Appendices

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Appendix A: Further Replication Results

(I) Shorter evaluation sample, 1992:01–2012:09

Our results from the narrow replication, using the evaluation sample examined by Baumeister and Kilian (2015) are shown in Tables A-1a and A-1b. These results use the same WTI and RAC measures considered by those authors. The results confirm the main findings of their paper. Equal weight point combinations have lower MSPE ratios and higher success ratios than inverse MSPE weights for most horizons. The corresponding recursive MSPE and success ratios for the Brent measure, with the same 1992:01 to 2012:09 evaluation sample are displayed in Table A-1c.

Table A-1a. Forecast Accuracy for RAC, Evaluation 1992:01-2012:09

	Real U.S. refiners' acquisition cost for oil imports				
			Rolling weights based on windows of length		
MH	Equal weight	Recursive weights	36	24	12
			Recursive MSPE ratios		
1	**0.931****(0.032)	**0.936****(0.044)	**0.938****(0.050)	**0.930****(0.036)	**0.928****(0.033)
3	**0.922****(0.009)	**0.925****(0.010)	**0.925****(0.011)	**0.920****(0.005)	**0.927****(0.005)
6	**0.983**(0.139)	**0.987**(0.208)	**0.989**(0.229)	**0.990**(0.256)	**0.989**(0.227)
9	**0.977***(0.082)	**0.982**(0.145)	**0.981**(0.131)	**0.985**(0.185)	**0.986**(0.233)
12	**0.938****(0.000)	**0.944****(0.001)	**0.948****(0.003)	**0.946****(0.002)	**0.943****(0.001)
15	**0.928****(0.000)	**0.939****(0.001)	**0.952****(0.011)	**0.952****(0.009)	**0.969***(0.078)
18	**0.969****(0.036)	**0.990**(0.277)	1.018(0.809)	1.026(0.883)	1.053(0.984)
21	1.002(0.543)	1.023(0.921)	1.049(0.992)	1.058(0.995)	1.101(1.000)
24	**0.981**(0.133)	**0.991**(0.296)	**0.994**(0.373)	**0.999**(0.488)	1.039(0.939)
			Success ratios		
1	**0.558***(0.064)	**0.550***(0.093)	**0.550***(0.093)	**0.546**(0.122)	**0.554***(0.084)
3	**0.587****(0.013)	**0.583****(0.018)	**0.583****(0.018)	**0.587****(0.014)	**0.579****(0.028)
6	**0.553**(0.135)	**0.533**(0.324)	**0.537**(0.271)	**0.516**(0.531)	**0.520**(0.419)
9	**0.548**(0.112)	**0.560****(0.046)	**0.564****(0.041)	**0.552***(0.085)	**0.552***(0.077)
12	**0.660****(0.000)	**0.647****(0.000)	**0.639****(0.000)	**0.639****(0.000)	**0.664****(0.000)
15	**0.626****(0.000)	**0.591****(0.001)	**0.574****(0.012)	**0.570****(0.016)	**0.574****(0.015)
18	**0.565****(0.003)	**0.543****(0.012)	**0.513**(0.177)	0.496(0.381)	0.496(0.326)
21	**0.581****(0.001)	**0.502**(0.124)	**0.550****(0.027)	**0.537**(0.114)	**0.502**(0.498)
24	**0.558****(0.033)	**0.522***(0.088)	**0.549***(0.079)	**0.540**(0.182)	**0.531**(0.264)

NOTES: MH represents monthly forecast horizons. Boldface indicates improvements relative to the no-change forecast. As a rough guide, p-values of a Harvey, Leybourne, and Newbold (1997) small-sample adjustment of the Diebold and Mariano (1995) test are reported in brackets after recursive MSPE ratios. We also report p-values for the Pesaran and Timmermann (2009) test for the null hypothesis of no directional accuracy in brackets after success ratios. $*$ denotes significance at the 10% level and $**$ at the 5% level.

