The evolving impact of global, region-specific and country-specific uncertainty: Online supplementary appendix

Annex I - Model specification and estimation

1 Model

The FAVAR model is defined as

$$
\begin{aligned}
X_{it} &= B_{i,t}^{W}F_{t}^{W} + B_{i,t}^{R}F_{t}^{R} + B_{i,t}^{C}F_{t}^{C} + v_{it} && (1)\\
B_{i,t} &= B_{i,t-1} + \left(Q_{i}^{B}\right)^{1/2}U_{t} \text{ where } B_{i,t} = [B_{i,t}^{W}; B_{i,t}^{R}; B_{i,t}^{C}] && (2)\\
F_{t}^{W} &= c^{W} + \sum_{j=1}^{P}\beta_{j}^{W}F_{t-j}^{W} + \left(\Omega_{t}^{W}\right)^{1/2}e_{t}^{W} && (3)\\
F_{t}^{R} &= c^{R} + \sum_{j=1}^{P}\beta_{j}^{R}F_{t-j}^{R} + \left(\Omega_{t}^{R}\right)^{1/2}e_{t}^{R} && (4)\\
F_{t}^{C} &= c^{C} + \sum_{j=1}^{P}\beta_{j}^{C}F_{t-j}^{C} + \left(\Omega_{t}^{C}\right)^{1/2}e_{t}^{C} && (5)\\
v_{it} &= \sum_{j=1}^{J}\rho_{j}v_{it-j} + h_{it}^{1/2}\varepsilon_{it} && (6)\\
R_{t} &= diag(h_{1t}, ..h_{Nt}) && (7)\\
\Omega_{t}^{W} &= \left(A^{W}\right)^{-1}H_{t}^{W}\left(A^{W}\right)^{-1\prime}, H_{t}^{W} = diag(S_{k}^{W}\lambda_{t}^{W}), k = 1,2,..N && (8)\\
\Omega_{t}^{R} &= \left(A^{R}\right)^{-1}H_{t}^{R}\left(A^{R}\right)^{-1\prime}, H_{t}^{R} = diag(S_{k}^{R}\lambda_{t}^{R}), k = 1,2,..N && (9)\\
\Omega_{t}^{C} &= \left(A^{C}\right)^{-1}H_{t}^{C}\left(A^{C}\right)^{-1\prime}, H_{t}^{C} = diag(S_{k}^{C}\lambda_{t}^{C}), k = 1,2,..N && (10)\\
\ln\lambda_{t}^{W} &= \alpha^{W} + \beta^{W}\ln\lambda_{t-1}^{W} + \left(Q^{W}\right)^{1/2}\eta_{t}^{W} && (11)\\
\ln\lambda_{t}^{R} &= \alpha^{R} + \beta^{R}\ln\lambda_{t-1}^{R} + \left(Q^{R}\right)^{1/2}\eta_{t}^{R} && (12)\\
\ln\lambda_{t}^{C} &= \alpha^{C} + \beta^{C}\ln\lambda_{t-1}^{C} + \left(Q^{C}\right)^{1/2}\eta_{t}^{C} && (13)\\
\ln h_{it} &= a_{i} + b_{i}\ln h_{it-1} + q_{i}^{1/2}n_{it} && (14)\\
& U_{t}, \varepsilon_{it}, e_{t}^{W}, e_{t}^{R}, e_{t}^{C}, \eta_{t}^{W}, \eta_{t}^{R}, \eta_{t}^{C}, n_{it} \tilde{} N(0,1) && (15)
\end{aligned}
$$

2 Estimation

2.1 Priors and starting values

2.1.1 Factor loadings and factors

The initial values for $B_{i,t}^{j}$ is normal and is assumed to be $N\left(B_{i,0}, V_{B}\right)$ where $B_{i,0}$ is set equal to the loadings obtained using a principal component estimate of $F_{t} = [F_{t}^{W}, F_{t}^{R}, F_{t}^{C}]$ over $T_{0} = 40$ observations. The variance $V_{i,B}$ is assumed to be equal to the OLS estimate of the coefficient covariance. The prior for Q_{i}^{B} is inverse Wishart with scale matrix $Q_{i,0}^{B} = V_{i,B} \times T_{0} \times \kappa$ where $\kappa = 3.5 \times 10^{-4}$ as in Cogley and Sargent (2005) and prior degrees of freedom $TT_{0} = \dim Q_{i,0}^{B} + 1$.

The initial estimate of the factors F_{t}^{PC} provides the initial value of the factors $F_{0\backslash 0}$ with the initial variance set equal to the identity matrix.

2.1.2 VAR Coefficients

Following Banbura et al. (2010) we introduce a natural conjugate prior for the VAR parameters $\tilde{b}^{j} = \{c^{j}, \beta^{j}\}$ via dummy observations for $j = W, R, C$. In our application, the prior means are chosen as the OLS estimates of the coefficients of an AR(1) regression estimated for each endogenous variable using a training sample. The overall prior tightness of this prior $\tau = 0.1$.

A similar procedure is used to set the prior for ρ with prior tightness parameter $\tau_{\rho} = 1$

2.1.3 Elements of S, A and the parameters of the common volatility transition equation

The elements of $S^j, j = W, R, C$ have an inverse Gamma prior: $P(s_i^j)\tilde{}IG(S_{0,i}^j, V_0^j)$. The degrees of freedom V_0 are set equal to 1. The prior scale parameters are set by estimating the following regression: $\bar{\lambda}_{it}^j = S_{0,i}^j \bar{\lambda}_t^j + \varepsilon_t^j$ where $\bar{\lambda}_t^j$ is the first principal component of the stochastic volatilities $\bar{\lambda}_{it}^j$ obtained using a univariate stochastic volatility model for the residuals of each equation of the VAR in equation 3 estimated via OLS using the principal components F_t^{PC}.

The prior for the off-diagonal elements $A^j, j = W, R, C$ is $A_0 \sim N\left(\hat{a}^{ols}, V\left(\hat{a}^{ols}\right)\right)$ where $\hat{a}^{ols}$ are the off-diagonal elements of the inverse of the Cholesky decomposition of $\hat{v}^{ols}$, with each row scaled by the corresponding element on the diagonal. These OLS estimates are obtained using the initial VAR model described above. $V\left(\hat{a}^{ols}\right)$ is assumed to be diagonal with the elements set equal to 10 times the absolute value of the corresponding element of $\hat{a}^{ols}$.

We set a normal prior for the unconditional mean $\mu^j = \frac{\alpha^j}{1-\beta^j}$ for $j = W, R, C$. This prior is $N(\mu_0, Z_0)$ where $\mu_0 = 0$ and $Z_0 = 10$.The prior for Q^j is $IG\left(Q_0, V_{Q0}\right)$ where Q_0 is the average of the variances of the transition equations of the initial univariate stochastic volatility estimates and $V_{Q0} = 5$. The prior for β^j is $N\left(F_0, L_0\right)$ where $F_0 = 0.8$ and $L_0 = 1$.

2.1.4 Parameters of the idiosyncratic shock volatility transition equation

We set a normal prior for the unconditional mean $\tilde{\mu} = \frac{a}{1-b}$. This prior is $N(\mu_0, Z_0)$ where $\mu_0 = 0$ and $Z_0 = 10$.The prior for q_i is $IG\left(q_0, V_{q0}\right)$ where$q_0 = 0.01$ and $V_{q0} = 5$. The prior for b is $N\left(F_0, L_0\right)$ where $F_0 = 0.8$ and $L_0 = 1$.

2.2 Gibbs algorithm

Following Del Negro and Otrok (2008) we fix the initial conditions for the the stochastic volatilities to fix the scale of the factors. As discussed in Del Negro and Otrok (2008) the sign of the factors and factor loadings is not identified separately. Notice, however, that our interest does not focus on recovering these two objects separately in this exercise. We are instead interested in the volatility of the shocks to the factors and this is unaffected by switch in sign of the factors. In addition, as the product of the factors and the factor loadings is unaffected by the sign indeterminancy, we can recover the contribution of each variance component to the variance of X_{it}.

The Gibbs algorithm cycles through the steps described below. Note that the superscript $j = W, R, C$. Note also that $F_t = [F_t^W, F_t^R, F_t^C]$ and $B_{i,t} = [B_{i,t}^W; B_{i,t}^R; B_{i,t}^C]$. The coefficients of the transition equations are given by $\tilde{b}^j = \{c^j, \beta^j\}$.

1. $G\left(F_t \backslash \Xi\right)$: Given a draw for all other parameters (denoted by Ξ), the algorithm of Carter and Kohn (2004) is used to sample from the conditional posterior distribution of F_t. The state-space of the model is:

$$
\begin{aligned}
X_{it}^{**} &= B_{i,t} F_t^{**} + R_t^{1/2} \varepsilon_{it} \\
F_t &= \mu + f F_{t-1} + \breve{Q}_t^{1/2} E_t
\end{aligned}
$$

   where $X_{it}^{**} = X_{it} - \sum_{j=1}^{J} \rho_j X_{it-j}, F_t^{**} = \left(F_t - \sum_{j=1}^{J} \rho_j F_{it-j}\right)$, $E_t = \left[e_t^W; e_t^R; e_t^C\right]$ and $\breve{Q}_t$ is block diagonal matrix with $\Omega_t^W, \Omega_t^R, \Omega_t^C$ on the main diagonal. The conditional posterior is: $F_t \backslash X_{it}, \Xi \sim N\left(F_{T \backslash T}, P_{T \backslash T}\right)$ and $F_t \backslash F_{t+1}, X_{it}, \Xi \sim N\left(F_{t \backslash t+1, F_{t+1}}, P_{t \backslash t+1, F_{t+1}}\right)$ where $t = T-1, ..1$. As shown by Carter and Kohn (2004) the simulation proceeds as follows. First we use the Kalman filter to draw $F_{T \backslash T}$ and $P_{T \backslash T}$ and then proceed backwards in time using $F_{t|t+1} = F_{t|t} + P_{t|t} f' P_{t+1|t}^{-1} \left(F_{t+1} - f F_{t \backslash t} - \mu\right)$ and $P_{t|t+1} = P_{t|t} - P_{t|t} f' P_{t+1|t}^{-1} f P_{t|t}$. Here f denotes the autoregressive coefficients of the transition equations 3, 4, 5 in companion form, while μ denotes the pre-determined regressors in the transition equations in companion form.

2. $G\left(B_{i,t} \backslash \Xi\right)$: Given a draw for the factors and the variance of the idiosyncratic component and the serial correlation coefficients ρ_j, a separate linear time-varying parameter regression model with heteroscedasticity and serial correlation applies to each X_{it}. In particular, the model for each i is

$$
\begin{aligned}
X_{it} &= B_{i,t} F_t + v_{it} \\
v_{it} &= \sum_{j=1}^{J} \rho_j v_{it-j} + h_{it}^{1/2} \varepsilon_{it} \\
B_{i,t} &= B_{i,t-1} + \left(Q_i^B\right)^{1/2} U_t
\end{aligned}
$$

The model can be transformed to remove heteroscedasticity and serial correlation by creating $X_{it}^{*}=\frac{\left(X_{it}-\sum_{j=1}^{J}\rho_j X_{it-j}\right)}{\sqrt{h_{it}}}$, $\tilde{F}_t^{*}=\frac{\left(F_t-\sum_{j=1}^{J}\rho_j F_{it-j}\right)}{\sqrt{h_{it}}}$.This is then a linear state-space model for each i with iid disturbances with a unit variance and given Q^B the Carter and Kohn (2004) algorithm is used to draw from the conditional posterior of $B_{i,t}$.

3. $G\left(Q_i^B\backslash\Xi\right)$: Given $B_{i,t}$, this conditional posterior is inverse Wishart with scale matrix $(B_{i,t}-B_{i,t-1})+Q_{i,0}^B$ and degrees of freedom $T+TT_0$

4. $G\left(\rho\backslash\Xi\right)$: Given a draw for the factors, the factor loadings and the variances h_{it} , a heteroscedastic AR(j) regression applies to each i :

$$v_{it}=\sum_{j=1}^{J}\rho_j v_{it-j}+h_{it}^{1/2}\varepsilon_{it}$$

The heteroscedasticity can be removed by dividing both sides by $\sqrt{h_{it}}$. Letting, $y_{it}=\frac{v_{it}}{\sqrt{h_{it}}}$ and $x_{it}=\frac{[v_{it-1},v_{it-2},..v_{it-j}]}{\sqrt{h_{it}}}$ the conditional posterior for $\rho=[\rho_1,\rho_2,..,\rho_j]$ is normal $N\left(M^*,V^*\right)$:

$$\begin{aligned}M^* &= \left(V_\rho^{-1}+x_{it}'x_{it}\right)^{-1}\left(V_\rho^{-1}\rho_0+x_{it}'y_{it}\right)\\ V^* &= \left(V_\rho^{-1}+x_{it}'x_{it}\right)^{-1}\end{aligned}$$

where ρ_0 and V_ρ are the prior mean and variance for ρ.

5. $G\left(h_{it}\backslash\Xi\right)$: Given a draw for the factors, the parameters of the transition equation 14, the serial correlation coefficients ρ_j and the factor loadings $B_{i,t}$, a univariate stochastic volatility model applies for each i:

$$\begin{aligned}\tilde{v}_{it} &= h_{it}^{1/2}\varepsilon_{it}\\ \ln h_{it} &= a_i+b_i\ln h_{it-1}+q_i^{1/2}n_{it}\end{aligned}$$

where $\tilde{v}_{it}=v_{it}-\sum_{j=1}^{J}\rho_j v_{it-j}$. A particle Gibbs step (described below) is used to draw h_{it}.

6. $G(\tilde{b}^j\backslash\Xi)$.Given a draw of λ_t^j, the left and the right hand side variables of the VAR: $y_t=F_t$ and $x_t=[c,F_{t-1},F_{t-2},..F_{t-j}]$ can be transformed to remove the heteroscedasticity in the following manner

$$\tilde{y}_t=\frac{y_t}{\lambda_t^{1/2}},\tilde{x}_t=\frac{x_t}{\lambda_t^{1/2}}$$

Then the conditional posterior distribution for the VAR coefficients is standard and given by

$$N(\tilde{b}^*,\bar{\Omega}\otimes\left(X^{*\prime}X^*\right)^{-1})$$

where $\tilde{b}^*=\left(X^{*\prime}X^*\right)^{-1}\left(X^{*\prime}Y^*\right),\bar{\Omega}=A^{-1}diag(S)A^{-1\prime}$ and Y^* and X^* denote the transformed data appended with the dummy (prior) observations.

7. $G(A^j\backslash\Xi)$. Given a draw for the VAR parameters (equations 3, 4 and 5 respectively) the model can be written as $A^{j\prime}\left(v_t^j\right)=\tilde{e}_t^j$ where $v_t^j=F_t^j-\left(c^j+\sum_{p=1}^{P}\beta_p^j F_{t-p}^j\right)$ and $VAR\left(\tilde{e}_t^j\right)=H_t^j$. This is a system of linear equations with a known form of heteroscedasticity. The conditional distributions for a linear regression apply to each equation of this system after a simple GLS transformation to make the errors homoscedastic. The kth equation of this system is given as $v_{kt}^j=-\alpha v_{-kt}^k+\tilde{e}_{kt}^j$ where the subscript k denotes the kth column while $-k$ denotes columns 1 to $k-1$. Note that the variance of $\tilde{e}_{kt}^j$ is time-varying and given by $\lambda_t^j S_k^j$. A GLS transformation involves dividing both sides of the equation by $\sqrt{\lambda_t^j S_k^j}$ to produce $v_{kt}^{j*}=-\alpha v_{-kt}^{j*}+\tilde{e}_{kt}^{j*}$ where * denotes the transformed variables and $var\left(\tilde{e}_{kt}^{j*}\right)=1$. The conditional posterior for α^j is normal with mean and variance given by M^* and V^* :

$$\begin{aligned}M^* &= \left(V\left(\hat{a}^{ols}\right)^{-1}+v_{-kt}^{j*\prime}v_{-kt}^{j*}\right)^{-1}\left(V\left(\hat{a}^{ols}\right)^{-1}\hat{a}^{ols}+v_{-jt}^{j*\prime}v_{jt}^{j*}\right)\\ V^* &= \left(V\left(\hat{a}^{ols}\right)^{-1}+v_{-jt}^{j*\prime}v_{-jt}^{j*}\right)^{-1}\end{aligned}$$

8. $G(S^j \backslash \Xi)$. Given a draw for the VAR parameters (equations 3, 4 and 5 respectively), $A^{j\prime}\left(v_t^j\right) = \tilde{e}_t^j$. The kth equation of this system is given by $v_{kt}^j = -\alpha v_{-kt}^k + \tilde{e}_{kt}^j$ where the variance of e_{kt}^j is time-varying and given by $\lambda_t^j S_k^j$. Given a draw for λ_t^j this equation can be re-written as $\bar{v}_{kt}^j = -\alpha \bar{v}_{-kt}^j + \bar{e}_{kt}^j$ where $\bar{v}_{kt}^j = \frac{v_{kt}^j}{\lambda_t^{j,1/2}}$ and the variance of $\bar{e}_{kt}^j$ is S_k^j. The conditional posterior is for this variance is inverse Gamma with scale parameter $\bar{e}_{kt}^{j\prime}\bar{e}_{kt}^j + S_{0,j}$ and degrees of freedom $V_0 + T$.

9. Elements of λ_t^j. Conditional on the VAR coefficients, and the parameters of the volatility transition equation, the model has a multivariate non-linear state-space representation. Following recent developments in the seminal paper by Andrieuet al. (2010), we employ a particle Gibbs step to sample from the conditional posterior of $\tilde{h}_t^j = \ln \lambda_t^j$. Andrieuet al. (2010) show how a version of the particle filter, conditioned on a fixed trajectory for one of the particles can be used to produce draws that result in a Markov Kernel with a target distribution that is invariant. However, the usual problem of path degeneracy in the particle filter can result in poor mixing in the original version of particle Gibbs. Recent developments, however, suggest that small modifications of this algorithm can largely alleviate this problem. In particular, Lindsten et al. (2014) propose the addition of a step that involves sampling the 'ancestors' or indices associated with the particle that is being conditioned on. They show that this results in a substantial improvement in the mixing of the algorithm even with a few particles.[1] As explained in Lindsten et al. (2014), ancestor sampling breaks the reference path into pieces and this causes the particle system to collapse towards something different than the reference path. In the absence of this step, the particle system tends to collapse to the conditioning path. We employ particle Gibbs with ancestor sampling in this step.

Let $\tilde{h}_t^{(g-1)}$ denote the fixed the fixed trajectory, for $t = 1, 2, ..T$ obtained in the previous draw of the Gibbs algorithm $g - 1$. Here we suppress the superscript $j = W, R, C$ for notational simplicity. The algorithm is applied the three non-linear state space systems defined by the observation and transition equations:

$$
\begin{aligned}
F_t^j &= c^j + \sum_{p=1}^{P} \beta_p^j F_{t-p}^j + \left(\Omega_t^j\right)^{1/2} e_t^W \\
\Omega_t^j &= \left(A^j\right)^{-1} H_t^j \left(A^j\right)^{-1\prime}, H_t^j = diag(\lambda_t^j S^j) \\
\ln \lambda_t^j &= \alpha^j + \beta^j \ln \lambda_{t-1}^j + \left(Q^j\right)^{1/2} \eta_t^j
\end{aligned}
$$

We denote the remaining parameters of the model by Ξ, and $m = 1, 2, ..M$ represents the particles. The conditional particle filter with ancestor sampling proceeds in the following steps:

1. (a) For $t = 1$
   i. Draw $\tilde{h}_1^{(m)} \backslash \tilde{h}_0^{(m)}, \Xi$ for $m = 1, 2, ..M - 1$. Fix $\tilde{h}_1^{(M)} = \tilde{h}_1^{(g-1)}$
   ii. Compute the normalised weights $p_1^{(m)} = \frac{w_1^{(m)}}{\sum_{j=1}^{M} w_1^{(m)}}$ where $w_1^{(m)}$ denotes the conditional likelihood: $\left|\Omega_1^{(m)}\right|^{-0.5} - 0.5 \exp\left(e_1 \left(\Omega_1^{(m)}\right)^{-1} e_1'\right)$ where $e_1 = F_t - \left(c + \sum_{j=1}^{P} \beta_j F_{t-j}\right)$ and $\Omega_1^{(m)} = A^{-1} H_1^{(m)} A^{-1\prime}$ with $H_1^{(m)} = diag\left(\exp\left(\tilde{h}_1^{(m)}\right) S\right)$.

   (b) For $t = 2$ to T
   i. Resample $\tilde{h}_{t-1}^{(m)}$ for $m = 1, 2, ..M - 1$ using indices $a_t^{(m)}$ with $\Pr\left(a_t^{(m)} = m\right) \propto p_{t-1}^{(m)}$
   ii. Draw $\tilde{h}_t^{(m)} \backslash \tilde{h}_{t-1}^{(a_t^{(m)})}, \Xi$ for $m = 1, 2, ..M - 1$ using the transition equation of the model. Note that $\tilde{h}_{t-1}^{(a_t^{(m)})}$ denotes the resampled particles in step (a) above.
   iii. Fix $\tilde{h}_t^{(M)} = \tilde{h}_t^{(g-1)}$
   iv. Sample $a_t^{(M)}$ with $\Pr\left(a_t^{(M)} = m\right) \propto p_{t-1}^{(j)} \Pr\left(\tilde{h}_t^{(g-1)} \backslash \tilde{h}_{t-1}^{(m)}, \alpha^j, \beta^j, Q^j\right)$ where the density $\Pr\left(\tilde{h}_t^{(g-1)} \backslash \tilde{h}_{t-1}^{(j)}, \alpha^j, \beta^j, Q\right.$ is computed as $\left|Q^j\right|^{-0.5} - 0.5 \exp\left(\tilde{\eta}_t^{(m)} (Q)^{-1} \tilde{\eta}_t^{(m)}\right)$ where $\tilde{\eta}_t = \tilde{h}_t^{(g-1)} - \left(\alpha^j + \beta^j \tilde{h}_{t-1}^{(m)}\right)$. This constitutes the ancestor sampling step. If $a_t^{(M)} = M$ then the algorithm collapses to the simple particle Gibbs.

