Supplemental Appendix to "Nowcasting Tail Risks to Economic Activity with Many Indicators"

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Abstract

This appendix provides information on the Bayesian priors and algorithms used with some of our models, as well as empirical results.

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1 Priors for models estimated with Bayesian methods

In the case of the BMF-SV, BQR, and BQR-Lasso models, Bayesian estimation methods necessitate priors. For the BMF-SV models with stochastic volatility (the same approach is used for the BMF-factor-SV models), we use independent priors for the coefficients (normal distribution) and volatility components (details below). Since the form of the prior is not dependent on m, in spelling out the prior we drop the index m from the model parameters for notational simplicity. For the BQR specifications, we use an independent Normal-Gamma prior, with a normal distribution for the regression coefficients and a Gamma distribution for the scale parameter (following Khare and Hobert (2012)). The BQR-Lasso specification has many similarities to the BQR case, but with a hierarchical structure and a Laplace (rather than Normal) prior on the regression coefficients, with independence across coefficients.

With BMF-SV and BQR specifications, the normal priors on the coefficient vector β have mean 0 (for all coefficients) and variance that takes a diagonal, Minnesota-style form. The prior variance is Minnesota style in the sense that shrinkage increases with the lag (with the quarter, not with the month within the quarter), and in the sense that we take account of the relative scales of variables. The shrinkage is controlled by three hyperparameters (in all cases, a smaller number means more shrinkage): λ_1, which controls the overall rate of shrinkage; λ_2, which controls the rate of shrinkage on variables other than lags of the dependent variable; and λ_3, which determines the rate of shrinkage associated with longer lags of GDP growth (it is not applied with monthly variables).

At each forecast origin, the prior standard deviation associated with the coefficient on the monthly or weekly variable $X_{w,j,t}$ of $X_{w,t}$ is specified as follows:

$$\text{sd}_{j,t} = \lambda_1 \lambda_2 \frac{\sigma_{GDP}}{\sigma_j}. \tag{1}$$

For coefficients on lag l of GDP, the prior standard deviation is

$$\text{sd}_l = \frac{\lambda_1}{l^{\lambda_3}}. \tag{2}$$

Finally, for the intercept, the prior is uninformative:

$$\text{sd}_{int} = 1000\sigma_{GDP}. \tag{3}$$

In setting these components of the prior, for σ_{GDP} and σ_j we use standard deviations from AR(4) models for GDP growth and $X_{w,j,t}$ estimated with the available sample of data as of the forecast origin. In all of our results, we follow CCM and fix the hyperparameters at values that may be considered very common in Minnesota-type priors and forecasting: $\lambda_1 = 0.2$, $\lambda_2 = 0.2$, and $\lambda_3 = 1$.

In the prior for the volatility-related components of the model, our approach is similar to that used in such studies as Clark (2011), Cogley and Sargent (2005), and Primiceri (2005). For the

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prior on ϕ, we use a mean of 0.035 and 5 degrees of freedom. For the period 0 value of volatility, we use a prior of

$$\underline{\mu}_\lambda = \log \hat{\lambda}_{0,OLS}, \ \underline{\Omega}_\lambda = 4. \tag{4}$$

To obtain $\log \hat{\lambda}_{0,OLS}$, we use a training sample of 40 observations preceding the estimation sample to fit an AR(4) model to GDP growth.

For the scale parameter $\sigma_{\tau,w}$ of the BQR and BQR-Lasso models, we use an inverse Gamma prior with 5 degrees of freedom and, for simplicity, with the mean set at the standard deviation of the residuals from regressing GDP growth on the variables of the model over the sample. In the Gamma prior on the parameter η^2 that governs the regularization rate of the BQR-Lasso model, we set the scale parameter at 2 and set the shape parameter to make the prior mean equal 5.

2 Estimation algorithms

We estimate the BMF-SV models with a Metropolis-within-Gibbs algorithm, used in such studies as Clark (2011) and CCM. The posterior mean and variance of the coefficient vector are given by

$$\bar{\mu}_\beta = \bar{\Omega}_\beta \left\{ \sum_{t=1}^{T} \lambda_t^{-1} X_{w,t} y_t + \underline{\Omega}_\beta^{-1} \underline{\mu}_\beta \right\} \tag{5}$$

$$\bar{\Omega}_\beta^{-1} = \underline{\Omega}_\beta^{-1} + \sum_{t=1}^{T} \lambda_t^{-1} X_{w,t} X_{w,t}', \tag{6}$$

where we again omit the w index from the parameters for notational simplicity. For the BMF-SV model and its variants, we obtain forecasts from the posterior predictive distribution. The point forecast is the posterior mean forecast, and we compute the quantiles of interest from the quantiles of forecast draws.

We estimate the Bayesian quantile regression with the three-step Gibbs sampling approach of Khare and Hobert (2012). The first step samples the mixture state time series z from an inverse Gaussian distribution. The second draws the scale parameter $\sigma_{\tau,w}$ from its inverse Gamma conditional posterior. In the third step, the regression parameter vector $\beta_{\tau,w}$ is drawn from its Normal conditional posterior, with posterior mean and variance that can be expressed in the same basic form indicated above for the BMF-SV case.

Finally, we estimate BQR-Lasso models with the Gibbs sampler of Li, Xi, and Lin (2010), which shares a number of the aspects of the BQR algorithm. The first step samples the mixture state time series z from an inverse Gaussian distribution. The second draws variance scale parameters (denoted s_k for each parameter k in the notation of Li, Xi, and Lin (2010)) associated with each regression coefficient from an inverse Gaussian distribution. In the third step, each individual element of the regression parameter vector $\beta_{\tau,w}$ is drawn from its Normal conditional posterior, with posterior mean and variance of the same basic form as that of the BMF-SV and BQR cases. The fourth step draws the scale parameter $\sigma_{\tau,w}$ from its inverse Gamma conditional posterior, and

the fifth draws from a Gamma distribution the parameter η^2 that governs the Lasso regularization rate.

The last aspect of estimation to mention is that our forecasts are produced by estimating the forecasting models with a recursive scheme: the estimation sample expands as forecasting moves forward in time. A rolling scheme, under which the size of the estimation sample remains fixed over time but the first observation moves forward in time, is in general less efficient but can be more robust in the presence of changes in regression parameters and (for density-related forecasts) error variances. However, in the nowcast (point and density) comparisons of CCM, recursive scheme forecasts were more accurate than rolling scheme forecasts.

Table A1: **Data sources**

indicator	data source
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, the best performing models are the BQR and BMF-SV specifications. No other specification yields forecasts more accurate than those obtained with these models applied to the base M variable set. In the case of point forecasts, using larger variable sets does not have much payoff to accuracy.

- Tables A3 through A5 compare results obtained with the MIDAS-based approach described below to the QR benchmark, BQR, and BMF-SV specifications (the results for QR, BQR, and BMF-SV are the same as those in the paper's tables). In these results, our MIDAS implementation often improves on the QR baseline but typically falls short of the performance of some of the other approaches covered in the paper, such as BMF-SV. This is particularly the case with larger variable sets and shorter estimation and evaluation samples.

- The results in Tables A6 through A10 indicate that our findings on 5 percent quantile forecast accuracy as measured by quantile score, coverage, and VaR-ES score are unchanged when we consider the 10 percent quantile.

- The results in Tables A11 through A15 indicate that our findings on 5 percent quantile forecast accuracy as measured by quantile score, coverage, and VaR-ES score are unchanged when we consider the 15 percent quantile.

- Tables A16 through A18 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.

2.1   QR-MIDAS setup

In results omitted from the paper for brevity, we consider a MIDAS version of quantile regression (Ghysels, Iania, and Striaukas (2018) develop an extension of QR-MIDAS for application to inflation

risks and provide an overview of earlier QR-MIDAS developments). For computational simplicity, instead of estimating a nonlinear quantile model to jointly estimate the quantile parameters and the lag polynomial coefficients with the MIDAS averaging of data, we follow a basic profile approach and search across a grid of polynomial parameters to pick the best-fitting quantile regression using weighted averages of monthly data in the regression. Consistent with common practice, in our MIDAS implementation we consider one monthly indicator at a time, estimating separate models for each monthly indicator, and then averaging predictions across the models associated with each indicator. (We also considered MIDAS results putting all monthly indicators available in the regression, but the resulting parameter estimates were highly variable over time in larger models, reducing forecast accuracy. The appendix provides some of these results.) We do not subject the weekly indicators to MIDAS treatment because, in many cases (e.g., steel production), the indicators are already smoothed as 52-week percent changes, and taking a weighted average of such observations across weeks seems less likely to have a payoff. In other cases (e.g., NFCI), the weekly indicator has a monthly indicator also included in the model, so MIDAS averaging of the weekly measure would add to overlap with the monthly readings and not add much new information to the regressor set.

