Internet Appendix

Table IA1: Return Extrapolation and Expected Volatility

Panel A reports AR(1) model estimates for the different expected volatility measures. The AR(1) model regresses the monthly expected volatility on its own lagged term and control variables. Vol_{T-1} is the lagged market volatility in the prior month *T−1*, $Vol_{T-6,T-2}$ is the average lagged monthly market volatility from *T−6* to *T−2*. VoV_{T-1} is the lagged volatility-of-volatility defined as the standard deviation of the daily VIX index during the month *T−1*. Panel B reports model estimates for the MIDAS regressions that regress monthly expected volatility on 22 lagged daily excess returns and control variables. $ExpVol_T = \mu_1 + \phi_1 \sum_{t=1}^{22} b_1(t;\theta) Ret_{T-t} + \gamma_1 ExpVol_{T-1} + X_{T-1} + \tau_T$. The MIDAS regressions utilize a Beta polynomial with two parameters, $\theta = [\theta_1; \theta_2]$ for the weighting function. Each lagged return has a weight $(t;\theta) = \frac{f(\frac{t}{t^{max}},\theta_1,\theta_2)}{\sum_{j=1}^{22} f(\frac{j}{t^{max}},\theta_1,\theta_2)}$, with $t = [1, \ldots, 22]$, and $t^{max} = 22$. $f(z,a,b) = z^{a-1}(1-z)^{b-1}/\beta(a,b)$, and $\beta(a,b)$ is based on the Gamma function $\beta(a,b) = \Gamma(a)\Gamma(b)/\Gamma(a+b)$. Also reported is adjusted R^2 for each model. *T*-statistics are reported in parentheses.

Panel A: AR(1) Model Estimates					
Dependent Variable:	VIX_T	IV_T	VOL_T^{GARCH}	VOL_T^{DY}	VOL_T^{Corsi}
Intercept	−0.401	−0.408	−0.484	−0.362	−0.606
	(−3.40)	(−3.52)	(−3.04)	(−2.27)	(−3.39)
AR(1)	0.777	0.790	0.741	0.836	0.767
	(13.49)	(14.85)	(9.81)	(13.33)	(13.25)
Vol_{T-1}	1.750	1.019	−2.654	0.274	0.024
	(0.54)	(0.30)	(−0.70)	(0.08)	(0.00)
$Vol_{T-6,T-2}$	4.275	4.229	5.676	3.113	9.388
	(1.15)	(1.11)	(1.49)	(0.70)	(1.71)
VoV_{T-1}	0.001	0.003	0.000	−0.002	−0.022
	(0.09)	(0.21)	(0.01)	(−0.14)	(−1.00)
Adj R^2	0.692	0.700	0.555	0.731	0.588
Panel B: Variance Risk Premium					
Dependent Variable:		VRP_T^{GARCH}	VRP_T^{DY}	VRP_T^{Corsi}	VRP_T^{BTZ}
Intercept		0.002	0.014	0.012	0.013
		(0.75)	(5.11)	(3.60)	(5.26)
AR(1)		0.021	−0.002	−0.055	−0.067
		(0.29)	(−0.03)	(−0.77)	(−1.03)
Vol_{T-1}		0.658	0.722	1.567	1.350
		(1.60)	(2.02)	(3.49)	(3.95)
$Vol_{T-6,T-2}$		1.356	0.895	2.746	2.590
		(3.31)	(2.51)	(5.51)	(6.47)
VoV_{T-1}		0.001	0.003	0.007	0.001
		(0.56)	(1.88)	(3.50)	(0.52)
Adj R^2		0.131	0.177	0.443	0.384
Panel C: The Change in Volatility Expectations					
Dependent Variable:	ΔVIX_T	ΔIV_T	ΔVOL_T^{GARCH}	ΔVOL_T^{DY}	ΔVOL_T^{Corsi}
Intercept	0.039	0.030	0.052	0.044	0.082
	(1.56)	(1.16)	(1.92)	(1.65)	(2.03)
AR(1)	−0.109	−0.153	−0.085	−0.075	−0.138
	(−1.52)	(−2.16)	(−1.15)	(−0.92)	(−2.01)