Table A-1b. Forecast Accuracy for WTI, Evaluation 1992:01-2012:09

	Real WTI price				
			Rolling weights based on windows of length		
MH	Equal weight	Recursive weights	36	24	12
			Recursive MSPE ratios		
1	**0.907****(0.008)	**0.911****(0.009)	**0.912****(0.011)	**0.912****(0.012)	**0.909****(0.013)
3	**0.923****(0.011)	**0.927****(0.012)	**0.929****(0.014)	**0.928****(0.011)	**0.934****(0.013)
6	**0.986**(0.214)	**0.991**(0.289)	**0.992**(0.309)	**0.994**(0.350)	**0.997**(0.419)
9	**0.980**(0.127)	**0.986**(0.208)	**0.982**(0.158)	**0.986**(0.217)	**0.989**(0.281)
12	**0.946****(0.002)	**0.954****(0.007)	**0.953****(0.008)	**0.949****(0.005)	**0.945****(0.003)
15	**0.939****(0.001)	**0.952****(0.007)	**0.962****(0.042)	**0.963****(0.041)	**0.943****(0.005)
18	**0.968****(0.035)	**0.993**(0.351)	1.020(0.843)	1.038(0.954)	1.065(0.988)
21	1.000(0.496)	1.029(0.948)	1.051(0.991)	1.062(0.994)	1.081(0.998)
24	**0.973***(0.080)	**0.994**(0.373)	**0.995**(0.403)	1.003(0.554)	1.048(0.958)
			Success ratios		
1	**0.550**(0.135)	**0.554**(0.124)	**0.550**(0.150)	**0.558**(0.102)	**0.558**(0.102)
3	**0.555**(0.124)	**0.551**(0.150)	**0.543**(0.210)	**0.547**(0.198)	**0.538**(0.306)
6	**0.529**(0.366)	**0.520**(0.487)	**0.508**(0.635)	**0.508**(0.584)	0.484(0.843)
9	**0.544**(0.130)	**0.560****(0.049)	**0.568****(0.031)	**0.556***(0.073)	**0.535**(0.181)
12	**0.588****(0.004)	**0.571****(0.014)	**0.584****(0.009)	**0.601****(0.001)	**0.601****(0.001)
15	**0.583****(0.005)	**0.583****(0.003)	**0.566****(0.028)	**0.566****(0.031)	**0.562****(0.024)
18	**0.573****(0.003)	**0.556****(0.004)	**0.534***(0.060)	**0.513**(0.221)	**0.509**(0.231)
21	**0.572****(0.002)	**0.502**(0.106)	**0.537***(0.050)	**0.515**(0.261)	**0.511**(0.324)
24	**0.549***(0.065)	0.496(0.290)	**0.531**(0.168)	**0.527**(0.325)	**0.527**(0.301)

NOTES: MH represents monthly forecast horizons. Boldface indicates improvements relative to the no-change forecast. As a rough guide, p-values of a Harvey et al. (1997) small-sample adjustment of the Diebold and Mariano (1995) test are reported in brackets after recursive MSPE ratios. We also report p-values for the Pesaran and Timmermann (2009) test for the null hypothesis of no directional accuracy in brackets after success ratios. $*$ denotes significance at the 10% level and $**$ at the 5% level.

