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Indirect inference and calibration of dynamic stochastic general equilibrium models

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Abstract

We advocate in this paper the use of a sequential partial indirect inference (SPII) approach, in order to account for calibration practice where dynamic stochastic general equilibrium models (DGSE) are studied only through their ability to reproduce some well-chosen moments. We stress that, despite a lack of statistical formalization, the controversial calibration methodology addresses a genuine issue on the consequences of misspecification in highly nonlinear and dynamic structural macro-models. We argue that a well-driven SPII strategy might be seen as a rigorous calibrationnist approach, that captures both the advantages of this approach (accounting for structural "a-statistical" ideas) and of the inferential approach (precise appraisal of loss functions and conditions of validity). This methodology should be useful for the empirical assessment of structural models such as those stemming from the real business cycle theory or the asset pricing literature.

JEL classification: C52; C51; C15

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1. Introduction

Dynamic stochastic general equilibrium (DSGE) models are the common framework of new classical macroeconomics, with the ambition to provide structural microfoundations

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for macroeconomics. However, this ambition comes at a price. Nobody can believe that DSGE models present a descriptively realistic model of the economic process. "Of course, the model is not 'true"' (Lucas, 1987) and this is probably the reason why the advent of DSGE models has led new classical macroeconomics to turn to calibration methods as an alternative to classical econometrics, involving estimation and testing.

The endorsement of calibration as an alternative to estimation, and the related endorsement of verification as an alternative to statistical tests may lead to the conclusion that "the new classical macroeconomics is now divided between calibrators and estimators" (Hoover, 1995). However some econometricians claim that considering, as Lucas (1987) and Kydland and Prescott (1991) do that "the specification errors being committed are of sufficient magnitude as to make conventional estimation and testing of dubious value" is simply misunderstanding econometrics since "traditional model building never proceeded under the assumption that any model was true" (Kim and Pagan, 1995).

The approach we advocate in this paper is somewhere in between the two extreme views that either some unrealistic features of DSGE models should lead to eschew orthodox econometrics altogether or that calibrators simply misunderstand that traditional econometrics "never proceed under the assumption that any model was true". On the contrary, we do think that econometricians have something to learn from calibrators and we try to go further in the research program put forward by Hansen and Heckman (1996): "model calibration and verification can be fruitfully posed as econometric estimation and testing problems".

We argue, by contrast with the "never" claim above, that more often than not econometric practices are seriously flawed with a maintained assumption of model truth. The recent regain of popularity of maximum likelihood (MLE) approaches to DSGE precisely shows that many econometricians still consider that MLE is the best thing to do, at least when it is tractable. However, there is no such thing in econometric theory as compelling arguments in favor of MLE in the case of misspecified models. Of course, properties of MLE in case of misspecification, also called quasi- or pseudo-maximum likelihood (QMLE) are well known since White (1982) and Gouriéroux et al. (1984). However, while the former stresses that QMLE converges towards a pseudo-true value of the unknown parameters and that its asymptotic variance is no longer conformable to the common Cramer Rao bound but must be replaced by the so-called sandwich formula, the latter characterizes the very restrictive assumptions under which the pseudo-true value coincides with the true unknown value. In other words, not only QMLE does not provide such thing as an efficient asymptotic variance but, even worse, it leads to select a pseudo-true value of unknown parameters which may be quite different from the one which would be associated to an economically meaningful loss function.

The econometrician's hopeless search for a well-specified parametric model ("quest for the Holy Grail" as dubbed by Monfort (1996)) and associated efficient estimators even remain popular when MLE becomes intractable due to highly nonlinear dynamic structures including latent variables. Efficiency properties of "efficient method of moments" (EMM, Gallant and Tauchen, 1996) or more generally of generalized method of moments (GMM, Hansen, 1982), simulated method of moments (SMM, Duffie and Singleton, 1993) and indirect inference (II, Gouriéroux et al. (1993)) when the set of moment conditions is sufficiently large to span the likelihood scores are often advocated as if the likelihood score was something well specified. Actually, not only one should not forget that we are the most often dealing with a pseudo-score but the resort to simulation