[1] See Nonejad (2015) for a recent application of this algorithm.

v. Update the weights $p_t^{(m)} = \frac{w_t^{(m)}}{\sum_{j=1}^M w_t^{(m)}}$ where $w_1^{(m)}$ denotes the conditional likelihood: $\left|\Omega_t^{(m)}\right|^{-0.5} - 0.5\exp\left(e_t\left(\Omega_t^{(m)}\right)^{-1}e_t'\right)$ where $e_t = F_t - \left(c + \sum_{j=1}^P \beta_j F_{t-j}\right)$ and $\Omega_t^{(m)} = A^{-1}H_t^{(m)}A^{-1\prime}$ with $H_t^{(m)} = diag\left(\exp\left(\tilde{h}_t^{(m)}\right)S^j\right)$.

vi. End

(c) Sample $\tilde{h}_t^{(g)}$ with $\Pr\left(\tilde{h}_t^{(g)} = \tilde{h}_t^{(m)}\right) \propto p_T^{(m)}$ to obtain a draw from the conditional posterior distribution

We use $M = 50$ particles in our application. The initial values μ_0 defined above are used to initialise step 1 of the filter.

8. $G(\alpha^j, \beta^j, Q^j \backslash \Xi)$.We re-write the transition equation in deviations from the mean (the superscript $j = W, R, C$ is supressed below for simplicity)

$$\tilde{h}_t - \mu = \beta\left(\tilde{h}_{t-1} - \mu\right) + \eta_t \tag{16}$$

where the elements of the mean vector μ are defined as $\frac{\alpha}{1-\beta}$. Conditional on a draw for $\tilde{h}_t$ and μ the transition equation 16 is a simply a linear regression and the standard normal and inverse Gamma conditional posteriors apply. Consider $\tilde{h}_t^* = \beta\tilde{h}_{t-1}^* + \eta_t, VAR(\eta_t) = Q$ and $\tilde{h}_t^* = \tilde{h}_t - \mu, \tilde{h}_{t-1}^* = \tilde{h}_{t-1} - \mu$. The conditional posterior of β is $N(\theta^*, L^*)$ where

$$\begin{aligned}
\theta^* &= \left(L_0^{-1} + \frac{1}{Q}\tilde{h}_{t-1}^{*\prime}\tilde{h}_{t-1}^*\right)^{-1}\left(L_0^{-1}F_0 + \frac{1}{Q}\tilde{h}_{t-1}^{*\prime}\tilde{h}_t^*\right) \\
L^* &= \left(L_0^{-1} + \frac{1}{Q}\tilde{h}_{t-1}^{*\prime}\tilde{h}_{t-1}^*\right)^{-1}
\end{aligned}$$

The conditional posterior of Q is inverse Gamma with scale parameter $\eta_t'\eta_t + Q_0$ and degrees of freedom $T + V_{Q0}$.

Given a draw for β, equation 16 can be expressed as $\bar{\Delta}\tilde{h}_t = C\mu + \eta_t$ where $\bar{\Delta}\tilde{h}_t = \tilde{h}_t - \beta\tilde{h}_{t-1}$ and $C = 1 - \beta$. The conditional posterior of μ is $N(\mu^*, Z^*)$ where

$$\begin{aligned}
\mu^* &= \left(Z_0^{-1} + \frac{1}{Q}C'C\right)^{-1}\left(Z_0^{-1}\mu_0 + \frac{1}{Q}C'\bar{\Delta}\tilde{h}_t\right) \\
Z^* &= \left(Z_0^{-1} + \frac{1}{Q}C'C\right)^{-1}
\end{aligned}$$

Note that α can be recovered as $\mu(1-\beta)$

9. $G(a_i, b_i, q_i \backslash \Xi)$. Given a draw for h_{it}, the conditional posterior distributions for the parameters of the transition equations 14 are as described in step 8.

2.3 A Monte-Carlo experiment

In order to examine the performance of this algorithm, we consider a small Monte-Carlo experiment

2.3.1 Data Generating Process

We generate data from the following DGP:

$$X_{it} = B_{i,t}^W F_t^W + B_{i,t}^R F_t^R + B_{i,t}^C F_t^C + v_{it} \tag{17}$$

where X_{it} is assumed to consist of eighty series (i.e. twenty series for four countries and two regions). That is $i = 1, 2, .., 80$. The number of observations is assumed to be 340 with the first 100 observations discarded to remove the influence of initial conditions: $t = 1, 2, .., 240$. The number of factors $K = 2$. The factor dynamics are given as:

$$F_t^J = \sum_{j=1}^2 \beta_j^J F_{t-j}^J + \left(\Omega_t^J\right)^{1/2} e_t^J, e_t^J \tilde{} N(0,1) \tag{18}$$

where:

$$\beta^W = \beta^R = \begin{pmatrix} 0.7 & 0.05 & 0.05 & 0.05 \\ 0.05 & 0.7 & 0.05 & 0.05 \end{pmatrix} \quad (19)$$

$$\beta^C = \begin{pmatrix} 0.7 & 0.2 & 0.05 & 0.05 \\ -0.05 & 0.7 & -0.05 & 0.2 \end{pmatrix}$$

$$\left(\Omega_t^J\right) = \begin{pmatrix} 1 & 0 \\ 0.01 & 1 \end{pmatrix}^{-1} \begin{pmatrix} \lambda_t^J & 0 \\ 0 & 2\lambda_t^J \end{pmatrix} \begin{pmatrix} 1 & 0 \\ 0.01 & 1 \end{pmatrix}^{-1\prime} \quad (20)$$

The stochastic volatilties evolve as:

$$\ln \lambda_t^J = 0.9 \ln \lambda_{t-1}^J + (0.1)^{1/2} \eta_t^J, \eta_t^J \tilde{} N(0,1)$$

The time-varying factor loadings $B_{i,t} = \begin{pmatrix} vec\left(B_{i,t}^W\right) \\ vec\left(B_{i,t}^R\right) \\ vec\left(B_{i,t}^C\right) \end{pmatrix}$ evolve as:

$$B_{i,t} = B_{i,t-1} + \left(Q_i^B\right)^{1/2} U_{it}, U_{it}, N(0,1)$$

where $Q_i^B = I_{3(K(KP+1))} \times 0.01$

The idiosyncratic components are defined as

$$v_{it} = 0.9 v_{it-1} + h_{it}^{1/2} \varepsilon_{it}, \varepsilon_{it} \tilde{} N(0,1)$$

where:

$$h_{it} = 0.9 h_{it-1} + (0.5)^{1/2} n_{it}, n_{it} \tilde{} N(0,1)$$

We generate 200 data sets. We generate the state-variables first. In each replication these are kept fixed when generating the data. For each of the 200 replications, the proposed MCMC algorithm is used to approximate the posterior distributions. The algorithm is run using 5000 iterations with inference based on the last 500 iterations.[2] Figure I.1 shows the estimates (median and 68% error band across iterations) and the true value of global, regional and country-specific uncertainty. Similarly Figures I.2 to I.4 present a comparison of the true contribution to the variance and the estimate across Monte-Carlo iterations. The figures shows that the estimates provide a reasonable approximation to the truth, despite the low number of MCMC iterations in each Monte-Carlo replication.

In Figure I.5 we also show the uncertainty estimates from the a restricted version of the model where the factor loadings are assumed to be fixed across time. The figure shows that the uncertainty estimates from the restricted model can deviate substantially from the truth in some cases. As discussed in the text, the results in Breitung and Eickmeier (2011) show that if time-variation in factor loadings is ignored, a larger number of factors are required to capture the common component. If the number of factors remain the same, then it is possible that the model may not fully capture the global, regional and country-specific component. As a consequence the volatility of shocks to these components would not accurately reflect the respective uncertainty measures.

2.4 Sensitivity Analysis

We re-estimate the benchmark model assuming an alternative prior for Q_i^B. The prior for Q_i^B is inverse Wishart with scale matrix $Q_{i,0}^B = V_{i,B} \times T_0 \times \kappa$ where $\kappa = 1 \times 10^{-4}$ instead of $\kappa = 3.5 \times 10^{-4}$ in the benchmark case.The prior degrees of freedom $TT_0 = \dim Q_{i,0}^B + 1$. Figures I.6 and I.7 present the the key variance decomposition results from this model. Figure I.6 shows that under this alternative prior, contributions to the variance of real activity indicators are very similar to the benchmark case. For example, as in the benchmark estimates, contributions of country-specific and global uncertainty decline over time when the considering the cross-country average and the European Countries. For North America there is an increase in the contribution of regional uncertainty while the role of global uncertainty remains fairly stable across time. Note that, the estimated contribution of regional uncertainty for Asia is larger than benchmark. Figure I.7 shows that, on average across countries, the estimated contributions to inflation volatility are very similar to benchmark. Similarly, the time-variation in the contributions for European countries retains the main features of the benchmark estimates. While the time-variation in the contributions to

[2] We limit the total iterations to 5000 to save computational time. For 200 Monte-Carlo iterations the experiment takes about 5 days to complete.

North American and Asian inflation volatility remains similar to benchmark, the role of regional uncertainty is estimated to be larger than benchmark. Overall. these estimates suggest that when an alternative prior is used, the broad results regarding the time-varying contributions remain close to benchmark. There are, however, some differences in the magnitude contributions for a few regions. This indicates that, as in all time-varying coefficient models, the prior for the variance of the shock to the transition equation remains important.

3 Convergence

Figure I.8 shows inefficiency factors for key parameters in the model. The inefficiency factors are low in most cases indicating some evidence in favour of convergence.

4 Fixed Factor loadings

In Figure I.9, we show a comparison between the estimate of global uncertainty from the benchmark model and this estimate obtained from a version of the model that restricts the factor loadings to be fixed across time. Restricting the time-variation in the factor loadings has important implications for the estimated uncertainty measure. In particular, the estimate from the restricted model appears to be more volatile than the benchmark estimate. This is evident from the behaviour of the measure during the two large increases in global uncertainty that occurred in the early 1980s (labelled 3 in Figure 1) and during the global financial crisis (labelled 15 in Figure 1). In both cases, the restricted model suggests that the increase in uncertainty is substantially less persistent than the benchmark case depicted in Figure 1. One possible reason for this difference may be that by erroneously restricting the factor loadings to be fixed across time, the uncertainty estimates from the restricted model are biased as they are based on the volatility of shocks to factors that do not fully capture the common component (see Breitung and Eickmeier, 2011).

5 References

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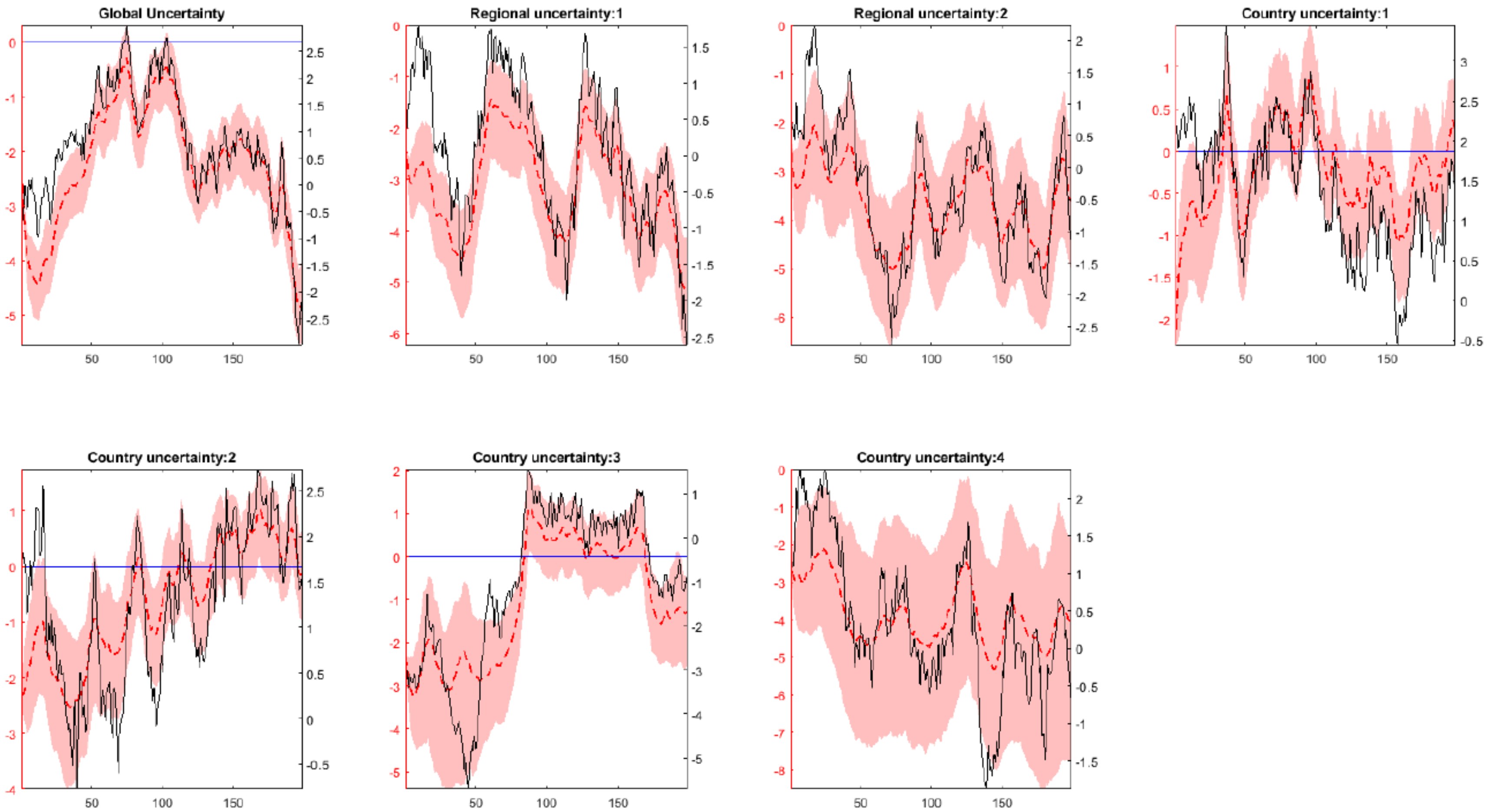


Figure I.1: True and estimated (log) uncertainty. The estimates (median and 68% error band across 200 Monte-Carlo iterations) are on the left axis. The true value (solid black line) is on the right axis.

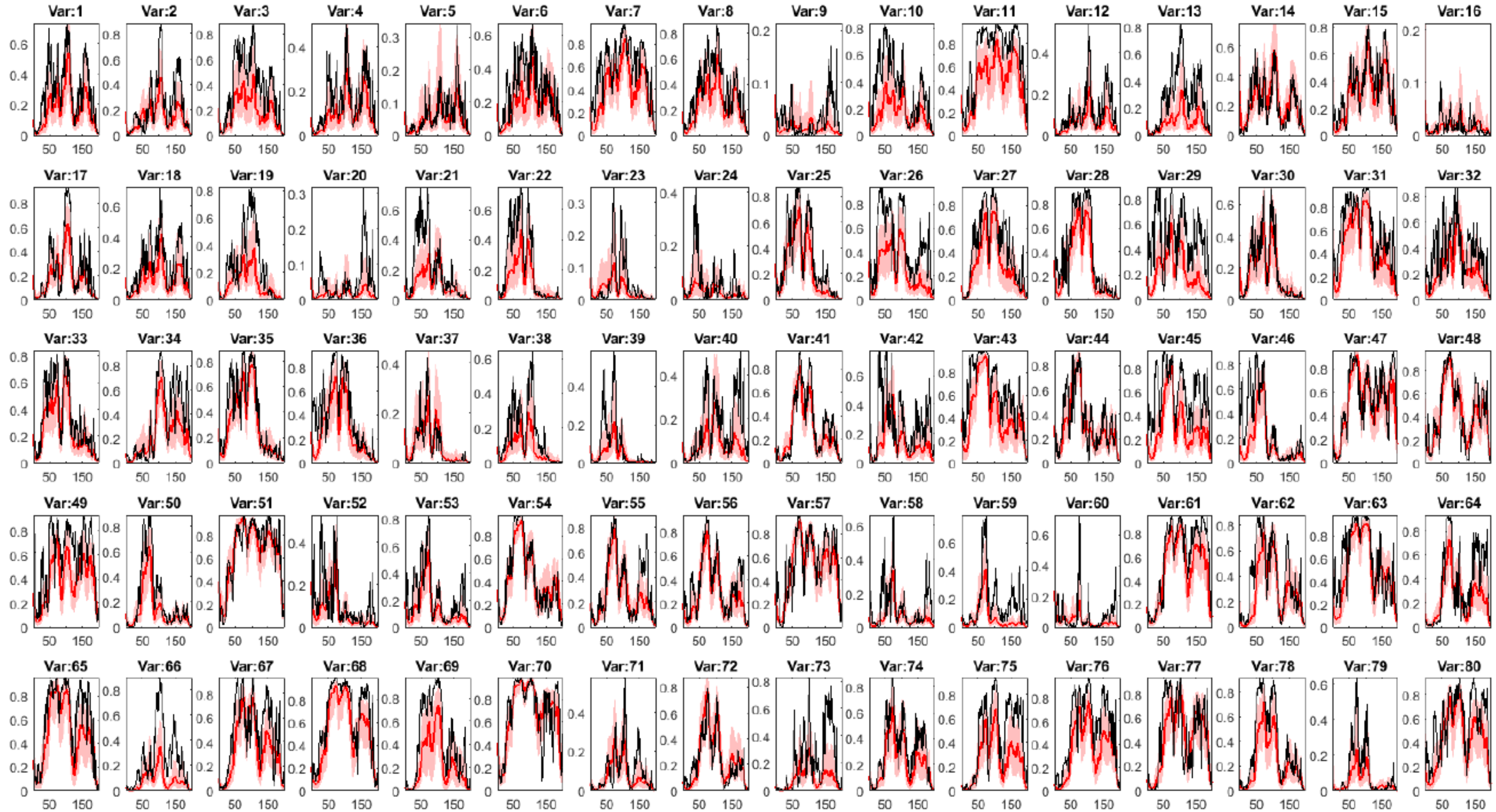


Figure I.2: Contribution of Global uncertainty. The estimates (median and 68% error band across 200 Monte-Carlo iterations) are shown in red. The true value is shown as a solid black line.

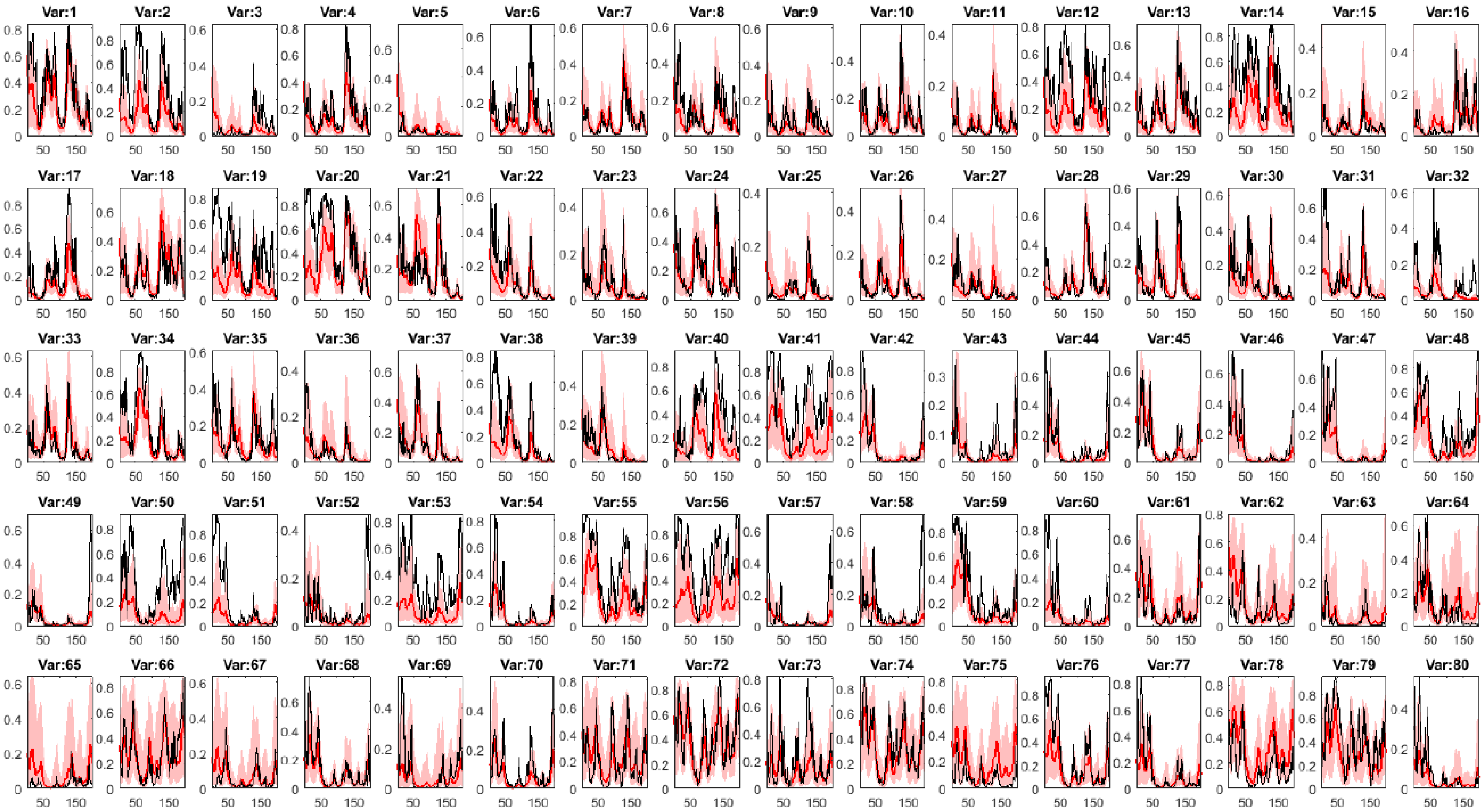


Figure I.3: Contribution of Regional uncertainty. The estimates (median and 68% error band across 200 Monte-Carlo iterations) are shown in red. The true value is shown as a solid black line.

