

DSGE models: A cup half full

John Williams 08 April 2018

Macroeconomic models are an essential part of a monetary policymaker's toolkit. In this column, taken from a VoxEU ebook, the author gives his personal assessment of the usefulness of DSGE models currently in use at the Federal Reserve and identifies three key issues that the next generation of DSGE models will need to address to be more relevant for policymakers.

Macroeconomic models are an essential part of a monetary policymaker's toolkit. Although simple theoretical models provide valuable insights into economic mechanisms and partial-equilibrium models are useful for forecasting and analysis, macroeconomic models provide a general equilibrium perspective that is critical for economic forecasting, assessing alternative scenarios and macroeconomic risks, and analysing monetary policy strategy. Over the past decade or so, a new generation of dynamic stochastic general equilibrium (DSGE) models have been developed and are now in everyday use at many central banks, including the Federal Reserve. In theory, DSGE models feature more explicit micro foundations, impose cross-equation restrictions that relate macroeconomic responses to shocks, and provide a closer connection between academic research and central bank practice. In this column, I will offer my personal assessment of the usefulness of DSGE models currently in use at the Federal Reserve and identify three key issues that the next generation of DSGE models will need to address to be more relevant for policymakers. My comments reflect my own views and not necessarily those of anyone else in the Federal Reserve System.

DSGE: One of many inputs to policy

DSGE models have supplemented, and in some cases, replaced, standard macroeconometric models at many central banks. At the Federal Reserve, a number of DSGE models currently coexist alongside more traditional structural models like FRB/US and FRB/Global (Brayton et al. 1997).

The staff of the Board of Governors has developed two working DSGE models: the EDO model of the US economy, and the SIGMA multi-country model. In addition, several research departments at Federal Reserve Banks have developed DSGE models that are used for forecasting and analysis. DSGE model-based forecasts and other analyses are regularly shared among economists and policymakers across the Federal Reserve System.

The addition of DSGE models to the suite of models my colleagues and I regularly consult at the Fed is a positive development. My research on robust monetary policy strategy emphasises that we shouldn't place too much confidence in any one model (Levin et al. 1999, Levin and Williams 2003). From a robustness perspective, the more models, the better! This is equally true for forecasting, alternative simulations, and policy strategy analysis. This is particularly salient for models that are designed to be consistent with key features of the macroeconomic data, which is the case for the set of DSGE models in use at the Fed. For these reasons, I find DSGE (alongside other macroeconomic) models

useful to help identify which results are robust across models and cases where different models yield different conclusions and why.

Despite these benefits, the practical value of DSGE models in addressing critical policy issues of the past decade has been limited by key modelling assumptions at the foundation of many DSGE models used at the Fed. Specifically, in recent years three key issues for monetary policymaking at the Federal Reserve have been the extent of slack in the labour market, the productivity slowdown, and the natural (or equilibrium) rate of interest. In theory, the claimed micro-foundations underlying DSGE models should make them well suited for analysing these issues. In practice, microeconomic theory is primarily used to pin down certain parameters and cross-equation restrictions in the dynamic responses to shocks, leaving the models silent on these key policy issues.

The labour market

This shortfall is illustrated by the treatment of the labour market in many DSGE models (Levin et al. 2006). Although there have been numerous advances in the modelling of the labour market in DSGE models over the past decade, the models in use at the Fed typically treat it in a cursory manner or abstract from it entirely.

The cyclical state of the economy is summarised by the output gap. In debates about the structural versus cyclical nature of fluctuations in the labour market that have been the subject of so much attention and research at the Fed in recent years – related to the unemployment rate, labour force participation, job vacancies, and part-time employment – these DSGE models are silent. Given that one-half of the Fed’s mandate concerns employment, the next generation of DSGE models needs to have a greater focus on modelling the labour market and the degree of slack.

