

The Stock-Bond Correlation: A Tale of Two Days in the U.S. Treasury Bond Market

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The Dual Role of U.S. Treasury in Global Markets

- U.S. Treasury Bonds: The deepest and single most important market in the world.
- **As a destination of safety**
 - ▶ Flights to safety ([Baele, Bekaert, Inghelbrecht, and Wei 2019](#)).
 - ▶ Global safety demand for UST ([Jiang, Krishnamurthy, and Lustig 2023](#)).
- **As a source of risk**
 - ▶ Interest rate risk – 2013 taper tantrum and FOMC rate hikes.
 - ▶ Inflation risk – 2021 inflation surge.
 - ▶ Dealer capacity risk – 2020 dash for cash ([Duffie, Jackson Hole 2023](#)).
- While the notion of UST as the primary safe haven is widely accepted, concerns over its resilience have only begun in recent years.
 - ▶ A well functioning UST: important for global markets and essential for USA.
- **Our paper:** A measure to capture UST safety and, more importantly, its riskiness.

Part I: A Measure for Dual UST – Stock-Bond Correlation

- We use high-frequency SPX E-mini (SPX) and 10-Year T-Note (UST) futures to construct a daily stock-bond correlation measure. For day t ,

$$\rho_t^{\text{UST}} = \text{corr} (R_{i,t}^{\text{SPX}}, R_{i,t}^{\text{UST}} \mid i \in t),$$

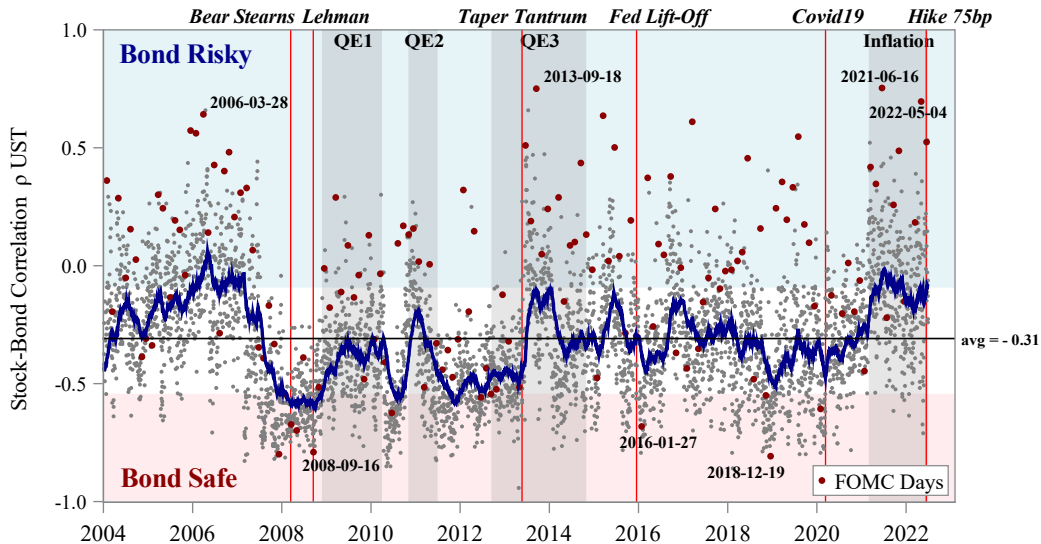
where $R_{i,t}^{\text{SPX}}$ and $R_{i,t}^{\text{UST}}$ are 5-minute SPX and UST returns realized on day t .

- Use ρ_t^{UST} to sort days into bond safety (lower 20%) and bond risky (upper 20%).

