Measuring global and country-specific uncertainty

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Motivation

- After the 2007-09 recession, the recovery has been slow for many economies – advanced and emerging market economies.

- One of the most pronounced reasons for the slow recovery has been the elevated economic uncertainty during and after the global recession.

Economists worry about uncertainty

- **Demand side:**

  Households *save more and postpone* their consumption of goods, especially durable goods. Companies delay their investment decisions and choose to *"wait and see"* until high economic uncertainty is resolved (Bernanke, 1983; Dixit and Pindyck, 1994).

- **Supply side:**

  Banks are reluctant to provide loans. C*redit conditions* for companies, especially for the new start-up companies which are good sources of innovation and high *productivity growth*, get *tightened* (Gilchrist, Sim, and Zakrajsek, 2010).

Policymakers think that uncertainty matters

FOMC (October 2001)
"increased uncertainty is depressing investment by fostering an increasingly widespread wait-and-see attitude about undertaking new investment expenditures."

FOMC (April 2008)
"participants reported that uncertainty about the economic outlook was leading firms to defer spending projects until prospects for economic activity became clearer."

FOMC (September 2010)
"A number of business contacts indicated that they were holding back on hiring and spending plans because of uncertainty about future fiscal and regulatory policies."

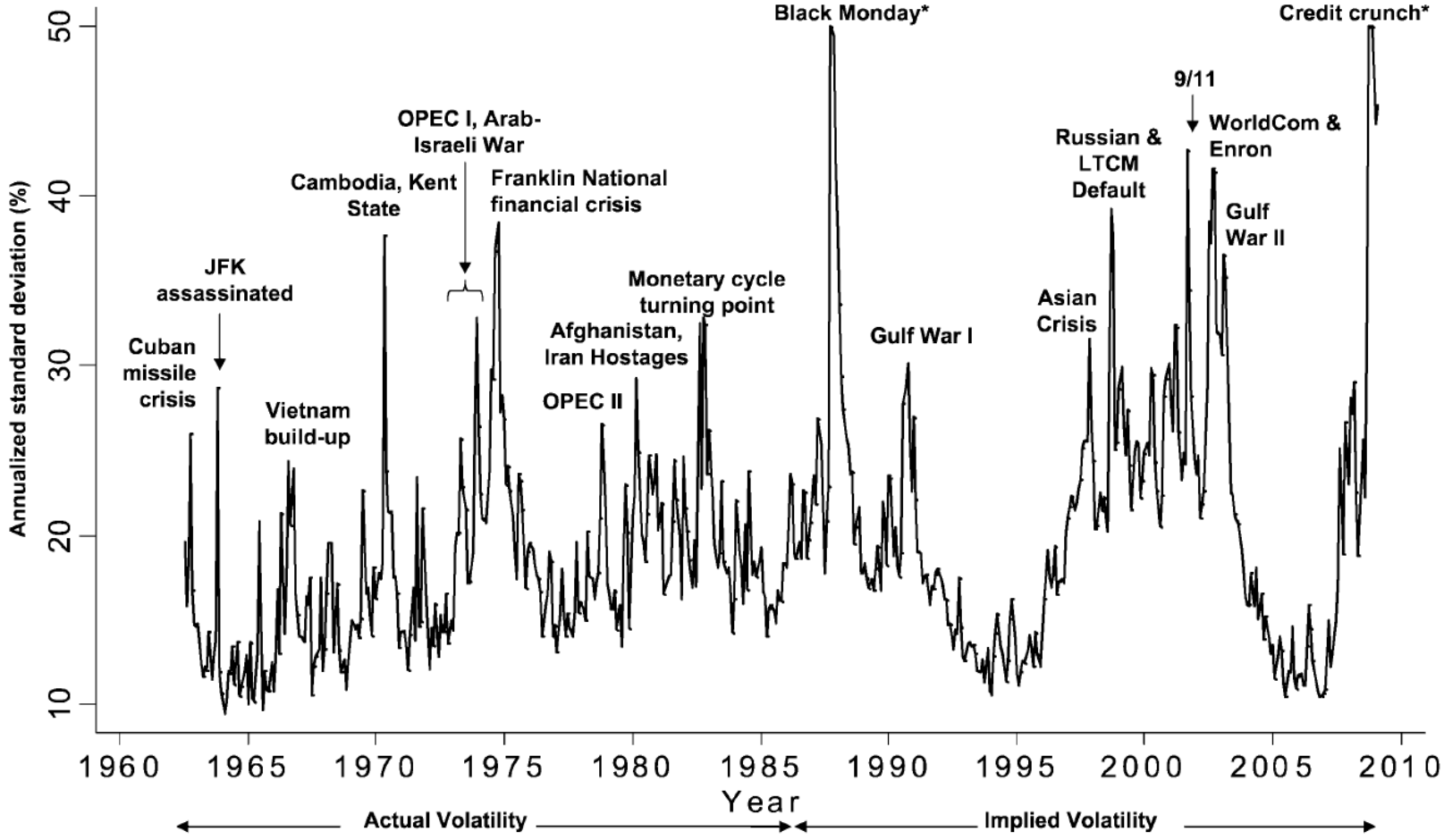
How to measure uncertainty?

Implied or realized volatility in stock market Bloom (2009, Econometrica)

Chicago Board Options Exchange Rate Volatility Index (VIX) based on trading of S&P100 options.