More specifically, at the forecast origin of week w, let $\tilde{X}_{w,m,t}$ denote one of the (scalar) monthly indicators of $X_{w,t}$, at the monthly frequency. We form a MIDAS-weighted average of each monthly indicator, with weights that depend on a parameter θ, denoted $\tilde{X}_{w,m,t}(\theta)$. Our MIDAS implementation uses the single-parameter beta polynomial of Ghysels and Qian (2019).[1] Of course, other polynomial choices are possible, and Ghysels and Qian (2019) discuss some of the pros and cons of alternatives. In a given quarter t, for a given monthly variable x, as of forecast origin week w, let x_s denote the most recently available month's reading of x, where s refers to a month. We form a polynomial lag-weighted sum of x_s and its preceding months of data (in monthly sequence) from $s - J + 1$ through $s - 1$, as $\tilde{x}_t = \sum_{j=0}^{J} c_j(\theta) x_{s-j}$, where $\Gamma(\cdot)$ denotes the usual Gamma function and

$$c_j(\theta) = \frac{f(j/J, \theta)}{\sum_{j=1}^{J} f(j/J, \theta)}, \quad f(j/J, \theta) = \frac{(1 - j)^{\theta - 1} \Gamma(1 + \theta)}{\Gamma(1) \Gamma(\theta)}. \tag{7}$$

With the monthly data and nowcasting objective, we set the upper limit J to 5, so as to use 6 monthly observations in the MIDAS-averaged variables. As an example of the polynomial-driven weights of the moving average, with a setting of $\theta = 4$, the c_j coefficients are $c_0 = 0.490$, $c_1 = 0.283$, $c_2 = 0.14$, ..., $c_5 = 0.002$. At lower values of θ, the polynomial coefficients are relatively more equal across months, whereas at higher values, the coefficients put more weight on more recent months compared to months further in the past.

With our QR-MIDAS implementation, the underlying regression for each indicator $\tilde{X}_{w,m,t}(\theta)$

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[1] As they suggest, we make the polynomial dependent on a single parameter by restricting the first parameter θ_1 of a two-parameter polynomial to equal 1. Our notation here drops out this second parameter that appears in the notation of Ghysels and Qian (2019), and our θ corresponds to their θ_2.

used at forecast origin w takes the form of a simple quantile regression

$$y_t = \breve{X}'_{w,t}\beta_{\tau,w} + \tilde{X}_{w,m,t}(\theta)\gamma_{\tau,w} + \epsilon_{\tau,w,m,t}, \tag{8}$$

in which $\breve{X}_{w,t}$ denotes the subset of $X_{w,t}$ composed of a constant, lagged GDP growth, and weekly indicators. At each forecast horizon and quantile, for each monthly indicator used, we consider a grid of QR-MIDAS regressions, each using a different $\tilde{X}_{w,m,t}(\theta)$ that relies on a different θ setting to obtain the polynomial-weighted averages of the available monthly observations. Our grid of θ values includes 1 through 10, 12, 15, 20, 25. For each different θ, we form $\tilde{X}_{w,m,t}(\theta)$ and estimate the quantile regression with the standard quantile regression method indicated above. We then select the regression for that forecast origin, quantile, and indicator having the best fit as defined by the minimal value of the QR loss function indicated above. We then form the nowcast as the equally weighted average of forecasts across different monthly indicators m.

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: QR	1.99	1.94	1.77	1.74	1.68	1.67	1.65	1.66
base M: QR-Lasso	1.00	1.02	1.12	1.14	1.18	1.19	1.21	1.19
base M: BQR	0.94	0.94	1.04	0.97	0.96	0.92 *	0.90 *	0.89 **
base M: BQR-Lasso	1.00	1.03	1.02	1.06	1.05	1.05	1.05	1.02
base M: BMF-SV	0.96	0.95	1.00	0.96	0.94	0.92	0.89 *	0.87 *
base M + NFCI: QR	1.01	1.00	1.02	1.03	1.02	1.03	1.03	1.03
base M + NFCI: QR-Lasso	1.01	1.03	1.13	1.15	1.19	1.20	1.22	1.21
base M + NFCI: BQR	0.95	0.93	1.04	0.97	0.95	0.93	0.91 *	0.89 *
base M + NFCI: BQR-Lasso	0.99	1.02	1.08	1.08	1.06	1.03	1.05	0.99
base M + NFCI: BMF-SV	0.95	0.94	0.99	0.95	0.94	0.92	0.90	0.88 *
base M-F: QR	1.02	1.01	1.05	1.06	1.07	1.06	1.07	1.06
base M-F: QR-Lasso	1.02	1.04	1.14	1.16	1.20	1.21	1.23	1.22
base M-F: QR-factor	1.10	1.02	1.16	1.12	1.09	1.06	1.02	1.04
base M-F: BQR	0.97	0.92	1.01	0.94	0.93	0.91	0.89	0.88
base M-F: BQR-Lasso	1.02	1.08	1.08	1.02	0.98	0.99	1.00	0.97
base M-F: BQR-factor	1.07	0.98	1.11	1.08	1.05	1.05	1.01	1.01
base M-F: PQR	1.03	0.97	1.09	1.08	1.04	1.03	1.02	1.01
base M-F: BMF-SV	1.00	0.96	0.99	0.93	0.92	0.90	0.89	0.89
base M-F: BMF-factor-SV	1.07	1.00	1.12	1.08	1.06	1.07	1.03	1.01
avg. all	0.95	0.94	1.00	0.96	0.95	0.94	0.94	0.92 *
avg. base M-F	0.98	0.94	1.02	0.98	0.96	0.95	0.94	0.93
avg. BQR	0.94	0.93	1.02	0.95	0.93	0.91	0.89 *	0.88 *
avg. BQR-Lasso	0.98	1.01	1.02	1.02	1.00	1.00	1.01	0.97
avg. BMF-SV	0.95	0.94	0.98	0.94	0.93	0.91	0.89 *	0.87 *

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, MIDAS comparisons, 5% 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
	5% quantile score							
base M: QR	0.31	0.30	0.25	0.27	0.26	0.26	0.26	0.26
base M: BQR	0.97	0.91 **	1.10	0.90 ***	0.90 ***	0.86 ***	0.86 ***	0.85 ***
base M: QR-MIDAS	0.94 *	0.86 ***	1.03	0.82 ***	0.94 ***	0.84 ***	0.93 ***	0.92 **
base M: BMF-SV	0.78 ***	0.72 ***	0.83	0.72 ***	0.72 ***	0.71 ***	0.68 ***	0.65 ***
base M + NFCI: QR	0.93 ***	0.98	0.90 ***	0.89 ***	0.92 ***	0.91 ***	0.92 ***	0.92 ***
base M + NFCI: BQR	0.73 ***	0.74 ***	0.85 ***	0.72 ***	0.73 ***	0.70 ***	0.67 ***	0.64 ***
base M + NFCI: QR-MIDAS	0.88 ***	0.58 ***	0.96	0.62 ***	0.88 ***	0.63 ***	0.87 ***	0.63 ***
base M + NFCI: BMF-SV	0.69 ***	0.67 ***	0.77 **	0.67 ***	0.69 ***	0.69 ***	0.67 ***	0.64 ***
base M-F: QR	0.98	1.00	1.08	0.95 **	1.00	0.98 *	1.01	0.98 *
base M-F: BQR	0.71 ***	0.67 ***	0.76 ***	0.62 ***	0.68 ***	0.65 ***	0.65 ***	0.66 ***
base M-F: QR-MIDAS	0.89	0.86	0.98	0.77 **	0.81 ***	0.69 ***	0.87 **	0.72 ***
base M-F: BMF-SV	0.69 ***	0.66 ***	0.76 ***	0.63 ***	0.68 ***	0.70 ***	0.71 ***	0.71 ***
	5% coverage							
base M: QR	0.02 *	0.01 ***	0.01 ***	0.01 ***	0.01 ***	0.01 ***	0.01 ***	0.01 ***
base M: BQR	0.01 **	0.01 ***	0.02 *	0.01 ***	0.01 ***	0.01 ***	0.01 ***	0.01 ***
base M: QR-MIDAS	0.01 ***	0.01 ***	0.01 ***	0.01 ***	0.01 ***	0.01 ***	0.01 ***	0.01 ***
base M: BMF-SV	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.03 *
base M + NFCI: QR	0.02 *	0.02 *	0.01 ***	0.01 ***	0.01 ***	0.01 ***	0.01 ***	0.01 ***
base M + NFCI: BQR	0.03	0.01 ***	0.02 *	0.02 **	0.02 **	0.03	0.03	0.04
base M + NFCI: QR-MIDAS	0.01 ***	0.04	0.01 ***	0.04	0.01 ***	0.02 **	0.01 ***	0.01 ***
base M + NFCI: BMF-SV	0.04	0.05	0.04	0.04	0.04	0.04	0.04	0.04
base M-F: QR	0.02 *	0.02 *	0.02 *	0.01 ***	0.01 ***	0.01 ***	0.01 ***	0.01 ***
base M-F: BQR	0.04	0.01 ***	0.03	0.03	0.04	0.03	0.03	0.04
base M-F: QR-MIDAS	0.06	0.10 **	0.06	0.06	0.03	0.05	0.02 ***	0.06
base M-F: BMF-SV	0.08	0.05	0.06	0.06	0.04	0.04	0.04	0.04

