Abstract

Essays in Heterogeneous Learning

by

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My dissertation makes a contribution to the field of heterogeneous adaptive learning in macroeconomic models. This contribution is presented in the form of three research papers that constitute different chapters of my thesis.

In the first chapter of my dissertation, "E-stability That Does Imply Learnability", I provide criteria and sufficient conditions for the stability of a structurally heterogeneous economy under the heterogeneous learning of agents, extending the results of Honkapohja and Mitra [36], Bogomolova and Kolyuzhnov [5], and Kolyuzhnov [40]. I provide general criteria (in terms of the corresponding Jacobian matrices) for stability under heterogeneous mixed RLS/SG learning for four classes of models: models without lags and with lags of the endogenous variable and with t- or $t-1$- dating of expectations, and provide sufficient conditions for stability for some simpler cases, where simplifications include either the diagonal structure of the shock process behaviour or the heterogeneous RLS learning. I also provide sufficient conditions for stability in terms of the structural heterogeneity independent of heterogeneity in learning (δ-stability) in terms of E-stability of a suitably defined aggregate economy for all four classes of models considered. In addition, I have found a very useful criterion for stabilty for all types of models in the general (non-diagonal) shock process case under mixed RLS/SG learning with equal degrees of inertia for each type of learning algorithm in terms of the stability of a suitably defined average economy with two agents.

In the second chapter, "Heterogeneous Learning: Beyond The Aggregate Economy Sufficient Conditions for Stability", I extend the results of the first chapter and of Honkapohja and Mitra [36], Bogomolova and Kolyuzhnov [5], and Kolyuzhnov [40]. Using the alternative definition of the D-stability approach, I provide alternative (to criteria written in terms of the corresponding Jacobian matrices in Kolyuzhnov [40] and in the first chapter of my thesis) general criteria for stability under mixed RLS/SG learning for the four classes of models considered and alternative sufficient conditions for stability for some simpler cases. This approach also allows me to provide criteria for δ-stability for univariate models without lags of the endogenous variable under mixed RLS/SG learning in economically meaningful terms, such as the "same sign" conditions and E-stability of a suitably defined average economy and its subeconomies, and to provide quite weak sufficient conditions for δ-stability for univariate models with a lag of the endogenous variable using the same economic terms. Using the characteristic equation approach, I provide quite strong, economically tractable, necessary conditions that can be used as an easy quick test for non-δ-stability.

The fundamental nature of the approach adopted in the papers presented in the first two chapters of my thesis allows one to apply its results to a vast majority of the existing and prospective linear and linearized economic models (including estimated DSGE models) with the adaptive learning of agents.

The third chapter of my dissertation is presented by the paper "Optimal Monetary Policy Rules: The Problem of Stability Under Heterogeneous Learning" (a joint work with Dmitri Kolyuzhnov). In this paper, we extend the analysis of optimal monetary policy rules in terms of the stability of the economy, started by Evans and Honkapohja [26], to the case of heterogeneous learning, using the results on δ-stability derived in Bogomolova and Kolyuzhnov [5], and Kolyuzhnov [40], which can be derived as special cases of the results presented in the first two chapters of the thesis.