

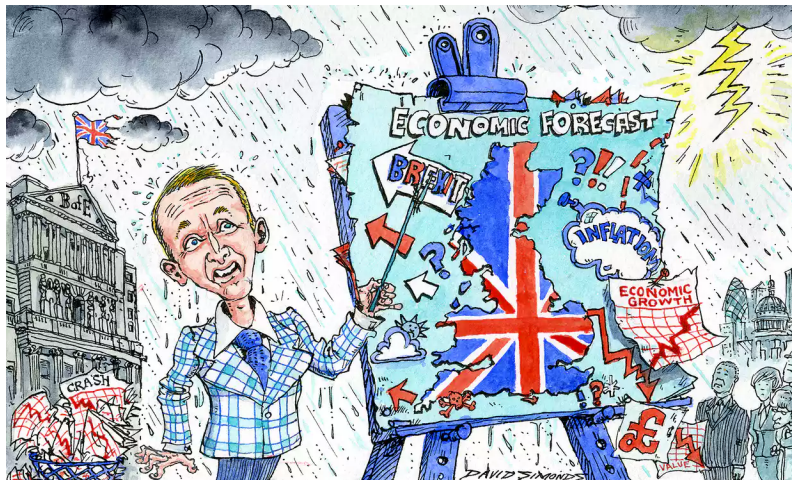
# Forecasting the Economy: for the Q-Step Centre Warwick Spring Camp

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WBS

20.03.17

- Background: why we should produce density forecasts
- Some methodological issues in economic forecasting
- An example: the *Warwick Business School Forecasting System*
  - <http://www2.warwick.ac.uk/fac/soc/wbs/subjects/emf/forecasting>

# Forecasting the Economy: Michael Fish moments



# But when is an error an error?

- Large forecast errors are surely to be expected, even of *good* models, at times of genuine uncertainty (“unknown unknowns”)



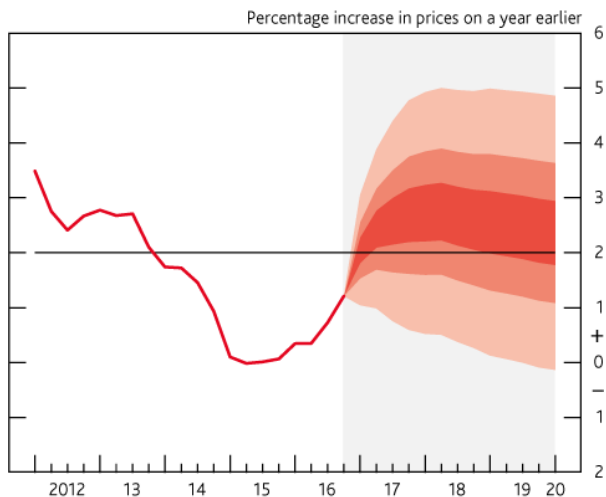
# Keynes on uncertainty

Keynes (1937):

*"The sense in which I am using the term [uncertainty] is that in which the prospect of a European war is uncertain, or the price of copper and the rate of interest twenty years hence, or the obsolescence of a new invention, or the position of private wealth-owners in the social system in 1970. About these matters there is no scientific basis on which to form any calculable probability whatever. We simply do not know."*

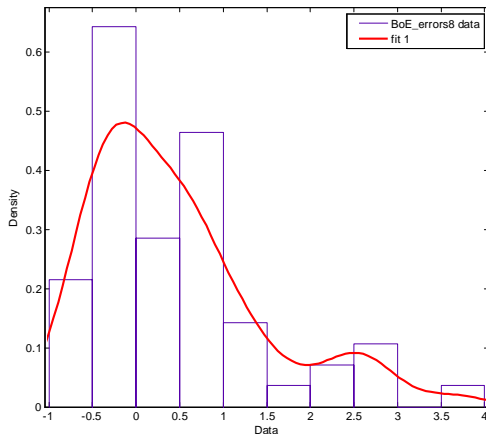


# Fan chart forecasts: latest inflation forecasts from Bank of England



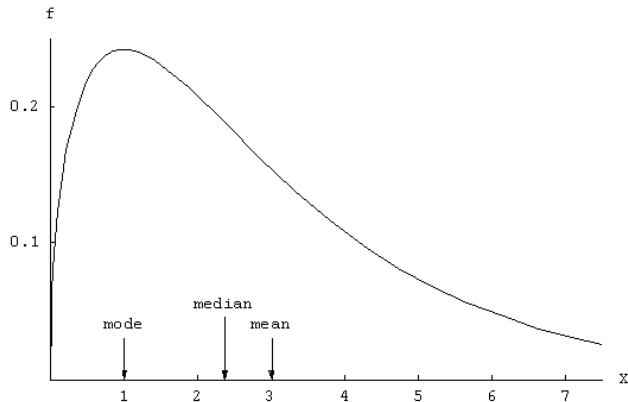
# The rationale for density forecasts

- 2-year ahead Bank of England fan chart mean forecast errors for inflation



# What's the *point*?

- Underlying any point forecast is a density forecast
  - perhaps formed looking at these historical forecasting errors



