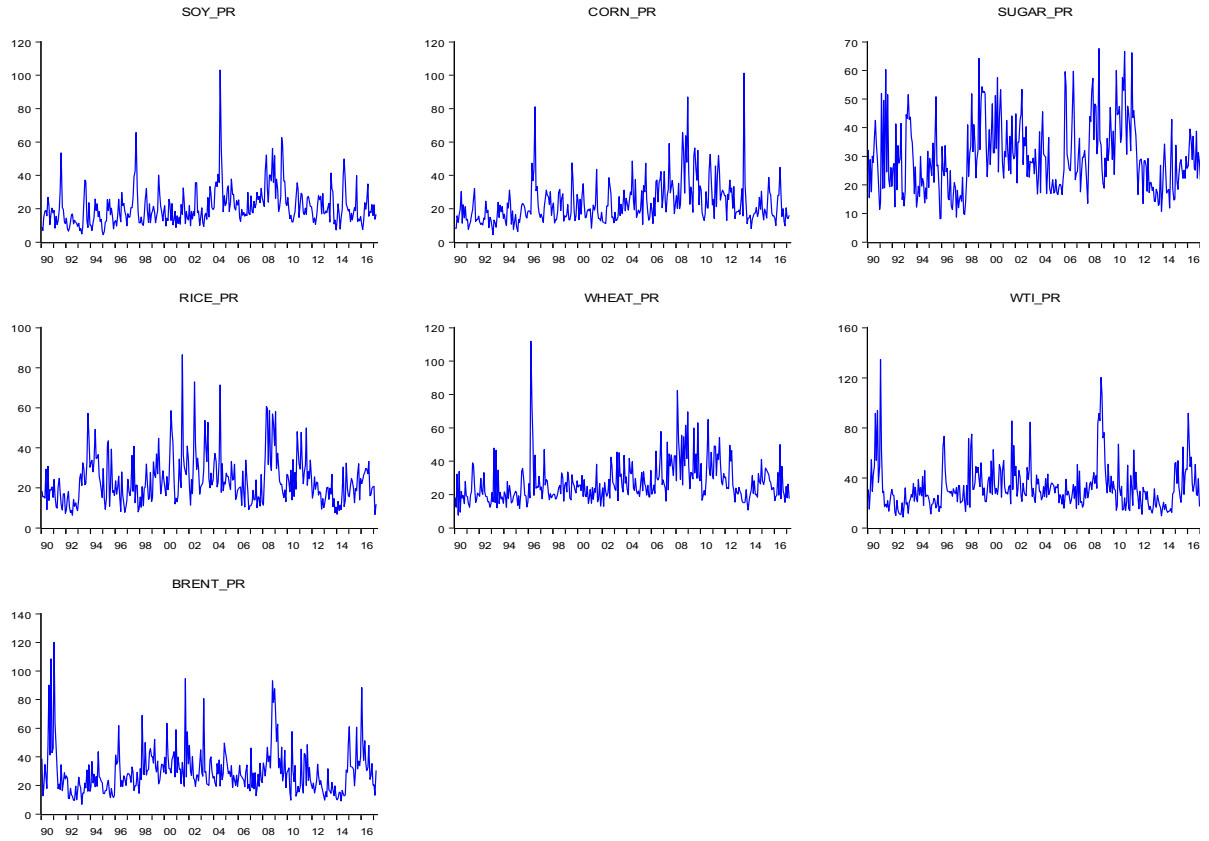


## Online Appendix

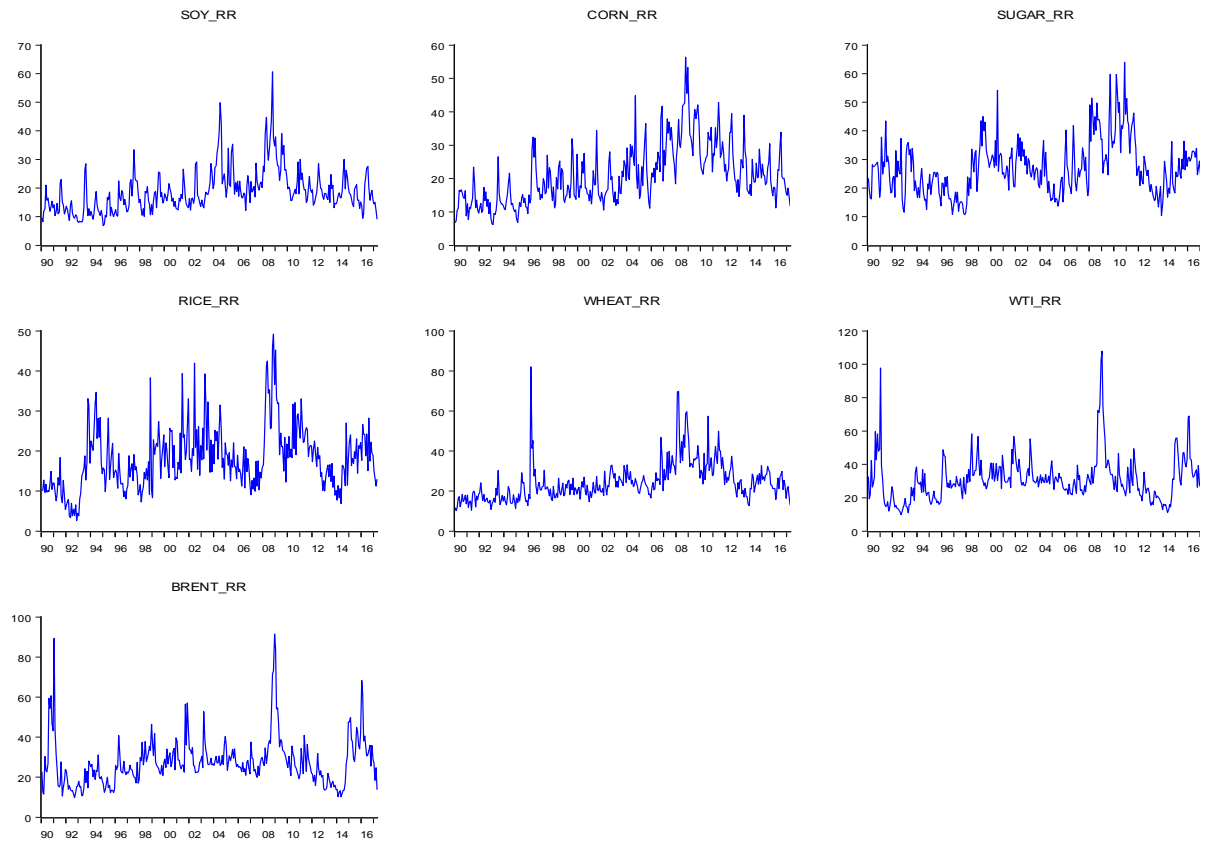
**Figure A1.** The annualized price-range volatility on a monthly frequency from January, 1990 up to March, 2017:

$$PR_t^{(M)} = \sqrt{12 \left( \frac{1}{2} \left( \log \frac{\max_{i=t, \dots, t-21, j=1, \dots, \tau} (P_{ij})}{\min_{i=t, \dots, t-21, j=1, \dots, \tau} (P_{ij})} \right)^2 - (2 \log(2) - 1) \left( \log \frac{P_{t\tau}}{P_{t-211}} \right)^2 \right)}.$$



**Figure A2.** The annualized realized range on a monthly frequency from January, 1990 up to March, 2017:

$$RR_t^{(M)} = \sqrt{\frac{252}{22} \sum_{t=1}^{22} \left( \frac{1}{2} \left( \log \frac{\max_{j=1, \dots, \tau} (P_{tj})}{\min_{j=1, \dots, \tau} (P_{tj})} \right)^2 - (2 \log(2) - 1) \left( \log \frac{P_{t\tau}}{P_{t1}} \right)^2 \right)}$$



**Table A1.** The Mean Absolute Forecasting Error (MAFE) evaluation function for 1-, 3-, 6-, 9-, 12- month ahead forecasting horizons. Volatility Measure: Monthly Realized Volatility;  $RV_t^{(M)}$ . Forecasting period: Jan 2000 – March 2017.

Months-ahead	RW	AR( $p$ )	HAR	HAR-WTI	HAR-BRN	MIDAS-HAR-WTI	MIDAS-HAR-BRN
SOY							
1	7.55	<b>0.7603*</b>	<b>0.7483*</b>	<b>0.7629*</b>	<b>0.7629*</b>	<b>0.7589*</b>	<b>0.7656*</b>
3	7.65	<b>0.9608*</b>	<b>0.9412*</b>	<b>0.9725</b>	<b>0.9725</b>	<b>0.9647*</b>	1.0013
6	7.71	<b>0.9935</b>	<b>0.9520*</b>	<b>0.9663*</b>	<b>0.9792</b>	<b>0.9520*</b>	<b>0.9935</b>
9	7.83	<b>0.9987</b>	<b>0.9681*</b>	<b>0.9872*</b>	<b>0.9949</b>	<b>0.9732*</b>	1.0000
12	7.93	<b>0.9987</b>	<b>0.9710*</b>	1.0000	1.0038	<b>0.9823*</b>	<b>0.9836*</b>
CORN							
1	9.20	<b>0.7859*</b>	<b>0.7424*</b>	<b>0.7500*</b>	<b>0.7554*</b>	<b>0.7370*</b>	<b>0.7707*</b>
3	9.28	<b>0.9580</b>	<b>0.8362*</b>	<b>0.8513*</b>	<b>0.8545*</b>	<b>0.8556*</b>	<b>0.8578*</b>
6	9.34	<b>0.9979</b>	<b>0.8587*</b>	<b>0.8715*</b>	<b>0.8801*</b>	<b>0.8747*</b>	<b>0.8801*</b>
9	9.42	1.0021	<b>0.8280*</b>	<b>0.8386*</b>	<b>0.8450*</b>	<b>0.8461*</b>	<b>0.8482*</b>
12	9.55	1.0021	<b>0.8471*</b>	<b>0.8440*</b>	<b>0.8534*</b>	<b>0.8691*</b>	<b>0.8649*</b>
SUGAR							
1	8.67	<b>0.7931*</b>	<b>0.7739*</b>	<b>0.7797*</b>	<b>0.7843*</b>	<b>0.8028*</b>	<b>0.7797*</b>
3	8.72	<b>0.9001</b>	<b>0.8429*</b>	<b>0.8406*</b>	<b>0.8463*</b>	<b>0.8911*</b>	<b>0.8865*</b>
6	8.79	<b>0.9455</b>	<b>0.9181*</b>	<b>0.9283*</b>	<b>0.9352*</b>	<b>0.9238*</b>	<b>0.8999*</b>
9	8.76	<b>0.9889</b>	<b>0.9658*</b>	<b>0.9600*</b>	<b>0.9726*</b>	<b>0.9680*</b>	<b>0.9566*</b>
12	8.74	<b>0.9912*</b>	1.0092	<b>0.9954*</b>	1.0080	<b>0.9954*</b>	1.0137
RICE							
1	7.41	<b>0.7981*</b>	<b>0.7949*</b>	<b>0.7895*</b>	<b>0.7922*</b>	<b>0.8205*</b>	<b>0.8246*</b>
3	7.54	<b>0.9101</b>	<b>0.8846*</b>	<b>0.8886*</b>	<b>0.8833*</b>	<b>0.9058*</b>	<b>0.9058*</b>
6	7.64	<b>0.9731</b>	<b>0.9267*</b>	<b>0.9411*</b>	<b>0.9476*</b>	<b>0.9830</b>	<b>0.9895</b>
9	7.26	<b>0.9918</b>	<b>0.9559*</b>	<b>0.9959</b>	1.0000	<b>0.9311*</b>	<b>0.9959</b>
12	7.29	<b>0.9973</b>	<b>0.9822*</b>	1.0178	1.0288	1.1440	1.0796
WHEAT							
1	8.31	<b>0.8172</b>	<b>0.7280*</b>	<b>0.7329*</b>	<b>0.7316*</b>	<b>0.7485*</b>	<b>0.7449*</b>
3	8.39	<b>0.9128</b>	<b>0.7998*</b>	<b>0.8010*</b>	<b>0.8021*</b>	<b>0.8129*</b>	<b>0.7950*</b>
6	8.51	<b>0.9372</b>	<b>0.8555*</b>	<b>0.8555*</b>	<b>0.8602*</b>	<b>0.8555*</b>	<b>0.8790</b>
9	8.61	<b>0.9712</b>	<b>0.8711*</b>	<b>0.8722*</b>	<b>0.8769*</b>	<b>0.8757*</b>	<b>0.8850*</b>
12	8.74	<b>0.9991</b>	<b>0.9119*</b>	<b>0.9062*</b>	<b>0.9142*</b>	<b>0.9291*</b>	<b>0.9508</b>

*Note:* WTI = WTI crude oil price volatility, BRN = Brent crude oil price volatility. The RW column shows the actual MAFE. All other columns show the MAFE ratios, for each forecasting model, that have been normalized relative to the monthly RW forecast. The order of the AR models for Soy and Corn is 1, whereas for Sugar, Rice and Wheat is 2, based on the Bayesian Information Criterion. Bold face numbers denote that the forecast outperforms the RW. \* denotes that the model is included in the set of the best models according to the Model Confidence Set (MCS).

**Table A2.** The Mean Absolute Forecasting Error (MAFE) evaluation function for 1-, 3-, 6-, 9-, 12- month ahead forecasting horizons. Volatility Measure: Monthly Realized Volatility;  $RV_t^{(M)}$ . Forecasting period: 1<sup>st</sup> Food Crisis (2007-2009).

Months-ahead	RW	AR( $p$ )	HAR	HAR-WTI	HAR-BRN	MIDAS-HAR-WTI	MIDAS-HAR-BRN
SOY							
1	13.9855	<b>0.4625*</b>	<b>0.3352*</b>	<b>0.3700*</b>	<b>0.3936*</b>	<b>0.4191*</b>	<b>0.3911*</b>
3	14.0689	<b>0.8490</b>	<b>0.6685*</b>	<b>0.6980*</b>	<b>0.6927*</b>	<b>0.6666*</b>	<b>0.7156*</b>
6	14.1756	<b>0.9710</b>	<b>0.7774*</b>	<b>0.8236*</b>	<b>0.8286*</b>	<b>0.8565</b>	<b>0.7989*</b>
9	14.2718	<b>0.9944</b>	<b>0.8517*</b>	<b>0.9058</b>	<b>0.8925</b>	<b>0.8939</b>	<b>0.8433*</b>
12	14.3528	1.0011	<b>0.9126*</b>	<b>0.9538</b>	<b>0.9499</b>	<b>0.9189*</b>	<b>0.9417*</b>
CORN							
1	16.1422	<b>0.5704</b>	<b>0.4009*</b>	<b>0.3906*</b>	<b>0.4152*</b>	<b>0.4317*</b>	<b>0.4569*</b>
3	16.2383	<b>0.9126</b>	<b>0.6641*</b>	<b>0.6565*</b>	<b>0.6455*</b>	<b>0.7196*</b>	<b>0.6972*</b>
6	16.3790	<b>0.9933</b>	<b>0.7289*</b>	<b>0.7062*</b>	<b>0.6983*</b>	<b>0.7316*</b>	<b>0.7249*</b>
9	16.5061	1.0016	<b>0.7611*</b>	<b>0.7433*</b>	<b>0.7277*</b>	<b>0.7375*</b>	<b>0.7398*</b>
12	16.6270	1.0025	<b>0.8018</b>	<b>0.7815</b>	<b>0.7614*</b>	<b>0.7691*</b>	<b>0.7290*</b>
SUGAR							
1	11.8797	<b>0.5769*</b>	<b>0.5432*</b>	<b>0.5147*</b>	<b>0.5263*</b>	<b>0.6121*</b>	<b>0.5321*</b>
3	11.9633	<b>0.9451</b>	<b>0.8089*</b>	<b>0.8040*</b>	<b>0.8137*</b>	<b>0.8165*</b>	<b>0.8363*</b>
6	12.0218	<b>0.9848</b>	<b>0.9599*</b>	1.0048	1.0061	<b>0.9366*</b>	<b>0.9485*</b>
9	12.0591	<b>0.9868</b>	1.0031	1.0256	1.0282	<b>0.8780*</b>	1.0195
12	12.0814	<b>0.9888*</b>	1.0613	1.0442	1.0437	<b>0.9796*</b>	1.0264
RICE							
1	9.8313	<b>0.4628*</b>	<b>0.4573*</b>	<b>0.4415*</b>	<b>0.4506*</b>	<b>0.4045*</b>	<b>0.4641*</b>
3	10.4693	<b>0.8903</b>	<b>0.7449*</b>	<b>0.7056*</b>	<b>0.7015*</b>	<b>0.7311*</b>	<b>0.7677*</b>
6	10.5569	<b>0.9735</b>	<b>0.8358*</b>	<b>0.8457*</b>	<b>0.8050*</b>	<b>0.8634</b>	<b>0.8826</b>
9	10.6286	<b>0.9935</b>	<b>0.9473*</b>	1.0011	<b>0.9470*</b>	<b>0.9274*</b>	<b>0.9171*</b>
12	10.6728	<b>0.9978*</b>	1.0526	1.1019	1.0378	1.0562	1.0679
WHEAT							
1	18.7489	<b>0.7581</b>	<b>0.4443*</b>	<b>0.4411*</b>	<b>0.4432*</b>	<b>0.4644*</b>	<b>0.4570*</b>
3	18.8665	<b>0.9727</b>	<b>0.5807*</b>	<b>0.5747*</b>	<b>0.5768*</b>	<b>0.6102*</b>	<b>0.5833*</b>
6	19.0386	<b>0.9912</b>	<b>0.6885*</b>	<b>0.6752*</b>	<b>0.6823*</b>	<b>0.6577*</b>	<b>0.6521*</b>
9	19.2019	<b>0.9917</b>	<b>0.7657</b>	<b>0.7514*</b>	<b>0.7585*</b>	<b>0.6837*</b>	<b>0.7860</b>
12	19.3518	<b>0.9918</b>	<b>0.8590*</b>	<b>0.8429*</b>	<b>0.8527*</b>	<b>0.8483*</b>	<b>0.8733*</b>

*Note:* WTI = WTI crude oil price volatility, BRN = Brent crude oil price volatility. The RW column shows the actual MAFE. All other columns show the MAFE ratios, for each forecasting model, that have been normalized relative to the monthly RW forecast. The order of the AR models for Soy and Corn is 1, whereas for Sugar, Rice and Wheat is 2, based on the Bayesian Information Criterion. Bold face numbers denote that the forecast outperforms the RW. \* denotes that the model is included in the set of the best models according to the Model Confidence Set (MCS).

**Table A3.** The Mean Absolute Forecasting Error (MAFE) evaluation function for 1-, 3-, 6-, 9-, 12- month ahead forecasting horizons. Volatility Measure: Monthly Realized Volatility;  $RV_t^{(M)}$ . Forecasting period: 2<sup>nd</sup> Food Crisis (2010-2012).