But, the volatility in Wall Street might not reflect uncertainty in Main Street. Changes in the VIX might be due to leverage or financial stress, despite low levels of economic uncertainty; see Bekaert et al. (2013, JME).

VIX (Bloom, 2009)



Economic Policy Uncertainty Index
Baker, Bloom and Davies (2016, QJE)

– News-based index *(weight=1/2)*

– Forecaster disagreement about government purchases of goods and services *(weight=1/6)*

– Forecaster disagreement about inflation *(weight=1/6)*

– Scheduled tax code expirations *(weight=1/6)*

But

- EPU index puts a high bar for the attention of reporters and editors, who might miss uncertainty events if they neglect to write a story on the subject, according to Hansen (2015).
- Subject to media bias: domestic vs. foreign newspaper

Macroeconomic uncertainty
Jurado, Ludvigson, and Ng (2015, AER)

Defined as the common variation in uncertainty across hundreds of economic series.

But

- their measure reflects uncertainty around objective statistical forecasts, rather than perceived uncertainty by market participants;
- as they focus on common uncertainty, there is no role for idiosyncratic uncertainty due to private information and heterogeneous agent models.

Forecast disagreement among economic agents

- When disagreement is taken to indicate uncertainty, the underlying assumption is that this **inter-personal** dispersion measure is an acceptable proxy for the average dispersion of **intra-personal** uncertainty.

- But, disagreement is only a part of uncertainty and misses an important component: the volatility of aggregate shocks.

A New Measure of Economic Uncertainty

Our measure is closely related to Jurado, Ludvigson and Ng (2015), but differs from theirs in two aspects:

- We construct uncertainty around subjective survey expectations rather than around objective statistical forecasts. Thus, our measure reflects perceived uncertainty by market participants.

- We capture both common uncertainty and idiosyncratic uncertainty.

Uncertainty of a typical forecaster

- Let $F_{it} = EY_t I_{i,t-h}$ be the forecast made by individual *i* at time $t-h$. Then individual *i*'s uncertainty in predicting the variable Y_t is given by U_{ith} :

$$U_{ith} = E[Y_t - F_{it}]^2 I_{i,t-h} \ .$$
(1)

- Given a panel of forecasts, we define the uncertainty of a "typical" forecaster, selected randomly from among all forecasters with equal probability, as the simple average of individual forecast uncertainties:

$$U_{th} \equiv 1/n \sum_{i=1}^{n} U_{ith} \ .$$
(2)

Lahiri-Sheng decomposition of uncertainty

The uncertainty of a typical forecaster has two components:

$$U_{th} = \sigma_{\lambda th}^2 + D_{th}, \quad (3)$$

where $\sigma_{\lambda th}^2$ is the perceived variability of future aggregate shocks and D_{th} is the disagreement among professional forecasters.

The uncertainty of a typical forecaster can be decomposed into two parts: uncertainty that is common to all forecasters (i.e. **common uncertainty**) and uncertainty that arises from heterogeneity of individual forecasters (i.e. **idiosyncratic uncertainty**).

Alternative decomposition of uncertainty Campbell et al. (2001, Journal of Finance)

Decomposition of uncertainty for a typical forecaster is similar to the decomposition of volatility for a typical stock. Let e_{it} be individual i's forecast error at time t. Then the mean forecast error, e_t, is defined as

$$e_t = \sum_{i=1}^{N} w_{it} \; e_{it} . \qquad \text{(A1)}$$

Motivated by the CAPM literature, we specify the relationship between individual and mean forecast errors as follows

$$e_{it} = \beta_i \; e_t + \varepsilon_{it} , \qquad \text{(A2)}$$

Alternative decomposition of uncertainty (cont.)

Taking the variance on both sides of equation (A2), we get

$$Var(e_{it}) = \beta_i^2 \, Var(e_t) + Var(\varepsilon_{it}). \qquad \text{(A3)}$$

$Var(e_t)$ measures common volatility and $Var(\varepsilon_{it})$ captures idiosyncratic volatility. Clearly, estimation of idiosyncratic volatility requires knowing β_i, which introduces another layer of uncertainty.

To avoid this problem, we follow Campbell et al. (2001):

$$\sum_{i=1}^{N} w_{it} \, Var(e_{it}) = Var(e_t) + D_t \,, \qquad \text{(A4)}$$

an alternative expression that decomposes the uncertainty of a typical forecaster into common and idiosyncratic uncertainty.

The views expressed in this paper are those of the authors and do not necessarily represent views and policies of the IMF.

Uncertainty in predicting a single variable

$$U_{th} = \sigma_{\lambda_{th}}^2 + D_{th}$$

Apply stochastic volatility model (or GARCH) to the median forecast errors

Calculated as the interquartile range of individual forecasts

Country-specific and global uncertainty

- Country-specific uncertainty = weighted average of uncertainty across eight variables

- Global uncertainty = PPP-weighted average of uncertainty across 46 countries, covering more than 90% of the world economy today

Data

- From Consensus Forecasts
- 1990-2014: monthly data
- Covering 46 countries: 15 advanced and 31 emerging market
- 8 variables: GDP, consumption, investment, industrial production, unemployment rate, inflation, short- and long-term interest rates
- Individual forecasts
- Fixed event forecasts: forecasts for the end of current year and next year

Transform fixed-event forecast into fixed-horizon forecast

$$F\downarrow i,t+12|t = k/12\ F\downarrow i,t+k|t + 12-k/12\ F\downarrow i,t+12+k|t$$

where $F\downarrow i,t+k|t$ and $F\downarrow i,t+12+k|t$ are the two forecasts based on the information set at time *t* with horizons of $k \in \{1, \ldots, 12\}$ and $k+12$ months, respectively.

