

Internet Appendix to

“To jump or not to jump: Momentum of jumps in crude oil price volatility prediction”

This Internet Appendix tabulates additional results that are mentioned in the paper. Below, we briefly describe the contents of the appendix.

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Note: MCS refers to the statistical test of the model confidence set proposed by [Hansen et al. \(2011\)](#). DM refers to the statistical test proposed by [Diebold and Mariano \(1995\)](#) and modified by [Harvey et al. \(1997\)](#).

Table A.1: MCS out-of-sample forecasting test based on the 1-day look-back period

Models	QLIKE	MSE	MAE	MSPE	MAPE	MSE-LOG
Panel A: 1-day horizon						
HAR-RV	0.428	0.104	0.003	0.034	0.000	0.001
HAR-CJ	0.073	0.501	0.051	0.767	0.001	0.001
Mean	0.428	0.298	0.003	0.324	0.000	0.001
MoJ	1.000	1.000	1.000	1.000	1.000	1.000
Panel B: 5-day horizon						
HAR-RV	0.000	0.001	0.000	0.000	0.000	0.000
HAR-CJ	0.000	0.001	0.000	0.000	0.000	0.000
Mean	0.000	0.001	0.000	0.000	0.000	0.000
MoJ	1.000	1.000	1.000	1.000	1.000	1.000
Panel C: 10-day horizon						
HAR-RV	0.000	0.000	0.000	0.023	0.000	0.000
HAR-CJ	0.000	0.000	0.000	0.000	0.000	0.000
Mean	0.000	0.000	0.000	0.000	0.000	0.000
MoJ	1.000	1.000	1.000	1.000	1.000	1.000
Panel D: 22-day horizon						
HAR-RV	0.000	0.008	0.000	0.024	0.000	0.001
HAR-CJ	0.000	0.000	0.000	0.000	0.000	0.000
Mean	0.000	0.000	0.000	0.000	0.000	0.000
MoJ	1.000	1.000	1.000	1.000	1.000	1.000

This table reports the MCS p -values of the four used models. Panels A, B, C, and D report the corresponding results for 1-day, 5-day, 10-day, and 22-day forecast horizons, respectively. The mean combination takes the equally weighted average of the individual HAR-RV and HAR-CJ forecasts, while our MoJ strategy switches between the HAR-RV and HAR-CJ forecasts based on their relatively past forecasting performance. The past forecasting performance is evaluated by a 1-day look-back period. The six considered loss functions are QLIKE, MSE, MAE, MSPE, MAPE, and MSE-LOG. Bold numbers highlight important instances in which the corresponding model falls into the MCS with the 10% significance level. The entire sample period consisting of 1619 observations spans from January 3, 2012 to May 11, 2018, while the out-of-sample forecasting period contains the last 800 observations.

Table A.2: MCS out-of-sample forecasting test based on the 10-day look-back period

Models	QLIKE	MSE	MAE	MSPE	MAPE	MSE-LOG
Panel A: 1-day horizon						
HAR-RV	0.186	0.096	0.003	0.001	0.000	0.000
HAR-CJ	0.020	0.275	0.104	0.001	0.000	0.000
Mean	0.186	0.195	0.006	0.001	0.000	0.000
MoJ	1.000	1.000	1.000	1.000	1.000	1.000
Panel B: 5-day horizon						
HAR-RV	0.001	0.034	0.006	0.000	0.003	0.002
HAR-CJ	0.000	0.068	0.006	0.000	0.000	0.000
Mean	0.000	0.034	0.006	0.000	0.000	0.000
MoJ	1.000	1.000	1.000	1.000	1.000	1.000
Panel C: 10-day horizon						
HAR-RV	0.001	0.019	0.002	0.000	0.006	0.004
HAR-CJ	0.000	0.019	0.002	0.000	0.000	0.000
Mean	0.000	0.019	0.002	0.000	0.000	0.000
MoJ	1.000	1.000	1.000	1.000	1.000	1.000
Panel D: 22-day horizon						
HAR-RV	0.003	0.000	0.002	0.048	0.007	0.008
HAR-CJ	0.000	0.000	0.000	0.000	0.000	0.000
Mean	0.000	0.000	0.000	0.000	0.000	0.000
MoJ	1.000	1.000	1.000	1.000	1.000	1.000