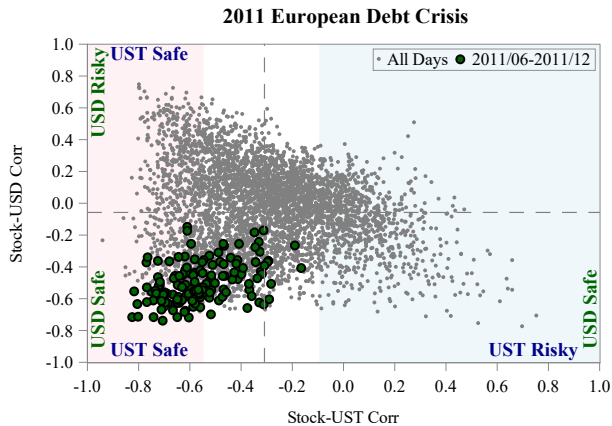
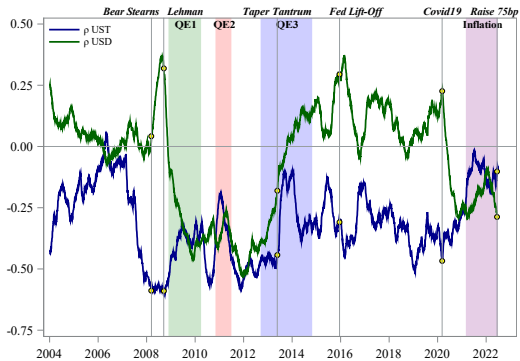
	mean	std	min	20%	median	80%	max
ρ_t^{UST}	-0.31	0.26	-0.94	-0.54	-0.33	-0.10	0.75
			UST Safety			UST Risky	
ρ_t^{USD}	-0.06	0.28	-0.77	-0.33	-0.04	0.18	0.75
			USD Safety			USD Risky	

- We further construct ρ_t^{USD} , ρ_t^{UST2Y} , and ρ_t^{UST3M} as alternative measures.

High-Frequency Stock-Bond Correlation ρ_t^{UST}

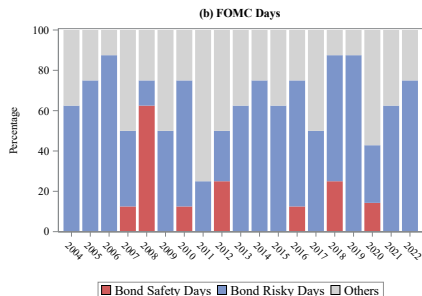
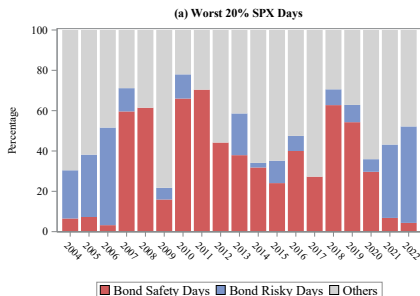


The Safety of UST vs. USD



What is Captured by the Stock-Bond Correlation Measure ρ_t^{UST} ?

- Three states with diverging sources of risks:
 - S=1: SPX is the main source of risk, with UST serving as the safe haven.
 - S=2: UST is the main source of risk (interest-rate, inflation, and liquidity).
- ρ_t^{UST} informs the probability, $\text{Prob}(S_t = i)$, of the regimes.
- An illustrative example:



Performance of Key Assets Under Dual UST

Bond Safety Days (Lower 20% of ρ_t^{UST})

	SPX	UST	DXY	EUR/USD	YEN/USD
Mean Return (bps)	-36.20*** [-8.04]	13.60*** [9.57]	1.20 [0.63]	-2.08 [-0.90]	15.83*** [6.72]
CAPM α (bps)		5.03*** [4.42]	-0.89 [-0.49]	0.96 [0.44]	6.11*** [3.13]
Δ Implied Vol (%)	0.51*** [6.48]	0.79*** [4.68]	0.07*** [3.75]	0.07*** [3.42]	0.14*** [4.28]
Δ Volatility (%)	1.11*** [4.22]	-0.02 [-0.21]			
Δ Volume (std)	0.25*** [7.29]	0.15*** [5.22]			
Daily ETF Flow (\$m)	-162.85** [-2.04]	13.09*** [2.61]			
Δ Net Position (std) Primary Dealers		0.40** [2.07]			

- Sharp decline in SPX; significant rally in UST.
- Large spikes in implied vol across the board.
- Significant SPX outflow and UST inflow.
- Primary dealers increase net UST position.

Bond Risky Days (Upper 20% of ρ_t^{UST})

	SPX	UST	DXY	EUR/USD	YEN/USD
Mean Return (bps)	13.75*** [4.76]	-6.05*** [-3.92]	2.14 [1.22]	-1.93 [-0.98]	-8.29*** [-4.16]
CAPM α (bps)		-7.96*** [-4.92]	3.61** [2.06]	-4.99** [-2.53]	-9.97*** [-5.06]
Δ Implied Vol (%)	-0.16*** [-4.12]	-0.11 [-0.96]	-0.03*** [-3.13]	-0.03** [-2.47]	-0.04*** [-3.04]
Δ Volatility (%)	-0.25** [-2.12]	0.28*** [3.64]			
Δ Volume (std)	-0.00 [-0.12]	0.12*** [3.97]			
Daily ETF Flow (\$m)	10.02 [0.11]	-6.26 [-1.03]			
Δ Net Position (std) Primary Dealers		-0.60*** [-3.88]			

- UST: decline in price and increase in volatility.
- Increase in SPX and reduction in VIX.
- Increased trading volume in UST, but not in SPX.
- Primary dealers reduce net UST position.

