Journal of Economic Dynamics & Control 33 (2009) 394–408

Contents lists available at ScienceDirect

Journal of Economic Dynamics & Control

journal homepage: www.elsevier.com/locate/jedc

History versus expectations in economic geography reconsidered

Daisuke Oyama

Graduate School of Economics, Hitotsubashi University, Naka 2-1, Kunitachi, Tokyo 186-8601, Japan

ARTICLE INFO

Article history:
Received 15 February 2008
Accepted 23 June 2008
Available online 5 July 2008

JEL classification:
C61
C62
C73
F12
R12
R23

Keywords:
Economic geography
Multiple equilibria
Forward-looking expectation
Global stability
Potential

ABSTRACT

This paper studies global stability of spatial configurations in a dynamic two-region model with quadratic adjustment costs where rational migrants make migration decisions so as to maximize their discounted future utilities. A global analysis is conducted to show that, except for knife–edge cases with symmetric regions, there exists a unique spatial configuration that is absorbing and globally accessible whenever the degree of friction is sufficiently small, and such a configuration is characterized as the unique maximizer of the potential function of the underlying static model.

1. Introduction

This paper addresses the issue of 'history versus expectations' in the context of 'new economic geography' (Krugman, 1991a). This literature, typically using a two-region general equilibrium framework with monopolistic competition, demonstrates how the interplay of pecuniary externalities, market competition, and trade costs determines the spatial distribution of mobile production factor. In particular, when trade costs are low enough, agglomeration forces arising from scale economies dominate dispersion forces due to market competition effects, giving rise to multiple equilibria, two 'core-periphery' (CP) equilibria with full agglomeration of mobile factor in each region as well as an interior equilibrium. In studying locational adjustment dynamics, most models in the literature abstract from the possibility of forward-looking behavior of migrants: instead, migrants are assumed to be myopic and base their migration decisions on current utility differences, so that CP equilibria are all locally stable under the myopic dynamics.[1]

In the present paper, we consider a class of adjustment dynamics with forward-looking migrants in a new economic geography model with two regions based on Ottaviano (2001) but incorporating exogenous asymmetries in trade costs and market size. Specifically, we employ the equilibrium dynamics due to Krugman (1991b) and Fukao and Benabou (1993) (KFB dynamics, in short), where migration requires moving costs which depend on the size of the current flow of migrants,

E-mail address: oyama@econ.hit-u.ac.jp

[1] See Fujita et al. (1999) and Baldwin et al. (2003), among others.

0165-1889/$ - see front matter
doi:10.1016/j.jedc.2008.06.007

so that migrants care about the future migration behavior of the economy. An equilibrium path of this dynamics is characterized by a no-arbitrage condition, that migrants are indifferent between staying in the current region and paying the cost to move to the other. The dynamics has stationary states, which correspond to the equilibria of the underlying static model.

Our main goal is to identify a state that is *absorbing* (i.e., if the initial condition is in a neighborhood of this state, then any equilibrium path converges to it) and *globally accessible* (i.e., for any initial condition, there exists an equilibrium path that converges to this state) for small frictions (i.e., when the migration cost is small and/or the rate of time discounting is small). We show that such a state *generically* exists (which is unique by definition) and is characterized as a *unique* maximizer of a potential function (Monderer and Shapley, 1996; Sandholm, 2001) of the static model. Even if all the agents are initially located in one region, there exists a set of self-fulfilling expectations that leads the economy toward full agglomeration in the other region, provided that the latter configuration is the potential maximizer, whenever the degree of friction is small, and once alarge fraction of agents have been located there, no self-fulfilling expectation can reverse this outcome. This may be seen as an equilibrium selection result which discriminates a unique equilibrium from others based on its distinctive stability properties under the KFB dynamics.

This result is to be contrasted with that by Ottaviano (2001), who, as many others in the literature, considers the case with completely symmetric regions. He shows that, when agglomeration economies are strong, both CP equilibria are absorbing under the KFB dynamics for any (positive) degree of friction (indeed they both are maximizers of the potential function by symmetry).[2]It should be noted that one of the aims of early studies in the literature has been to explore when the symmetric spatial configuration over exogenously identical regions becomes unstable while an asymmetric one endogenously emerges as a (locally) stable long run outcome (see e.g., Fujita et al., 1999), and that *under myopic dynamics*, the local stability properties are in fact not altered by introduction of small exogenous asymmetries. By contrast, our equilibrium selection result demonstrates that *when one incorporates forward-looking expectations*, the case of perfect symmetry should be considered as a knife-edge case, and insights obtained may not be robust to exogenous asymmetries between regions.

The proof strategy for our result follows that of Hofbauer and Sorger (1999), who study stability under a different class of perfect foresight dynamics due to Matsuyama (1991) and Matsui and Matsuyama (1995) (MM dynamics, in short)[3] in potential games. First, we show that optimal solutions to an associated optimal control problem, whose objective functional is, roughly, a 'dynamical extension' of the potential function of the static model, are equilibrium paths of our dynamics and that those solutions, regardless of the initial condition, must visit small neighborhoods of the unique maximizer of the potential function for sufficiently small degrees of friction. Together with the absorption property below, this proves the global accessibility of the potential maximizer. Second, we show that the maximized Hamiltonian of the above optimal control problem serves as a Lyapunov function for equilibrium trajectories, from which the absorption of the potential maximizer follows.

In comparison with the MM dynamics, the KFB dynamics involves extra technical complications due to the assumption that agents are assumed to be able to migrate at any point in time (with the migration costs). This assumption implies that feasible paths of the aggregate spatial configuration may hit the boundary of the state space (the one-dimensional simplex) in finite time, which can make binding the constraint that the state variable must be contained in the simplex. This fact considerably complicates the formal definition of equilibrium paths of the dynamics: we have to carefully incorporate transition between the phases, one in which the constraint does not bind and the other in which it does.[4] When considering the associated optimal control problem in our proofs, moreover, we need to rely on non-standard techniques for problems with state-variable inequality constraints (Hartl et al., 1995). Accordingly, the KFB dynamics requires a mathematically subtle treatment compared to the MM dynamics, while, as the results by Hofbauer and Sorger (1999) and the present paper show, these classes of dynamics share the same stability property when the underlying model admits a potential.

The rest of the paper is organized as follows. Section 2 presents our static model. Section 3 formally defines our equilibrium dynamics. Section 4 states our main theorems, while their proofs are given in Section 5. Section 6 concludes.

2. Static model

In this section, we present our static model which will be embedded in the dynamic context in Section 3. Section 2.1 introduces a non-atomic game with binary actions as a canonical framework and defines its potential function, while Section 2.2 outlines how a two-region general equilibrium model à la Krugman (1991a) reduces to such a non-atomic game.

[2] Baldwin (2001) considers a related dynamics in the original CP model of Krugman (1991a) with symmetric regions and obtains the same conclusion by numerical simulation analyses.

[3] See also, among others, Matsuyama (1992), Kaneda (2003), and Oyama (2006) for applications in economic contexts and Hofbauer and Sorger (2002), Oyama (2002), and Oyama et al. (2008) for studies in random-matching game frameworks.

[4] This is the source of the error in Krugman (1991b) pointed out by Fukao and Benabou (1993).