This table reports the MCS p -values of the four used models. Panels A, B, C, and D report the corresponding results for 1-day, 5-day, 10-day, and 22-day forecast horizons, respectively. The mean combination takes the equally weighted average of the individual HAR-RV and HAR-CJ forecasts, while our MoJ strategy switches between the HAR-RV and HAR-CJ forecasts based on their relatively past forecasting performance. The past forecasting performance is evaluated by a 10-day look-back period. The six considered loss functions are QLIKE, MSE, MAE, MSPE, MAPE, and MSE-LOG. Bold numbers highlight important instances in which the corresponding model falls into the MCS with the 10% significance level. The entire sample period consisting of 1619 observations spans from January 3, 2012 to May 11, 2018, while the out-of-sample forecasting period contains the last 800 observations.

Table A.3: MCS out-of-sample forecasting test based on the 22-day look-back period

Models	QLIKE	MSE	MAE	MSPE	MAPE	MSE-LOG
Panel A: 1-day horizon						
HAR-RV	0.212	0.109	0.008	0.021	0.002	0.001
HAR-CJ	0.049	0.455	0.301	0.021	0.002	0.001
Mean	0.212	0.424	0.028	0.021	0.000	0.001
MoJ	1.000	1.000	1.000	1.000	1.000	1.000
Panel B: 5-day horizon						
HAR-RV	0.008	0.030	0.014	0.002	0.010	0.009
HAR-CJ	0.003	0.042	0.023	0.002	0.001	0.001
Mean	0.003	0.030	0.023	0.002	0.001	0.001
MoJ	1.000	1.000	1.000	1.000	1.000	1.000
Panel C: 10-day horizon						
HAR-RV	0.013	0.041	0.057	0.001	0.038	0.017
HAR-CJ	0.001	0.041	0.091	0.001	0.001	0.000
Mean	0.001	0.041	0.091	0.003	0.001	0.002
MoJ	1.000	1.000	1.000	1.000	1.000	1.000
Panel D: 22-day horizon						
HAR-RV	0.133	0.003	0.107	0.183	0.267	0.174
HAR-CJ	0.000	0.003	0.000	0.000	0.000	0.000
Mean	0.000	0.019	0.002	0.003	0.000	0.000
MoJ	1.000	1.000	1.000	1.000	1.000	1.000

This table reports the MCS p -values of the four used models. Panels A, B, C, and D report the corresponding results for 1-day, 5-day, 10-day, and 22-day forecast horizons, respectively. The mean combination takes the equally weighted average of the individual HAR-RV and HAR-CJ forecasts, while our MoJ strategy switches between the HAR-RV and HAR-CJ forecasts based on their relatively past forecasting performance. The past forecasting performance is evaluated by a 22-day look-back period. The six considered loss functions are QLIKE, MSE, MAE, MSPE, MAPE, and MSE-LOG. Bold numbers highlight important instances in which the corresponding model falls into the MCS with the 10% significance level. The entire sample period consisting of 1619 observations spans from January 3, 2012 to May 11, 2018, while the out-of-sample forecasting period contains the last 800 observations.

Table A.4: MCS out-of-sample test based on the MIDAS-RV and MIDAS-CJ models with a truncation of 60 daily lags