Months-ahead	RW	AR( $p$ )	HAR	HAR-WTI	HAR-BRN	MIDAS-HAR-WTI	MIDAS-HAR-BRN
SOY							
1	4.7843	<b>0.3576*</b>	<b>0.5017</b>	<b>0.5021</b>	<b>0.5066</b>	<b>0.4662*</b>	<b>0.4671*</b>
3	4.8134	<b>0.9904*</b>	1.1892	1.1814	1.1987	1.2028	1.2692
6	4.8178	1.0243	1.3816	1.3892	1.4272	1.3090	1.3407
9	4.7987	1.0119	1.3351	1.3254	1.3848	1.2840	1.4207
12	4.7790	1.0048	1.3174	1.3248	1.3905	1.3117	1.2002
CORN							
1	10.2521	<b>0.4745*</b>	<b>0.4251*</b>	<b>0.4155*</b>	<b>0.4327*</b>	<b>0.4010*</b>	<b>0.4060*</b>
3	10.3104	<b>0.8847</b>	<b>0.7164*</b>	<b>0.7225*</b>	<b>0.7347*</b>	<b>0.7566</b>	<b>0.6965*</b>
6	10.3898	<b>0.9877</b>	<b>0.7939*</b>	<b>0.8141*</b>	<b>0.8405</b>	<b>0.8178*</b>	<b>0.8111*</b>
9	10.4606	1.0025	<b>0.7154*</b>	<b>0.7163*</b>	<b>0.7308*</b>	<b>0.7112*</b>	<b>0.7189*</b>
12	10.5422	1.0044	<b>0.7170*</b>	<b>0.7132*</b>	<b>0.7219*</b>	<b>0.7284*</b>	<b>0.7673</b>
SUGAR							
1	11.9224	<b>0.5427*</b>	<b>0.4610*</b>	<b>0.4677*</b>	<b>0.4860*</b>	<b>0.4997*</b>	<b>0.4661*</b>
3	11.9889	<b>0.9291</b>	<b>0.6783*</b>	<b>0.7114*</b>	<b>0.7209*</b>	<b>0.6873*</b>	<b>0.7267*</b>
6	12.0726	<b>0.9808</b>	<b>0.8287*</b>	<b>0.8615</b>	<b>0.8745</b>	<b>0.9133</b>	<b>0.7917*</b>
9	12.1457	<b>0.9862</b>	<b>0.9048</b>	<b>0.9336</b>	<b>0.9518</b>	<b>0.8672*</b>	<b>0.7884*</b>
12	12.2098	<b>0.9877</b>	<b>0.9837</b>	<b>0.9991</b>	1.0212	1.0227	<b>0.9524*</b>
RICE							
1	4.5634	<b>0.4288*</b>	<b>0.4519*</b>	<b>0.4858*</b>	<b>0.5044*</b>	<b>0.5590*</b>	<b>0.6425</b>
3	4.5440	<b>0.9592*</b>	1.0655	1.0976	1.1343	1.0581	<b>0.9746*</b>
6	4.5541	<b>0.9901*</b>	1.1639	1.1692	1.2232	1.2879	1.5632
9	4.5586	1.0006	1.2145	1.1812	1.2391	1.2636	1.4657
12	4.5432	1.0019	1.2764	1.1932	1.2646	1.1552	1.4338
WHEAT							
1	10.8431	<b>0.6214</b>	<b>0.5226*</b>	<b>0.5154*</b>	<b>0.5180*</b>	<b>0.5073*</b>	<b>0.5438</b>
3	10.9047	<b>0.9399</b>	<b>0.7137*</b>	<b>0.7075*</b>	<b>0.7100*</b>	<b>0.7525</b>	<b>0.7419</b>
6	10.9799	<b>0.9914</b>	<b>0.7909*</b>	<b>0.7760*</b>	<b>0.7818*</b>	<b>0.7837*</b>	<b>0.7872*</b>
9	11.0420	<b>0.9931</b>	<b>0.7509*</b>	<b>0.7323*</b>	<b>0.7380*</b>	<b>0.7219*</b>	<b>0.7183*</b>
12	11.1124	<b>0.9932</b>	<b>0.7892*</b>	<b>0.7550*</b>	<b>0.7691*</b>	<b>0.7958</b>	<b>0.7629*</b>

*Note:* WTI = WTI crude oil price volatility, BRN = Brent crude oil price volatility. The RW column shows the actual MAFE. All other columns show the MAFE ratios, for each forecasting model, that have been normalized relative to the monthly RW forecast. The order of the AR models for Soy and Corn is 1, whereas for Sugar, Rice and Wheat is 2, based on the Bayesian Information Criterion. Bold face numbers denote that the forecast outperforms the RW. \* denotes that the model is included in the set of the best models according to the Model Confidence Set (MCS).

**Table A4.** The Mean Absolute Forecasting Error (MAFE) evaluation function for 1-, 3-, 6-, 9-, 12- month ahead forecasting horizons. Volatility Measure: Monthly Realized Volatility;  $RV_t^{(M)}$ . Forecasting period: Oil price collapse (2014-2016).

Months-ahead	RW	AR( $p$ )	HAR	HAR-WTI	HAR-BRN	MIDAS-HAR-WTI	MIDAS-HAR-BRN
SOY							
1	8.0025	<b>0.4007*</b>	<b>0.4668*</b>	<b>0.4889*</b>	<b>0.4738*</b>	<b>0.4704*</b>	<b>0.4536*</b>
3	8.0377	<b>0.9323*</b>	<b>0.9954</b>	1.0410	1.0206	1.0275	1.0463
6	8.0403	1.0123	1.0583	1.1127	1.0778	1.1092	1.1308
9	8.0215	1.0006	1.0256	1.0967	1.0559	1.0797	1.0594
12	8.0207	<b>0.9974</b>	<b>0.9913</b>	1.0215	<b>0.9690*</b>	<b>0.9756*</b>	1.0526
CORN							
1	4.5887	<b>0.4297*</b>	<b>0.6245*</b>	<b>0.6098*</b>	<b>0.6162*</b>	<b>0.6918</b>	<b>0.6298*</b>
3	4.6094	1.0169	1.0690	1.0768	1.0905	1.2531	1.1955
6	4.6040	1.0203	1.1268	1.1007	1.0749	1.1673	1.2324
9	4.5885	1.0032	1.0277	1.0190	1.0056	1.0901	<b>0.9662*</b>
12	4.5936	1.0002	1.2054	1.3531	1.3823	1.2743	1.3034
SUGAR							
1	5.7242	<b>0.4631*</b>	<b>0.6638*</b>	<b>0.6264*</b>	<b>0.6382*</b>	<b>0.7650</b>	<b>0.7130</b>
3	5.7415	<b>0.9403</b>	<b>0.9640</b>	<b>0.9315*</b>	<b>0.9305*</b>	<b>0.9027*</b>	1.0781
6	5.7604	<b>0.9881</b>	<b>0.9075</b>	<b>0.8397*</b>	<b>0.8346*</b>	<b>0.8730</b>	<b>0.7617*</b>
9	5.7876	<b>0.9873</b>	<b>0.9552</b>	<b>0.8680*</b>	<b>0.8868*</b>	<b>0.9909</b>	<b>0.9834</b>
12	5.8091	<b>0.9874</b>	<b>0.9058</b>	<b>0.9129</b>	<b>0.8657*</b>	1.1078	1.0763
RICE							
1	4.0212	<b>0.4022*</b>	<b>0.5902*</b>	<b>0.5689*</b>	<b>0.5955</b>	<b>0.6291</b>	<b>0.6071</b>
3	4.5574	<b>0.8937</b>	<b>0.7518*</b>	<b>0.8637</b>	<b>0.8877</b>	<b>0.8447</b>	<b>0.8979</b>
6	4.5917	<b>0.9813</b>	<b>0.6913*</b>	<b>0.8547</b>	<b>0.8897</b>	<b>0.7627*</b>	<b>0.8552</b>
9	4.6350	<b>0.9841</b>	<b>0.7927*</b>	<b>0.9545</b>	1.0037	<b>0.7799*</b>	<b>0.8358*</b>
12	4.6682	<b>0.9944</b>	<b>0.7944*</b>	<b>0.9398</b>	1.0267	<b>0.8819*</b>	<b>0.9051</b>
WHEAT							
1	5.1022	<b>0.5401*</b>	<b>0.7117</b>	<b>0.6976</b>	<b>0.6853*</b>	<b>0.7516</b>	<b>0.7436</b>
3	5.1220	<b>0.9914</b>	1.0448	<b>0.9897*</b>	1.0046	1.1230	1.0391
6	5.1267	<b>0.9879*</b>	1.1859	1.0991	1.1328	1.2129	1.1750
9	5.1265	<b>0.9913*</b>	1.2334	1.1406	1.1931	1.2047	1.2284
12	5.1365	<b>0.9882*</b>	1.1846	1.0878	1.1509	1.1506	1.1945

*Note:* WTI = WTI crude oil price volatility, BRN = Brent crude oil price volatility. The RW column shows the actual MAFE. All other columns show the MAFE ratios, for each forecasting model, that have been normalized relative to the monthly RW forecast. The order of the AR models for Soy and Corn is 1, whereas for Sugar, Rice and Wheat is 2, based on the Bayesian Information Criterion. Bold face numbers denote that the forecast outperforms the RW. \* denotes that the model is included in the set of the best models according to the Model Confidence Set (MCS).

**Table A5.** Directional accuracy for 1-, 3-, 6-, 9-, 12- month ahead forecasting horizons. Volatility Measure: Monthly Realized Volatility;  $RV_t^{(M)}$ . Forecasting period: 1st Food Crisis (2007-2009).

Months-ahead	RW	AR( $p$ )	HAR	HAR-WTI	HAR-BRN	MIDAS-HAR-WTI	MIDAS-HAR-BRN
SOY							
1	0.4400	0.6400	0.7600	0.7200	0.6800	0.6800	0.6000
3	0.6800	0.7200	0.7200	0.6800	0.6400	0.7200	0.6400
6	0.6000	0.6000	0.6000	0.6000	0.6000	0.5600	0.6000
9	0.5600	0.5600	0.6400	0.5200	0.5200	0.5200	0.5600
12	0.4800	0.4800	0.5600	0.4400	0.4400	0.4800	0.4800
CORN							
1	0.6000	0.7200	0.8800	0.8800	0.8400	0.7200	0.7600
3	0.5200	0.5600	0.5200	0.5200	0.4800	0.4800	0.4400
6	0.4400	0.4400	0.5600	0.5600	0.5600	0.5600	0.5600
9	0.4800	0.4800	0.6800	0.6800	0.6800	0.6400	0.6400
12	0.4800	0.4800	0.6000	0.6000	0.6000	<b>0.6400</b>	<b>0.6400</b>
SUGAR							
1	0.6400	0.8400	0.8800	0.8400	0.8400	0.8400	0.8400
3	0.5600	0.6400	0.6400	<b>0.6800</b>	<b>0.6800</b>	0.6400	<b>0.6800</b>
6	0.7600	0.8000	0.8000	0.6800	0.6800	0.7600	0.7200
9	0.8000	0.8000	0.7600	0.7600	0.7600	<b>0.8800</b>	0.7600
12	0.8400	0.8400	0.8000	0.8400	0.8000	0.8400	0.8400
RICE							
1	0.5200	0.7200	0.7200	<b>0.7600</b>	<b>0.7600</b>	<b>0.7600</b>	0.6800
3	0.7200	0.7200	0.8000	0.8000	0.8000	<b>0.8400</b>	0.6800
6	0.6800	0.7200	0.7600	0.7600	0.7600	0.7200	0.7200
9	0.8400	0.8400	0.7600	0.6800	0.6800	0.7600	0.7600
12	0.7600	0.7600	0.7600	0.7200	0.7600	<b>0.8000</b>	<b>0.8000</b>
WHEAT							
1	0.4800	0.5600	0.7600	0.7600	0.7600	0.7600	0.7600
3	0.5200	0.5200	0.6800	<b>0.7200</b>	0.6800	0.6400	0.6400
6	0.4400	0.4400	0.5600	0.5600	0.5600	<b>0.6000</b>	<b>0.6000</b>
9	0.3600	0.3600	0.4000	0.4400	0.4000	0.4400	0.4400
12	0.3200	0.3200	0.4000	0.4000	0.4000	0.4400	0.4000

*Note:* WTI = WTI crude oil price volatility, BRN = Brent crude oil price volatility. Bold face indicates improvement in directional accuracy relative to the benchmark models (RW, AR( $p$ ) or HAR). The order of the AR models for Soy and Corn is 1, whereas for Sugar, Rice and Wheat is 2, based on the Bayesian Information Criterion.

**Table A6.** Directional accuracy for 1-, 3-, 6-, 9-, 12- month ahead forecasting horizons. Volatility Measure: Monthly Realized Volatility;  $RV_t^{(M)}$ . Forecasting period: 2<sup>nd</sup> Food Crisis (2010-2012).

Months-ahead	RW	AR( $p$ )	HAR	HAR-WTI	HAR-BRN	MIDAS-HAR-WTI	MIDAS-HAR-BRN
SOY							
1	0.7222	0.9167	0.8611	0.8611	0.8333	0.8889	0.8889
3	0.7778	0.7222	0.6667	0.6944	0.6944	0.6111	0.6667
6	0.8056	0.7778	0.6944	0.6944	0.7222	0.7500	0.7222
9	0.7778	0.7778	0.7500	0.7500	0.7222	<b>0.8056</b>	0.7222
12	0.8333	0.8333	0.8056	<b>0.8889</b>	<b>0.8611</b>	0.8056	0.8056
CORN							
1	0.5556	0.7500	0.8333	<b>0.8611</b>	0.8333	<b>0.8611</b>	<b>0.8889</b>
3	0.6667	0.6389	0.6944	<b>0.7222</b>	0.6944	0.6667	<b>0.7222</b>
6	0.6389	0.6389	0.7500	<b>0.7778</b>	<b>0.7778</b>	0.7500	0.7500
9	0.5833	0.5833	0.7222	0.7222	0.6667	<b>0.7500</b>	<b>0.7500</b>
12	0.6111	0.6111	0.5556	0.5833	0.5833	<b>0.6389</b>	0.5556
SUGAR							
1	0.5556	0.6967	0.6944	0.6667	0.6389	<b>0.7778</b>	0.6389
3	0.6944	0.6944	0.6667	0.6389	0.6667	0.6944	0.6667
6	0.7222	0.7222	0.7222	0.7222	0.7222	0.6944	0.7222
9	0.6667	0.6667	0.6667	0.6944	<b>0.7222</b>	0.6667	<b>0.7222</b>
12	0.6944	0.6944	0.6944	<b>0.7222</b>	<b>0.7222</b>	<b>0.7222</b>	<b>0.7222</b>
RICE							
1	0.6667	0.9444	0.9444	0.8611	0.8333	0.8333	0.8611
3	0.6667	0.6667	0.5833	0.6111	0.6111	0.5278	0.6111
6	0.6111	0.6389	0.5833	0.5000	0.4722	0.4722	0.3889
9	0.6667	0.6389	0.5833	0.6111	0.6111	0.5278	0.5000
12	0.6667	0.6667	0.6389	0.5833	0.5556	0.6111	0.5278
WHEAT							
1	0.5556	0.6111	0.6944	<b>0.7222</b>	0.6944	0.6944	0.6944
3	0.7222	0.7500	0.6389	0.6111	0.6111	0.5556	0.6111
6	0.5833	0.5833	0.6667	<b>0.6944</b>	<b>0.6944</b>	<b>0.7222</b>	<b>0.7222</b>
9	0.5833	0.5833	0.6667	0.6667	0.6667	0.6389	<b>0.6944</b>
12	0.6667	0.6667	0.6944	<b>0.7222</b>	<b>0.7222</b>	0.6944	0.6944

*Note:* WTI = WTI crude oil price volatility, BRN = Brent crude oil price volatility. Bold face indicates improvement in directional accuracy relative to the benchmark models (RW, AR( $p$ ) or HAR). The order of the AR models for Soy and Corn is 1, whereas for Sugar, Rice and Wheat is 2, based on the Bayesian Information Criterion.



**Table A7.** Directional accuracy for 1-, 3-, 6-, 9-, 12- month ahead forecasting horizons. Volatility Measure: Monthly Realized Volatility;  $RV_t^{(M)}$ . Forecasting period: Oil price collapse (2014-2016).

Months-ahead	RW	AR( $p$ )	HAR	HAR-WTI	HAR-BRN	MIDAS-HAR-WTI	MIDAS-HAR-BRN
SOY							
1	0.6190	0.8571	0.7619	0.7619	0.8095	0.8095	0.8095
3	0.6667	0.6667	0.5714	0.6190	0.6190	0.6190	0.6667
6	0.8571	0.8571	0.8571	0.8095	0.8095	0.7619	0.8095
9	0.6667	0.6667	0.6667	0.6190	0.6667	0.6190	<b>0.7143</b>
12	0.7619	0.7619	0.8095	0.7143	0.7619	0.8095	0.8095
CORN							
1	0.7143	0.9524	0.7619	0.8571	0.8571	0.7619	0.8095
3	0.6190	0.6190	0.6667	0.6190	0.6190	0.6667	0.5714
6	0.7619	0.7619	0.7619	<b>0.8571</b>	<b>0.8571</b>	0.7619	0.7143
9	0.6667	0.6667	0.6667	0.6190	0.6190	0.6667	0.6667
12	0.7143	0.7143	0.6190	0.7143	0.6667	0.6667	0.5714
SUGAR							
1	0.5714	0.7143	0.7143	<b>0.7619</b>	0.7143	<b>0.7619</b>	<b>0.7619</b>
3	0.7143	0.7619	0.7143	0.6667	0.7619	<b>0.8571</b>	<b>0.8095</b>
6	0.7143	0.7143	0.6667	0.6190	0.6190	0.6667	<b>0.7619</b>
9	0.9524	0.9524	0.8571	0.9048	0.8095	0.8571	0.8571
12	0.8571	0.8571	0.7619	0.8095	0.8571	0.7143	0.7143
RICE							
1	0.7143	0.9048	0.8095	0.8571	0.8571	0.8571	0.6667
3	0.6667	0.7143	0.7143	0.6667	0.6667	0.7143	0.5714
6	0.8095	0.8095	0.8571	0.8095	0.8095	0.8571	0.8571
9	0.8095	0.8571	0.8571	0.8571	0.8571	0.8571	0.8571
12	0.8095	0.8095	0.8571	0.8571	0.8095	0.8571	0.8095
WHEAT							
1	0.7143	0.9524	0.8571	0.8095	0.8571	0.8571	0.7619
3	0.6667	0.7143	0.6190	0.6667	0.6667	0.6190	0.6667
6	0.8571	0.8571	0.8571	0.8571	0.8571	0.7619	0.7619
9	0.8571	0.8571	0.9524	0.9524	0.9524	0.8571	0.9048
12	0.8571	0.8571	0.8571	0.8095	0.8571	0.8571	0.8095

*Note:* WTI = WTI crude oil price volatility, BRN = Brent crude oil price volatility. Bold face indicates improvement in directional accuracy relative to the benchmark models (RW, AR( $p$ ) or HAR). The order of the AR models for Soy and Corn is 1, whereas for Sugar, Rice and Wheat is 2, based on the Bayesian Information Criterion.

**Table A8.** Forecast average measures. The Mean Squared Forecasting Error (MSFE) evaluation function for 1-, 3-, 6-, 9-, 12- month ahead forecasting horizons. Volatility Measure: Monthly Realized Volatility,  $RV_t^{(M)}$ . Forecasting period: Jan 2000 – March 2017.

Months-ahead	FA_BRN_1	FA_WTI_1	FA_BRN_2	FA_WTI_2	All vs. Non-oil
SOY					
1	<b>0.1912</b>	<b>0.1832</b>	<b>0.1949</b>	<b>0.1843</b>	0.9434
3	0.7539	0.7325	0.7532	0.7289	0.9663
6	0.8622	0.8751	0.9803	0.9929	0.9724
9	0.8831	0.8975	1.0088	1.0140	0.9794
12	0.9036	0.8977	0.9020	0.9204	0.9784
CORN					
1	<b>0.3005</b>	<b>0.2987</b>	<b>0.2939</b>	<b>0.2962</b>	0.9910
3	0.6758	0.6626	0.6654	0.6583	0.9208
6	0.8049	0.7989	0.8497	0.8747	0.9450
9	0.7491	0.7467	0.7667	0.7715	0.9116
12	0.7388	0.7026	0.6830	0.6874	<b>0.8877</b>
SUGAR					
1	<b>0.3425</b>	<b>0.3546</b>	<b>0.3439</b>	<b>0.3521</b>	1.0120
3	0.7231	0.7468	0.7208	0.7454	0.9308
6	0.8567	0.8310	0.9106	0.8739	0.9411
9	0.9432	0.9414	1.0296	1.0066	0.9761
12	1.0045	1.0077	1.2323	1.1825	0.9946
RICE					
1	<b>0.2885</b>	<b>0.2995</b>	<b>0.2849</b>	<b>0.2979</b>	1.0345
3	0.7927	0.7963	0.7855	0.8006	0.9615
6	0.9129	0.9124	0.9682	0.9784	0.9947
9	0.8763	0.9005	1.0216	1.0071	0.9697
12	0.9710	0.9331	0.9342	0.9387	1.0186
WHEAT					
1	<b>0.3435</b>	<b>0.3474</b>	<b>0.3471</b>	<b>0.3501</b>	<b>0.8783</b>
3	0.5881	0.5768	0.5846	0.5795	<b>0.8661</b>
6	0.6555	0.6866	0.6586	0.6492	<b>0.8868</b>
9	0.7226	0.7538	0.7047	0.7033	0.8981
12	0.8111	0.8305	0.7720	0.7663	0.9488

*Note:* FA\_BRN\_1 denotes the simple forecast average between HAR-BRN and MIDAS-HAR-BRN. FA\_WTI\_1 denotes the simple forecast average between HAR-WTI and MIDAS-HAR-WTI. FA\_BRN\_2 denotes forecast average between HAR-BRN and MIDAS-HAR-BRN weighted by the inverse of the mean squared forecast error of the previous forecast. FA\_WTI\_2 denotes forecast average between HAR-WTI and MIDAS-HAR-WTI weighted by the inverse of the mean squared forecast error of the previous forecast. All Values show the MSFE ratios, for each forecast average model, that have been normalized relative to the monthly RW forecast. Bold face numbers denote that the forecast average outperforms all other models according to the Model Confidence Set (MCS). All vs. Non-oil denotes the MSFE ratio between the forecast average of all models (excluding the RW) and the non-oil models (i.e. AR(p) and HAR), respectively. The

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statistical significance is gauged via the Diebold-Mariano test. Bold face denotes that the performance of the forecast average based on all models is superior compared to the non-oil models.

