

Supplemental Appendix to “Nowcasting Tail Risks to Economic Activity with Many Indicators”

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Abstract

This appendix provides additional empirical results.

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Table A1: **Data sources**

<i>indicator</i>	<i>data source</i>
real GDP	RTDSM
payroll employment	RTDSM
ISM purchasing managers index, manufacturing	FAME
retail sales (nominal/CPI)	ALFRED for retail sales, BLS website for CPI
industrial production	RTDSM
housing starts	RTDSM
initial claims for unemployment insurance	Haver Analytics
continuing claims for unemployment insurance	Haver Analytics
Chicago Fed index of financial conditions	FRED
S&P index of stock prices	FAME
term spread: 10-year less 1-year Treasury rates	FAME
credit spread: Moody's Baa yield less 10-year Treasury	FAME
Bloomberg index of consumer comfort	Bloomberg
raw steel production	Haver Analytics
electric utility output	Haver Analytics
loadings of railroad cars	Haver Analytics
fuel sales	Energy Information Agency website
Redbook same-store retail sales	Haver Analytics

Notes: RTDSM refers to the Federal Reserve Bank of Philadelphia's Real-Time Data Set for Macroeconomists. FAME refers to the FAME database of the Federal Reserve Board of Governors. FRED is the Federal Reserve Bank of St. Louis' public database; ALFRED, also maintained by the St. Louis Fed, is an archive of FRED containing real-time data.

To summarize evidence in the following supplemental tables on out-of-sample forecast accuracy:

- The results in Table A2 show that, in point forecast accuracy, none of the specifications making use of larger data sets or alternative models can improve on the accuracy of the benchmark base M: BMF-SV specification. Some models achieve essentially the same level of accuracy, whereas others yield less accurate point forecasts.
- The results in Tables A3 and A4 indicate that the BMF-GFSV model described in the paper’s section 3 does not improve on the accuracy of the BMF-SV model (and is often a little less accurate). The BMF-GFSV model refers to a regression specification like that of the BMF-SV model given in the paper but with the volatility process modified to take an AR(1) form allowing the 4-week average of the NFCI to affect volatility, as in: $\log(\lambda_{w,t}) = \delta_0 + \delta_1 \log(\lambda_{w,t-1}) + \delta_2 \overline{\text{NFCI}}_{w,t} + \nu_{w,t}$, where $\overline{\text{NFCI}}_{w,t}$ refers to the most recent 4-week average of the NFCI.
- The results in Tables A5 through A9 indicate that our findings on 5 percent quantile forecast accuracy as measured by quantile score and coverage are unchanged when we consider the 10 percent quantile.
- Tables A10 and A11 compare the QR and QR-MIDAS results in the paper, which are obtained by putting one indicator in the model at a time and estimating forecasts across the resulting model estimates, to QR and QR-MIDAS forecasts obtained by putting all regressors available in the model at a time. The tables refer to these as the “QR joint” and “QR-MIDAS joint” forecasts. To be clear about the exercise, consider the QR case. As described in the paper’s section 3, the QR results in the paper are obtained by estimating a quantile regression including as predictors the vector $X_{w,j,t}$, of the form

$$y_t = X'_{w,j,t} \beta_{\tau,w,j} + \epsilon_{\tau,w,j,t}, \quad (1)$$

where $\tilde{X}_{w,j,t}$ denotes one of the (scalar) monthly or weekly indicators of $\tilde{X}_{w,t}$ and $X_{w,j,t}$ denotes the vector containing a constant, lagged GDP growth, and $\tilde{X}_{w,j,t}$. We estimate different models for each available j and then average predictions across these models. The QR joint results are instead obtained with a single, larger quantile regression of the form

$$y_t = X'_{w,t} \beta_{\tau,w} + \epsilon_{\tau,w,t}. \quad (2)$$

The results indicate that the single regression approach often yields a forecast less accurate than the one-at-a-time approach.

- Tables A12 through A14 provide results for in-sample forecasts. We compute in-sample forecast results just as we do for the out-of-sample case, with the differences that the parameter estimates used are obtained for the full sample rather than a recursive window, and we abstract from real-time data in the in-sample results. In these results, it is much easier to

improve on the tail risk forecast accuracy of the benchmark, both quantitatively and with respect to statistical significance. Some approaches, particularly QR joint and QR-MIDAS joint, perform very well in-sample but relatively poorly out of sample. This is likely due to the imprecision of parameter estimates in the smaller samples of recursive model estimation for out-of-sample forecasts.

- Using the base M-F variable set, Figure A1 shows that, when QR is estimated with all regressors used at once, the resulting coefficient estimates vary substantially over time, more so with the tail quantiles than the median. Applying Bayesian shrinkage with the BQR specification greatly reduces the variability of coefficient estimates over the forecast origins of the sample. The coefficient variability likely contributes to the relatively poor out-of-sample forecast performance of the QR joint approach.

Table A2: Point forecast accuracy (RMSE), 1985:Q1-2019:Q3

variable and model	week 1	week 3	week 5	week 7	week 9	week 11	week 13	week 15
base M: BMF-SV	1.91	1.85	1.77	1.66	1.58	1.54	1.47	1.44
base M: QR	1.04	1.05	1.00	1.04	1.06	1.09	1.12	1.15
base M: BQR	0.98	0.99	1.05	1.01	1.02	1.00	1.01	1.02
base M: BQR-Lasso	1.04	1.08	1.03	1.11	1.12	1.14	1.17	1.17
base M: QR-MIDAS	1.00	0.98	1.00	0.95	1.00	0.97	0.99	1.04
base M + NFCI: BMF-SV	0.99	0.99	1.00	1.00	1.00	1.01	1.01	1.02
base M + NFCI: QR	1.05	1.05	1.03	1.07	1.09	1.12	1.15	1.18
base M + NFCI: BQR	0.99	0.98	1.04	1.01	1.01	1.01	1.01	1.03
base M + NFCI: BQR-Lasso	1.03	1.07	1.08	1.12	1.12	1.12	1.18	1.14
base M + NFCI: QR-MIDAS	1.02	1.13	1.02	1.05	1.02	1.01	1.04	1.11
base M-F: BMF-SV	1.04	1.01	1.00	0.97	0.98	0.98	1.00	1.02
base M-F: QR	1.06	1.06	1.06	1.10	1.14	1.16	1.20	1.22
base M-F: BQR	1.01	0.97	1.01	0.98	0.99	0.99	1.00	1.02
base M-F: BQR-Lasso	1.06	1.13	1.08	1.06	1.04	1.07	1.12	1.12
base M-F: QR-MIDAS	1.23	1.22	1.13	1.13	1.08	1.06	1.07	1.11
base M-F: BMF-factor-SV	1.11	1.05	1.13	1.13	1.13	1.16	1.16	1.17
base M-F: QR-factor	1.14	1.08	1.17	1.17	1.16	1.16	1.15	1.20
base M-F: BQR-factor	1.11	1.03	1.12	1.13	1.12	1.14	1.14	1.16
base M-F: PQR	1.08	1.02	1.10	1.13	1.11	1.12	1.14	1.16
avg. all	0.98	0.98	0.99	0.98	0.98	0.99	1.01	1.02
avg. base M-F	1.03	0.99	1.03	1.02	1.00	1.02	1.03	1.05
avg. BMF-SV	0.99	0.99	0.99	0.98	0.98	0.98	0.99	1.00
avg. BQR	0.98	0.97	1.03	0.99	0.99	0.99	1.00	1.01
avg. BQR-Lasso	1.02	1.06	1.03	1.06	1.06	1.09	1.14	1.12

Notes: The weeks indicated in the columns refer to the weeks of forecast origins for the quarter (omitting even-numbered weeks to reduce the size of the table). The top row gives the RMSE from the benchmark model and variable set, and other rows report the ratio of RMSE for the indicated variable set and model to the benchmark (lower is better). Statistical significance of differences in MSEs is indicated by *** (1%), ** (5%), or * (10%), obtained with the Diebold and Mariano–West *t*-test, conducted on a one-sided basis, such that the alternative hypothesis is that the indicated forecast is more accurate than the benchmark.

