



UvA-DARE (Digital Academic Repository)

Essays on nonlinear evolutionary game dynamics

Ochea, M.I.

Publication date
2010

[Link to publication](#)

Citation for published version (APA):

Ochea, M. I. (2010). *Essays on nonlinear evolutionary game dynamics*. [Thesis, fully internal, Universiteit van Amsterdam]. Thela Thesis.

General rights

It is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), other than for strictly personal, individual use, unless the work is under an open content license (like Creative Commons).

Disclaimer/Complaints regulations

If you believe that digital publication of certain material infringes any of your rights or (privacy) interests, please let the Library know, stating your reasons. In case of a legitimate complaint, the Library will make the material inaccessible and/or remove it from the website. Please Ask the Library: <https://uba.uva.nl/en/contact>, or a letter to: Library of the University of Amsterdam, Secretariat, Singel 425, 1012 WP Amsterdam, The Netherlands. You will be contacted as soon as possible.

Contents

Contents	vii
List of Tables	xi
List of Figures	xiii
1 Introduction	1
1.1 Literature on convergence of game dynamics	4
1.2 Literature on complicated game dynamics	5
1.3 Thesis Outline	7
1.3.1 Multiple Steady States, Limit Cycles and Chaotic Attractors in Logit Dynamics	8
1.3.2 Heterogenous Learning Rules in Cournot Games	10
1.3.3 On the Stability of the Cournot Solution: An Evolutionary Ap- proach	
1.3.4 Evolution in Iterated Prisoner’s Dilemma Games under Smoothed Best-Reply Dynamics	12
2 Multiple Steady States, Limit Cycles and Chaotic Attractors in Logit Dynamics	15
2.1 Introduction	15
2.1.1 Motivation	15

2.1.2	‘Replicative’ vs. ‘rationalistic’ dynamics	18
2.2	The Logit Dynamics	19
2.2.1	Evolutionary dynamics	19
2.2.2	Discrete choice models-the Logit choice rule	21
2.3	Hopf and degenerate Hopf bifurcations	23
2.4	Three strategy games	26
2.4.1	Rock-Scissors-Paper Games	27
2.4.2	Coordination Game	39
2.5	Weighted Logit Dynamics(wLogit)	52
2.5.1	Rock-Scissors-Paper and wLogit Dynamics	52
2.5.2	Schuster et al.(1991) Game and wLogit Dynamics	55
2.6	Conclusions	58
2.A	Rock-Scissor-Paper game with Logit Dynamics: Computation of the first Lyapunov coefficient	59
3	Heterogenous Learning Rules in Cournot Games	61
3.1	Introduction	61
3.2	Standard Static Cournot Analysis	64
3.3	Heterogenous Learning Rules	65
3.3.1	Adaptive Expectations	65
3.3.2	Fictitious Play	66
3.3.3	Weighted Fictitious Play	66
3.4	Evolutionary Cournot Games	67
3.4.1	Adaptive Expectations vs. Rational/Nash play	67
3.4.2	Adaptive vs. Exponentially Weighted Fictitious Play	76
3.4.3	Local stability analysis	78
3.4.4	Naive vs. Fictitious Play	84
3.5	Concluding Remarks	87

4	On the Stability of the Cournot Solution: An Evolutionary Approach	89
4.1	Introduction	89
4.2	The model	91
4.3	Results	96
4.3.1	Best-response dynamics limit, $\beta \rightarrow \infty$	97
4.3.2	Costly Rational Expectations, $k > 0$ and finite β	98
4.4	Conclusions	101
5	Evolution in Iterated Prisoner's Dilemma Games under Smoothed Best-Reply Dynamics	103
5.1	Introduction	103
5.2	An Evolutionary Iterated PD game	105
5.3	2×2 Ecologies	109
5.3.1	AllD vs. TFT	109
5.3.2	TFT vs. AllC	111
5.3.3	AllD vs. AllC	114
5.3.4	AllD vs. GTFT	115
5.3.5	AllD-WSLS	117
5.3.6	GTFT vs. AllC	120
5.3.7	GTFT vs. WSLS	121
5.3.8	TFT vs. GTFT	124
5.3.9	TFT vs. WSLS	127
5.3.10	WSLS vs. AllC	128
5.3.11	Summary	130
5.4	3×3 Ecologies	132
5.4.1	AllD-TFT-AllC	132
5.4.2	AllD-GTFT-WSLS	135
5.4.3	AllD-GTFT-AllC	139

5.4.4	AllID-TFT-WSLS	141
5.4.5	AllID-TFT-GTFT	144
5.4.6	AllID-WSLS-AllC	146
5.4.7	TFT-WSLS-AllC	148
5.4.8	TFT-GTFT-WSLS	150
5.4.9	Summary	152
5.5	4×4 ecologies	153
5.5.1	No TFT	153
5.5.2	No AllID	156
5.5.3	No GTFT	159
5.5.4	No WSLS	161
5.5.5	No AllC	163
5.5.6	Summary	165
5.6	5×5 Ecology	166
5.6.1	Numerical Bifurcation Curves	170
5.7	Conclusions	172
5.A	Iterated PD Game-stationary distributions and average payoffs	173
6	Summary	181
	Bibliography	185
	Samenvatting - summary in Dutch	195