisis, respectively in Panels A, B, and C. The dependent variable is bond illiquidity measured by *Roll*, *Amihud*, or *Highlow* in month τ respectively. Key explanatory variables are i) $\Sigma_j NP^{12}_{i,j,\tau-1}$, the sum of 12-month rolling average net purchases across insurers; ii) $\Sigma_j NP^{12}_{i,j,\tau-1} X_{\tau-1}$, the sum of the 12-month rolling net purchase in rainy days; iii) $\Sigma_j NP^{12}_{i,j,\tau-1} HLS_{j,\tau-1}$, the sum of the 12-month rolling net purchase by high *LS* insurers; and iv) $\Sigma_j NP^{12}_{i,j,\tau-1} HLS_{j,\tau-1} X_{\tau-1}$, the sum of the 12-month rolling net purchase by high *LS* insurers in *RD* periods. $NP^{12}_{i,j,\tau-1}$ is the rolling 12-month net purchase of bond i by insurer j from month $\tau - 12$ to $\tau - 1$. $LS_{j,\tau-1}$ is the liquidity supply score of insurer j from month $\tau - 12$ to $\tau - 1$; $HLS_{j,\tau-1}$ is an indicator variable for high *LS* insurer equal to 1 if $LS_{j,\tau-1}$ is in the above-median group of month $\tau - 1$ and zero otherwise. $X_{\tau-1}$ is a binary indicator that identifies the "rainy day" periods. It equals 1 when the difference in the proportions of bonds in positive and negative dealer inventory cycles exceeds the median of these fractional differences observed from the beginning of the sample to month $\tau - 1$, and equals zero otherwise. Control variables include *BondSize*, *Maturity*, *BondAge*, and bond rating dummies. The coefficients on control variables are not reported. The t-statistics reported in the parentheses are based on standard errors of two-way clustered (by month and by the bond issuer). *, **, and *** indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Pre Crisis

	Roll (1)	Amihud (2)	Highlow (3)	Roll (4)	Amihud (5)	Highlow (6)	Roll (7)	Amihud (8)	Highlow (9)
$\Sigma_j \mathrm{NP}^{12}_{i,j}$	-0.95***	-0.62***	-0.82***	-0.60*	-0.56***	-0.67***	-4.69***	-0.96***	-2.35***
	(-2.99)	(-5.15)	(-5.07)	(-1.82)	(-4.84)	(-3.93)	(-7.85)	(-5.74)	(-7.65)
$\Sigma_j \mathrm{NP}^{12}_{i,j}\mathrm{X}$				-7.67***	-1.17***	-3.37***	-1.72	-0.22	-1.07*
				(-6.45)	(-5.66)	(-6.34)	(-1.42)	(-0.46)	(-1.85)
$\Sigma_j \mathrm{NP}^{12}_{i,j}\mathrm{HLS}_j$							11.15***	1.09***	4.57***
							(8.42)	(3.35)	(6.63)
$\Sigma_j \mathrm{NP}^{12}_{i,j}\mathrm{HLS}_j\mathrm{X}$							-17.42***	-2.95**	-6.63***
							(-4.31)	(-2.21)	(-3.94)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj R^2	0.23	0.24	0.17	0.23	0.24	0.17	0.23	0.24	0.17
N	154,094	170,676	170,731	154,094	170,676	170,731	154,094	170,676	170,731

Panel B: In Financial Crisis

	Roll (1)	Amihud (2)	Highlow (3)	Roll (4)	Amihud (5)	Highlow (6)	Roll (7)	Amihud (8)	Highlow (9)
$\Sigma_j \mathrm{NP}^{12}_{i,j}$	-11.02***	-3.34***	-3.89***	-6.28**	-2.58***	-1.96**	-7.98**	-3.49***	-2.53**
	(-7.73)	(-7.97)	(-8.95)	(-2.26)	(-4.35)	(-2.09)	(-2.56)	(-3.95)	(-2.35)
$\Sigma_j \mathrm{NP}^{12}_{i,j}\mathrm{X}$				-13.26***	-2.00***	-5.11***	-3.79	-0.14	-1.68
				(-3.41)	(-3.02)	(-4.38)	(-0.98)	(-0.13)	(-1.27)
$\Sigma_j \mathrm{NP}^{12}_{i,j}\mathrm{HLS}_j$							4.30	2.32	1.43
							(1.04)	(1.40)	(1.03)
$\Sigma_j \mathrm{NP}^{12}_{i,j}\mathrm{HLS}_j\mathrm{X}$							-26.30***	-5.00*	-9.45***
							(-3.19)	(-1.74)	(-2.79)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj R^2	0.13	0.19	0.10	0.13	0.20	0.10	0.13	0.20	0.10
N	57,249	65,006	65,064	57,249	65,006	65,064	57,249	65,006	65,064