Table A-1c. Forecast Accuracy for Brent, Evaluation 1992:01-2012:09

	Real Brent price				
			Rolling weights based on windows of length		
MH	Equal weight	Recursive weights	36	24	12
			Recursive MSPE ratios		
1	**0.956**(0.107)	**0.935****(0.018)	**0.933****(0.017)	**0.936****(0.022)	**0.948***(0.084)
3	**0.942****(0.027)	**0.941****(0.021)	**0.939****(0.016)	**0.943****(0.023)	**0.947****(0.026)
6	**0.992**(0.350)	**0.999**(0.472)	1.004(0.590)	1.004(0.587)	1.007(0.658)
9	**0.981**(0.152)	**0.988**(0.244)	**0.989**(0.256)	**0.995**(0.373)	**0.995**(0.392)
12	**0.949****(0.002)	**0.959****(0.009)	**0.963****(0.014)	**0.965****(0.014)	**0.957****(0.009)
15	**0.943****(0.000)	**0.957****(0.005)	**0.969****(0.036)	**0.976***(0.071)	**0.979***(0.093)
18	**0.981**(0.119)	1.005(0.631)	1.026(0.944)	1.041(0.993)	1.075(1.000)
21	1.014(0.842)	1.040(0.996)	1.058(1.000)	1.064(1.000)	1.098(1.000)
24	1.008(0.688)	1.025(0.932)	1.034(0.971)	1.041(0.993)	1.096(1.000)
			Success ratios		
1	**0.522**(0.128)	**0.526**(0.133)	**0.534***(0.094)	**0.534***(0.089)	**0.558****(0.016)
3	**0.522**(0.263)	**0.518**(0.284)	**0.530**(0.174)	**0.530**(0.163)	**0.538**(0.125)
6	**0.508**(0.406)	0.484(0.673)	0.471(0.832)	0.471(0.764)	0.488(0.597)
9	**0.506**(0.355)	0.498(0.414)	0.485(0.540)	0.465(0.753)	0.490(0.455)
12	**0.592****(0.000)	**0.592****(0.001)	**0.584****(0.001)	**0.584****(0.001)	**0.597****(0.000)
15	**0.604****(0.000)	**0.591****(0.000)	**0.587****(0.000)	**0.587****(0.000)	**0.609****(0.000)
18	**0.543****(0.001)	**0.539****(0.001)	**0.504****(0.035)	0.483(0.195)	0.474(0.284)
21	**0.541****(0.001)	**0.515****(0.002)	0.493**(0.050)	0.463(0.427)	0.450(0.582)
24	0.500(0.136)	0.456(0.461)	**0.504***(0.087)	0.451(0.782)	0.456(0.749)

NOTES: MH represents monthly forecast horizons. Boldface indicates improvements relative to the no-change forecast. As a rough guide, p-values of a Harvey et al. (1997) small-sample adjustment of the Diebold and Mariano (1995) test are reported in brackets after recursive MSPE ratios. We also report p-values for the Pesaran and Timmermann (2009) test for the null hypothesis of no directional accuracy in brackets after success ratios. $*$ denotes significance at the 10% level and $**$ at the 5% level.

(II) Longer evaluation sample, 1992:01–2017:12, for RAC and WTI measures

We also present the forecast accuracy of RAC and WTI for the extended 1992:01 to 2017:12 evaluation sample in Tables A-2a and A-2b, respectively.

Table A-2a. Forecast Accuracy for RAC, Evaluation 1992:01 to 2017:12

	Real U.S. refiners' acquisition cost for oil imports				
			Rolling weights based on windows of length		
MH	Equal weight	Recursive weights	36	24	12
			Recursive MSPE ratios		
1	**0.933****(0.017)	**0.937****(0.024)	**0.941****(0.032)	**0.934****(0.022)	**0.930****(0.018)
3	**0.922****(0.002)	**0.925****(0.003)	**0.930****(0.004)	**0.922****(0.001)	**0.922****(0.001)
6	**0.975****(0.035)	**0.981***(0.075)	**0.982***(0.080)	**0.978****(0.045)	**0.969****(0.019)
9	**0.969****(0.011)	**0.977****(0.043)	**0.973****(0.023)	**0.971****(0.023)	**0.968****(0.023)
12	**0.934****(0.000)	**0.943****(0.000)	**0.940****(0.000)	**0.929****(0.000)	**0.921****(0.000)
15	**0.929****(0.000)	**0.941****(0.000)	**0.941****(0.000)	**0.933****(0.000)	**0.925****(0.000)
18	**0.941****(0.000)	**0.959****(0.004)	**0.971****(0.047)	**0.968***(0.051)	**0.949****(0.035)
21	**0.969****(0.014)	**0.994**(0.324)	**0.994**(0.363)	**0.998**(0.449)	**0.995**(0.425)
24	**0.966****(0.014)	1.007(0.692)	**0.985**(0.163)	**0.986**(0.213)	1.001(0.519)
			Success ratios		
1	**0.558****(0.042)	**0.554****(0.047)	**0.567****(0.017)	**0.561****(0.031)	**0.574****(0.010)
3	**0.603****(0.001)	**0.600****(0.001)	**0.603****(0.001)	**0.610****(0.000)	**0.594****(0.002)
6	**0.580****(0.011)	**0.564****(0.047)	**0.564****(0.040)	**0.550***(0.098)	**0.560****(0.044)
9	**0.559****(0.032)	**0.566****(0.019)	**0.582****(0.004)	**0.576****(0.007)	**0.569****(0.013)
12	**0.661****(0.000)	**0.645****(0.000)	**0.645****(0.000)	**0.651****(0.000)	**0.681****(0.000)
15	**0.621****(0.000)	**0.594****(0.001)	**0.587****(0.002)	**0.594****(0.001)	**0.584****(0.002)
18	**0.576****(0.002)	**0.556****(0.017)	**0.529**(0.142)	**0.512**(0.326)	**0.512**(0.293)
21	**0.579****(0.003)	**0.507**(0.340)	**0.548***(0.055)	**0.551****(0.042)	**0.514**(0.350)
24	**0.564****(0.019)	**0.512**(0.341)	**0.550***(0.063)	**0.540**(0.123)	**0.529**(0.181)

