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Forecasting global recessions in a GVAR model of actual and expected output

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ABSTRACT

We compare a Global VAR model of actual and expected outputs with alternative models for assessing the roles of cross-country interdependencies and confidence in forecasting. Forecast performances are judged on point and density forecasts of growth, on probability forecasts of the occurrence of national and global recessionary events, and, through a novel 'fair bet' exercise, on decision-making using probability forecasts. We find that multi-country and survey data are required in order to capture the influence of global interactions and expectations in forecasts fully. We argue that output predictions should avoid simple point forecasts and focus on densities and events that are relevant to decision-makers.

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1. Introduction

This paper investigates the importance of two aspects of the forecasting of business cycles that were highlighted during the slowdown in economic growth that followed the financial crisis of 2007. First, given the global reach of the slowdown, we investigate the importance of incorporating cross-country interactions in a forecasting model. Second, we acknowledge the potential roles of confidence and pessimism in initiating and propagating business cycle dynamics, and the contribution of expectations data, obtained directly from surveys, to the calculation of output forecasts. The paper considers the importance of these factors for point and density forecasts of output outcomes in standard statistical terms. However, it also focuses on the extent to which different models are able to forecast the likelihood of particular recessionary events and

to make predictions that are useful for decision-making. This is important, given that little of the popular discussion of growth predictions has focused on the exact forecast of output at a specific time in the future; rather, the discussion concentrates on the likely occurrence of 'global recessions', 'double-dip recessions', 'signs of green shoots', and so on; i.e., more broadly defined events occurring over some future interval.[1] Our forecast evaluation exercise considers the contribution of international interactions and expectations data to the forecasting of the likelihood of this sort of event, and also considers a decision-making situation involving a bet that the events occur. This provides a novel perspective, and one that matches the popular view on forecasting output outcomes, on the usefulness of this data and of output modelling in general.

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[1] A thorough analysis of the nature and timing of business cycle events is also provided in the literature; see for example the special issue of the *Journal of Applied Econometrics* edited by van Dijk, van Dijk, and Frances (2005).

The paper investigates the importance of the two factors through a comparison of the forecasting performances of a range of models that aim to isolate the separate contributions of cross-country interdependencies and survey expectations. The most general model considered is a multi-country Global Vector Autoregressive (GVAR) model that explains more than 80% of world output movements, as well as expected outputs in the G7 countries. The GVAR modelling framework is outlined by Garratt, Lee, Pesaran, and Shin (2006), Pesaran, Schuermann, and Weiner (2004), and, in the context of forecasting, Pesaran, Schuermann, and Smith (2009), *inter alia*. It uses trade-weighted averages of foreign variables to capture the effects of external influences in an otherwise unconstrained VAR model of separate national models. The further inclusion of direct measures of expected outputs (at home and abroad) allows the model to accommodate the complex dynamic interactions that arise when decisions are made by forward-looking agents who are influenced by confidence and pessimism on current and future growth prospects at the national and international levels. The individual country models are then brought together in a single coherent GVAR system that accommodates the complexity of cross-country interactions while at the same time allowing for the sophisticated short-run dynamics found in the data.

Of course, there is no shortage of papers in the academic literature that are concerned with investigating cross-country interactions in the global business cycle, including the large-scale structural econometric systems of the United Nations' Project LINK, or the IMF's multi-regional model MULTIMOD, for example (see Laxton, Isard, Faruqee, Prasad, & Turtleboom, 1998).[2] There have also been many modelling exercises that have aimed to provide a statistical characterisation of macroeconomic variables across a range of countries, often estimating dynamic factor models in order to identify global, nation-specific and idiosyncratic components in different series and across different sets of countries; see for example del Negro and Otrok (2008), Kose, Otrok, and Whiteman (2003, 2008), Lumsdaine and Prasad (2003), or Crucini, Kose, and Otrok (2011). However, these latter models are not typically used in forecasting, and while global interactions are at the heart of the forecasts delivered by the large structural models, it is not easy to isolate the contribution of the global effects to these models. We believe that our GVAR analysis is well suited to this exercise. At the same time, our model can capture the influence of expectations effects at both the national and global levels through the inclusion of the direct measures of expectations.[3] The potential role of confidence and expectation formation in business cycle fluctuations has been explored recently in Akerlof and Shiller's (2009) discussion of 'animal spirits', for example, and in the analyses of information rigidities by Barsky and Sims (2012), Blanchard,

L'Huillier, and Lorenzoni (2013), and Coibion and Gorodnichenko (2012), *inter alia*. This aspect of business cycle dynamics is potentially crucial to any forecasting exercise, and can be incorporated readily using the GVAR methods we use in our models.

In a complementary paper, Garratt, Lee, and Shields (2013) [GLS] use a GVAR model of G7 outputs to examine the role of inter-country interactions and expectations in explaining output growth. A variance-based measure of the persistent effect of shocks shows that, on average, the split between the global and national influences on persistent movements in the countries' outputs is in the ratio 50:50. Further, while most of the persistent movements in output are explained by fundamentals, around 10% are explained by 'sentiment' captured using survey data on the expected output alongside the actual output data. GLS demonstrates that cross-country interactions and survey data can therefore play a considerable role in modelling countries' output growth. The focus of the current paper goes beyond the description of model properties, though, and also considers the use of output growth models for 29 countries in producing forecasts, and, in particular, in producing probability forecasts of recessionary events. The use of models for producing forecasts of the probable occurrences of different types of recessionary events, in addition to density and point forecasts of output growth, focuses attention on decision-making and the economic significance of forecasts, complementing the more usual statistical assessments of their forecasting performances.[4]

As we shall see, the results show that, judged by statistical criteria, the performances of models that nowcast and forecast countries' outputs are enhanced considerably by taking into account international links and the information available from survey data. We also find that, when focusing on economic criteria, both the expectations data and the international interactions are important for calculating density forecasts, for forecasting the occurrence of recessionary events, defined at the national and G7-wide levels, and, through a 'fair bet' exercise, for decision-making based on forecasts. Ultimately, the analysis argues for a nuanced approach to representing and evaluating output predictions, by avoiding simple point forecasts and focusing instead on densities and future output outcomes that are relevant for decision-makers.

The layout of the remainder of the paper is as follows. Section 2 describes our modelling framework, explaining how our national models of actual and expected output growths are developed and brought together in the GVAR. Section 3 explains the use of density and probability forecasts for model evaluation using statistical and economic criteria, introducing a novel, generally-applicable approach to making an economic evaluation of forecasts over a range of different recessionary events, based around a fair bet. Section 4 describes the GVAR model obtained for the 29 economies over the period 1994q1–2014q2 and the details of our forecasting exercise. Section 5 concludes with a brief summary of the findings.

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[2] A recent IMF characterisation of periods of recession in advanced economies since the 1960s shows that recessions are deeper and last longer when they are synchronized across countries than when they are more localised; see Kannan, Scott, and Terrones (2009).

[3] The usefulness of output forecasts obtained directly from surveys is also explored in a multi-country context by Isiklar and Lahiri (2007).

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[4] See Garratt, Lee, Pesaran, and Shin (2003); Garratt et al. (2006) for a discussion of the estimation of event probability forecasts; and Clements (2006), Garratt and Lee (2010), and Lahiri and Wang (2007, 2013) for a discussion of their use in forecast evaluation.