Panel C: Post Crisis

	Roll (1)	Amihud (2)	Highlow (3)	Roll (4)	Amihud (5)	Highlow (6)	Roll (7)	Amihud (8)	Highlow (9)
$\Sigma_j \text{NP}^{12}_{i,j}$	-1.16***	-0.65***	-0.56***	3.39**	-0.15	1.43**	0.17	-0.52	-0.02
	(-3.40)	(-7.50)	(-3.22)	(2.50)	(-0.64)	(2.12)	(0.14)	(-1.52)	(-0.04)
$\Sigma_j \text{NP}^{12}_{i,j}\text{X}$				-5.39***	-0.59**	-2.34***	-1.18	-0.21	-1.06*
				(-3.20)	(-2.18)	(-2.81)	(-0.85)	(-0.58)	(-1.66)
$\Sigma_j \text{NP}^{12}_{i,j}\text{HLS}_j$							8.41**	0.97	3.78**
							(2.17)	(1.30)	(2.13)
$\Sigma_j \text{NP}^{12}_{i,j}\text{HLS}_j\text{X}$							-10.65**	-1.00	-3.42*
							(-2.54)	(-1.29)	(-1.78)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj R^2	0.28	0.27	0.16	0.28	0.27	0.16	0.28	0.27	0.16
N	285,173	313,472	313,578	285,173	313,472	313,578	285,173	313,472	313,578

Table A3: Effect of Life Insurer Net Purchase of Comparable Bonds on Bonds Not Traded by Insurers in Prior 12 Months

This table reports the results of panel regressions of life insurers' net purchase of comparable bonds on illiquidity of bonds not traded by sample life insurers during the previous 12-month period. The dependent variable is the bond illiquidity (*ILQ*), measured by *Roll*, *Amihud*, or *Highlow* in month τ respectively. $\text{CNP}^{12}_{i,j,\tau-1} = \Sigma_{i' \in \mathcal{C}(i)} w_{i',j,\tau-1} \text{NP}^{12}_{i',j,\tau-1}$ where $\mathcal{C}(i)$ denotes a set of comparable bonds for a sample bond i when these two bonds i) have the same credit rating, ii) have similar maturity (the maturity difference within 6 months), and iii) are from the same industry (with the same first digit SIC code). $HLS_{j,\tau-1}$ and $X_{\tau-1}$ are defined in the same way as in Table 6. Key explanatory variables include i) the sum of net purchases of matching bonds by all life insurers scaled by the aggregated matching bonds par value ($\Sigma_j CNP^{12}_{i,j,\tau-1}$), ii) the sum of net purchases of matching bonds by all life insurers in *RD* periods *X* ($\Sigma_j CNP^{12}_{i,j,\tau-1} X_{\tau-1}$), iii) the sum of net purchases of similar bonds by high *LS* insurers ($\Sigma_j CNP^{12}_{i,j,\tau-1} HLS_{j,\tau-1}$), and iv) the sum of net purchases of similar bonds by high *LS* insurers in rainy days ($\Sigma_j CNP^{12}_{i,j,\tau-1} HLS_{j,\tau-1} X_{\tau-1}$). The same control variables used in Table 6 are applied. The t-statistics reported in the parentheses are based on standard errors of two-way clustered (by time and by the bond issuer). *, **, and *** indicate statistical significance at the 1%, 5%, and 10% level, respectively.

	Roll (1)	Amihud (2)	Highlow (3)	Roll (4)	Amihud (5)	Highlow (6)
$\Sigma_j \text{CNP}^{12}_{i,j}$	23.25**	4.44	14.10***	7.94	-0.21	12.39***
	(2.29)	(1.13)	(3.45)	(0.70)	(-0.05)	(2.84)
$\Sigma_j \text{CNP}^{12}_{i,j}\text{X}$	-50.96***	-14.28***	-25.00***	-14.83	-3.87	-16.10***
	(-3.95)	(-3.03)	(-5.03)	(-1.13)	(-0.76)	(-3.17)
$\Sigma_j \text{CNP}^{12}_{i,j}\text{HLS}_j$				41.71	12.71	4.60
				(1.36)	(1.31)	(0.46)
$\Sigma_j \text{NP}^{12}_{i,j}\text{HLS}_j\text{X}$				-92.99***	-26.88**	-22.39**
				(-2.63)	(-2.42)	(-1.99)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Adj R^2	0.24	0.20	0.23	0.24	0.20	0.22
N	25,606	29,178	29,224	25,524	29,081	29,127