BANK OF ENGLAND

Speech

Telling Tails of oil and global inflation

Technical Appendix to speech given by Martin Weale, Monetary Policy Committee

1 Details of models used

1.1 Estimating the impact of the oil price fall on the UK

The modelling framework used in this section was developed by Harvey (2013) and Creal, Koopman and Lucas (2012). It is based on the assumption that shocks in the model follow a t distribution rather than a more conventional Gaussian distribution. The model can then distinguish between outliers and genuine noise – placing little weight on the former, and much more on the latter. By looking through random shocks, the model provides a better picture of the underlying relationship between the variables in the model.

The model itself comprises four variables: the quarterly growth in oil prices; quarterly GDP growth; quarterly CPI inflation; and the quarter-on-quarter difference in Bank Rate (in percentage points).

1.2 Measuring the relationship between UK and OECD inflation

An excellent overview of the copula models used in this speech is provided by Patton (2006) and Fan and Patton (2014).

Chart 6 was constructed using the method described by Patton (2006, p. 909). This provides a measure of the dependence between the tails of the distributions of UK and OECD inflation.

The probability plots in Chart 7 were constructed by estimating three different measures of dependence between the UK and OECD core inflation rates. In the first, a Gaussian copula was estimated and the correlation coefficient found to be $\rho = 0.47$. In (b),

a t-distributed copula was estimated, with estimated correlation $\rho = 0.49$ and $\nu = 10.0$ degrees of freedom. The advantage of the t copula is that one can estimate the degree of dependence between the tails of the distribution; this is assumed to be the same for the left-hand and right-hand tails, and in this sample is equal to 0.079. In (c), a Symmetrized-Joe-Clayton copula was estimated. This allows for differing degrees of tail dependence, and in this sample the difference is large: the dependence of the lower tail – that is, for low rates of inflation – is 0.012, whilst that of the upper tail – high inflation – it is 0.469.

Chart 8 shows the estimated linear correlation from a t-distributed copula, where the correlation is allowed to vary over time. The estimate of the correlation is obtained by the same DCS/GAS framework described above.

2 Data sources

2.1 Estimating the impact of the oil price fall on the UK

The model results presented in Chart 3, and referred to in the text, used quarterly data for the UK over time sample 1993Q3 to 2014Q4. The **oil data** were constructed from daily data from Datastream; **GDP** and **CPI** data were from the ONS; and **Bank Rate** data from the Bank of England.

2.2 Measuring the relationship between UK and OECD inflation

Monthly data on core and headline inflation were obtained from the OECD Statistics database. The full sample is from January 1971 to March 2015, unless stated otherwise in the text. The data were seasonally adjusted using the X13 procedure (in Eviews), and then converted into month-on-month percentage changes. The series for OECD inflation excluding the UK was constructed by subtracting the weighted logarithm of the UK price level from the logarithm of the whole OECD price level. The weight used was the average UK share in OECD consumption, which is around 6%.

References

Creal, D., Koopman, S. J. and Lucas, A. (2012) , 'Generalized autoregressive score models with applications', *Journal of Applied Econometrics*

Fan, Y. and Patton, A. (2014) 'Copulas in Econometrics', *Annual Review of Economics*, 6, pp. 179-200.

Harvey, A. (2013) *Dynamic Models for Volatility and Heavy Tails*, Cambridge University Press

Patton, A. (2013) 'Copula methods for forecasting multivariate time series', in Handbook of Economic Forecasting vol. 2B, Elsevier