Models	QLIKE	MSE	MAE	MSPE	MAPE	MSE-LOG
Panel A: 1-day horizon						
MIDAS-RV	0.175	0.083	0.003	0.007	0.000	0.001
MIDAS-CJ	0.032	0.163	0.022	0.007	0.000	0.001
Mean	0.175	0.160	0.003	0.007	0.000	0.000
MoJ	1.000	1.000	1.000	1.000	1.000	1.000
Panel B: 5-day horizon						
MIDAS-RV	0.000	0.004	0.000	0.001	0.000	0.000
MIDAS-CJ	0.001	0.004	0.000	0.001	0.000	0.000
Mean	0.000	0.004	0.000	0.001	0.000	0.000
MoJ	1.000	1.000	1.000	1.000	1.000	1.000
Panel C: 10-day horizon						
MIDAS-RV	0.000	0.001	0.000	0.017	0.000	0.000
MIDAS-CJ	0.000	0.001	0.000	0.000	0.000	0.000
Mean	0.000	0.001	0.000	0.000	0.000	0.000
MoJ	1.000	1.000	1.000	1.000	1.000	1.000
Panel D: 22-day horizon						
MIDAS-RV	0.000	0.016	0.000	0.028	0.000	0.000
MIDAS-CJ	0.000	0.000	0.000	0.000	0.000	0.000
Mean	0.000	0.000	0.000	0.000	0.000	0.000
MoJ	1.000	1.000	1.000	1.000	1.000	1.000

This table reports the MCS p -values of the four used models. In this table, the MIDAS-RV and MIDAS-CJ models are used to replace the HAR-RV and HAR-CJ models, respectively. In particular, we use a truncation of 60 daily lags in the estimation of the MIDAS-RV and MIDAS-CJ models. Panels A, B, C, and D report the corresponding results for 1-day, 5-day, 10-day, and 22-day forecast horizons, respectively. The mean combination takes the equally weighted average of the individual MIDAS-RV and MIDAS-CJ forecasts, while our MoJ strategy switches between the MIDAS-RV and MIDAS-CJ forecasts based on their relatively past forecasting performance. The past forecasting performance is evaluated by a 5-day look-back period. The six considered loss functions are QLIKE, MSE, MAE, MSPE, MAPE, and MSE-LOG. Bold numbers highlight important instances in which the corresponding model falls into the MCS with the 10% significance level. The entire sample period consisting of 1619 observations spans from January 3, 2012 to May 11, 2018, while the out-of-sample forecasting period contains the last 800 observations.

Table A.5: MCS out-of-sample test using the 1% significance level for jump detection test

Models	QLIKE	MSE	MAE	MSPE	MAPE	MSE-LOG
Panel A: 1-day horizon						
HAR-RV	0.313	0.105	0.004	0.018	0.001	0.002
HAR-CJ	0.073	0.383	0.333	0.018	0.001	0.002
Mean	0.313	0.283	0.022	0.018	0.000	0.001
MoJ	1.000	1.000	1.000	1.000	1.000	1.000
Panel B: 5-day horizon						
HAR-RV	0.000	0.007	0.000	0.000	0.000	0.001
HAR-CJ	0.000	0.007	0.000	0.000	0.000	0.000
Mean	0.000	0.007	0.000	0.000	0.000	0.000
MoJ	1.000	1.000	1.000	1.000	1.000	1.000
Panel C: 10-day horizon						
HAR-RV	0.000	0.002	0.000	0.029	0.001	0.001
HAR-CJ	0.000	0.002	0.000	0.000	0.000	0.000
Mean	0.000	0.002	0.000	0.000	0.000	0.000
MoJ	1.000	1.000	1.000	1.000	1.000	1.000
Panel D: 22-day horizon						
HAR-RV	0.000	0.014	0.000	0.032	0.001	0.001
HAR-CJ	0.000	0.000	0.000	0.000	0.000	0.000
Mean	0.000	0.000	0.000	0.000	0.000	0.000
MoJ	1.000	1.000	1.000	1.000	1.000	1.000

This table reports the MCS p -values of the four used models. In particular, we use the 1% significance level to detect significant jumps for the HAR-CJ model. Panels A, B, C, and D report the corresponding results for 1-day, 5-day, 10-day, and 22-day forecast horizons, respectively. The mean combination takes the equally weighted average of the individual HAR-RV and HAR-CJ forecasts, while our MoJ strategy switches between the HAR-RV and HAR-CJ forecasts based on their relatively past forecasting performance. The past forecasting performance is evaluated by a 5-day look-back period. The six considered loss functions are QLIKE, MSE, MAE, MSPE, MAPE, and MSE-LOG. Bold numbers highlight important instances in which the corresponding model falls into the MCS with the 10% significance level. The entire sample period consisting of 1619 observations spans from January 3, 2012 to May 11, 2018, while the out-of-sample forecasting period contains the last 800 observations.