Including longer cycles

A second and related shortcoming of the current set of DSGE models is their exclusive focus on shorter-term, or business-cycle frequency, responses to transitory shocks. Many of the most important issues facing central banks today are related to medium- or long-run developments to both the ‘supply’ and ‘demand’ sides of the economy, including the labour market, productivity, and other structural changes. Because the current crop of DSGE models assumes that all shocks are transitory and that the economy eventually returns to a fixed steady state, these models are not designed to analyse longer-term shifts in demographics, productivity, preferences, or other structural shifts. Instead, through the lens of these models, such developments manifest themselves as positively correlated sequences of shocks. For example, a trend slowdown in the rate of productivity growth would appear as a long sequence of negative shocks to productivity, and a permanent shift in household preferences towards greater risk aversion would appear as a sequence of shocks to risk preferences.

This confusion between transitory and longer-term changes in the economy is not without consequences. For example, the macroeconomic response to a transitory slowdown in productivity growth can be very different from the response to a long- lasting one, due to the very different wealth effects implied in the two cases (Edge et al. 2007). The restriction that treats all shocks as transitory in nature may significantly bias the predictions of these models when substantial structural changes occur, such as those that

currently appear to be affecting many advanced economies, including demographic swings, a productivity slowdown, and shifts in risk aversion (Holston et al. 2016).

The assumption that all shocks are transitory has also had a particularly strong effect on the predictions of DSGE models for the natural rate of interest, that is, the real short-term interest rate that would prevail absent nominal frictions. In DSGE models, the long-run natural rate of interest is assumed to be a constant, and the natural rate fluctuates around this value in response to temporary shocks. In contrast, other models that allow for low-frequency time variation in the natural rate of interest display a marked persistent decline in the natural rate over the past decade (Laubach and Williams 2003, Lubik and Matthes 2015, Holston et al. 2016). In DSGE models, this period of a persistently low natural rate of interest is ‘explained’ by a long sequence of unanticipated negative shocks to the economy (Cúrdia 2015). According to the logic of these models, once this unusual set of shocks wears off, everything will return to normal. That is, the ‘new normal’ is always the same as the ‘old normal’. This contrasts with the predictions of models that allow for structural shifts, which suggest the future may be very different from the past.

This brings me to the second area where the next generation of DSGE models needs to evolve: the inclusion of medium- and longer-term shocks and dynamics. This is already done in a coherent way in the Federal Reserve Board’s FRB/US model, where the supply-side block is modelled and estimated using the Kalman filter (Fleischman and Roberts 2011). DSGE models can similarly be augmented to incorporate and estimate longer-term trends in the labour market, productivity, and other structural factors. By extension, these models will also be able to speak to the issue of longer-term movements in the natural rate of interest. This will provide a richer description of the various factors influencing the macroeconomic landscape and help make these models more useful to policymakers.

Financial markets

Finally, the first generation of DSGE models incorporated a very restrictive set of assumptions about financial markets and asset prices. A great deal of research has gone into relaxing these assumptions to provide models that can confront the data and issues on policymakers’ minds.

Given the importance of unconventional monetary policy actions and their transmission to financial market conditions, DSGE models used at central banks need to be developed further to incorporate a richer and more realistic description of the financial system and account for the ways in which unconventional policies are transmitted. Such improvements will help these models be effectively integrated into policy discussions.

Next steps

The origin of current, policy relevant DSGE models was the splicing of the DNA from micro-founded real business cycle models with theories of nominal frictions. The goal was to create a new generation macroeconomic synthesis that combines factors that influence aggregate supply and demand in a coherent framework. Much of the development of these models, both in the academic literature and at central banks, focused on matching key aspects of the data in terms of the responses to shocks and forecasting. This progress has made such models useful to policymakers like myself for certain purposes. However, DSGE models will need to evolve further – including incorporating a more thorough representation of the labour market; adding medium- term shocks and

dynamics related to demographics, productivity, and other structural shifts; and including a richer description of the financial system and unconventional monetary policies – in order to become more useful for addressing the key issues before policymakers today and the future.

Author's note: The views presented are the view of the author and do not necessarily reflect the views of the Federal Reserve Bank of San Francisco or the Federal Reserve System.

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