The average of two fixed event forecasts weighted by their share in the forecasting horizon approximates the fixed horizon forecast, $F\downarrow i,t+12|t$, for the next 12 months.

Properties of forecasts: biased and inefficient for most variables

Table A.2. Forecast Efficiency Regression Results

	α	β	F	p-value		α	β	F	p-value
United States					**United Kingdom**				
Output	0.787***	-0.339***	8.9	0.0	Output	0.542**	-0.230**	3.1	0.0
Industrial production	1.163**	-0.617***	19.6	0.0	Industrial production	-0.160	-0.867***	78.1	0.0
CPI	1.553***	-0.632***	25.5	0.0	CPI	-0.706***	0.040	47.7	0.0
Consumption	0.227	0.012	5.4	0.0	Consumption	0.239	0.103	14.1	0.0
Investment	-0.101	-0.412***	97.6	0.0	Investment	-0.038	-0.472***	27.8	0.0
Unemployment rate	0.052	-0.013	0.9	0.4	Unemployment rate	3.450***	-0.351***	981.9	0.0
Short-term interest rate	-0.123***	0.015***	62.6	0.0	Short-term interest rate	-0.022	0.022***	25.6	0.0
Long-term interest rate	-0.301***	0.037***	61.6	0.0	Long-term interest rate	-0.136***	0.021***	9.8	0.0

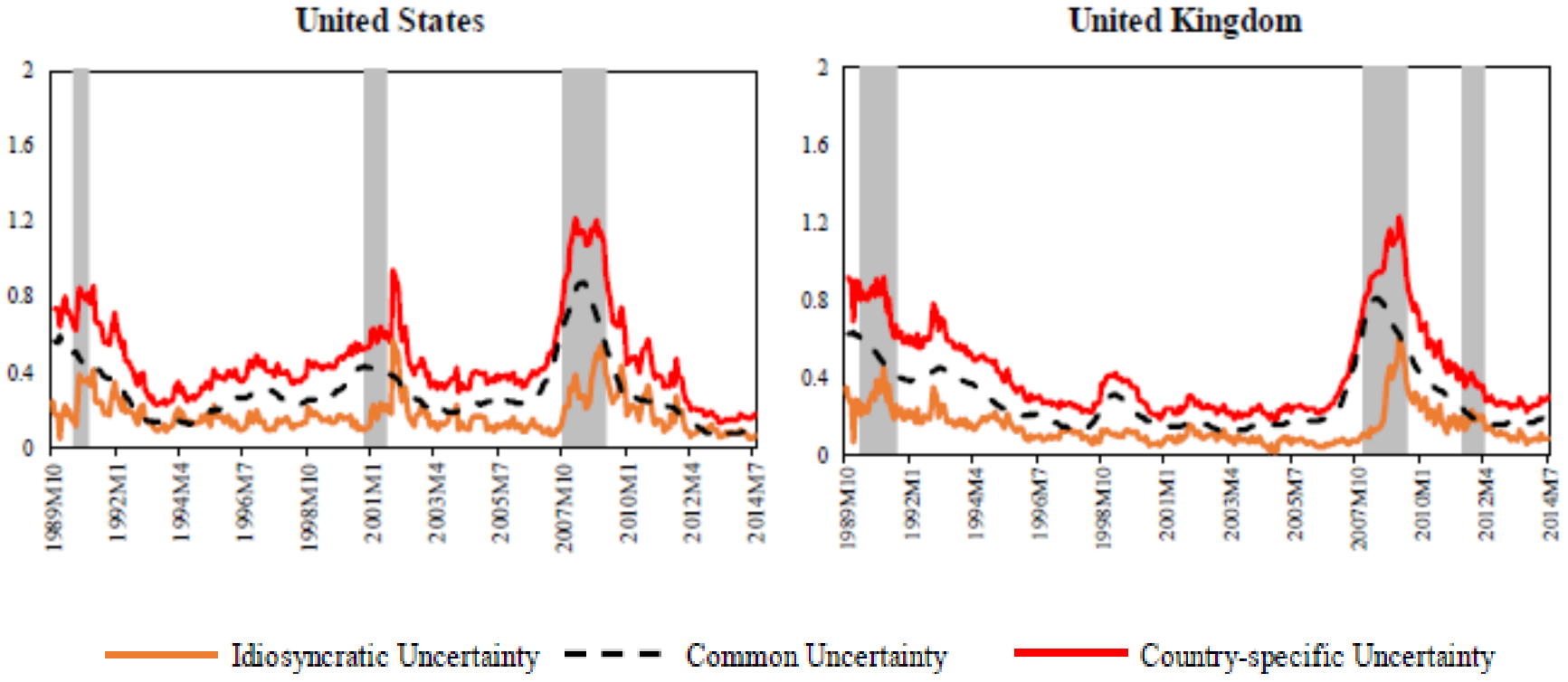
Imperfect correlation of uncertainty across eight variables

