ISBN 978 90 5170 799 1

Cover design: Crasborn Graphic Designers bno, Valkenburg a.d. Geul

This book is no. 650 of the Tinbergen Institute Research Series, established through cooperation between Rozenberg Publishers and the Tinbergen Institute. A list of books which already appeared in the series can be found in the back.
RESOURCE EXTRACTION AND THE GREEN PARADOX:
ACCOUNTING FOR POLITICAL ECONOMY ISSUES AND CLIMATE POLICIES IN A HETEROGENEOUS WORLD

ter verkrijging van de graad Doctor aan
de Vrije Universiteit Amsterdam,
op gezag van de rector magnificus
prof.dr. V. Subramaniam,
in het openbaar te verdedigen
ten overstaan van de promotiecommissie
van de Faculteit der Economische Wetenschappen en Bedrijfswetenschappen
op woensdag 20 april 2016 om 11.45 uur
in de aula van de universiteit,
De Boelelaan 1105

door

Karolina Ryszka

geboren te Rybnik, Polen
promotor: prof.dr. C.A.A.M. Withagen
copromotor: dr. G.C. van der Meijden
List of Figures

2.1 Equilibrium paths of the producer and consumer prices in the home and foreign region, \( Y^*_0 = 3 \) and \( X_0 = 1 \) .......................................... 21
2.2 Resource extraction paths before and after the increase in the home region’s subsidy, \( X_0 = 1, Y^*_0 = 3 \), with \( N_1, N^*_1 \) and \( N_2^* \) denoting the new switching points after the policy change ........................................ 23
2.3 Resource extraction paths before and after the increase in the home region’s tax rate, \( X_0 = 3, Y^*_0 = 4 \) ........................................ 26
2.4 Aggregate resource extraction paths before and after the increase in the home region’s tax rate, \( X_0 = 3, Y^*_0 = 4 \): no Weak Green Paradox ............ 26
2.5 Home and foreign regions’ welfare as function of different carbon tax rates in the home region ........................................ 32
2.6 Green and non-green welfare components in the home region as function of carbon tax rates ........................................ 33
2.7 Total resource usage in the case of no climate policies and in the case of a Pigouvian tax in the home country, \( N \) and \( N^* \) denoting the new switching points after the policy change ........................................ 39
2.8 Aggregate resource usage in the case of \( \sigma_2 = 0.3 \) and in the case of no climate policies ........................................ 40
3.1 Consumption paths - change in \( \sigma \) and \( \tau \) ........................................ 59
3.2 Effect of a unit increase in the backstop subsidy on green welfare for different discount rates ........................................ 60
3.3 Effect of higher \( \sigma \) or lower \( b \) on overall welfare for different damage parameter values ........................................ 61
3.4 Inverse demand curves ........................................ 63
3.5 Stage switch - four scenarios ........................................ 70
LIST OF FIGURES

3.6 Price path and inverse demand functions without speculators .......................... 72
3.7 Price paths for the parameter sets $\kappa_1$ and $\kappa_2$ ................................. 74
3.8 Price path and inverse demand functions with speculators .............................. 77
3.9 Price paths in the discontinuous and the continuous price case ......................... 79
3.10 Consumption and price paths - discontinuous and continuous case ................. 80
3.11 Consumption path - change in $b$ .................................................. 85
3.12 Consumption path - change in $\sigma$ ............................................... 85
3.13 Consumption path - change in $\tau$ .................................................. 86

4.1 Resource consumption paths for $\gamma = 0.9$, $\gamma = 0.6$ and $\gamma = 0.4$, compared to the Social Planner outcome ..................................................... 101
4.2 Resource consumption paths for $\delta = 0.04$, $\delta = 0.08$ and $\delta = 0.12$, compared to the Social Planner outcome ................................................. 103
4.3 Resource consumption paths and for $T = 50$ and $T = 10$, compared to the Social Planner and infinite horizon outcomes ......................................... 104
4.4 The politician’s resource consumption in the endogenous and exogenous cases 111
4.5 Aggregated resource consumption in the endogenous and exogenous cases 111
4.6 Social resource consumption in the endogenous and exogenous cases ............. 112
4.7 The politician’s discount rates and reelection probabilities in the cases without and with commitment ......................................................... 113
List of Tables

3.1 Parameter values - single-market model ................................... 58
3.2 Parameter values - two-region model ................................. 79
3.3 Comparison of equilibrium results in the continuous and discontinuous price case ........................................... 80
3.4 Effects of policy changes on welfare ....................................... 86
A.1 Parameter values for the numerical exercise regarding $\frac{dN}{dT} < 0$ .................. 142
A.2 Parameter values for the numerical exercises .......................... 145
A.3 Parameter values for the calibration exercise .......................... 145
B.1 Effects of policy changes in the continuous price case .............. 151
B.2 Effects of policy changes in the discontinuous price case .......... 152
C.1 Parameter values for the numerical exercises .......................... 160
Acknowledgements

Writing a PhD dissertation can be very solitary work. Nevertheless, I have never felt left alone on my PhD path, and many people, colleagues, friends and loved ones, contributed to this journey being a success. Hereby I would like to give them credit and thanks for their support, their practical and emotional help and all the love I received.

In particular, my thanks go to all my academic advisors. Above all, I am grateful to my PhD supervisor prof. Cees Withagen for accepting me as his PhD student and for all the support and understanding he gave me during the process of writing this thesis. Dear Cees, I really appreciate that you have always been available with your advice and with your many kind and uplifting words when I was doubting my research and my abilities. I enjoyed working with you on our common projects. Many thanks for working hard and prioritizing our last paper so that it would be finished in time. From the bottom of my heart I can say that I am very grateful for having had you as supervisor.