Further Evidence: Global Assets Under Dual UST

- We use global asset returns to estimate the day- t stock and bond factors via

$$R_t^i - r_f = a_t + \beta_{i,t-1}^S F_t^{\text{Stock}} + \beta_{i,t-1}^B F_t^{\text{Bond}} + \epsilon_t^i,$$

where the factor loadings are estimated over a 3-year rolling window.

- The performance of the extracted stock and bond factors:

	US. Equity		US. Fixed Income		FX+Commodity	
	F^{Stock}	F^{Bond}	F^{Stock}	F^{Bond}	F^{Stock}	F^{Bond}
Bond Safety Days	-54.40*** [-6.70]	22.95 [1.61]	-103.14*** [-5.47]	17.12*** [8.20]	-43.27*** [-3.57]	29.30*** [3.27]
Bond Risky Days	15.60*** [2.72]	-22.00*** [-2.69]	47.34*** [3.46]	-7.52*** [-4.69]	-1.41 [-0.14]	-27.09*** [-3.10]
Other Days	12.77*** [3.09]	-12.24* [-1.78]	58.06*** [6.07]	-1.42 [-1.50]	11.62* [1.91]	-6.99 [-1.56]

Part II: A Tale of Two Days – Summary of Main Results

- On bond safety days, safety matters the most:
 - ▶ Global asset returns are determined by their relative safety, not fundamentals.
 - ▶ Treasury convenience yield widens, indicating increased demand for UST safety.
 - ▶ Significant reduction in UST term premium, driven by flights-to-safety.
 - ▶ The otherwise positive linkage between USD and UST breaks down – the decrease in UST yield not accompanied by USD depreciation.
- On bond risky days, UST risk takes center stage:
 - ▶ Significant increase in UST term premium, driven by increased duration risk.
 - ▶ The positive linkage between USD and UST strengthens – the increase in UST yield accompanied by double the appreciation of USD.
 - ▶ A stock+bond model outperforms the CAPM in explaining global asset returns.
 - ▶ UST is the source of risk: intraday UST return can predict SPX.

UST Safety – Widening of UST Convenience Yield

- UST basis is y_t^{UST} minus a currency-hedged synthetic government bond yield.
- Negative basis indicates UST convenience: lower funding cost for US government.
- Our result: it is the safety of UST, not USD, that drives the UST convenience.

	1-Year			5-Year		
	$\Delta\text{UST Basis}$	$\Delta\text{UST Basis}$ (CIP Adj.)	$\Delta\text{Swap Spread}$	$\Delta\text{UST Basis}$	$\Delta\text{UST Basis}$ (CIP Adj.)	$\Delta\text{Swap Spread}$
UST Safety Days	-0.66*** [-3.51]	-0.45*** [-3.07]	-0.43*** [-3.01]	-0.51*** [-4.04]	-0.36*** [-3.36]	-0.26*** [-2.76]
UST Risky Days	0.1 [0.93]	0.03 [0.35]	-0.06 [-0.80]	-0.07 [-0.74]	-0.05 [-0.62]	-0.08 [-1.26]
USD Safety Days	0.23 [1.58]	0.21* [1.73]	0.14 [1.32]	0.07 [0.64]	0.13 [1.34]	0.14* [1.68]
USD Risky Days	0.05 [0.37]	0.12 [1.24]	0.14 [1.56]	-0.03 [-0.24]	0.05 [0.57]	0.09 [1.23]
Intercept	0.07 [0.85]	0.02 [0.38]	0.04 [0.71]	0.11* [1.87]	0.05 [1.10]	0.03 [0.87]
NOBS	4423	4423	4423	4428	4428	4428
R2 (%)	0.55	0.37	0.4	0.47	0.29	0.31

UST Safety – UST Basis Widening Unique to UST Safety

$$\Delta \text{UST Basis} = \overbrace{\Delta y^{\text{US}} - \Delta(y^{\text{FX}} - (f - s))}^{\text{Decomposition \#1}} = \overbrace{\Delta(y^{\text{US}} - y^{\text{FX}}) + \Delta(f - s)}^{\text{Decomposition \#2}}$$