Table 1. Correlation between Variable-specific Uncertainty Measures: United States

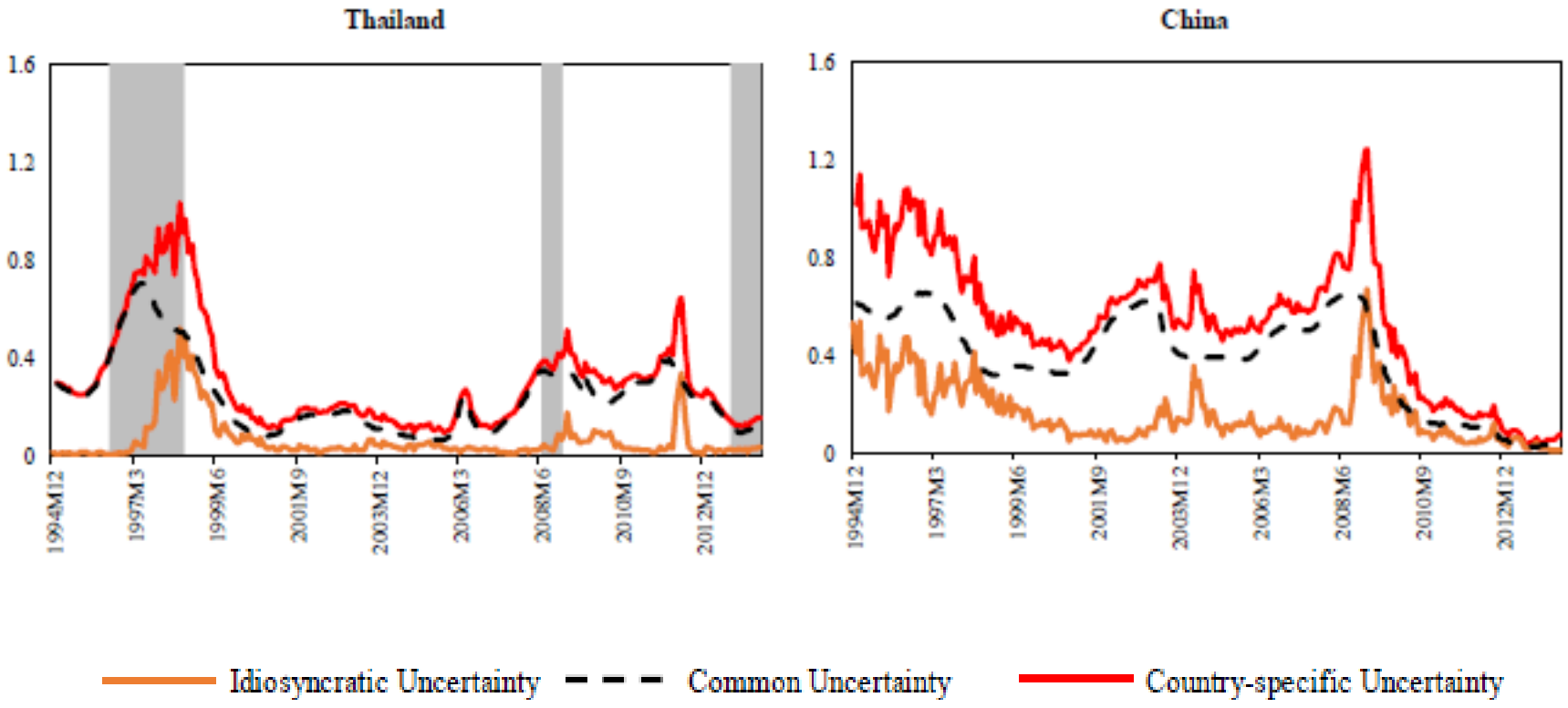
A. Correlation between Variable-specific Uncertainty Measures

	Output	Inflation	Consumption	Investment	Industrial production	Unemployment rate	Short-term interest rate	Long-term interest rate
Output	1.00							
Inflation	0.57	1.00						
Consumption	0.79	0.51	1.00					
Investment	0.77	0.64	0.61	1.00				
Industrial production	0.82	0.70	0.61	0.79	1.00			
Unemployment rate	0.77	0.53	0.72	0.70	0.67	1.00		
Short-term interest rate	0.43	0.22	0.55	0.42	0.37	0.28	1.00	
Long-term interest rate	0.41	0.27	0.27	0.42	0.33	0.47	0.24	1.00