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 10% is also indicated by *** (1%), ** (5%), or * (10%), obtained with two-sided t-tests.

Table A4: **Out-of-sample forecast accuracy, MIDAS comparisons, 5% quantile score and coverage, 2000:Q1-2019:Q3**

variable and model	week 1	week 3	week 5	week 7	week 9	week 11	week 13	week 15
	5% quantile score							
base M: QR	0.31	0.29	0.22	0.25	0.24	0.24	0.23	0.24
base M: BQR	0.96	0.90 *	1.12	0.89 **	0.89 ***	0.87 ***	0.88 ***	0.88 **
base M: QR-MIDAS	0.91	0.83 **	1.03	0.81 ***	0.93 ***	0.82 ***	0.92 **	0.92
base M: BMF-SV	0.88	0.80 **	1.07	0.84 *	0.84 *	0.83 **	0.78 ***	0.77 **
base M + NFCI: QR	0.94 **	0.99	0.93 ***	0.90 ***	0.92 ***	0.92 ***	0.93 ***	0.93 ***
base M + NFCI: BQR	0.79 **	0.75 **	0.86 *	0.81 **	0.81 **	0.80 **	0.76 ***	0.75 **
base M + NFCI: QR-MIDAS	0.86 **	0.67 ***	0.97	0.70 ***	0.89 ***	0.68 **	0.87 ***	0.72 **
base M + NFCI: BMF-SV	0.81 **	0.78 **	0.98	0.80 ***	0.81 **	0.80 ***	0.78 ***	0.76 ***
base M-F: QR	1.03	1.02	1.15	0.96	0.99	0.97	1.01	0.99
base M-F: BQR	0.80 *	0.75 **	0.83	0.68 ***	0.75 **	0.71 **	0.75 **	0.79 *
base M-F: QR-MIDAS	0.80	0.65 **	0.99	0.69 **	0.93	0.74 *	0.95	0.79
base M-F: BMF-SV	0.77 **	0.76 **	0.88	0.69 ***	0.71 ***	0.71 ***	0.73 ***	0.72 ***
base M-F + small weekly: QR	1.01	1.03	1.07	0.96	0.89	0.87 *	0.90	0.89
base M-F + small weekly: BQR	0.78 **	0.87	0.91	0.71 ***	0.71 ***	0.72 ***	0.75 **	0.77 *
base M-F + small weekly: QR-MIDAS	0.98	1.64	0.84 *	1.05	0.81 *	0.95	0.83	0.96
base M-F + small weekly: BMF-SV	0.78 **	0.76 **	0.87	0.78 *	0.79	0.76 *	0.78 *	0.78 *
	5% coverage							
base M: QR	0.04	0.01 ***	0.03	0.01 ***	0.01 ***	0.01 ***	0.03	0.03
base M: BQR	0.03	0.01 ***	0.04	0.01 ***	0.03	0.03	0.03	0.03
base M: QR-MIDAS	0.03	0.01 ***	0.01 ***	0.03	0.01 ***	0.01 ***	0.01 ***	0.01 ***
base M: BMF-SV	0.05	0.06	0.05	0.05	0.05	0.05	0.05	0.04
base M + NFCI: QR	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03
base M + NFCI: BQR	0.05	0.03	0.04	0.04	0.04	0.05	0.05	0.06
base M + NFCI: QR-MIDAS	0.03	0.05	0.03	0.04	0.03	0.04	0.01 ***	0.03
base M + NFCI: BMF-SV	0.05	0.06	0.05	0.05	0.05	0.05	0.05	0.05
base M-F: QR	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03
base M-F: BQR	0.06	0.03	0.05	0.04	0.05	0.04	0.04	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-F: BMF-SV	0.08	0.06	0.06	0.05	0.03	0.04	0.04	0.05
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: BQR	0.05	0.06	0.06	0.05	0.05	0.06	0.06	0.05
base M-F + small weekly: QR-MIDAS	0.05	0.20 ***	0.06	0.15 ***	0.05	0.13 **	0.04	0.10 *
base M-F + small weekly: BMF-SV	0.08	0.08	0.05	0.08	0.11 **	0.09	0.11 *	0.15 **

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 10% is also indicated by *** (1%), ** (5%), or * (10%), obtained with two-sided t-tests.

Table A5: **Out-of-sample forecast accuracy, MIDAS comparisons, 5% 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: QR	0.33	0.29	0.21	0.25	0.24	0.24	0.23	0.23
base M: BQR	0.99	0.93	1.15	0.94	0.93	0.91 ***	0.92 *	0.92
base M: QR-MIDAS	0.89	0.77 **	1.08	0.79 ***	0.96	0.76 **	0.91 *	0.89
base M: BMF-SV	1.02	0.88	1.28	0.92	0.93	0.87	0.86	0.84
base M + NFCI: QR	0.98	1.03	0.99	0.91 ***	0.94 ***	0.93 ***	0.95 *	0.95
base M + NFCI: BQR	0.85	0.77 **	0.98	0.85 **	0.87 *	0.82 *	0.80 *	0.79 *
base M + NFCI: QR-MIDAS	0.87	0.69 **	1.04	0.69 **	0.92 **	0.73 *	0.89 *	0.82
base M + NFCI: BMF-SV	0.89	0.86	1.17	0.84 **	0.87	0.84 *	0.84	0.81
base M-F: QR	1.11	1.07	1.27	0.95	0.99	0.97	1.02	1.01
base M-F: BQR	0.84	0.78	1.00	0.69 **	0.78 *	0.74 *	0.78	0.87
base M-F: QR-MIDAS	0.82	0.67 *	1.14	0.74	0.98	0.81	0.99	0.88
base M-F: BMF-SV	0.83	0.83	1.01	0.69 **	0.75 *	0.75 *	0.78 *	0.79
base M-F + small weekly: QR	1.21	1.27	1.34	1.11	1.01	0.98	1.03	1.02
base M-F + small weekly: BQR	0.90	1.02	1.02	0.67 **	0.72 *	0.75 *	0.83	0.89
base M-F + small weekly: QR-MIDAS	1.14	1.71	0.97	0.89	0.91	1.08	0.96	1.17
base M-F + small weekly: BMF-SV	0.85	0.83	1.00	0.73 *	0.83	0.76	0.82	0.80
base M-F + large weekly: QR	1.29	1.41	1.51	1.24	1.11	1.08	1.15	1.15
base M-F + large weekly: QR-MIDAS	1.05	2.02	1.74	1.78	1.11	2.03	0.88	1.68