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**Table A9.** Forecast average measures. The Mean Squared Forecasting Error (MSFE) evaluation function for 1-, 3-, 6-, 9-, 12- month ahead forecasting horizons. Volatility Measure: Monthly Realized Volatility,  $RV_t^{(M)}$ . Forecasting period: 1st Food Crisis (2007-2009).

Months-ahead	FA_BRN_1	FA_WTI_1	FA_BRN_2	FA_WTI_2	All vs. Non-oil
SOY					
1	0.1850	0.1899	0.1871	0.1921	1.0171
3	0.5392	0.5449	0.5360	0.5431	0.8930
6	0.7451	0.7072	<b>0.5659</b>	<b>0.5564</b>	0.9318
9	0.8381	0.7950	<b>0.6985</b>	<b>0.6865</b>	0.9528
12	0.9107	0.9172	0.8132	0.8091	0.9840
CORN					
1	0.1938	0.2077	0.1919	0.2080	0.8603
3	0.4627	0.4424	0.4669	0.4408	<b>0.7910</b>
6	0.6313	0.5989	0.5492	0.5658	0.8520
9	0.6360	0.6369	0.5850	0.5847	<b>0.8386</b>
12	0.6974	0.6384	<b>0.5505</b>	<b>0.5413</b>	0.8461
SUGAR					
1	0.3881	0.3074	0.3710	0.2964	0.9398
3	0.7495	0.7701	0.7314	0.7635	0.9180
6	1.0212	0.9999	1.1053	1.1152	0.9985
9	1.0342	1.0853	1.3059	1.3500	1.0071
12	1.0768	1.1209	1.4708	1.5034	1.0194
RICE					
1	0.2112	0.2148	0.2094	0.2073	0.8761
3	0.7499	0.6943	0.7460	0.6921	0.9364
6	1.0882	1.0238	1.1275	1.1225	1.0257
9	1.1358	1.0786	1.1644	1.1574	1.0273
12	1.2193	1.1965	1.4019	1.4362	1.0540
WHEAT					
1	0.2699	0.2607	0.2722	0.2646	<b>0.7651</b>
3	0.4550	0.4477	0.4494	0.4450	<b>0.7803</b>
6	0.5215	0.5355	0.4630	0.4601	<b>0.8008</b>
9	0.5988	0.6894	0.5323	0.5603	0.8303
12	0.7843	0.8020	<b>0.6156</b>	<b>0.6269</b>	0.9227

*Note:* FA\_BRN\_1 denotes the simple forecast average between HAR-BRN and MIDAS-HAR-BRN. FA\_WTI\_1 denotes the simple forecast average between HAR-WTI and MIDAS-HAR-WTI. FA\_BRN\_2 denotes forecast average between HAR-BRN and MIDAS-HAR-BRN weighted by the inverse of the mean squared forecast error of the previous forecast. FA\_WTI\_2 denotes forecast average between HAR-WTI and MIDAS-HAR-WTI weighted by the inverse of the mean squared forecast error of the previous forecast. Values show the MSFE ratios, for each forecast average model, that have been normalized relative to the monthly RW forecast. Bold face numbers denote that the forecast average outperforms all other models according to the Model Confidence Set (MCS). All vs. Non-oil denotes the MSFE ratio between the forecast average of all models (excluding the RW) and the non-oil models (i.e. AR(p) and HAR), respectively. The statistical

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significance is gauged via the Diebold-Mariano test. Bold face denotes that the performance of the forecast average based on all models is superior compared to the non-oil models.

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**Table A10.** Forecast average measures. The Mean Squared Forecasting Error (MSFE) evaluation function for 1-, 3-, 6-, 9-, 12- month ahead forecasting horizons. Volatility Measure: Monthly Realized Volatility,  $RV_t^{(M)}$ . Forecasting period: 2<sup>nd</sup> Food Crisis (2010-2012).

Months-ahead	FA_BRN_1	FA_WTI_1	FA_BRN_2	FA_WTI_2	All vs. Non-oil
SOY					
1	0.2086	0.2242	0.2163	0.2218	1.0891
3	1.3395	1.4503	1.3041	1.3795	1.1508
6	1.6254	1.7137	2.7140	2.8767	1.1597
9	1.5894	1.9007	3.1647	3.1720	1.2283
12	1.5909	1.4998	3.0828	3.1272	1.2033
CORN					
1	0.1674	0.1714	0.1683	0.1801	0.8751
3	0.5408	0.4949	0.5249	0.4896	0.8848
6	0.6659	0.6920	0.8316	0.8880	0.9281
9	0.5354	0.5507	0.6113	0.6744	<b>0.8081</b>
12	0.5335	0.5352	0.5852	0.5919	<b>0.8050</b>
SUGAR					
1	0.2522	0.2773	0.2416	0.2731	0.9455
3	0.5898	0.6234	0.5957	0.6251	0.9196
6	0.8047	0.7477	0.6271	<b>0.5819</b>	0.9576
9	0.8405	0.7984	0.6818	0.6886	0.9362
12	0.9834	0.9784	0.9409	0.8995	1.0121
RICE					
1	0.2646	0.3155	0.2824	0.3758	1.2404
3	0.9815	0.9450	0.9390	0.9596	1.0031
6	1.1983	1.6525	1.1676	1.1197	1.1178
9	1.2491	1.6002	1.3579	1.3700	1.0748
12	1.5169	1.7618	2.0595	2.0481	1.1457
WHEAT					
1	0.2822	0.3017	0.2793	0.2969	0.9173
3	0.5359	0.5277	0.5324	0.5262	0.8481
6	0.5646	0.5750	0.6731	0.6540	<b>0.8292</b>
9	0.5236	0.5272	0.5534	0.5417	<b>0.7819</b>
12	0.5995	0.6077	0.6390	0.6424	0.8466

*Note:* FA\_BRN\_1 denotes the simple forecast average between HAR-BRN and MIDAS-HAR-BRN. FA\_WTI\_1 denotes the simple forecast average between HAR-WTI and MIDAS-HAR-WTI. FA\_BRN\_2 denotes forecast average between HAR-BRN and MIDAS-HAR-BRN weighted by the inverse of the mean squared forecast error of the previous forecast. FA\_WTI\_2 denotes forecast average between HAR-WTI and MIDAS-HAR-WTI weighted by the inverse of the mean squared forecast error of the previous forecast. Values show the MSFE ratios, for each forecast average model, that have been normalized relative to the monthly RW forecast. Bold face numbers denote that the forecast average outperforms all other models according to the Model Confidence Set (MCS). All vs. Non-oil denotes the MSFE ratio between the forecast average of all models (excluding the RW) and the non-oil models (i.e. AR(p) and HAR), respectively. The statistical significance is gauged via the Diebold-Mariano test. Bold face denotes that the performance of the forecast average based on all models is superior compared to the non-oil models.

**Table A11.** Forecast average measures. The Mean Squared Forecasting Error (MSFE) evaluation function for 1-, 3-, 6-, 9-, 12- month ahead forecasting horizons. Volatility Measure: Monthly Realized Volatility,  $RV_t^{(M)}$ . Forecasting period: Oil price collapse (2014-2016).

Months-ahead	FA_BRN_1	FA_WTI_1	FA_BRN_2	FA_WTI_2	All vs. Non-oil
SOY					
1	0.2906	0.2590	0.3023	0.2622	1.1581
3	1.0454	1.0801	1.0412	1.0823	1.0844
6	1.2649	1.2101	1.4336	1.3932	1.1146
9	1.0594	1.0363	1.4564	1.4078	1.0223
12	0.9133	0.8689	0.8537	0.8601	0.9629
CORN					
1	0.4348	0.4035	0.3949	0.4291	1.2814
3	1.3657	1.3112	1.3356	1.3228	1.1298
6	1.1763	1.2216	1.2570	1.2705	1.0673
9	0.9391	0.8984	1.1021	1.1362	0.9212
12	1.4487	1.5999	1.9534	2.0619	1.2041
SUGAR					
1	0.4951	0.4591	0.5362	0.4892	1.2587
3	0.7565	0.9124	0.7776	0.9007	0.9066
6	0.8027	0.6947	1.0075	0.9622	<b>0.8386</b>
9	0.9643	0.9942	1.5565	1.4900	0.9682
12	1.0176	0.9660	1.6319	1.5751	0.9883
RICE					
1	0.5453	0.5600	0.5360	0.5480	1.4809
3	1.6367	1.6409	1.6331	1.6540	1.0557
6	1.2751	1.2692	1.6681	1.7140	1.1026
9	1.0526	1.1580	1.7333	1.7910	1.0162
12	1.1673	1.0851	1.5142	1.5877	1.0223
WHEAT					
1	0.6177	0.6125	0.6174	0.6121	1.2465
3	1.2206	1.1206	1.1666	1.0982	1.0636
6	1.3994	1.3562	1.4474	1.4501	1.1231
9	1.4500	1.5645	2.0213	1.9584	1.1488
12	1.3648	1.4533	1.8855	1.8770	1.1166

*Note:* FA\_BRN\_1 denotes the simple forecast average between HAR-BRN and MIDAS-HAR-BRN. FA\_WTI\_1 denotes the simple forecast average between HAR-WTI and MIDAS-HAR-WTI. FA\_BRN\_2 denotes forecast average between HAR-BRN and MIDAS-HAR-BRN weighted by the inverse of the mean squared forecast error of the previous forecast. FA\_WTI\_2 denotes forecast average between HAR-WTI and MIDAS-HAR-WTI weighted by the inverse of the mean squared forecast error of the previous forecast. Values show the MSFE ratios, for each forecast average model, that have been normalized relative to the monthly RW forecast. Bold face numbers denote that the forecast average outperforms all other models according to the Model Confidence Set (MCS). All vs. Non-oil denotes the MSFE ratio between the forecast average of all models (excluding the RW) and the non-oil models (i.e. AR(p))

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and HAR), respectively. The statistical significance is gauged via the Diebold-Mariano test. Bold face denotes that the performance of the forecast average based on all models is superior compared to the non-oil models.

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**Table A12.** The Mean Squared Forecasting Error (MSFE) evaluation function for 1-, 3-, 6-, 9-, 12- month ahead forecasting horizons. Volatility Measure: Monthly Price Range;  $PR_t^{(M)}$ . Forecasting period: Jan 2000 – March 2017.

Months-ahead	RW	AR( $p$ )	HAR	HAR-WTI	HAR-BRN	MIDAS-HAR-WTI	MIDAS-HAR-BRN
SOY							
1	164.9	<b>0.6398*</b>	<b>0.5894*</b>	<b>0.6101*</b>	<b>0.6095*</b>	<b>0.5973*</b>	<b>0.5713*</b>
3	166.5	<b>0.9285</b>	<b>0.8000*</b>	<b>0.8378*</b>	<b>0.8318*</b>	<b>0.8024*</b>	<b>0.7694*</b>
6	169.6	<b>0.9900</b>	<b>0.8290*</b>	<b>0.8567*</b>	<b>0.8496*</b>	<b>0.8667</b>	<b>0.8768</b>
9	172.5	1.0000	<b>0.8510*</b>	<b>0.9038</b>	<b>0.8875</b>	<b>0.8516*</b>	<b>0.8725*</b>
12	176.1	1.0006	<b>0.8887*</b>	<b>0.9710</b>	<b>0.9472</b>	<b>0.8864*</b>	<b>0.8325*</b>
CORN							
1	215.8	<b>0.7447</b>	<b>0.6738*</b>	<b>0.6835*</b>	<b>0.6872*</b>	<b>0.6997*</b>	<b>0.6951*</b>
3	217.8	<b>0.9408</b>	<b>0.7893*</b>	<b>0.8090*</b>	<b>0.8035*</b>	<b>0.8108*</b>	<b>0.7562*</b>
6	221.2	<b>0.9964</b>	<b>0.8142*</b>	<b>0.8413</b>	<b>0.8291*</b>	<b>0.8404</b>	<b>0.8395*</b>
9	223.7	1.0013	<b>0.8002*</b>	<b>0.8118*</b>	<b>0.8006*</b>	<b>0.7881*</b>	<b>0.7962*</b>
12	228.4	1.0013	<b>0.8170*</b>	<b>0.8139*</b>	<b>0.8034*</b>	<b>0.8341</b>	<b>0.8249</b>
SUGAR							
1	155.8	<b>0.6836*</b>	<b>0.6380*</b>	<b>0.6418*</b>	<b>0.6508*</b>	<b>0.6534*</b>	<b>0.6605*</b>
3	154.5	<b>0.8254</b>	<b>0.7650*</b>	<b>0.7780*</b>	<b>0.7845*</b>	<b>0.7599*</b>	<b>0.8304</b>
6	154.4	<b>0.9141</b>	<b>0.8316*</b>	<b>0.8400*</b>	<b>0.8407*</b>	<b>0.8426*</b>	<b>0.8543*</b>
9	152.5	<b>0.9731</b>	<b>0.9115*</b>	<b>0.9154*</b>	<b>0.9102*</b>	<b>0.8492*</b>	<b>0.9633</b>
12	148.0	<b>0.9914</b>	<b>0.9514*</b>	<b>0.9473*</b>	<b>0.9358*</b>	<b>0.9500*</b>	<b>0.9419*</b>
RICE							
1	184.6	<b>0.7324</b>	<b>0.6961*</b>	<b>0.6880*</b>	<b>0.6999*</b>	<b>0.7015*</b>	<b>0.6999*</b>
3	187.2	<b>0.8864</b>	<b>0.8510*</b>	<b>0.8691*</b>	<b>0.8574*</b>	<b>0.8226*</b>	<b>0.8729*</b>
6	190.8	<b>0.9388*</b>	<b>0.9193*</b>	<b>0.9397*</b>	<b>0.9429</b>	<b>0.9471</b>	1.0026
9	180.4	<b>0.9406*</b>	<b>0.9396*</b>	<b>0.9712*</b>	<b>0.9739*</b>	<b>0.9800</b>	<b>0.9784</b>
12	181.1	<b>0.9721*</b>	<b>0.9807*</b>	1.0160	1.0160	1.0105	<b>0.9475*</b>
WHEAT							
1	168.5	<b>0.6967*</b>	<b>0.6641*</b>	<b>0.6724*</b>	<b>0.6766*</b>	<b>0.6831*</b>	<b>0.6712*</b>
3	170.6	<b>0.8668</b>	<b>0.7327*</b>	<b>0.7497*</b>	<b>0.7444*</b>	<b>0.7644*</b>	<b>0.7356*</b>
6	174.0	<b>0.9388</b>	<b>0.7540*</b>	<b>0.7672*</b>	<b>0.7563*</b>	<b>0.7764*</b>	<b>0.7891*</b>
9	177.7	<b>0.9795</b>	<b>0.7980*</b>	<b>0.8087*</b>	<b>0.7980*</b>	<b>0.7698*</b>	<b>0.8402</b>
12	181.4	<b>0.9941</b>	<b>0.8512*</b>	<b>0.8583*</b>	<b>0.8506*</b>	<b>0.8771</b>	<b>0.8528*</b>

*Note:* WTI = WTI crude oil price volatility, BRN = Brent crude oil price volatility. The RW column shows the actual MSFE. All other columns show the MSFE ratios, for each forecasting model, that have been normalized relative to the monthly RW forecast. The order of the AR models for Soy and Corn is 1, for Sugar and Wheat is 2, whereas for Rice is 4, based on the Bayesian Information Criterion. Bold face numbers denote that the forecast outperforms the RW. \* denotes that the model is included in the set of the best models according to the Model Confidence Set (MCS).

**Table A13.** The Mean Absolute Forecasting Error (MAFE) evaluation function for 1-, 3-, 6-, 9-, 12-month ahead forecasting horizons. Volatility Measure: Monthly Price Range;  $PR_t^{(M)}$ . Forecasting period: Jan 2000 – March 2017.

Months-ahead	RW	AR( $p$ )	HAR	HAR-WTI	HAR-BRN	MIDAS-HAR-WTI	MIDAS-HAR-BRN
SOY							
1	8.28	<b>0.8056*</b>	<b>0.7874*</b>	<b>0.7983*</b>	<b>0.8007*</b>	<b>0.8068*</b>	<b>0.7971*</b>
3	8.31	<b>0.9567</b>	<b>0.9266*</b>	<b>0.9362*</b>	<b>0.9471</b>	<b>0.9483</b>	<b>0.9206*</b>
6	8.40	<b>0.9976</b>	<b>0.9381*</b>	<b>0.9571*</b>	<b>0.9583*</b>	<b>0.9714</b>	<b>0.9714</b>
9	8.46	1.0000	<b>0.9480*</b>	<b>0.9764</b>	<b>0.9811</b>	<b>0.9492*</b>	<b>0.9681*</b>
12	8.58	<b>0.9988</b>	<b>0.9697*</b>	1.0210	1.0186	<b>0.9848</b>	<b>0.9231*</b>
CORN							
1	9.76	<b>0.8596*</b>	<b>0.8279*</b>	<b>0.8412*</b>	<b>0.8432*</b>	<b>0.8494*</b>	<b>0.8361*</b>
3	9.81	<b>0.9664</b>	<b>0.9072*</b>	<b>0.9307</b>	<b>0.9307</b>	<b>0.9246*</b>	<b>0.9011*</b>
6	9.88	<b>0.9970</b>	<b>0.9089*</b>	<b>0.9160*</b>	<b>0.9170*</b>	<b>0.9028*</b>	<b>0.9281*</b>
9	9.92	1.0010	<b>0.9063*</b>	<b>0.9042*</b>	<b>0.9073*</b>	<b>0.9103*</b>	<b>0.9073*</b>
12	10.08	<b>0.9990</b>	<b>0.9216*</b>	<b>0.9028*</b>	<b>0.9077*</b>	<b>0.9296*</b>	<b>0.9266*</b>
SUGAR							
1	9.31	<b>0.8160*</b>	<b>0.7916*</b>	<b>0.8067*</b>	<b>0.8088*</b>	<b>0.8185*</b>	<b>0.8281</b>
3	9.25	<b>0.8801*</b>	<b>0.8649*</b>	<b>0.8768*</b>	<b>0.8843*</b>	<b>0.8822*</b>	<b>0.9373*</b>
6	9.25	<b>0.9512</b>	<b>0.9276*</b>	<b>0.9308*</b>	<b>0.9265*</b>	<b>0.9578</b>	<b>0.9362*</b>
9	9.23	<b>0.9858</b>	<b>0.9653*</b>	<b>0.9664*</b>	<b>0.9599*</b>	<b>0.9480*</b>	<b>0.9859</b>
12	9.08	<b>0.9981</b>	<b>0.9802*</b>	<b>0.9714*</b>	<b>0.9626*</b>	<b>0.9725*</b>	<b>0.9548*</b>
RICE							
1	9.18	<b>0.8299*</b>	<b>0.8039*</b>	<b>0.7974*</b>	<b>0.8061*</b>	<b>0.8246*</b>	<b>0.8072*</b>
3	9.29	<b>0.9391*</b>	<b>0.9247*</b>	<b>0.9279*</b>	<b>0.9225*</b>	<b>0.9386*</b>	<b>0.9440</b>
6	9.41	<b>0.9871*</b>	<b>0.9692*</b>	<b>0.9809*</b>	<b>0.9745*</b>	1.0085	1.0159
9	9.15	<b>0.9991</b>	<b>0.9770*</b>	<b>0.9934</b>	<b>0.9891*</b>	1.0120	<b>0.9967</b>
12	9.14	<b>1.0001</b>	1.0022	1.0230	1.0219	<b>0.9967*</b>	<b>0.9847*</b>
WHEAT							
1	8.96	<b>0.8945</b>	<b>0.8426*</b>	<b>0.8460*</b>	<b>0.8516*</b>	<b>0.8549*</b>	<b>0.8571*</b>
3	9.04	<b>0.9512</b>	<b>0.8982*</b>	<b>0.9060*</b>	<b>0.8993*</b>	<b>0.9237*</b>	<b>0.9126*</b>
6	9.15	<b>0.9873</b>	<b>0.9246*</b>	<b>0.9246*</b>	<b>0.9126*</b>	<b>0.9530</b>	<b>0.9574</b>
9	9.26	<b>0.9981</b>	<b>0.9374*</b>	<b>0.9363*</b>	<b>0.9276*</b>	<b>0.9201*</b>	<b>0.9644</b>
12	9.37	<b>0.9973</b>	<b>0.9626*</b>	<b>0.9626*</b>	<b>0.9552*</b>	<b>0.9968</b>	<b>0.9787</b>

*Note:* WTI = WTI crude oil price volatility, BRN = Brent crude oil price volatility. The RW column shows the actual MAFE. All other columns show the MAFE ratios, for each forecasting model, that have been normalized relative to the monthly RW forecast. The order of the AR models for Soy and Corn is 1, for Sugar and Wheat is 2, whereas for Rice is 4, based on the Bayesian Information Criterion. Bold face numbers denote that the forecast outperforms the RW. \* denotes that the model is included in the set of the best models according to the Model Confidence Set (MCS).

