Available online at www.sciencedirect.com
ScienceDirect
International Journal of Forecasting 25 (2009) 81–102
international journal of forecasting
www.elsevier.com/locate/ijforecast

Real time representation of the UK output gap in the presence of model uncertainty

Anthony Garratt[a,*], Kevin Lee[b], Emi Mise[b], Kalvinder Shields[c]

[a] *Birkbeck College, University of London, UK*
[b] *University of Leicester, UK*
[c] *University of Melbourne, Australia*

Abstract

We undertake an empirical analysis of the UK output gap using real-time data and an approach that accommodates, in a coherent way, three types of uncertainty when measuring the gap. These are model uncertainty (associated with the choice of model and de-trending technique), estimation uncertainty (with a given model) and measurement uncertainty (associated with the reliability of the data). The approach employs VAR models, along with Bayesian-style 'model averaging' procedures, to jointly explain and forecast real-time measures and realisations of output series. A comprehensive representation of the UK output gap and the associated uncertainties are provided in real time by probability forecasts over $1961q2 - 2005q4$.

Keywords: Output gap; Real time data; Revisions; Output trends; Model uncertainty; Probability forecasts

1. Introduction

The measurement of the output gap, i.e. the difference between the economy's actual output level and its potential or trend level, is central to much applied macroeconometric work, and to the analysis of monetary policy in particular. However, a well known difficulty with the use of the output gap arises from the uncertainty that surrounds its measurement. This uncertainty is generated from a range of sources, including: the *model uncertainty* surrounding the choice of model used to characterise the output series and of the corresponding detrending technique; the *estimation uncertainty* associated with any chosen model/technique and characterised by the estimated stochastic variation and variation in the estimated parameters of the model; and the *measurement uncertainty* associated with the availability and reliability of the data used to calculate the gap in real time. The latter source of uncertainty has been highlighted in the recent literature, typified by Orphanides (2001), who illustrates the importance of acknowledging that macroeconomic decisions are

* Corresponding address: Department of Economics, Birkbeck College, Malet Street, London, WC1E 7HX, UK.
E-mail address: a.garratt@bbk.ac.uk (A. Garratt).

0169-2070/$ - see front matter © 2008 International Institute of Forecasters. Published by Elsevier B.V. All rights reserved.
doi:10.1016/j.ijforecast.2008.11.005

made in real time and on the basis of data that is frequently subject to subsequent revisions.[1]

This paper describes an analysis of the output gap in the UK over the period $1961q2$–$2005q4$, employing an approach to measuring and representing the output gap that accommodates all these types of uncertainty in a coherent way. The analysis pays particular attention to model uncertainty, extending the work of Orphanides and van Norden (2002) [OvN] and Garratt, Lee, Mise, and Shields (2008) [GLMS] on US data. OvN highlight the unreliability in the measures of the US output gap due to measurement uncertainty based on data revisions and the unreliability of end-of-sample estimates of trend output. Using a recursive analysis of the successive vintages of data that became available over $1965q1$–$1997q4$, they observe that revisions of the US gap have been of the same order of magnitude as the gap itself over this period. GLMS acknowledge the role of measurement uncertainty, but argue that part of this can be offset by the use of a joint model that explains the time series of measured output as released in real time alongside the time series of revisions in measured output. Such a model enables forecasts to be made of the post-revision output level (i.e. the output measure that will be released after all revisions are complete), both currently and into the future. Hence, any systematic elements in the revisions are anticipated and taken into account, and this directly reduces the extent of measurement uncertainty and its impact on gap measures. Further, the model provides a means of characterising the uncertainty surrounding the measure, and this is important if the gap is to be represented in a way that is useful and easily-interpretable by decision-makers.

In this paper, we repeat the analyses of OvN and GLMS using real time data on UK output, confirming that the problems of measurement uncertainty and estimation uncertainty encountered in measuring the US output gap are also found in the UK, and that the procedures suggested by GLMS are appropriate for the UK too.[2] However, the analysis in this paper is extended to focus on the role of *model uncertainty* in the measurement of the output gap. We find that the revision process is more prolonged and more complex for the UK data than for the US data. This means that the choice of an appropriate model with which to characterise the series released in real time is more difficult, and that more attention needs to be paid to the uncertainty surrounding this aspect of the output gap measures. We therefore adopt an approach to measuring the output gap in the UK that deals with the uncertainties surrounding the choice of model and the associated detrending technique, in addition to the estimation and measurement uncertainties that dominate the US analysis. The approach employs a Bayesian-style 'model averaging' procedure to accommodate the model uncertainty,[3] and the focus is on combining forecast probability density functions to provide a comprehensive representation of the output gap and the associated uncertainties in real time.

The remainder of the paper is organised as follows. In Section 2, the proposed method for measuring the output gap is described. In this, the appropriate real time measure of the gap is discussed based on models that can jointly explain output growth and the revision process. The joint models can provide point forecasts of 'post-revision' output series and can describe the range of potential output outcomes that might occur using simulation methods. The section also explains how the simulation methods can be used to calculate and represent trends and gap measures, taking into account measurement uncertainty, estimation uncertainty and model uncertainty. Section 3 describes the application of the proposed methods to obtain output gap measures for the UK, taking all the various sources of uncertainty into account, and compares these with the measures obtained following the procedures of OvN and GLMS. Section 4 presents some probability forecasts obtained using our

[1] In monetary policy analysis, it is now acknowledged that the use of ex post revised data can yield misleading descriptions of historical policy, and can generate very different policy recommendations to those obtained on the basis of real-time data. Also, the identification and interpretation of monetary policy shocks are very sensitive to assumptions on the timing of the release of information and decisions. See, for example, Orphanides (1998); Amato and Swanson (2001), Brunner (2000), Christiano, Eichenbaum, and Evans (1999), Garratt, Lee, Pesaran, and Shin (2006), Orphanides, Porter, Reifschneider, Tetlow, and Finan (2000), and Rotemberg and Woodford (1999).

[2] Related work includes that of Harvey, Trimbur, and van Dijk (2007) for the US and Adam and Cobham (2005) for the UK.

[3] See Burnham and Anderson (1998) for a general discussion of model averaging, and for recent examples of the use of the techniques, see Garratt, Lee, Pesaran, and Shin (2003), Pesaran and Zaffaroni (2004), and Stone and Weeks (2001).