Table A3: Out-of-sample forecast accuracy, QS and coverage, BMF-SV and BMF-GFSV

variable and model	week 1	week 3	week 5	week 7	week 9	week 11	week 13	week 15
<i>5% quantile score, 1985:Q1-2019:Q3</i>								
base M: BMF-SV	0.24	0.22	0.20	0.19	0.18	0.18	0.17	0.17
base M: BMF-GFSV	1.00	1.01	1.03	1.06	1.05	1.03	1.07	1.07
base M + NFCI: BMF-SV	0.88 **	0.93 ***	0.93 **	0.94 **	0.97	0.98	0.98	0.98
base M + NFCI: BMF-GFSV	0.92	0.98	0.96	0.98	0.98	0.97	1.01	1.01
base M-F: BMF-SV	0.89	0.92 **	0.91	0.88	0.95	0.99	1.04	1.09
base M-F: BMF-GFSV	0.90	0.95	0.89	0.90	0.92	0.91	0.97	0.98
<i>5% coverage, 1985:Q1-2019:Q3</i>								
base M: BMF-SV	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.03 *
base M: BMF-GFSV	0.02 *	0.02 **	0.02 *	0.02 **	0.02 **	0.03	0.03	0.02 **
base M + NFCI: BMF-SV	0.04	0.05	0.04	0.04	0.04	0.04	0.04	0.04
base M + NFCI: BMF-GFSV	0.03	0.02 **	0.03	0.02 **	0.03	0.03	0.03	0.03
base M-F: BMF-SV	0.08	0.05	0.06	0.06	0.04	0.04	0.04	0.04
base M-F: BMF-GFSV	0.03	0.02 **	0.03	0.02 **	0.01 ***	0.02 **	0.01 ***	0.01 ***
<i>5% quantile score, 2000:Q1-2019:Q3</i>								
base M: BMF-SV	0.27	0.23	0.24	0.21	0.20	0.20	0.18	0.18
base M: BMF-GFSV	0.98	0.99	0.96	1.05	1.01	1.02	1.05	1.05
base M + NFCI: BMF-SV	0.92	0.98	0.92 *	0.95	0.97	0.97	1.00	0.98
base M + NFCI: BMF-GFSV	0.93	0.97	0.90	0.99	0.98	0.97	1.02	1.01
base M-F: BMF-SV	0.88	0.95	0.82	0.82	0.84	0.86	0.93	0.93
base M-F: BMF-GFSV	0.88	0.96	0.82	0.88	0.89	0.90	0.97	0.97
base M + small weekly: BMF-SV	1.10	1.19	1.04	1.01	0.98	0.96	0.98	0.93
base M + small weekly: BMF-GFSV	1.01	1.11	0.98	1.09	1.08	1.04	1.04	0.97
base M-F + small weekly: BMF-SV	0.89	0.95	0.81	0.92	0.94	0.92	0.99	1.02
base M-F + small weekly: BMF-GFSV	0.93	1.04	0.90	0.99	0.96	0.92	0.97	0.96
<i>5% coverage, 2000:Q1-2019:Q3</i>								
base M: BMF-SV	0.05	0.06	0.05	0.05	0.05	0.05	0.05	0.04
base M: BMF-GFSV	0.04	0.04	0.04	0.04	0.04	0.05	0.05	0.04
base M + NFCI: BMF-SV	0.05	0.06	0.05	0.05	0.05	0.05	0.05	0.05
base M + NFCI: BMF-GFSV	0.05	0.04	0.05	0.04	0.05	0.05	0.05	0.05
base M-F: BMF-SV	0.08	0.06	0.06	0.05	0.03	0.04	0.04	0.05
base M-F: BMF-GFSV	0.04	0.04	0.04	0.04	0.03	0.04	0.03	0.03
base M + small weekly: BMF-SV	0.09	0.09	0.09	0.05	0.06	0.05	0.06	0.08
base M + small weekly: BMF-GFSV	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.04
base M-F + small weekly: BMF-SV	0.08	0.08	0.05	0.08	0.11 **	0.09	0.11 *	0.15 **
base M-F + small weekly: BMF-GFSV	0.04	0.04	0.04	0.04	0.04	0.03	0.01 ***	0.03
<i>5% quantile score, 2007:Q1-2019:Q3</i>								
base M: BMF-SV	0.33	0.26	0.26	0.23	0.22	0.21	0.20	0.20
base M: BMF-GFSV	0.96	1.01	1.01	1.08	1.04	1.07	1.09	1.09
base M-F: BMF-SV	0.82	0.93	0.79	0.76	0.81	0.86	0.91	0.94
base M-F: BMF-GFSV	0.83	0.97	0.80	0.86	0.87	0.94	0.99	1.00
base M + small weekly: BMF-SV	1.13	1.27	1.09	0.97	0.95	0.93	0.94	0.88 **
base M + small weekly: BMF-GFSV	1.01	1.17	1.02	1.13	1.12	1.11	1.08	1.01
base M-F + small weekly: BMF-SV	0.84	0.94	0.78	0.80	0.89	0.87	0.96	0.94
base M-F + small weekly: BMF-GFSV	0.90	1.07	0.90	0.98	0.95	0.95	1.01	1.00
base M + large weekly: BMF-SV	1.16	1.39	1.23	0.97	1.00	1.08	1.02	0.96
base M + large weekly: BMF-GFSV	1.05	1.28	1.18	1.23	1.24	1.24	1.26	1.18

Notes: The weeks indicated in the columns refer to the weeks of forecast origins for the quarter (omitting even-numbered weeks to reduce the size of the table). In each QS panel, the top row gives the 5% quantile scores (QS) from the benchmark model and variable set, and other rows report the ratio of QS for the indicated variable set and model to the benchmark (lower is better). Each coverage panel reports empirical coverage rates for 5% quantile forecasts (percentage of outcomes at or below the quantile). Statistical significance of differences in quantile scores is indicated by *** (1%), ** (5%), or * (10%), obtained with the Diebold and Mariano–West t -test, conducted on a one-sided basis, such that the alternative hypothesis is that the indicated forecast is more accurate than the benchmark. Statistical significance of departures of empirical coverage from the nominal 5% is also indicated by *** (1%), ** (5%), or * (10%), obtained with two-sided t -tests. The BMF-GFSV model refers to a regression specification like that of the BMF-SV model given in the paper but with the volatility process modified to take an AR(1) form allowing the 4-week average of the NFCI to affect volatility, as in: $\log(\lambda_{w,t}) = \delta_0 + \delta_1 \log(\lambda_{w,t-1}) + \delta_2 \overline{\text{NFCI}}_{w,t} + \nu_{w,t}$, where $\overline{\text{NFCI}}_{w,t}$ refers to the most recent 4-week average of the NFCI.

Table A4: Out-of-sample forecast accuracy, 5% VaR-ES scores, BMF-SV and BMF-GFSV

variable and model	week 1	week 3	week 5	week 7	week 9	week 11	week 13	week 15
	<i>1985:Q1-2019:Q3</i>							
base M: BMF-SV	0.59	0.49	0.37	0.27	0.24	0.36	0.29	0.27
base M: BMF-GFSV	-0.03	-0.05	-0.10	-0.09	-0.09	0.02	-0.04	-0.06
base M + NFCI: BMF-SV	0.16 ***	0.06 *	0.08 ***	0.01	-0.05	-0.02	-0.03	-0.03
base M + NFCI: BMF-GFSV	0.05	-0.02	-0.05	-0.00	-0.02	0.09	0.02	0.01
base M-F: BMF-SV	0.04	0.03	0.00	-0.07	-0.24	-0.28	-0.35	-0.49
base M-F: BMF-GFSV	0.02	-0.05	-0.05	0.03	-0.00	0.12	0.01	0.03
base M-F: BMF-factor-SV	-0.03	0.12 **	-0.23	-0.33	-0.20	0.07	-0.06	-0.10
	<i>2000:Q1-2019:Q3</i>							
base M: BMF-SV	0.62	0.51	0.46	0.25	0.26	0.38	0.31	0.37
base M: BMF-GFSV	-0.03	-0.03	-0.04	-0.10	-0.06	0.02	-0.07	-0.03
base M + NFCI: BMF-SV	0.11 *	-0.01	0.06 *	0.01	-0.01	0.04	-0.04	0.01
base M + NFCI: BMF-GFSV	0.03	-0.02	-0.01	-0.05	-0.03	0.05	-0.05	0.02
base M-F: BMF-SV	0.04	0.00	0.03	0.05	0.03	0.10	-0.01	0.07
base M-F: BMF-GFSV	-0.03	-0.10	-0.03	-0.03	-0.03	0.08	-0.07	0.04
base M-F: BMF-factor-SV	0.01	0.11	-0.07	-0.11	-0.14	0.00	-0.18	-0.18
base M + small weekly: BMF-SV	-0.19	-0.05	0.03	-0.04	0.02	0.10	0.06	0.03
base M + small weekly: BMF-GFSV	-0.01	-0.00	0.03	-0.09	-0.06	0.10	0.03	0.10
base M + small weekly: BMF-factor-SV	-0.19	0.06	0.03	0.06	0.01	0.08	0.04	-0.04
base M-F + small weekly: BMF-SV	-0.03	0.16 *	0.02	-0.25	-0.34	-0.20	-0.34	-0.38
base M-F + small weekly: BMF-GFSV	-0.04	-0.05	-0.03	-0.12	-0.12	0.06	-0.12	0.02
base M-F + small weekly: BMF-factor-SV	0.13	0.13 **	0.05	-0.13	-0.19	-0.03	-0.18	-0.32
	<i>2007:Q1-2019:Q3</i>							
base M: BMF-SV	0.90	0.71	0.51	0.44	0.45	0.45	0.46	0.55
base M: BMF-GFSV	-0.00	-0.05	-0.18	-0.15	-0.10	-0.10	-0.12	-0.09
base M + NFCI: BMF-SV	0.13 **	-0.07	0.02	0.04	0.03	-0.00	-0.05	-0.01
base M + NFCI: BMF-GFSV	0.02	-0.06	-0.15	-0.11	-0.08	-0.09	-0.10	-0.08
base M-F: BMF-SV	0.00	-0.01	-0.03	0.02	-0.04	-0.05	-0.08	-0.05
base M-F: BMF-GFSV	-0.09	-0.19	-0.18	-0.12	-0.12	-0.15	-0.18	-0.12
base M-F: BMF-factor-SV	0.02	0.10	-0.28	-0.26	-0.29	-0.23	-0.37	-0.44
base M + small weekly: BMF-SV	-0.43	-0.15	-0.13	0.08	0.08	0.13	0.08	0.07
base M + small weekly: BMF-GFSV	-0.03	-0.04	-0.09	-0.10	-0.09	-0.07	-0.06	-0.01
base M + small weekly: BMF-factor-SV	-0.28	0.10	-0.06	0.09 **	-0.03	0.03	-0.01	-0.14
base M-F + small weekly: BMF-SV	-0.11	0.12	-0.16	-0.06	-0.44	-0.27	-0.44	-0.29
base M-F + small weekly: BMF-GFSV	-0.11	-0.14	-0.17	-0.14	-0.16	-0.14	-0.30	-0.16
base M-F + small weekly: BMF-factor-SV	0.17	0.19 **	-0.03	-0.17	-0.23	-0.20	-0.34	-0.52
base M + large weekly: BMF-SV	-0.59	-0.61	-0.47	0.04	0.03	-0.18	0.04	0.20 **
base M + large weekly: BMF-GFSV	0.07	-0.01	-0.18	-0.15	-0.14	-0.12	-0.18	-0.05
base M + large weekly: BMF-factor-SV	0.00	0.21 **	-0.05	0.09	-0.04	-0.11	-0.25	-0.21
base M-F + large weekly: BMF-factor-SV	0.27 *	0.16 *	0.06	-0.01	-0.40	-0.23	-0.47	-0.56

Notes: The weeks indicated in the columns refer to the weeks of forecast origins for the quarter (omitting even-numbered weeks to reduce the size of the table). The first row gives the 5% VaR-ES from the benchmark model and variable set, and other rows report the difference in score for the indicated variable set and model relative to the benchmark (higher is better). Statistical significance of differences in scores is indicated by *** (1%), ** (5%), or * (10%), obtained with the Diebold and Mariano–West t -test, conducted on a one-sided basis, such that the alternative hypothesis is that the indicated forecast is more accurate than the benchmark. The BMF-GFSV model refers to a regression specification like that of the BMF-SV model given in the paper but with the volatility process modified to take an AR(1) form allowing the 4-week average of the NFCI to affect volatility, as in: $\log(\lambda_{w,t}) = \delta_0 + \delta_1 \log(\lambda_{w,t-1}) + \delta_2 \overline{\text{NFCI}}_{w,t} + \nu_{w,t}$, where $\overline{\text{NFCI}}_{w,t}$ refers to the most recent 4-week average of the NFCI.

