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Environmental policy and technology diffusion under imperfect competition

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Environmental Policy and Technology Diffusion under Imperfect Competition

An Evolutionary Game Theoretical Approach

Frans P. de Vries

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Preface

Before I entered my Ph.D. period, I read some work on evolutionary game theory and its applications. Especially the modelling framework developed by Daniel Friedman, suitable for applications, kept activating my thoughts. I told my supervisor Andries Nentjes that I would like to go into the matter and apply it to study the internal organizational decision making process in response to environmental regulation. I ran into many research complexities and had to relax some of my (too) ambitious endeavors. Still, applying evolutionary game theory to environmental economics remained to have my interest. So, I changed the core subject. This thesis is the result. It applies evolutionary games to study the impact of environmental policy on technology diffusion. I am much indebted to my supervisor Andries Nentjes for his unlimited support and room he has given me to explore the field. It has been, and still is, a great thing working with him, both on a personal as well as professional basis.

A part of the first stage of my research was done while being a student in the Young Scientists Summer Program of IIASA in 1999. I would like to thank the mathematicians Arkadii Kryazhinskii and Alexander Tarasiev for helping me shaping the behavioral theory of the firm into a formal model. The summer of 1999 would not have been the same without the great company of my friends Noel Watson and Guoyi Han.

The initiation of the research as reported in this thesis, has led me to Daniel Friedman. I owe him many thanks. He has given me the opportunity to visit the Economics Department of the University of California at Santa Cruz in the fall of 2000. My thanks to the Department for the kind hospitality. Since then on he has provided me numerous comments and suggestions for improving the research and the thesis. I gratefully acknowledge this.

During my visit to Santa Cruz I also had the opportunity to meet other people as well. I would like to thank K.C. Fung for his very supporting talks and collaboration. Matt McGinty was working on a similar topic at the time. Our mutual interest in the applied evolutionary game stuff is still active. My thanks for sharing your thoughts on the matter.

I would also like to stress my gratitude to Bouwe Dijkstra. He has provided me with many suggestions during the stage of research. Moreover, he is very fine company to travel with. Especially the trip to Catania I won't forget.

Participation in the second World Congress of Environmental and Resource Economists in Monterey in June 2002 became very fruitful. Since then, many e-mail conversations on the economics of pollution control have passed with Nathaniel Keohane. Thank you very much for your very valuable comments and suggestions on specific parts of the thesis and your enlightening thoughts on the theory of pollution control.

My thanks also to the Interdisciplinary Institute for Environmental Economics of the University of Heidelberg and in particular to Till Requate for providing me the opportunity to visit the Institute.

My thanks to others as well who have helped shaping my work. In arbitrary order, Roel Jongeneel, Henk Folmer, Bert Schoonbeek, Thomas Ziesemer, the colleagues of ECOF and all the people at seminars, workshops and conferences. I won't forget the feedback I received from Sergey Shibayev and the time he was getting me into the wonderful music of *Porcupine Tree*. Also thanks to Edwin Woerdman for his interest and advice on some parts of the thesis and to Hilde Feenstra for linguistical assistance.

Finally, there is a group of people who have not only supported me during times of research, but also in 'real life'. My sincere gratitude to my friends Wietze, Geert and Klaas for everything since we were kids. A dear friend is Martijn van der Heide. His support, laughter and 'just being a friend' is admiring. Many thanks also to my family and other friends for showing their interest and relaxing moments.

The most thanks go to you, Alie. You were the one who was always there. Your unlimited support and patience were definitely necessary for finishing this project. Hopefully we can spend more time together now and share continuously the joy and presence of our lovely son Gerrit and our dog Rakker.

Finally, I would like to share a moment of thought to my father, who died in the spring of 2001. The final moments we had were so intense, yet so sad. I dedicate this thesis to him.

Frans de Vries
Buitenpost, March 2003

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*Voor mijn vader
(1935-2001)*