Vol_{T-1}	−0.752	−1.775	−7.149	−2.431	−5.218
	(−0.23)	(−0.52)	(−2.00)	(−0.70)	(−0.96)
$Vol_{T-6,T-2}$	−5.094	−5.461	−2.040	−5.749	−1.529
	(−1.55)	(−1.59)	(−0.55)	(−1.60)	(−0.29)
VoV_{T-1}	−0.011	−0.004	−0.012	−0.009	−0.033
	(−0.75)	(−0.24)	(−0.76)	(−0.59)	(−1.42)
Adj R^2	0.027	0.031	0.089	0.035	0.076
Panel D: Unexpected Shocks to Volatility Expectations					
Dependent Variable:	ε_T^{VIX}	ε_T^{IV}	ε_T^{GARCH}	ε_T^{DY}	ε_T^{Corsi}
Intercept	−0.006	−0.015	0.013	−0.009	0.004
	(−0.33)	(−0.92)	(0.82)	(−0.69)	(0.16)
AR(1)	−0.116	−0.068	−0.022	−0.066	−0.121
	(−1.77)	(−1.03)	(−0.32)	(−0.97)	(−1.84)
Vol_{T-1}	2.398	2.043	−0.817	1.384	−0.688
	(1.05)	(0.91)	(−0.39)	(0.79)	(−0.22)
$Vol_{T-6,T-2}$	−3.549	−2.373	−1.440	−2.109	−0.328
	(−1.6)	(−1.09)	(−0.71)	(−1.27)	(−0.11)
VoV_{T-1}	0.004	0.008	−0.003	0.006	0.000
	(0.47)	(0.90)	(−0.36)	(0.82)	(−0.01)
Adj R^2	0.016	0.013	−0.005	0.008	−0.002

Table IA2: Extrapolative Belief in Pessimistic and Optimistic Periods

This table reports the MIDAS regression results for pessimistic and optimistic subsamples. A month *T* is classified as pessimistic (optimistic) if the excess return in month *T−1* is below (above) the median excess market returns over a 60-month rolling window as a benchmark. MIDAS regressions are estimated for the pessimistic and optimistic subsamples separately. In Panel A, the dependent variable is the monthly expected volatility. In Panel B, the dependent variable is the monthly variance risk premium. In Panel C, the dependent variable is the monthly change in volatility expectations. In Panel D, the dependent variable is the unexpected shocks of volatility expectations. All MIDAS regressions control for the lagged market volatility in the prior month (Vol_{T-1}), the average lagged monthly market volatility from *T−6* to *T−2* ($Vol_{T-6,T-2}$), and the lagged volatility-of-volatility defined as the standard deviation of the daily VIX index during the month *T−1* (VoV_{T-1}). The MIDAS regressions utilize a Beta polynomial with two parameters, $\theta = [\theta_1; \theta_2]$ for the weighting function. Each lagged return has a weight $(t;\theta) = \frac{f(\frac{t}{t^{max}},\theta_1,\theta_2)}{\sum_{j=1}^{22} f(\frac{j}{t^{max}},\theta_1,\theta_2)}$, with $t = [1, \ldots, 22]$, and $t^{max} = 22.f(z,a,b) = z^{a-1}(1-z)^{b-1}/\beta(a,b)$, and $\beta(a,b)$ is based on the Gamma function $\beta(a,b) = \Gamma(a)\Gamma(b)/\Gamma(a+b)$. Also reported is the adjusted R^2 for each model. t-statistics for the estimated coefficients are reported in parentheses.

Panel A: Expected Volatility								
Dependent Variable	VIX_T		VOL_T^{GARCH}		VOL_T^{DY}		VOL_T^{Corsi}	
	Pessimism	Optimism	Pessimism	Optimism	Pessimism	Optimism	Pessimism	Optimism
Lagged Ret Coefficient ϕ_1	−0.615	−0.330	−0.477	−0.199	−0.735	−0.454	−1.142	−0.621
	(−10.53)	(−3.95)	(−7.54)	(−2.98)	(−11.67)	(−6.51)	(−10.65)	(−3.97)
BIC	0.890	0.870	0.862	0.851	0.919	0.938	0.835	0.803
Adj R^2	−0.615	−0.330	−0.477	−0.199	−0.735	−0.454	−1.142	−0.621
Control	Y	Y	Y	Y	Y	Y	Y	Y
Panel B: Variance Risk Premium								
Dependent Variable	VRP_T^{GARCH}		VRP_T^{DY}		VRP_T^{Corsi}		VRP_T^{BTZ}	
	Pessimism	Optimism	Pessimism	Optimism	Pessimism	Optimism	Pessimism	Optimism
Lagged Ret Coefficient ϕ_1	−0.057	−0.004	−0.043	−0.005	−0.053	−0.016	−0.053	−0.018
	(−6.65)	(−4.96)	(−3.98)	(−1.04)	(−4.24)	(−2.45)	(−6.11)	(−3.22)
Adj R^2	0.610	0.601	0.381	0.667	0.631	0.871	0.636	0.762
Control	Y	Y	Y	Y	Y	Y	Y	Y