NOTES: MH represents monthly forecast horizons. Boldface indicates improvements relative to the no-change forecast. As a rough guide, p-values of a Harvey et al. (1997) small-sample adjustment of the Diebold and Mariano (1995) test are reported in brackets after recursive MSPE ratios. We also report p-values for the Pesaran and Timmermann (2009) test for the null hypothesis of no directional accuracy in brackets after success ratios. $*$ denotes significance at the 10% level and $**$ at the 5% level.

Table A-2b. Forecast Accuracy for WTI, Evaluation 1992:01 to 2017:12

	Real WTI price				
			Rolling weights based on windows of length		
MH	Equal weight	Recursive weights	36	24	12
			Recursive MSPE ratios		
1	**0.910****(0.002)	**0.912****(0.002)	**0.915****(0.003)	**0.915****(0.004)	**0.912****(0.004)
3	**0.922****(0.003)	**0.925****(0.003)	**0.930****(0.004)	**0.928****(0.003)	**0.929****(0.002)
6	**0.977***(0.064)	**0.982**(0.115)	**0.983**(0.114)	**0.982**(0.104)	**0.987**(0.177)
9	**0.972****(0.023)	**0.979***(0.069)	**0.974****(0.035)	**0.973****(0.039)	**0.978***(0.090)
12	**0.940****(0.000)	**0.948****(0.000)	**0.942****(0.000)	**0.930****(0.000)	**0.936****(0.000)
15	**0.934****(0.000)	**0.945****(0.000)	**0.942****(0.000)	**0.932****(0.000)	**0.914****(0.000)
18	**0.940****(0.000)	**0.959****(0.005)	**0.966****(0.033)	**0.968***(0.060)	**0.978**(0.197)
21	**0.967****(0.013)	**0.990**(0.240)	**0.987**(0.237)	**0.988**(0.274)	**0.985**(0.276)
24	**0.952****(0.003)	**0.989**(0.239)	**0.962****(0.018)	**0.960****(0.021)	**0.986**(0.331)
			Success ratios		
1	**0.561****(0.045)	**0.564****(0.040)	**0.554***(0.083)	**0.561***(0.052)	**0.571****(0.024)
3	**0.571****(0.021)	**0.565****(0.035)	**0.568****(0.026)	**0.571****(0.022)	**0.568****(0.033)
6	**0.554***(0.087)	**0.544**(0.176)	**0.537**(0.236)	**0.541**(0.162)	**0.511**(0.548)
9	**0.566****(0.020)	**0.576****(0.009)	**0.579****(0.007)	**0.569****(0.018)	**0.559****(0.032)
12	**0.621****(0.000)	**0.608****(0.000)	**0.611****(0.000)	**0.631****(0.000)	**0.608****(0.000)
15	**0.607****(0.000)	**0.604****(0.000)	**0.597****(0.001)	**0.604****(0.000)	**0.594****(0.001)
18	**0.590****(0.000)	**0.583****(0.001)	**0.580****(0.002)	**0.556****(0.026)	**0.553****(0.028)
21	**0.592****(0.000)	**0.527**(0.103)	**0.558****(0.020)	**0.548***(0.054)	**0.555****(0.036)
24	**0.561****(0.025)	**0.502**(0.457)	**0.547***(0.069)	**0.536**(0.136)	**0.536**(0.118)

NOTES: MH represents monthly forecast horizons. Boldface indicates improvements relative to the no-change forecast. As a rough guide, p-values of a Harvey et al. (1997) small-sample adjustment of the Diebold and Mariano (1995) test are reported in brackets after recursive MSPE ratios. We also report p-values for the Pesaran and Timmermann (2009) test for the null hypothesis of no directional accuracy in brackets after success ratios. $*$ denotes significance at the 10% level and $**$ at the 5% level.