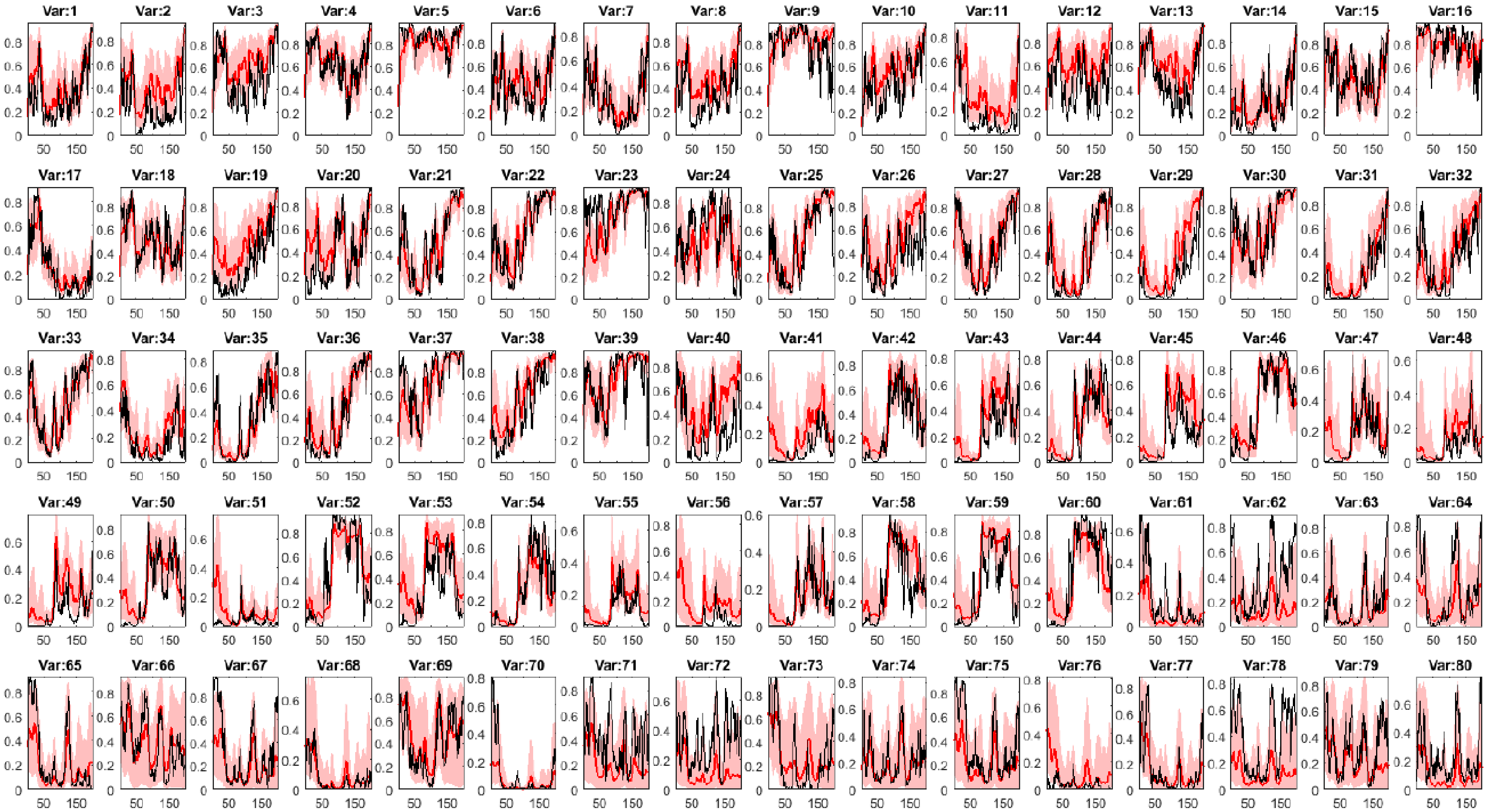


Figure I.4: Contribution of Country-Specific uncertainty. The estimates (median and 68% error band across 200 Monte-Carlo iterations) are shown in red. The true value is shown as a solid black line.

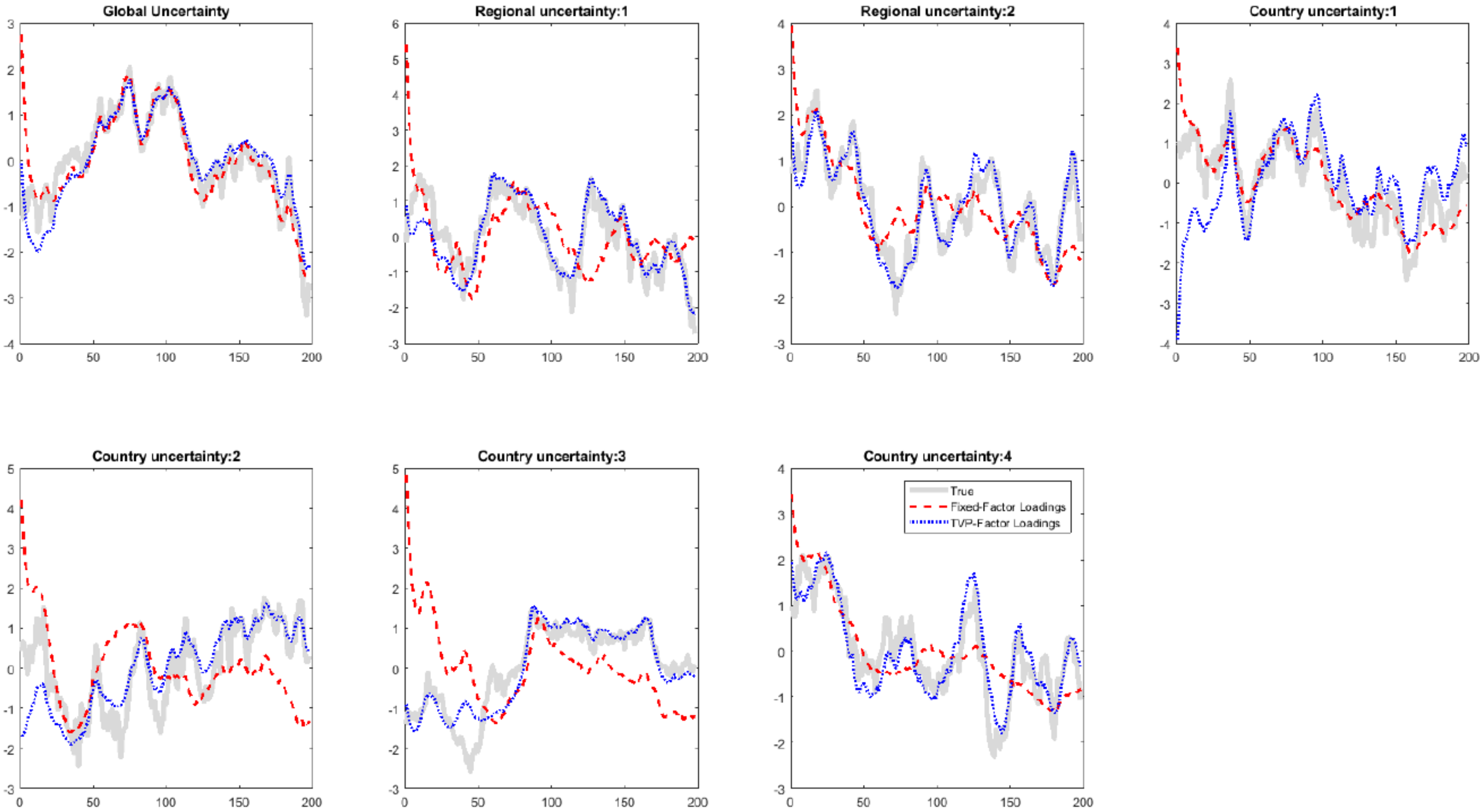


Figure I.5: Comparison of estimates from the time-varying and fixed factor loadings model.

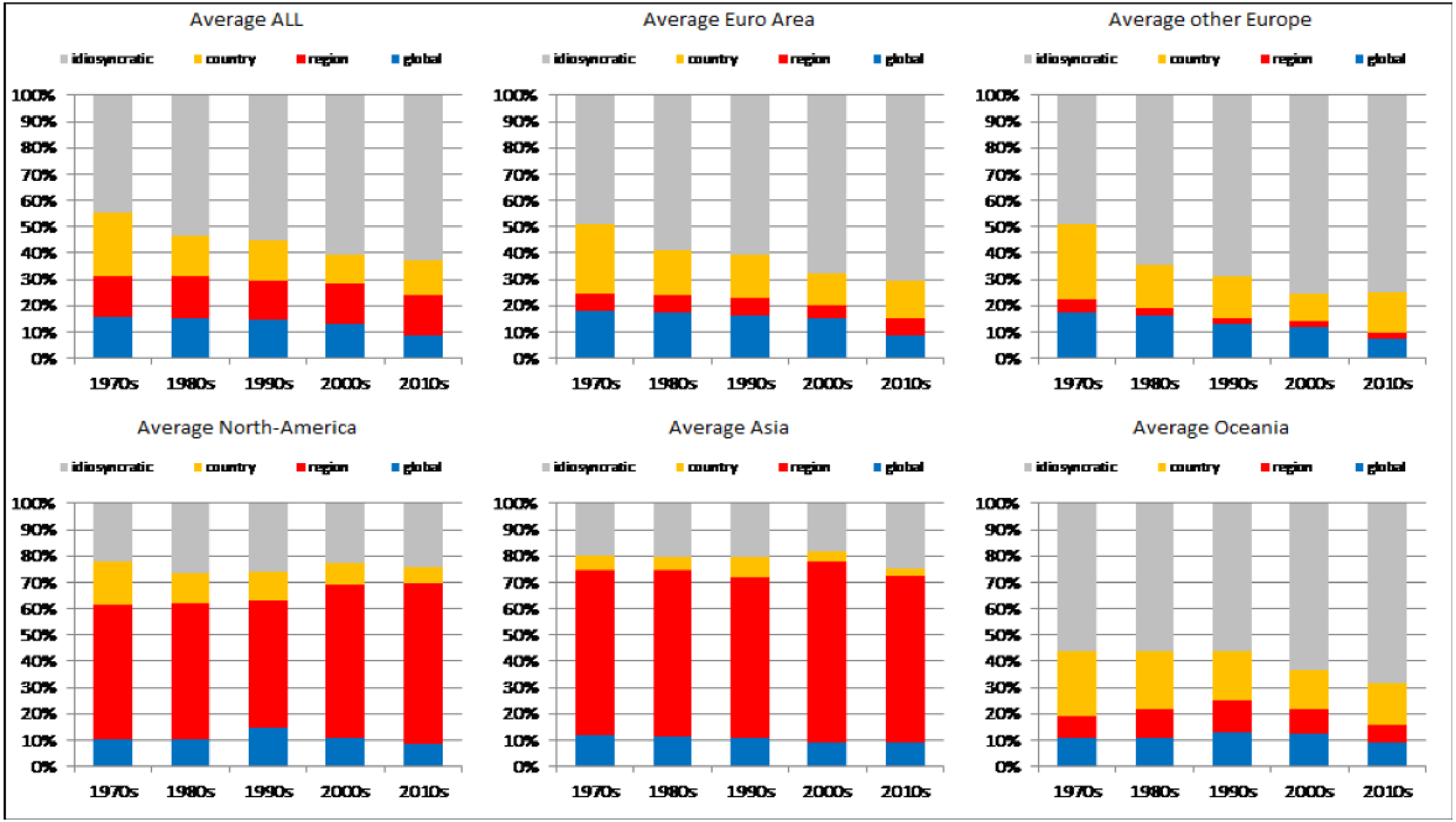


Figure I.6: Contribution to variance of real activity.

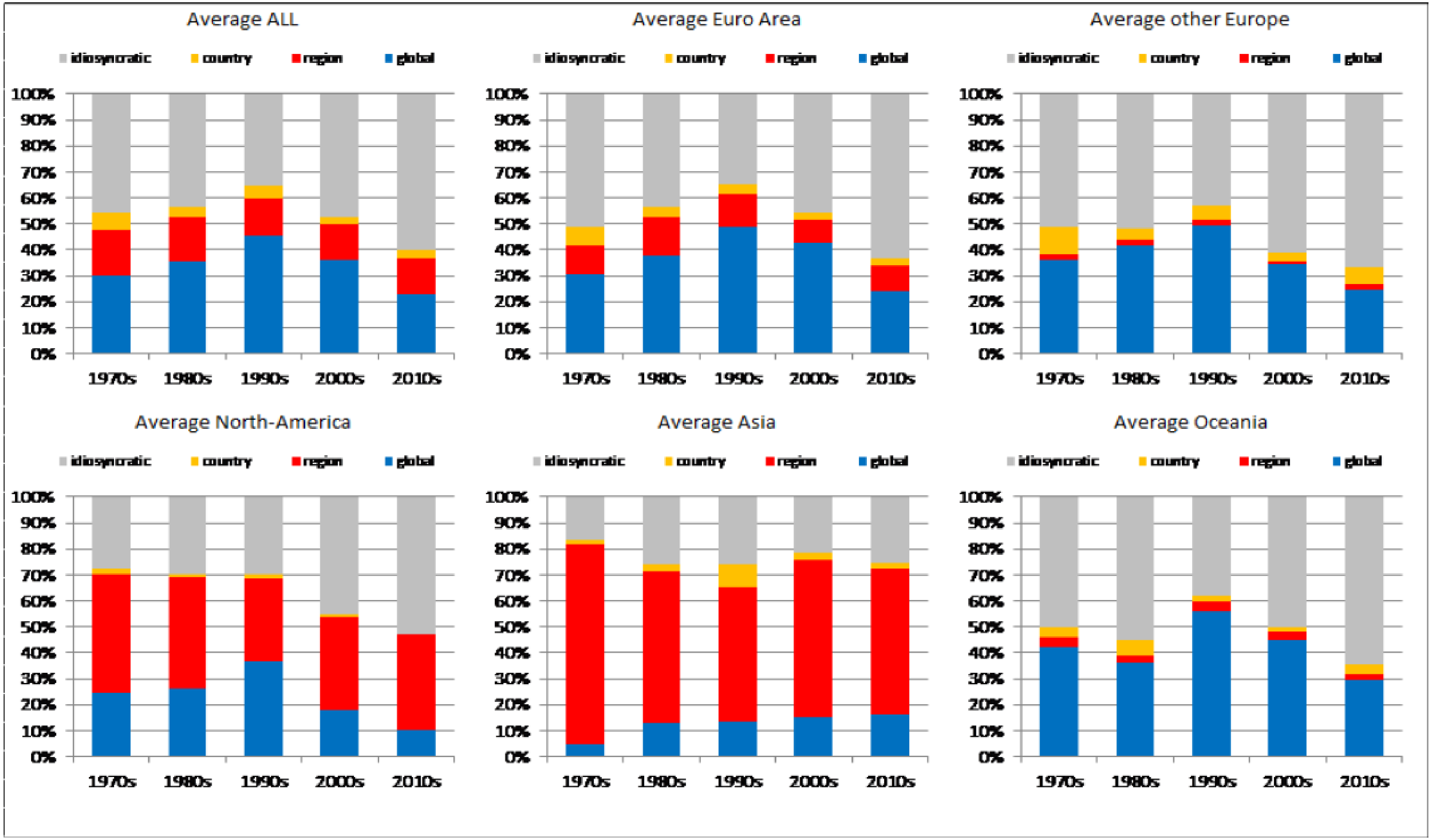


Figure I.7: Contribution to the variance of CPI inflation.

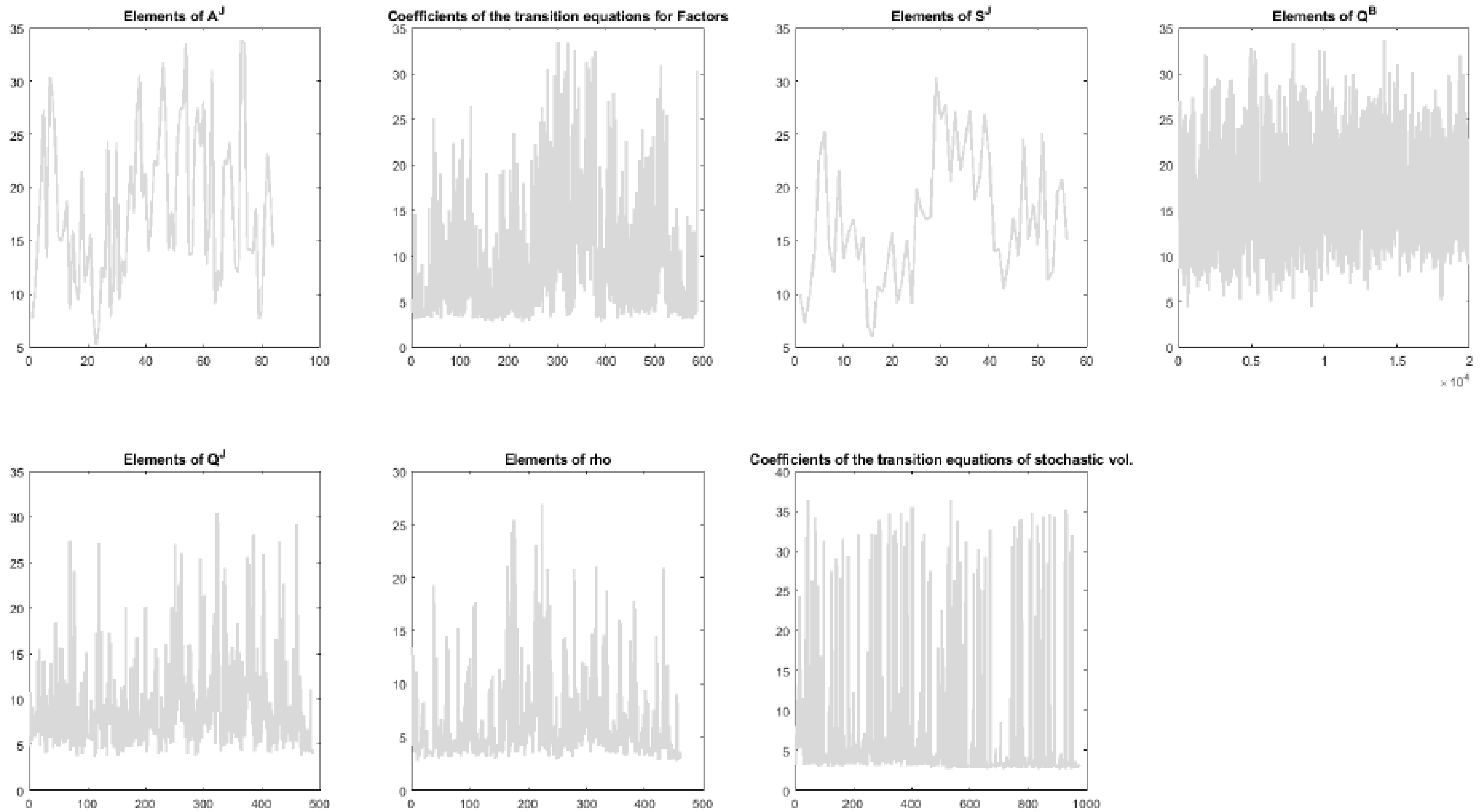


Figure I.8: Inefficiency Factors.