Table A.6: MCS out-of-sample test using the 0.1% significance level for jump detection test

Models	QLIKE	MSE	MAE	MSPE	MAPE	MSE-LOG
Panel A: 1-day horizon						
HAR-RV	0.429	0.078	0.005	0.034	0.001	0.004
HAR-CJ	0.226	1.000	0.884	0.040	0.006	0.008
Mean	0.501	0.633	0.088	0.034	0.000	0.004
MoJ	1.000	0.887	1.000	1.000	1.000	1.000
Panel B: 5-day horizon						
HAR-RV	0.000	0.015	0.001	0.000	0.001	0.002
HAR-CJ	0.000	0.015	0.001	0.000	0.000	0.000
Mean	0.000	0.015	0.001	0.000	0.000	0.000
MoJ	1.000	1.000	1.000	1.000	1.000	1.000
Panel C: 10-day horizon						
HAR-RV	0.000	0.003	0.000	0.000	0.001	0.001
HAR-CJ	0.000	0.003	0.000	0.000	0.000	0.000
Mean	0.000	0.003	0.000	0.000	0.000	0.000
MoJ	1.000	1.000	1.000	1.000	1.000	1.000
Panel D: 22-day horizon						
HAR-RV	0.000	0.000	0.000	0.030	0.001	0.001
HAR-CJ	0.000	0.000	0.000	0.000	0.000	0.000
Mean	0.000	0.000	0.000	0.000	0.000	0.000
MoJ	1.000	1.000	1.000	1.000	1.000	1.000

This table reports the MCS p -values of the four used models. In particular, we use the 0.1% significance level to detect significant jumps for the HAR-CJ model. Panels A, B, C, and D report the corresponding results for 1-day, 5-day, 10-day, and 22-day forecast horizons, respectively. The mean combination takes the equally weighted average of the individual HAR-RV and HAR-CJ forecasts, while our MoJ strategy switches between the HAR-RV and HAR-CJ forecasts based on their relatively past forecasting performance. The past forecasting performance is evaluated by a 5-day look-back period. The six considered loss functions are QLIKE, MSE, MAE, MSPE, MAPE, and MSE-LOG. Bold numbers highlight important instances in which the corresponding model falls into the MCS with the 10% significance level. The entire sample period consisting of 1619 observations spans from January 3, 2012 to May 11, 2018, while the out-of-sample forecasting period contains the last 800 observations.

Table A.7: MCS test based on the last 600 out-of-sample forecasting observations

Models	QLIKE	MSE	MAE	MSPE	MAPE	MSE-LOG
Panel A: 1-day horizon						
HAR-RV	0.315	0.125	0.011	0.034	0.001	0.005
HAR-CJ	0.204	0.304	0.358	0.057	0.003	0.005
Mean	0.315	0.169	0.036	0.034	0.000	0.001
MoJ	1.000	1.000	1.000	1.000	1.000	1.000
Panel B: 5-day horizon						
HAR-RV	0.002	0.016	0.000	0.000	0.000	0.002
HAR-CJ	0.002	0.016	0.000	0.000	0.000	0.000
Mean	0.000	0.016	0.000	0.000	0.000	0.000
MoJ	1.000	1.000	1.000	1.000	1.000	1.000
Panel C: 10-day horizon						
HAR-RV	0.004	0.014	0.001	0.000	0.006	0.010
HAR-CJ	0.000	0.014	0.001	0.000	0.000	0.000
Mean	0.000	0.014	0.001	0.009	0.000	0.000
MoJ	1.000	1.000	1.000	1.000	1.000	1.000
Panel D: 22-day horizon						
HAR-RV	0.002	0.000	0.001	0.046	0.002	0.007
HAR-CJ	0.000	0.000	0.000	0.000	0.000	0.000
Mean	0.000	0.000	0.000	0.000	0.000	0.000
MoJ	1.000	1.000	1.000	1.000	1.000	1.000