Synthetic Treasury Yield
Hedging Cost

Maturity: 1-Year		Decomposition #1		Decomposition #2	
	$\Delta \text{UST Basis}$	Δy^{UST}	$\Delta(y^{\text{FX}} - (f - s))$	$\Delta(y^{\text{UST}} - y^{\text{FX}})$	$\Delta(f - s)$
UST Safety Days	-0.51*** [-3.16]	-1.02*** [-5.97]	-0.51*** [-2.62]	-0.95*** [-5.77]	0.44** [2.33]
Matched Days (without bond safety features)					
Matching Criterion	$\Delta \text{UST Basis}$	Δy^{UST}	$\Delta(y^{\text{FX}} - (f - s))$	$\Delta(y^{\text{UST}} - y^{\text{FX}})$	$\Delta(f - s)$
(1) by Δy^{UST}	-0.14 [-0.93]	-1.02*** [-6.17]	-0.88*** [-4.75]	-0.95*** [-6.07]	0.81*** [4.69]
(2) by UST10Y Ret	0.23* [1.81]	-0.09 [-0.88]	-0.33** [-2.37]	-0.11 [-0.97]	0.34** [2.53]
(3) by SPX Ret	-0.08 [-0.59]	-0.34** [-2.57]	-0.25* [-1.87]	-0.29** [-2.20]	0.21 [1.55]
(4) by ΔVIX	-0.07 [-0.57]	-0.04 [-0.40]	0.03 [0.22]	-0.06 [-0.55]	-0.01 [-0.09]

Transmission of UST to USD

	USD Return (bps)	
$\Delta y^{\text{UST}} \times \text{UST Safety}$		-1.39*** [-2.79]
$\Delta y^{\text{UST}} \times \text{UST Risky}$		1.89*** [4.36]
Δy^{UST} (bps)	1.52*** [6.96]	1.16*** [4.43]
$R^{\text{SPX}} \times \text{UST Safety}$		0.04* [1.68]
$R^{\text{SPX}} \times \text{UST Risky}$		-0.04 [-1.57]
R^{SPX} (bps)	-0.09*** [-7.65]	-0.08*** [-5.26]
UST Safety	-0.11 [-0.06]	-0.83 [-0.41]
UST Risky	1.63 [0.85]	0.75 [0.38]
Intercept	0.36 [0.42]	0.27 [0.31]
NOBS	4604	4604
R2 (%)	4.97	6.46

- USD appreciates when UST yield increases.
 - ▶ 1 bps increase in y^{UST} leads to 1.52 bps increase in USD return.
- On UST safety days, this transmission breaks down.
 - ▶ Reductions in UST yield due to flights-to-safety do not translate to USD depreciation.
- On UST risky days, this transmission more than doubles.
 - ▶ Increase in UST yield due to heightened risk in UST leads to amplified USD appreciation.

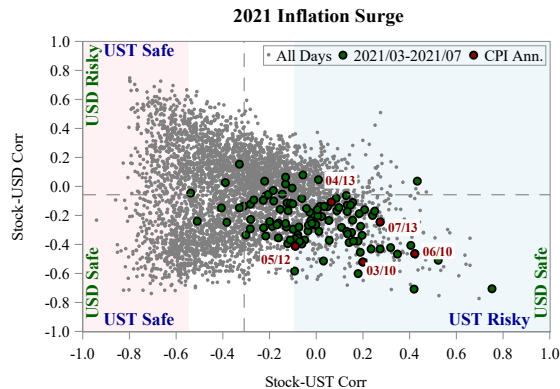
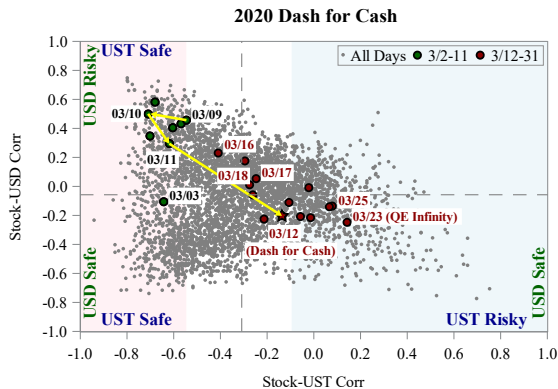
UST Term Premium