Table A5: Out-of-sample forecast accuracy, 10% quantile score and coverage, 1985:Q1-2019:Q3

variable and model	week 1	week 3	week 5	week 7	week 9	week 11	week 13	week 15
	<i>10% quantile score</i>							
base M: BMF-SV	0.37	0.34	0.32	0.30	0.29	0.29	0.28	0.27
base M: QR	1.32	1.40	1.19	1.36	1.37	1.40	1.45	1.50
base M: BQR	1.28	1.28	1.23	1.23	1.21	1.21	1.22	1.24
base M: BQR-Lasso	0.92	1.12	1.17	1.21	1.19	1.26	1.24	1.23
base M: QR-MIDAS	1.25	1.14	1.26	1.11	1.28	1.14	1.30	1.29
base M + NFCI: BMF-SV	0.92 ***	0.95 **	0.95 *	0.94 ***	0.94 **	0.98	0.97 *	0.97
base M + NFCI: QR	1.21	1.35	1.08	1.22	1.25	1.28	1.34	1.38
base M + NFCI: BQR	0.92	1.04	1.03	0.96	0.96	0.96	0.98	0.99
base M + NFCI: BQR-Lasso	0.89	0.93	0.85 *	1.06	1.08	1.19	1.19	1.19
base M + NFCI: QR-MIDAS	1.17	0.87 **	1.17	0.86 **	1.18	0.87 **	1.22	0.94
base M-F: BMF-SV	0.99	0.95 *	0.98	0.91	0.95	0.99	1.02	1.06
base M-F: QR	1.22	1.35	1.24	1.31	1.35	1.35	1.43	1.45
base M-F: BQR	0.94	0.93	0.98	0.92	0.94	0.92	0.98	1.01
base M-F: BQR-Lasso	0.99	1.04	1.00	1.04	1.05	1.04	1.12	1.05
base M-F: QR-MIDAS	1.17	1.17	1.21	1.14	1.16	0.95	1.19	1.09
base M-F: BMF-factor-SV	0.90	0.91	0.94	0.94	0.96	0.91	0.98	0.96
base M-F: QR-factor	0.96	1.05	1.04	0.93	0.95	0.93	1.02	1.04
base M-F: BQR-factor	0.93	0.99	0.99	0.89	0.96	0.92	1.02	1.01
base M-F: PQR	0.86 *	0.94	0.94	0.91	0.90	0.90	0.99	1.01
avg. all	0.93	0.93	0.93	0.96	0.98	0.97	1.04	1.03
avg. base M-F	0.89	0.86 *	0.92	0.91	0.92	0.91 *	0.99	0.98
avg. BMF-SV	0.92 ***	0.94 ***	0.96	0.94 **	0.96	0.99	0.99	1.01
avg. BQR	1.01	1.07	1.05	1.01	1.01	1.01	1.03	1.05
avg. BQR-Lasso	0.86	0.90	0.91	1.04	1.05	1.11	1.12	1.13
	<i>10% coverage</i>							
base M: BMF-SV	0.05 **	0.06	0.09	0.05 ***	0.04 ***	0.05 ***	0.04 ***	0.05 ***
base M: QR	0.02 ***	0.02 ***	0.02 ***	0.01 ***	0.01 ***	0.01 ***	0.01 ***	0.01 ***
base M: BQR	0.02 ***	0.03 ***	0.02 ***	0.03 ***	0.03 ***	0.03 ***	0.03 ***	0.02 ***
base M: BQR-Lasso	0.06 *	0.06 **	0.04 ***	0.09	0.08	0.09	0.07	0.06 *
base M: QR-MIDAS	0.02 ***	0.01 ***	0.01 ***	0.03 ***	0.01 ***	0.01 ***	0.01 ***	0.01 ***
base M + NFCI: BMF-SV	0.09	0.09	0.10	0.06 **	0.05 ***	0.05 ***	0.04 ***	0.05 ***
base M + NFCI: QR	0.02 ***	0.02 ***	0.02 ***	0.01 ***	0.01 ***	0.01 ***	0.01 ***	0.01 ***
base M + NFCI: BQR	0.06 *	0.04 ***	0.05 **	0.03 ***	0.04 ***	0.04 ***	0.04 ***	0.05 ***
base M + NFCI: BQR-Lasso	0.14	0.13	0.08	0.13	0.10	0.12	0.13	0.11
base M + NFCI: QR-MIDAS	0.03 ***	0.12	0.01 ***	0.06 **	0.01 ***	0.06 **	0.01 ***	0.06 *
base M-F: BMF-SV	0.12	0.09	0.12	0.06 *	0.07	0.06 *	0.06 *	0.06 *
base M-F: QR	0.03 ***	0.02 ***	0.02 ***	0.02 ***	0.02 ***	0.02 ***	0.02 ***	0.02 ***
base M-F: BQR	0.06 *	0.04 ***	0.08	0.09	0.07	0.06 **	0.06 **	0.06 *
base M-F: BQR-Lasso	0.16 **	0.17 **	0.13	0.13	0.15 *	0.14	0.14 *	0.12
base M-F: QR-MIDAS	0.13	0.18 **	0.09	0.13	0.05 ***	0.07	0.02 ***	0.11
base M-F: BMF-factor-SV	0.08	0.09	0.09	0.11	0.09	0.07	0.08	0.07
base M-F: QR-factor	0.10	0.11	0.14	0.10	0.10	0.12	0.10	0.09
base M-F: BQR-factor	0.10	0.09	0.13	0.09	0.08	0.09	0.09	0.08
base M-F: PQR	0.09	0.04 ***	0.11	0.12	0.06 *	0.08	0.05 ***	0.06 *
avg. all	0.04 ***	0.04 ***	0.06 **	0.04 ***	0.04 ***	0.04 ***	0.04 ***	0.04 ***
avg. base M-F	0.06 *	0.05 ***	0.06 **	0.06 *	0.06 *	0.06 *	0.05 ***	0.05 ***
avg. BMF-SV	0.07	0.07	0.10	0.06 **	0.06 **	0.05 ***	0.04 ***	0.05 ***
avg. BQR	0.03 ***	0.02 ***	0.05 **	0.03 ***	0.04 ***	0.04 ***	0.03 ***	0.04 ***
avg. BQR-Lasso	0.11	0.11	0.06	0.12	0.11	0.12	0.12	0.09

Notes: The weeks indicated in the columns refer to the weeks of forecast origins for the quarter (omitting even-numbered weeks to reduce the size of the table). In the top panel, the top row gives the 10% quantile scores (QS) from the benchmark model and variable set, and other rows report the ratio of QS for the indicated variable set and model to the benchmark (lower is better). The lower panel reports empirical coverage rates for 10% quantile forecasts (percentage of outcomes at or below the quantile). Statistical significance of differences in quantile scores is indicated by *** (1%), ** (5%), or * (10%), obtained with the Diebold and Mariano–West t -test, conducted on a one-sided basis, such that the alternative hypothesis is that the indicated forecast is more accurate than the benchmark. Statistical significance of departures of empirical coverage from the nominal 10% is also indicated by *** (1%), ** (5%), or * (10%), obtained with two-sided t -tests.

Table A6: Out-of-sample forecast accuracy: 10% quantile score, 2000:Q1-2019:Q3

variable and model	week 1	week 3	week 5	week 7	week 9	week 11	week 13	week 15
base M: BMF-SV	0.40	0.36	0.36	0.31	0.30	0.30	0.29	0.28
base M: QR	1.18	1.29	0.98	1.19	1.20	1.22	1.25	1.30
base M: BQR	1.15	1.16	0.98	1.08	1.08	1.07	1.06	1.08
base M: BQR-Lasso	0.84	0.99	0.92	1.20	1.20	1.32	1.28	1.25
base M: QR-MIDAS	1.09	0.96	1.03	0.96	1.10	0.93	1.09	1.07
base M + NFCI: BMF-SV	0.94 *	0.96 **	0.92 *	0.97	0.96	0.99	0.99	0.99
base M + NFCI: QR	1.09	1.24	0.92	1.10	1.12	1.13	1.17	1.22
base M + NFCI: BQR	0.92	0.97	0.85 *	0.95	0.95	0.96	0.96	0.99
base M + NFCI: BQR-Lasso	0.81	0.88	0.82	1.11	1.17	1.26	1.26	1.26
base M + NFCI: QR-MIDAS	1.04	0.83 **	0.98	0.84 *	1.06	0.85	1.05	0.93
base M-F: BMF-SV	0.95	0.95	0.89	0.87	0.90	0.91	0.95	0.97
base M-F: QR	1.13	1.25	1.07	1.20	1.20	1.19	1.25	1.28
base M-F: BQR	0.94	0.93	0.87	0.88	0.91	0.89	0.94	0.97
base M-F: BQR-Lasso	0.89	0.95	0.81	1.00	1.03	1.06	1.12	0.97
base M-F: QR-MIDAS	1.00	0.90	0.99	0.92	1.13	0.90	1.14	1.00
base M-F: BMF-factor-SV	0.84 *	0.83	0.82	0.83	0.93	0.92	0.98	0.97
base M-F: QR-factor	0.87	0.90	0.90	0.88	0.92	0.92	0.99	1.02
base M-F: BQR-factor	0.88	0.86	0.89	0.83	0.93	0.90	0.97	0.97
base M-F: PQR	0.85	0.95	0.83	0.87	0.95	0.94	0.99	1.04
base M + small weekly: BMF-SV	1.08	1.13	1.04	1.02	1.00	0.96	0.95	0.95
base M + small weekly: QR	1.08	1.19	1.03	1.17	1.13	1.10	1.13	1.15
base M + small weekly: BQR	0.99	1.16	1.03	1.10	1.05	1.07	1.05	1.00
base M + small weekly: BQR-Lasso	0.92	1.33	1.18	1.20	1.08	1.13	1.17	1.09
base M + small weekly: QR-MIDAS	1.02	1.32	1.04	1.07	1.07	0.94	0.99	0.89
base M + small weekly: BMF-factor-SV	1.06	1.07	0.97	0.97	0.93	0.94	0.95	0.97
base M + small weekly: QR-factor	1.13	1.03	1.16	1.31	1.24	1.13	1.20	1.17
base M + small weekly: BQR-factor	1.01	1.06	0.97	1.09	1.07	1.05	1.02	1.03
base M + small weekly: PQR	1.05	1.21	1.11	1.26	1.33	1.35	1.37	1.37
base M-F + small weekly: BMF-SV	0.94	1.00	0.90	0.97	1.03	1.01	0.99	1.04
base M-F + small weekly: QR	1.08	1.17	1.01	1.14	1.12	1.09	1.13	1.15
base M-F + small weekly: BQR	0.90	1.04	0.93	0.97	0.97	0.95	0.97	0.97
base M-F + small weekly: BQR-Lasso	0.99	1.26	1.08	1.07	1.00	1.06	1.36	1.15
base M-F + small weekly: QR-MIDAS	1.05	1.31	0.95	1.09	1.13	1.01	1.12	1.17
base M-F + small weekly: BMF-factor-SV	0.82 *	0.98	0.84	0.93	0.94	0.95	0.98	1.03
base M-F + small weekly: QR-factor	0.97	0.96	0.82	0.96	1.02	1.01	1.12	1.12
base M-F + small weekly: BQR-factor	0.89	0.97	0.84	0.93	0.96	0.94	0.98	0.99
base M-F + small weekly: PQR	0.94	1.07	0.81	0.91	0.99	1.03	1.09	1.11
avg. all	0.90 *	0.95 *	0.85	0.91 *	0.92	0.92	0.94	0.93
avg. base M-F	0.85	0.82	0.79	0.84	0.88	0.87	0.93	0.93
avg. base M-F + small weekly	0.88 *	0.99	0.84	0.88	0.90	0.90	0.93	0.96
avg. BMF-SV	0.93 **	0.97	0.92	0.91 **	0.93 *	0.94 *	0.94 *	0.92 **
avg. BQR	0.95	1.02	0.89	0.96	0.95	0.95	0.95	0.97
avg. BQR-Lasso	0.78 *	0.93	0.85	0.97	0.96	1.03	1.02	1.01

Notes: The weeks indicated in the columns refer to the weeks of forecast origins for the quarter (omitting even-numbered weeks to reduce the size of the table). The top row gives the 10% quantile scores (QS) from the benchmark model and variable set, and other rows report the ratio of QS for the indicated variable set and model to the benchmark (lower is better). Statistical significance of differences in quantile scores is indicated by *** (1%), ** (5%), or * (10%), obtained with the Diebold and Mariano–West t -test, conducted on a one-sided basis, such that the alternative hypothesis is that the indicated forecast is more accurate than the benchmark.