Uncertainty measures for US and UK



Uncertainty measures for Thailand and China



Country-specific uncertainty is not driven by uncertainty of any single variable

Table 2. R-square: Variable-specific Uncertainty on Country-specific Uncertainty

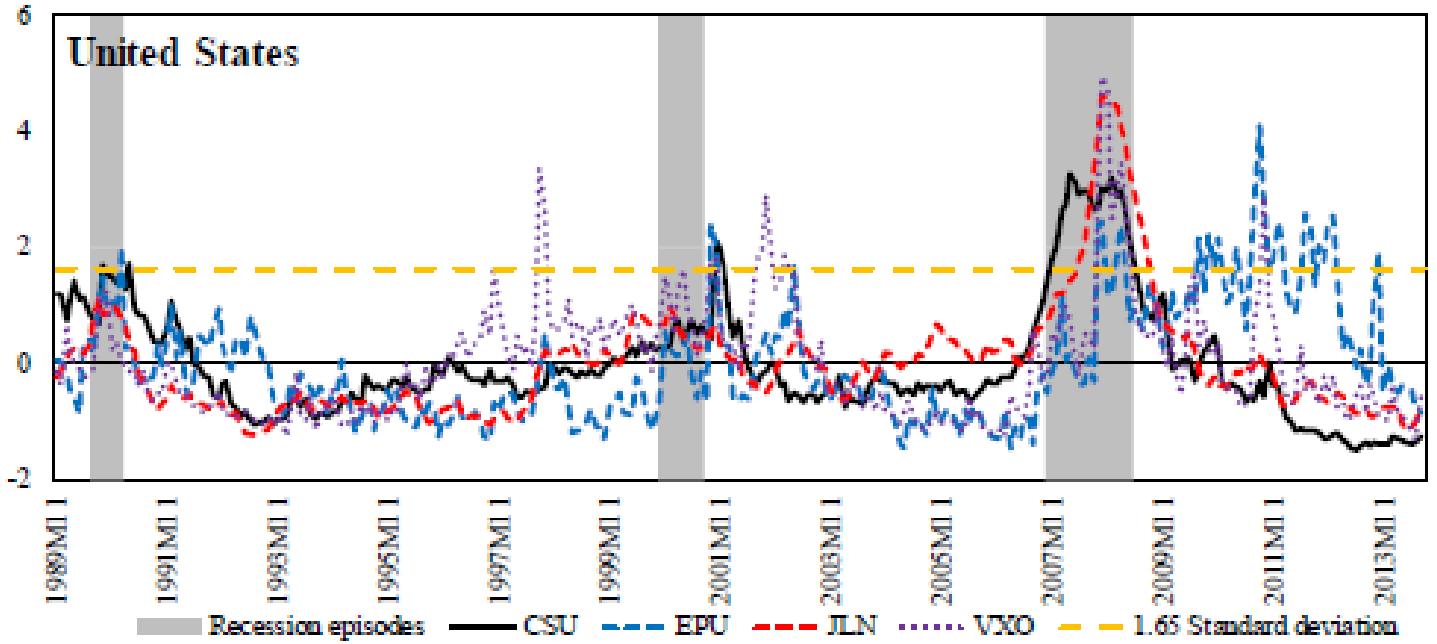
	Output	Consumption	Investment	Industrial production	Unemployment rate	Inflation	Short-term interest rate	Long-term interest rate	Average
United States									
Full sample	0.822	0.678	0.763	0.734	0.690	0.506	0.348	0.303	0.606
Recessions	0.833	0.628	0.657	0.662	0.506	0.807	0.065	0.000	0.520
Expansions	0.715	0.554	0.618	0.550	0.513	0.158	0.292	0.364	0.471
United Kingdom									
Full sample	0.777	0.805	0.564	0.659	0.479	0.627	0.512	0.511	0.617
Recessions	0.721	0.803	0.857	0.648	0.124	0.662	0.424	0.157	0.550
Expansions	0.618	0.663	0.240	0.413	0.534	0.438	0.414	0.646	0.496

Compared to other uncertainty measures

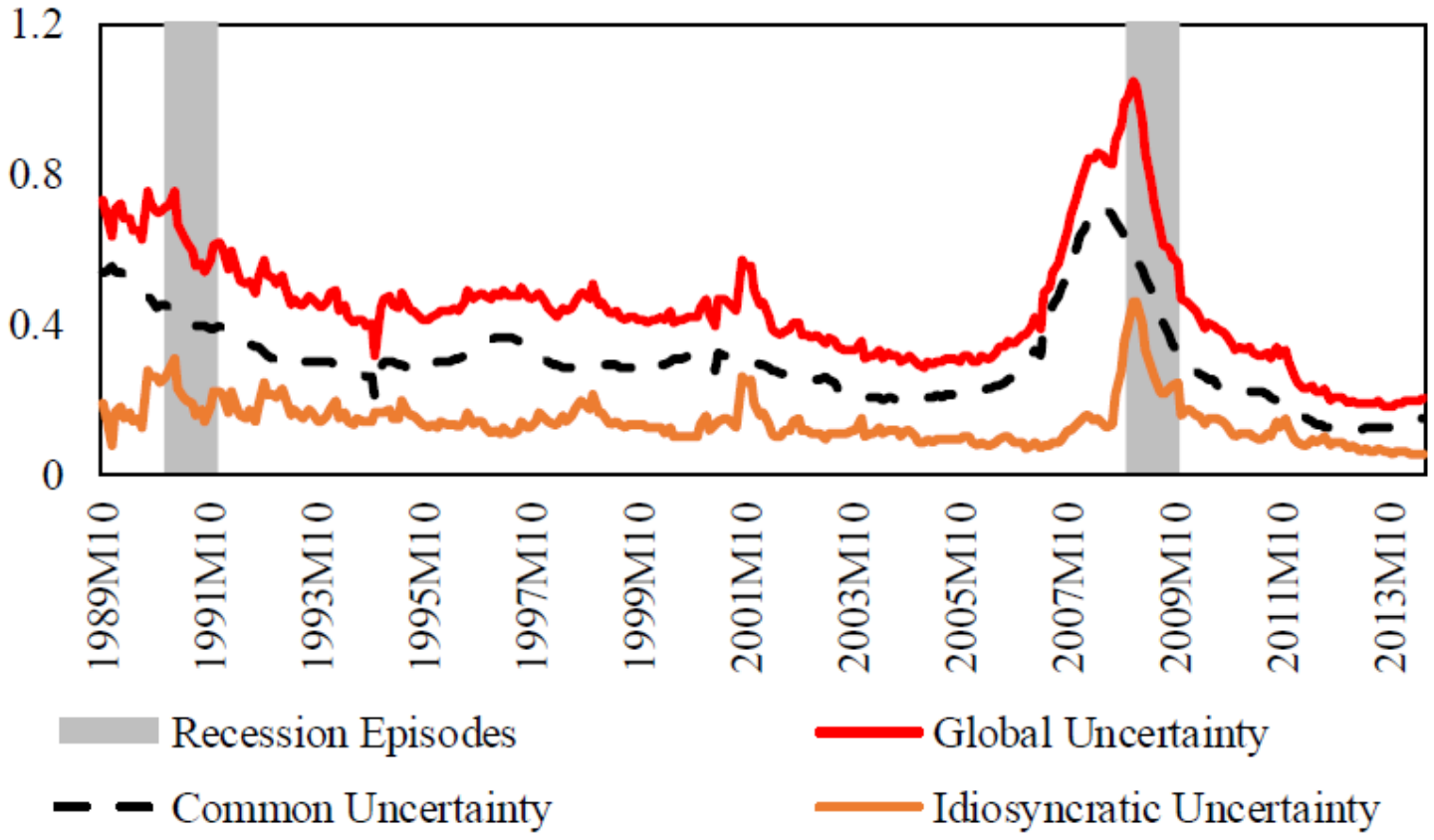
Table 4. Correlations of Uncertainty Measures: United States