	Panel A: Adrian, Crump, and Moench (2013)					Panel B: Kim and Wright (2005)				
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
UST Safety Days	-0.99*** [-4.71]	-0.82*** [-3.78]	-0.99*** [-4.72]	-0.59*** [-2.91]	-0.63*** [-2.94]	-0.84*** [-8.06]	-0.63*** [-5.52]	-0.84*** [-8.05]	-0.58*** [-5.64]	-0.51*** [-4.74]
UST Risky Days	0.45** [2.31]	0.44** [2.22]	0.50** [2.55]	0.45** [2.28]	0.53*** [2.74]	0.37*** [3.40]	0.35*** [3.20]	0.41*** [3.74]	0.36*** [3.17]	0.42*** [3.79]
FTS by Baele et al. (2019)		-1.97* [-1.82]			-0.81 [-0.82]		-2.38*** [-7.52]			-1.64*** [-5.18]
FOMC			-0.61 [-1.11]		-0.90* [-1.67]			-0.46 [-1.53]		-0.51* [-1.74]
SPX worst 20%				-1.60*** [-5.60]	-1.70*** [-6.50]				-1.13*** [-8.90]	-1.05*** [-8.46]
SPX best 20%				1.97*** [8.57]	1.88*** [8.11]				0.86*** [8.02]	0.80*** [7.73]
VIX top 20%					0.32 [1.11]					0.14 [0.89]
VIX bottom 20%					-0.30** [-2.03]					-0.21** [-2.33]
Δ Noise					1.63*** [2.99]					0.14 [0.59]
Δ TYF Vol					0.00 [0.09]					-0.01 [-0.48]
Intercept	0.06 [0.60]	0.08 [0.77]	0.07 [0.71]	-0.10 [-1.00]	-0.02 [-0.19]	0.07 [1.22]	0.09 [1.59]	0.07 [1.38]	0.07 [1.26]	0.11 [1.64]
NOBS	4570	4570	4570	4570	4557	4570	4570	4570	4570	4557
R2 (%)	0.81	1.13	0.86	5.3	5.99	2.42	4.36	2.51	8.23	9.23

Part III: A Unique Measure of UST Riskiness – Summary of Results

- We document significantly higher stock-bond correlation ρ_t^{UST} under increased
 - ▶ Interest-rate risk: releases of FOMC decisions and minutes.
 - ▶ Dealer capacity risk: quarter ends and increased issuance of 10Y UST notes.
- Captured by ρ_t^{UST} are prominent examples when UST becomes a source of risk:
 - ▶ 2013 taper tantrum – interest rate risk.
 - ▶ 2020 dash for cash – lack of UST resilience.
 - ▶ 2021 inflation surge – inflation risk.
 - ▶ 2022 rate hikes – interest rate risk.
- By contrast, existing measures of market risk (e.g., VIX, MOVE, and HPW Noise) are not designed specifically to capture the UST riskiness.

UST Riskiness – Prominent Episodes Captured by ρ_t^{UST}



UST Riskiness – Interest Rate Risk

	N	$\Delta\rho^{UST}$	ΔVIX	$\Delta MOVE$	$\Delta Noise$	$\Delta UST Vol$	$\Delta SPX Vol$
FOMC Announcement Days	147	0.30*** [10.18]	-0.52*** [-3.26]	-2.30*** [-6.63]	0.07*** [2.92]	2.19*** [6.53]	2.66*** [5.60]
<i>rate hike</i>	29	0.30*** [5.63]	-0.66** [-2.13]	-2.26*** [-3.83]	0.10* [1.72]	2.43*** [6.75]	2.94*** [2.72]
<i>rate unchanged</i>	107	0.31*** [9.64]	-0.42** [-2.28]	-1.83*** [-5.35]	0.06** [2.26]	2.09*** [5.01]	2.17*** [3.95]
<i>rate cut</i>	11	0.18* [1.74]	-1.19 [-1.31]	-6.91*** [-2.89]	0.11** [2.16]	2.57*** [5.08]	6.66*** [4.15]
FOMC Minutes Release	146	0.10*** [3.39]	-0.09 [-0.99]	0.18 [0.78]	-0.03 [-1.34]	0.44** [2.24]	0.07 [0.15]
<i>rate hike</i>	28	0.06 [1.14]	-0.17 [-1.33]	0.45 [0.90]	-0.06 [-0.94]	0.79** [2.25]	0.33 [0.38]
<i>rate unchanged</i>	107	0.13*** [3.90]	-0.09 [-0.86]	0.18 [0.75]	-0.02 [-1.07]	0.42* [1.76]	-0.14 [-0.21]
<i>rate cut</i>	11	-0.12*** [-4.68]	0.06 [0.08]	-0.42 [-0.25]	0.00 [0.09]	-0.27 [-0.25]	1.55 [1.40]