**Table A14.** The Mean Squared Forecasting Error (MSFE) evaluation function for 1-, 3-, 6-, 9-, 12- month ahead forecasting horizons. Volatility Measure: Monthly Realized Range;  $RR_t^{(M)}$ . Forecasting period: Jan 2000 – March 2017.

Months-ahead	RW	AR( $p$ )	HAR	HAR-WTI	HAR-BRN	MIDAS-HAR-WTI	MIDAS-HAR-BRN
SOY							
1	85.1	<b>0.3325*</b>	<b>0.3067*</b>	<b>0.3231*</b>	<b>0.3184*</b>	<b>0.3243*</b>	<b>0.3114*</b>
3	86.4	<b>0.6574*</b>	<b>0.5498*</b>	<b>0.5880*</b>	<b>0.5799*</b>	<b>0.6088*</b>	<b>0.5822*</b>
6	88.3	<b>0.8732</b>	<b>0.6750*</b>	<b>0.7180*</b>	<b>0.7135*</b>	<b>0.7644*</b>	<b>0.7180*</b>
9	90.3	<b>0.9424</b>	<b>0.7165*</b>	<b>0.7663*</b>	<b>0.7730*</b>	<b>0.7486*</b>	<b>0.7841*</b>
12	92.7	<b>0.9752</b>	<b>0.7843*</b>	<b>0.8382*</b>	<b>0.8522</b>	<b>0.8662</b>	<b>0.8166*</b>
CORN							
1	123.8	<b>0.3207*</b>	<b>0.2722*</b>	<b>0.2851*</b>	<b>0.2827*</b>	<b>0.2892*</b>	<b>0.2722*</b>
3	125.4	<b>0.6364</b>	<b>0.4306*</b>	<b>0.4514*</b>	<b>0.4434*</b>	<b>0.4665*</b>	<b>0.4290*</b>
6	128.1	<b>0.8704</b>	<b>0.4965*</b>	<b>0.5144*</b>	<b>0.5090*</b>	<b>0.5144*</b>	<b>0.5105*</b>
9	130.4	<b>0.9363</b>	<b>0.4816*</b>	<b>0.4847*</b>	<b>0.4847*</b>	<b>0.4425*</b>	<b>0.5199*</b>
12	134.0	<b>0.9716</b>	<b>0.5321*</b>	<b>0.5328*</b>	<b>0.5358*</b>	<b>0.5015*</b>	<b>0.5358*</b>
SUGAR							
1	115.6	<b>0.4230*</b>	<b>0.3832*</b>	<b>0.3901*</b>	<b>0.3884*</b>	<b>0.3867*</b>	<b>0.3910*</b>
3	116.2	<b>0.7177</b>	<b>0.5740*</b>	<b>0.5981*</b>	<b>0.5895*</b>	<b>0.5912*</b>	<b>0.5921*</b>
6	118.0	<b>0.8763</b>	<b>0.6483*</b>	<b>0.6729*</b>	<b>0.6619*</b>	<b>0.6466*</b>	<b>0.6737*</b>
9	115.9	<b>0.9560</b>	<b>0.7455*</b>	<b>0.7619*</b>	<b>0.7386*</b>	<b>0.7567*</b>	<b>0.7092*</b>
12	117.5	<b>0.9813</b>	<b>0.8170*</b>	<b>0.8077*</b>	<b>0.7719*</b>	<b>0.7455*</b>	<b>0.7319*</b>
RICE							
1	83.3	<b>0.4128*</b>	<b>0.4418*</b>	<b>0.4406*</b>	<b>0.4442*</b>	<b>0.4394*</b>	<b>0.4286*</b>
3	83.8	<b>0.5849*</b>	<b>0.5871*</b>	<b>0.6241*</b>	<b>0.6062*</b>	<b>0.5752*</b>	<b>0.5979*</b>
6	85.8	<b>0.7105</b>	<b>0.6620*</b>	<b>0.7401</b>	<b>0.7168</b>	<b>0.6667*</b>	<b>0.7063*</b>
9	85.8	<b>0.8574</b>	<b>0.8112*</b>	<b>0.8916</b>	<b>0.8636</b>	<b>0.8497*</b>	<b>0.8427*</b>
12	87.5	<b>0.9136*</b>	<b>0.8560*</b>	<b>0.9406</b>	<b>0.9131*</b>	<b>0.9246</b>	<b>0.8789*</b>
WHEAT							
1	126.2	<b>0.3938*</b>	<b>0.3201*</b>	<b>0.3249*</b>	<b>0.3217*</b>	<b>0.3526*</b>	<b>0.3249*</b>
3	128.0	<b>0.7164</b>	<b>0.4445*</b>	<b>0.4484*</b>	<b>0.4453*</b>	<b>0.4422*</b>	<b>0.4211*</b>
6	131.4	<b>0.9110</b>	<b>0.5076*</b>	<b>0.5068*</b>	<b>0.5061*</b>	<b>0.5046*</b>	<b>0.5076*</b>
9	134.6	<b>0.9688</b>	<b>0.5676*</b>	<b>0.5691*</b>	<b>0.5698*</b>	<b>0.5743*</b>	<b>0.6248*</b>
12	138.3	<b>0.9913</b>	<b>0.6905*</b>	<b>0.6898*</b>	<b>0.6949*</b>	<b>0.7332</b>	<b>0.7166*</b>

*Note:* WTI = WTI crude oil price volatility, BRN = Brent crude oil price volatility. The RW column shows the actual MSFE. All other columns show the MSFE ratios, for each forecasting model, that have been normalized relative to the monthly RW forecast. The order of the AR models for Soy, Corn and Sugar is 1, whereas for Rice and Wheat is 2, based on the Bayesian Information Criterion. Bold face numbers denote that the forecast outperforms the RW. \* denotes that the model is included in the set of the best models according to the Model Confidence Set (MCS).

**Table A15.** The Mean Absolute Forecasting Error (MAFE) evaluation function for 1-, 3-, 6-, 9-, 12-month ahead forecasting horizons. Volatility Measure: Monthly Realized Range;  $RR_t^{(M)}$ . Forecasting period: Jan 2000 – March 2017.

Months-ahead	RW	AR( $p$ )	HAR	HAR-WTI	HAR-BRN	MIDAS-HAR-WTI	MIDAS-HAR-BRN
SOY							
1	6.18	<b>0.5971*</b>	<b>0.5922*</b>	<b>0.6019*</b>	<b>0.5987*</b>	<b>0.6052*</b>	<b>0.6019*</b>
3	6.25	<b>0.8064*</b>	<b>0.7904*</b>	<b>0.8032*</b>	<b>0.8080*</b>	<b>0.7952*</b>	<b>0.7984*</b>
6	6.32	<b>0.9351</b>	<b>0.8544*</b>	<b>0.8766*</b>	<b>0.8797*</b>	<b>0.9035</b>	<b>0.8813*</b>
9	6.39	<b>0.9687</b>	<b>0.8545*</b>	<b>0.8967*</b>	<b>0.9014*</b>	<b>0.8936*</b>	<b>0.9061*</b>
12	6.51	<b>0.9800</b>	<b>0.8771*</b>	<b>0.9155*</b>	<b>0.9217</b>	<b>0.9263</b>	<b>0.8894*</b>
CORN							
1	8.18	<b>0.5685*</b>	<b>0.5342*</b>	<b>0.5440*</b>	<b>0.5428*</b>	<b>0.5538*</b>	<b>0.5440*</b>
3	8.27	<b>0.8041</b>	<b>0.6892*</b>	<b>0.7146*</b>	<b>0.7074*</b>	<b>0.7146*</b>	<b>0.6868*</b>
6	8.36	<b>0.9378</b>	<b>0.7201*</b>	<b>0.7344*</b>	<b>0.7368*</b>	<b>0.7261*</b>	<b>0.7249*</b>
9	8.42	<b>0.9644</b>	<b>0.6888*</b>	<b>0.6865*</b>	<b>0.6936*</b>	<b>0.6449*</b>	<b>0.7078*</b>
12	8.59	<b>0.9802</b>	<b>0.7183*</b>	<b>0.7229*</b>	<b>0.7311*</b>	<b>0.6950*</b>	<b>0.7229*</b>
SUGAR							
1	7.95	<b>0.6365*</b>	<b>0.5950*</b>	<b>0.6038*</b>	<b>0.6025*</b>	<b>0.6088*</b>	<b>0.6038*</b>
3	7.94	<b>0.8300</b>	<b>0.7481*</b>	<b>0.7657*</b>	<b>0.7620*</b>	<b>0.7758*</b>	<b>0.7670*</b>
6	7.99	<b>0.9299</b>	<b>0.8198*</b>	<b>0.8373*</b>	<b>0.8260*</b>	<b>0.8235*</b>	<b>0.8373*</b>
9	7.96	<b>0.9749</b>	<b>0.8907*</b>	<b>0.8945*</b>	<b>0.8794*</b>	<b>0.8957*</b>	<b>0.8593*</b>
12	8.00	<b>0.9875</b>	<b>0.9338*</b>	<b>0.9375*</b>	<b>0.9175*</b>	<b>0.9038*</b>	<b>0.9088*</b>
RICE							
1	6.51	<b>0.7311</b>	<b>0.6897*</b>	<b>0.6928*</b>	<b>0.6959*</b>	<b>0.6928*</b>	<b>0.6774*</b>
3	6.53	<b>0.8291</b>	<b>0.7734*</b>	<b>0.8132</b>	<b>0.8086</b>	<b>0.7657*</b>	<b>0.7871*</b>
6	6.62	<b>0.9417</b>	<b>0.8006*</b>	<b>0.8550</b>	<b>0.8535</b>	<b>0.8218*</b>	<b>0.8414*</b>
9	6.59	<b>0.9739</b>	<b>0.8801*</b>	<b>0.9256</b>	<b>0.9135*</b>	<b>0.9272</b>	<b>0.9181*</b>
12	6.68	<b>0.9889</b>	<b>0.8862*</b>	<b>0.9251*</b>	<b>0.9087*</b>	<b>0.9341</b>	<b>0.9222*</b>
WHEAT							
1	7.78	<b>0.6056*</b>	<b>0.5566*</b>	<b>0.5604*</b>	<b>0.5591*</b>	<b>0.5823*</b>	<b>0.5527*</b>
3	7.88	<b>0.7810</b>	<b>0.6459*</b>	<b>0.6383*</b>	<b>0.6434*</b>	<b>0.6472*</b>	<b>0.6244*</b>
6	8.00	<b>0.8911</b>	<b>0.7163*</b>	<b>0.7088*</b>	<b>0.7150*</b>	<b>0.7150*</b>	<b>0.7138*</b>
9	8.12	<b>0.9472</b>	<b>0.7648*</b>	<b>0.7586*</b>	<b>0.7722*</b>	<b>0.7623*</b>	<b>0.7931*</b>
12	8.28	<b>0.9608</b>	<b>0.8200*</b>	<b>0.8249*</b>	<b>0.8297*</b>	<b>0.8466*</b>	<b>0.8285*</b>

*Note:* WTI = WTI crude oil price volatility, BRN = Brent crude oil price volatility. The RW column shows the actual MAFE. All other columns show the MAFE ratios, for each forecasting model, that have been normalized relative to the monthly RW forecast. The order of the AR models for Soy, Corn and Sugar is 1, whereas for Rice and Wheat is 2, based on the Bayesian Information Criterion. Bold face numbers denote that the forecast outperforms the RW. \* denotes that the model is included in the set of the best models according to the Model Confidence Set (MCS).

**Table A16.** Directional accuracy for 1-, 3-, 6-, 9-, 12- month ahead forecasting horizons. Volatility Measure: Monthly Price Range;  $PR_t^{(M)}$ . Forecasting period: Jan 2000 – March 2017.

Months-ahead	RW	AR( $p$ )	HAR	HAR-WTI	HAR-BRN	MIDAS-HAR-WTI	MIDAS-HAR-BRN
SOY							
1	0.6893	0.8981	0.8981	0.8981	0.8883	0.8932	0.8786
3	0.6912	0.6765	0.7108	<b>0.7157</b>	0.6961	0.7108	<b>0.7206</b>
6	0.7413	0.7264	0.7463	0.7463	0.7463	0.7463	<b>0.7512</b>
9	0.6919	0.6919	0.7020	<b>0.7121</b>	<b>0.7121</b>	<b>0.7273</b>	<b>0.7374</b>
12	0.6513	0.6410	0.6821	0.6513	0.6615	0.6667	0.6769
CORN							
1	0.6699	0.8447	0.8738	0.8544	0.8544	0.8447	0.8592
3	0.6814	0.6765	0.7402	0.6912	0.7010	0.7255	0.7059
6	0.7164	0.7214	0.7761	0.7313	0.7512	0.7463	0.7264
9	0.6919	0.6970	0.7273	0.7121	0.7071	<b>0.7424</b>	<b>0.7475</b>
12	0.6923	0.6872	0.6923	<b>0.6974</b>	<b>0.6974</b>	<b>0.7026</b>	0.6923
SUGAR							
1	0.6650	0.8058	0.7816	0.7913	0.7816	0.7864	0.7864
3	0.6961	0.7157	0.7402	0.7157	0.7255	0.7255	0.7402
6	0.6766	0.6766	0.6667	0.6468	<b>0.6816</b>	0.6517	0.6617
9	0.7677	0.7677	0.8030	<b>0.8081</b>	0.8030	<b>0.8081</b>	<b>0.8081</b>
12	0.6821	0.7128	0.7128	<b>0.7333</b>	<b>0.7282</b>	<b>0.7282</b>	<b>0.7333</b>
RICE							
1	0.6990	0.8932	0.8981	<b>0.9078</b>	0.8835	0.8981	<b>0.9029</b>
3	0.6961	0.7353	0.7353	0.7255	0.7010	0.7059	0.7304
6	0.6766	0.7214	0.7413	0.7214	0.7114	0.7214	0.7164
9	0.7071	0.7071	0.7071	<b>0.7424</b>	0.7071	0.7020	0.6768
12	0.7333	0.7333	0.7231	<b>0.7436</b>	<b>0.7436</b>	<b>0.7385</b>	0.7282
WHEAT							
1	0.7184	0.8058	0.7524	0.7670	0.7864	0.7670	0.7282
3	0.6912	0.6912	0.7157	0.7157	<b>0.7206</b>	<b>0.7255</b>	0.7059
6	0.6866	0.6716	0.6816	0.6766	0.6716	0.6766	0.6816
9	0.6667	0.6667	0.6768	0.6768	0.6616	<b>0.6970</b>	<b>0.6919</b>
12	0.6564	0.6564	0.6513	0.6256	0.6256	0.6154	0.6462

*Note:* WTI = WTI crude oil price volatility, BRN = Brent crude oil price volatility. Bold face indicates improvement in directional accuracy relative to the benchmark models (RW, AR( $p$ ) or HAR). The order of the AR models for Soy and Corn is 1, for Sugar and Wheat is 2, whereas for Rice is 4, based on the Bayesian Information Criterion.

**Table A17.** Directional accuracy for 1-, 3-, 6-, 9-, 12- month ahead forecasting horizons. Volatility Measure: Monthly Realized Range;  $RR_t^{(M)}$ . Forecasting period: Jan 2000 – March 2017.

Months-ahead	RW	AR( $p$ )	HAR	HAR-WTI	HAR-BRN	MIDAS-HAR-WTI	MIDAS-HAR-BRN
SOY							
1	0.5874	0.8592	0.8544	<b>0.8641</b>	<b>0.8738</b>	0.8447	0.8350
3	0.6373	0.6618	0.6422	0.6324	0.6422	0.6127	0.6225
6	0.6169	0.6269	0.6816	0.6617	<b>0.6915</b>	0.6617	0.6219
9	0.6667	0.6717	0.6919	0.6768	0.6616	0.6515	0.6364
12	0.6256	0.6308	0.6615	0.6256	0.6051	0.6154	0.6513
CORN							
1	0.5922	0.8495	0.8447	0.8204	0.8495	0.8398	0.8252
3	0.5882	0.6176	0.6765	<b>0.6961</b>	<b>0.6863</b>	0.6618	0.6667
6	0.6468	0.6517	0.7463	0.7164	0.7463	0.7214	0.7264
9	0.6212	0.6162	0.7273	0.7172	0.7121	<b>0.7626</b>	0.7222
12	0.6410	0.6410	0.6359	0.6205	0.6359	<b>0.6564</b>	0.6051
SUGAR							
1	0.5825	0.8350	0.8738	<b>0.8932</b>	<b>0.8786</b>	0.8447	0.8398
3	0.6422	0.6667	0.6912	0.6863	0.6716	<b>0.6961</b>	<b>0.7108</b>
6	0.6318	0.6368	0.6965	<b>0.7164</b>	<b>0.7065</b>	0.6716	0.6866
9	0.6970	0.7020	0.6818	<b>0.7071</b>	<b>0.7222</b>	0.6970	<b>0.7121</b>
12	0.6872	0.6923	0.6821	<b>0.7026</b>	<b>0.7077</b>	0.6821	<b>0.7231</b>
RICE							
1	0.6214	0.8981	0.8835	0.8981	0.8981	0.8932	0.8689
3	0.6127	0.7353	0.7696	0.7549	0.7598	<b>0.8039</b>	0.7696
6	0.6020	0.6219	0.6368	0.6020	0.6119	0.6219	0.5920
9	0.6768	0.6869	0.7778	0.7071	0.7121	0.7778	0.7677
12	0.6769	0.6769	0.6667	0.6769	<b>0.6872</b>	<b>0.7026</b>	0.6718
WHEAT							
1	0.5922	0.8495	0.8350	0.8252	0.8447	0.8350	0.8252
3	0.5784	0.6225	0.6471	<b>0.6667</b>	0.6373	<b>0.6667</b>	<b>0.6520</b>
6	0.6070	0.6269	0.7313	0.7065	0.7214	<b>0.7463</b>	0.7214
9	0.6313	0.6263	0.6616	0.6465	0.6465	0.6465	0.6414
12	0.6103	0.6103	0.6103	<b>0.6256</b>	0.6000	0.5795	<b>0.6154</b>

*Note:* WTI = WTI crude oil price volatility, BRN = Brent crude oil price volatility. Bold face indicates improvement in directional accuracy relative to the benchmark models (RW, AR( $p$ ) or HAR). The order of the AR models for Soy, Corn and Sugar is 1, whereas for Rice and Wheat is 2, based on the Bayesian Information Criterion.