Table A7: **Out-of-sample forecast accuracy: 10% coverage, 2000:Q1-2019:Q3**

variable and model	week 1	week 3	week 5	week 7	week 9	week 11	week 13	week 15
base M: BMF-SV	0.08	0.09	0.11	0.06	0.05 **	0.06	0.05 **	0.06
base M: QR	0.04 **	0.04 **	0.04 **	0.03 ***	0.03 ***	0.03 ***	0.03 ***	0.03 ***
base M: BQR	0.04 **	0.05	0.04 **	0.05 **	0.05 **	0.05 **	0.05 **	0.04 ***
base M: BQR-Lasso	0.09	0.06	0.08	0.13	0.13	0.13	0.11	0.11
base M: QR-MIDAS	0.04 **	0.03 ***	0.03 ***	0.05 **	0.03 ***	0.01 ***	0.03 ***	0.01 ***
base M + NFCI: BMF-SV	0.08	0.09	0.09	0.06	0.05 **	0.06	0.05 **	0.06
base M + NFCI: QR	0.04 **	0.04 **	0.04 **	0.03 ***	0.03 ***	0.03 ***	0.03 ***	0.03 ***
base M + NFCI: BQR	0.09	0.06	0.09	0.05 **	0.06	0.08	0.06	0.09
base M + NFCI: BQR-Lasso	0.13	0.13	0.11	0.16 *	0.14	0.16 *	0.15	0.14
base M + NFCI: QR-MIDAS	0.05	0.09	0.03 ***	0.08	0.03 ***	0.08	0.03 ***	0.10
base M-F: BMF-SV	0.11	0.09	0.11	0.06	0.08	0.08	0.08	0.06
base M-F: QR	0.05	0.04 **	0.04 **	0.04 **	0.04 **	0.04 **	0.04 **	0.04 **
base M-F: BQR	0.08	0.06	0.11	0.11	0.09	0.08	0.08	0.08
base M-F: BQR-Lasso	0.16 *	0.18 *	0.14	0.15 *	0.19 **	0.16 *	0.16 *	0.16 *
base M-F: QR-MIDAS	0.09	0.13	0.06	0.09	0.03 ***	0.08	0.03 ***	0.13
base M-F: BMF-factor-SV	0.08	0.06	0.09	0.10	0.10	0.09	0.09	0.08
base M-F: QR-factor	0.08	0.11	0.13	0.11	0.10	0.15	0.13	0.11
base M-F: BQR-factor	0.10	0.11	0.11	0.10	0.10	0.13	0.13	0.11
base M-F: PQR	0.09	0.06	0.08	0.13	0.09	0.09	0.08	0.09
base M + small weekly: BMF-SV	0.14	0.15	0.14	0.15	0.13	0.14	0.14	0.15
base M + small weekly: QR	0.10	0.10	0.09	0.08	0.08	0.08	0.06	0.06
base M + small weekly: BQR	0.06	0.10	0.10	0.10	0.10	0.11	0.10	0.10
base M + small weekly: BQR-Lasso	0.14	0.18	0.27 ***	0.23 ***	0.20 ***	0.19 **	0.15	0.16 *
base M + small weekly: QR-MIDAS	0.09	0.18	0.14	0.16 *	0.10	0.14	0.10	0.09
base M + small weekly: BMF-factor-SV	0.10	0.10	0.13	0.13	0.10	0.14	0.14	0.11
base M + small weekly: QR-factor	0.13	0.13	0.15	0.23 **	0.22 **	0.22 ***	0.22 ***	0.15 *
base M + small weekly: BQR-factor	0.08	0.10	0.11	0.16	0.19 **	0.15	0.15 *	0.15 *
base M + small weekly: PQR	0.11	0.13	0.19 **	0.15	0.16	0.20 **	0.18 *	0.20 **
base M-F + small weekly: BMF-SV	0.14	0.14	0.14	0.18	0.15	0.18 **	0.18 *	0.20 **
base M-F + small weekly: QR	0.10	0.09	0.08	0.05	0.08	0.05	0.05	0.05
base M-F + small weekly: BQR	0.08	0.09	0.10	0.11	0.10	0.09	0.10	0.08
base M-F + small weekly: BQR-Lasso	0.20 ***	0.23 ***	0.22 ***	0.25 ***	0.18 **	0.24 ***	0.16 *	0.22 ***
base M-F + small weekly: QR-MIDAS	0.09	0.22 **	0.11	0.15	0.09	0.09	0.06	0.10
base M-F + small weekly: BMF-factor-SV	0.09	0.11	0.11	0.10	0.08	0.08	0.06	0.08
base M-F + small weekly: QR-factor	0.11	0.13	0.08	0.11	0.13	0.15	0.13	0.13
base M-F + small weekly: BQR-factor	0.10	0.10	0.09	0.08	0.11	0.11	0.11	0.09
base M-F + small weekly: PQR	0.09	0.13	0.09	0.06	0.08	0.13	0.09	0.11
avg. all	0.06	0.06	0.08	0.08	0.06	0.08	0.09	0.08
avg. base M-F	0.06	0.05 **	0.06	0.08	0.09	0.09	0.06	0.06
avg. base M-F + small weekly	0.10	0.10	0.13	0.11	0.10	0.08	0.09	0.08
avg. BMF-SV	0.10	0.09	0.11	0.10	0.08	0.09	0.09	0.08
avg. BQR	0.05	0.05	0.08	0.05 **	0.05 **	0.08	0.08	0.08
avg. BQR-Lasso	0.09	0.13	0.14	0.14	0.15	0.16 **	0.11	0.09

Notes: The weeks indicated in the columns refer to the weeks of forecast origins for the quarter (omitting even-numbered weeks to reduce the size of the table). The table reports empirical coverage rates for 10% quantile forecasts (percentage of outcomes at or below the quantile). Statistical significance of departures of empirical coverage from the nominal 10% is also indicated by *** (1%), ** (5%), or * (10%), obtained with two-sided *t*-tests.

Table A8: **Out-of-sample forecast accuracy: 10% quantile score, 2007:Q1-2019:Q3**

variable and model	week 1	week 3	week 5	week 7	week 9	week 11	week 13	week 15
base M: BMF-SV	0.48	0.40	0.38	0.34	0.32	0.32	0.31	0.30
base M: QR	1.11	1.26	0.88	1.16	1.16	1.22	1.24	1.28
base M: BQR	1.12	1.15	0.95	1.10	1.10	1.09	1.07	1.08
base M: BQR-Lasso	0.72	0.88	0.86	1.17	1.17	1.24	1.22	1.23
base M: QR-MIDAS	1.00	0.85	0.98	0.89	1.07	0.84	1.04	0.96
base M-F: BMF-SV	0.89	0.94	0.89	0.83	0.87	0.89	0.93	0.97
base M-F: QR	1.09	1.25	1.05	1.18	1.17	1.18	1.25	1.27
base M-F: BQR	0.84	0.89	0.90	0.85	0.88	0.85	0.92	0.98
base M-F: BQR-Lasso	0.80	0.92	0.85	0.98	0.96	0.99	1.06	0.90
base M-F: QR-MIDAS	0.88	0.85	0.97	0.95	1.08	0.94	1.13	1.01
base M-F: BMF-factor-SV	0.79 *	0.78	0.81	0.83	0.90	0.90	0.96	0.99
base M-F: QR-factor	0.80	0.84	0.91	0.90	0.93	0.92	0.95	1.00
base M-F: BQR-factor	0.82	0.81	0.89	0.83	0.93	0.91	0.95	0.98
base M-F: PQR	0.82	0.95	0.77	0.88	0.96	0.97	1.02	1.09
base M + small weekly: BMF-SV	1.11	1.17	1.10	0.97	1.00	0.94	0.94	0.93 *
base M + small weekly: QR	1.08	1.24	1.09	1.23	1.19	1.17	1.20	1.21
base M + small weekly: BQR	1.02	1.23	1.05	1.08	1.04	1.08	1.05	1.04
base M + small weekly: BQR-Lasso	0.85	1.37	1.27	1.18	1.13	1.03	1.00	0.93
base M + small weekly: QR-MIDAS	1.02	1.26	1.06	0.95	1.05	0.93	0.96	0.90
base M + small weekly: BMF-factor-SV	1.07	1.05	1.00	0.97	0.93	0.91	0.93	0.97
base M + small weekly: QR-factor	1.11	1.03	1.19	1.26	1.21	1.11	1.23	1.27
base M + small weekly: BQR-factor	1.05	1.08	0.96	1.11	1.08	1.04	1.02	1.08
base M + small weekly: PQR	1.03	1.21	1.20	1.31	1.42	1.43	1.46	1.44
base M-F + small weekly: BMF-SV	0.89	0.99	0.90	0.88	1.01	0.98	0.97	0.95
base M-F + small weekly: QR	1.07	1.22	1.06	1.18	1.16	1.14	1.19	1.20
base M-F + small weekly: BQR	0.87	1.07	0.92	0.91	0.96	0.95	1.00	1.04
base M-F + small weekly: BQR-Lasso	0.93	1.31	1.15	1.06	1.02	1.02	1.11	1.09
base M-F + small weekly: QR-MIDAS	1.03	1.18	0.94	0.95	1.13	1.12	1.16	1.25
base M-F + small weekly: BMF-factor-SV	0.78 *	0.97	0.80	0.87	0.88	0.94	0.98	1.06
base M-F + small weekly: QR-factor	0.99	0.99	0.79	0.95	1.04	1.01	1.11	1.19
base M-F + small weekly: BQR-factor	0.88	0.99	0.80	0.93	0.97	0.93	0.98	1.03
base M-F + small weekly: PQR	0.88	1.08	0.80	0.90	0.99	1.05	1.07	1.11
base M + large weekly: BMF-SV	1.15	1.27	1.22	1.05	1.08	1.04	1.06	1.00
base M + large weekly: QR	1.14	1.33	1.20	1.35	1.26	1.25	1.31	1.37
base M + large weekly: BQR	1.15	1.42	1.20	1.18	1.13	1.18	1.17	1.16
base M + large weekly: BQR-Lasso	0.91	1.42	1.45	1.11	1.15	1.09	1.06	1.60
base M + large weekly: QR-MIDAS	1.11	1.55	1.35	1.14	1.25	1.32	1.34	1.39
base M + large weekly: BMF-factor-SV	1.03	1.00	1.01	0.97	0.95	1.02	1.05	1.04
base M + large weekly: QR-factor	1.13	0.96	1.24	1.10	1.27	1.10	1.23	1.14
base M + large weekly: BQR-factor	1.00	1.02	1.01	0.98	1.09	1.07	1.06	1.11
base M + large weekly: PQR	1.18	1.33	1.36	1.31	1.35	1.44	1.45	1.33
base M-F + large weekly: QR	1.11	1.31	1.17	1.31	1.25	1.25	1.32	1.37
base M-F + large weekly: QR-MIDAS	1.06	1.77	1.30	1.65	1.17	1.64	1.02	1.62
base M-F + large weekly: BMF-factor-SV	0.81	0.98	0.88	0.87	0.94	0.93	0.98	1.00
base M-F + large weekly: QR-factor	0.92	1.17	0.80	0.97	0.94	0.94	1.01	1.18
base M-F + large weekly: BQR-factor	0.88	0.99	0.86	0.90	0.94	0.91	0.94	1.04
base M-F + large weekly: PQR	0.85	1.08	1.00	1.00	1.03	1.12	1.18	1.18
avg. all	0.90 *	0.99	0.86	0.88	0.90	0.94	0.96	0.97
avg. base M-F	0.78	0.76	0.76	0.83	0.86	0.85	0.92	0.93
avg. base M-F + small weekly	0.85 *	1.01	0.83	0.85	0.90	0.92	0.96	1.00
avg. base M-F + large weekly	0.88	1.05	0.87	0.84	0.85	0.95	1.00	1.02
avg. BMF-SV	0.96 *	1.02	0.97	0.89 **	0.92	0.93	0.96	0.94 *
avg. BQR	0.97	1.09	0.93	0.98	0.98	0.99	0.99	1.00
avg. BQR-Lasso	0.73	0.99	0.95	0.90	0.89 *	0.91	0.93	0.93