UST Riskiness – Dealer Capacity

	N	$\Delta\rho^{\text{UST}}$	ΔVIX	ΔMOVE	ΔNoise	$\Delta\text{UST Vol}$	$\Delta\text{SPX Vol}$
Quarter End	74	0.04** [1.97]	-0.17 [-0.83]	0.27 [1.11]	0.04 [0.98]	0.10 [0.30]	-0.96 [-1.10]
<i>post Volcker Rule</i>	28	0.09*** [2.98]	-0.50** [-1.98]	-0.09 [-0.19]	0.08 [1.13]	-0.08 [-0.28]	0.49 [0.56]
Month End (ex. Qtr End)	148	0.03* [1.84]	0.40*** [3.77]	0.59** [2.28]	0.05** [2.46]	1.92*** [3.63]	0.42 [0.64]
<i>post Volcker Rule</i>	56	0.06* [1.89]	0.50*** [2.68]	0.87** [2.12]	0.03 [1.23]	0.15 [0.22]	0.60 [0.93]
10Y UST Auctions	74	0.00 [0.22]	0.32 [1.19]	-0.12 [-0.27]	-0.03 [-0.88]	0.32 [1.05]	-0.53 [-0.58]
<i>with Increased Off. Amt.</i>	14	0.13*** [2.64]	0.06 [0.11]	-1.37 [-1.09]	-0.16 [-1.62]	-0.75 [-1.40]	-6.18* [-1.86]
<i>post Volcker Rule</i>	7	0.22** [2.56]	-0.13 [-0.14]	-0.69 [-1.27]	0.02 [0.88]	-0.87 [-1.00]	-9.59 [-1.60]
5Y UST Auctions	222	0.02 [1.25]	-0.02 [-0.21]	0.50* [1.68]	0.01 [0.37]	0.41*** [2.68]	-0.44 [-1.13]
<i>with Increased Off. Amt.</i>	37	0.06 [1.51]	0.2 [0.53]	0.7 [0.67]	-0.02 [-0.38]	1.07** [2.43]	0.38 [0.35]
<i>post Volcker Rule</i>	17	0.02 [0.39]	0.32 [0.47]	0.26 [0.62]	0.04 [1.44]	0.03 [0.08]	0.98 [0.46]

UST Riskiness – UST Leading SPX in Intraday Pricing

	Bond Risky Days		Other Days		Full Sample	
	$R_{i+1,t}^{SPX}$	$R_{i+1,t}^{UST}$	$R_{i+1,t}^{SPX}$	$R_{i+1,t}^{UST}$	$R_{i+1,t}^{SPX}$	$R_{i+1,t}^{UST}$
$R_{i,t}^{SPX}$	-0.03** [-2.58]	0.01 [1.63]	-0.02** [-2.29]	-0.01*** [-7.91]	-0.02** [-2.38]	-0.01*** [-4.26]
$R_{i,t}^{UST}$	0.15*** [2.65]	-0.03** [-2.05]	-0.01 [-0.40]	-0.08*** [-11.54]	0.03 [1.46]	-0.06*** [-7.56]
Intercept	0.08** [2.51]	-0.03** [-2.33]	-0.01 [-0.42]	0.02*** [2.87]	0.01 [0.29]	0.01* [1.84]
NOBS	70,147	69,992	283,174	282,891	353,331	352,893
R2 (%)	0.39	0.11	0.04	0.50	0.05	0.34

- On UST risky days, UST is the source of risk:
 - ▶ UST can positively predict SPX, not vice versa.
- On other days, SPX is the source of risk:
 - ▶ SPX can negatively predict UST, not vice versa.

Conclusions

- Our stock-bond correlation measure is effective in capturing not only UST safety, but, more importantly, its riskiness, and with *opposite signals*.
- UST Safety – days with highly negative stock-bond correlation
 - ▶ Alignment of global asset returns by their relative safety, not fundamentals.
 - ▶ Widening of UST convenience yield due to UST (not USD) safety.
- UST Riskiness – days with high stock-bond correlation
 - ▶ UST dominated by interest rate risk, inflation risk, and dealer capacity risk.
- The unique importance of our measure amid increasing concerns over UST:
 - ▶ Steady decline of dealer capacity to UST outstanding since 2007.
 - ▶ Persistent fiscal deficits leading to further growth of UST outstanding.
 - ▶ Trump's campaign promises that are inflationary: taxes, tariffs, labor, the Fed.