Panel C: The Change of Volatility Expectations

Dependent Variable	ΔVIX_T		ΔVOL_T^{GARCH}		ΔVOL_T^{DY}		ΔVOL_T^{Corsi}	
	Pessimism	Optimism	Pessimism	Optimism	Pessimism	Optimism	Pessimism	Optimism
Lagged Ret Coefficient $\boldsymbol{\phi_1}$	−0.636	−0.410	−0.514	−0.272	−0.686	−0.509	−1.173	−0.726
	(−9.90)	(−4.64)	(−7.09)	(−3.51)	(−10.58)	(−6.55)	(−10.41)	(−5.01)
Adj R	0.566	0.579	0.620	0.686	0.714	0.711	0.609	0.567
Control	Y	Y	Y	Y	Y	Y	Y	Y

Panel D: Unexpected Shocks of Volatility Expectations

Dependent Variable	ε_T^{VIX}		ε_T^{GARCH}		ε_T^{DY}		ε_T^{Corsi}	
	Pessimism	Optimism	Pessimism	Optimism	Pessimism	Optimism	Pessimism	Optimism
Lagged Ret Coefficient $\boldsymbol{\phi_1}$	−0.350	−0.125	−0.059	−0.064	−0.224	−0.132	−0.393	−0.335
	(−7.34)	(−1.75)	(−1.44)	(−3.47)	(−6.58)	(−3.75)	(−6.42)	(−3.54)
Adj R	0.405	0.182	0.123	0.205	0.454	0.214	0.320	0.164
Control	Y	Y	Y	Y	Y	Y	Y	Y

Table IA3: Stock-Level MIDAS Regressions

This table summarizes the results for the firm-level MIDAS regressions. The MIDAS regression is estimated for a firm if it has valid options and stock data for more than sixty months. In Panel A, the dependent variable is $ExpVol_T$. We follow Bakshi, Kapadia and Madan (2003b) to construct the model-free risk-neutral volatility as a proxy for $ExpVol_T$. In Panel B, the dependent variable is variance risk premium $VRP_{i,T}$, defined as the difference between variance under risk-neutral expectation and physical expectation. $VRP_T = \mathbb{E}_T^Q(Var_{T,T+1}) - \mathbb{E}_T^P(Var_{T,T+1})$. Following Bollerslev, Tauchen, and Zhou (2011), the realized variance in the month $T-1$ is used as a proxy for $\mathbb{E}_T^P(Var_{T,T+1})$. In Panel C, the dependent variable is the change in volatility expectations, $\Delta ExpVol_{i,T}$, defined as the monthly change of the expected volatility. In Panel D, the dependent variable is the unexpected shocks of volatility expectations. The Unexpected Shocks of Volatility Expectations are the residuals. ε_1 is the residual from the linear regression $\Delta ExpVol_T = \beta_0 + \sum_{i=1}^{n} \beta_{1,i}\, \Delta ExpVol_{T-i} + \sum_{i=1}^{n} \beta_{2,i}\, \Delta RVol_{T-i} + \varepsilon_T$ that regress $\Delta ExpVol_T$ on the lagged $\Delta ExpVol_{T-i}$ and lagged $\Delta RVOL_{T-j}$, where $\Delta ExpVol_{iT}$ is the monthly change of the expected volatility and $\Delta RVOL_{iT}$ is the monthly change of the realized volatility. The MIDAS regressions, $Y_{j,T} = \mu_1 + \phi_1 \sum_{t=1}^{22} b_1(t;\theta) Ret_{T-t} + \gamma * Y_{j,T-1} + X_{T-1} + \varepsilon_{j,T}$, utilize a Beta polynomial with two parameters, $\theta = [\theta_1; \theta_2]$ for the weighting function. The weight of each lagged return is $(t;\theta) = \frac{f(\frac{t}{t^{max}},\theta_1,\theta_2)}{\sum_{j=1}^{22} f(\frac{j}{t^{max}},\theta_1,\theta_2)}$, with $t = [1, \ldots, 22]$, and $t^{max} = 22.f(z,a,b) = z^{a-1}(1-z)^{b-1}/\beta(a,b)$, and $\beta(a,b)$ is based on the Gamma function $\beta(a,b) = \Gamma(a)\Gamma(b)/\Gamma(a+b)$. The mean and median return coefficients are reported. The proportion of these coefficients that are significantly positive, insignificantly positive, significantly negative, and insignificantly negative are reported in columns 3 to 6. Weights_Lag3 is the cumulative weight from the first 3 lagged daily returns, Weights_Lag5 is the cumulative weight from the first 5 lagged daily returns, and Weights_Lag10 is the cumulative weight from the first 10 lagged daily returns.

