Available online at www.sciencedirect.com
SCIENCE DIRECT®
European Economic Review 50 (2006) 425–446
EUROPEAN ECONOMIC REVIEW
www.elsevier.com/locate/econbase

Location choice by households and polluting firms: An evolutionary approach

Bouwe R. Dijkstra[a,*], Frans P. de Vries[b,c]

[a]*School of Economics and GEP, University of Nottingham, University Park, Nottingham NG7 2RD, UK*
[b]*Department of Economics and CentER, Tilburg University, Tilburg, The Netherlands*
[c]*Department of Law and Economics, Faculty of Law, University of Groningen, Groningen, The Netherlands*

Received 19 August 2003; accepted 15 September 2004
Available online 2 December 2004

Abstract

This paper examines several policy regimes to deal with the problem of households suffering from environmental damage by firms in the same region. We employ an evolutionary framework to analyze migration movements in the course of time, since firms and households will not relocate immediately in response to payoff differentials. We show that taxation gives firms and households an incentive to stay away from each other. Laissez faire (compensation) only gives households (firms) an incentive to stay away from firms (households). We find that taxation creates the right incentives to reach a local welfare maximum. However, when there are multiple local maxima, circumstances may arise under which compensation leads to a better outcome than taxation.

JEL classification: Q28; R20; R30

Keywords: Environmental policy; Location choice; Evolutionary game theory

1. Introduction

Environmental problems occur on different geographical scales: Local, national, transboundary and even global. Depending on the nature of the problem, there may

*Corresponding author. Tel.: +44 115 8467 205; fax: +44 115 9514 159.
E-mail address: bouwe.dijkstra@nottingham.ac.uk (B.R. Dijkstra).

0014-2921/$ - see front matter © 2004 Elsevier B.V. All rights reserved.
doi:10.1016/j.euroecorev.2004.09.006

be several ways of dealing with it: for instance, one could think of reducing emissions, taking protective measures to limit the damage, or moving polluters and victims away from each other. Our paper focuses on the latter remedy. Needless to say, we do not wish to suggest that segregation is the only or the preferable answer to all environmental problems, but in some cases where economic activities cause local damage to other activities (like agriculture or recreation) or to human health, segregation may be effective.

We study the equilibria that will occur when both polluters and victims of pollution (which we call firms and households, respectively) can choose their location in a two-region model. We examine whether laissez faire, taxation of pollution or compensation of damage to the victims is most likely to lead to the optimal outcome.

One may wonder why we wish to compare taxation with laissez faire and compensation at all. After all, it is well known that marginal damage taxation is efficient. On the other hand, one of the first things we learn in environmental economics is that laissez faire leads to too much pollution. Compensation might also be regarded with suspicion, as it gives households no incentive to stay away from polluting firms. However, we shall see that when we look at location choice, laissez faire and compensation are no longer necessarily inferior to taxation. We show that in case multiple local welfare optima exist and the demand for land by households exceed that of firms, a compensation regime may outperform taxation in reaching a higher welfare level. When the demand for land by firms is larger than that of households it is the laissez faire regime that may dominate taxation.

In order to examine the dynamics and the stability of equilibria, we employ evolutionary game theory as applied in economics by Friedman (1991, 1998), Young (1993), Kandori et al. (1993) and Samuelson (1997). We regard an evolutionary approach as quite suitable for location decisions. When there is a payoff differential between regions, firms and households do not immediately move to the higher-payoff region. There will rather be a stream of migration in the course of time. For example, firms that recently made location-specific investments would have relatively low incentives to move. Likewise for households; they can be attached to their region of residence because of the close vicinity of their family and friends, and jobs and schools.

The literature on polluter mobility (Motta and Thisse, 1994; Hoel, 1997; Dijkstra, 2003; Rauscher, 1997, 2000) and victim mobility (Wellisch, 1995; Hoel and Shapiro, 2003) has mainly focused on the question of whether and how the noncooperative policy equilibrium deviates from the optimum. In our paper, however, the regions do not set the policy that maximizes their own welfare, but they follow particular policy rules.

Several authors have previously noted that victim defence activities like migrating introduce nonconvexities, which may result in multiple welfare optima. Baumol (1972) was the first to note that when there are multiple local welfare maxima, taxation will lead toward a local optimum, but may lead away from the global optimum. Unlike the present paper, Baumol (1972) does not explore the possibility that other instruments may improve upon taxation.

Shibata and Winrich (1983) show that when it is (locally) optimal to have only victim defence measures and no abatement by firms, laissez faire also implements the