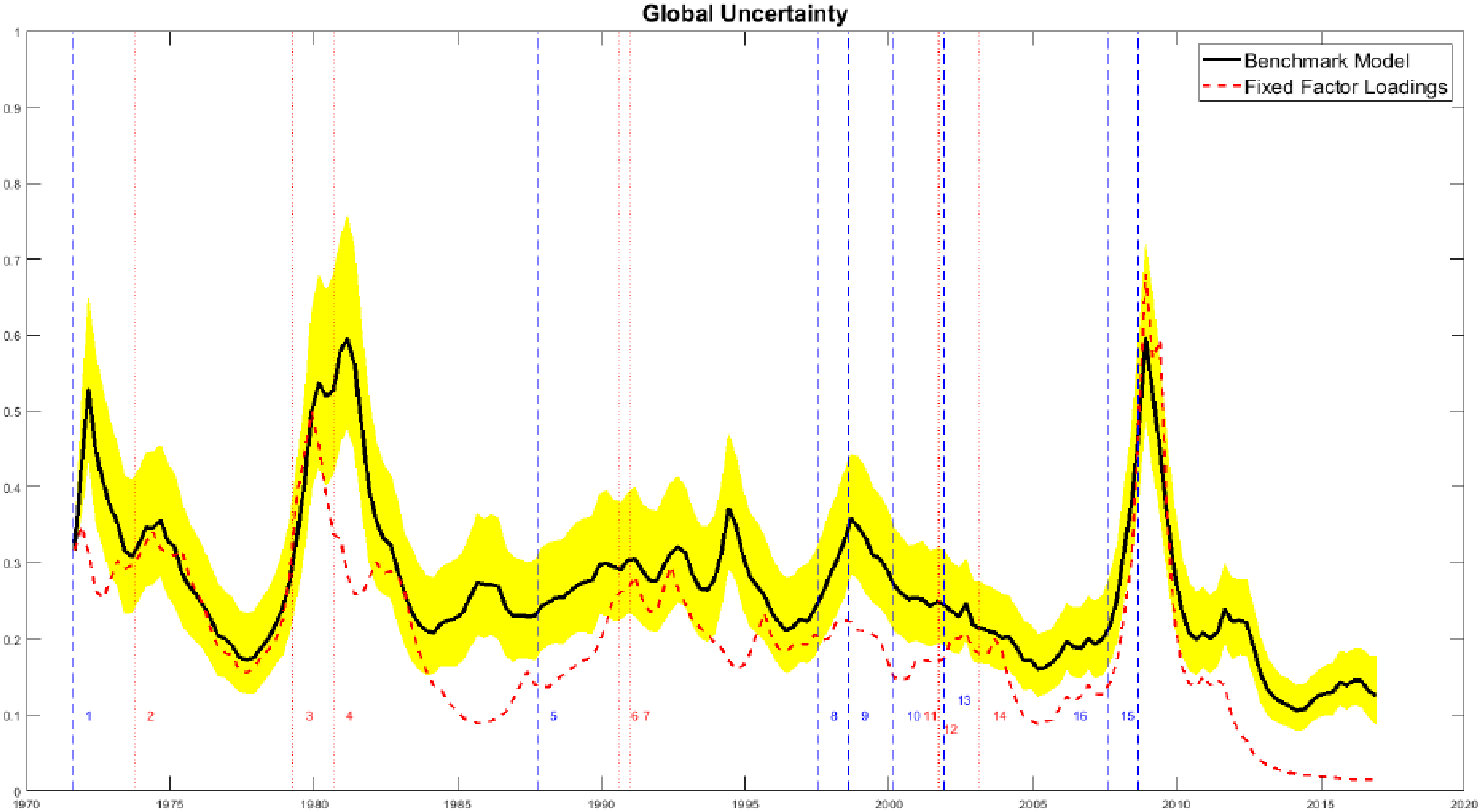


Figure I.9: Comparison of Global Uncertainty measures. Benchmark model vs a model with time-varying factor loadings.

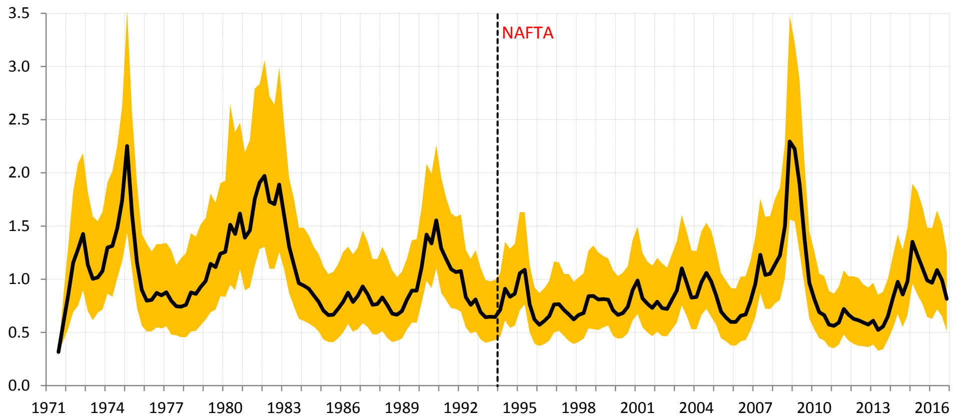
Annex II – Data: definitions and sources

Variable	Definition	Source
real GDP	Gross Domestic Product (GDP), volumes	BIS, Eurostat, IMF, OECD
real private consumption	Private final consumption expenditure, volumes	BIS, Eurostat, IMF, OECD
real gross fixed capital formation	Gross fixed capital formation, total, volume	BIS, Eurostat, IMF, OECD
real exports	Exports of goods and services, volume	BIS, Eurostat, IMF, OECD
real imports	Imports of goods and services, volume	BIS, Eurostat, IMF, OECD
employment	Total employment, number of people	BIS, ECB, IMF, OECD
unemployment rate	Unemployment rate, percetn of the labour force	BIS, ECB, IMF, OECD
industrial production	Industrial production, total industry excluding construction, index	ECB, IMF, OECD
retail sales	Sales, total retail trade, volume index	ECB, Fed, IMF, OECD
consumer prices	Consumer prices, index	ECB, OECD
stock prices	Stock prices, index	BIS, ECB, IMF, OECD
house prices	House prices, index	BIS, ECB, IMF, OECD
short-term interest rates	Three-month interest rates (Treasury bonds or 3-month Euribor), percent	BIS, ECB, IMF, OECD
long-term interest rates	Ten-year interest rate (government bond yield)	BIS, ECB, IMF, OECD
private sector credit	Total credit to the private sector, outstanding amounts	BIS, ECB, IMF, OECD
bank loans	Bank loans to the non-financial private sector, outstanding amounts	BIS, ECB, IMF, OECD
narrow money	M1	BIS, ECB, IMF, OECD
broad money	M3 (or M2, or M4)	BIS, ECB, IMF, OECD
nominal effective exchange rate	Nominal effective exchange rate	ECB, IMF
US dollar exchange rate	US dollar exchange rate (or SDRs per US dollar for the US), average of daily rates	ECB, IMF, OECD
Crude oil, average	Crude oil price, monthly average, nominal US dollars	World Bank
Natural gas	Natural gas price index, monthly average, nominal US dollars	World Bank
Agriculture: Beverages	Agriculture: Beverages, price index, monthly average, nominal US dollars	World Bank
Agriculture: Food	Agriculture: Food, price index, monthly average, nominal US dollars	World Bank
Agriculture: Raw Materials	Agriculture: Raw Materials, price index, monthly average, nominal US dollars	World Bank
Fertilizers	Fertilizers, price index, monthly average, nominal US dollars	World Bank
Metals & Minerals	Metals & Minerals, price index, monthly average, nominal US dollars	World Bank
Precious Metals	Precious Metals, price index, monthly average, nominal US dollars	World Bank

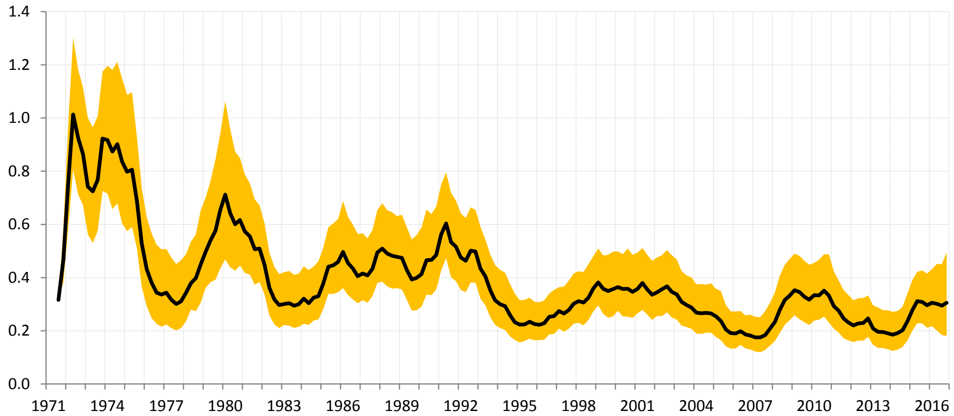
Annex III – Additional estimates

Chart A – Other region-specific uncertainty estimates

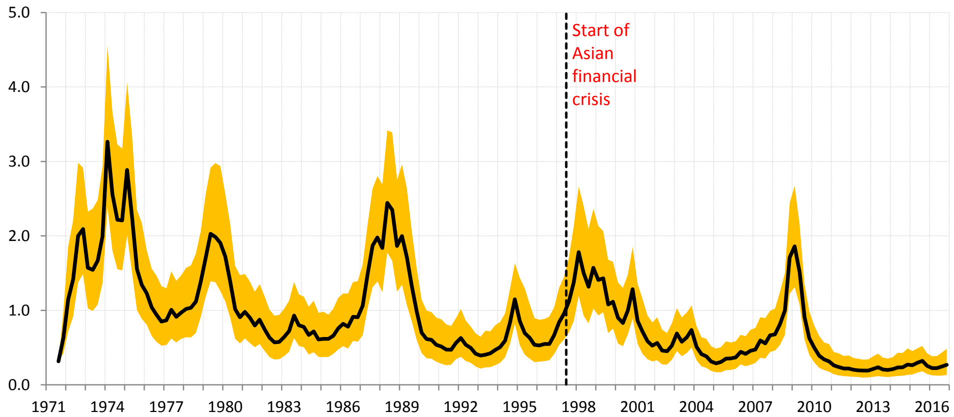
NORTH-AMERICA COMMON UNCERTAINTY



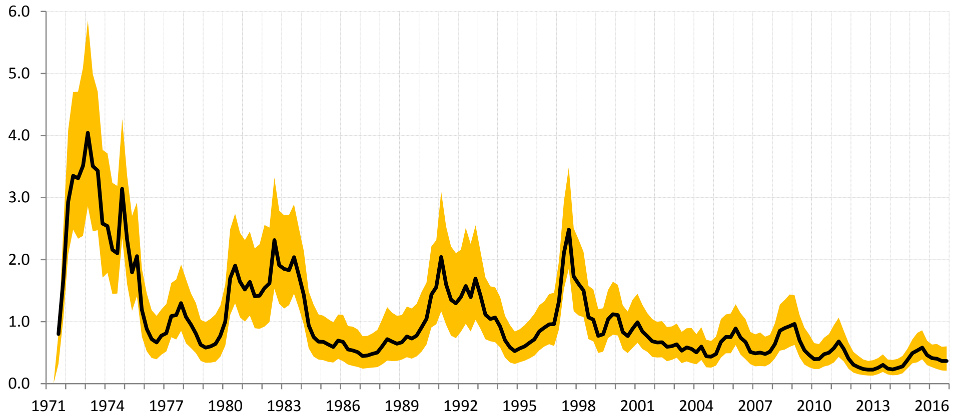
OTHER EUROPE COMMON UNCERTAINTY



ASIA COMMON UNCERTAINTY

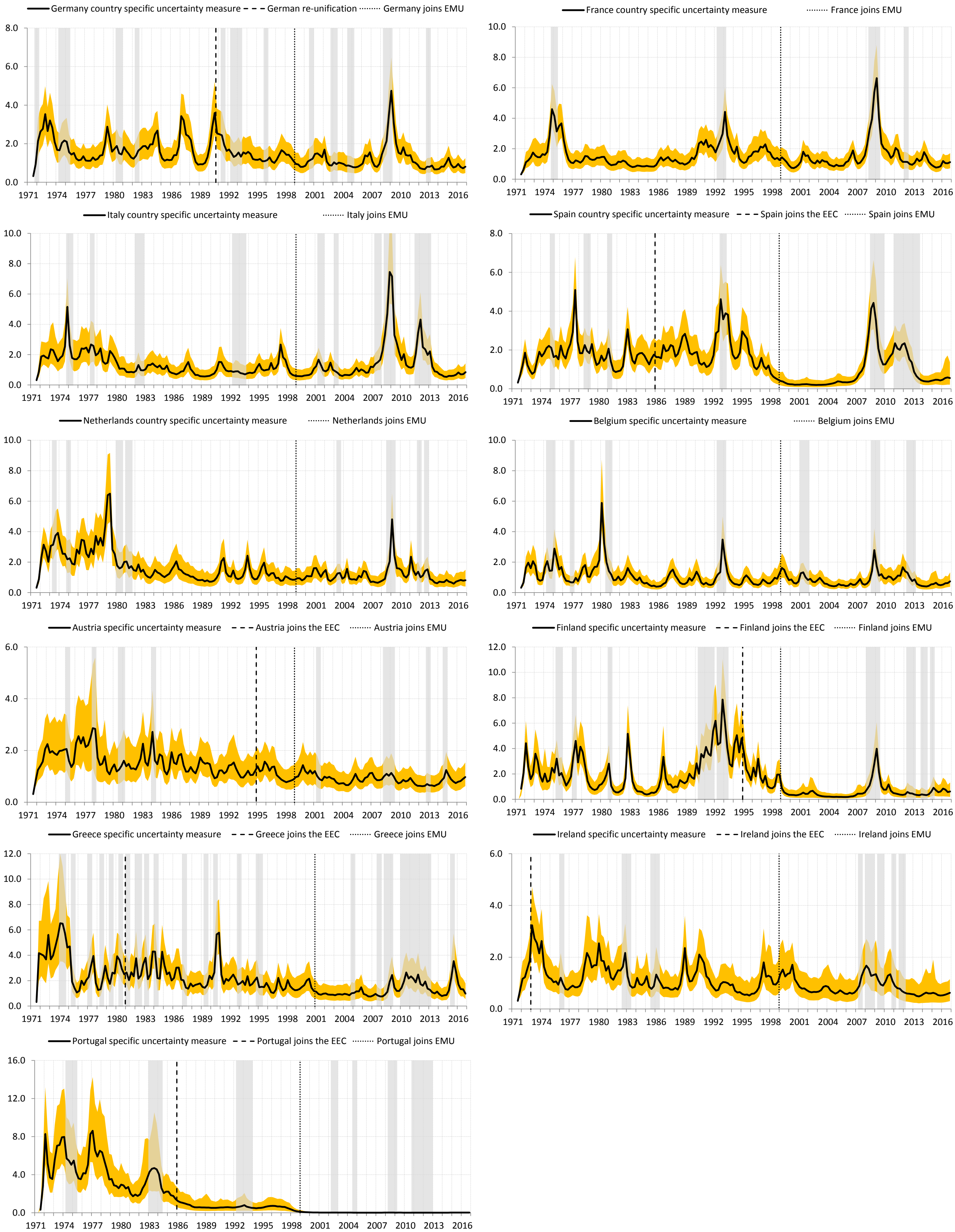


OCEANIA COMMON UNCERTAINTY



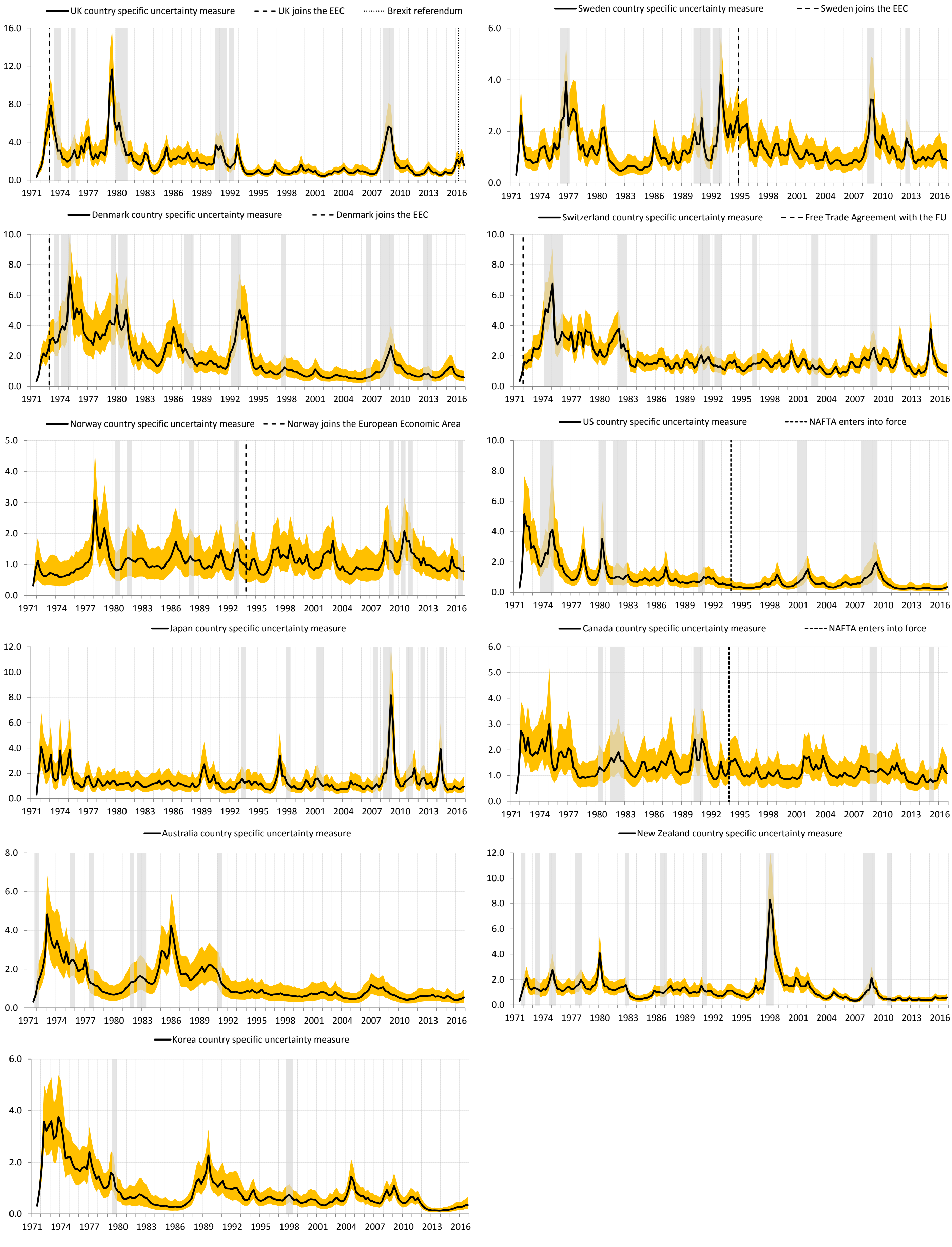
Notes: Estimate of the common standard deviation of shocks to region-specific factors (median and 68 percentile band).

Chart B – Euro Area country-specific uncertainty estimates



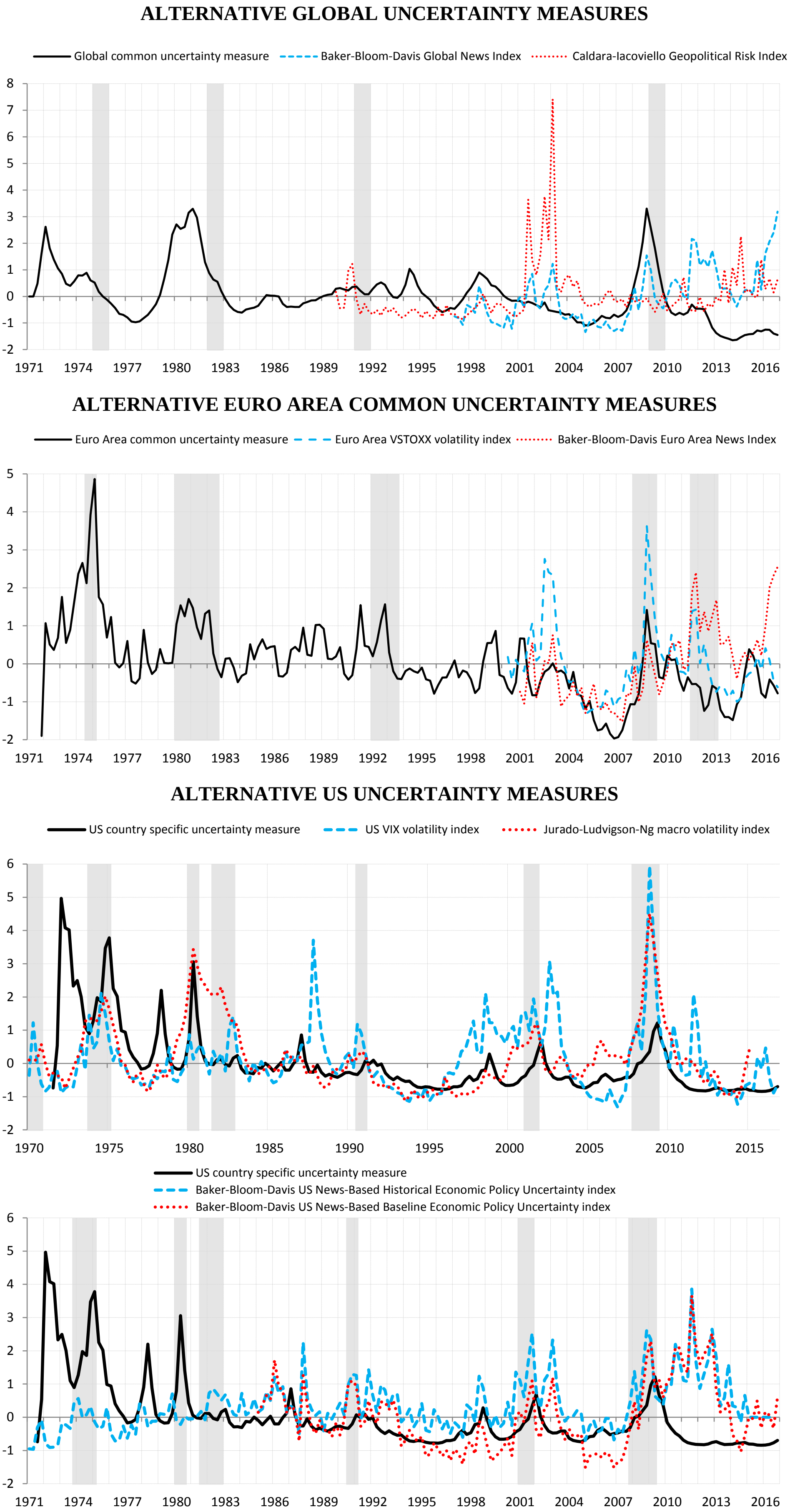
Notes: Estimate of the common standard deviation of shocks to the country factors (median and 68 percentile band). Grey areas delimit recessions as dated according to a “two or more consecutive quarters of negative quarterly real GDP growth” rule.