(III) Sensitivity of the inclusion of futures-based forecasts

Analysing the effect of including the futures-based forecasts, in Table A-3a and A-3b we compare the the forecast accuracy of equal weight combinations with and without futures-based forecasts in the 1992:01-2012:09 and 1992:01-2017:12 sample periods at horizons 18 to 24 months for RAC and WTI. As with Brent in the main text, the inclusion of futures-based forecasts at these horizons reduces MSPE ratios and raises the success ratios. Table A-4 additionally presents the effect of including the futures-based forecasts for the Brent measure in the 1992:01-2012:09 evaluation sample.

Table A-3a: Forecast Accuracy for RAC, Equal Weight Combinations, Excluding and Including Futures-based Forecasts (FUTURES)

	Real RAC price			
	1992:01-2012:09		1992:01-2017:12	
MH	Excluding FUTURES	Including FUTURES	Excluding FUTURES	Including FUTURES
	Recursive MSPE ratios			
18	1.007(0.615)	**0.969****(0.036)	**0.996**(0.385)	**0.941****(0.000)
19	1.023(0.845)	**0.985**(0.180)	1.005(0.639)	**0.948****(0.000)
20	1.038(0.953)	**0.999**(0.482)	1.022(0.932)	**0.961****(0.004)
21	1.039(0.953)	1.002(0.543)	1.033(0.986)	**0.969****(0.014)
22	1.030(0.892)	**0.996**(0.401)	1.033(0.983)	**0.968****(0.013)
23	1.015(0.733)	**0.986**(0.196)	1.030(0.966)	**0.965****(0.009)
24	1.007(0.605)	**0.981**(0.133)	1.031(0.964)	**0.966****(0.014)
	Success ratios			
18	**0.534**(0.456)	**0.565****(0.003)	**0.522**(0.358)	**0.576****(0.002)
19	**0.537**(0.366)	**0.589****(0.000)	**0.551***(0.065)	**0.602****(0.000)
20	**0.561**(0.132)	**0.613****(0.000)	**0.553***(0.082)	**0.618****(0.000)
21	**0.507**(0.875)	**0.581****(0.001)	0.486(0.899)	**0.579****(0.003)
22	**0.518**(0.857)	**0.561****(0.010)	0.488(0.881)	**0.557****(0.026)
23	**0.542**(0.650)	**0.555****(0.026)	**0.503**(0.762)	**0.552****(0.044)
24	**0.535**(0.701)	**0.558****(0.033)	**0.509**(0.715)	**0.564****(0.019)

NOTES: MH represents monthly forecast horizons. Boldface indicates improvements relative to the no-change forecast. As a rough guide, p-values of a Harvey et al. (1997) small-sample adjustment of the Diebold and Mariano (1995) test are reported in brackets after recursive MSPE ratios. We also report p-values for the Pesaran and Timmermann (2009) test for the null hypothesis of no directional accuracy in brackets after success ratios. $*$ denotes significance at the 10% level and $**$ at the 5% level.

Table A-3b: Forecast Accuracy for WTI, Equal Weight Combinations, Excluding and Including Futures-based Forecasts (FUTURES)

