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Solving macroeconomic models with "off-the-shelf" software: An example of potential pitfalls

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Abstract

When working with large-scale models or numerous small models, there can be a temptation to rely on default settings in proprietary software to derive solutions to the model. In this paper we show that, for the solution of non-linear dynamic models, this approach can be inappropriate. Alternative linear and non-linear specifications of a particular model are examined. One version of the model, expressed in levels, is highly non-linear. A second version of the model, expressed in logarithms, is linear. The dynamic solution of each model version has a combination of stable and unstable eigenvalues so that any dynamic solution requires the calculation of appropriate "jumps" in endogenous variables. We can derive a closed-form solution of the model, which we use as our "true" benchmark, for comparison with computational solutions of both linear and non-linear models. Our approach is to compare the "goodness of fit" of reverse-shooting solutions for both the linear and non-linear model, by comparing the computational solutions with the benchmark solution. Under the basic solution method with default settings, we show that there is significant difference between the computational solution for the non-linear model and the benchmark closed-form solution. We show that this result can be substantially improved using modifications to the solver and to parameter settings.

Keywords: Solving non-linear models; Reverse-shooting; Computational economics; Computer software

1. Introduction

When working with large-scale models or numerous small models, there can be a temptation to rely on default settings in proprietary software to derive solutions to the model. In this paper we show that, for the solution of non-linear dynamic models, this approach can be inappropriate.

We consider a simple linear model with two stable eigenvalues (real-valued or complex-valued) and one unstable eigenvalue (real-valued). Alternative linear and non-linear specifications of the model are examined. One version of the model, expressed in levels, is highly non-linear. A second version of the model, expressed in logarithms, is linear. The dynamic solution of each model version has a combination of stable and unstable eigenvalues so that any dynamic solution requires the calculation of appropriate "jumps" in endogenous variables.

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