Chart C – Other country-specific uncertainty estimates



Notes: Estimate of the common standard deviation of shocks to the country factors (median and 68 percentile band). Grey areas delimit recessions as dated according to a “two or more consecutive quarters of negative quarterly real GDP growth” rule, except for the US, for which they are based on the NBER's Business Cycle Dating Committee.

Chart D – Alternative uncertainty indicators



Source: Baker, Bloom and Davies (2016), CEPR, ECB, Fed of St Louis FRED-QD, Jurado, Ludvigson, Ng (2015), IMF, NBER and own calculations.

Notes: All indicators normalised. Grey areas delimit global recessions as dated by the IMF (April 2009 World Economic Outlook, Box 1.1. on Global Business Cycles), Euro Area recessions as dated by the CEPR Euro Area Business Cycle Dating Committee, and US recessions as dated by the NBER's Business Cycle Dating Committee.

Table A – Cross-correlations among uncertainty measures

	Global	Euro Area	North-Am.	Oth. Eur.	Asia	Oceania	Germany	France	Italy	Spain	Netherlands	Belgium	Austria	Finland	Greece	Ireland	Portugal	UK	Sweden	Denmark	Switzerland	Norway	US	Canada	Japan	Australia	New Zealand	Korea
Global	1.00	0.48	0.56	0.57	0.48	0.48	0.49	0.35	0.31	0.29	0.29	0.53	0.14	0.31	0.37	0.53	0.22	0.50	0.24	0.43	0.27	0.02	0.50	0.31	0.38	0.16	0.31	0.37
Euro Area	0.48	1.00	0.53	0.75	0.64	0.53	0.41	0.38	0.25	0.34	0.36	0.51	0.49	0.32	0.51	0.46	0.48	0.41	0.12	0.65	0.66	0.00	0.60	0.55	0.31	0.51	0.50	0.24
North-America	0.56	0.53	1.00	0.41	0.35	0.40	0.52	0.43	0.40	0.17	0.27	0.39	0.22	0.20	0.40	0.41	0.26	0.42	0.03	0.37	0.52	-0.08	0.45	0.41	0.41	0.22	0.27	0.10
Other Europe	0.57	0.75	0.41	1.00	0.70	0.72	0.50	0.23	0.14	0.18	0.47	0.50	0.44	0.29	0.68	0.60	0.59	0.55	0.03	0.62	0.51	-0.15	0.77	0.61	0.27	0.60	0.75	0.24
Asia	0.48	0.64	0.35	0.70	1.00	0.47	0.46	0.26	0.28	0.25	0.46	0.45	0.44	0.13	0.44	0.54	0.48	0.50	0.04	0.52	0.51	-0.02	0.58	0.39	0.38	0.49	0.64	0.47
Oceania	0.48	0.53	0.40	0.72	0.47	1.00	0.49	0.22	0.19	0.12	0.33	0.34	0.44	0.39	0.64	0.60	0.62	0.37	0.02	0.39	0.39	-0.19	0.70	0.53	0.31	0.50	0.70	0.30
Germany	0.49	0.41	0.52	0.50	0.46	0.49	1.00	0.49	0.45	0.35	0.44	0.35	0.31	0.32	0.46	0.48	0.29	0.57	0.16	0.35	0.25	0.10	0.50	0.46	0.48	0.39	0.41	0.16
France	0.35	0.38	0.43	0.23	0.26	0.22	0.49	1.00	0.64	0.47	0.24	0.37	0.04	0.42	0.09	0.17	0.01	0.26	0.44	0.37	0.30	0.09	0.32	0.23	0.57	0.10	0.22	0.12
Italy	0.31	0.25	0.40	0.14	0.28	0.19	0.45	0.64	1.00	0.45	0.44	0.34	0.16	0.14	0.18	0.18	0.26	0.39	0.34	0.23	0.41	0.16	0.36	0.19	0.61	0.10	0.27	0.08
Spain	0.29	0.34	0.17	0.18	0.25	0.12	0.35	0.47	0.45	1.00	0.32	0.36	0.40	0.55	0.27	0.16	0.29	0.33	0.52	0.52	0.25	0.24	0.15	0.17	0.27	0.23	0.22	-0.03
Netherlands	0.29	0.36	0.27	0.47	0.46	0.33	0.44	0.24	0.44	0.32	1.00	0.31	0.52	0.20	0.36	0.44	0.63	0.62	0.27	0.59	0.56	0.25	0.47	0.29	0.32	0.32	0.56	0.12
Belgium	0.53	0.51	0.39	0.50	0.45	0.34	0.35	0.37	0.34	0.36	0.31	1.00	0.23	0.29	0.32	0.40	0.31	0.48	0.21	0.56	0.36	0.07	0.51	0.20	0.27	0.09	0.30	0.31
Austria	0.14	0.49	0.22	0.44	0.44	0.44	0.31	0.04	0.16	0.40	0.52	0.23	1.00	0.36	0.49	0.35	0.78	0.39	0.20	0.60	0.57	0.05	0.43	0.41	0.09	0.63	0.54	0.08
Finland	0.31	0.32	0.20	0.29	0.13	0.39	0.32	0.42	0.14	0.55	0.20	0.29	0.36	1.00	0.27	0.19	0.30	0.23	0.53	0.41	0.15	0.11	0.25	0.29	0.19	0.22	0.32	0.08
Greece	0.37	0.51	0.40	0.68	0.44	0.64	0.46	0.09	0.18	0.27	0.36	0.32	0.49	0.27	1.00	0.56	0.62	0.39	0.04	0.44	0.50	-0.11	0.52	0.52	0.26	0.56	0.57	0.10
Ireland	0.53	0.46	0.41	0.60	0.54	0.60	0.48	0.17	0.18	0.16	0.44	0.40	0.35	0.19	0.56	1.00	0.43	0.59	0.01	0.41	0.41	0.08	0.44	0.33	0.28	0.48	0.54	0.28
Portugal	0.22	0.48	0.26	0.59	0.48	0.62	0.29	0.01	0.26	0.29	0.63	0.31	0.78	0.30	0.62	0.43	1.00	0.47	0.17	0.62	0.63	-0.05	0.64	0.50	0.21	0.59	0.70	0.13
UK	0.50	0.41	0.42	0.55	0.50	0.37	0.57	0.26	0.39	0.33	0.62	0.48	0.39	0.23	0.39	0.59	0.47	1.00	0.20	0.58	0.34	0.10	0.44	0.27	0.27	0.39	0.50	0.12
Sweden	0.24	0.12	0.03	0.03	0.04	0.02	0.16	0.44	0.34	0.52	0.27	0.21	0.20	0.53	0.04	0.01	0.17	0.20	1.00	0.32	0.10	0.20	0.07	0.16	0.28	-0.04	0.14	0.07
Denmark	0.43	0.65	0.37	0.62	0.52	0.39	0.35	0.37	0.23	0.52	0.59	0.56	0.60	0.41	0.44	0.41	0.62	0.58	0.32	1.00	0.64	0.04	0.53	0.36	0.19	0.50	0.46	0.19
Switzerland	0.27	0.66	0.52	0.51	0.51	0.39	0.25	0.30	0.41	0.25	0.56	0.36	0.57	0.15	0.50	0.41	0.63	0.34	0.10	0.64	1.00	0.07	0.52	0.45	0.25	0.42	0.49	0.18
Norway	0.02	0.00	-0.08	-0.15	-0.02	-0.19	0.10	0.09	0.16	0.24	0.25	0.07	0.05	0.11	-0.11	0.08	-0.05	0.10	0.20	0.04	0.07	1.00	-0.10	-0.13	0.05	-0.17	-0.20	0.15
US	0.50	0.60	0.45	0.77	0.58	0.70	0.50	0.32	0.36	0.15	0.47	0.51	0.43	0.25	0.52	0.44	0.64	0.44	0.07	0.53	0.52	-0.10	1.00	0.61	0.45	0.49	0.67	0.25
Canada	0.31	0.55	0.41	0.61	0.39	0.53	0.46	0.23	0.19	0.17	0.29	0.20	0.41	0.29	0.52	0.33	0.50	0.27	0.16	0.36	0.45	-0.13	0.61	1.00	0.26	0.57	0.60	0.09
Japan	0.38	0.31	0.41	0.27	0.38	0.31	0.48	0.57	0.61	0.27	0.32	0.27	0.09	0.19	0.26	0.28	0.21	0.27	0.28	0.19	0.25	0.05	0.45	0.26	1.00	0.19	0.35	0.10
Australia	0.16	0.51	0.22	0.60	0.49	0.50	0.39	0.10	0.10	0.23	0.32	0.09	0.63	0.22	0.56	0.48	0.59	0.39	-0.04	0.50	0.42	-0.17	0.49	0.57	0.19	1.00	0.60	0.02
New Zealand	0.31	0.50	0.27	0.75	0.64	0.70	0.41	0.22	0.27	0.22	0.56	0.30	0.54	0.32	0.57	0.54	0.70	0.50	0.14	0.46	0.49	-0.20	0.67	0.60	0.35	0.60	1.00	0.16
Korea	0.37	0.24	0.10	0.24	0.47	0.30	0.16	0.12	0.08	-0.03	0.12	0.31	0.08	0.08	0.10	0.28	0.13	0.12	0.07	0.19	0.18	0.15	0.25	0.09	0.10	0.02	0.16	1.00

Notes: Contemporaneous correlations between pairs of uncertainty measures over 1971Q3-2016Q4.

Table B – Correlations between uncertainty measures, real GDP growth and CPI inflation

	correlation uncertainty - real GDP quarterly growth	correlation uncertainty - CPI inflation
Global	**-0.23**	**0.46**
Euro Area	**-0.14**	**0.56**
Germany	**-0.06**	**0.26**
France	**-0.47**	**0.03**
Italy	**-0.36**	**0.19**
Spain	**-0.33**	**0.37**
Netherlands	**-0.03**	**0.52**
Belgium	**-0.04**	**0.36**
Austria	0.09	**0.61**
Finland	**-0.19**	**0.20**
Greece	**-0.03**	**0.58**
Ireland	**-0.11**	**0.39**
Portugal	0.19	**0.76**
UK	**-0.10**	**0.53**
Sweden	**-0.37**	**0.12**
Denmark	**-0.05**	**0.68**
Switzerland	**-0.43**	**0.47**
Norway	**-0.16**	-0.01
US	**-0.02**	**0.45**
Canada	**-0.06**	**0.45**
Japan	**-0.23**	**0.23**
Australia	**-0.06**	**0.63**
New Zealand	0.06	**0.32**
Korea	**-0.24**	**0.28**

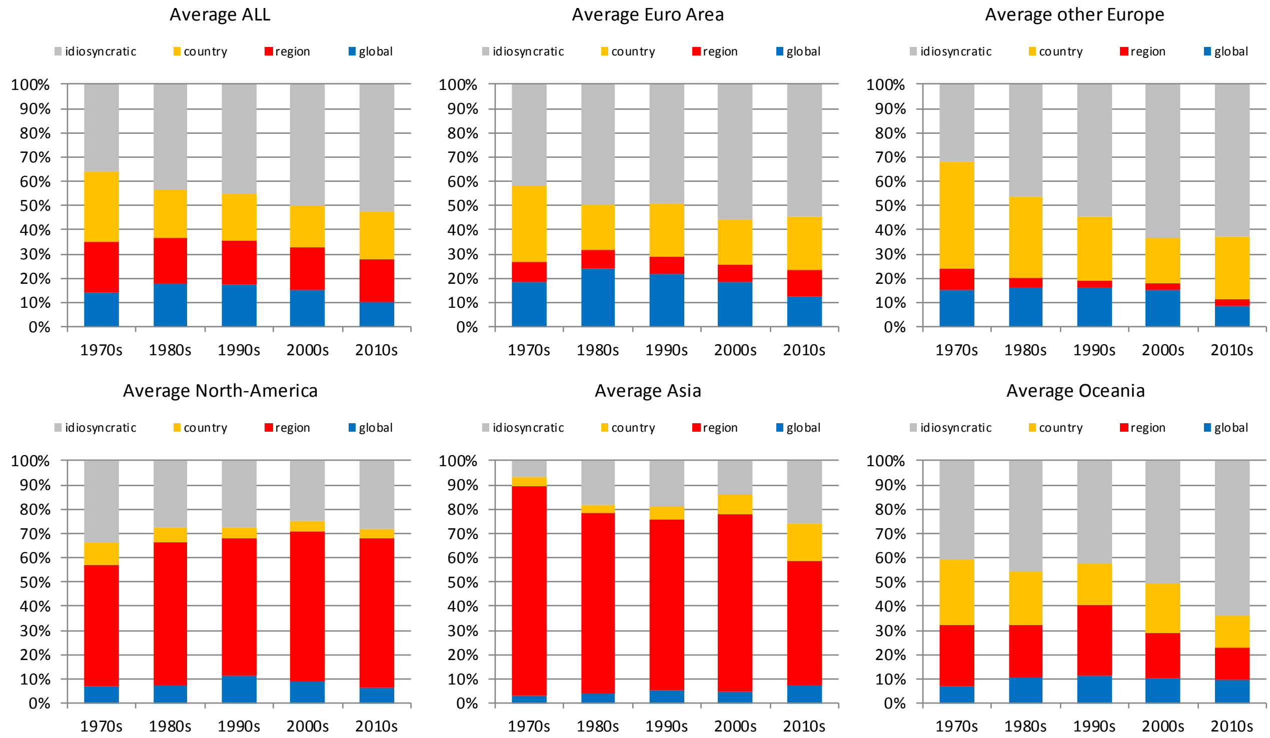
Source: ECB, Eurostat, OECD, own estimates.
Notes: The table reports the contemporaneous correlation between uncertainty measures and real GDP quarterly growth or CPI inflation over 1971Q3-2016Q4. Global real GDP (global CPI) is represented by the aggregate OECD real GDP (OECD CPI) as computed by the OECD and Euro Area real GDP (Euro Area CPI) is represented by the aggregate Euro Area real GDP (HICP) as reported in the Area Wide Model database. Negative values for the correlations with real GDP growth and positive values for the correlations with CPI inflation are highlighted.

Table C – Variance decompositions: contributions of uncertainty components to the volatility of real GDP growth

	global			region-specific			country-specific			idiosyncratic
	16th p.	median	84th p.	16th p.	median	84th p.	16th p.	median	84th p.	residual*
Germany	6%	18%	42%	6%	14%	28%	18%	37%	60%	31%
France	9%	22%	46%	10%	21%	38%	11%	25%	43%	32%
Italy	12%	27%	52%	2%	6%	14%	8%	18%	36%	49%
Spain	12%	24%	45%	1%	4%	11%	17%	33%	51%	39%
Netherlands	5%	14%	33%	5%	14%	28%	14%	32%	56%	40%
Belgium	18%	38%	63%	1%	3%	8%	12%	31%	58%	29%
Austria	7%	22%	48%	6%	16%	34%	2%	10%	24%	52%
Finland	10%	21%	42%	1%	2%	6%	7%	14%	26%	63%
Greece	3%	7%	19%	1%	3%	9%	9%	23%	52%	66%
Ireland	1%	7%	22%	0%	2%	7%	3%	12%	32%	79%
Portugal	6%	18%	41%	0%	1%	4%	2%	11%	28%	71%
UK	5%	12%	29%	0%	1%	3%	17%	33%	54%	54%
Sweden	6%	14%	31%	0%	1%	4%	19%	42%	69%	43%
Denmark	4%	10%	26%	1%	3%	9%	24%	37%	50%	49%
Switzerland	10%	25%	51%	4%	11%	26%	8%	19%	36%	45%
Norway	3%	11%	31%	2%	5%	10%	4%	16%	41%	67%
US	3%	10%	27%	30%	60%	84%	1%	3%	14%	27%
Canada	2%	7%	21%	28%	55%	79%	2%	8%	22%	30%
Japan	2%	6%	17%	34%	58%	79%	4%	13%	30%	23%
Australia	2%	6%	20%	8%	21%	42%	3%	10%	27%	63%
New Zealand	4%	14%	36%	7%	24%	53%	12%	30%	56%	32%
Korea	1%	4%	13%	64%	86%	96%	0%	1%	5%	9%
Av. Euro Area	8%	20%	41%	3%	8%	17%	10%	22%	42%	50%
Av. other Europe	5%	15%	34%	1%	4%	10%	14%	29%	50%	52%
Av. North-America	3%	8%	24%	29%	57%	81%	1%	6%	18%	29%
Av. Asia	1%	5%	15%	49%	72%	88%	2%	7%	18%	16%
Av. Oceania	3%	10%	28%	7%	22%	47%	7%	20%	41%	47%
Average ALL	6%	15%	34%	10%	19%	30%	9%	21%	40%	45%

Notes: Contributions of the global, region-specific, country-specific and idiosyncratic components to the variance of real GDP growth over the whole sample period 1971Q1-2016Q4. * Idiosyncratic contribution derived as residual.

Chart E – Variance decompositions: contributions of uncertainty components to the volatility of real GDP growth over time



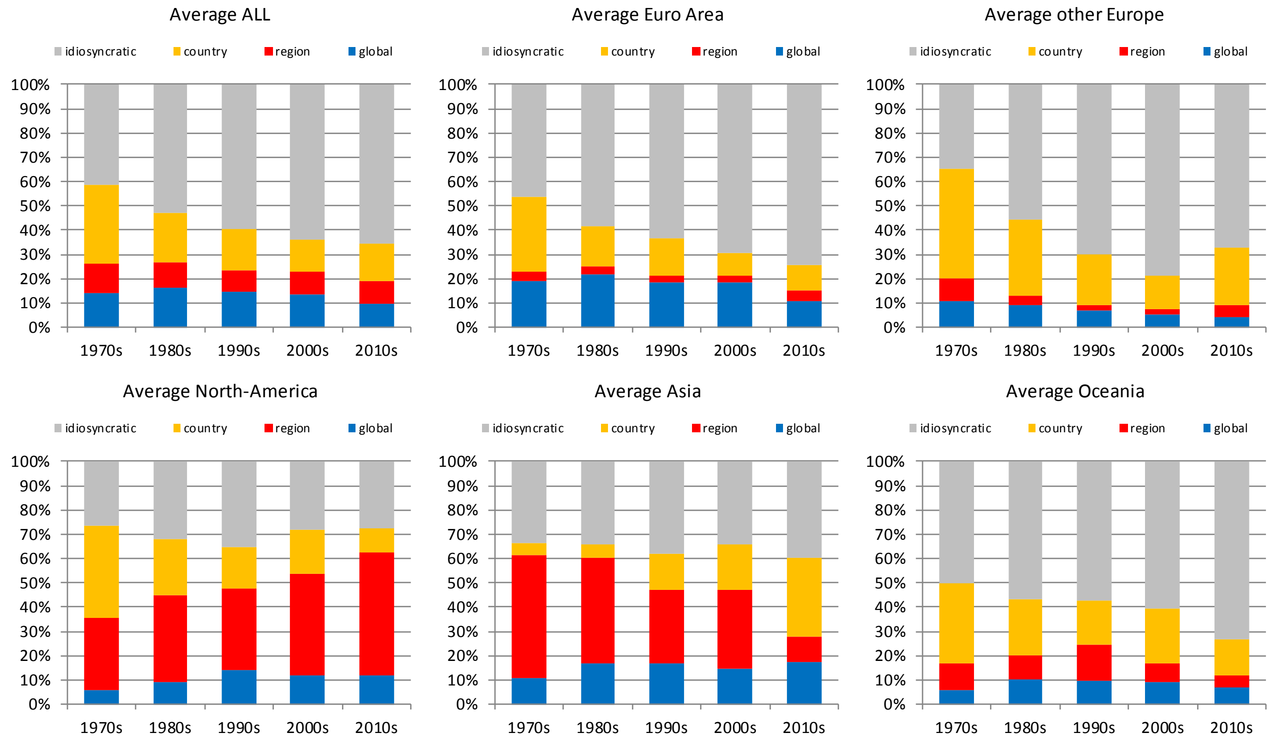
Notes: Contributions of the global, region-specific, country-specific and idiosyncratic components to the variance of real GDP growth. Idiosyncratic contribution derived as residual. 1970s: average 1971Q1-1979Q4, 1980s: average 1980Q1-1989Q4, 1990s: average 1990Q1-1999Q4, 2000s: average 2000Q1-2009Q4, 2010s: average 2010Q1-2016Q4.