Special thanks go to my co-promotor and co-author Gerard for his hard work, his patience, his research enthusiasm and his fierce internal strive to get to the bottom of things. Gerard, you were always ready to help me with any of my research problems and questions. I really enjoyed working with you and I value your thorough and accurate way of conducting research from which I could learn a lot. Even more I appreciate your ‘gezelligheid’ and I will never forget your harmonica performance as the highlight of my last birthday party.

I would also like to thank prof. Rick van der Ploeg for his feedback and in-depth questioning of my writings. Regarding the financing of my PhD project, I gratefully acknowledge financial support of the European Research Council. I am grateful to the Tinbergen Institute and the department of Spatial Economics at the Vrije Universiteit Amsterdam for creating a high quality academic environment during my MPhil and PhD studies.

From the department of Spatial Economics I would like to thank Alexandros in particular, for all his research and career advice during our tea breaks, for supplying me with chocolate and occasionally with Polish vodka.
ACKNOWLEDGEMENTS

My life during my Mphil and my PhD was made much easier by the support staff, both at TI and at the VU: special thanks go to Ester van den Bragt, Arianne de Jong and Judith van Kronenburg from the Tinbergen Institute, and to Elfie Bonke, Jenny Wiersema and Mariska van den Berg from the department of Spatial Economics.

During my PhD studies I benefited greatly from a research stay at the University of California. I am grateful to prof. Larry Karp for hosting me for three months at U.C. Berkeley. I want to thank the participants of the ERE seminar at U.C. Berkeley for their clever and to the point comments on my presentation, which improved Chapter 4 of my thesis significantly. Special thanks go to prof. Leo Simon for the attention he has given to me, to my research and for the inspiring talks I had with him about my work. I also would like to thank prof. Karen Pittel, who was visiting at Berkeley at the same time, for the discussions about research ideas we had in our coffee breaks. Lastly, I would like to thank the University Council of the Vrije Universiteit Amsterdam for granting me the University Fellowship which allowed me to finance my stay in the United States.

Not only my supervisor contributed to the success of my PhD; I also profited by a great working environment. Hence, I am very thankful to the other members of the “Green Paradox group”, namely Jacob, Mark and Yuan. Thank you for being not only my colleagues, but also my friends. Great thanks to Jacob for being a colleague and friend. I always enjoyed our discussions about (the pitfalls of) economics, dating and relationships, life inside and outside of academia, Elon Musk, poems and many other topics.\footnote{I was also urged, surely not at all by Jacob himself, to mention how wonderful, kind, smart, intelligent, funny, tall and handsome Jacob is. Dear Jacob, I hope I’ve given you the acknowledgement that you truly deserve. Oh, and by the way, I deeply regret punching you in the eye.} I have enjoyed Yuan’s company only for a year, but I am very grateful that she joined the department. Thanks for being such a happy, social and interesting person. Last, but not least, I would like to thank Mark with whom I shared an office for two years. Mark, I appreciate your professional and personal support during that time. My gratitude almost outweighs the inconvenience I suffered from sitting in an icy office (apparently your feel-good temperature lies 10 degrees Celsius below mine). Nevertheless, I was very happy to have a fellow Tinbergen student, somebody I knew from my MPhil days as the ‘crazy Russian’, among my colleagues. Mark, you’re a great, smart, social and caring person and I’m happy and grateful that we can share our defense day.

I would like to thank all my friends who accompanied and supported me during my PhD journey and the last five years. I will never forget the painstaking times during my MPhil studies, the late-night studying and later-night drinking sessions at the institute, the
permanent frustration about the work load, and the short, but excessive after-exam bursts of joy. Despite (or due to) these circumstances I treasure the moments I spent with the TI gang, studying and learning (not only about Economics), hanging out and discussing philosophy, politics, music and research.

I was very lucky to find truly amazing people within this diverse group of fellow TI students. Eszter, Inez, and Swapnil, I cannot express how much I value your friendship, your continuous help, inspiration, motivation, the moments of fun we shared, and the difficult moments when you were there for me. All I can say is, hence, that YOU GUYS FREAKING ROCK, YEAH!!!!!

Finishing this PhD would have seemed impossible without Sefan, who was my inexhaustible source of support during some difficult times, especially towards the end of my PhD. Dear Seef, when I was stuck in unsuccessful research projects, doubting myself and my abilities to finish my PhD, you urged me to bring myself back on track. You get the credit for motivating me to overcome my lethargy, to push forward and to finish what had seemed an impossible task only a couple of months earlier. During the last weeks of thesis writing I dearly needed your love and the understanding that you showed for my anxious and stressed-out self. And I am deeply grateful for both your emotional and practical help during that time. I have been and I am very lucky to have you in my life. Schat, ik ben heel blij met jou!

To my mother and father: Jest niemożliwym podziękować wam wystarczająco, na zawsze pozostanę waszym dłużnikiem. Kochana mamo i kochany tato, to wielkie błogosławieństwo mieć was jako rodziców. Dzięki wam miałam szczęście dorastać w rodzinie pełnej miłości. Wiele ofiarowaliście, aby umożliwić nam lepszą przyszłość. Wyjeżdżając do Niemiec, zostawiście za sobą rodziny, przyjaciół i całe wasze życie, wierząc, że zapewni to nam, waszym dzieciom, korzystniejsze możliwości. Jestem też wam wdzięczna za wsparcie w mojej edukacji, dzięki wam od dzieciństwa chłonęłam znaczenie nauki. Kochana mamo, kochany tato, bardzo wam dziękuję! Jestem szczęśliwa i dumna, że mogę dzielić z wami dzień obrony mojego doktoratu.