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 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 A6: **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
	10% quantile score							
base M: QR	0.49	0.48	0.38	0.40	0.39	0.40	0.40	0.40
base M: QR-Lasso	0.99 ***	1.02	1.29	1.21	1.23	1.21	1.22	1.21
base M: BQR	0.97	0.92 *	1.03	0.91 ***	0.89 ***	0.87 ***	0.84 ***	0.83 ***
base M: BQR-Lasso	0.69 ***	0.80 ***	0.98	0.89	0.87 *	0.90	0.86 *	0.82 **
base M: BMF-SV	0.76 ***	0.72 ***	0.84 *	0.74 ***	0.73 ***	0.71 ***	0.69 ***	0.67 ***
base M + NFCI: QR	0.92 ***	0.97 ***	0.91 ***	0.90 ***	0.92 ***	0.91 ***	0.92 ***	0.92 ***
base M + NFCI: QR-Lasso	0.90 ***	0.92 ***	1.17	1.10	1.11	1.10	1.10	1.10
base M + NFCI: BQR	0.70 ***	0.74 ***	0.86 ***	0.71 ***	0.70 ***	0.69 ***	0.67 ***	0.66 ***
base M + NFCI: BQR-Lasso	0.67 ***	0.67 ***	0.71 ***	0.78 ***	0.79 ***	0.85 *	0.82 **	0.79 **
base M + NFCI: BMF-SV	0.70 ***	0.68 ***	0.80 ***	0.69 ***	0.69 ***	0.70 ***	0.67 ***	0.65 ***
base M-F: QR	0.92 ***	0.97 ***	1.04	0.97 *	0.98	0.96 **	0.98	0.97 **
base M-F: QR-Lasso	0.91 ***	0.93 **	1.18	1.11	1.13	1.11	1.12	1.11
base M-F: QR-factor	0.72 ***	0.75 ***	0.88 *	0.68 ***	0.70 ***	0.67 ***	0.70 ***	0.70 ***
base M-F: BQR	0.71 ***	0.67 ***	0.82 ***	0.68 ***	0.69 ***	0.66 ***	0.68 ***	0.67 ***
base M-F: BQR-Lasso	0.75 **	0.75 **	0.83 *	0.76 ***	0.77 ***	0.74 ***	0.78 ***	0.70 ***
base M-F: BQR-factor	0.70 ***	0.71 ***	0.83 **	0.65 ***	0.70 ***	0.66 ***	0.70 ***	0.68 ***
base M-F: PQR	0.65 ***	0.67 ***	0.79 ***	0.67 ***	0.66 ***	0.65 ***	0.69 ***	0.68 ***
base M-F: BMF-SV	0.75 ***	0.68 ***	0.82 ***	0.67 ***	0.70 ***	0.71 ***	0.71 ***	0.71 ***
base M-F: BMF-factor-SV	0.68 ***	0.65 ***	0.79 ***	0.69 ***	0.71 ***	0.65 ***	0.67 ***	0.64 ***
avg. all	0.72 ***	0.72 ***	0.82 ***	0.75 ***	0.76 ***	0.75 ***	0.76 ***	0.74 ***
avg. base M-F	0.68 ***	0.64 ***	0.79 ***	0.69 ***	0.70 ***	0.68 ***	0.70 ***	0.68 ***
avg. BQR	0.76 ***	0.77 ***	0.88 ***	0.75 ***	0.74 ***	0.72 ***	0.71 ***	0.70 ***
avg. BQR-Lasso	0.65 ***	0.65 ***	0.77 ***	0.77 ***	0.77 ***	0.79 ***	0.77 ***	0.75 ***
avg. BMF-SV	0.69 ***	0.67 ***	0.81 ***	0.69 ***	0.70 ***	0.70 ***	0.68 ***	0.67 ***
	10% coverage							
base M: QR	0.02 ***	0.02 ***	0.02 ***	0.01 ***	0.01 ***	0.01 ***	0.01 ***	0.01 ***
base M: QR-Lasso	0.02 ***	0.02 ***	0.02 ***	0.02 ***	0.02 ***	0.02 ***	0.02 ***	0.02 ***
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: BMF-SV	0.05 **	0.06	0.09	0.05 ***	0.04 ***	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: QR-Lasso	0.02 ***	0.02 ***	0.02 ***	0.02 ***	0.02 ***	0.02 ***	0.02 ***	0.02 ***
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: BMF-SV	0.09	0.09	0.10	0.06 **	0.05 ***	0.05 ***	0.04 ***	0.05 ***
base M-F: QR	0.03 ***	0.02 ***	0.02 ***	0.02 ***	0.02 ***	0.02 ***	0.02 ***	0.02 ***
base M-F: QR-Lasso	0.03 ***	0.03 ***	0.03 ***	0.03 ***	0.03 ***	0.03 ***	0.03 ***	0.03 ***
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	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: 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 *
base M-F: BMF-SV	0.12	0.09	0.12	0.06 *	0.07	0.06 *	0.06 *	0.06 *
base M-F: BMF-factor-SV	0.08	0.09	0.09	0.11	0.09	0.07	0.08	0.07
avg. all	0.04 ***	0.03 ***	0.04 ***	0.03 ***	0.03 ***	0.03 ***	0.03 ***	0.04 ***
avg. base M-F	0.06 *	0.03 ***	0.07	0.06 *	0.06 **	0.05 ***	0.05 ***	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
avg. BMF-SV	0.07	0.07	0.10	0.06 **	0.06 **	0.05 ***	0.04 ***	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 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 A7: **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: QR	0.48	0.46	0.35	0.37	0.36	0.37	0.37	0.37
base M: QR-Lasso	0.99 ***	1.02	1.35	1.27	1.29	1.26	1.29	1.28
base M: BQR	0.97	0.90	1.00	0.91 ***	0.89 ***	0.87 ***	0.85 ***	0.83 ***
base M: BQR-Lasso	0.71 *	0.77 *	0.94 *	1.01	1.00	1.08	1.02	0.97
base M: BMF-SV	0.84 ***	0.78 ***	1.02	0.84 ***	0.83 ***	0.82 ***	0.80 ***	0.77 ***
base M + NFCI: QR	0.92 ***	0.96 ***	0.94 ***	0.92 ***	0.93 ***	0.93 ***	0.94 ***	0.94 ***
base M + NFCI: QR-Lasso	0.91 ***	0.93 **	1.23	1.16	1.18	1.16	1.18	1.17
base M + NFCI: BQR	0.78 ***	0.76 *	0.87 **	0.79 ***	0.79 ***	0.79 ***	0.77 ***	0.77 ***
base M + NFCI: BQR-Lasso	0.68 **	0.68 **	0.84 **	0.93	0.97	1.03	1.01	0.97
base M + NFCI: BMF-SV	0.79 ***	0.75 ***	0.94	0.81 ***	0.80 ***	0.82 ***	0.79 ***	0.76 ***
base M-F: QR	0.95	0.98	1.09	1.00	1.00	0.97	1.00	0.98
base M-F: QR-Lasso	0.94 **	0.97	1.28	1.20	1.23	1.20	1.22	1.22
base M-F: QR-factor	0.73 **	0.70 **	0.92	0.74 ***	0.76 **	0.75 **	0.79 **	0.78 **
base M-F: BQR	0.79 **	0.72 **	0.89	0.74 ***	0.75 ***	0.73 ***	0.75 ***	0.75 ***
base M-F: BQR-Lasso	0.75	0.74	0.83	0.84 **	0.85 *	0.87	0.90	0.75 **
base M-F: BQR-factor	0.74 **	0.67 **	0.90	0.70 ***	0.77 **	0.74 ***	0.78 **	0.75 ***
base M-F: PQR	0.72 **	0.74 *	0.84 **	0.73 ***	0.79 **	0.77 ***	0.79 ***	0.80 ***
base M-F: BMF-SV	0.80 **	0.74 ***	0.91	0.73 ***	0.75 ***	0.75 ***	0.76 ***	0.75 ***
base M-F: BMF-factor-SV	0.71 ***	0.65 **	0.84 *	0.69 ***	0.77 **	0.75 ***	0.78 **	0.74 ***
base M-F + small weekly: QR	0.91 *	0.91	1.04	0.96	0.93	0.89 *	0.91	0.89 *
base M-F + small weekly: QR-Lasso	0.91 *	0.94	1.24	1.16	1.18	1.16	1.18	1.17
base M-F + small weekly: QR-factor	0.82 **	0.74 ***	0.84 *	0.81 **	0.85 **	0.82 **	0.89 *	0.86 *
base M-F + small weekly: BQR	0.76 ***	0.81 ***	0.95	0.81 **	0.81 **	0.78 **	0.77 ***	0.75 ***
base M-F + small weekly: BQR-Lasso	0.84 *	0.98	1.11	0.90	0.83 *	0.87	1.08	0.88
base M-F + small weekly: BQR-factor	0.75 **	0.75 ***	0.86 *	0.78 **	0.80 **	0.77 **	0.78 **	0.76 **
base M-F + small weekly: PQR	0.79 **	0.83 ***	0.82 **	0.76 ***	0.83 **	0.85 **	0.87 *	0.85 **
base M-F + small weekly: BMF-SV	0.79 **	0.77 ***	0.92	0.81 *	0.85 *	0.83 *	0.79 **	0.80 **
base M-F + small weekly: BMF-factor-SV	0.70 ***	0.76 ***	0.85 **	0.78 **	0.78 **	0.78 **	0.79 **	0.80 **
avg. all	0.76 ***	0.75 ***	0.88 ***	0.78 ***	0.78 ***	0.78 ***	0.78 ***	0.76 ***
avg. base M-F	0.73 **	0.66 **	0.84 **	0.73 ***	0.75 ***	0.74 ***	0.76 ***	0.74 ***
avg. base M-F + small weekly	0.74 ***	0.78 ***	0.89 **	0.75 ***	0.77 ***	0.75 ***	0.76 ***	0.73 ***
avg. BQR	0.80 ***	0.77 **	0.90 *	0.79 ***	0.78 ***	0.77 ***	0.75 ***	0.74 ***
avg. BQR-Lasso	0.67 **	0.70 ***	0.84 **	0.82 **	0.79 **	0.85	0.86	0.81 **
avg. BMF-SV	0.76 ***	0.73 ***	0.93	0.77 ***	0.77 ***	0.77 ***	0.76 ***	0.72 ***