	Country-specific uncertainty	Common uncertainty	Idiosyncratic uncertainty	Economic policy uncertainty	News-based policy uncertainty	Jurado et al. (2015)	VXO
Country-specific uncertainty	1.00						
Common uncertainty	0.94	1.00					
Idiosyncratic uncertainty	0.80	0.54	1.00	0.00			
Economic policy uncertainty	0.18	0.05	0.36	1.00			
News-based policy uncertainty	0.19	0.07	0.35	0.90	1.00		
Jurado et al. (2015)	0.79	0.75	0.59	0.28	0.27	1.00	
VXO	0.54	0.48	0.49	0.40	0.49	0.60	1.00

Compared to other uncertainty measures (cont.)



Global uncertainty



Regression of national on global uncertainty

	β	R^2
Estonia	1.597***	0.880
Bulgaria	1.396***	0.886
Lithuania	1.351***	0.925
Latvia	1.346***	0.904
Taiwan	1.320***	0.891
Peru	1.296***	0.694
Russia	1.268***	0.836
Philippines	1.255***	0.857
United States	1.212***	0.782
Canada	1.211***	0.677
United Kingdom	1.210***	0.711
New Zealand	1.161***	0.798
Euro Zone	1.144***	0.679

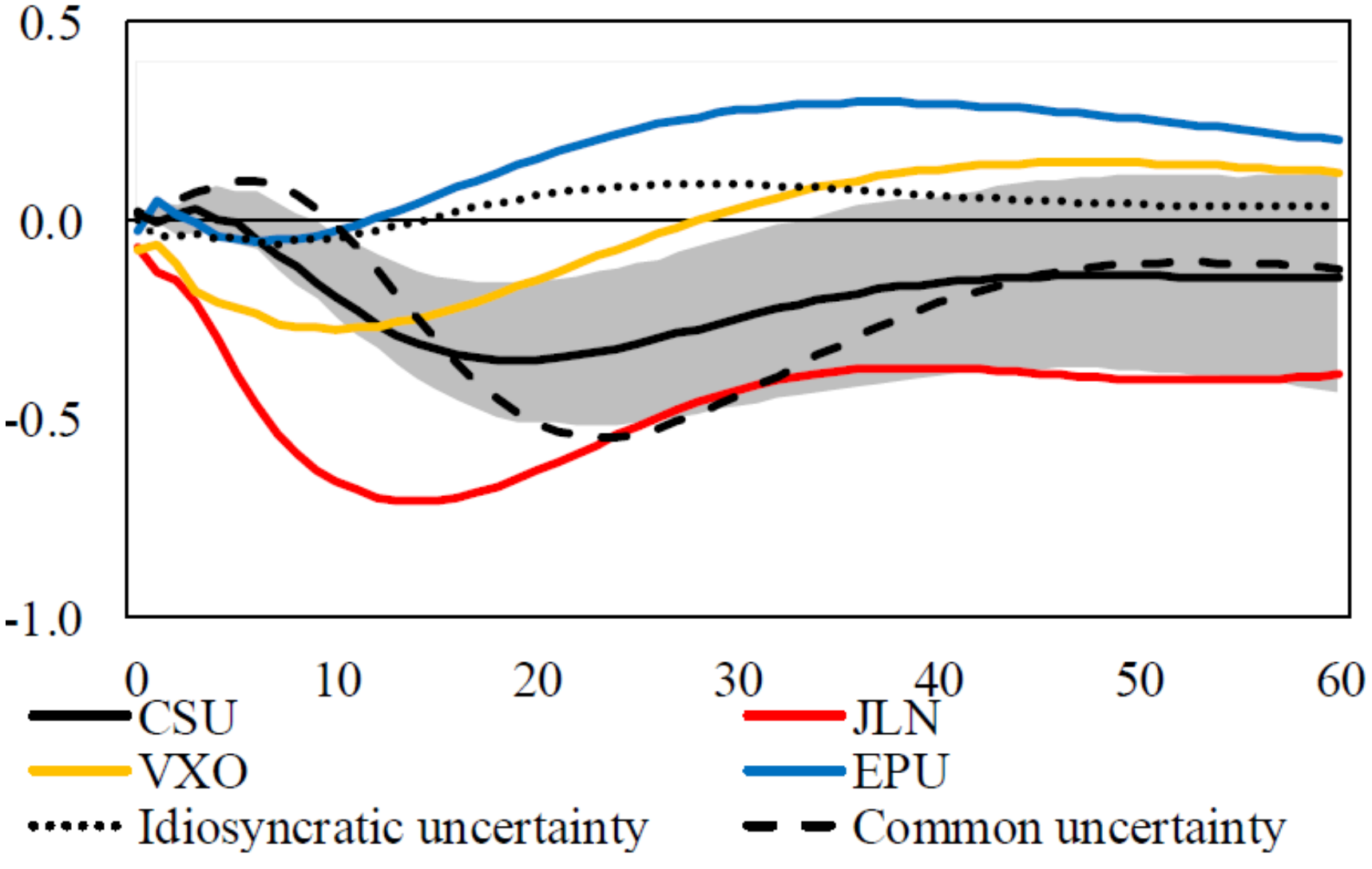
Regression of national on global uncertainty

