Publication: The Business Times, p 11
Date: 20 January 2016
Headline: Forecasting economic uncertainty

Forecasting economic uncertainty

The primary purpose of macroeconomic forecasts is to convey the degree of uncertainty facing an economy, says SMU Associate Professor Anthony Tay

EXPECTATIONS regarding future economic conditions play a central role in economic decisions. For guidance in forming these expectations, many people eagerly await GDP and inflation forecast announcements by prominent industry economists, central banks, and various government institutions. Every quarter, these forecast announcements are given prominent coverage in the newspapers. A recent example in Singapore is the announcement from the Ministry of Trade and Industry (MTI) that Singapore's GDP growth for 2016 is forecast to be between 1 and 3 per cent.

That the MTI forecasts are announced as an interval is a vast improvement over the past practice by forecasters in general of giving 'point' forecasts (eg, "Singapore's GDP growth in 2016 is forecast to be 2 per cent"). The improvement lies in the fact that forecast intervals relay to some extent the idea of uncertainty. For instance, an interval forecast of 1.9 to 2.1 per cent gives a very different message than an interval forecast of 1 to 3 per cent. Point forecasts are often preferred by some forecast users, perhaps because it 'gives them a number to work with'. However, point forecasts can give forecast users a false sense of certainty, and certainly does nothing in conveying notions of economic uncertainty. I would go so far as to say that the primary purpose of a macroeconomic forecast is to convey the degree of uncertainty facing the economy.

Predictable uncertainty?

At the start of my undergraduate 'Economic Forecasting' course at the Singapore Management University, I tell my students to "prepare to be wrong". I tell them that they will make forecast errors since they are forecasters, not psychics. After all, there will always be a large unpredictable component in any complex system centred on human interactions and human decisions, and furthermore, all economic models are simplifications of the real economy.

For macroeconomic variables, this element of unpredictability tends to be very large. Rough estimates show that professional forecasts made at the start of each quarter are able to account for just over 30 per cent of all movements in future GDP growth. But while forecast errors are inevitable, forecasters can estimate how wrong they might be with their forecasts. One way to do this is to compute forecast 'standard errors'. These numbers are useful because they tell the forecast user how much uncertainty is associated with the forecast, and forecast users can adjust their behaviour accordingly. For instance, investors may hedge their positions more aggressively in more uncertain times.

It turns out that the degree of unpredictability is predictable, at least to some extent. This was first pointed out over 30 years ago. Since then, there has been much progress in developing models that forecast volatilities, and this is an area where several researchers at SMU's School of Economics have made important contributions. However, the development of such volatility forecasting models has focused mainly on the analysis of financial data, and many macroeconomic forecasting models in use today still make the unrealistic assumption that uncertainties do not change over time.

Density forecasts

Volatility models focus on forecasting the future variance of a variable. One limitation of this is that the variance gives only an idea of the size of potential forecast errors, not the sign, and furthermore does not tell us if positive or negative errors are more likely.

It is interesting, however, to go one step further and develop models that produce density forecasts. A density forecast is a complete probabilistic description of the possible future realisations of a variable, given some information set. For example, a density forecaster might say something like "based on current information, GDP growth over the next year is expected to be normally distributed with mean 2 per cent and standard deviation 0.5 per cent" ('normally distributed' means that the distribution of probabilities is 'bell-shaped'). Density forecasts have the potential to be much more interesting, as the 'bell' can be asymmetric, with long tails, and so on. To put it in the language of the more familiar point and interval forecast, perhaps one immediate advantage of density forecasting is to allow forecasters to say something like "Singapore's real GDP growth is expected to be between 1 and 3 per cent, and is more likely to be in the higher end of that range".

> **"Structural macroeconomic density forecasting models would be helpful in assessing and studying the effects of policy on the probabilities of events of interest."**
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> **Anthony Tay, Associate Professor of Economics and PhD in Economics Programme Director at the School of Economics, Singapore Management University**

Another advantage of density forecasts is that it allows a forecast user to estimate probabilities of specific future events. For instance, the normally distributed density forecast example stated above would imply that there is roughly a 95 per cent chance of GDP growth in 2016 falling between 1 and 3 per cent, to put it in terms reminiscent of a weather forecast. But probabilities of other events can be inferred as well (eg, what is the probability that GDP growth turns out negative?). Density forecasts derived from multivariate dynamic models may also be able to shed light on the conditions under which such an event might come to pass.

Examples of density forecasts

Density forecasts are already in regular use, the most prominent ones being density forecasts (possibly subjective ones) elicited from professional forecasters through surveys. In 1968, the Business and Economics Statistics Section of the American Statistical Association (ASA) and the National Bureau of Economic Research (NBER) initiated the ASA-NBER survey, a quarterly survey of professional macroeconomic forecasters in the US.