- Chosen or *optimal* point forecast depends on **your** loss function - as well as your density forecast



# Forecasting the Economy

- "It's tough to make predictions, especially about the future" (Yogi Berra)
- Unlike in meteorology, what people think will happen (their "expectations") affects the outcome in Economics



# The theory of economic forecasting

Live debate on

- 1 Merits of theory based models (that model expectations) versus non-structural statistical models (simplest is random walk)
- 2 And on the role of judgement
  - What value is there in subjective forecasts from “experts”?
  - People appear better than models at reacting to (if not anticipating) “breaks”
  - Use of qualitative survey data popular in economic forecasting

- Theory (e.g. DSGE) models with tight microeconomic foundations grew in popularity pre-GFC
  - *The 'Lucas critique' is a criticism of [models] that fail to recognise that optimal decision rules of economic agents vary systematically with changes in policy. In particular, it criticises using estimated statistical relationships from past data to forecast the effects of adopting a new policy, because the estimated regression coefficients are not invariant but will change along with agents' decision rules in response to a new policy*
- Increasingly these DSGE models were brought to the data using Bayesian methods
- But these DSGE models didn't so well predicting the GFC!
  - "Why did no one see it coming?": Queen Elizabeth II

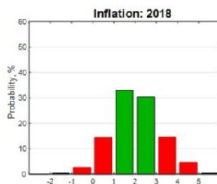
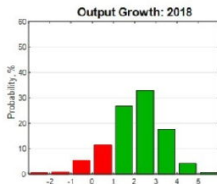
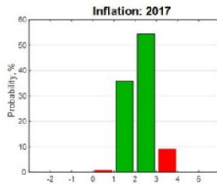
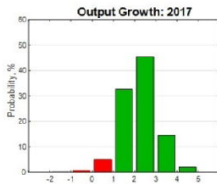
# The post-mortem: economic forecasting post crisis

- Financial variables matter
  - It's "hard" to forecast - as the relevant predictors keep changing
- Nonlinearities matter  $\Leftrightarrow$  linear models with time-varying parameters (not just in first but higher moments) increasingly popular
- It's often "hard" to beat univariate forecasting models

- How can the economist robustify their forecasts against instabilities?
  - 1 model the instabilities
  - 2 use large dimensional, mixed-frequency, more disaggregated data sets
  - 3 model/forecast combination
  - 4 use of leading indicators (survey, financial data)
  - 5 use simple “robust” models
  - 6 (Use a *better* DSGE model or set of theory models)

- Builds on research by members of the EMF Group
  - On density forecasting, combination and evaluation
- Designed to produce benchmark probabilistic (or uncertainty) forecasts for UK macroeconomic aggregates, specifically GDP growth and inflation
  - On a regular, quarterly basis (but using monthly information) since Nov. 2014
  - Accompanied by a press release
  - Historical OOS forecasts evaluated, *ex post*, via probability integral transforms and scoring rules
    - <http://www2.warwick.ac.uk/fac/soc/wbs/subjects/emf/forecasting/>

# Latest WBS Forecasts: Feb. 2017



*"Favourable" outcomes are coloured green; with "unfavourable" ones coloured red. For GDP growth, "favourable" outcomes are defined as GDP growth greater than 1% p.a.. For inflation, "favourable" outcomes are defined as inflation within the Bank of England's target range of 1%-3%, such that the Governor does not have to write a letter of explanation to the Chancellor.*

# Combined density forecasts

- WBS forecasting system seeks to quantify (and benchmark) the risks associated with macroeconomic forecasts
- Uses density forecast combination methods - over a range of popular atheoretical econometric models

$$p(z_{t+h}) = \sum_{i=1}^N w_{i,t} g(z_{t+h} | I_{i,t})$$

- where  $g(z_{t+h} | I_{i,t})$  are the  $h$ -step ahead forecast densities from model  $i$ ,  $i = 1, \dots, N$ , for output growth or inflation, conditional on the information set  $I_{i,t}$
- No one single model is likely correct - certainly across time and forecast horizons
  - Estimated weights on the component models,  $\hat{w}_{i,t}$ , vary across time and  $h$



# The WBS system accommodates model uncertainty

Considers 4 popular sets of model + an AR(2)

- 1 two Bayesian VARs which have different information sets, via a different number and type of variables
- 2 a 3 variable (output growth, inflation and interest rates) time-varying parameter VAR with stochastic volatility
- 3 Mixed-Frequency (ADL-MIDAS) models, with predictors such as commodities prices, house prices, consumer confidence ... sampled at a monthly frequency
- 4 + an AR(2),