**Table A18.** The Mean Squared Forecasting Error (MSFE) evaluation function for 1-, 3-, 6-, 9-, 12- month ahead forecasting horizons. Volatility Measure: Monthly Price Range;  $PR_t^{(M)}$ . Forecasting period: 1<sup>st</sup> Food Crisis (2007-2009).

Months-ahead	RW	AR( $p$ )	HAR	HAR-WTI	HAR-BRN	MIDAS-HAR-WTI	MIDAS-HAR-BRN
SOY							
1	307.8759	<b>0.2548*</b>	<b>0.1341*</b>	<b>0.1642*</b>	<b>0.1738*</b>	<b>0.1368*</b>	<b>0.1568*</b>
3	311.0233	<b>0.7969</b>	<b>0.4952*</b>	<b>0.5681</b>	<b>0.5310*</b>	<b>0.5422*</b>	<b>0.5663</b>
6	315.1073	<b>0.9634</b>	<b>0.6044*</b>	<b>0.6553*</b>	<b>0.6162*</b>	<b>0.7922</b>	<b>0.7344*</b>
9	318.7726	<b>0.9959</b>	<b>0.6872*</b>	<b>0.7352*</b>	<b>0.7029*</b>	<b>0.7039*</b>	<b>0.7537*</b>
12	321.8291	1.0021	<b>0.7811*</b>	<b>0.8448</b>	<b>0.8051*</b>	<b>0.7259*</b>	<b>0.7295*</b>
CORN							
1	641.4172	<b>0.3625*</b>	<b>0.2435*</b>	<b>0.2124*</b>	<b>0.2158*</b>	<b>0.2318*</b>	<b>0.2498*</b>
3	646.7001	<b>0.8964</b>	<b>0.6378*</b>	<b>0.6463*</b>	<b>0.6337*</b>	<b>0.6754*</b>	<b>0.6302*</b>
6	652.5210	<b>0.9879</b>	<b>0.7255*</b>	<b>0.7561*</b>	<b>0.7351*</b>	<b>0.7602*</b>	<b>0.7427*</b>
9	657.5189	1.0010	<b>0.7684*</b>	<b>0.7923*</b>	<b>0.7751*</b>	<b>0.7949*</b>	<b>0.7973*</b>
12	661.9364	1.0018	<b>0.7966*</b>	<b>0.8067*</b>	<b>0.7933*</b>	<b>0.7535*</b>	<b>0.7832*</b>
SUGAR							
1	215.7638	<b>0.3856*</b>	<b>0.3912*</b>	<b>0.3625*</b>	<b>0.3862*</b>	<b>0.4327</b>	<b>0.4052*</b>
3	218.0761	<b>0.9347</b>	<b>0.8443*</b>	<b>0.8920*</b>	<b>0.9314</b>	<b>0.8738*</b>	<b>0.8983*</b>
6	219.5691	<b>0.9859</b>	<b>0.9771*</b>	1.0541	1.0763	<b>0.9971</b>	1.0509
9	220.5991	<b>0.9870*</b>	1.0027	1.0745	1.0938	<b>0.9836*</b>	1.0424
12	221.1037	<b>0.9885*</b>	1.0192	1.0924	1.1020	1.0661	1.1148
RICE							
1	394.1671	<b>0.3564*</b>	<b>0.3210*</b>	<b>0.2567*</b>	<b>0.2608*</b>	<b>0.2597*</b>	<b>0.3057*</b>
3	398.0422	<b>0.8920</b>	<b>0.7667*</b>	<b>0.7598*</b>	<b>0.7125*</b>	<b>0.7058*</b>	<b>0.7327*</b>
6	401.6413	<b>0.9883</b>	<b>0.9531*</b>	<b>0.9864</b>	<b>0.9515*</b>	<b>0.9418*</b>	1.0484
9	403.8994	<b>0.9973*</b>	1.0416	1.0800	1.0316	1.0706	1.0054
12	404.5361	1.0001	1.1247	1.1669	1.1108	1.1228	1.0645
WHEAT							
1	569.5917	<b>0.7248</b>	<b>0.4076*</b>	<b>0.4027*</b>	<b>0.3962*</b>	<b>0.4106*</b>	<b>0.3592*</b>
3	574.6782	<b>0.9827</b>	<b>0.5253*</b>	<b>0.5529*</b>	<b>0.5380*</b>	<b>0.5693*</b>	<b>0.5410*</b>
6	581.1326	<b>0.9908</b>	<b>0.6305*</b>	<b>0.6535*</b>	<b>0.6372*</b>	<b>0.6128*</b>	<b>0.6466*</b>
9	587.1412	<b>0.9906</b>	<b>0.6739*</b>	<b>0.6825*</b>	<b>0.6710*</b>	<b>0.5973*</b>	<b>0.7396</b>
12	593.7450	<b>0.9910</b>	<b>0.8162*</b>	<b>0.8351*</b>	<b>0.8163*</b>	<b>0.8486</b>	<b>0.8198*</b>

*Note:* WTI = WTI crude oil price volatility, BRN = Brent crude oil price volatility. The RW column shows the actual MSFE. All other columns show the MSFE ratios, for each forecasting model, that have been normalized relative to the monthly RW forecast. The order of the AR models for Soy and Corn is 1, for Sugar and Wheat is 2, whereas for Rice is 4, based on the Bayesian Information Criterion. Bold face numbers denote that the forecast outperforms the RW. \* denotes that the model is included in the set of the best models according to the Model Confidence Set (MCS).

**Table A19.** The Mean Absolute Forecasting Error (MAFE) evaluation function for 1-, 3-, 6-, 9-, 12-month ahead forecasting horizons. Volatility Measure: Monthly Price Range;  $PR_t^{(M)}$ . Forecasting period: 1<sup>st</sup> Food Crisis (2007-2009).

Months-ahead	RW	AR( $p$ )	HAR	HAR-WTI	HAR-BRN	MIDAS-HAR-WTI	MIDAS-HAR-BRN
SOY							
1	14.3849	<b>0.4920*</b>	<b>0.3385*</b>	<b>0.3897*</b>	<b>0.3937*</b>	<b>0.3368*</b>	<b>0.3570*</b>
3	14.4688	<b>0.8656</b>	<b>0.6549*</b>	<b>0.7147*</b>	<b>0.6856*</b>	<b>0.7131*</b>	<b>0.7453</b>
6	14.5951	<b>0.9761</b>	<b>0.7499*</b>	<b>0.8028*</b>	<b>0.7712*</b>	<b>0.8969</b>	<b>0.8641</b>
9	14.7148	<b>0.9970</b>	<b>0.8086*</b>	<b>0.8434*</b>	<b>0.8254*</b>	<b>0.8291*</b>	<b>0.8635*</b>
12	14.8153	1.0019	<b>0.8591*</b>	<b>0.9030</b>	<b>0.8798</b>	<b>0.8559*</b>	<b>0.8299*</b>
CORN							
1	18.8599	<b>0.5843*</b>	<b>0.4551*</b>	<b>0.4441*</b>	<b>0.4323*</b>	<b>0.4211*</b>	<b>0.4356*</b>
3	18.9544	<b>0.9366</b>	<b>0.7840*</b>	<b>0.8244*</b>	<b>0.7940*</b>	<b>0.8313</b>	<b>0.7958*</b>
6	19.0814	<b>0.9947</b>	<b>0.8215*</b>	<b>0.8394*</b>	<b>0.8269*</b>	<b>0.8581*</b>	<b>0.8382*</b>
9	19.1879	<b>0.9998</b>	<b>0.8340*</b>	<b>0.8549*</b>	<b>0.8369*</b>	<b>0.8487*</b>	<b>0.8519*</b>
12	19.2947	1.0013	<b>0.8592*</b>	<b>0.8717</b>	<b>0.8580*</b>	<b>0.8443*</b>	<b>0.8607*</b>
SUGAR							
1	10.8396	<b>0.5943*</b>	<b>0.6110*</b>	<b>0.6358*</b>	<b>0.6557*</b>	<b>0.6572*</b>	<b>0.6293*</b>
3	10.9028	<b>0.9535*</b>	<b>0.9184*</b>	<b>0.9571*</b>	1.0090	<b>0.9779</b>	1.0144
6	10.9359	<b>0.9861</b>	<b>0.9656*</b>	1.0316	1.0475	<b>0.9779</b>	1.0271
9	10.9658	<b>0.9880*</b>	<b>0.9954*</b>	1.0566	1.0761	1.0391	1.0447
12	10.9778	<b>0.9879*</b>	<b>0.9952*</b>	1.0547	1.0607	1.0115	1.0161
RICE							
1	15.1502	<b>0.5685*</b>	<b>0.5110*</b>	<b>0.4453*</b>	<b>0.4384*</b>	<b>0.4468*</b>	<b>0.4984*</b>
3	15.2369	<b>0.9286</b>	<b>0.8192*</b>	<b>0.8305*</b>	<b>0.7931*</b>	<b>0.8353*</b>	<b>0.8517</b>
6	15.3417	<b>0.9911</b>	<b>0.9430*</b>	<b>0.9639</b>	<b>0.9414*</b>	<b>0.9530*</b>	<b>0.9864</b>
9	15.4185	<b>0.9971</b>	<b>0.9878*</b>	1.0036	<b>0.9819*</b>	1.0068	<b>0.9646*</b>
12	15.4726	<b>0.9993*</b>	1.0601	1.0777	1.0542	1.0317	1.0045
WHEAT							
1	19.3052	<b>0.8395</b>	<b>0.5853*</b>	<b>0.5975*</b>	<b>0.5826*</b>	<b>0.5931*</b>	<b>0.5666*</b>
3	19.4149	<b>0.9868</b>	<b>0.6989*</b>	<b>0.7197*</b>	<b>0.7088*</b>	<b>0.7442</b>	<b>0.7304*</b>
6	19.5589	<b>0.9907</b>	<b>0.7598*</b>	<b>0.7851*</b>	<b>0.7685*</b>	<b>0.7550*</b>	<b>0.7718*</b>
9	19.7040	<b>0.9909</b>	<b>0.7768*</b>	<b>0.7929*</b>	<b>0.7778*</b>	<b>0.7335*</b>	<b>0.8445</b>
12	19.8400	<b>0.9910</b>	<b>0.8581*</b>	<b>0.8841</b>	<b>0.8631*</b>	<b>0.8782*</b>	<b>0.8544*</b>

*Note:* WTI = WTI crude oil price volatility, BRN = Brent crude oil price volatility. The RW column shows the actual MAFE. All other columns show the MAFE ratios, for each forecasting model, that have been normalized relative to the monthly RW forecast. The order of the AR models for Soy and Corn is 1, for Sugar and Wheat is 2, whereas for Rice is 4, based on the Bayesian Information Criterion. Bold face numbers denote that the forecast outperforms the RW. \* denotes that the model is included in the set of the best models according to the Model Confidence Set (MCS).



**Table A20.** The Mean Squared Forecasting Error (MSFE) evaluation function for 1-, 3-, 6-, 9-, 12- month ahead forecasting horizons. Volatility Measure: Monthly Realized Range;  $RR_t^{(M)}$ . Forecasting period: 1st Food Crisis (2007-2009).

Months-ahead	RW	AR( $p$ )	HAR	HAR-WTI	HAR-BRN	MIDAS-HAR-WTI	MIDAS-HAR-BRN
SOY							
1	302.9379	<b>0.0832*</b>	<b>0.0582*</b>	<b>0.0654*</b>	<b>0.0751*</b>	<b>0.0610*</b>	<b>0.0593*</b>
3	306.1570	<b>0.5072</b>	<b>0.3735*</b>	<b>0.4152*</b>	<b>0.4074*</b>	<b>0.4262*</b>	<b>0.3896*</b>
6	310.4160	<b>0.7931</b>	<b>0.5339*</b>	<b>0.6094*</b>	<b>0.5927*</b>	<b>0.6951</b>	<b>0.6510</b>
9	314.2463	<b>0.9295</b>	<b>0.6318*</b>	<b>0.7016*</b>	<b>0.6781*</b>	<b>0.7112*</b>	<b>0.7438*</b>
12	317.2987	<b>0.9835</b>	<b>0.7065*</b>	<b>0.7661*</b>	<b>0.7444*</b>	<b>0.7860</b>	<b>0.6717*</b>
CORN							
1	395.1188	<b>0.1009*</b>	<b>0.0452*</b>	<b>0.0498*</b>	<b>0.0545*</b>	<b>0.0522*</b>	<b>0.0480*</b>
3	399.4645	<b>0.4927*</b>	<b>0.2305*</b>	<b>0.2261*</b>	<b>0.2185*</b>	<b>0.2736*</b>	<b>0.2211*</b>
6	405.6371	<b>0.8197</b>	<b>0.3645*</b>	<b>0.3881*</b>	<b>0.3741*</b>	<b>0.4017*</b>	<b>0.3875*</b>
9	411.2174	<b>0.9444</b>	<b>0.3870*</b>	<b>0.3954*</b>	<b>0.3838*</b>	<b>0.3537*</b>	<b>0.4593*</b>
12	416.3806	<b>0.9877</b>	<b>0.5522</b>	<b>0.4264*</b>	<b>0.4119*</b>	<b>0.3295*</b>	<b>0.3895*</b>
SUGAR							
1	216.0686	<b>0.1439*</b>	<b>0.1208*</b>	<b>0.1095*</b>	<b>0.1147*</b>	<b>0.1227*</b>	<b>0.1141*</b>
3	218.6752	<b>0.6678</b>	<b>0.5291*</b>	<b>0.5660*</b>	<b>0.5814*</b>	<b>0.5569*</b>	<b>0.5435*</b>
6	221.5799	<b>0.9137</b>	<b>0.7221*</b>	<b>0.8120*</b>	<b>0.8276</b>	<b>0.6950*</b>	<b>0.7872*</b>
9	224.0076	<b>0.9745</b>	<b>0.7943*</b>	<b>0.8627</b>	<b>0.8599</b>	<b>0.7755*</b>	<b>0.7422*</b>
12	225.9439	<b>0.9925</b>	<b>0.8671*</b>	<b>0.8891</b>	<b>0.8677*</b>	<b>0.8635*</b>	<b>0.7954*</b>
RICE							
1	281.1942	<b>0.1582*</b>	<b>0.1323*</b>	<b>0.1071*</b>	<b>0.1048*</b>	<b>0.1176*</b>	<b>0.1004*</b>
3	284.0688	<b>0.6528</b>	<b>0.3902*</b>	<b>0.4017*</b>	<b>0.3841*</b>	<b>0.3641*</b>	<b>0.3897*</b>
6	287.5526	<b>0.9136</b>	<b>0.6278*</b>	<b>0.7112</b>	<b>0.6572*</b>	<b>0.5882*</b>	<b>0.6351*</b>
9	290.2009	<b>0.9803</b>	<b>0.7880*</b>	<b>0.8501</b>	<b>0.7876*</b>	<b>0.7710*</b>	<b>0.7917*</b>
12	291.8690	<b>1.0000</b>	<b>0.9506*</b>	1.0357	<b>0.9785*</b>	<b>0.9410*</b>	<b>0.9121*</b>
WHEAT							
1	560.3674	<b>0.1685*</b>	<b>0.1108*</b>	<b>0.1080*</b>	<b>0.1082*</b>	<b>0.1238*</b>	<b>0.1159*</b>
3	566.3112	<b>0.6745</b>	<b>0.3438*</b>	<b>0.3493*</b>	<b>0.3419*</b>	<b>0.3552*</b>	<b>0.3132*</b>
6	573.9298	<b>0.9027</b>	<b>0.4227*</b>	<b>0.4259*</b>	<b>0.4182*</b>	<b>0.4055*</b>	<b>0.4111*</b>
9	581.4297	<b>0.9679</b>	<b>0.4497*</b>	<b>0.4738*</b>	<b>0.4516*</b>	<b>0.4426*</b>	<b>0.5380*</b>
12	588.6527	<b>0.9879</b>	<b>0.6082*</b>	<b>0.6596*</b>	<b>0.6164*</b>	<b>0.6299*</b>	<b>0.6260*</b>

*Note:* WTI = WTI crude oil price volatility, BRN = Brent crude oil price volatility. The RW column shows the actual MSFE. All other columns show the MSFE ratios, for each forecasting model, that have been normalized relative to the monthly RW forecast. The order of the AR models for Soy, Corn and Sugar is 1, whereas for Rice and Wheat is 2, based on the Bayesian Information Criterion. Bold face numbers denote that the forecast outperforms the RW. \* denotes that the model is included in the set of the best models according to the Model Confidence Set (MCS).

**Table A21.** The Mean Absolute Forecasting Error (MAFE) evaluation function for 1-, 3-, 6-, 9-, 12-month ahead forecasting horizons. Volatility Measure: Monthly Realized Range;  $RR_t^{(M)}$ . Forecasting period: 1st Food Crisis (2007-2009).

Months-ahead	RW	AR( $p$ )	HAR	HAR-WTI	HAR-BRN	MIDAS-HAR-WTI	MIDAS-HAR-BRN
SOY							
1	14.6792	<b>0.2811*</b>	<b>0.2088*</b>	<b>0.2317*</b>	<b>0.2473*</b>	<b>0.2223*</b>	<b>0.2178*</b>
3	14.7666	<b>0.6221</b>	<b>0.5447*</b>	<b>0.5880*</b>	<b>0.5852*</b>	<b>0.6093</b>	<b>0.5649*</b>
6	14.8933	<b>0.8503</b>	<b>0.6889*</b>	<b>0.7488*</b>	<b>0.7321*</b>	<b>0.8069</b>	<b>0.7907</b>
9	15.0089	<b>0.9459</b>	<b>0.7251*</b>	<b>0.7848*</b>	<b>0.7653*</b>	<b>0.7937*</b>	<b>0.8094</b>
12	15.1069	<b>0.9870</b>	<b>0.7506*</b>	<b>0.8090*</b>	<b>0.7908*</b>	<b>0.8022*</b>	<b>0.7116*</b>
CORN							
1	17.9252	<b>0.3146*</b>	<b>0.1830*</b>	<b>0.1888*</b>	<b>0.1905*</b>	<b>0.1913*</b>	<b>0.1860*</b>
3	18.0314	<b>0.6642</b>	<b>0.4367*</b>	<b>0.4285*</b>	<b>0.4276*</b>	<b>0.4840*</b>	<b>0.4389*</b>
6	18.1946	<b>0.8788</b>	<b>0.5412*</b>	<b>0.5626*</b>	<b>0.5606*</b>	<b>0.5671*</b>	<b>0.5638*</b>
9	18.3514	<b>0.9634</b>	<b>0.5058*</b>	<b>0.5337*</b>	<b>0.5171*</b>	<b>0.5097*</b>	<b>0.5948*</b>
12	18.4982	<b>0.9920</b>	<b>0.6906</b>	<b>0.5654*</b>	<b>0.5504*</b>	<b>0.4746*</b>	<b>0.5231*</b>
SUGAR							
1	12.3213	<b>0.3677*</b>	<b>0.3124*</b>	<b>0.3071*</b>	<b>0.3214*</b>	<b>0.3292*</b>	<b>0.2961*</b>
3	12.4028	<b>0.7970</b>	<b>0.6846*</b>	<b>0.7335</b>	<b>0.7552</b>	<b>0.7327</b>	<b>0.7376</b>
6	12.4974	<b>0.9439</b>	<b>0.8564*</b>	<b>0.9354</b>	<b>0.9449</b>	<b>0.8363*</b>	<b>0.9138</b>
9	12.5835	<b>0.9795</b>	<b>0.8770*</b>	<b>0.9592</b>	<b>0.9560</b>	<b>0.8778*</b>	<b>0.8533*</b>
12	12.6704	<b>0.9917</b>	<b>0.8791*</b>	<b>0.9527</b>	<b>0.9422</b>	<b>0.8789*</b>	<b>0.8476*</b>
RICE							
1	13.1535	<b>0.3814*</b>	<b>0.3068*</b>	<b>0.3033*</b>	<b>0.2990*</b>	<b>0.3024*</b>	<b>0.2863*</b>
3	13.2239	<b>0.7564</b>	<b>0.5510*</b>	<b>0.5873*</b>	<b>0.5598*</b>	<b>0.5322*</b>	<b>0.5695*</b>
6	13.3186	<b>0.9381</b>	<b>0.7744*</b>	<b>0.8370</b>	<b>0.8031*</b>	<b>0.7345*</b>	<b>0.7757*</b>
9	13.3911	<b>0.9775</b>	<b>0.8540*</b>	<b>0.8961</b>	<b>0.8553*</b>	<b>0.8598*</b>	<b>0.8625*</b>
12	13.4387	<b>0.9899</b>	<b>0.9615*</b>	<b>0.9936</b>	<b>0.9645*</b>	<b>0.9508*</b>	<b>0.9329*</b>
WHEAT							
1	20.6266	<b>0.3944*</b>	<b>0.2541*</b>	<b>0.2501*</b>	<b>0.2474*</b>	<b>0.2693*</b>	<b>0.2648*</b>
3	20.7493	<b>0.7531</b>	<b>0.4785*</b>	<b>0.4793*</b>	<b>0.4732*</b>	<b>0.4851*</b>	<b>0.4424*</b>
6	20.9338	<b>0.9258</b>	<b>0.5711*</b>	<b>0.5774*</b>	<b>0.5667*</b>	<b>0.5672*</b>	<b>0.5593*</b>
9	21.1103	<b>0.9763</b>	<b>0.6058*</b>	<b>0.6337*</b>	<b>0.6065*</b>	<b>0.6053*</b>	<b>0.6759*</b>
12	21.2725	<b>0.9884</b>	<b>0.7156*</b>	<b>0.7644*</b>	<b>0.7209*</b>	<b>0.7320*</b>	<b>0.7181*</b>

*Note:* WTI = WTI crude oil price volatility, BRN = Brent crude oil price volatility. The RW column shows the actual MAFE. All other columns show the MAFE ratios, for each forecasting model, that have been normalized relative to the monthly RW forecast. The order of the AR models for Soy, Corn and Sugar is 1, whereas for Rice and Wheat is 2, based on the Bayesian Information Criterion. Bold face numbers denote that the forecast outperforms the RW. \* denotes that the model is included in the set of the best models according to the Model Confidence Set (MCS).