This table reports the MCS p -values of the four used models. Panels A, B, C, and D report the corresponding results for 1-day, 5-day, 10-day, and 22-day forecast horizons, respectively. The mean combination takes the equally weighted average of the individual HAR-RV and HAR-CJ forecasts, while our MoJ strategy switches between the HAR-RV and HAR-CJ forecasts based on their relatively past forecasting performance. The past forecasting performance is evaluated by a 5-day look-back period. The six considered loss functions are QLIKE, MSE, MAE, MSPE, MAPE, and MSE-LOG. Bold numbers highlight important instances in which the corresponding model falls into the MCS with the 10% significance level. The entire sample period consisting of 1619 observations spans from January 3, 2012 to May 11, 2018, while the out-of-sample forecasting period contains the last 600 observations.

Table A.8: MCS test based on the last 1000 out-of-sample forecasting observations

Models	QLIKE	MSE	MAE	MSPE	MAPE	MSE-LOG
Panel A: 1-day horizon						
HAR-RV	0.139	0.112	0.003	0.002	0.000	0.000
HAR-CJ	0.035	0.182	0.060	0.002	0.000	0.000
Mean	0.139	0.182	0.010	0.002	0.000	0.000
MoJ	1.000	1.000	1.000	1.000	1.000	1.000
Panel B: 5-day horizon						
HAR-RV	0.000	0.003	0.000	0.000	0.000	0.000
HAR-CJ	0.000	0.003	0.000	0.000	0.000	0.000
Mean	0.000	0.003	0.000	0.000	0.000	0.000
MoJ	1.000	1.000	1.000	1.000	1.000	1.000
Panel C: 10-day horizon						
HAR-RV	0.000	0.000	0.000	0.018	0.000	0.000
HAR-CJ	0.000	0.000	0.000	0.000	0.000	0.000
Mean	0.000	0.000	0.000	0.000	0.000	0.000
MoJ	1.000	1.000	1.000	1.000	1.000	1.000
Panel D: 22-day horizon						
HAR-RV	0.000	0.007	0.000	0.019	0.000	0.000
HAR-CJ	0.000	0.000	0.000	0.000	0.000	0.000
Mean	0.000	0.000	0.000	0.000	0.000	0.000
MoJ	1.000	1.000	1.000	1.000	1.000	1.000

This table reports the MCS p -values of the four used models. Panels A, B, C, and D report the corresponding results for 1-day, 5-day, 10-day, and 22-day forecast horizons, respectively. The mean combination takes the equally weighted average of the individual HAR-RV and HAR-CJ forecasts, while our MoJ strategy switches between the HAR-RV and HAR-CJ forecasts based on their relatively past forecasting performance. The past forecasting performance is evaluated by a 5-day look-back period. The six considered loss functions are QLIKE, MSE, MAE, MSPE, MAPE, and MSE-LOG. Bold numbers highlight important instances in which the corresponding model falls into the MCS with the 10% significance level. The entire sample period consisting of 1619 observations spans from January 3, 2012 to May 11, 2018, while the out-of-sample forecasting period contains the last 1000 observations.

Table A.9: MCS out-of-sample forecasting test based on the recursive estimation window

Models	QLIKE	MSE	MAE	MSPE	MAPE	MSE-LOG
Panel A: 1-day horizon						
HAR-RV	0.153	0.098	0.001	0.027	0.001	0.003
HAR-CJ	0.765	0.513	1.000	1.000	1.000	0.527
Mean	0.765	0.252	0.022	0.058	0.006	0.037
MoJ	1.000	1.000	0.261	0.907	0.934	1.000
Panel B: 5-day horizon						
HAR-RV	0.001	0.018	0.004	0.024	0.001	0.001
HAR-CJ	0.001	0.031	0.020	0.054	0.001	0.002
Mean	0.001	0.018	0.006	0.024	0.001	0.001
MoJ	1.000	1.000	1.000	1.000	1.000	1.000
Panel C: 10-day horizon						
HAR-RV	0.000	0.008	0.000	0.014	0.001	0.001
HAR-CJ	0.000	0.008	0.000	0.014	0.001	0.001
Mean	0.000	0.008	0.000	0.014	0.001	0.001
MoJ	1.000	1.000	1.000	1.000	1.000	1.000
Panel D: 22-day horizon						
HAR-RV	0.001	0.000	0.000	0.051	0.001	0.001
HAR-CJ	0.000	0.000	0.000	0.001	0.000	0.000
Mean	0.000	0.000	0.000	0.001	0.000	0.000
MoJ	1.000	1.000	1.000	1.000	1.000	1.000