Notes: The weeks indicated in the columns refer to the weeks of forecast origins for the quarter (omitting even-numbered weeks to reduce the size of the table). The top row gives the 10% quantile scores (QS) from the benchmark model and variable set, and other rows report the ratio of QS for the indicated variable set and model to the benchmark (lower is better). Statistical significance of differences in MSEs and quantile scores is indicated by *** (1%), ** (5%), or * (10%), obtained with the Diebold and Mariano–West *t*-test, conducted on a one-sided basis, such that the alternative hypothesis is that the indicated forecast is more accurate than the benchmark.

Table A9: **Out-of-sample forecast accuracy, 10% VaR-ES scores**

variable and model	week 1	week 3	week 5	week 7	week 9	week 11	week 13	week 15
	<i>1985:Q1-2019:Q3</i>							
base M: BMF-SV	0.39	0.27	0.09	0.02	-0.01	0.01	-0.04	-0.07
base M + NFCI: BMF-SV	0.15 ***	0.07 *	0.07 **	0.06 *	0.03	-0.02	0.00	0.00
base M-F: BMF-SV	-0.16	0.01	-0.09	0.02	-0.11	-0.17	-0.20	-0.27
base M-F: BMF-factor-SV	0.00	0.00	-0.22	-0.13	-0.18	0.01	-0.11	-0.06
	<i>2000:Q1-2019:Q3</i>							
base M: BMF-SV	0.44	0.32	0.24	0.02	0.02	0.09	0.05	0.06
base M + NFCI: BMF-SV	0.10	0.03	0.10 **	-0.00	0.01	-0.03	-0.02	0.00
base M-F: BMF-SV	-0.09	0.02	0.00	0.06	-0.01	0.01	-0.03	-0.02
base M-F: BMF-factor-SV	0.11	0.09	-0.09	0.04	-0.18	-0.06	-0.20	-0.11
base M + small weekly: BMF-SV	-0.22	-0.14	-0.05	-0.04	-0.03	0.06	0.06	0.05
base M + small weekly: BMF-factor-SV	-0.18	0.02	-0.05	0.03	0.02	-0.00	-0.06	-0.10
base M-F + small weekly: BMF-SV	-0.09	0.01	0.01	-0.17	-0.38	-0.30	-0.24	-0.34
base M-F + small weekly: BMF-factor-SV	0.20 *	0.12	0.01	-0.09	-0.17	-0.12	-0.20	-0.26
	<i>2007:Q1-2019:Q3</i>							
base M: BMF-SV	0.85	0.66	0.33	0.24	0.23	0.25	0.26	0.31
base M + NFCI: BMF-SV	0.14 **	0.04	0.04	0.04	0.03	-0.01	-0.02	0.01
base M-F: BMF-SV	-0.01	0.02	-0.12	0.06	-0.04	-0.03	-0.07	-0.08
base M-F: BMF-factor-SV	0.16	0.07	-0.39	-0.15	-0.28	-0.18	-0.30	-0.28
base M + small weekly: BMF-SV	-0.41	-0.19	-0.21	0.11	-0.01	0.07	0.06	0.05
base M + small weekly: BMF-factor-SV	-0.28	0.12	-0.19	0.00	-0.03	-0.00	-0.03	-0.16
base M-F + small weekly: BMF-SV	-0.08	-0.01	-0.16	-0.04	-0.48	-0.37	-0.31	-0.22
base M-F + small weekly: BMF-factor-SV	0.26	0.19 *	-0.14	-0.11	-0.21	-0.25	-0.32	-0.41
base M + large weekly: BMF-SV	-0.52	-0.54	-0.53	-0.12	-0.21	-0.13	-0.13	0.08
base M + large weekly: BMF-factor-SV	-0.16	0.16	-0.12	-0.01	-0.07	-0.16	-0.30	-0.28
base M-F + large weekly: BMF-factor-SV	0.24 *	0.09	-0.17	-0.20	-0.39	-0.30	-0.40	-0.40

Notes: The weeks indicated in the columns refer to the weeks of forecast origins for the quarter (omitting even-numbered weeks to reduce the size of the table). The first row gives the 10% VaR-ES from the benchmark model and variable set, and other rows report the difference in score for the indicated variable set and model relative to the benchmark (higher is better). Statistical significance of differences in scores is indicated by *** (1%), ** (5%), or * (10%), obtained with the Diebold and Mariano–West *t*-test, conducted on a one-sided basis, such that the alternative hypothesis is that the indicated forecast is more accurate than the benchmark.

Table A10: Accuracy of alternative QR and QR MIDAS approaches, 1985:Q1-2019:Q3

variable and model	week 1	week 3	week 5	week 7	week 9	week 11	week 13	week 15
	<i>5% quantile score</i>							
base M: QR joint	1.24	1.41	1.30	1.18	1.17	1.21	1.56	1.81
base M: QR	1.28	1.39	1.20	1.39	1.39	1.41	1.47	1.54
base M: QR-MIDAS joint	1.22	1.38	1.47	1.10	1.33	1.13	1.26	1.33
base M: QR-MIDAS	1.20	1.19	1.24	1.14	1.31	1.18	1.37	1.41
base M + NFCI: QR joint	1.50	1.79	0.96	1.21	1.34	1.65	1.81	2.08
base M + NFCI: QR	1.19	1.36	1.08	1.24	1.28	1.28	1.36	1.41
base M + NFCI: QR-MIDAS joint	1.12	1.25	1.02	0.98	1.17	0.96	1.02	1.01
base M + NFCI: QR-MIDAS	1.13	0.81 **	1.15	0.86 *	1.22	0.89	1.28	0.98
base M-F: QR joint	2.83	2.51	1.05	1.22	1.35	1.62	1.70	2.58
base M-F: QR	1.26	1.38	1.29	1.32	1.39	1.38	1.48	1.51
base M-F: QR-MIDAS joint	1.71	1.91	1.36	1.43	1.20	1.48	1.14	1.35
base M-F: QR-MIDAS	1.14	1.20	1.18	1.07	1.13	0.98	1.28	1.11
	<i>5% coverage</i>							
base M: QR joint	0.05	0.06	0.02 ***	0.04	0.05	0.06	0.07	0.11 **
base M: QR	0.02 *	0.01 ***	0.01 ***	0.01 ***	0.01 ***	0.01 ***	0.01 ***	0.01 ***
base M: QR-MIDAS joint	0.04	0.03 *	0.04	0.05	0.01 ***	0.04	0.03	0.04
base M: QR-MIDAS	0.01 ***	0.01 ***	0.01 ***	0.01 ***	0.01 ***	0.01 ***	0.01 ***	0.01 ***
base M + NFCI: QR joint	0.16 ***	0.16 ***	0.05	0.06	0.09	0.08	0.08	0.14 ***
base M + NFCI: QR	0.02 *	0.02 *	0.01 ***	0.01 ***	0.01 ***	0.01 ***	0.01 ***	0.01 ***
base M + NFCI: QR-MIDAS joint	0.09 *	0.09	0.03 *	0.06	0.04	0.05	0.02 **	0.05
base M + NFCI: QR-MIDAS	0.01 ***	0.04	0.01 ***	0.04	0.01 ***	0.02 **	0.01 ***	0.01 ***
base M-F: QR joint	0.25 ***	0.21 ***	0.10	0.08	0.10 **	0.09	0.11 **	0.19 ***
base M-F: QR	0.02 *	0.02 *	0.02 *	0.01 ***	0.01 ***	0.01 ***	0.01 ***	0.01 ***
base M-F: QR-MIDAS joint	0.12 **	0.15 ***	0.16 ***	0.12 ***	0.11 **	0.12 ***	0.08	0.08
base M-F: QR-MIDAS	0.06	0.10 **	0.06	0.06	0.03	0.05	0.02 ***	0.06

Notes: The weeks indicated in the columns refer to the weeks of forecast origins for the quarter (omitting even-numbered weeks to reduce the size of the table). The top panel reports the ratio of QS for the indicated variable set and model to the benchmark (lower is better). The lower panel reports empirical coverage rates for 5% quantile forecasts (percentage of outcomes at or below the quantile). Statistical significance of differences in quantile scores is indicated by *** (1%), ** (5%), or * (10%), obtained with the Diebold and Mariano–West t -test, conducted on a one-sided basis, such that the alternative hypothesis is that the indicated forecast is more accurate than the benchmark. Statistical significance of departures of empirical coverage from the nominal 5% is also indicated by *** (1%), ** (5%), or * (10%), obtained with two-sided t -tests. The QR and QR-MIDAS rows provide results from the paper’s one-at-a-time approach to QR and QR-MIDAS, which averages the predictions obtained with each different variable. The QR joint and QR-MIDAS joint rows provide results from alternative QR and QR-MIDAS specifications in which a single model is estimated with the full set of indicators available at the forecast origin.