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 A8: **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: QR	0.04 **	0.04 **	0.04 **	0.03 ***	0.03 ***	0.03 ***	0.03 ***	0.03 ***
base M: QR-Lasso	0.04 **	0.04 **	0.04 **	0.04 **	0.04 **	0.04 **	0.04 **	0.04 **
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: BMF-SV	0.08	0.09	0.11	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: QR-Lasso	0.04 **	0.04 **	0.04 **	0.04 **	0.04 **	0.04 **	0.04 **	0.04 **
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: BMF-SV	0.08	0.09	0.09	0.06	0.05 **	0.06	0.05 **	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: QR-Lasso	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
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	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: 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-F: BMF-SV	0.11	0.09	0.11	0.06	0.08	0.08	0.08	0.06
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 + small weekly: QR	0.10	0.09	0.08	0.05	0.08	0.05	0.05	0.05
base M-F + small weekly: QR-Lasso	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
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	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: 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
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: BMF-factor-SV	0.09	0.11	0.11	0.10	0.08	0.08	0.06	0.08
avg. all	0.06	0.05	0.09	0.04 ***	0.05 **	0.05 **	0.08	0.06
avg. base M-F	0.08	0.04 ***	0.09	0.08	0.08	0.06	0.06	0.06
avg. base M-F + small weekly	0.10	0.10	0.14	0.08	0.11	0.10	0.09	0.08
avg. BQR	0.05	0.05	0.09	0.05 **	0.05 **	0.08	0.09	0.08
avg. BQR-Lasso	0.10	0.11	0.13	0.14	0.11	0.14	0.11	0.10
avg. BMF-SV	0.08	0.08	0.11	0.06	0.08	0.09	0.09	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 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 A9: **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: QR	0.53	0.51	0.33	0.39	0.37	0.39	0.38	0.38
base M: QR-Lasso	0.99 ***	1.02	1.57	1.34	1.40	1.34	1.39	1.37
base M: BQR	1.01	0.91	1.07	0.95 **	0.94 ***	0.89 ***	0.87 ***	0.84 ***
base M: BQR-Lasso	0.65 *	0.70 *	0.97	1.01	1.01	1.01	0.98	0.96
base M: BMF-SV	0.90 ***	0.79 ***	1.13	0.86 ***	0.86 ***	0.82 ***	0.81 ***	0.78 ***
base M + NFCI: QR	0.94 ***	0.98 ***	0.97 *	0.93 **	0.94 ***	0.94 ***	0.95 ***	0.95 ***
base M + NFCI: QR-Lasso	0.92 ***	0.95	1.46	1.25	1.30	1.25	1.29	1.27
base M + NFCI: BQR	0.79 **	0.74 *	0.96	0.81 ***	0.81 ***	0.79 ***	0.78 ***	0.78 ***
base M + NFCI: BQR-Lasso	0.66 **	0.67 **	0.95	0.91	0.94	0.93	0.97	0.92
base M + NFCI: BMF-SV	0.82 ***	0.75 ***	1.05	0.81 ***	0.81 ***	0.80 ***	0.79 ***	0.76 ***
base M-F: QR	0.98	0.99	1.19	1.01	1.00	0.97	1.01	0.99
base M-F: QR-Lasso	0.96	1.00	1.54	1.31	1.37	1.32	1.36	1.34
base M-F: QR-factor	0.72 *	0.66 *	1.03	0.77 *	0.80	0.75 *	0.77 *	0.78 *
base M-F: BQR	0.76 *	0.70 *	1.02	0.74 **	0.75 **	0.70 ***	0.74 **	0.76 **
base M-F: BQR-Lasso	0.72	0.73	0.97	0.85	0.82 *	0.81 *	0.86	0.70 **
base M-F: BQR-factor	0.73 *	0.64 *	1.01	0.72 **	0.80	0.74 *	0.77 *	0.77 *
base M-F: PQR	0.73 *	0.75	0.87	0.76 *	0.83	0.79 *	0.82 *	0.85 *
base M-F: BMF-SV	0.80 **	0.74 ***	1.01	0.71 ***	0.75 **	0.73 ***	0.76 ***	0.76 ***
base M-F: BMF-factor-SV	0.71 **	0.62 **	0.92	0.71 **	0.77 *	0.74 **	0.78 *	0.78 **
base M-F + small weekly: QR	0.96	0.97	1.21	1.01	1.00	0.93	0.97	0.94
base M-F + small weekly: QR-Lasso	0.95	0.99	1.52	1.29	1.35	1.30	1.34	1.32
base M-F + small weekly: QR-factor	0.89	0.78 ***	0.90	0.82 *	0.90	0.83	0.90	0.93
base M-F + small weekly: BQR	0.78 **	0.85 ***	1.04	0.78 **	0.82 *	0.78 **	0.81 *	0.81 *
base M-F + small weekly: BQR-Lasso	0.83	1.03	1.31	0.92	0.88	0.83	0.89	0.85
base M-F + small weekly: BQR-factor	0.79 *	0.78 ***	0.91	0.80 *	0.83 *	0.76 *	0.80 *	0.80 *
base M-F + small weekly: PQR	0.79 *	0.85 **	0.91	0.77 **	0.85	0.86	0.86	0.87 *
base M-F + small weekly: BMF-SV	0.80 *	0.78 ***	1.02	0.76 **	0.87	0.80 *	0.79 *	0.75 **
base M-F + small weekly: BMF-factor-SV	0.70 **	0.77 ***	0.91	0.75 **	0.76 *	0.77 **	0.79 *	0.83 *
base M-F + large weekly: QR	1.00	1.04	1.33	1.13	1.07	1.02	1.07	1.07
base M-F + large weekly: QR-Lasso	1.00	1.03	1.59	1.35	1.41	1.36	1.40	1.38
base M-F + large weekly: QR-factor	0.83	0.93	0.91	0.83	0.81	0.77 *	0.82	0.93
base M-F + large weekly: BQR-factor	0.79 *	0.79 **	0.98	0.78 *	0.81	0.75 **	0.76 *	0.82 *
base M-F + large weekly: PQR	0.77	0.85 *	1.13	0.86	0.89	0.91	0.96	0.92
base M-F + large weekly: BMF-factor-SV	0.73 **	0.77 ***	1.00	0.75 *	0.81 *	0.76 **	0.79 *	0.79 *
avg. all	0.77 **	0.76 ***	0.96	0.78 ***	0.79 ***	0.77 ***	0.80 ***	0.80 ***
avg. base M-F	0.71 **	0.62 **	0.91	0.74 ***	0.77 **	0.73 ***	0.77 ***	0.75 ***
avg. base M-F + small weekly	0.77 ***	0.82 ***	0.99	0.75 ***	0.80 **	0.76 **	0.79 **	0.77 **
avg. base M-F + large weekly	0.80 **	0.84 ***	1.01	0.77 **	0.79 **	0.79 **	0.88 *	0.88 *
avg. BQR	0.83 *	0.78 *	0.99	0.80 ***	0.81 ***	0.76 ***	0.76 ***	0.76 ***
avg. BQR-Lasso	0.65 *	0.69 **	0.97	0.80 **	0.75 ***	0.76 **	0.78 **	0.78 **
avg. BMF-SV	0.81 ***	0.75 ***	1.03	0.77 ***	0.78 ***	0.75 ***	0.76 ***	0.74 ***

