



Exploiting MIT shocks in heterogeneous-agent economies: the impulse response as a numerical derivative[☆]

Timo Boppart^a, Per Krusell^b, Kurt Mitman^{a,*}

^a Institute for International Economic Studies, CEPR, Sweden

^b Institute for International Economic Studies, NBER, CEPR, Sweden

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ABSTRACT

We propose a new method for computing equilibria in heterogeneous-agent models with aggregate uncertainty. The idea relies on an assumption that linearization offers a good approximation; we share this assumption with existing linearization methods. However, unlike those methods, the approach here does not rely on direct derivation of first-order Taylor terms. It also does not use recursive methods, whereby aggregates and prices would be expressed as linear functions of the state, usually a very high-dimensional object (such as the wealth distribution). Rather, we rely merely on solving nonlinearly for a deterministic transition path: we study the equilibrium response to a single, small “MIT shock” carefully. We then regard this impulse response path as a numerical derivative in sequence space and hence provide our linearized solution directly using this path. The method can easily be extended to the case of many shocks and computation time rises linearly in the number of shocks. We also propose a set of checks on whether linearization is a good approximation. We assert that our method is the simplest and most transparent linearization technique among currently known methods. The key numerical tool required to implement it is value-function iteration, using a very limited set of state variables.

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1. Introduction

In this paper we propose a new and simple linearization method for analyzing frameworks with consumer heterogeneity and aggregate shocks. We apply it in the context of an otherwise standard real business cycle model with two kinds of technology shocks: those that are neutral, as in [Kydland and Prescott \(1982\)](#), and those that are investment-specific, as in [Greenwood et al. \(2000\)](#). Our main goal is to show how the method works but we also consider the simplest type of potentially stabilizing fiscal policy for a version of our environment, namely, countercyclical budget deficits (financed by lump-sum transfers). The method we propose is very straightforward and therefore, we hope, significantly easier to use than many existing methods—it is accessible even to advanced undergraduates in economics. In this introduction, we begin

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* Corresponding author.

E-mail addresses: timo.boppart@ies.su.se (T. Boppart), per.krusell@ies.su.se (P. Krusell), kurt.mitman@ies.su.se (K. Mitman).