Table D – Variance decompositions: contributions of uncertainty components to the volatility of consumption growth

	global			region-specific			country-specific			idiosyncratic
	16th p.	median	84th p.	16th p.	median	84th p.	16th p.	median	84th p.	residual*
Germany	3%	10%	28%	2%	5%	12%	7%	18%	36%	67%
France	6%	16%	39%	2%	7%	18%	6%	16%	33%	61%
Italy	9%	23%	48%	1%	4%	10%	2%	5%	13%	69%
Spain	9%	19%	37%	1%	2%	5%	18%	33%	52%	46%
Netherlands	8%	18%	38%	1%	2%	6%	10%	22%	41%	58%
Belgium	15%	33%	59%	0%	1%	5%	4%	12%	27%	54%
Austria	5%	14%	32%	1%	3%	6%	3%	10%	23%	73%
Finland	6%	17%	38%	1%	4%	13%	10%	21%	39%	58%
Greece	6%	19%	44%	0%	2%	6%	1%	3%	16%	76%
Ireland	3%	11%	30%	1%	3%	10%	6%	19%	44%	67%
Portugal	6%	20%	46%	1%	3%	12%	11%	23%	40%	53%
UK	1%	5%	14%	1%	4%	10%	24%	43%	64%	49%
Sweden	4%	10%	22%	1%	3%	7%	10%	25%	49%	62%
Denmark	1%	5%	15%	1%	4%	11%	18%	31%	45%	61%
Switzerland	5%	13%	33%	1%	4%	12%	11%	23%	40%	59%
Norway	1%	4%	13%	2%	6%	12%	4%	12%	29%	79%
US	3%	12%	31%	11%	31%	61%	9%	25%	52%	32%
Canada	3%	9%	24%	18%	44%	73%	6%	18%	41%	28%
Japan	1%	4%	14%	27%	52%	75%	8%	23%	46%	22%
Australia	2%	6%	17%	3%	8%	18%	9%	20%	37%	66%
New Zealand	3%	11%	29%	4%	12%	28%	10%	26%	50%	51%
Korea	10%	26%	54%	5%	18%	47%	2%	6%	17%	49%
Av. Euro Area	7%	18%	40%	1%	3%	9%	7%	17%	33%	62%
Av. other Europe	3%	7%	19%	1%	4%	10%	14%	27%	45%	62%
Av. North-America	3%	11%	28%	15%	37%	67%	8%	22%	46%	30%
Av. Asia	5%	15%	34%	16%	35%	61%	5%	14%	32%	35%
Av. Oceania	3%	8%	23%	4%	10%	23%	9%	23%	44%	59%
Average ALL	5%	14%	32%	4%	10%	21%	9%	20%	38%	56%

Notes: Contributions of the global, region-specific, country-specific and idiosyncratic components to the variance of consumption growth over the whole sample period 1971Q1-2016Q4. * Idiosyncratic contribution derived as residual.

Chart F – Variance decompositions: contributions of uncertainty components to the volatility of consumption growth over time



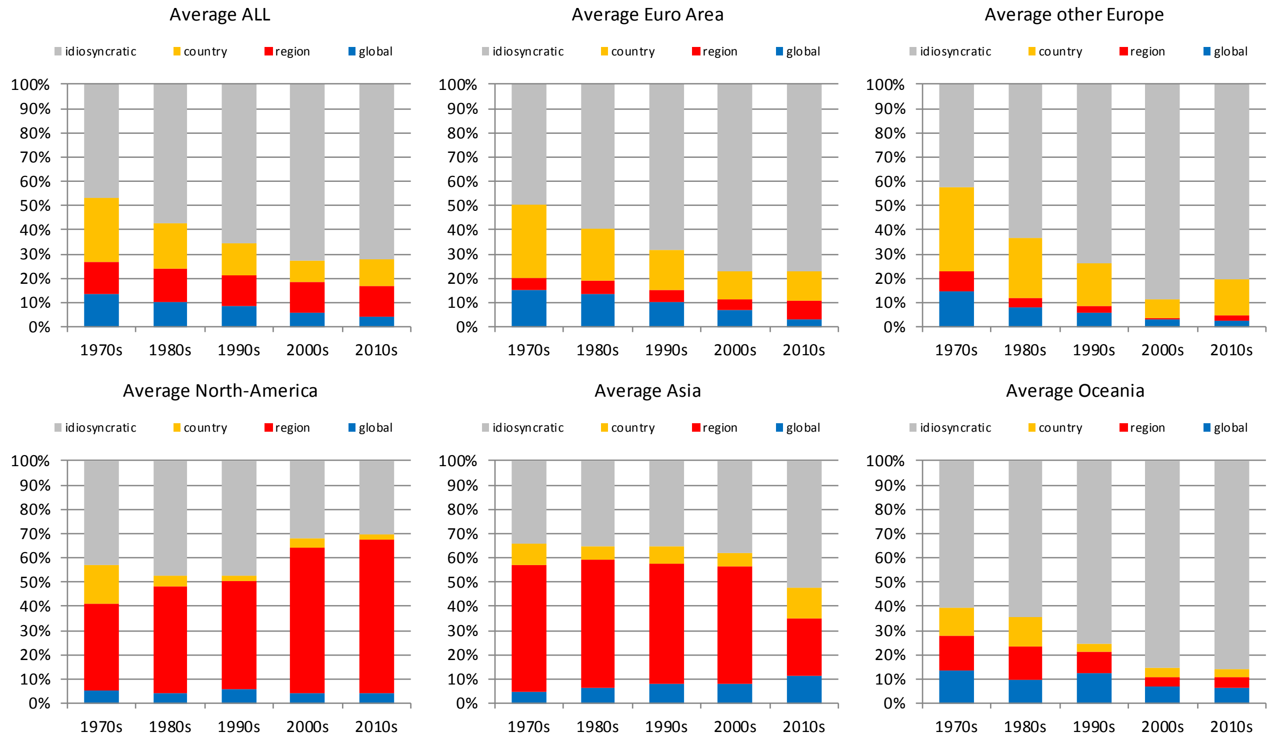
Notes: Contributions of the global, region-specific, country-specific and idiosyncratic components to the variance of consumption growth. 1970s: average 1971Q1-1979Q4, 1980s: average 1980Q1-1989Q4, 1990s: average 1990Q1-1999Q4, 2000s: average 2000Q1-2009Q4, 2010s: average 2010Q1-2016Q4.

Table E – Variance decompositions: contributions of uncertainty components to the volatility of investment growth

	global			region-specific			country-specific			idiosyncratic
	16th p.	median	84th p.	16th p.	median	84th p.	16th p.	median	84th p.	residual*
Germany	1%	5%	17%	6%	14%	28%	11%	23%	43%	57%
France	7%	17%	37%	5%	13%	28%	4%	9%	20%	61%
Italy	2%	7%	20%	2%	5%	12%	10%	22%	41%	66%
Spain	7%	16%	33%	1%	3%	9%	15%	29%	48%	53%
Netherlands	1%	4%	13%	4%	9%	19%	13%	29%	50%	58%
Belgium	4%	14%	36%	1%	4%	12%	5%	19%	47%	63%
Austria	3%	9%	22%	1%	2%	5%	3%	10%	22%	79%
Finland	2%	7%	21%	0%	1%	5%	5%	11%	25%	80%
Greece	4%	12%	29%	0%	2%	6%	2%	10%	37%	76%
Ireland	2%	7%	22%	0%	2%	5%	13%	29%	46%	62%
Portugal	5%	14%	32%	0%	1%	4%	3%	13%	29%	72%
UK	2%	8%	22%	1%	3%	8%	4%	11%	27%	79%
Sweden	3%	8%	19%	2%	5%	14%	13%	31%	59%	55%
Denmark	2%	6%	20%	1%	3%	7%	16%	28%	43%	63%
Switzerland	3%	9%	24%	1%	3%	7%	6%	14%	28%	74%
Norway	1%	3%	12%	1%	3%	7%	4%	13%	31%	80%
US	1%	5%	15%	28%	56%	80%	3%	9%	25%	30%
Canada	1%	5%	15%	15%	41%	74%	1%	2%	9%	52%
Japan	2%	6%	18%	27%	50%	74%	2%	8%	21%	36%
Australia	4%	15%	43%	2%	6%	16%	5%	13%	29%	66%
New Zealand	1%	5%	15%	4%	12%	27%	0%	1%	3%	82%
Korea	3%	9%	27%	20%	44%	71%	2%	7%	20%	40%
Av. Euro Area	3%	10%	26%	2%	5%	12%	8%	19%	37%	66%
Av. other Europe	2%	7%	19%	1%	3%	9%	9%	20%	37%	70%
Av. North-America	1%	5%	15%	22%	48%	77%	2%	6%	17%	41%
Av. Asia	2%	7%	22%	24%	47%	72%	2%	7%	20%	38%
Av. Oceania	3%	10%	29%	3%	9%	22%	2%	7%	16%	74%
Average ALL	3%	9%	23%	6%	13%	24%	6%	16%	32%	63%

Notes: Contributions of the global, region-specific, country-specific and idiosyncratic components to the variance of investment growth over the whole sample period 1971Q1-2016Q4. * Idiosyncratic contribution derived as residual.

Chart G – Variance decompositions: contributions of uncertainty components to the volatility of investment growth over time



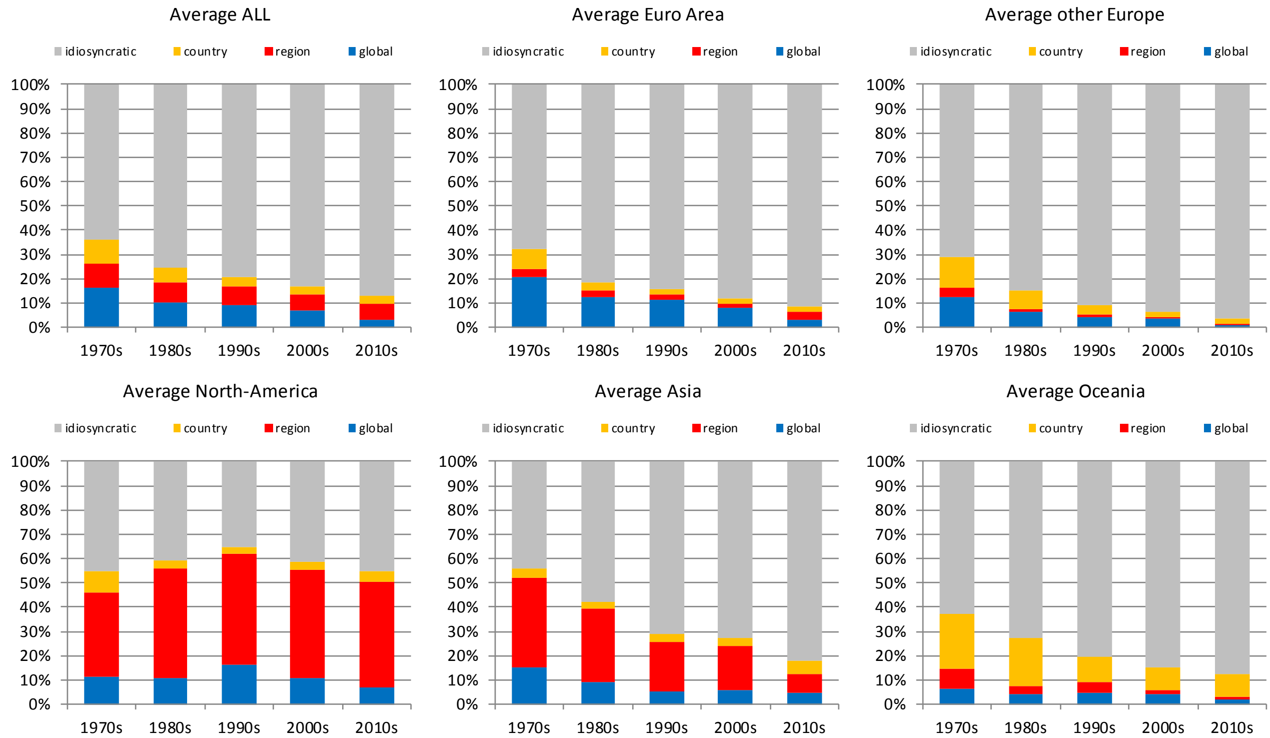
Notes: Contributions of the global, region-specific, country-specific and idiosyncratic components to the variance of investment growth. 1970s: average 1971Q1-1979Q4, 1980s: average 1980Q1-1989Q4, 1990s: average 1990Q1-1999Q4, 2000s: average 2000Q1-2009Q4, 2010s: average 2010Q1-2016Q4.

Table F – Variance decompositions: contributions of uncertainty components to the volatility of employment growth

	global			region-specific			country-specific			idiosyncratic
	16th p.	median	84th p.	16th p.	median	84th p.	16th p.	median	84th p.	residual*
Germany	6%	20%	45%	0%	2%	7%	1%	4%	13%	74%
France	4%	12%	31%	1%	2%	8%	0%	1%	3%	85%
Italy	4%	12%	31%	1%	5%	16%	2%	6%	16%	77%
Spain	2%	5%	13%	0%	0%	1%	0%	0%	0%	95%
Netherlands	2%	7%	20%	0%	2%	5%	0%	1%	4%	90%
Belgium	6%	20%	49%	1%	5%	15%	1%	2%	8%	73%
Austria	2%	5%	13%	2%	5%	11%	0%	1%	5%	89%
Finland	1%	3%	12%	1%	3%	9%	1%	5%	13%	89%
Greece	5%	13%	29%	0%	1%	3%	1%	3%	14%	83%
Ireland	6%	19%	44%	0%	1%	5%	2%	10%	37%	69%
Portugal	5%	12%	28%	1%	2%	5%	2%	5%	13%	81%
UK	4%	12%	30%	0%	1%	4%	0%	1%	6%	86%
Sweden	1%	4%	12%	1%	2%	6%	2%	8%	25%	86%
Denmark	3%	8%	21%	1%	3%	7%	8%	19%	33%	71%
Switzerland	1%	3%	10%	0%	0%	1%	0%	0%	1%	96%
Norway	1%	2%	8%	0%	0%	1%	0%	1%	5%	96%
US	2%	9%	26%	23%	47%	72%	1%	4%	13%	41%
Canada	5%	15%	37%	16%	38%	66%	1%	5%	16%	42%
Japan	1%	5%	20%	17%	38%	65%	1%	4%	14%	53%
Australia	1%	5%	18%	1%	4%	13%	11%	29%	56%	62%
New Zealand	1%	3%	10%	1%	3%	9%	0%	0%	1%	93%
Korea	3%	11%	31%	2%	9%	27%	1%	3%	12%	77%
Av. Euro Area	4%	12%	29%	1%	3%	8%	1%	3%	11%	82%
Av. other Europe	2%	6%	17%	0%	1%	4%	2%	6%	14%	87%
Av. North-America	4%	12%	32%	19%	42%	69%	1%	4%	14%	41%
Av. Asia	2%	8%	25%	9%	24%	46%	1%	4%	13%	65%
Av. Oceania	1%	4%	14%	1%	4%	11%	5%	15%	29%	77%
Average ALL	3%	9%	25%	3%	8%	16%	2%	5%	14%	78%

Notes: Contributions of the global, region-specific, country-specific and idiosyncratic components to the variance of employment growth over the whole sample period 1971Q1-2016Q4. * Idiosyncratic contribution derived as residual.

Chart H – Variance decompositions: contributions of uncertainty components to the volatility of employment growth over time



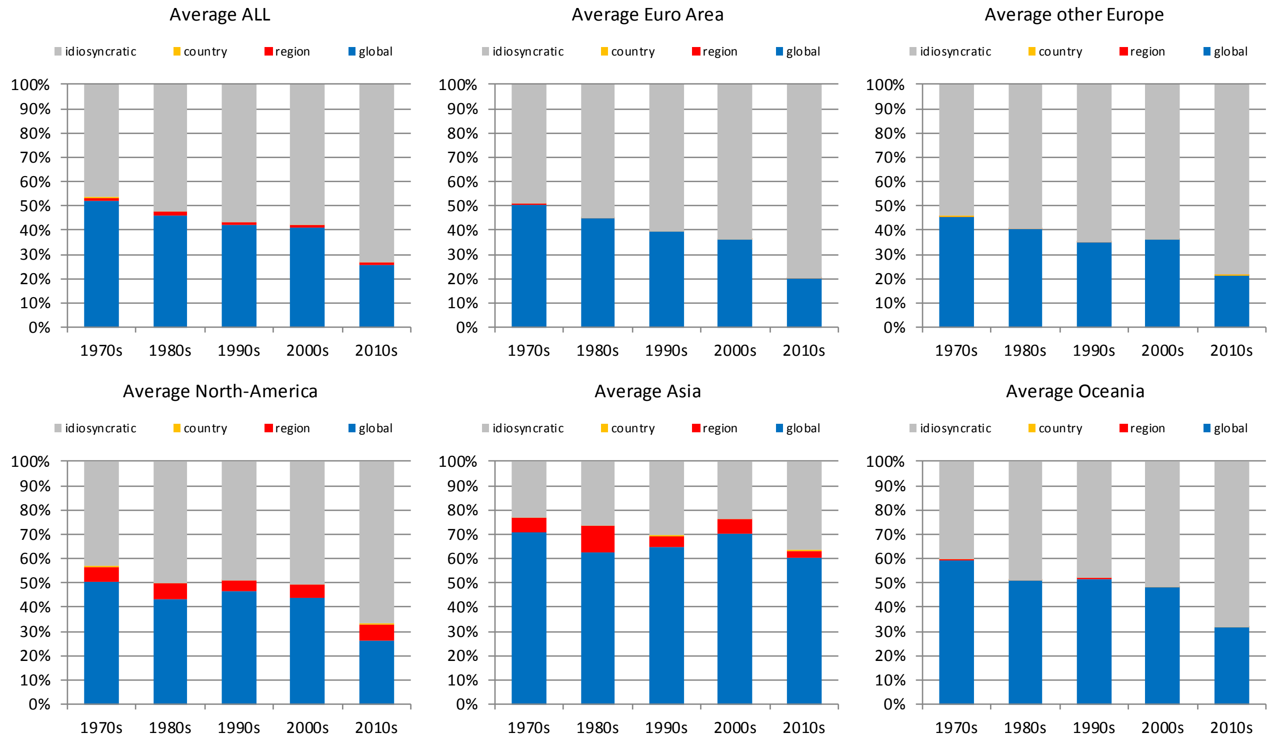
Notes: Contributions of the global, region-specific, country-specific and idiosyncratic components to the variance of employment growth. 1970s: average 1971Q1-1979Q4, 1980s: average 1980Q1-1989Q4, 1990s: average 1990Q1-1999Q4, 2000s: average 2000Q1-2009Q4, 2010s: average 2010Q1-2016Q4.

Table G – Variance decompositions: contributions of uncertainty components to the volatility of the unemployment rate changes

	global			region-specific			country-specific			idiosyncratic
	16th p.	median	84th p.	16th p.	median	84th p.	16th p.	median	84th p.	residual*
Germany	11%	30%	55%	0%	0%	0%	0%	0%	0%	70%
France	12%	33%	60%	0%	0%	0%	0%	0%	0%	67%
Italy	8%	22%	47%	0%	0%	0%	0%	0%	0%	78%
Spain	15%	38%	64%	0%	0%	0%	0%	0%	0%	62%
Netherlands	39%	62%	83%	0%	0%	0%	0%	0%	0%	37%
Belgium	42%	63%	82%	0%	0%	0%	0%	0%	0%	36%
Austria	60%	77%	90%	0%	0%	0%	0%	0%	0%	22%
Finland	22%	41%	64%	0%	0%	0%	0%	0%	0%	59%
Greece	12%	26%	45%	0%	0%	0%	0%	0%	1%	73%
Ireland	8%	22%	45%	0%	0%	0%	0%	0%	0%	78%
Portugal	8%	20%	39%	0%	0%	1%	0%	1%	3%	79%
UK	12%	29%	53%	0%	0%	0%	0%	0%	0%	71%
Sweden	13%	32%	61%	0%	0%	0%	0%	0%	2%	67%
Denmark	39%	61%	81%	0%	0%	1%	0%	0%	1%	39%
Switzerland	10%	26%	52%	0%	0%	0%	0%	0%	0%	74%
Norway	15%	35%	62%	0%	0%	0%	0%	0%	1%	65%
US	13%	32%	61%	2%	9%	26%	0%	0%	2%	59%
Canada	29%	54%	78%	1%	3%	10%	0%	0%	1%	43%
Japan	33%	58%	81%	0%	1%	5%	0%	0%	0%	41%
Australia	36%	61%	82%	0%	0%	0%	0%	0%	1%	38%
New Zealand	18%	38%	63%	0%	0%	0%	0%	0%	0%	62%
Korea	45%	74%	92%	2%	11%	34%	0%	0%	2%	14%
Av. Euro Area	22%	40%	61%	0%	0%	0%	0%	0%	1%	60%
Av. other Europe	18%	37%	62%	0%	0%	0%	0%	0%	1%	63%
Av. North-America	21%	43%	70%	1%	6%	18%	0%	0%	1%	51%
Av. Asia	39%	66%	86%	1%	6%	20%	0%	0%	1%	27%
Av. Oceania	27%	50%	72%	0%	0%	0%	0%	0%	0%	50%
Average ALL	23%	43%	65%	0%	1%	4%	0%	0%	1%	56%

Notes: Contributions of the global, region-specific, country-specific and idiosyncratic components to the variance of the unemployment rate changes over the whole sample period 1971Q1-2016Q4. * Idiosyncratic contribution derived as residual.