This table reports the MCS p -values of the four used models. In particular, we use the recursive (expanding) estimation window instead of the rolling window to generate out-of-sample forecasts in this table. Panels A, B, C, and D report the corresponding results for 1-day, 5-day, 10-day, and 22-day forecast horizons, respectively. The mean combination takes the equally weighted average of the individual HAR-RV and HAR-CJ forecasts, while our MoJ strategy switches between the HAR-RV and HAR-CJ forecasts based on their relatively past forecasting performance. The past forecasting performance is evaluated by a 5-day look-back period. The six considered loss functions are QLIKE, MSE, MAE, MSPE, MAPE, and MSE-LOG. Bold numbers highlight important instances in which the corresponding model falls into the MCS with the 10% significance level. The entire sample period consisting of 1619 observations spans from January 3, 2012 to May 11, 2018, while the out-of-sample forecasting period contains the last 800 observations.

Table A.10: MCS out-of-sample test using QLIKE to evaluate past forecasting performance

Models	QLIKE	MSE	MAE	MSPE	MAPE	MSE-LOG
Panel A: 1-day horizon						
HAR-RV	0.533	0.103	0.012	0.039	0.002	0.007
HAR-CJ	0.195	0.664	0.821	0.039	0.008	0.007
Mean	0.533	0.521	0.124	0.039	0.000	0.007
MoJ	1.000	1.000	1.000	1.000	1.000	1.000
Panel B: 5-day horizon						
HAR-RV	0.001	0.022	0.002	0.000	0.003	0.002
HAR-CJ	0.001	0.024	0.002	0.000	0.000	0.000
Mean	0.000	0.022	0.002	0.000	0.000	0.000
MoJ	1.000	1.000	1.000	1.000	1.000	1.000
Panel C: 10-day horizon						
HAR-RV	0.000	0.004	0.000	0.000	0.003	0.002
HAR-CJ	0.000	0.004	0.000	0.000	0.000	0.000
Mean	0.000	0.004	0.000	0.000	0.000	0.000
MoJ	1.000	1.000	1.000	1.000	1.000	1.000
Panel D: 22-day horizon						
HAR-RV	0.000	0.000	0.000	0.033	0.001	0.001
HAR-CJ	0.000	0.000	0.000	0.000	0.000	0.000
Mean	0.000	0.000	0.000	0.000	0.000	0.000
MoJ	1.000	1.000	1.000	1.000	1.000	1.000

This table reports the MCS p -values of the four used models. Panels A, B, C, and D report the corresponding results for 1-day, 5-day, 10-day, and 22-day forecast horizons, respectively. The mean combination takes the equally weighted average of the individual HAR-RV and HAR-CJ forecasts, while our MoJ strategy switches between the HAR-RV and HAR-CJ forecasts based on their relatively past forecasting performance. The past forecasting performance is evaluated by the QLIKE (rather than MSE) criterion using a 5-day look-back period. The six considered loss functions are QLIKE, MSE, MAE, MSPE, MAPE, and MSE-LOG. Bold numbers highlight important instances in which the corresponding model falls into the MCS with the 10% significance level. The entire sample period consisting of 1619 observations spans from January 3, 2012 to May 11, 2018, while the out-of-sample forecasting period contains the last 800 observations.