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 A10: **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
	1985:Q1-2019:Q3							
base M: BMF-SV (benchmark)	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
avg. BMF-SV	0.14 ***	0.07 **	0.04	0.04	-0.01	-0.05	-0.05	-0.08
	2000:Q1-2019:Q3							
base M: BMF-SV (benchmark)	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-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
avg. BMF-SV	0.14 *	0.09 **	0.08	0.07	0.02	0.03	0.02	0.08 *
	2007:Q1-2019:Q3							
base M: BMF-SV (benchmark)	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-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-F + large weekly: BMF-factor-SV	0.24 *	0.09	-0.17	-0.20	-0.39	-0.30	-0.40	-0.40
avg. BMF-SV	0.09	0.07	0.01	0.07	0.00	0.02	-0.02	-0.01

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 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 A11: **Out-of-sample forecast accuracy, 15% 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
	15% quantile score							
base M: QR	0.57	0.56	0.46	0.48	0.46	0.47	0.47	0.47
base M: BQR	0.98 *	0.94 **	1.00	0.94 ***	0.93 ***	0.90 ***	0.89 ***	0.86 ***
base M: BQR-Lasso	0.81 **	0.87 ***	1.00	0.96	0.94 *	0.94	0.94	0.89 **
base M: BMF-SV	0.81 ***	0.78 ***	0.88 **	0.77 ***	0.78 ***	0.76 ***	0.74 ***	0.71 ***
base M + NFCI: QR	0.92 ***	0.97 ***	0.91 ***	0.91 ***	0.92 ***	0.92 ***	0.93 ***	0.92 ***
base M + NFCI: BQR	0.76 ***	0.78 ***	0.87 ***	0.75 ***	0.75 ***	0.74 ***	0.74 ***	0.72 ***
base M + NFCI: BQR-Lasso	0.76 ***	0.75 ***	0.79 ***	0.85 **	0.86 **	0.88 **	0.86 **	0.84 **
base M + NFCI: BMF-SV	0.78 ***	0.76 ***	0.86 ***	0.73 ***	0.74 ***	0.74 ***	0.71 ***	0.69 ***
base M-F: QR	0.93 ***	0.96 ***	1.03	0.96 **	0.98 *	0.96 **	0.98 *	0.97 **
base M-F: QR-factor	0.84 **	0.83 **	0.97	0.76 ***	0.78 ***	0.73 ***	0.80 ***	0.75 ***
base M-F: BQR	0.79 ***	0.73 ***	0.86 ***	0.74 ***	0.76 ***	0.73 ***	0.75 ***	0.74 ***
base M-F: BQR-Lasso	0.85 **	0.89 *	0.92 *	0.86 **	0.81 ***	0.84 **	0.81 ***	0.79 ***
base M-F: BQR-factor	0.78 ***	0.82 ***	0.91 *	0.74 ***	0.77 ***	0.73 ***	0.77 ***	0.73 ***
base M-F: PQR	0.73 ***	0.73 ***	0.86 **	0.75 ***	0.77 ***	0.75 ***	0.79 ***	0.75 ***
base M-F: BMF-SV	0.84 ***	0.76 ***	0.87 **	0.73 ***	0.77 ***	0.75 ***	0.76 ***	0.75 ***
base M-F: BMF-factor-SV	0.77 ***	0.73 ***	0.84 **	0.76 ***	0.76 ***	0.72 ***	0.73 ***	0.70 ***
	15% coverage							
base M: QR	0.04 ***	0.04 ***	0.04 ***	0.04 ***	0.04 ***	0.04 ***	0.04 ***	0.03 ***
base M: BQR	0.03 ***	0.04 ***	0.07 ***	0.03 ***	0.03 ***	0.04 ***	0.04 ***	0.04 ***
base M: BQR-Lasso	0.15	0.12 *	0.08 ***	0.16	0.16	0.15	0.15	0.14
base M: BMF-SV	0.09 **	0.12	0.14	0.09 ***	0.10 **	0.09 ***	0.09 ***	0.07 ***
base M + NFCI: QR	0.05 ***	0.04 ***	0.06 ***	0.05 ***	0.04 ***	0.04 ***	0.04 ***	0.04 ***
base M + NFCI: BQR	0.09 **	0.07 ***	0.10 **	0.11 **	0.10 ***	0.09 ***	0.08 ***	0.08 ***
base M + NFCI: BQR-Lasso	0.20 **	0.22 **	0.22 **	0.19 *	0.19 *	0.20 **	0.19 *	0.17
base M + NFCI: BMF-SV	0.14	0.14	0.16	0.16	0.11 **	0.12 **	0.10 **	0.11 **
base M-F: QR	0.05 ***	0.04 ***	0.06 ***	0.04 ***	0.04 ***	0.03 ***	0.03 ***	0.03 ***
base M-F: QR-factor	0.14	0.16	0.21 **	0.19 **	0.17	0.14	0.14	0.17
base M-F: BQR	0.13	0.10 **	0.13	0.11 **	0.10 **	0.09 **	0.12 *	0.11 **
base M-F: BQR-Lasso	0.24 ***	0.22 **	0.21 **	0.21 **	0.19 *	0.21 **	0.18	0.19 *
base M-F: BQR-factor	0.16	0.15	0.17	0.17	0.17	0.14	0.14	0.14
base M-F: PQR	0.16	0.11 **	0.17	0.20 **	0.12	0.12	0.11 **	0.12
base M-F: BMF-SV	0.17	0.18	0.17	0.16	0.13	0.12 **	0.11 **	0.11 **
base M-F: BMF-factor-SV	0.19 *	0.17	0.19 *	0.17	0.15	0.16	0.14	0.14

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 15% 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 15% 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 15% is also indicated by *** (1%), ** (5%), or * (10%), obtained with two-sided *t*-tests.

