



PhD in Information Technology and Electrical Engineering

Università degli Studi di Napoli Federico II

PhD Student: Elena Napoletano

XXX Cycle

Training and Research Activities Report – First Year

Tutor: Franco Garofalo



UNIVERSITÀ DEGLI STUDI DI NAPOLI
FEDERICO II

1. Information

- a. Elena Napoletano, M. Sc. Degree cum laude in Ingegneria Gestionale – University of Naples Federico II
- b. XXX Cycle- ITEE – Università di Napoli Federico II
- c. Fellowship: «Fondo Sociale Europeo, P.O. Campania 2007/2013-2014/2020»
- d. Tutor: Prof. Franco Garofalo

2. Study and Training activities

a. Courses

- *“Statistica e Applicazioni”* (6CFU)
Lecturers: Antonio D’Ambrosio, Pasquale Erto, Biagio Palumbo, Roberta Siciliano, Amalia Vanacore, Massimiliano Giorgio, Gianluca Frasso.
- *“Project management per la ricerca”* (3 CFU)
Lecturer: Prof. Guido Capaldo
- *“Modelli, metodi e software per l’Ottimizzazione”* (4CFU)
Lecturer: Prof. Antonio Sforza
- *“Fondamenti di analisi funzionale”* (7CFU)
Lecturer: Prof. Renato Fiorenza

b. Seminars

- *“Efficient service distribution in next generation cloud networks”*
Lecturers: Dr. Jaime Llorca, Prof. Simon Pietro Romano, Prof. Paola Festa, Prof. Stefano Avallone, Roberto Canonico and Giovanni Di Stasi, Prof. Sabato Manfredi.
Date: 10.02.2015 – 4h
- *“Partial possibilistic regression path modeling”*
Lecturer: Prof. Rosaria Romano
Date: 20.04.2015 – 2h
- *“Colloquium on robotics: six keynote talks by international experts”*
Lecturers: Prof. Oussama KHATIB, Prof. Tamim ASFOUR, Prof. Ron LUMIA, Prof. Giovanni INDIVERI, Prof. Kostas KYRIAKOPOULOS, Dr. Raj MADHAVAN.
Date: 21.04.2015 – 5h
- *“Agents with truly perfect recall”*

Lecturer: Nils Bulling

Date: 28.04.2015 – 1h

- *“On Abel differential equations of the 2nd kind and exact inversion of boost DC/AC converters”*

Lecturer: Prof. Josep Olm

Date: 13.05.2015 – 1h

- *“Regularization of two-fold bifurcations in planar piecewise-smooth systems”*

Lecturer: Prof. John Hogan

Date: 23.06.2015 – 1h

- *“On the complexity of temporal Equilibrium Logic (joint work with David Pearce)”*

Lecturer: Prof. Laura Bozzelli

Date: 22.10.15 – 1h

3. Research activity

- a. Title: A complex network approach to the analysis of artificial markets
- b. Study: Complex networks, agent-based models, dynamical systems.
- c. Fellowship type: «Fondo Sociale Europeo, P.O. Campania 2007/2013-2014/2020»
- d. Research description:

Neoclassical economics plays a fundamental role in the study of price and income distributions in markets. Recent studies are focused on the development of tools and approaches that may complement neoclassical economics, removing some of its main assumptions, such as rationality and homogeneity of the financial agents. A special interest emerged for a complex system approach, which involves the use of agent-based and behavioural models. In this way, the simulated behaviour of a high number of decision-makers and institutions (the agents), interacting through prescribed rules, can be investigated to highlight the macro features of the market emerging from the dynamic interactions among the players.

In this framework, we build a novel artificial financial market capable of testing the delicate interplay between herding-like interactions, the inequality in wealth distribution, and the balancing of two common alternative taxation schemes. The agents behave according to utility theory, and are grouped in three classes with different risk attitudes and subsequent trading strategies. We study the emerging features of the market in terms of trading volumes and wealth distribution, characterized through the Gini coefficient, in presence of a Tobin-like tax (TT) and a flat tax (FT), respectively. Specifically, we investigate two agents' behavioural scenarios: (i) stubborn agents, who keep their own risk attitude regardless of the effectiveness of the consequent trading strategy (reference scenario); (ii) adaptive agents, who self-organize in communities to emulate the strategy of their richest neighbours (focal scenario). These latter act as leaders and are modelled as the hubs of a directed scale-free network. Numerical simulations are performed to analyse the interplay between the different taxation systems and agents' behavioural adaptation, with a special emphasis on the effects on wealth distribution and trading volumes. Specifically, we observed that our model is capable of replicating the benefits and drawbacks of the two taxation systems and that the interactions among the agents strongly affect the wealth distribution across the communities. Remarkably, the

communities benefit from the presence of leaders with successful trading strategies, and are more likely to increase their average wealth. Moreover, this emulation mechanism mitigates the decrease in trading volumes, which is a typical drawback of TTs.

4. Products

a. Publications

- i. Already published: DeLellis, P., Garofalo, F., Iudice, F. L., & Napoletano, E. (2015). "Wealth distribution across communities of adaptive financial agents". *New Journal of Physics*, 17(8), 083003. (Impact factor: 3.558)
- ii. In preparation: DeLellis, P., Garofalo, F., Iudice, F. L., & Napoletano, E. "The Topologies of Entrainment in a Squad of Proximity Kuramoto Oscillators".

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PhD in Information Technology and Electrical Engineering – XXX Cycle

Elena Napoletano

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Cycle XXX

	Credits year 1								Credits year 2								Credits year 3								Total
	Estimated	1	2	3	4	5	6	Summary	Estimated	1	2	3	4	5	6	Summary	Estimated	1	2	3	4	5	6	Summary	
Modules	18			3	4	7	6	20	9							0								0	20
Seminars	13		0,8	1,6	0,4		0,2	3	6							0								0	3
Research	34	10	9	5	7	6	5	42	42							0								0	42
	65	10	9,8	9,6	11	13	11	65	57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	65