Chart I – Variance decompositions: contributions of uncertainty components to the volatility of the unemployment rate changes over time



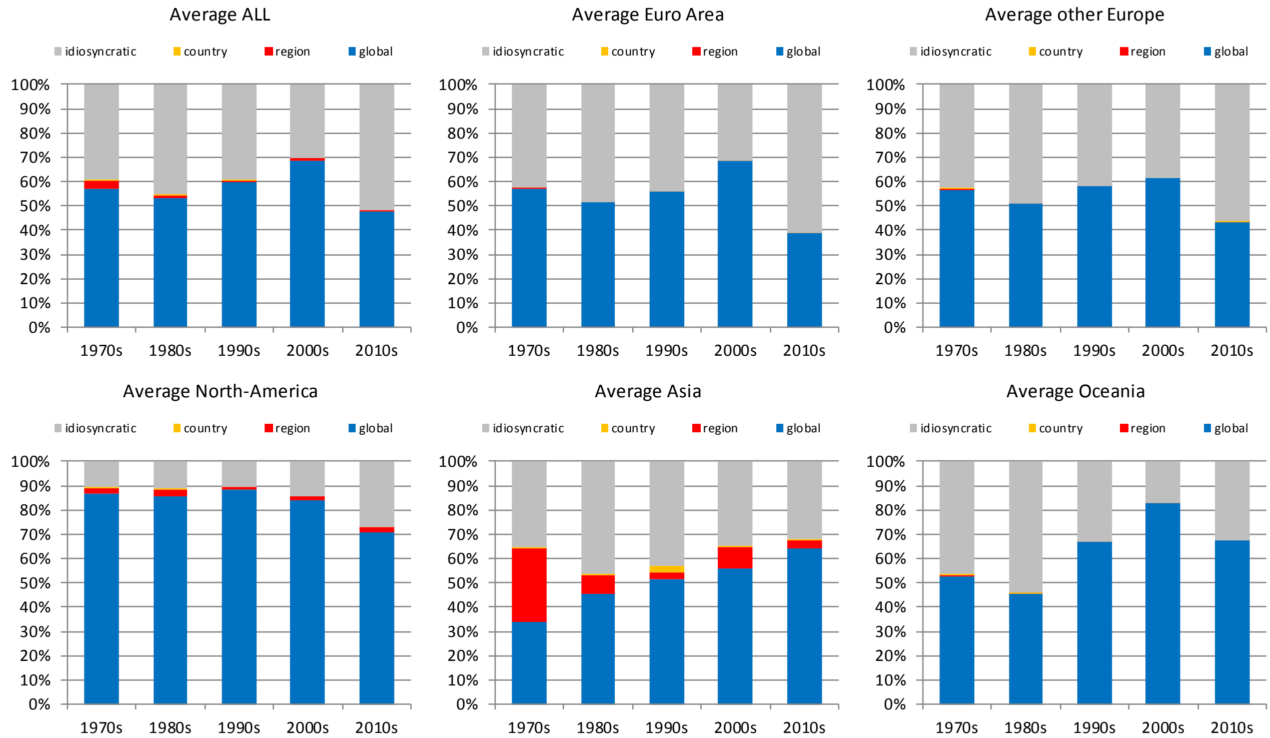
Notes: Contributions of the global, region-specific, country-specific and idiosyncratic components to the variance of the unemployment rate changes. 1970s: average 1971Q1-1979Q4, 1980s: average 1980Q1-1989Q4, 1990s: average 1990Q1-1999Q4, 2000s: average 2000Q1-2009Q4, 2010s: average 2010Q1-2016Q4.

Table H – Variance decompositions: contributions of uncertainty components to the volatility of long-term interest rate changes

	global			region-specific			country-specific			idiosyncratic
	16th p.	median	84th p.	16th p.	median	84th p.	16th p.	median	84th p.	residual*
Germany	60%	79%	91%	0%	0%	0%	0%	0%	0%	20%
France	77%	89%	96%	0%	0%	0%	0%	0%	0%	11%
Italy	24%	45%	70%	0%	0%	0%	0%	0%	0%	54%
Spain	16%	38%	64%	0%	0%	0%	0%	0%	0%	62%
Netherlands	74%	87%	95%	0%	0%	0%	0%	0%	0%	13%
Belgium	59%	79%	92%	0%	0%	0%	0%	0%	0%	21%
Austria	3%	10%	26%	0%	0%	0%	0%	0%	0%	90%
Finland	4%	16%	44%	0%	0%	0%	0%	0%	0%	84%
Greece	21%	45%	72%	0%	0%	1%	0%	1%	8%	54%
Ireland	68%	84%	94%	0%	0%	0%	0%	0%	0%	16%
Portugal	19%	38%	60%	0%	0%	0%	0%	0%	2%	62%
UK	73%	87%	95%	0%	0%	1%	0%	0%	1%	12%
Sweden	34%	62%	84%	0%	0%	1%	0%	0%	1%	38%
Denmark	11%	33%	62%	0%	0%	0%	0%	0%	0%	67%
Switzerland	50%	72%	88%	0%	0%	1%	0%	0%	0%	28%
Norway	7%	21%	47%	0%	0%	0%	0%	0%	0%	79%
US	67%	83%	93%	1%	2%	8%	0%	0%	1%	14%
Canada	68%	85%	95%	0%	2%	7%	0%	0%	0%	13%
Japan	9%	28%	56%	1%	3%	12%	0%	0%	0%	69%
Australia	44%	72%	92%	0%	0%	1%	0%	0%	1%	28%
New Zealand	32%	54%	76%	0%	0%	1%	0%	0%	0%	45%
Korea	42%	71%	90%	6%	18%	44%	0%	2%	6%	9%
Av. Euro Area	39%	56%	73%	0%	0%	0%	0%	0%	1%	44%
Av. other Europe	35%	55%	75%	0%	0%	1%	0%	0%	0%	45%
Av. North-America	68%	84%	94%	0%	2%	8%	0%	0%	1%	14%
Av. Asia	26%	50%	73%	3%	11%	28%	0%	1%	3%	39%
Av. Oceania	38%	63%	84%	0%	0%	1%	0%	0%	0%	37%
Average ALL	39%	58%	76%	0%	1%	4%	0%	0%	1%	40%

Notes: Contributions of the global, region-specific, country-specific and idiosyncratic components to the variance of long-term interest rate changes over the whole sample period 1971Q1-2016Q4. * Idiosyncratic contribution derived as residual.

Chart J – Variance decompositions: contributions of uncertainty components to the volatility of long-term interest rate changes over time



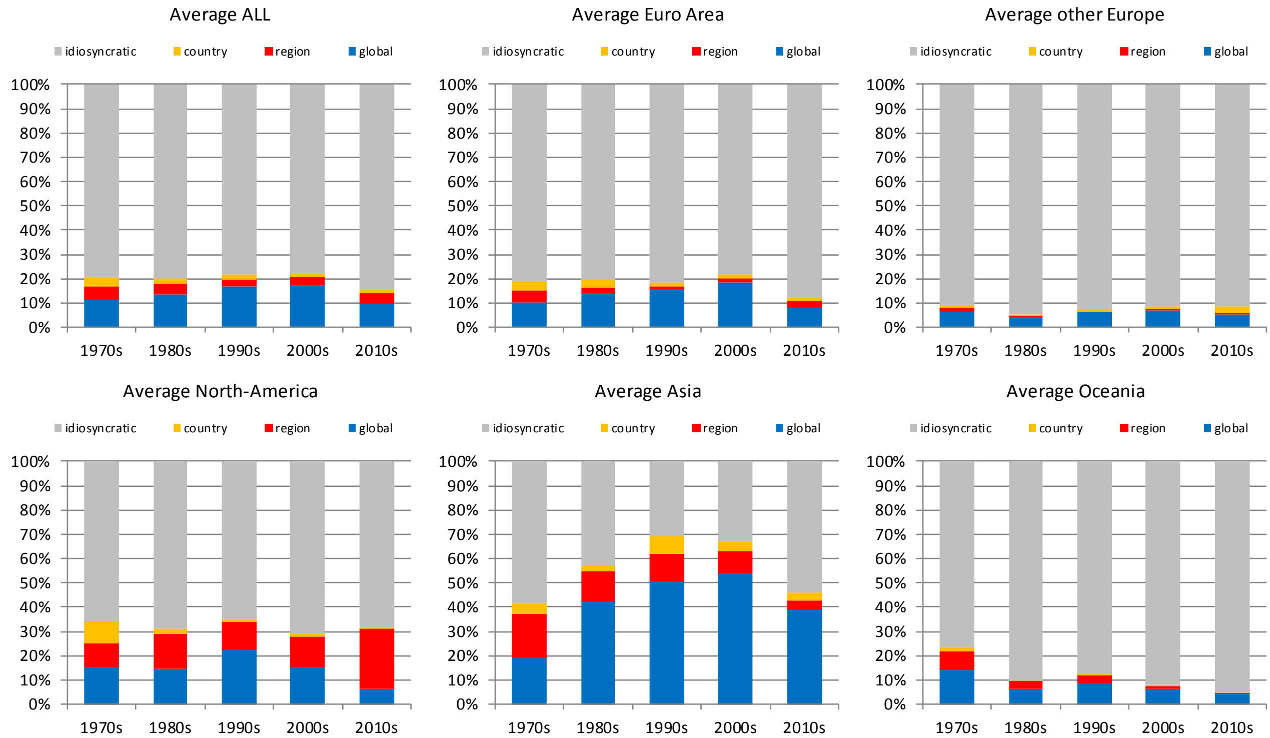
Notes: Contributions of the global, region-specific, country-specific and idiosyncratic components to the variance of long-term interest rate changes. 1970s: average 1971Q1-1979Q4, 1980s: average 1980Q1-1989Q4, 1990s: average 1990Q1-1999Q4, 2000s: average 2000Q1-2009Q4, 2010s: average 2010Q1-2016Q4.

Table I – Variance decompositions: contributions of uncertainty components to the volatility of house price growth

	global			region-specific			country-specific			idiosyncratic
	16th p.	median	84th p.	16th p.	median	84th p.	16th p.	median	84th p.	residual*
Germany	15%	32%	53%	0%	0%	2%	0%	1%	4%	67%
France	3%	9%	22%	0%	0%	1%	0%	0%	0%	91%
Italy	6%	21%	47%	0%	2%	5%	0%	0%	2%	77%
Spain	3%	9%	21%	0%	1%	3%	0%	0%	1%	90%
Netherlands	4%	13%	32%	1%	3%	9%	0%	0%	1%	84%
Belgium	3%	9%	24%	1%	4%	10%	0%	1%	3%	86%
Austria	2%	6%	16%	4%	10%	20%	1%	4%	11%	80%
Finland	3%	8%	20%	0%	1%	4%	0%	0%	1%	90%
Greece	5%	15%	37%	0%	2%	6%	0%	2%	18%	81%
Ireland	2%	6%	16%	0%	1%	3%	2%	8%	24%	85%
Portugal	9%	26%	52%	1%	4%	12%	2%	8%	24%	63%
UK	3%	8%	20%	0%	0%	1%	0%	1%	4%	91%
Sweden	2%	5%	12%	1%	1%	4%	0%	1%	5%	92%
Denmark	2%	6%	14%	0%	0%	1%	0%	0%	1%	94%
Switzerland	2%	6%	15%	0%	1%	2%	1%	3%	7%	91%
Norway	2%	5%	13%	0%	1%	2%	0%	1%	2%	94%
US	6%	28%	68%	3%	14%	41%	1%	5%	20%	52%
Canada	1%	3%	8%	4%	13%	31%	0%	0%	2%	84%
Japan	22%	49%	72%	1%	6%	21%	0%	0%	1%	46%
Australia	3%	8%	21%	0%	1%	4%	0%	0%	2%	90%
New Zealand	3%	8%	22%	2%	5%	14%	0%	1%	2%	86%
Korea	15%	35%	61%	5%	18%	45%	2%	8%	23%	39%
Av. Euro Area	5%	14%	31%	1%	2%	7%	1%	2%	8%	81%
Av. other Europe	2%	6%	15%	0%	1%	2%	0%	1%	4%	92%
Av. North-America	3%	15%	38%	4%	14%	36%	1%	3%	11%	68%
Av. Asia	19%	42%	67%	3%	12%	33%	1%	4%	12%	42%
Av. Oceania	3%	8%	21%	1%	3%	9%	0%	1%	2%	88%
Average ALL	5%	14%	30%	1%	4%	11%	1%	2%	7%	80%

Notes: Contributions of the global, region-specific, country-specific and idiosyncratic components to the variance of house price growth over the whole sample period 1971Q1-2016Q4. * Idiosyncratic contribution derived as residual.

Chart K – Variance decompositions: contributions of uncertainty components to the volatility of house price growth over time



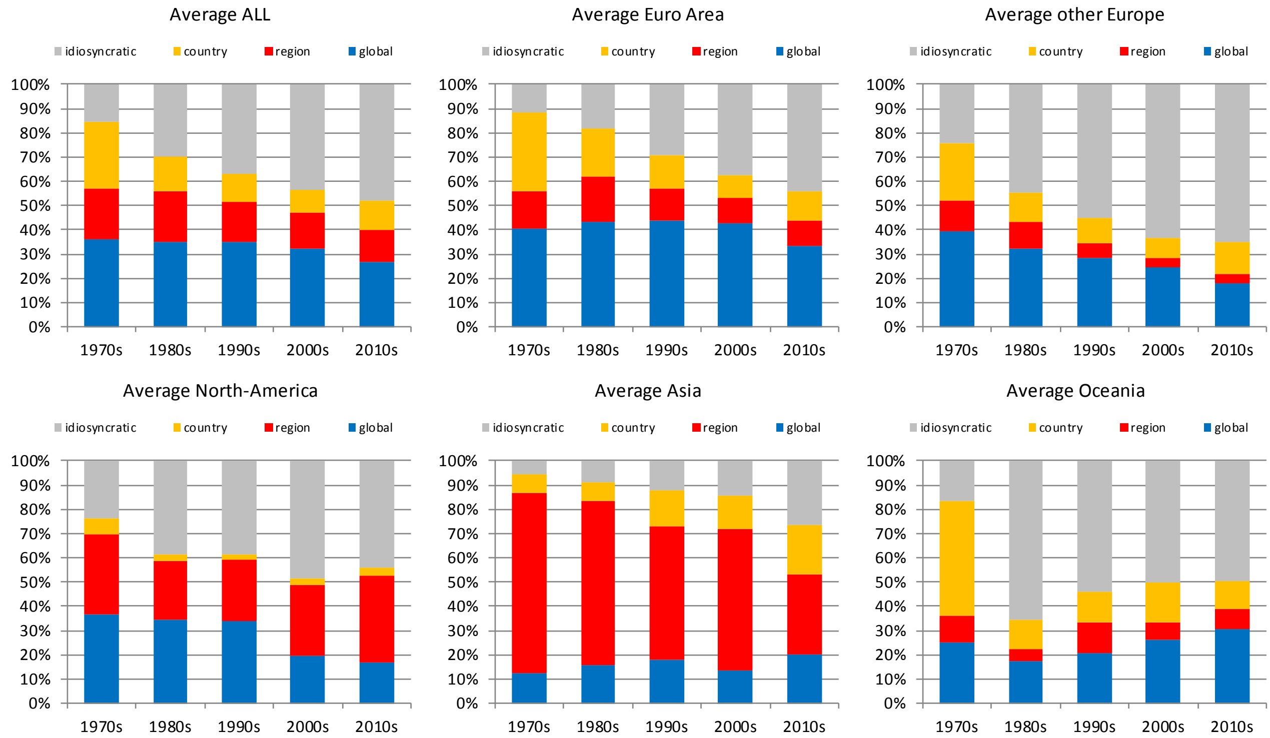
Notes: Contributions of the global, region-specific, country-specific and idiosyncratic components to the variance of house price growth. 1970s: average 1971Q1-1979Q4, 1980s: average 1980Q1-1989Q4, 1990s: average 1990Q1-1999Q4, 2000s: average 2000Q1-2009Q4, 2010s: average 2010Q1-2016Q4.

Table J – Variance decompositions: contributions of uncertainty components to the volatility of credit growth

	global			region-specific			country-specific			idiosyncratic
	16th p.	median	84th p.	16th p.	median	84th p.	16th p.	median	84th p.	residual*
Germany	24%	45%	69%	10%	22%	39%	3%	9%	23%	24%
France	41%	60%	79%	2%	5%	13%	1%	2%	7%	32%
Italy	27%	49%	74%	17%	35%	57%	2%	6%	15%	10%
Spain	32%	54%	76%	14%	32%	52%	1%	4%	11%	11%
Netherlands	20%	37%	62%	1%	3%	9%	7%	15%	26%	45%
Belgium	18%	36%	60%	5%	13%	28%	7%	19%	38%	32%
Austria	32%	54%	76%	3%	6%	14%	9%	24%	45%	16%
Finland	26%	46%	70%	3%	8%	20%	1%	3%	10%	43%
Greece	5%	22%	51%	0%	3%	11%	24%	59%	92%	16%
Ireland	8%	21%	47%	9%	19%	35%	8%	23%	47%	37%
Portugal	17%	33%	56%	2%	5%	11%	19%	30%	44%	32%
UK	6%	19%	46%	7%	18%	36%	3%	9%	24%	54%
Sweden	7%	20%	43%	8%	19%	35%	6%	16%	36%	45%
Denmark	17%	30%	47%	0%	1%	4%	0%	0%	2%	68%
Switzerland	35%	57%	79%	0%	0%	1%	19%	39%	61%	3%
Norway	11%	20%	37%	0%	0%	1%	0%	1%	3%	79%
US	7%	21%	51%	13%	40%	73%	1%	4%	19%	34%
Canada	17%	37%	63%	5%	17%	44%	1%	2%	10%	43%
Japan	7%	21%	50%	24%	54%	80%	3%	10%	27%	15%
Australia	12%	25%	48%	1%	3%	8%	4%	11%	24%	61%
New Zealand	10%	22%	42%	6%	15%	31%	14%	28%	47%	35%
Korea	3%	11%	32%	36%	64%	86%	5%	15%	35%	10%
Av. Euro Area	23%	41%	65%	6%	14%	26%	8%	18%	33%	27%
Av. other Europe	15%	29%	50%	3%	8%	15%	6%	13%	25%	50%
Av. North-America	12%	29%	57%	9%	29%	59%	1%	3%	15%	39%
Av. Asia	5%	16%	41%	30%	59%	83%	4%	12%	31%	13%
Av. Oceania	11%	23%	45%	3%	9%	20%	9%	20%	35%	48%
Average ALL	17%	34%	57%	7%	17%	31%	6%	15%	29%	34%

Notes: Contributions of the global, region-specific, country-specific and idiosyncratic components to the variance of credit growth over the whole sample period 1971Q1-2016Q4. * Idiosyncratic contribution derived as residual.

Chart L – Variance decompositions: contributions of uncertainty components to the volatility of credit growth over time



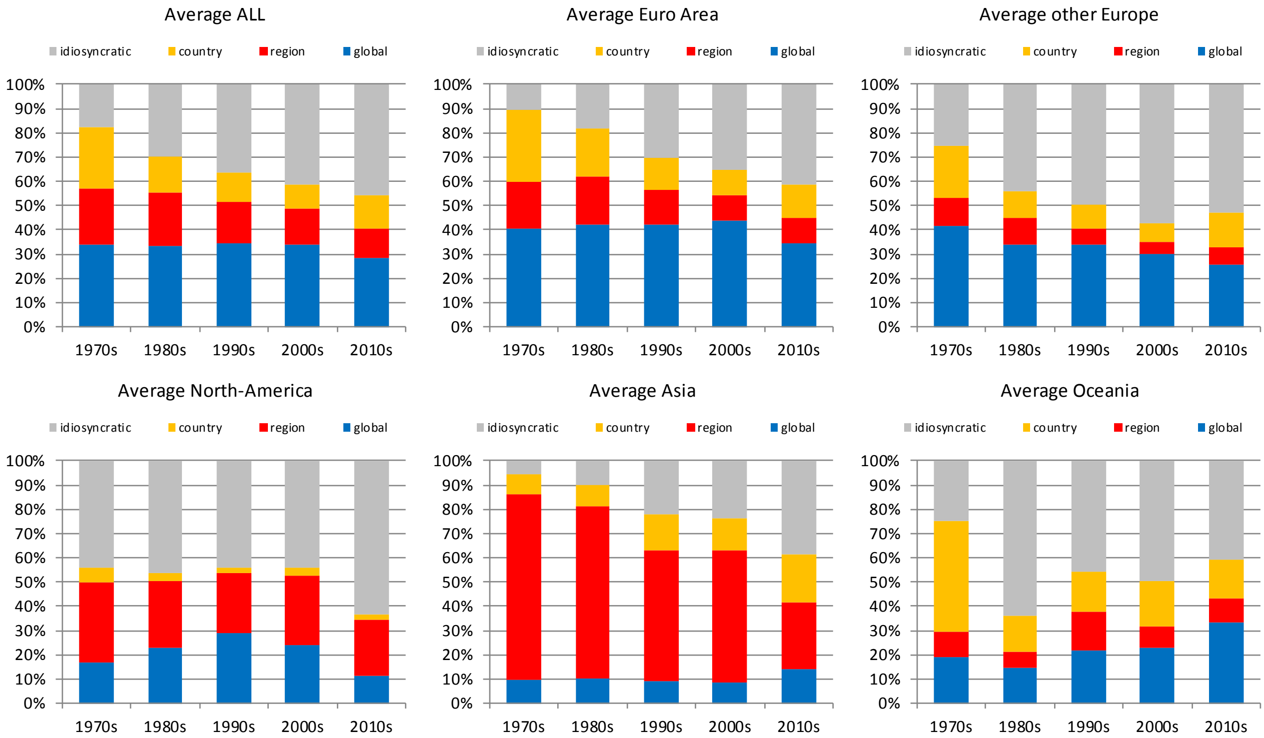
Notes: Contributions of the global, region-specific, country-specific and idiosyncratic components to the variance of credit growth. 1970s: average 1971Q1-1979Q4, 1980s: average 1980Q1-1989Q4, 1990s: average 1990Q1-1999Q4, 2000s: average 2000Q1-2009Q4, 2010s: average 2010Q1-2016Q4.