**Table A22.** Directional accuracy for 1-, 3-, 6-, 9-, 12- month ahead forecasting horizons. Volatility Measure: Monthly Price Range;  $PR_t^{(M)}$ . Forecasting period: 1st Food Crisis (2007-2009).

Months-ahead	RW	AR( $p$ )	HAR	HAR-WTI	HAR-BRN	MIDAS-HAR-WTI	MIDAS-HAR-BRN
SOY							
1	0.5600	0.8000	0.9200	0.9200	0.9200	0.9200	0.8800
3	0.4400	0.4800	0.5200	0.5200	0.5200	<b>0.5600</b>	<b>0.6400</b>
6	0.5200	0.5200	0.6800	0.6400	0.6800	0.6000	0.5600
9	0.4000	0.3600	0.5600	0.4800	0.5200	0.5200	0.5200
12	0.4000	0.3600	0.5200	0.4000	0.4800	0.4800	<b>0.5600</b>
CORN							
1	0.5600	0.8000	0.9200	0.8800	0.8800	0.9200	0.9200
3	0.6000	0.6400	0.8000	0.7200	0.7600	0.7200	0.7600
6	0.6000	0.6000	0.8000	0.7600	0.8000	0.8000	0.8000
9	0.5200	0.5200	0.7200	0.6800	<b>0.7600</b>	0.7200	0.6800
12	0.6000	0.6000	0.6000	0.6000	0.6000	0.6000	<b>0.6400</b>
SUGAR							
1	0.6000	0.7600	0.7600	<b>0.8000</b>	0.7600	0.7600	<b>0.8000</b>
3	0.8000	0.8000	0.8400	0.8000	0.7600	0.7200	0.7200
6	0.6400	0.6400	0.5600	0.5200	0.5600	0.5600	0.6000
9	0.6800	0.6800	0.6400	0.6800	0.6800	<b>0.7600</b>	0.6800
12	0.7200	0.7200	0.7200	0.7200	0.7200	0.7200	0.7200
RICE							
1	0.6400	0.7600	0.8800	<b>0.9200</b>	0.8800	0.8400	0.8000
3	0.7600	0.7600	0.7200	0.6800	0.7200	0.7200	0.6800
6	0.7200	0.7200	0.8000	0.8000	0.8000	0.8000	0.7600
9	0.6400	0.6400	0.6400	0.6400	0.6400	0.6400	0.6400
12	0.7600	0.7600	0.7200	0.7600	0.7200	0.7200	0.7600
WHEAT							
1	0.6400	0.7600	0.7600	<b>0.8400</b>	<b>0.8400</b>	<b>0.8400</b>	<b>0.8000</b>
3	0.6400	0.6400	0.8000	0.7600	0.7600	0.7600	0.8000
6	0.5600	0.6000	0.6000	0.5600	0.6000	0.5600	0.5200
9	0.4800	0.4800	0.6000	0.6000	0.5200	0.6400	0.6000
12	0.4400	0.4400	0.5200	0.5200	0.5200	0.5200	0.5200

*Note:* WTI = WTI crude oil price volatility, BRN = Brent crude oil price volatility. Bold face indicates improvement in directional accuracy relative to the benchmark models (RW, AR( $p$ ) or HAR). The order of the AR models for Soy and Corn is 1, for Sugar and Wheat is 2, whereas for Rice is 4, based on the Bayesian Information Criterion.

**Table A23.** Directional accuracy for 1-, 3-, 6-, 9-, 12- month ahead forecasting horizons. Volatility Measure: Monthly Realized Range;  $RR_t^{(M)}$ . Forecasting period: 1st Food Crisis (2007-2009).

Months-ahead	RW	AR( $p$ )	HAR	HAR-WTI	HAR-BRN	MIDAS-HAR-WTI	MIDAS-HAR-BRN
SOY							
1	0.5200	0.7600	0.8400	0.7600	0.8000	0.7600	0.8000
3	0.4800	0.5600	0.4800	0.4400	0.4800	0.4000	0.4400
6	0.3200	0.3600	0.4000	0.3600	0.4000	0.3200	0.2800
9	0.4400	0.4400	0.5600	0.5200	0.5200	0.4400	0.4800
12	0.3200	0.3200	0.4400	0.4400	0.4000	0.3600	0.5200
CORN							
1	0.5200	0.6800	0.7600	0.7200	0.7600	<b>0.8000</b>	<b>0.8000</b>
3	0.4800	0.5200	0.6400	0.6400	0.5600	0.4800	0.6000
6	0.4000	0.4000	0.6000	0.5600	0.5600	0.4800	0.4800
9	0.4800	0.4800	0.6400	0.6000	<b>0.6800</b>	0.6400	0.6000
12	0.3600	0.3600	0.4000	0.4000	0.4800	<b>0.6000</b>	0.4400
SUGAR							
1	0.5600	0.7600	0.8800	<b>0.9600</b>	<b>0.9600</b>	0.8400	<b>0.9200</b>
3	0.7600	0.8000	0.6800	0.6800	0.6400	0.7600	0.6400
6	0.7600	0.8000	0.8400	0.7200	0.6400	0.8400	0.8000
9	0.7200	0.7200	0.7200	0.6800	0.6800	0.7200	0.7200
12	0.6000	0.6000	0.6800	0.6800	<b>0.7200</b>	0.6400	<b>0.7200</b>
RICE							
1	0.4800	0.7600	0.7200	0.6800	0.6800	0.7600	0.7600
3	0.6800	0.7200	0.8000	0.8000	0.8000	0.8000	0.7200
6	0.5600	0.5600	0.5600	0.5600	<b>0.6000</b>	0.5600	0.4800
9	0.6400	0.6400	0.6000	0.4800	0.4800	0.6400	0.5600
12	0.7200	0.7200	0.7200	0.6400	0.6800	0.6800	0.6800
WHEAT							
1	0.5200	0.8000	0.8000	0.8000	0.8000	0.8000	0.8000
3	0.4800	0.4800	0.7600	0.7200	0.7200	0.7200	0.7200
6	0.4800	0.4800	0.6800	0.6000	0.6800	0.6000	0.6400
9	0.4000	0.4000	0.4000	0.4000	0.4000	0.4800	0.4000
12	0.3200	0.3200	0.4000	0.4000	0.4000	0.4000	0.4000

*Note:* WTI = WTI crude oil price volatility, BRN = Brent crude oil price volatility. Bold face indicates improvement in directional accuracy relative to the benchmark models (RW, AR( $p$ ) or HAR). The order of the AR models for Soy, Corn and Sugar is 1, whereas for Rice and Wheat is 2, based on the Bayesian Information Criterion.

**Table A24.** The Mean Squared Forecasting Error (MSFE) evaluation function for 1-, 3-, 6-, 9-, 12- month ahead forecasting horizons. Volatility Measure: Monthly Price Range;  $PR_t^{(M)}$ . Forecasting period: 2<sup>nd</sup> Food Crisis (2010-2012).

Months-ahead	RW	AR( $p$ )	HAR	HAR-WTI	HAR-BRN	MIDAS-HAR-WTI	MIDAS-HAR-BRN
SOY							
1	44.6642	<b>0.1648*</b>	<b>0.2778*</b>	<b>0.3132*</b>	<b>0.3031*</b>	<b>0.2970*</b>	<b>0.3146*</b>
3	45.1307	<b>0.9525*</b>	1.2995	1.4249	1.4623	1.1198	1.1279
6	45.1790	1.0364	1.6468	1.8790	1.9601	1.5741	1.7753
9	44.9614	1.0230	1.6345	1.9926	2.0933	1.7966	1.9055
12	44.8095	1.0058	1.3159	1.8602	1.8485	1.1096	1.2986
CORN							
1	163.3885	<b>0.2698*</b>	<b>0.2706*</b>	<b>0.2764*</b>	<b>0.2624*</b>	<b>0.3095*</b>	<b>0.2873*</b>
3	164.7547	<b>0.9110</b>	<b>0.7994*</b>	<b>0.8422</b>	<b>0.8139*</b>	<b>0.8216</b>	<b>0.7238*</b>
6	165.6785	<b>0.9980</b>	<b>0.9135*</b>	<b>0.9119*</b>	<b>0.9007*</b>	<b>0.8692*</b>	<b>0.9917</b>
9	166.2834	1.0023	<b>0.8415</b>	<b>0.8271*</b>	<b>0.8050*</b>	<b>0.7561*</b>	<b>0.8796</b>
12	167.4844	1.0050	<b>0.8076*</b>	<b>0.7908*</b>	<b>0.7614*</b>	<b>0.8304</b>	<b>0.7516*</b>
SUGAR							
1	262.4001	<b>0.3487*</b>	<b>0.2567*</b>	<b>0.2792*</b>	<b>0.2874*</b>	<b>0.2757*</b>	<b>0.2551*</b>
3	265.0368	<b>0.8930</b>	<b>0.5891*</b>	<b>0.6078*</b>	<b>0.6421</b>	<b>0.6097*</b>	<b>0.5964*</b>
6	267.9442	<b>0.9758</b>	<b>0.7082*</b>	<b>0.7372*</b>	<b>0.7817</b>	<b>0.6618*</b>	<b>0.7526</b>
9	270.9380	<b>0.9844</b>	<b>0.8152</b>	<b>0.8432</b>	<b>0.8824</b>	<b>0.6857*</b>	<b>0.8884</b>
12	273.3100	<b>0.9861</b>	<b>0.9151*</b>	<b>0.9354</b>	<b>0.9609</b>	<b>0.8849*</b>	<b>0.8886*</b>
RICE							
1	110.6482	<b>0.3003*</b>	<b>0.3033*</b>	<b>0.3582*</b>	<b>0.3448*</b>	<b>0.3463*</b>	<b>0.3330*</b>
3	111.5965	<b>0.9087</b>	<b>0.7767*</b>	<b>0.8561</b>	<b>0.8976</b>	<b>0.8108*</b>	<b>0.8379*</b>
6	112.4538	<b>0.9926</b>	<b>0.9246*</b>	<b>0.9853</b>	<b>0.9826</b>	1.0109	1.0295
9	112.8238	<b>0.9969</b>	<b>0.9531*</b>	1.0239	1.0173	<b>0.9348*</b>	<b>0.9648*</b>
12	113.2969	1.0000	1.0543	1.1131	1.1075	1.1919	1.0947
WHEAT							
1	201.9052	<b>0.5710*</b>	<b>0.5081*</b>	<b>0.5201*</b>	<b>0.4998*</b>	<b>0.5150*</b>	<b>0.5341*</b>
3	203.7855	<b>0.9736</b>	<b>0.7520*</b>	<b>0.7676*</b>	<b>0.7554*</b>	<b>0.7454*</b>	<b>0.7550*</b>
6	205.0665	<b>0.9913</b>	<b>0.8148*</b>	<b>0.8349*</b>	<b>0.8156*</b>	<b>0.8347*</b>	<b>0.8576</b>
9	206.2018	<b>0.9914</b>	<b>0.7794*</b>	<b>0.8014</b>	<b>0.7781*</b>	<b>0.7256*</b>	<b>0.7921</b>
12	207.6606	<b>0.9911</b>	<b>0.7493*</b>	<b>0.7623*</b>	<b>0.7536*</b>	<b>0.8032</b>	<b>0.7028*</b>

*Note:* WTI = WTI crude oil price volatility, BRN = Brent crude oil price volatility. The RW column shows the actual MSFE. All other columns show the MSFE ratios, for each forecasting model, that have been normalized relative to the monthly RW forecast. The order of the AR models for Soy and Corn is 1, for Sugar and Wheat is 2, whereas for Rice is 4, based on the Bayesian Information Criterion. Bold face numbers denote that the forecast outperforms the RW. \* denotes that the model is included in the set of the best models according to the Model Confidence Set (MCS).

**Table A25.** The Mean Absolute Forecasting Error (MAFE) evaluation function for 1-, 3-, 6-, 9-, 12-month ahead forecasting horizons. Volatility Measure: Monthly Price Range;  $PR_t^{(M)}$ . Forecasting period: 2<sup>nd</sup> Food Crisis (2010-2012).

Months-ahead	RW	AR( $p$ )	HAR	HAR-WTI	HAR-BRN	MIDAS-HAR-WTI	MIDAS-HAR-BRN
SOY							
1	5.5170	<b>0.3899*</b>	<b>0.5267</b>	<b>0.5591</b>	<b>0.5558</b>	<b>0.5420</b>	<b>0.5648</b>
3	5.5460	<b>0.9741*</b>	1.1514	1.2050	1.2164	1.0796	1.0872
6	5.5501	1.0211	1.2789	1.3663	1.3870	1.2735	1.3292
9	5.5349	1.0078	1.2234	1.3210	1.3332	1.2590	1.3388
12	5.5199	1.0006	1.1649	1.3441	1.3382	1.0498	1.1610
CORN							
1	9.7750	<b>0.4953*</b>	<b>0.4952*</b>	<b>0.4995*</b>	<b>0.4953*</b>	<b>0.5192*</b>	<b>0.5193*</b>
3	9.8229	<b>0.9489</b>	<b>0.8774*</b>	<b>0.9206</b>	<b>0.9058</b>	<b>0.8914</b>	<b>0.8462*</b>
6	9.8499	1.0010	<b>0.9608</b>	<b>0.9675</b>	<b>0.9535</b>	<b>0.9158*</b>	1.0253
9	9.8682	1.0029	<b>0.9541</b>	<b>0.9301</b>	<b>0.9258</b>	<b>0.8821*</b>	<b>0.9994</b>
12	9.9003	1.0021	<b>0.9271*</b>	<b>0.9003*</b>	<b>0.8836*</b>	<b>0.9321</b>	<b>0.9104*</b>
SUGAR							
1	12.3806	<b>0.5652*</b>	<b>0.4722*</b>	<b>0.4847*</b>	<b>0.4970*</b>	<b>0.4802*</b>	<b>0.4803*</b>
3	12.4485	<b>0.9309</b>	<b>0.7380*</b>	<b>0.7527*</b>	<b>0.7753</b>	<b>0.7663*</b>	<b>0.7679*</b>
6	12.5342	<b>0.9808</b>	<b>0.8687*</b>	<b>0.8841</b>	<b>0.9049</b>	<b>0.8640*</b>	<b>0.8821*</b>
9	12.6122	<b>0.9857</b>	<b>0.9403*</b>	<b>0.9446*</b>	<b>0.9715</b>	<b>0.8233*</b>	<b>0.9634</b>
12	12.6885	<b>0.9868</b>	1.0044	1.0063	1.0216	<b>0.9559*</b>	<b>0.9365*</b>
RICE							
1	7.8768	<b>0.5171*</b>	<b>0.5198*</b>	<b>0.5687*</b>	<b>0.5734*</b>	<b>0.5613*</b>	<b>0.5286*</b>
3	7.9133	<b>0.9448</b>	<b>0.8678*</b>	<b>0.9443</b>	1.0014	<b>0.9178</b>	<b>0.9160</b>
6	7.9494	<b>0.9968</b>	<b>0.9835*</b>	1.0055	1.0188	1.0630	1.0681
9	7.9670	<b>0.9975</b>	<b>0.9952</b>	1.0213	1.0256	<b>0.9675*</b>	1.0179
12	7.9868	<b>0.9988*</b>	1.0486	1.0628	1.0623	1.0567	1.0506
WHEAT							
1	10.6118	<b>0.7345*</b>	<b>0.7196*</b>	<b>0.7247*</b>	<b>0.7059*</b>	<b>0.7121*</b>	<b>0.7431*</b>
3	10.6690	<b>0.9781</b>	<b>0.9138*</b>	<b>0.9283</b>	<b>0.9162*</b>	<b>0.8804*</b>	<b>0.8879*</b>
6	10.7096	<b>0.9909*</b>	1.0047	1.0274	1.0069	1.0188	1.0348
9	10.7394	<b>0.9912</b>	<b>0.9834</b>	1.0104	<b>0.9925</b>	<b>0.9238*</b>	<b>0.9444*</b>
12	10.7654	<b>0.9911</b>	<b>0.9240*</b>	0.9180	<b>0.9137*</b>	<b>0.9416*</b>	<b>0.9004*</b>

*Note:* WTI = WTI crude oil price volatility, BRN = Brent crude oil price volatility. The RW column shows the actual MAFE. All other columns show the MAFE ratios, for each forecasting model, that have been normalized relative to the monthly RW forecast. The order of the AR models for Soy and Corn is 1, for Sugar and Wheat is 2, whereas for Rice is 4, based on the Bayesian Information Criterion. Bold face numbers denote that the forecast outperforms the RW. \* denotes that the model is included in the set of the best models according to the Model Confidence Set (MCS).

**Table A26.** The Mean Squared Forecasting Error (MSFE) evaluation function for 1-, 3-, 6-, 9-, 12- month ahead forecasting horizons. Volatility Measure: Monthly Realized Range;  $RR_t^{(M)}$ . Forecasting period: 2<sup>nd</sup> Food Crisis (2010-2012).

