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Econometric analysis of linearized singular dynamic stochastic general equilibrium models

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Abstract

In this paper I propose an alternative to calibration of linearized singular dynamic stochastic general equilibrium models. Given an a-theoretical econometric model as a representative of the data generating process, I will construct an information measure which compares the conditional distribution of the econometric model variables with the corresponding singular conditional distribution of the theoretical model variables. The singularity problem will be solved by using convolutions of both distributions with a non-singular distribution. This information measure will then be maximized to the deep parameters of the theoretical model, which links these parameters to the parameters of the econometric model and provides an alternative to calibration. This approach will be illustrated by an application to a linearized version of the stochastic growth model of King, Plosser and Rebelo.

JEL classification: C13; C32; C52; D90

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1. Introduction

In the forties through the sixties of the past century the development of macroeconometrics was inspired and directed by Keynesian macroeconomic theory,

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and vice versa, the construction and estimation of large Keynesian macroeconomic models was facilitated by econometrics, in particular simultaneous equations theory. With the rise of neoclassical dynamic stochastic general equilibrium (DSGE) macroeconomics, however, econometrics and economic theory have grown apart, to the point where most macro-theorists now consider econometrics irrelevant for what they do. Admittedly, quite a few econometricians have the same attitude towards theoretical macroeconomics.

Most economic theories, including DSGE theory, are partial theories in the sense that only a few related economic phenomena are studied. The analysis of this "partial" theory is justified, explicitly or implicitly, by the ceteris paribus assumption (other things being equal or constant). See Bierens and Swanson (2000) and the references therein. However, when simple economic models of this type are estimated using data which are themselves generated from a much more complex real economy, it is not surprising that they often fit poorly. Thus, these models do not represent data generating processes, and are not designed to do. The purpose of these models is to gain insight in particular related economic phenomena rather than to describe an actual economy, and to conduct numerical experiments. Consequently, most macro-theorists do not bother to estimate their models, but instead calibrate the model parameters. See Hansen and Heckman (1996) for a review of calibration, and Sims (1996) and Kydland and Prescott (1996) for opposite views on calibration.

The literature on econometric analysis of DSGE models can be divided in two rather short strands. One strand of literature is concerned with model evaluation, i.e., the problem how to measure the fit of these models. The other strand of literature is concerned with finding alternatives to calibration.

Watson (1993) proposes to augment the variables in the theoretical model with just enough stochastic error so that the model can match the second moments of the actual data. Measures of fit for the model, called relative mean square approximation errors, are then constructed on the basis of the variance of this stochastic error relative to the variance of the actual series. An alternative approach is to compare the empirical VAR innovation response curves with those computed on the basis of artificial data generated by the calibrated theoretical model. See for example the papers in Pagan (1994), in particular Feve and Langot (1994) and Nason and Cogley (1994). Schorfheide (2000) compares two DSGE models with a benchmark model, using a Bayesian approach. Bierens and Swanson (2000) propose a new measure of fit, called the average conditional reality bound, which compares the non-singular part of a linearized DSGE model with a corresponding marginalized econometric model. Corradi and Swanson (2006) also compare DSGE models with a benchmark model, using squared differences of their distribution functions.

DeJong et al. (1996, 2000) and Geweke (1999) propose a Bayesian approach. They assume prior distribution for the deep parameters centered around calibrated values. This is indeed a natural extension of calibration. However, there are two major limitations to the Bayesian approach. First, one has to assume that conditional on the parameters the theoretical model represents the data generating process, which is too farfetched an assumption. Second, the Bayesian approach requires the existence