	Real WTI price			
	1992:01-2012:09		1992:01-2017:12	
MH	Excluding FUTURES	Including FUTURES	Excluding FUTURES	Including FUTURES
	Recursive MSPE ratios			
18	1.005(0.583)	**0.968****(0.035)	**0.994**(0.357)	**0.940****(0.000)
19	1.016(0.757)	**0.980**(0.129)	1.004(0.596)	**0.949****(0.001)
20	1.029(0.890)	**0.994**(0.351)	1.017(0.861)	**0.959****(0.004)
21	1.034(0.920)	1.000(0.496)	1.028(0.958)	**0.967****(0.013)
22	1.021(0.793)	**0.990**(0.293)	1.024(0.921)	**0.963****(0.007)
23	1.005(0.571)	**0.979**(0.131)	1.017(0.829)	**0.956****(0.004)
24	**0.994**(0.420)	**0.973***(0.080)	1.012(0.731)	**0.952****(0.003)
	Success ratios			
18	**0.517**(0.624)	**0.573****(0.003)	**0.519**(0.456)	**0.590****(0.000)
19	**0.545**(0.201)	**0.593****(0.000)	**0.551***(0.081)	**0.609****(0.000)
20	**0.539**(0.289)	**0.587****(0.000)	**0.543**(0.162)	**0.590****(0.000)
21	0.493(0.938)	**0.572****(0.002)	**0.503**(0.818)	**0.592****(0.000)
22	**0.522**(0.758)	**0.561****(0.012)	**0.505**(0.788)	**0.577****(0.004)
23	**0.511**(0.876)	**0.568****(0.011)	**0.507**(0.742)	**0.586****(0.002)
24	**0.527**(0.780)	**0.549***(0.065)	**0.505**(0.735)	**0.561****(0.025)

NOTES: MH represents monthly forecast horizons. Boldface indicates improvements relative to the no-change forecast. As a rough guide, p-values of a Harvey et al. (1997) small-sample adjustment of the Diebold and Mariano (1995) test are reported in brackets after recursive MSPE ratios. We also report p-values for the Pesaran and Timmermann (2009) test for the null hypothesis of no directional accuracy in brackets after success ratios. $*$ denotes significance at the 10% level and $**$ at the 5% level.

Table A-4: Forecast Accuracy for Brent, Equal Weight Combinations, Excluding and Including Futures-based Forecasts (FUTURES), Evaluation 1992:01 to 2012:09

	Recursive MSPE ratios		**Success ratios**	
MH	Excluding FUTURES	Including FUTURES	Excluding FUTURES	Including FUTURES
9	**0.995**(0.420)	**0.981**(0.152)	0.494(0.584)	**0.506**(0.355)
10	**0.989**(0.320)	**0.973***(0.057)	0.500(0.533)	**0.533***(0.069)
11	**0.976**(0.142)	**0.959****(0.007)	**0.523**(0.320)	**0.582****(0.001)
12	**0.970***(0.092)	**0.949****(0.002)	**0.534**(0.214)	**0.592****(0.000)
13	**0.970***(0.087)	**0.946****(0.001)	**0.511**(0.446)	**0.578****(0.004)
14	**0.968***(0.080)	**0.942****(0.000)	**0.525**(0.262)	**0.576****(0.003)
15	**0.971***(0.099)	**0.943****(0.000)	**0.528**(0.230)	**0.604****(0.000)
16	**0.984**(0.232)	**0.953****(0.002)	**0.534**(0.155)	**0.577****(0.001)
17	1.002(0.530)	**0.968****(0.021)	**0.511**(0.306)	**0.545****(0.005)
18	1.016(0.766)	**0.981**(0.119)	**0.539****(0.038)	**0.543****(0.001)
19	1.030(0.911)	**0.996**(0.395)	**0.524****(0.046)	**0.532****(0.001)
20	1.042(0.973)	1.008(0.695)	**0.548****(0.009)	**0.539****(0.000)
21	1.049(0.986)	1.014(0.842)	**0.511**(0.324)	**0.541****(0.001)
22	1.046(0.975)	1.014(0.820)	**0.509**(0.438)	**0.522****(0.016)
23	1.036(0.933)	1.007(0.681)	0.493(0.604)	**0.515****(0.043)
24	1.034(0.912)	1.008(0.688)	0.496(0.660)	0.500(0.136)

NOTES: MH represents monthly forecast horizons. Boldface indicates improvements relative to the no-change forecast. As a rough guide, p-values of a Harvey et al. (1997) small-sample adjustment of the Diebold and Mariano (1995) test are reported in brackets after recursive MSPE ratios. We also report p-values for the Pesaran and Timmermann (2009) test for the null hypothesis of no directional accuracy in brackets after success ratios. $*$ denotes significance at the 10% level and $**$ at the 5% level.

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