Months-ahead	RW	AR( $p$ )	HAR	HAR-WTI	HAR-BRN	MIDAS-HAR-WTI	MIDAS-HAR-BRN
SOY							
1	20.7780	<b>0.0501*</b>	<b>0.1205*</b>	<b>0.1219*</b>	<b>0.1233*</b>	<b>0.1574*</b>	<b>0.1527*</b>
3	20.9913	<b>0.7627*</b>	1.0155	1.0267	1.0656	1.0616	1.1122
6	21.1388	1.0483	1.5486	1.5431	1.6825	1.6332	1.4853
9	21.2359	<b>0.9752*</b>	1.6403	1.6119	1.8860	1.4609	1.7546
12	21.3914	<b>0.9711*</b>	1.8433	1.9092	2.4176	2.2477	2.8585
CORN							
1	115.7960	<b>0.0545*</b>	<b>0.0594*</b>	<b>0.0587*</b>	<b>0.0558*</b>	<b>0.0502*</b>	<b>0.0589*</b>
3	117.0610	<b>0.4775*</b>	<b>0.3748*</b>	<b>0.3948*</b>	<b>0.3994*</b>	<b>0.3714*</b>	<b>0.3608*</b>
6	118.6893	<b>0.7671</b>	<b>0.5269*</b>	<b>0.5542*</b>	<b>0.5819</b>	<b>0.5082*</b>	<b>0.4972*</b>
9	120.2932	<b>0.8410</b>	<b>0.4629*</b>	<b>0.4319*</b>	<b>0.4783*</b>	<b>0.3959*</b>	<b>0.5551</b>
12	122.2206	<b>0.9098</b>	<b>0.4570*</b>	<b>0.4226*</b>	<b>0.4974*</b>	<b>0.3883*</b>	<b>0.4379*</b>
SUGAR							
1	251.5367	<b>0.1068*</b>	<b>0.0596*</b>	<b>0.0677*</b>	<b>0.0717*</b>	<b>0.0754*</b>	<b>0.0632*</b>
3	254.2560	<b>0.5611</b>	<b>0.3372*</b>	<b>0.3640*</b>	<b>0.3605*</b>	<b>0.3620*</b>	<b>0.3764*</b>
6	257.8190	<b>0.8255</b>	<b>0.4518*</b>	<b>0.4851*</b>	<b>0.4747*</b>	<b>0.4259*</b>	<b>0.4780*</b>
9	261.6524	<b>0.9271</b>	<b>0.5621*</b>	<b>0.5995*</b>	<b>0.5773*</b>	<b>0.6092*</b>	<b>0.5305*</b>
12	265.1334	<b>0.9752</b>	<b>0.7199</b>	<b>0.7424</b>	<b>0.6928</b>	<b>0.5476*</b>	<b>0.5764*</b>
RICE							
1	83.3472	<b>0.5837</b>	<b>0.1150*</b>	<b>0.1468*</b>	<b>0.1798*</b>	<b>0.1711*</b>	<b>0.2096*</b>
3	83.8201	<b>0.6868</b>	<b>0.5995</b>	<b>0.3307*</b>	<b>0.4402*</b>	<b>0.4202*</b>	<b>0.3458*</b>
6	85.8951	<b>0.7903</b>	<b>0.8775</b>	<b>0.5279*</b>	<b>0.6711*</b>	<b>0.6563*</b>	<b>0.5307*</b>
9	85.8082	<b>0.8685</b>	<b>0.9481</b>	<b>0.5851*</b>	<b>0.7612*</b>	<b>0.7527*</b>	<b>0.6428*</b>
12	87.5434	<b>0.9833</b>	<b>0.9896</b>	<b>0.7092*</b>	<b>0.8606*</b>	<b>0.8640</b>	<b>0.8956</b>
WHEAT							
1	147.0142	<b>0.0925*</b>	<b>0.1314*</b>	<b>0.1402*</b>	<b>0.1318*</b>	<b>0.1305*</b>	<b>0.1289*</b>
3	148.5144	<b>0.5941</b>	<b>0.3808*</b>	<b>0.3629*</b>	<b>0.3757*</b>	<b>0.3669*</b>	<b>0.3960*</b>
6	150.4761	<b>0.8481</b>	<b>0.4743*</b>	<b>0.4400*</b>	<b>0.4679*</b>	<b>0.4857*</b>	<b>0.5154*</b>
9	152.3439	<b>0.9217</b>	<b>0.4484*</b>	<b>0.4204*</b>	<b>0.4500*</b>	<b>0.3930*</b>	<b>0.3986*</b>
12	154.5133	<b>0.9594</b>	<b>0.4884*</b>	<b>0.4422*</b>	<b>0.5004</b>	<b>0.4972*</b>	<b>0.4674*</b>

*Note:* WTI = WTI crude oil price volatility, BRN = Brent crude oil price volatility. The RW column shows the actual MSFE. All other columns show the MSFE ratios, for each forecasting model, that have been normalized relative to the monthly RW forecast. The order of the AR models for Soy, Corn and Sugar is 1, whereas for Rice and Wheat is 2, based on the Bayesian Information Criterion. Bold face numbers denote that the forecast outperforms the RW. \* denotes that the model is included in the set of the best models according to the Model Confidence Set (MCS).

**Table A27.** The Mean Absolute Forecasting Error (MAFE) evaluation function for 1-, 3-, 6-, 9-, 12-month ahead forecasting horizons. Volatility Measure: Monthly Realized Range;  $RR_t^{(M)}$ . Forecasting period: 2<sup>nd</sup> Food Crisis (2010-2012).

Months-ahead	RW	AR( $p$ )	HAR	HAR-WTI	HAR-BRN	MIDAS-HAR-WTI	MIDAS-HAR-BRN
SOY							
1	3.3533	<b>0.2144*</b>	<b>0.3601*</b>	<b>0.3530*</b>	<b>0.3660*</b>	<b>0.4046</b>	<b>0.4211</b>
3	3.3744	<b>0.8914*</b>	1.0932	1.0933	1.1125	1.1209	1.1577
6	3.3885	1.0231	1.3623	1.3527	1.4008	1.3932	1.3408
9	3.3984	<b>0.9520*</b>	1.3762	1.3664	1.4500	1.3117	1.3858
12	3.4219	<b>0.9644*</b>	1.4811	1.5060	1.6405	1.5898	1.7155
CORN							
1	9.0002	<b>0.2294*</b>	<b>0.2415*</b>	<b>0.2490*</b>	<b>0.2384*</b>	<b>0.2268*</b>	<b>0.2435*</b>
3	9.0549	<b>0.6461*</b>	<b>0.6196*</b>	<b>0.6236*</b>	<b>0.6305*</b>	<b>0.6118*</b>	<b>0.6144*</b>
6	9.1445	<b>0.8216</b>	<b>0.7311*</b>	<b>0.7503*</b>	<b>0.7684</b>	<b>0.7267*</b>	<b>0.7170*</b>
9	9.2371	<b>0.8907</b>	<b>0.6788</b>	<b>0.6655*</b>	<b>0.6906</b>	<b>0.6102*</b>	<b>0.6978</b>
12	9.3387	<b>0.9415</b>	<b>0.6444*</b>	<b>0.6289*</b>	<b>0.6873</b>	<b>0.6033*</b>	<b>0.6283*</b>
SUGAR							
1	12.3376	<b>0.3120*</b>	<b>0.2250*</b>	<b>0.2292*</b>	<b>0.2407*</b>	<b>0.2640*</b>	<b>0.2371*</b>
3	12.4081	<b>0.7230</b>	<b>0.5656*</b>	<b>0.5891*</b>	<b>0.5813*</b>	<b>0.5872*</b>	<b>0.6170*</b>
6	12.5079	<b>0.9058</b>	<b>0.6584*</b>	<b>0.6884*</b>	<b>0.6847*</b>	<b>0.6455*</b>	<b>0.6800*</b>
9	12.6084	<b>0.9662</b>	<b>0.7717*</b>	<b>0.7931*</b>	<b>0.7674*</b>	<b>0.8149</b>	<b>0.7578*</b>
12	12.7016	<b>0.9841</b>	<b>0.9187</b>	<b>0.9204</b>	<b>0.8760*</b>	<b>0.7686*</b>	<b>0.8014*</b>
RICE							
1	6.1474	<b>0.3260*</b>	<b>0.3410*</b>	<b>0.3826*</b>	<b>0.3717*</b>	<b>0.4273*</b>	<b>0.3844*</b>
3	6.1860	<b>0.7440</b>	<b>0.5451*</b>	<b>0.6360</b>	<b>0.6255</b>	<b>0.5737*</b>	<b>0.5940*</b>
6	6.2365	<b>0.9114</b>	<b>0.6187*</b>	<b>0.7430</b>	<b>0.7319</b>	<b>0.6369*</b>	<b>0.6939</b>
9	6.2856	<b>0.9671</b>	<b>0.6893*</b>	<b>0.8176</b>	<b>0.8151</b>	<b>0.7467</b>	<b>0.6740*</b>
12	6.3373	<b>0.9870</b>	<b>0.7631*</b>	<b>0.8449</b>	<b>0.8455</b>	<b>0.8604</b>	<b>0.8602</b>
WHEAT							
1	9.6425	<b>0.2910*</b>	<b>0.3328*</b>	<b>0.3372*</b>	<b>0.3355*</b>	<b>0.3305*</b>	<b>0.3280*</b>
3	9.7015	<b>0.7113</b>	<b>0.5920*</b>	<b>0.5693*</b>	<b>0.5919*</b>	<b>0.5716*</b>	<b>0.6162*</b>
6	9.7911	<b>0.8768</b>	<b>0.6699*</b>	<b>0.6346*</b>	<b>0.6666*</b>	<b>0.6696*</b>	<b>0.6977*</b>
9	9.8850	<b>0.9326</b>	<b>0.6572*</b>	<b>0.6273*</b>	<b>0.6653*</b>	<b>0.6151*</b>	<b>0.6027*</b>
12	9.9882	<b>0.9674</b>	<b>0.7028*</b>	<b>0.6572*</b>	<b>0.7255</b>	<b>0.7050*</b>	<b>0.6866*</b>

*Note:* WTI = WTI crude oil price volatility, BRN = Brent crude oil price volatility. The RW column shows the actual MAFE. All other columns show the MAFE ratios, for each forecasting model, that have been normalized relative to the monthly RW forecast. The order of the AR models for Soy, Corn and Sugar is 1, whereas for Rice and Wheat is 2, based on the Bayesian Information Criterion. Bold face numbers denote that the forecast outperforms the RW. \* denotes that the model is included in the set of the best models according to the Model Confidence Set (MCS).



**Table A28.** Directional accuracy for 1-, 3-, 6-, 9-, 12- month ahead forecasting horizons. Volatility Measure: Monthly Price Range;  $PR_t^{(M)}$ . Forecasting period: 2<sup>nd</sup> Food Crisis (2010-2012).

Months-ahead	RW	AR( $p$ )	HAR	HAR-WTI	HAR-BRN	MIDAS-HAR-WTI	MIDAS-HAR-BRN
SOY							
1	0.6944	0.9167	0.8611	0.8611	0.8056	0.8333	0.8611
3	0.8056	0.8333	0.7500	0.7222	0.6667	0.7222	0.7222
6	0.9167	0.9167	0.8056	0.7778	0.7500	0.8056	0.8056
9	0.6667	0.6667	0.6389	0.6667	0.6389	<b>0.6944</b>	0.6667
12	0.7222	0.7222	0.7222	0.6944	0.7222	0.7222	0.6944
CORN							
1	0.6944	0.8056	0.8333	0.8056	0.8056	0.8333	0.8333
3	0.6667	0.6944	0.8056	0.7500	0.7778	0.8056	0.7500
6	0.6944	0.6944	0.7222	0.6667	0.6667	0.7222	0.6389
9	0.5833	0.5833	0.6667	0.6389	0.6389	<b>0.7222</b>	0.6111
12	0.6944	0.6944	0.7500	0.7222	0.7500	0.7500	0.7500
SUGAR							
1	0.6389	0.8056	0.8056	<b>0.8611</b>	<b>0.8333</b>	0.7778	0.8056
3	0.6667	0.7222	0.7222	0.7222	0.7222	<b>0.7500</b>	<b>0.7500</b>
6	0.7222	0.7222	0.6667	0.6389	0.6667	0.6667	0.6389
9	0.6944	0.6944	0.6944	<b>0.7222</b>	<b>0.7222</b>	<b>0.7500</b>	0.6667
12	0.6389	0.6389	0.6111	0.6111	0.5833	0.6389	0.6111
RICE							
1	0.7778	0.9444	0.9444	0.9722	0.9444	0.9167	0.9722
3	0.7222	0.7500	0.7222	0.5833	0.5278	0.6667	0.7222
6	0.7222	0.7500	0.7500	0.6944	0.7222	0.7500	0.7500
9	0.7222	0.7222	0.6389	<b>0.7500</b>	0.6944	0.6944	0.6111
12	0.8611	0.8611	0.7778	0.8333	0.8056	0.7778	0.7778
WHEAT							
1	0.5833	0.7222	0.7222	0.6944	<b>0.7500</b>	0.6944	0.6667
3	0.7500	0.7500	0.7778	<b>0.8056</b>	<b>0.8056</b>	0.7778	0.7778
6	0.6944	0.6944	0.6111	0.6111	0.6111	0.6667	0.6111
9	0.7222	0.7222	0.6944	0.7222	0.6944	<b>0.7500</b>	<b>0.7500</b>
12	0.6944	0.6944	0.7222	0.6389	0.6111	0.6389	<b>0.7222</b>

*Note:* WTI = WTI crude oil price volatility, BRN = Brent crude oil price volatility. Bold face indicates improvement in directional accuracy relative to the benchmark models (RW, AR( $p$ ) or HAR). The order of the AR models for Soy and Corn is 1, for Sugar and Wheat is 2, whereas for Rice is 4, based on the Bayesian Information Criterion.

**Table A29.** Directional accuracy for 1-, 3-, 6-, 9-, 12- month ahead forecasting horizons. Volatility Measure: Monthly Realized Range;  $RR_t^{(M)}$ . Forecasting period: 2<sup>nd</sup> Food Crisis (2010-2012).

Months-ahead	RW	AR( $p$ )	HAR	HAR-WTI	HAR-BRN	MIDAS-HAR-WTI	MIDAS-HAR-BRN
SOY							
1	0.6667	0.9444	0.9444	0.9722	0.9444	0.9444	0.9444
3	0.8333	0.8333	0.6667	0.6944	0.6667	0.6389	0.6389
6	0.7500	0.7778	0.6944	0.7222	0.6944	0.6389	0.6667
9	0.7222	0.7500	0.7500	0.7500	0.6944	0.7500	0.6667
12	0.7778	0.8056	0.7222	0.7500	0.6667	0.7222	0.6389
CORN							
1	0.5278	0.8333	0.8611	<b>0.8889</b>	<b>0.9167</b>	0.8611	0.8333
3	0.5278	0.6111	0.7500	<b>0.7778</b>	<b>0.7778</b>	0.7222	0.7500
6	0.5833	0.6111	0.7222	0.6944	<b>0.7500</b>	0.7222	0.7222
9	0.5278	0.5278	0.6944	0.6944	0.6667	<b>0.7500</b>	0.6944
12	0.6944	0.6944	0.7222	0.6944	0.6944	<b>0.7778</b>	0.6944
SUGAR							
1	0.5556	0.8056	0.8889	0.8889	0.8611	0.8611	0.8889
3	0.6389	0.6389	0.7500	0.6944	0.6667	0.6944	0.7222
6	0.5833	0.6111	0.6667	<b>0.7222</b>	<b>0.6944</b>	0.6667	0.6667
9	0.7222	0.7500	0.6389	0.6667	0.6944	0.6111	0.6389
12	0.6389	0.6389	0.6389	0.6389	0.6389	<b>0.7500</b>	<b>0.7778</b>
RICE							
1	0.5556	0.8889	0.8889	0.8889	0.8889	0.8333	0.8889
3	0.6111	0.7500	0.7500	0.7500	<b>0.7778</b>	<b>0.7778</b>	<b>0.7778</b>
6	0.6111	0.6667	0.8333	0.7222	0.7222	0.6667	0.6944
9	0.7500	0.7500	0.8889	0.7500	0.7778	0.8611	0.8889
12	0.7222	0.7222	0.7222	0.7222	0.6944	0.7222	<b>0.7500</b>
WHEAT							
1	0.5000	0.8611	0.8333	0.8056	0.8333	0.8611	0.8333
3	0.6389	0.7500	0.6389	0.6944	0.6389	0.6667	0.6389
6	0.6389	0.6944	0.8333	0.8333	0.8056	<b>0.8611</b>	0.7500
9	0.5278	0.6667	0.6667	0.6667	0.6389	0.6389	0.6944
12	0.6667	0.6667	0.6389	<b>0.6944</b>	0.6111	0.5556	0.6389

*Note:* WTI = WTI crude oil price volatility, BRN = Brent crude oil price volatility. Bold face indicates improvement in directional accuracy relative to the benchmark models (RW, AR( $p$ ) or HAR). The order of the AR models for Soy, Corn and Sugar is 1, whereas for Rice and Wheat is 2, based on the Bayesian Information Criterion.

**Table A30.** The Mean Squared Forecasting Error (MSFE) evaluation function for 1-, 3-, 6-, 9-, 12- month ahead forecasting horizons. Volatility Measure: Monthly Price Range;  $PR_t^{(M)}$ . Forecasting period: Oil price collapse (2014-2016).

Months-ahead	RW	AR( $p$ )	HAR	HAR-WTI	HAR-BRN	MIDAS-HAR-WTI	MIDAS-HAR-BRN
SOY							
1	121.8969	<b>0.2195*</b>	<b>0.3569*</b>	<b>0.3666*</b>	<b>0.3663*</b>	<b>0.3651*</b>	<b>0.3954*</b>
3	122.8292	<b>0.9551*</b>	1.0899	1.1448	1.1248	1.1723	1.3306
6	122.6115	1.0230	1.1381	1.2551	1.1881	1.3792	1.4104
9	122.0617	1.0153	1.0834	1.2146	1.1348	1.2931	1.3400
12	121.5293	<b>0.9986</b>	<b>0.8785</b>	<b>0.9939</b>	<b>0.8807</b>	<b>0.7265*</b>	<b>0.8551*</b>
CORN							
1	47.4760	<b>0.2335*</b>	<b>0.3940*</b>	<b>0.4280*</b>	<b>0.3990*</b>	<b>0.4265*</b>	<b>0.3631*</b>
3	47.8947	<b>0.9925*</b>	1.1381	1.2435	1.2020	1.2389	1.1800
6	47.8319	1.0172	1.2056	1.1793	1.1941	1.3150	1.3639
9	47.7050	<b>0.9969*</b>	1.0662	<b>0.9628*</b>	<b>0.9719*</b>	1.3664	<b>0.9747*</b>
12	47.8403	<b>0.9995*</b>	1.2759	1.2135	1.2598	1.3172	1.4567
SUGAR							
1	57.5135	<b>0.2090*</b>	<b>0.4394*</b>	<b>0.4983*</b>	<b>0.4562*</b>	<b>0.4449*</b>	<b>0.5148</b>
3	58.1219	1.0432	1.0349	1.0390	1.0398	1.0285	1.0790
6	58.3557	<b>0.9789</b>	<b>0.8079*</b>	<b>0.8053*</b>	<b>0.7866*</b>	<b>0.8089*</b>	<b>0.7839*</b>
9	58.8467	<b>0.9828</b>	<b>0.7975*</b>	<b>0.8030*</b>	<b>0.8030*</b>	<b>0.8220*</b>	<b>0.8703*</b>
12	59.3987	<b>0.9847</b>	<b>0.7974*</b>	<b>0.8003*</b>	<b>0.7877*</b>	<b>0.7868*</b>	<b>0.8134*</b>
RICE							
1	36.4679	<b>0.2222*</b>	<b>0.5486</b>	<b>0.5684</b>	<b>0.5669</b>	<b>0.5955</b>	<b>0.5791</b>
3	36.7066	1.0920	1.4782	1.5218	1.5492	1.4578	1.5037
6	36.6490	<b>0.9832*</b>	1.1640	1.2443	1.3227	<b>0.9931*</b>	1.0798
9	36.7804	<b>0.9962*</b>	1.1412	1.1905	1.2668	1.2717	1.2262
12	36.9719	<b>0.9967*</b>	1.0851	1.0551	1.1122	1.3148	1.1311
WHEAT							
1	42.3858	<b>0.4449*</b>	<b>0.6064*</b>	<b>0.6164*</b>	<b>0.5614*</b>	<b>0.6564</b>	<b>0.6530</b>
3	42.7715	<b>0.9664</b>	1.0305	<b>0.9214*</b>	<b>0.8888*</b>	<b>0.9554</b>	1.0664
6	42.9733	1.0025	1.2998	1.1482	1.0724	1.5327	1.5360
9	43.0873	1.0013	1.4823	1.3449	1.2591	1.9740	2.0886
12	43.0174	1.0035	1.5903	1.5572	1.4710	1.6677	1.9983

*Note:* WTI = WTI crude oil price volatility, BRN = Brent crude oil price volatility. The RW column shows the actual MSFE. All other columns show the MSFE ratios, for each forecasting model, that have been normalized relative to the monthly RW forecast. The order of the AR models for Soy and Corn is 1, for Sugar and Wheat is 2, whereas for Rice is 4, based on the Bayesian Information Criterion. Bold face numbers denote that the forecast outperforms the RW. \* denotes that the model is included in the set of the best models according to the Model Confidence Set (MCS).