Table A12: **Out-of-sample forecast accuracy: 15% 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: QR	0.54	0.53	0.42	0.44	0.42	0.43	0.42	0.43
base M: BQR	0.98	0.93 *	1.00	0.94 **	0.95 **	0.94 **	0.92 **	0.88 ***
base M: BQR-Lasso	0.81 **	0.86 ***	0.98	1.09	1.09	1.11	1.12	1.05
base M: BMF-SV	0.91 ***	0.86 **	1.05	0.88 ***	0.90 **	0.88 **	0.86 ***	0.82 ***
base M + NFCI: QR	0.94 ***	0.98 ***	0.95 ***	0.95 ***	0.95 ***	0.95 ***	0.95 ***	0.95 ***
base M + NFCI: BQR	0.86 **	0.82 **	0.93 **	0.86 **	0.86 **	0.84 **	0.84 **	0.82 **
base M + NFCI: BQR-Lasso	0.82 **	0.77 **	0.97	1.02	1.04	1.07	1.03	1.00
base M + NFCI: BMF-SV	0.85 **	0.83 **	0.99	0.86 **	0.87 **	0.88 **	0.85 **	0.82 ***
base M-F: QR	0.97 **	0.98 **	1.08	1.02	1.03	1.00	1.02	1.00
base M-F: QR-factor	0.85 *	0.82 *	0.96	0.81 **	0.86 **	0.86 **	0.93 *	0.84 **
base M-F: BQR	0.89 *	0.79 **	0.94	0.82 **	0.85 **	0.82 **	0.83 **	0.81 **
base M-F: BQR-Lasso	0.87	0.89	0.95	0.92 *	0.91 *	0.97	0.90 *	0.84 **
base M-F: BQR-factor	0.82 **	0.83 *	0.95	0.79 **	0.87 **	0.86 **	0.88 **	0.83 **
base M-F: PQR	0.80 **	0.86 *	0.93	0.86 **	0.92 *	0.91 *	0.94 *	0.91 **
base M-F: BMF-SV	0.88 **	0.81 **	0.96	0.80 **	0.84 **	0.83 **	0.84 **	0.81 **
base M-F: BMF-factor-SV	0.78 **	0.73 **	0.88 *	0.80 **	0.87 **	0.85 **	0.86 **	0.83 **
base M-F + small weekly: QR	0.98	0.99	1.09	1.04	1.03	0.98	0.99	0.96 *
base M-F + small weekly: QR-factor	0.82 **	0.91 **	0.96	0.89 **	1.00	0.93 *	0.93 *	0.92 **
base M-F + small weekly: BQR	0.84 **	0.88 **	1.02	0.91 *	0.94 *	0.89 **	0.86 **	0.81 **
base M-F + small weekly: BQR-Lasso	0.95	1.04	1.11	0.98	0.98	0.91 *	0.82 **	1.01
base M-F + small weekly: BQR-factor	0.80 **	0.87 **	0.94	0.87 **	0.92 *	0.87 **	0.86 **	0.84 **
base M-F + small weekly: PQR	0.89 *	0.90 **	0.95	1.00	1.01	1.05	1.00	0.98
base M-F + small weekly: BMF-SV	0.90 *	0.88 **	0.97	0.91 *	0.94	0.91 *	0.88 **	0.88 **
base M-F + small weekly: BMF-factor-SV	0.80 **	0.88 ***	0.93 *	0.87 **	0.89 **	0.87 **	0.86 **	0.86 **

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 15% 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 A13: **Out-of-sample forecast accuracy: 15% 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: QR	0.06 ***	0.06 ***	0.06 ***	0.06 ***	0.06 ***	0.06 ***	0.06 ***	0.05 ***
base M: BQR	0.05 ***	0.06 ***	0.13	0.05 ***	0.05 ***	0.08 ***	0.08 ***	0.08 ***
base M: BQR-Lasso	0.19	0.13	0.14	0.24 **	0.23 **	0.22 **	0.20 *	0.19
base M: BMF-SV	0.13	0.14	0.14	0.13	0.13	0.10 **	0.10 **	0.09 **
base M + NFCI: QR	0.08 **	0.06 ***	0.09 **	0.08 **	0.06 ***	0.08 **	0.08 **	0.08 **
base M + NFCI: BQR	0.11	0.13	0.15	0.18	0.14	0.11 *	0.10 **	0.10 **
base M + NFCI: BQR-Lasso	0.19	0.23 **	0.30 ***	0.27 ***	0.25 **	0.25 **	0.24 **	0.23 **
base M + NFCI: BMF-SV	0.13	0.15	0.16	0.14	0.13	0.11 *	0.10 **	0.10 **
base M-F: QR	0.08 **	0.06 ***	0.08 **	0.05 ***	0.06 **	0.05 ***	0.05 ***	0.05 ***
base M-F: QR-factor	0.14	0.19	0.19	0.20 **	0.16	0.18	0.18	0.22 *
base M-F: BQR	0.13	0.13	0.16	0.15	0.11 *	0.10 **	0.11 *	0.10 **
base M-F: BQR-Lasso	0.25 **	0.23 **	0.22 **	0.22 **	0.24 **	0.24 **	0.22 **	0.23 **
base M-F: BQR-factor	0.15	0.18	0.14	0.18	0.18	0.18	0.18	0.19
base M-F: PQR	0.11 *	0.11	0.16	0.20 *	0.15	0.15	0.14	0.16
base M-F: BMF-SV	0.15	0.16	0.18	0.11	0.11 *	0.11 *	0.11 *	0.11 *
base M-F: BMF-factor-SV	0.16	0.16	0.18	0.16	0.15	0.16	0.16	0.16
base M-F + small weekly: QR	0.15	0.16	0.14	0.14	0.10 *	0.10 *	0.11	0.10 *
base M-F + small weekly: QR-factor	0.13	0.23 **	0.16	0.14	0.16	0.16	0.15	0.20 *
base M-F + small weekly: BQR	0.14	0.13	0.18	0.15	0.15	0.15	0.14	0.14
base M-F + small weekly: BQR-Lasso	0.30 ***	0.29 ***	0.28 ***	0.29 ***	0.23 **	0.23 **	0.18	0.19
base M-F + small weekly: BQR-factor	0.14	0.20 *	0.15	0.14	0.16	0.19	0.16	0.18
base M-F + small weekly: PQR	0.16	0.19	0.19	0.20	0.15	0.19	0.18	0.16
base M-F + small weekly: BMF-SV	0.24 **	0.22	0.18	0.23 **	0.19	0.22 **	0.23 **	0.27 **
base M-F + small weekly: BMF-factor-SV	0.16	0.23 **	0.16	0.19 *	0.16	0.15	0.14	0.15

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 15% quantile forecasts (percentage of outcomes at or below the quantile). Statistical significance of departures of empirical coverage from the nominal 15% is also indicated by *** (1%), ** (5%), or * (10%), obtained with two-sided *t*-tests.

Table A14: **Out-of-sample forecast accuracy: 15% 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: QR	0.60	0.59	0.42	0.46	0.43	0.45	0.44	0.45
base M: BQR	1.04	0.95	1.04	0.97 *	0.98 *	0.93 ***	0.91 ***	0.87 ***
base M: BQR-Lasso	0.74 **	0.83 **	1.03	1.07	1.09	1.04	1.09	0.99
base M: BMF-SV	0.97 *	0.86 **	1.14	0.89 ***	0.91 ***	0.87 ***	0.85 ***	0.82 ***
base M + NFCI: QR	0.95 ***	0.98 ***	0.97 **	0.94 **	0.95 ***	0.94 ***	0.95 ***	0.95 ***
base M + NFCI: BQR	0.89 *	0.82 *	1.00	0.84 **	0.88 **	0.83 ***	0.83 **	0.81 **
base M + NFCI: BQR-Lasso	0.80 **	0.76 **	1.07	0.98	1.01	0.99	0.99	0.94
base M + NFCI: BMF-SV	0.89 **	0.81 **	1.07	0.83 ***	0.87 ***	0.86 ***	0.85 ***	0.80 ***
base M-F: QR	0.98 *	0.99 *	1.13	1.01	1.05	1.00	1.02	1.00
base M-F: QR-factor	0.82 *	0.77 *	1.02	0.84 *	0.89	0.87 *	0.92	0.87 *
base M-F: BQR	0.86 *	0.77 **	1.02	0.81 **	0.86 **	0.80 **	0.81 **	0.78 **
base M-F: BQR-Lasso	0.83	0.89	1.10	0.91	0.92	0.90 *	0.85 **	0.76 **
base M-F: BQR-factor	0.80 *	0.81 *	1.01	0.82 **	0.89 *	0.86 *	0.87 *	0.83 **
base M-F: PQR	0.83 *	0.87	0.99	0.88 *	0.93	0.90 *	0.94	0.93
base M-F: BMF-SV	0.88 **	0.82 **	1.04	0.75 **	0.84 **	0.81 **	0.83 **	0.80 **
base M-F: BMF-factor-SV	0.81 **	0.70 **	0.95	0.81 **	0.86 *	0.84 **	0.85 **	0.84 **
base M-F + small weekly: QR	1.01	1.02	1.21	1.08	1.12	1.03	1.05	0.99
base M-F + small weekly: QR-factor	0.86 *	0.91 **	1.00	0.85 *	0.92 *	0.89 **	0.87 *	0.92 *
base M-F + small weekly: BQR	0.86 **	0.89 **	1.08	0.87 **	0.96	0.89 **	0.87 **	0.85 **
base M-F + small weekly: BQR-Lasso	1.04	1.06	1.27	0.97	0.98	0.94	0.84 **	0.91
base M-F + small weekly: BQR-factor	0.83 **	0.87 **	0.96	0.84 **	0.89 *	0.85 **	0.85 **	0.85 **
base M-F + small weekly: PQR	0.91	0.93	1.00	1.00	1.01	1.05	0.99	0.97
base M-F + small weekly: BMF-SV	0.89 *	0.87 **	1.05	0.83 **	0.96	0.88 **	0.86 **	0.81 **
base M-F + small weekly: BMF-factor-SV	0.81 **	0.89 **	0.94	0.82 **	0.85 *	0.84 **	0.84 **	0.87 *
base M-F + large weekly: QR	1.03	1.06	1.30	1.14	1.16	1.08	1.11	1.08
base M-F + large weekly: QR-factor	0.89	0.99	1.14	0.93	0.93	0.94	0.87 *	0.94
base M-F + large weekly: BQR-factor	0.85 *	0.88 *	1.05	0.85 *	0.87 *	0.83 **	0.84 **	0.85 **
base M-F + large weekly: PQR	0.87 *	0.98	1.21	1.03	0.98	0.97	0.96	0.93
base M-F + large weekly: BMF-factor-SV	0.81 **	0.90 **	1.04	0.81 **	0.85 *	0.80 **	0.82 **	0.80 **