Table A11: Accuracy of alternative QR and QR MIDAS approaches, 2000:Q1-2019:Q3

variable and model	week 1	week 3	week 5	week 7	week 9	week 11	week 13	week 15
	<i>5% quantile score</i>							
base M: QR joint	1.02	1.21	1.04	1.12	1.15	1.20	1.31	1.46
base M: QR	1.14	1.25	0.93	1.19	1.19	1.21	1.28	1.30
base M: QR-MIDAS joint	0.98	1.02	0.97	0.94	1.30	1.14	1.26	1.48
base M: QR-MIDAS	1.03	1.04	0.96	0.96	1.11	0.99	1.18	1.20
base M + NFCI: QR joint	1.00	1.24	0.75	1.19	1.35	1.57	1.49	1.52
base M + NFCI: QR	1.07	1.23	0.87	1.07	1.10	1.11	1.19	1.21
base M + NFCI: QR-MIDAS joint	1.03	1.14	0.83	0.90	1.14	1.01	0.92	0.99
base M + NFCI: QR-MIDAS	0.98	0.84	0.91	0.83	1.05	0.83	1.12	0.93
base M-F: QR joint	1.59	1.29	0.84	0.88	1.17	1.24	1.39	1.76
base M-F: QR	1.17	1.27	1.07	1.14	1.18	1.18	1.29	1.29
base M-F: QR-MIDAS joint	1.15	1.08	1.01	1.04	1.01	1.33	1.00	1.20
base M-F: QR-MIDAS	0.91	0.81	0.93	0.81	1.11	0.89	1.22	1.03
base M + small weekly: QR joint	1.67	2.45	1.33	2.28	2.05	2.26	2.11	3.14
base M + small weekly: QR	1.12	1.30	1.07	1.22	1.11	1.11	1.18	1.20
base M + small weekly: QR-MIDAS joint	1.05	1.89	1.21	1.93	1.69	1.67	1.53	1.48
base M + small weekly: QR-MIDAS	1.07	1.73	0.95	1.15	1.08	0.93	1.05	0.86 **
base M-F + small weekly: QR joint	2.87	3.59	1.94	2.69	2.92	3.01	4.76	6.13
base M-F + small weekly: QR	1.14	1.29	1.00	1.15	1.06	1.06	1.15	1.16
base M-F + small weekly: QR-MIDAS joint	1.55	4.33	2.06	2.57	2.30	2.24	1.48	1.70
base M-F + small weekly: QR-MIDAS	1.12	2.05	0.79	1.25	0.96	1.15	1.06	1.25
	<i>5% coverage</i>							
base M: QR joint	0.05	0.05	0.01 ***	0.04	0.05	0.08	0.06	0.09
base M: QR	0.04	0.01 ***	0.03	0.01 ***	0.01 ***	0.01 ***	0.03	0.03
base M: QR-MIDAS joint	0.04	0.01 ***	0.03	0.05	0.01 ***	0.04	0.03	0.05
base M: QR-MIDAS	0.03	0.01 ***	0.01 ***	0.03	0.01 ***	0.01 ***	0.01 ***	0.01 ***
base M + NFCI: QR joint	0.08	0.08	0.06	0.04	0.08	0.08	0.06	0.10
base M + NFCI: QR	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03
base M + NFCI: QR-MIDAS joint	0.10	0.10	0.03	0.05	0.04	0.06	0.03	0.05
base M + NFCI: QR-MIDAS	0.03	0.05	0.03	0.04	0.03	0.04	0.01 ***	0.03
base M-F: QR joint	0.16 ***	0.13 *	0.10	0.08	0.11 *	0.08	0.09	0.18 ***
base M-F: QR	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03
base M-F: QR-MIDAS joint	0.09	0.10 *	0.11	0.10 *	0.09	0.10	0.09	0.04
base M-F: QR-MIDAS	0.03	0.06	0.04	0.04	0.03	0.04	0.03	0.08
base M + small weekly: QR joint	0.11	0.22 ***	0.10	0.15 *	0.15 **	0.20 ***	0.24 ***	0.29 ***
base M + small weekly: QR	0.04	0.04	0.05	0.05	0.03	0.03	0.03	0.03
base M + small weekly: QR-MIDAS joint	0.09	0.13	0.09	0.14 *	0.13 *	0.18 ***	0.16 **	0.13 **
base M + small weekly: QR-MIDAS	0.05	0.15 **	0.08	0.09	0.06	0.08	0.04	0.06
base M-F + small weekly: QR joint	0.28 ***	0.22 ***	0.11	0.28 ***	0.23 ***	0.32 ***	0.33 ***	0.37 ***
base M-F + small weekly: QR	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03
base M-F + small weekly: QR-MIDAS joint	0.14 **	0.23 **	0.23 ***	0.27 ***	0.22 ***	0.19 ***	0.13 **	0.18 ***
base M-F + small weekly: QR-MIDAS	0.05	0.20 ***	0.06	0.15 ***	0.05	0.13 **	0.04	0.10 *

Notes: The weeks indicated in the columns refer to the weeks of forecast origins for the quarter (omitting even-numbered weeks to reduce the size of the table). The top panel reports the ratio of QS for the indicated variable set and model to the benchmark (lower is better). The lower panel reports empirical coverage rates for 5% quantile forecasts (percentage of outcomes at or below the quantile). Statistical significance of differences in quantile scores is indicated by *** (1%), ** (5%), or * (10%), obtained with the Diebold and Mariano–West *t*-test, conducted on a one-sided basis, such that the alternative hypothesis is that the indicated forecast is more accurate than the benchmark. Statistical significance of departures of empirical coverage from the nominal 5% is also indicated by *** (1%), ** (5%), or * (10%), obtained with two-sided *t*-tests. The QR and QR-MIDAS rows provide results from the paper’s one-at-a-time approach to QR and QR-MIDAS, which averages the predictions obtained with each different variable. The QR joint and QR-MIDAS joint rows provide results from alternative QR and QR-MIDAS specifications in which a single model is estimated with the full set of indicators available at the forecast origin.

Table A12: In-sample forecast accuracy, 1971:Q2-2019:Q4

variable and model	week 1	week 3	week 5	week 7	week 9	week 11	week 13	week 15
	<i>5% quantile score</i>							
base M: BMF-SV	0.27	0.25	0.26	0.23	0.22	0.21	0.20	0.20
base M: BMF-GFSV	0.94 *	0.98	0.97	0.99	1.00	0.96	1.00	0.99
base M: QR joint	0.67 ***	0.69 ***	0.78 **	0.78 ***	0.82 **	0.77 **	0.77 ***	0.73 ***
base M: BQR	0.87 **	0.78 ***	0.88 **	0.88 *	0.93	0.89 *	0.90 *	0.88 **
base M: QR-MIDAS joint	0.95	0.87	0.79 **	0.75 **	0.82 **	0.84 *	0.91	0.96
base M + NFCI: BMF-SV	0.87 ***	0.90 ***	0.92 ***	0.88 **	0.90 **	0.89 **	0.95 *	0.93 **
base M + NFCI: BMF-GFSV	0.90 **	0.94 *	0.95	0.91 *	0.94	0.92 *	0.97	0.95
base M + NFCI: QR joint	0.62 ***	0.69 ***	0.78 **	0.76 ***	0.79 **	0.75 ***	0.76 ***	0.70 ***
base M + NFCI: BQR	0.86 **	0.79 ***	0.87 *	0.89 *	0.92	0.89 *	0.89 *	0.87 **
base M + NFCI: QR-MIDAS joint	0.74 **	0.73 ***	1.69	0.66 ***	0.73 ***	0.76 ***	0.82 **	0.82 **
base M-F: BMF-SV	0.84 ***	0.85 ***	0.85 **	0.80 **	0.85 **	0.84 **	0.91 *	0.90 ***
base M-F: BMF-GFSV	0.88 **	0.89 **	0.88 *	0.86 *	0.90	0.91	0.96	0.95
base M-F: QR joint	0.52 ***	0.63 ***	0.66 ***	0.60 ***	0.61 ***	0.59 ***	0.60 ***	0.59 ***
base M-F: BQR	0.74 ***	0.74 ***	0.77 **	0.75 **	0.85 **	0.83 **	0.85 **	0.84 ***
base M-F: QR-MIDAS joint	0.65 ***	0.67 ***	0.61 ***	0.56 ***	0.60 ***	0.75 ***	0.76 ***	0.76 ***
base M-F: BMF-factor	0.94	0.81 **	0.84 *	0.89	1.01	1.02	1.10	1.13
base M-F: BMF-factor-SV	0.91	0.80 **	0.85 *	0.93	1.00	1.01	1.06	1.07
base M-F: QR-factor	0.78 **	0.75 ***	0.79 **	0.83 *	0.94	0.93	1.01	1.00
base M-F: BQR-factor	0.79 **	0.76 ***	0.79 **	0.83 *	0.95	0.94	1.02	1.01
base M-F: PQR	0.94	0.98	0.81 **	0.84 *	0.95	0.96	1.03	1.03
	<i>5% coverage</i>							
base M: BMF-SV	0.06	0.05	0.06	0.06	0.06	0.06	0.05	0.05
base M: BMF-GFSV	0.04	0.03	0.04	0.04	0.04	0.04	0.04	0.04
base M: QR joint	0.02 ***	0.03 **	0.07	0.04	0.09 *	0.02 ***	0.10 **	0.12 ***
base M: BQR	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
base M: QR-MIDAS joint	0.03	0.07	0.07	0.04	0.07	0.04	0.08	0.07
base M + NFCI: BMF-SV	0.05	0.04	0.05	0.05	0.05	0.04	0.04	0.04
base M + NFCI: BMF-GFSV	0.04	0.03	0.04	0.05	0.05	0.04	0.03	0.03
base M + NFCI: QR joint	0.07	0.11 ***	0.07	0.03	0.03 **	0.10 **	0.12 ***	0.14 ***
base M + NFCI: BQR	0.05	0.06	0.05	0.05	0.05	0.04	0.05	0.04
base M + NFCI: QR-MIDAS joint	0.07	0.03	0.09 *	0.03	0.03	0.03 *	0.03 **	0.08
base M-F: BMF-SV	0.06	0.05	0.06	0.05	0.05	0.05	0.04	0.04
base M-F: BMF-GFSV	0.05	0.04	0.04	0.04	0.04	0.03	0.03	0.04
base M-F: QR joint	0.16 ***	0.02 ***	0.07	0.11 ***	0.13 ***	0.01 ***	0.17 ***	0.19 ***
base M-F: BQR	0.05	0.05	0.05	0.05	0.05	0.04	0.05	0.04
base M-F: QR-MIDAS joint	0.02 ***	0.02 ***	0.01 ***	0.01 ***	0.05	0.02 ***	0.03	0.10 **
base M-F: BMF-factor	0.03	0.04	0.04	0.02 ***	0.04	0.03 **	0.03 **	0.03
base M-F: BMF-factor-SV	0.03	0.02 ***	0.03 **	0.03 **	0.03	0.03 **	0.03 **	0.02 ***
base M-F: QR-factor	0.05	0.06	0.06	0.06	0.06	0.05	0.06	0.05
base M-F: BQR-factor	0.04	0.05	0.05	0.04	0.04	0.05	0.04	0.05
base M-F: PQR	0.05	0.06	0.06	0.04	0.06	0.05	0.05	0.05