**Table A31.** The Mean Absolute Forecasting Error (MAFE) evaluation function for 1-, 3-, 6-, 9-, 12-month ahead forecasting horizons. Volatility Measure: Monthly Price Range;  $PR_t^{(M)}$ . Forecasting period: Oil price collapse (2014-2016).

Months-ahead	RW	AR( $p$ )	HAR	HAR-WTI	HAR-BRN	MIDAS-HAR-WTI	MIDAS-HAR-BRN
SOY							
1	7.3925	<b>0.4279*</b>	<b>0.5677*</b>	<b>0.5458*</b>	<b>0.5653*</b>	<b>0.5723*</b>	<b>0.5740*</b>
3	7.4270	<b>0.9694*</b>	1.0673	1.0701	1.0805	1.1410	1.3055
6	7.4277	1.0220	1.1463	1.1873	1.1654	1.3608	1.3691
9	7.3954	1.0082	1.1201	1.1699	1.1296	1.2327	1.2555
12	7.3833	<b>0.9958*</b>	1.0191	1.0887	1.0411	<b>0.9793*</b>	1.0201
CORN							
1	5.6398	<b>0.4613*</b>	<b>0.5773*</b>	<b>0.6271</b>	<b>0.6027</b>	<b>0.5976*</b>	<b>0.5662*</b>
3	5.6656	<b>0.9653*</b>	1.0019	1.0883	1.0764	1.0977	1.0837
6	5.6669	1.0017	1.0502	1.0536	1.0673	1.0968	1.0837
9	5.6767	<b>0.9906</b>	<b>0.9837</b>	<b>0.9348*</b>	<b>0.9515*</b>	1.0247	<b>0.9136*</b>
12	5.7028	<b>0.9942*</b>	1.1144	1.1127	1.1495	1.1747	1.1927
SUGAR							
1	5.9479	<b>0.4581*</b>	<b>0.6073*</b>	<b>0.6628</b>	<b>0.6157</b>	<b>0.6450</b>	<b>0.6583</b>
3	5.9789	<b>0.9953</b>	<b>0.9250</b>	<b>0.9112*</b>	<b>0.8887*</b>	<b>0.9718</b>	<b>0.9038*</b>
6	6.0011	<b>0.9810</b>	<b>0.8597</b>	<b>0.8279*</b>	<b>0.7689*</b>	<b>0.8452</b>	<b>0.8122*</b>
9	6.0200	<b>0.9856</b>	<b>0.8407*</b>	<b>0.8253*</b>	<b>0.7815*</b>	<b>0.8509*</b>	<b>0.8634</b>
12	6.0694	<b>0.9877</b>	<b>0.8918</b>	<b>0.8563</b>	<b>0.8210*</b>	<b>0.7987*</b>	<b>0.8068*</b>
RICE							
1	4.9528	<b>0.4660*</b>	<b>0.6721*</b>	<b>0.6855</b>	<b>0.6859</b>	<b>0.7411</b>	<b>0.6845</b>
3	4.9714	1.0157	1.1456	1.1736	1.1869	1.1195	1.0787
6	4.9767	<b>0.9854*</b>	<b>0.9758*</b>	<b>0.9955</b>	1.0821	<b>0.9276*</b>	<b>0.9460*</b>
9	4.9933	<b>0.9957</b>	<b>0.9807*</b>	1.0059	1.0451	1.0802	1.0534
12	5.0147	<b>0.9975*</b>	1.0142	<b>0.9803*</b>	1.0433	1.1334	1.0517
WHEAT							
1	5.2991	<b>0.6534*</b>	<b>0.7310*</b>	<b>0.7512</b>	<b>0.7393*</b>	<b>0.7953</b>	<b>0.8080</b>
3	5.3279	<b>0.9699</b>	1.0041	<b>0.9219*</b>	<b>0.9274*</b>	<b>0.9409*</b>	<b>0.9943</b>
6	5.3431	1.0019	1.1250	1.0381	<b>0.9933</b>	1.2493	1.2396
9	5.3446	1.0005	1.1740	1.1029	1.0494	1.4170	1.4523
12	5.3409	1.0019	1.2760	1.2407	1.2037	1.2625	1.4231

*Note:* WTI = WTI crude oil price volatility, BRN = Brent crude oil price volatility. The RW column shows the actual MAFE. All other columns show the MAFE ratios, for each forecasting model, that have been normalized relative to the monthly RW forecast. The order of the AR models for Soy and Corn is 1, for Sugar and Wheat is 2, whereas for Rice is 4, based on the Bayesian Information Criterion. Bold face numbers denote that the forecast outperforms the RW. \* denotes that the model is included in the set of the best models according to the Model Confidence Set (MCS).

**Table A32.** The Mean Squared Forecasting Error (MSFE) evaluation function for 1-, 3-, 6-, 9-, 12- month ahead forecasting horizons. Volatility Measure: Monthly Realized Range;  $RR_t^{(M)}$ . Forecasting period: Oil price collapse (2014-2016).

Months-ahead	RW	AR( $p$ )	HAR	HAR-WTI	HAR-BRN	MIDAS-HAR-WTI	MIDAS-HAR-BRN
SOY							
1	24.0730	<b>0.0488*</b>	<b>0.1255*</b>	<b>0.1321*</b>	<b>0.1329*</b>	<b>0.1190*</b>	<b>0.1487*</b>
3	24.3079	<b>0.7987*</b>	<b>0.9224</b>	1.0511	1.0009	1.1602	1.0954
6	24.4169	1.0570	1.2170	1.4800	1.4110	1.5654	1.7685
9	24.3628	1.0610	1.2276	1.5220	1.4621	1.4717	1.4699
12	24.2985	1.0075	1.1405	1.4289	1.3571	1.2752	1.0790
CORN							
1	21.3347	<b>0.0446*</b>	<b>0.1531*</b>	<b>0.1790*</b>	<b>0.1720*</b>	<b>0.1691*</b>	<b>0.1768*</b>
3	21.5230	<b>0.9960*</b>	<b>0.9851*</b>	1.1081	1.0346	1.2091	1.1695
6	21.5988	1.0795	1.0932	1.1210	1.0974	1.2324	1.1607
9	21.6168	1.0561	1.0289	1.0075	1.0055	1.0441	1.2185
12	21.6473	1.0550	1.3170	1.2589	1.2774	1.2800	1.2317
SUGAR							
1	28.7057	<b>0.0690*</b>	<b>0.1777*</b>	<b>0.1541*</b>	<b>0.1658*</b>	<b>0.2197*</b>	<b>0.2601</b>
3	28.9520	<b>0.9784*</b>	<b>0.9947</b>	<b>0.9793*</b>	<b>0.9624*</b>	1.1161	1.1628
6	29.0191	<b>0.9376*</b>	1.0227	1.0324	1.0151	<b>0.9787</b>	<b>0.9214*</b>
9	29.2981	<b>0.9797*</b>	1.3442	1.3903	1.3786	1.2972	1.1285
12	29.2826	<b>0.9715*</b>	1.2994	1.4528	1.4719	1.8418	1.8181
RICE							
1	24.8292	<b>0.1097*</b>	<b>0.4881</b>	<b>0.4464</b>	<b>0.4505</b>	<b>0.4379</b>	<b>0.5178</b>
3	24.9686	<b>0.9210</b>	<b>0.8746*</b>	1.1590	1.0407	<b>0.8701*</b>	<b>0.8815*</b>
6	25.1246	1.0054	1.2643	1.6543	1.5670	1.2686	1.1591
9	25.1423	1.0072	1.2149	1.6506	1.4876	1.5630	1.7313
12	25.1099	1.0094	1.3347	1.5497	1.3956	1.4472	1.3031
WHEAT							
1	22.7409	<b>0.0724*</b>	<b>0.2552</b>	<b>0.2372</b>	<b>0.2177</b>	<b>0.2847</b>	<b>0.2664</b>
3	22.9599	<b>0.6334*</b>	<b>0.8882</b>	<b>0.7884*</b>	<b>0.8182</b>	<b>0.8076*</b>	<b>0.7862*</b>
6	23.1637	<b>0.9481*</b>	1.3792	1.2344	1.3012	1.2099	1.3439
9	23.2409	1.0126	1.6275	1.4059	1.5394	2.0060	2.2435
12	23.1996	1.0113	1.7743	1.5591	1.7003	1.9534	2.2151

*Note:* WTI = WTI crude oil price volatility, BRN = Brent crude oil price volatility. The RW column shows the actual MSFE. All other columns show the MSFE ratios, for each forecasting model, that have been normalized relative to the monthly RW forecast. The order of the AR models for Soy, Corn and Sugar is 1, whereas for Rice and Wheat is 2, based on the Bayesian Information Criterion. Bold face numbers denote that the forecast outperforms the RW. \* denotes that the model is included in the set of the best models according to the Model Confidence Set (MCS).

**Table A33.** The Mean Absolute Forecasting Error (MAFE) evaluation function for 1-, 3-, 6-, 9-, 12-month ahead forecasting horizons. Volatility Measure: Monthly Realized Range;  $RR_t^{(M)}$ . Forecasting period: Oil price collapse (2014-2016).

Months-ahead	RW	AR( $p$ )	HAR	HAR-WTI	HAR-BRN	MIDAS-HAR-WTI	MIDAS-HAR-BRN
SOY							
1	3.8820	<b>0.2112*</b>	<b>0.3454*</b>	<b>0.3493*</b>	<b>0.3447*</b>	<b>0.3616*</b>	<b>0.3720*</b>
3	3.9025	<b>0.9150*</b>	<b>0.9944</b>	1.0627	1.0210	1.1414	1.0985
6	3.9131	1.0493	1.1291	1.2496	1.1929	1.2789	1.3729
9	3.9125	1.0224	1.1257	1.2797	1.2337	1.2868	1.2626
12	3.9090	1.0024	1.0749	1.2200	1.1966	1.1560	1.0726
CORN							
1	3.4551	<b>0.2049*</b>	<b>0.4236*</b>	<b>0.4545</b>	<b>0.4356</b>	<b>0.4423</b>	<b>0.4773</b>
3	3.4745	1.0534	1.0784	1.1937	1.1528	1.2213	1.2011
6	3.4817	1.0462	1.1074	1.1528	1.1382	1.2053	1.1861
9	3.4813	1.0195	1.0326	1.0757	1.0505	<b>0.9962*</b>	1.1887
12	3.4791	1.0393	1.2120	1.2187	1.2356	1.3214	1.2692
SUGAR							
1	4.3146	<b>0.2561*</b>	<b>0.3520*</b>	<b>0.3267*</b>	<b>0.3274*</b>	<b>0.4060*</b>	<b>0.4291*</b>
3	4.3348	<b>0.9460</b>	<b>0.8894*</b>	<b>0.8278*</b>	<b>0.8084*</b>	<b>0.8960*</b>	<b>0.8962*</b>
6	4.3520	<b>0.9603</b>	<b>0.9165</b>	<b>0.8462*</b>	<b>0.8115*</b>	<b>0.9070</b>	<b>0.8173*</b>
9	4.3770	<b>0.9799*</b>	1.0573	1.0512	1.0324	1.0397	<b>0.9603*</b>
12	4.3881	<b>0.9623*</b>	1.0630	1.1444	1.1454	1.3679	1.3191
RICE							
1	3.8536	<b>0.3222*</b>	<b>0.7121</b>	<b>0.6992</b>	<b>0.6983</b>	<b>0.6654</b>	<b>0.7373</b>
3	3.8640	<b>0.9886*</b>	<b>0.9950*</b>	1.1416	1.0873	<b>0.9862*</b>	1.0043
6	3.8771	1.0426	1.1086	1.2969	1.2769	1.1444	1.1008
9	3.8879	1.0084	1.0679	1.1854	1.1451	1.2741	1.3504
12	3.8895	1.0257	1.1942	1.1659	1.1051	1.2465	1.1558
WHEAT							
1	3.7516	<b>0.2637*</b>	<b>0.5286</b>	<b>0.5249</b>	<b>0.4939*</b>	<b>0.5543</b>	<b>0.5299</b>
3	3.7720	<b>0.8346*</b>	1.0095	<b>0.9493</b>	<b>0.9588</b>	<b>0.9387</b>	<b>0.9269</b>
6	3.7820	1.0035	1.3130	1.2028	1.2645	1.1873	1.2728
9	3.7863	1.0424	1.4568	1.2719	1.3854	1.6141	1.7008
12	3.7724	1.0368	1.5132	1.3911	1.4651	1.5791	1.6458

*Note:* WTI = WTI crude oil price volatility, BRN = Brent crude oil price volatility. The RW column shows the actual MAFE. All other columns show the MAFE ratios, for each forecasting model, that have been normalized relative to the monthly RW forecast. The order of the AR models for Soy, Corn and Sugar is 1, whereas for Rice and Wheat is 2, based on the Bayesian Information Criterion. Bold face numbers denote that the forecast outperforms the RW. \* denotes that the model is included in the set of the best models according to the Model Confidence Set (MCS).

**Table A34.** Directional accuracy for 1-, 3-, 6-, 9-, 12- month ahead forecasting horizons. Volatility Measure: Monthly Price Range;  $PR_t^{(M)}$ . Forecasting period: Oil price collapse (2014-2016).

Months-ahead	RW	AR( $p$ )	HAR	HAR-WTI	HAR-BRN	MIDAS-HAR-WTI	MIDAS-HAR-BRN
SOY							
1	0.7143	0.8571	0.8571	<b>0.9048</b>	<b>0.9048</b>	<b>0.9048</b>	<b>0.9048</b>
3	0.7619	0.7143	0.6667	0.7619	0.7143	0.6667	0.6190
6	0.8095	0.8095	0.6667	0.6667	0.6667	0.6190	0.6190
9	0.7143	0.7143	0.7143	0.6190	0.7143	0.7143	0.7143
12	0.7619	0.7619	0.7619	0.7143	0.6667	<b>0.8095</b>	0.7143
CORN							
1	0.6190	0.9048	0.8571	0.8095	0.8571	0.8095	0.7619
3	0.7143	0.6667	0.6667	0.6667	0.6667	0.6667	<b>0.7619</b>
6	0.8095	0.8571	0.8095	0.7143	0.7619	0.7143	0.7619
9	0.6190	0.6667	0.6190	<b>0.7143</b>	0.6190	0.6667	0.6667
12	0.8095	0.7619	0.7619	0.7619	0.7143	0.8095	0.7143
SUGAR							
1	0.7143	0.9048	0.8571	0.7143	0.7619	0.8095	0.8095
3	0.7619	0.8095	0.8095	0.8095	0.8095	<b>0.9048</b>	<b>0.8571</b>
6	0.7143	0.7143	0.7143	0.7143	0.7619	0.7143	<b>0.7619</b>
9	0.8095	0.8095	0.9048	0.9048	0.9048	0.9048	<b>0.9524</b>
12	0.7143	0.7143	0.7619	<b>0.8095</b>	<b>0.8095</b>	<b>0.8095</b>	<b>0.8095</b>
RICE							
1	0.6667	0.9048	0.8571	0.8095	0.8571	0.8095	0.9048
3	0.8095	0.8095	0.7619	0.8095	0.8095	0.8095	0.7619
6	0.6667	0.7143	0.8095	0.7143	0.6667	0.6667	0.8095
9	0.9048	0.9048	0.9048	0.9048	0.8571	0.8571	0.8571
12	0.8095	0.8095	0.8095	0.8095	0.8095	<b>0.9524</b>	0.8095
WHEAT							
1	0.7619	0.9524	0.7619	0.7619	0.7619	0.6667	0.5714
3	0.6190	0.6190	0.5238	0.5714	0.5714	0.5714	0.5714
6	0.7143	0.7143	0.7619	<b>0.8095</b>	<b>0.8095</b>	0.6667	0.7143
9	0.7619	0.7619	0.7619	0.7143	0.7619	0.6190	0.6190
12	0.9524	0.9524	0.8095	0.8095	0.8095	0.8095	0.7619

*Note:* WTI = WTI crude oil price volatility, BRN = Brent crude oil price volatility. Bold face indicates improvement in directional accuracy relative to the benchmark models (RW, AR( $p$ ) or HAR). The order of the AR models for Soy and Corn is 1, for Sugar and Wheat is 2, whereas for Rice is 4, based on the Bayesian Information Criterion.

**Table A35.** Directional accuracy for 1-, 3-, 6-, 9-, 12- month ahead forecasting horizons. Volatility Measure: Monthly Realized Range;  $RR_t^{(M)}$ . Forecasting period: Oil price collapse (2014-2016).

Months-ahead	RW	AR( $p$ )	HAR	HAR-WTI	HAR-BRN	MIDAS-HAR-WTI	MIDAS-HAR-BRN
SOY							
1	0.5238	0.9524	0.8095	0.8571	0.8571	0.8571	0.6667
3	0.6667	0.7619	0.7143	0.5714	0.5714	0.4762	0.5714
6	0.7143	0.7143	0.7143	0.5714	0.6667	0.6190	0.5714
9	0.8095	0.8095	0.6190	0.5238	0.5238	0.4762	0.4762
12	0.7619	0.7619	0.6667	0.6190	0.6667	0.6667	0.7143
CORN							
1	0.6190	0.9048	0.8095	0.8095	0.8571	0.8095	0.7143
3	0.7143	0.7143	0.6190	0.6190	0.6667	0.6190	0.6190
6	0.6190	0.6667	0.7619	0.6667	0.7143	0.7143	0.7619
9	0.7619	0.7143	0.6190	0.6190	0.5714	0.8571	0.6190
12	0.8571	0.8571	0.7143	0.6667	0.7143	0.7143	0.6667
SUGAR							
1	0.6190	0.9048	0.8571	0.9048	<b>0.9524</b>	0.8571	0.8571
3	0.7143	0.8095	0.7143	0.7143	0.7619	0.8095	<b>0.8571</b>
6	0.6667	0.6667	0.6667	<b>0.8571</b>	<b>0.8571</b>	<b>0.7143</b>	<b>0.7143</b>
9	0.8571	0.8571	0.7619	0.8571	0.8571	0.8571	<b>0.9048</b>
12	0.8571	0.8571	0.7619	0.8095	0.7619	0.6190	0.7143
RICE							
1	0.6190	0.9048	0.8571	<b>0.9524</b>	<b>0.9524</b>	<b>0.9524</b>	0.9048
3	0.7143	0.8571	0.8095	0.7143	0.7619	0.8571	0.8571
6	0.6667	0.6190	0.5714	0.5238	0.5238	0.5714	0.6190
9	0.8571	0.8571	0.8571	0.7619	0.7143	0.8095	0.6667
12	0.8095	0.8095	0.7619	<b>0.8571</b>	0.9048	0.8095	0.8095
WHEAT							
1	0.5238	0.9524	0.7619	0.8095	0.7619	0.7619	0.7619
3	0.4762	0.6667	0.5714	0.6190	0.5714	0.5714	0.6667
6	0.7143	0.8095	0.6667	0.7143	0.6190	0.7619	0.6667
9	0.7143	0.7143	0.6190	0.7143	0.6667	0.5714	0.6190
12	0.8571	0.8571	0.6190	0.7143	0.6667	0.5714	0.6190

*Note:* WTI = WTI crude oil price volatility, BRN = Brent crude oil price volatility. Bold face indicates improvement in directional accuracy relative to the benchmark models (RW, AR( $p$ ) or HAR). The order of the AR models for Soy, Corn and Sugar is 1, whereas for Rice and Wheat is 2, based on the Bayesian Information Criterion.