Table A.11: MCS out-of-sample test using MAE to evaluate past forecasting performance

Models	QLIKE	MSE	MAE	MSPE	MAPE	MSE-LOG
Panel A: 1-day horizon						
HAR-RV	0.320	0.103	0.002	0.000	0.000	0.000
HAR-CJ	0.015	0.338	0.004	0.000	0.000	0.000
Mean	0.320	0.316	0.002	0.000	0.000	0.000
MoJ	1.000	1.000	1.000	1.000	1.000	1.000
Panel B: 5-day horizon						
HAR-RV	0.000	0.006	0.001	0.000	0.001	0.001
HAR-CJ	0.000	0.008	0.001	0.000	0.000	0.000
Mean	0.000	0.006	0.001	0.000	0.000	0.000
MoJ	1.000	1.000	1.000	1.000	1.000	1.000
Panel C: 10-day horizon						
HAR-RV	0.000	0.003	0.000	0.000	0.001	0.002
HAR-CJ	0.000	0.003	0.000	0.000	0.000	0.000
Mean	0.000	0.003	0.000	0.000	0.000	0.000
MoJ	1.000	1.000	1.000	1.000	1.000	1.000
Panel D: 22-day horizon						
HAR-RV	0.001	0.000	0.000	0.034	0.001	0.002
HAR-CJ	0.000	0.000	0.000	0.000	0.000	0.000
Mean	0.000	0.000	0.000	0.000	0.000	0.000
MoJ	1.000	1.000	1.000	1.000	1.000	1.000

This table reports the MCS p -values of the four used models. Panels A, B, C, and D report the corresponding results for 1-day, 5-day, 10-day, and 22-day forecast horizons, respectively. The mean combination takes the equally weighted average of the individual HAR-RV and HAR-CJ forecasts, while our MoJ strategy switches between the HAR-RV and HAR-CJ forecasts based on their relatively past forecasting performance. The past forecasting performance is evaluated by the MAE (rather than MSE) criterion using a 5-day look-back period. The six considered loss functions are QLIKE, MSE, MAE, MSPE, MAPE, and MSE-LOG. Bold numbers highlight important instances in which the corresponding model falls into the MCS with the 10% significance level. The entire sample period consisting of 1619 observations spans from January 3, 2012 to May 11, 2018, while the out-of-sample forecasting period contains the last 800 observations.

Table A.12: DM out-of-sample test

Models	QLIKE	MSE	MAE	MSPE	MAPE	MSE-LOG
Panel A: 1-day horizon						
HAR-CJ	-0.534	2.157**	3.346***	1.586*	1.999**	0.978
Mean	0.867	2.892***	4.091***	2.028**	2.550***	2.147**
MoJ	1.552*	2.930***	4.725***	2.608***	5.439***	4.455***
Panel B: 5-day horizon						
HAR-CJ	-0.605	1.204	1.027	0.509	0.117	-0.179
Mean	0.153	1.483*	1.652**	0.928	0.490	0.489
MoJ	2.754***	1.822**	2.542***	1.832**	2.460***	2.512***
Panel C: 10-day horizon						
HAR-CJ	-0.732	1.161	0.732	0.214	-0.115	-0.417
Mean	-0.013	1.486*	1.295*	0.655	0.245	0.232
MoJ	2.639***	1.875**	2.749***	1.533*	2.592***	2.420***
Panel D: 22-day horizon						
HAR-CJ	-1.672	0.299	-1.005	-0.862	-1.552	-1.577
Mean	-1.211	0.834	-0.630	-0.417	-1.359	-1.181
MoJ	2.461***	1.773**	2.490***	1.574*	2.484***	2.394***

This table provides the DM statistics. A positive DM statistic implies that the corresponding predictive model outperforms the HAR-RV benchmark, while a negative value indicates the opposite. Panels A, B, C, and D report the corresponding results for 1-day, 5-day, 10-day, and 22-day horizons, respectively. The mean combination uses the equally weighted average (that is, simple mean) of the individual HAR-RV and HAR-CJ forecasts, while our MoJ strategy switches between the HAR-RV and HAR-CJ forecasts based on their relatively past forecasting performance. The past forecasting performance is evaluated by a 5-day look-back period. The six considered loss functions are QLIKE, MSE, MAE, MSPE, MAPE, and MSE-LOG. *, **, and *** correspond to significance at the 10%, 5%, and 1% levels, respectively. The entire sample period consisting of 1619 observations spans from January 3, 2012 to May 11, 2018, while the out-of-sample forecasting period contains the last 800 observations.

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