Spain	0.860***	0.378
Hungary	0.783***	0.819
Slovenia	0.722***	0.537
Italy	0.702***	0.315
Poland	0.632***	0.788
Malaysia	0.605***	0.180
Netherlands	0.541***	0.451
South Korea	0.500***	0.090
India	0.460***	0.432
Norway	0.452***	0.215
Argentina	0.412***	0.076
Thailand	0.350***	0.079
Indonesia	0.208***	0.017
Venezuela	0.039	0.001

Impact of uncertainty: VAR analysis

[■log(*S*&*P*500 *index*) *Uncertainty measure* *Federal funds rate* log(*wages*) log(*consumer price index*) *Hours* log(*employment*) log(*industrial production*)]

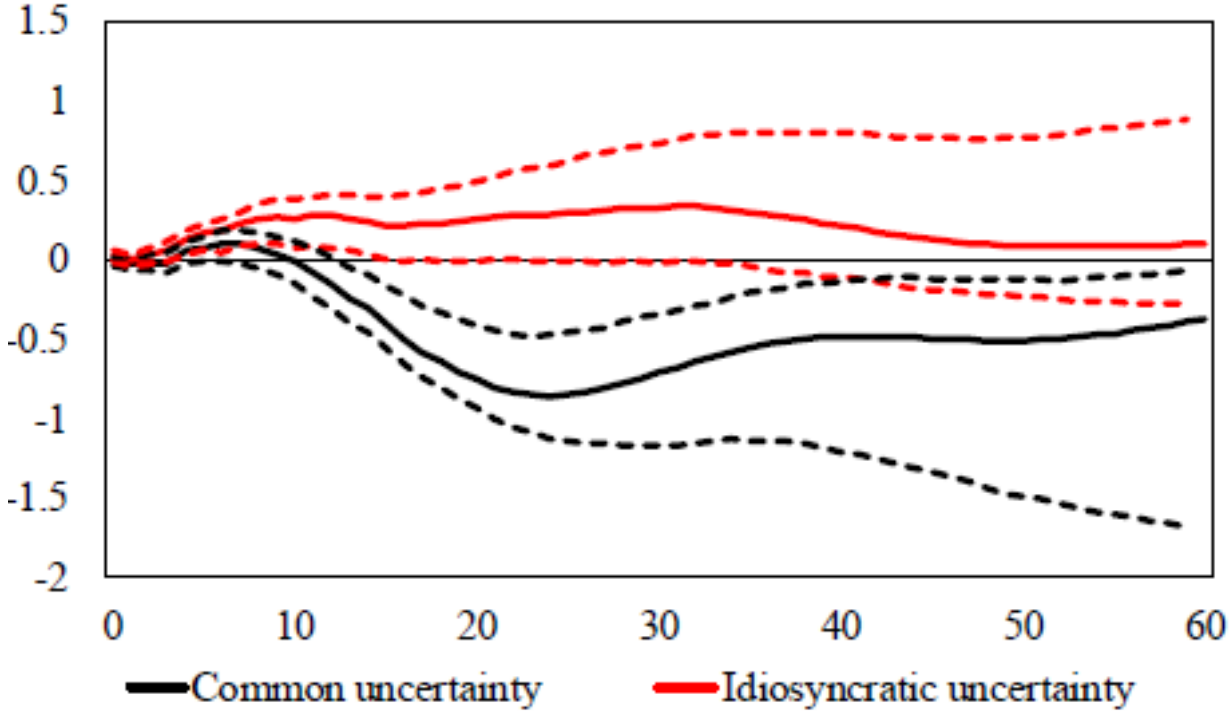
Response of industrial production to uncertainty shock (US)