Table K – Variance decompositions: contributions of uncertainty components to the volatility of loan growth

	global			region-specific			country-specific			idiosyncratic
	16th p.	median	84th p.	16th p.	median	84th p.	16th p.	median	84th p.	residual*
Germany	29%	51%	75%	10%	23%	40%	4%	12%	26%	15%
France	32%	54%	76%	9%	20%	37%	1%	3%	8%	24%
Italy	28%	50%	74%	17%	36%	58%	1%	5%	15%	9%
Spain	32%	53%	75%	13%	29%	48%	1%	4%	12%	14%
Netherlands	15%	31%	55%	1%	2%	7%	7%	16%	28%	51%
Belgium	22%	40%	64%	3%	8%	18%	3%	9%	22%	43%
Austria	35%	56%	78%	2%	6%	14%	9%	24%	46%	13%
Finland	16%	34%	60%	2%	7%	19%	1%	3%	8%	56%
Greece	5%	22%	52%	0%	3%	11%	25%	61%	92%	14%
Ireland	10%	26%	53%	11%	23%	41%	9%	24%	49%	27%
Portugal	20%	37%	59%	2%	6%	14%	20%	31%	46%	26%
UK	13%	35%	66%	7%	20%	41%	1%	4%	14%	40%
Sweden	9%	25%	53%	8%	20%	37%	7%	18%	39%	37%
Denmark	18%	32%	53%	0%	1%	4%	0%	0%	2%	66%
Switzerland	35%	57%	78%	0%	0%	1%	19%	39%	61%	4%
Norway	9%	16%	31%	0%	0%	1%	0%	0%	2%	83%
US	4%	12%	32%	13%	34%	64%	1%	4%	17%	50%
Canada	12%	32%	60%	6%	21%	50%	1%	3%	11%	45%
Japan	3%	9%	29%	28%	57%	81%	3%	12%	33%	22%
Australia	10%	22%	44%	1%	2%	6%	5%	13%	28%	62%
New Zealand	9%	21%	42%	7%	19%	37%	15%	31%	51%	30%
Korea	3%	11%	32%	33%	61%	84%	5%	14%	32%	15%
Av. Euro Area	22%	41%	66%	6%	15%	28%	7%	17%	32%	26%
Av. other Europe	17%	33%	56%	3%	8%	17%	5%	12%	24%	46%
Av. North-America	8%	22%	46%	9%	27%	57%	1%	3%	14%	47%
Av. Asia	3%	10%	30%	30%	59%	82%	4%	13%	33%	19%
Av. Oceania	10%	22%	43%	4%	10%	22%	10%	22%	40%	46%
Average ALL	17%	33%	56%	8%	18%	32%	6%	15%	29%	34%

Notes: Contributions of the global, region-specific, country-specific and idiosyncratic components to the variance of loan growth over the whole sample period 1971Q1-2016Q4. * Idiosyncratic contribution derived as residual.

Chart M – Variance decompositions: contributions of uncertainty components to the volatility of loan growth over time



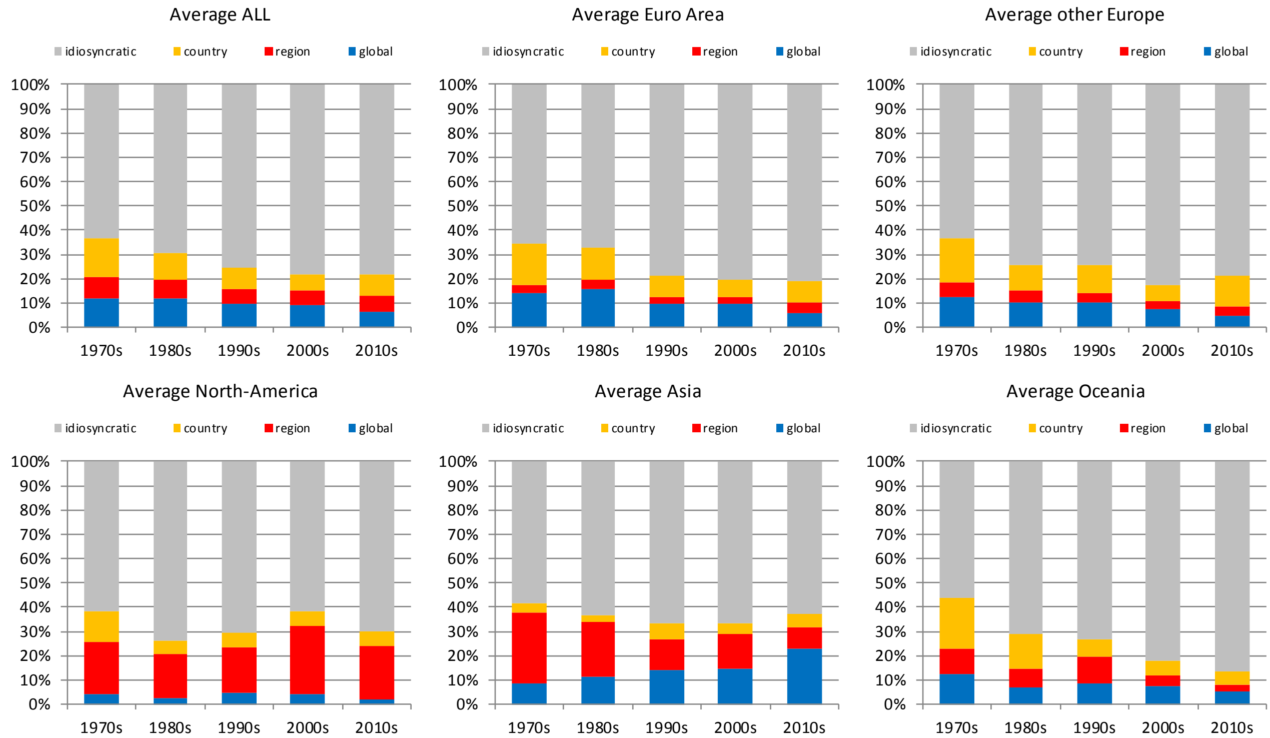
Notes: Contributions of the global, region-specific, country-specific and idiosyncratic components to the variance of loan growth. 1970s: average 1971Q1-1979Q4, 1980s: average 1980Q1-1989Q4, 1990s: average 1990Q1-1999Q4, 2000s: average 2000Q1-2009Q4, 2010s: average 2010Q1-2016Q4.

Table L – Variance decompositions: contributions of uncertainty components to the volatility of narrow money growth

	global			region-specific			country-specific			idiosyncratic
	16th p.	median	84th p.	16th p.	median	84th p.	16th p.	median	84th p.	residual*
Germany	2%	6%	17%	0%	1%	2%	4%	9%	19%	84%
France	5%	14%	32%	2%	5%	13%	5%	14%	32%	67%
Italy	9%	23%	48%	1%	3%	9%	3%	9%	21%	65%
Spain	12%	27%	52%	1%	3%	10%	3%	8%	19%	61%
Netherlands	3%	8%	24%	1%	4%	11%	0%	1%	5%	87%
Belgium	2%	5%	13%	2%	6%	13%	6%	16%	35%	73%
Austria	3%	9%	23%	0%	1%	3%	0%	1%	5%	89%
Finland	2%	7%	21%	1%	4%	11%	2%	6%	15%	84%
Greece	2%	8%	25%	0%	2%	6%	3%	13%	50%	77%
Ireland	2%	7%	21%	1%	5%	13%	9%	25%	51%	63%
Portugal	4%	12%	31%	1%	2%	6%	7%	20%	39%	66%
UK	2%	7%	22%	3%	9%	22%	1%	3%	11%	80%
Sweden	1%	2%	7%	2%	4%	9%	21%	43%	68%	51%
Denmark	4%	11%	26%	3%	6%	14%	3%	8%	17%	75%
Switzerland	4%	14%	34%	0%	1%	3%	1%	2%	5%	83%
Norway	4%	13%	31%	0%	1%	5%	0%	3%	11%	84%
US	1%	4%	17%	5%	17%	44%	1%	3%	11%	76%
Canada	1%	3%	10%	9%	26%	53%	3%	11%	28%	60%
Japan	7%	18%	40%	3%	13%	37%	0%	2%	9%	67%
Australia	4%	12%	31%	2%	5%	15%	6%	18%	39%	64%
New Zealand	2%	4%	12%	4%	9%	20%	1%	3%	8%	83%
Korea	3%	10%	29%	7%	23%	50%	2%	7%	21%	60%
Av. Euro Area	4%	11%	28%	1%	3%	9%	4%	11%	27%	74%
Av. other Europe	3%	9%	24%	2%	4%	11%	5%	12%	23%	75%
Av. North-America	1%	4%	13%	7%	21%	49%	2%	7%	20%	68%
Av. Asia	5%	14%	35%	5%	18%	44%	1%	5%	15%	64%
Av. Oceania	3%	8%	22%	3%	7%	17%	4%	11%	24%	74%
Average ALL	4%	10%	26%	2%	7%	17%	4%	10%	24%	73%

Notes: Contributions of the global, region-specific, country-specific and idiosyncratic components to the variance of narrow money growth over the whole sample period 1971Q1-2016Q4. * Idiosyncratic contribution derived as residual.

Chart N – Variance decompositions: contributions of uncertainty components to the volatility of narrow money growth over time



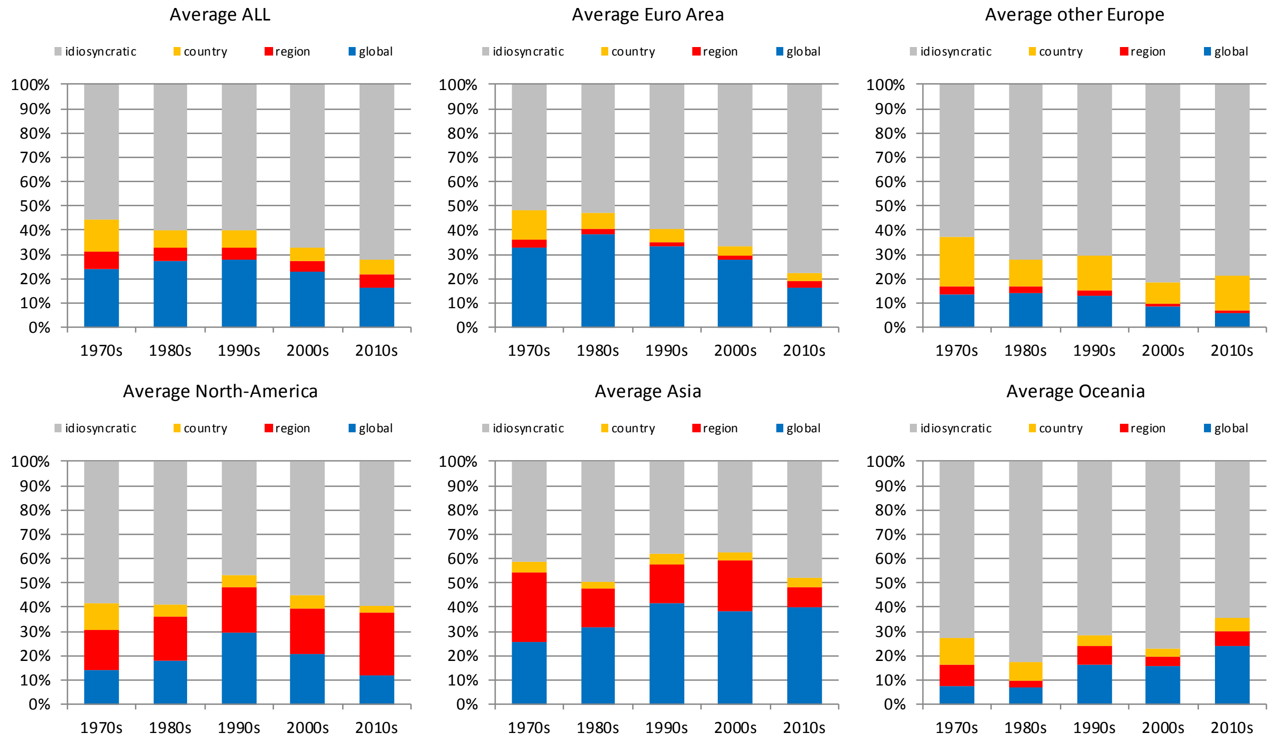
Notes: Contributions of the global, region-specific, country-specific and idiosyncratic components to the variance of narrow money growth. 1970s: average 1971Q1-1979Q4, 1980s: average 1980Q1-1989Q4, 1990s: average 1990Q1-1999Q4, 2000s: average 2000Q1-2009Q4, 2010s: average 2010Q1-2016Q4.

Table M – Variance decompositions: contributions of uncertainty components to the volatility of broad money growth

	global			region-specific			country-specific			idiosyncratic
	16th p.	median	84th p.	16th p.	median	84th p.	16th p.	median	84th p.	residual*
Germany	10%	23%	46%	0%	2%	6%	2%	7%	17%	68%
France	24%	42%	65%	1%	2%	5%	3%	9%	19%	48%
Italy	18%	37%	63%	0%	1%	3%	0%	1%	3%	61%
Spain	36%	59%	79%	1%	2%	5%	0%	1%	4%	38%
Netherlands	7%	19%	40%	1%	3%	7%	1%	2%	7%	77%
Belgium	7%	18%	38%	1%	4%	8%	6%	14%	30%	65%
Austria	15%	30%	54%	1%	2%	6%	0%	1%	4%	67%
Finland	13%	27%	50%	0%	1%	4%	1%	3%	8%	69%
Greece	7%	26%	56%	1%	3%	9%	2%	9%	38%	63%
Ireland	3%	10%	26%	1%	3%	8%	6%	20%	45%	67%
Portugal	26%	49%	74%	0%	1%	4%	1%	3%	10%	47%
UK	7%	19%	42%	1%	4%	9%	1%	3%	10%	75%
Sweden	2%	6%	17%	0%	0%	2%	31%	55%	78%	38%
Denmark	2%	5%	16%	1%	3%	7%	1%	3%	8%	89%
Switzerland	4%	12%	33%	1%	3%	9%	1%	3%	8%	81%
Norway	5%	15%	35%	0%	1%	2%	1%	3%	10%	82%
US	1%	5%	20%	5%	19%	50%	2%	10%	29%	66%
Canada	15%	34%	61%	5%	19%	48%	0%	2%	7%	45%
Japan	22%	48%	77%	4%	13%	35%	0%	1%	4%	38%
Australia	4%	11%	28%	0%	2%	6%	2%	6%	17%	82%
New Zealand	6%	16%	37%	3%	10%	23%	2%	7%	15%	68%
Korea	7%	23%	52%	7%	24%	54%	2%	6%	19%	47%
Av. Euro Area	15%	31%	54%	1%	2%	6%	2%	6%	17%	61%
Av. other Europe	4%	11%	29%	1%	2%	6%	7%	13%	23%	73%
Av. North-America	8%	20%	41%	5%	19%	49%	1%	6%	18%	56%
Av. Asia	14%	35%	64%	5%	19%	45%	1%	3%	11%	43%
Av. Oceania	5%	13%	32%	2%	6%	14%	2%	6%	16%	75%
Average ALL	11%	24%	46%	2%	5%	14%	3%	8%	18%	63%

Notes: Contributions of the global, region-specific, country-specific and idiosyncratic components to the variance of broad money growth over the whole sample period 1971Q1-2016Q4. * Idiosyncratic contribution derived as residual.

Chart O – Variance decompositions: contributions of uncertainty components to the volatility of broad money growth over time



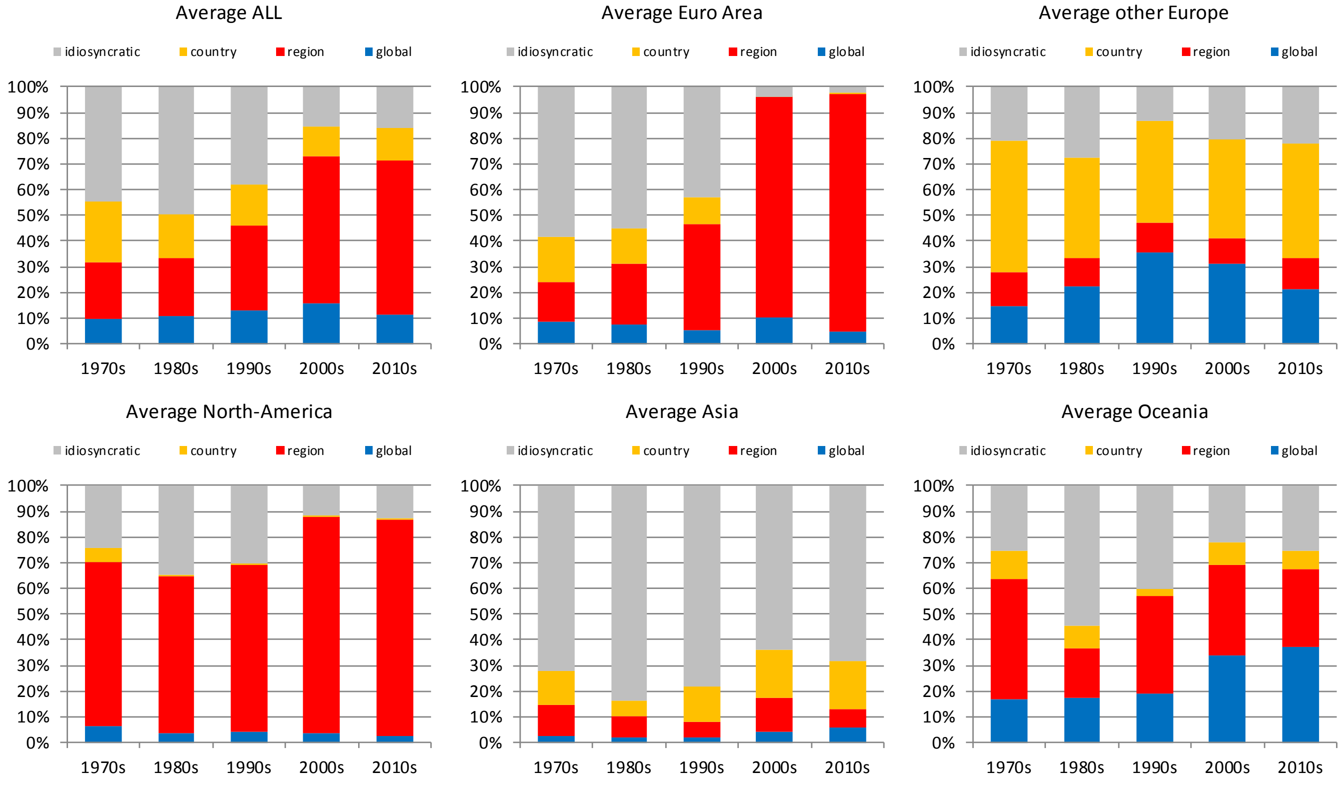
Notes: Contributions of the global, region-specific, country-specific and idiosyncratic components to the variance of broad money growth. 1970s: average 1971Q1-1979Q4, 1980s: average 1980Q1-1989Q4, 1990s: average 1990Q1-1999Q4, 2000s: average 2000Q1-2009Q4, 2010s: average 2010Q1-2016Q4.

Table N – Variance decompositions: contributions of uncertainty components to the volatility of nominal effective exchange rate growth

	global			region-specific			country-specific			idiosyncratic
	16th p.	median	84th p.	16th p.	median	84th p.	16th p.	median	84th p.	residual*
Germany	2%	7%	19%	48%	62%	74%	0%	1%	3%	31%
France	4%	8%	20%	43%	53%	64%	0%	0%	1%	38%
Italy	3%	8%	18%	28%	38%	47%	0%	0%	0%	55%
Spain	2%	7%	19%	34%	42%	50%	28%	41%	50%	10%
Netherlands	2%	5%	13%	56%	71%	82%	0%	0%	1%	25%
Belgium	1%	4%	12%	47%	59%	70%	0%	0%	1%	37%
Austria	4%	9%	24%	40%	58%	74%	0%	1%	3%	32%
Finland	3%	11%	27%	27%	38%	51%	27%	42%	55%	9%
Greece	4%	11%	26%	20%	34%	49%	0%	2%	11%	53%
Ireland	1%	4%	11%	37%	50%	63%	0%	2%	7%	44%
Portugal	3%	9%	20%	29%	39%	49%	3%	10%	30%	43%
UK	7%	20%	42%	2%	6%	14%	45%	68%	86%	6%
Sweden	2%	6%	20%	0%	2%	8%	61%	82%	93%	10%
Denmark	24%	44%	67%	12%	24%	42%	8%	19%	37%	13%
Switzerland	19%	36%	60%	8%	18%	32%	21%	39%	59%	7%
Norway	8%	24%	51%	2%	7%	20%	0%	1%	21%	68%
US	2%	6%	17%	26%	55%	80%	0%	2%	7%	37%
Canada	1%	2%	9%	57%	86%	96%	0%	2%	6%	10%
Japan	0%	1%	5%	0%	2%	7%	2%	6%	15%	91%
Australia	13%	29%	52%	12%	34%	59%	3%	9%	22%	29%
New Zealand	8%	20%	40%	14%	34%	57%	2%	7%	17%	40%
Korea	1%	5%	15%	6%	17%	39%	10%	21%	38%	57%
Av. Euro Area	3%	7%	19%	37%	49%	61%	5%	9%	15%	34%
Av. other Europe	12%	26%	48%	5%	11%	23%	27%	42%	59%	21%
Av. North-America	1%	4%	13%	42%	71%	88%	0%	2%	7%	24%
Av. Asia	1%	3%	10%	3%	10%	23%	6%	14%	26%	74%
Av. Oceania	11%	24%	46%	13%	34%	58%	3%	8%	19%	34%
Average ALL	5%	12%	27%	25%	38%	51%	10%	16%	26%	34%

Notes: Contributions of the global, region-specific, country-specific and idiosyncratic components to the variance of nominal effective exchange rate growth over the whole sample period 1971Q1-2016Q4. * Idiosyncratic contribution derived as residual.

Chart P – Variance decompositions: contributions of uncertainty components to the volatility of nominal effective exchange rate growth over time



Notes: Contributions of the global, region-specific, country-specific and idiosyncratic components to the variance of nominal effective exchange rate growth. 1970s: average 1971Q1-1979Q4, 1980s: average 1980Q1-1989Q4, 1990s: average 1990Q1-1999Q4, 2000s: average 2000Q1-2009Q4, 2010s: average 2010Q1-2016Q4.