Notes: The weeks indicated in the columns refer to the weeks of forecast origins for the quarter (omitting even-numbered weeks to reduce the size of the table). In the top panel, the top row gives the 5% quantile scores (QS) from the benchmark model and variable set, and other rows report the ratio of QS for the indicated variable set and model to the benchmark (lower is better). The lower panel reports empirical coverage rates for 5% quantile forecasts (percentage of outcomes at or below the quantile). Statistical significance of differences in quantile scores is indicated by *** (1%), ** (5%), or * (10%), obtained with the Diebold and Mariano–West *t*-test, conducted on a one-sided basis, such that the alternative hypothesis is that the indicated forecast is more accurate than the benchmark. Statistical significance of departures of empirical coverage from the nominal 5% is also indicated by *** (1%), ** (5%), or * (10%), obtained with two-sided *t*-tests.

Table A13: In-sample forecast accuracy: 5% quantile score, 1996:Q3-2019:Q4

variable and model	week 1	week 3	week 5	week 7	week 9	week 11	week 13	week 15
base M: BMF-SV	0.22	0.19	0.22	0.19	0.17	0.17	0.16	0.16
base M: BMF-GFSV	0.96	1.05	0.97	1.05	1.07	1.04	1.04	1.04
base M: QR joint	0.65 *	0.81	0.83	0.89 ***	0.83	0.80 *	0.91	0.90
base M: BQR	0.95	0.86	0.90	0.92	0.94	0.90	0.90	0.91
base M: QR-MIDAS joint	1.11	0.99	0.89	0.76	0.87	0.90	1.02	1.27
base M + NFCI: BMF-SV	0.97 *	0.95 **	0.95 **	0.93 *	0.96	0.94 **	0.99	0.99
base M + NFCI: BMF-GFSV	0.94	1.01	0.93 **	0.97	1.00	0.98	0.99	0.99
base M + NFCI: QR joint	0.63 *	0.80	0.84	0.90 **	0.87	0.87	0.96	0.88 *
base M + NFCI: BQR	0.95	0.86	0.88 *	0.92	0.94	0.90	0.90	0.90
base M + NFCI: QR-MIDAS joint	0.82	0.93	0.72 *	0.70 *	0.78	0.88	0.93	0.94
base M-F: BMF-SV	0.95	0.95	0.84	0.80	0.87	0.84	0.90	0.94
base M-F: BMF-GFSV	0.92	0.98	0.85	0.84	0.87	0.87	0.92	0.96
base M-F: QR joint	0.57 **	0.77	0.69 **	0.61 **	0.73 *	0.72 **	0.83 *	0.81 **
base M-F: BQR	0.85	0.89	0.74 *	0.71 *	0.83	0.82	0.87	0.89 *
base M-F: QR-MIDAS joint	0.81	0.83	0.64 **	0.64 **	0.76 *	0.81 *	0.80 *	0.88
base M-F: BMF-factor-SV	0.95	0.87	0.80	0.84	0.95	0.93	0.99	1.02
base M-F: QR-factor	0.88	0.98	0.85	0.81	0.96	0.96	1.02	1.06
base M-F: BQR-factor	0.90	0.98	0.83	0.81	0.96	0.93	1.04	1.06
base M-F: PQR	0.93	0.98	0.78	0.80	0.90	0.91	0.97	1.00
base M + small weekly: BMF-SV	1.01	1.07	0.99	1.07	1.09	1.01	0.97	0.94 *
base M + small weekly: BMF-GFSV	1.03	1.14	1.01	1.12	1.12	1.09	1.03	1.00
base M + small weekly: QR joint	0.65 **	0.73 *	0.67 ***	0.55 **	0.68 **	0.55 ***	0.60 ***	0.52 ***
base M + small weekly: BQR	1.01	1.10	0.98	0.99	0.93	0.87	0.87 *	0.86 **
base M + small weekly: QR-MIDAS joint	0.73	0.71 **	0.54 ***	0.52 ***	0.63 **	0.72 **	0.73 **	0.76 **
base M + small weekly: BMF-factor-SV	0.99	1.13	1.00	1.12	1.23	1.23	1.23	0.99
base M + small weekly: QR-factor	1.01	1.09	0.88	1.03	1.02	1.02	1.03	0.95
base M + small weekly: BQR-factor	1.05	1.13	0.90	1.05	1.04	1.06	1.07	0.96
base M + small weekly: PQR	1.10	1.23	0.99	1.15	1.20	1.17	1.19	1.17
base M + large weekly: BMF-SV	1.02	1.10	1.01	1.09	1.10	1.06	1.02	1.02
base M + large weekly: BMF-GFSV	1.02	1.10	0.99	1.10	1.13	1.11	1.10	1.08
base M + large weekly: QR joint	0.55 **	0.52 ***	0.61 **	0.50 ***	0.55 ***	0.52 ***	0.53 ***	0.46 ***
base M + large weekly: BQR	1.04	1.13	1.01	1.01	0.96	0.88	0.85 *	0.85 **
base M + large weekly: QR-MIDAS joint	0.72 *	0.62 **	0.45 ***	0.49 ***	0.56 ***	0.64 ***	0.67 ***	0.59 ***
base M + large weekly: BMF-factor-SV	0.96	1.11	1.01	1.13	1.23	1.14	1.10	1.08
base M + large weekly: QR-factor	0.94	1.05	0.92	0.97	1.02	0.93	0.89	0.98
base M + large weekly: BQR-factor	0.97	1.10	0.96	1.01	1.05	0.96	0.90	1.02
base M + large weekly: PQR	1.09	1.18	0.98	1.13	1.16	1.12	1.15	1.19
base M-F + small weekly: BMF-SV	0.97	1.01	0.85 *	0.88	0.89	0.84	0.88	0.90
base M-F + small weekly: BMF-GFSV	0.99	1.05	0.87 *	0.93	0.94	0.89	0.92	0.94
base M-F + small weekly: QR joint	0.42 ***	0.58 ***	0.52 ***	0.50 ***	0.52 ***	0.52 ***	0.49 ***	0.44 ***
base M-F + small weekly: BQR	0.84 *	0.86	0.67 **	0.72 *	0.79	0.77 *	0.77 **	0.80 ***
base M-F + small weekly: QR-MIDAS joint	0.59 **	0.57 ***	0.48 ***	0.41 ***	0.59 ***	0.66 **	0.66 ***	0.65 ***
base M-F + small weekly: BMF-factor-SV	0.98	0.95	0.82	0.93	1.03	1.04	1.10	1.11
base M-F + small weekly: QR-factor	0.89	0.91	0.69 **	0.81	0.89	0.89	0.95	0.99
base M-F + small weekly: BQR-factor	0.88	0.90	0.71 *	0.82	0.91	0.92	0.99	1.01
base M-F + small weekly: PQR	0.94	0.99	0.70 *	0.83	0.90	0.93	0.99	0.99
base M-F + large weekly: BMF-SV	0.96	1.03	0.83 **	0.87	0.89	0.85	0.89	0.95
base M-F + large weekly: BMF-GFSV	0.97	1.05	0.86 *	0.90	0.94	0.93	0.94	0.97
base M-F + large weekly: QR joint	0.38 ***	0.45 ***	0.47 ***	0.38 ***	0.42 ***	0.39 ***	0.35 ***	0.27 ***
base M-F + large weekly: BQR	0.90	0.89	0.69 **	0.75	0.81	0.80	0.79 **	0.80 ***
base M-F + large weekly: QR-MIDAS joint	0.57 **	0.51 ***	0.39 ***	0.36 ***	0.46 ***	0.54 ***	0.56 ***	0.49 ***
base M-F + large weekly: BMF-factor-SV	0.98	0.95	0.78	0.93	1.03	1.03	1.08	1.07
base M-F + large weekly: QR-factor	0.89	0.91	0.62 **	0.78	0.88	0.87	0.94	0.94
base M-F + large weekly: BQR-factor	0.91	0.92	0.64 **	0.79	0.89	0.88	0.96	0.97
base M-F + large weekly: PQR	0.92	0.97	0.76	0.88	0.94	0.95	0.99	1.03

Notes: The weeks indicated in the columns refer to the weeks of forecast origins for the quarter (omitting even-numbered weeks to reduce the size of the table). The top row gives the 5% quantile scores (QS) from the benchmark model and variable set, and other rows report the ratio of QS for the indicated variable set and model to the benchmark (lower is better). Statistical significance of differences in quantile scores is indicated by *** (1%), ** (5%), or * (10%), obtained with the Diebold and Mariano–West *t*-test, conducted on a one-sided basis, such that the alternative hypothesis is that the indicated forecast is more accurate than the benchmark.