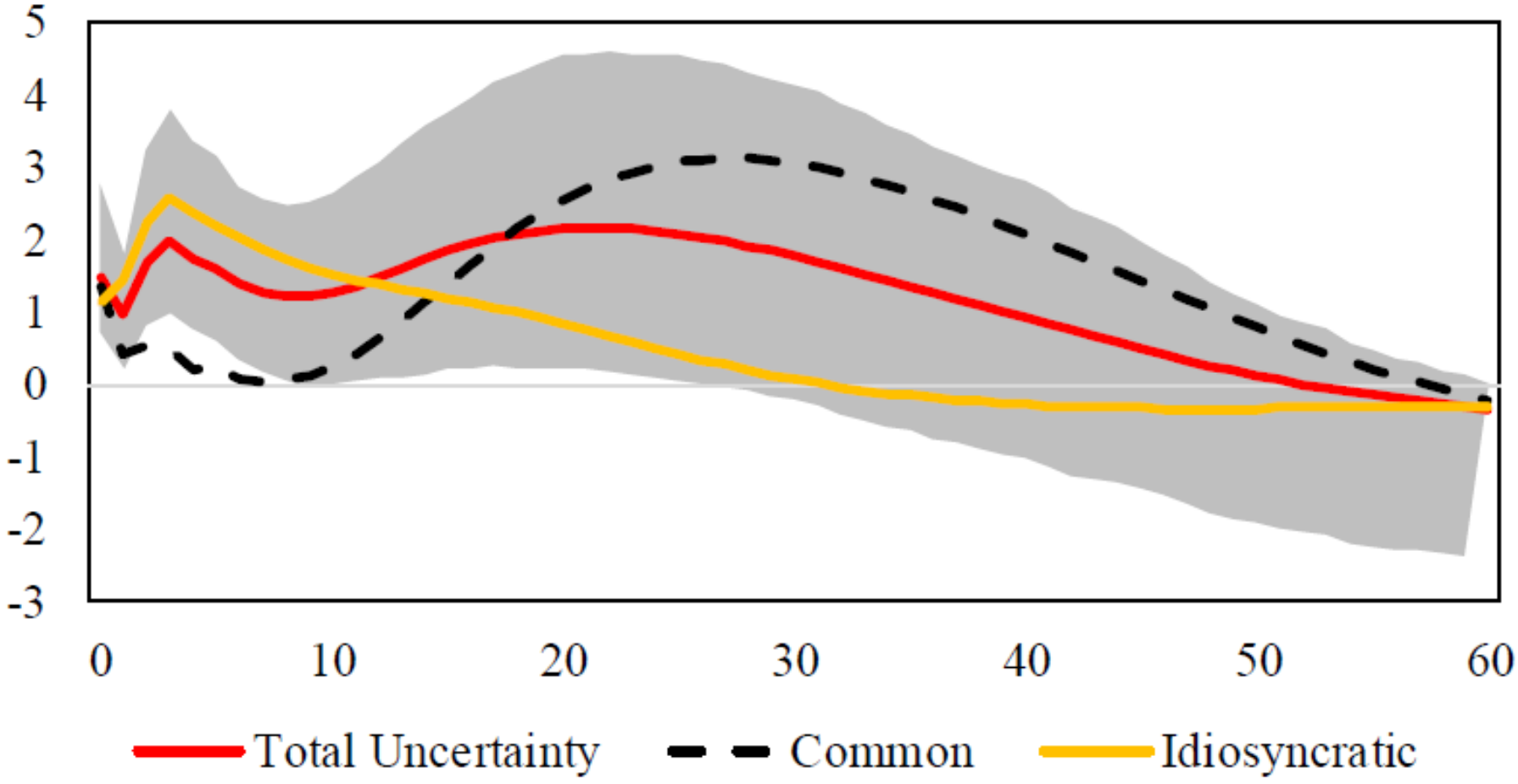
Role of common vs. idiosyncratic uncertainty

[■log(*stock price*)*common uncertaintyidiosyncratic uncertaintymonetary policy rate*log(*consumer price index*)log(*industrial production*) *]*

Response of industrial production to uncertainty shock (US)



Impact of global uncertainty shocks on global unemployment



Conclusion

- We propose a new monthly index of uncertainty that has both common and idiosyncratic components, namely, perceived variability of future aggregate shocks and the disagreement among forecasters.
- We use actual forecasts of real time market analysts instead of using hindsight to specify econometric forecasts. As such, our uncertainty measure captures perceived uncertainty for market participants.
- Compared to alternative leading measures, our country-specific uncertainty measures have fewer volatile peaks and more persistent and heightened uncertainty during recessions.

Conclusion (cont.)

- Using the VAR analysis, we find that shocks to country-specific uncertainty are associated with large and persistent drops in real activity as characterized in Jurado et al. (2015). This result also holds for the world economy: global uncertainty shocks have long-lived effects on industrial production and unemployment.
- The two components of economic uncertainty shows different behavior. Common uncertainty shocks account for a large fraction of fluctuations in economic activity at business cycle frequencies, whereas idiosyncratic uncertainty shocks play a small role. This result stands in odds with Choi and Loungani (2015).

The 2nd workshop on uncertainty "Impact of uncertainty shocks on the global economy", London, May 12-13, 2016

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and

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