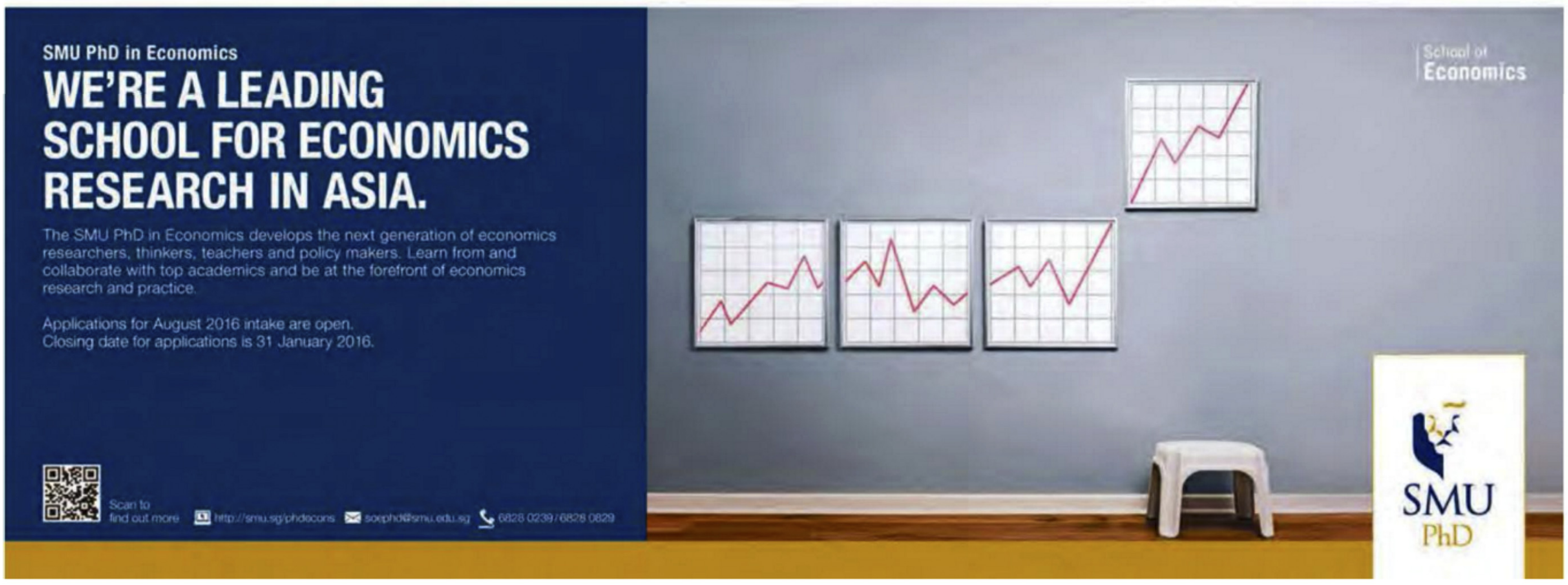
The Federal Reserve Bank of Philadelphia later took over the implementation of the survey, which was renamed as the Survey of Professional Forecasters (SPF). This survey mostly asks forecasters for their point forecasts for a range of variables and horizons, but it also asks for probability density forecasts for inflation and output growth in the form of histograms. The forecasters are given a set of intervals, or bins, and asked to assign probabilities to each bin. These are then averaged over all respondents to form an average representation of the expectations of the survey participants.

In Singapore, density forecasts of output growth, similar in form to those in the SPF survey, have been published in the Monetary Authority of Singapore's Survey of Professional Forecasters since 2001. Other prominent examples of density forecasts in macroeconomics include the quarterly density forecasts of 1-year ahead UK RPIX (retail price index excluding mortgage interest payments) inflation issued by the Bank of England from Q1 1993 to Q2 2004, and since Q3 1992, by the National Institute of Economic and Social Research in the UK.

My research focused initially on assessment of such types of forecasts. How do you show dynamic probability forecasts to be 'accurate'? In an early paper, my co-authors and I argued that 'accurate' density forecasts should be probabilistically well-calibrated and 'dynamically correct' so that the forecasted probabilities of events should match the actual occurrence of the events, and furthermore that deviations of these probabilities from the actual frequency of realisation should not be predictable using information available at the time the forecasts were made.

My more recent research is focused on producing models that can generate good macroeconomic density forecasts. Currently, many density forecasting models take the form of single-variable models that use information only in the target variable's past. More interesting is the challenging task of producing structural models that can generate well-calibrated and dynamically-correct density forecasts of macroeconomic variables. Such a model would be helpful in assessing and studying the effects of policy on the probabilities of events of interest, such as recessions.

This is a monthly series brought to you by the Singapore Management University. Next month's feature will consider some tax measures and proposals for Budget 2016.



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