Table A14: In-sample forecast accuracy: 5% coverage, 1996:Q3-2019:Q4

variable and model	week 1	week 3	week 5	week 7	week 9	week 11	week 13	week 15
base M: BMF-SV	0.03	0.03	0.05	0.03	0.03	0.03	0.02 **	0.02 **
base M: BMF-GFSV	0.03	0.03	0.04	0.02 *	0.02 *	0.03	0.03	0.03
base M: QR joint	0.02 **	0.03	0.06	0.02 **	0.06	0.00 ***	0.07	0.10 *
base M: BQR	0.05	0.04	0.04	0.05	0.05	0.05	0.04	0.06
base M: QR-MIDAS joint	0.02 **	0.03	0.04	0.01 ***	0.05	0.02 **	0.04	0.04
base M + NFCI: BMF-SV	0.05	0.03	0.05	0.04	0.04	0.02 **	0.02 **	0.03
base M + NFCI: BMF-GFSV	0.03	0.03	0.04	0.03	0.04	0.03	0.02 **	0.02 **
base M + NFCI: QR joint	0.03	0.07	0.05	0.02 **	0.01 ***	0.10 *	0.07	0.11 *
base M + NFCI: BQR	0.04	0.06	0.04	0.04	0.05	0.04	0.04	0.05
base M + NFCI: QR-MIDAS joint	0.04	0.05	0.04	0.02 **	0.01 ***	0.03	0.03	0.06
base M-F: BMF-SV	0.06	0.04	0.05	0.04	0.03	0.03	0.02 **	0.02 **
base M-F: BMF-GFSV	0.04	0.03	0.04	0.02 **	0.03	0.01 ***	0.01 ***	0.02 **
base M-F: QR joint	0.16 ***	0.03	0.05	0.06	0.10 *	0.00 ***	0.11 *	0.15 **
base M-F: BQR	0.04	0.04	0.03	0.04	0.04	0.03	0.04	0.04
base M-F: QR-MIDAS joint	0.03	0.02 **	0.01 ***	0.01 ***	0.03	0.01 ***	0.04	0.12 **
base M-F: BMF-factor-SV	0.03	0.02 **	0.02 **	0.02 **	0.02 **	0.02 **	0.02 **	0.02 **
base M-F: QR-factor	0.05	0.04	0.04	0.05	0.04	0.04	0.04	0.04
base M-F: BQR-factor	0.05	0.04	0.04	0.03	0.03	0.04	0.03	0.03
base M-F: PQR	0.05	0.04	0.02 **	0.04	0.04	0.03	0.02 **	0.04
base M + small weekly: BMF-SV	0.05	0.06	0.07	0.06	0.07	0.06	0.06	0.06
base M + small weekly: BMF-GFSV	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.04
base M + small weekly: QR joint	0.18 ***	0.14 ***	0.10	0.13 **	0.15 ***	0.11 *	0.07	0.01 ***
base M + small weekly: BQR	0.04	0.05	0.04	0.06	0.05	0.07	0.06	0.05
base M + small weekly: QR-MIDAS joint	0.10 *	0.13 **	0.02 **	0.00 ***	0.13 ***	0.02 **	0.05	0.01 ***
base M + small weekly: BMF-factor-SV	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.04
base M + small weekly: QR-factor	0.07	0.06	0.07	0.07	0.06	0.05	0.06	0.05
base M + small weekly: BQR-factor	0.04	0.05	0.05	0.03	0.05	0.06	0.06	0.06
base M + small weekly: PQR	0.04	0.05	0.07	0.06	0.07	0.04	0.07	0.06
base M + large weekly: BMF-SV	0.04	0.07	0.06	0.07	0.06	0.06	0.05	0.05
base M + large weekly: BMF-GFSV	0.03	0.04	0.04	0.04	0.04	0.04	0.03	0.03
base M + large weekly: QR joint	0.00 ***	0.00 ***	0.14 **	0.13 **	0.00 ***	0.26 ***	0.00 ***	0.01 ***
base M + large weekly: BQR	0.03	0.05	0.04	0.04	0.03	0.05	0.04	0.05
base M + large weekly: QR-MIDAS joint	0.11 **	0.12 **	0.13 **	0.00 ***	0.00 ***	0.00 ***	0.16 ***	0.18 ***
base M + large weekly: BMF-factor-SV	0.04	0.03	0.04	0.03	0.05	0.03	0.05	0.04
base M + large weekly: QR-factor	0.07	0.04	0.04	0.03	0.09	0.06	0.05	0.03
base M + large weekly: BQR-factor	0.04	0.05	0.05	0.03	0.05	0.04	0.03	0.04
base M + large weekly: PQR	0.04	0.06	0.03	0.05	0.04	0.05	0.05	0.05
base M-F + small weekly: BMF-SV	0.05	0.05	0.06	0.06	0.07	0.06	0.05	0.05
base M-F + small weekly: BMF-GFSV	0.04	0.04	0.04	0.04	0.05	0.03	0.02 **	0.02 **
base M-F + small weekly: QR joint	0.01 ***	0.00 ***	0.16 ***	0.00 ***	0.00 ***	0.00 ***	0.20 ***	0.36 ***
base M-F + small weekly: BQR	0.04	0.04	0.03	0.05	0.05	0.04	0.03	0.03
base M-F + small weekly: QR-MIDAS joint	0.03	0.07	0.00 ***	0.00 ***	0.02 **	0.01 ***	0.14 ***	0.01 ***
base M-F + small weekly: BMF-factor-SV	0.05	0.04	0.02 **	0.02 **	0.02 **	0.02 **	0.02 **	0.02 **
base M-F + small weekly: QR-factor	0.03	0.06	0.04	0.06	0.04	0.04	0.04	0.05
base M-F + small weekly: BQR-factor	0.04	0.06	0.03	0.04	0.04	0.04	0.04	0.04
base M-F + small weekly: PQR	0.07	0.05	0.07	0.06	0.05	0.05	0.05	0.06
base M-F + large weekly: BMF-SV	0.06	0.07	0.05	0.07	0.07	0.06	0.05	0.05
base M-F + large weekly: BMF-GFSV	0.03	0.04	0.04	0.04	0.03	0.03	0.02 **	0.02 **
base M-F + large weekly: QR joint	0.00 ***	0.00 ***	0.12 **	0.00 ***	0.32 ***	0.00 ***	0.00 ***	0.00 ***
base M-F + large weekly: BQR	0.03	0.03	0.02 **	0.03	0.04	0.03	0.02 **	0.02 **
base M-F + large weekly: QR-MIDAS joint	0.17 ***	0.00 ***	0.01 ***	0.27 ***	0.00 ***	0.02	0.00 ***	0.27 ***
base M-F + large weekly: BMF-factor-SV	0.05	0.03	0.02 **	0.02 **	0.02 **	0.02 **	0.02 **	0.02 **
base M-F + large weekly: QR-factor	0.03	0.05	0.06	0.07	0.05	0.03	0.04	0.04
base M-F + large weekly: BQR-factor	0.05	0.04	0.04	0.03	0.04	0.03	0.04	0.04
base M-F + large weekly: PQR	0.04	0.05	0.06	0.05	0.04	0.04	0.05	0.05

Notes: The weeks indicated in the columns refer to the weeks of forecast origins for the quarter (omitting even-numbered weeks to reduce the size of the table). The table reports empirical coverage rates for 5% quantile forecasts (percentage of outcomes at or below the quantile). Statistical significance of departures of empirical coverage from the nominal 5% is also indicated by *** (1%), ** (5%), or * (10%), obtained with two-sided *t*-tests.

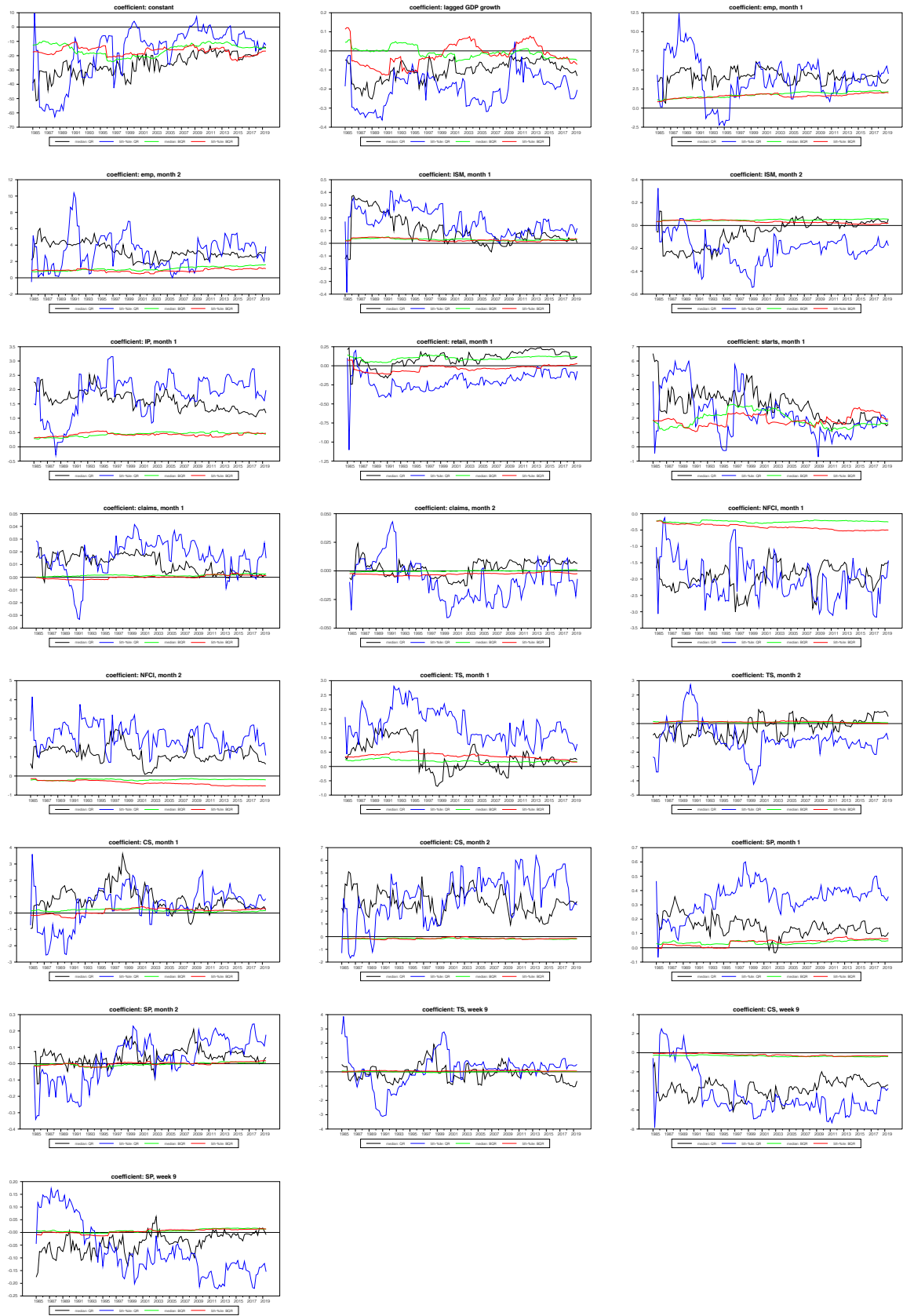


Figure A1: Recursively estimated coefficients from QR and BQR specifications, 50% (median) and 5% quantiles, base M-F variable set. The QR¹⁹ estimates shown are from a joint specification in which a single model is estimated with the full set of indicators available at the forecast origin.