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 15% 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 A15: **Out-of-sample forecast accuracy, 15% VaR-ES scores**

variable and model	week 1	week 3	week 5	week 7	week 9	week 11	week 13	week 15
	1985:Q1-2019:Q3							
base M: BMF-SV (benchmark)	0.16	0.08	-0.12	-0.23	-0.25	-0.25	-0.31	-0.35
base M + NFCI: BMF-SV	0.09 **	0.05 *	0.05 **	0.08 **	0.05 **	0.02	0.03 *	0.04 *
base M-F: BMF-SV	-0.22	-0.01	-0.08	0.03	-0.09	-0.09	-0.15	-0.19
base M-F: BMF-factor-SV	-0.01	-0.08	-0.15	-0.12	-0.14	-0.00	-0.09	-0.06
	2000:Q1-2019:Q3							
base M: BMF-SV (benchmark)	0.25	0.15	0.07	-0.20	-0.19	-0.15	-0.19	-0.21
base M + NFCI: BMF-SV	0.11 **	0.03	0.09 **	-0.00	0.00	-0.04	-0.02	0.00
base M-F: BMF-SV	-0.09	0.04	0.03	0.04	-0.02	-0.02	-0.05	-0.04
base M-F: BMF-factor-SV	0.14 *	0.07	-0.01	-0.02	-0.19	-0.12	-0.17	-0.15
base M-F + small weekly: BMF-SV	-0.17	-0.08	0.02	-0.24	-0.31	-0.26	-0.21	-0.34
base M-F + small weekly: BMF-factor-SV	0.13 *	-0.01	-0.01	-0.12	-0.17	-0.15	-0.20	-0.25
	2007:Q1-2019:Q3							
base M: BMF-SV (benchmark)	0.77	0.53	0.26	0.06	0.06	0.08	0.07	0.11
base M + NFCI: BMF-SV	0.17 ***	0.08 **	0.05 *	0.06 **	0.04 **	-0.01	-0.03	0.01
base M-F: BMF-SV	0.05	0.00	-0.10	0.08	-0.04	-0.03	-0.08	-0.07
base M-F: BMF-factor-SV	0.18 *	-0.01	-0.26	-0.17	-0.29	-0.22	-0.25	-0.28
base M-F + small weekly: BMF-SV	-0.03	-0.05	-0.11	-0.09	-0.42	-0.32	-0.25	-0.19
base M-F + small weekly: BMF-factor-SV	0.23 **	-0.00	-0.09	-0.10	-0.21	-0.24	-0.25	-0.36
base M-F + large weekly: BMF-factor-SV	0.23 **	-0.06	-0.15	-0.23	-0.28	-0.21	-0.28	-0.28

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 15% 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 A16: **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
	5% quantile score							
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
	5% coverage							
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 A17: **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 A18: **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.
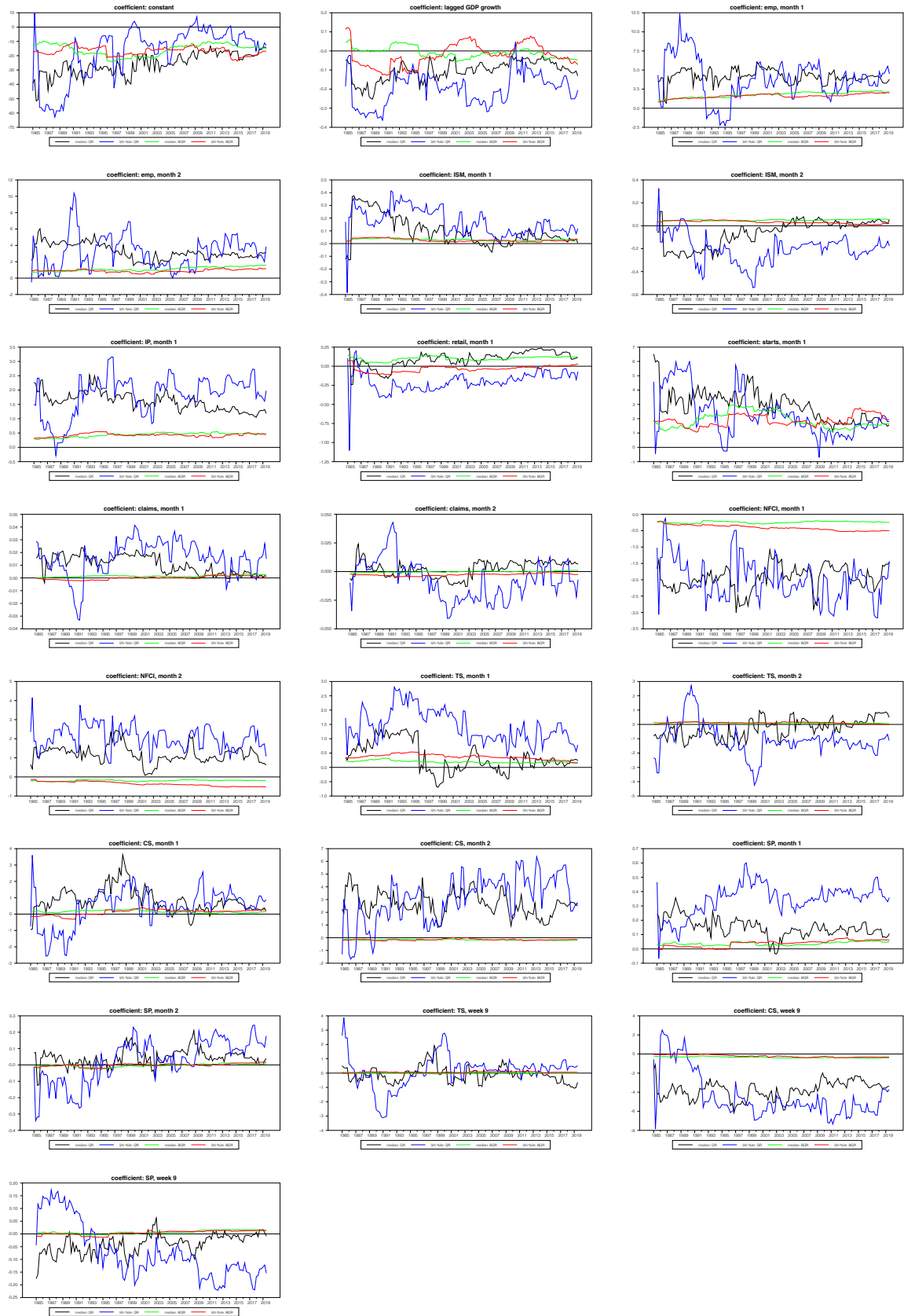
Figure A1: Recursively estimated coefficients from QR and BQR specifications, 50% (median) and 5% quantiles, base M-F variable set. The QR estimates shown are from a joint specification in which a single model is estimated with the full set of indicators available at the forecast origin.