Panel A: Risk-Neutral Expected Volatility

	Mean	Median	Significantly Positive %	Insignificantly Positive %	Significantly Negative %	Insignificantly Negative %
Lagged Ret Coefficient ϕ_1	−0.159	−0.158	0%	1%	96%	3%
Weights_Lag3	0.185	0.161				
Weights_Lag5	0.304	0.286				
Weights_Lag10	0.599	0.582				

Panel B: Variance Risk Premium

	Mean	Median	Significantly Positive %	Insignificantly Positive %	Significantly Negative %	Insignificantly Negative %
Lagged Ret Coefficient ϕ_1	−0.040	−0.033	2%	2%	90%	7%
Weights_Lag3	0.276	0.198				
Weights_Lag5	0.398	0.328				
Weights_Lag10	0.676	0.646				

Panel C: The Change of Volatility Expectations

	Mean	Median	Significantly Positive %	Insignificantly Positive %	Significantly Negative %	Insignificantly Negative %
Lagged Ret Coefficient ϕ_1	−0.169	−0.166	0%	1%	97%	2%
Weights_Lag3	0.177	0.159				
Weights_Lag5	0.295	0.280				
Weights_Lag10	0.584	0.568				

Panel D: Unexpected Shocks of Volatility Expectations

	Mean	Median	Significantly Positive %	Insignificantly Positive %	Significantly Negative %	Insignificantly Negative %
Lagged Ret Coefficient ϕ_1	−0.161	−0.158	0%	1%	97%	2%
Weights_Lag3	0.183	0.163				
Weights_Lag5	0.301	0.284				
Weights_Lag10	0.589	0.571				

Table IA4: Stock-Level MIDAS Regression for Out-of-Money Put Option Implied Volatility Change

This table summarizes the results for the firm-level MIDAS regressions with out-of-money put option implied volatility change as the dependent variable. The MIDAS regression is estimated for a firm if it has valid options and stock data for more than sixty months. In Panel A, the MIDAS regression, $\Delta IV_{i,T}^{OTMPut} = \mu_1 + \phi_1 \sum_{t=1}^{22} b_1(t;\theta) Ret_{T-t} + \gamma * \Delta IV_{i,T}^{OTMPut} + X_{T-1} + \varepsilon_{i,T}$, is estimated with the full sample data. In Panel B, the MIDAS regression includes past daily positive excess returns and the past daily negative excess returns as separate high-frequency variables. $\Delta IV_{i,T}^{OTMPut} = \mu_1 + \phi^{Neg} \sum_{t=1}^{22} b_1(t;\theta) Ret_{T-t}\ D_{T-t}^{Neg} + \phi^{Pos} \sum_{t=1}^{22} b_2(t;\theta) Ret_{T-t}\ D_{T-t}^{Pos} + \gamma * Y_{i,T-1} + X_{T-1} + \varepsilon_{i,T}$. D_{T-t}^{Neg} (D_{T-t}^{Pos}) is a dummy variable that equals 1 if the excess return on day $T-t$ is negative (positive) and zero otherwise. ϕ^{Neg} (ϕ^{Pos}) captures the relation between the dependent variable and lagged negative (positive) daily excess returns. The mean and median return coefficients are reported. The proportion of these return coefficients that are significantly positive, insignificantly positive, significantly negative, and insignificantly negative are reported in columns 3 to 6. Weights_Lag3 is the cumulative weight from the first 3 lagged daily returns, Weights_Lag5 is the cumulative weight from the first 5 lagged daily returns, and Weights_Lag10 is the cumulative weight from the first 10 lagged daily returns.

Panel A: Overall Return Extrapolation Effect

	Mean	Median	Significantly Positive %	Insignificantly Positive %	Significantly Negative %	Insignificantly Negative %
Lagged Ret Coefficient	−0.062	−0.058	2%	6%	73%	19%
Weights_Lag3	0.330	0.205				
Weights_Lag5	0.460	0.347				
Weights_Lag10	0.718	0.695				

Panel B: Asymmetric Return Extrapolation Effect

	Mean	Median	Significantly Positive %	Insignificantly Positive %	Significantly Negative %	Insignificantly Negative %
Positive Lagged Ret Coefficient	−0.022	−0.018	11%	27%	32%	30%
Positive Weights_Lag3	0.536	0.542				
Positive Weights_Lag5	0.664	0.861				

Positive Weights_Lag10	0.836	0.999				
Negative Lagged Ret Coefficient	−0.079	−0.071	1%	4%	75%	20%
Negative Weights_Lag3	0.357	0.272				
Negative Weights_Lag5	0.513	0.456				
Negative Weights_Lag10	0.790	0.826				