Complex Economics: Individual and Collective Rationality

Lecturer

Course objectives

This course will be based on the book of the same name published in 2010. The main objective is to argue that the current crisis has put into sharp relief the incapacity of our modern theoretical models and, in particular, our macroeconomic models to provide an adequate explanation of the sudden and large changes that take place in the economy. The course will provide an account of how we have come to be locked into models which have been declared by former Governor Trichet of the European Central Bank, by Lord Turner, the Director of the Financial Services Authority in the U.K., and Governor Bernanke of the Federal Reserve Board to be useless in times of crisis. They have called for new approaches and this course will provide an opening to such approaches and will draw on the lessons to be learned from other disciplines, such as statistical physics, biology, and the neurosciences.

Course Content

The main theme, using various economic examples, will be to argue that the basic problem has been to treat the economy as if the aggregate behaved like a (representative) individual. As in other disciplines we have to recognize that aggregate phenomena, although derived from the interaction between individuals, do not have the same characteristics as those of individuals. Such systems, referred to as complex adaptive systems, have a dynamic of their own which may pass through abrupt changes without any exogenous shock. This theme has a long history in economics but its most eloquent advocate in recent times has been Thomas Schelling.

The standard explanations for the crisis given by those responsible for making economic policy invoke three themes, contagion, networks, and trust, yet none of these has a place in modern macroeconomics. Yet they are features of complex adaptive systems, of systems of interacting particles, of social insects, of networks of neurons, and of epidemic diseases, for example. The economy should be considered as a complex adaptive system in which the agents constantly react to, influence, and are influenced by, the other individuals in the economy. The message of the course is that coordination rather than efficiency is the central problem in economics. How do the myriads of individual choices and decisions come to be coordinated? How does the economy or a market "self-organize" and how does this sometimes result in major upheavals, or to use the phrase from physics, "phase transitions"? The sort of system described in this course is not in equilibrium in
the standard sense, it is constantly changing and moving from state to state and its very structure is always being modified.

Prerequisites
N/A

Instructional methods
In this course we will examine examples including Schelling’s model of segregation, contributions to public goods, the evolution of buyer seller relations in fish markets, to financial models based on the foraging behaviour of ants. In particular we shall analyse some simple models which capture the way in which large scale movements emerge from the interaction between individuals who may not themselves be very important players in the economy.

Schedule: 13-17 August 2012

1st Session:
The first day will be devoted to examining the basic foundations of modern theoretical economics. Starting from the observation that the current crisis was not forecast because it was not even possible within our standard models, we will then examine the road that has led us to this point.

• The history of economic theory from Walras to Arrow Debreu
• The switch from the idea of establishing relations between macroeconomic variables to the desire to found economic models on sound scientific principles, i.e on the behaviour of rational optimising but isolated individuals
• The idea of equilibrium and its relevance to the empirical evolution of the economy
• The fundamental theorems of welfare economics
• The problems of stability and uniqueness; the destructive results of Sonnenschein Mantel and Debreu
• The problem of aggregation; dealing with the heterogeneity of individuals.
• The appearance of the «representative individual» in macroeconomics
• The problem of the direct interaction between individuals
• Game theory its insights and its limitations.
• The rationality assumptions, are they based on the observation of behaviour or on the introspection of economists?
• The influence of behavioural economics
• Agent based models
• Lessons from social insects
• Rational expectations and its problems
• Self-organisation: Do markets self-organise and if so do they achieve an optimal state?
• The importance of coordination as opposed to efficiency

2nd Session:
This session will be devoted to examining how the way in which individuals interact influences economic outcomes. In most theoretical models little is said about who trades with whom, who communicates with whom and who sets prices for example. We will
examine the consequences of direct interaction. Then we will examine the role of the networks which govern that interaction and how these networks evolve. We will look at both deterministic and stochastic networks.

- The role of networks in the crisis, Haldane’s analysis
- The interaction of simple individuals can produce sophisticated results: some examples.
- The interaction of apparently rational individuals may not generate results which are “collectively rational”, some examples
- Economics and sociology: two very different approaches to the relationships between individuals.
- The role of networks in economic analysis, the notion of local interaction and of “neighbours”
- Given graph structures and their consequences.
- The importance of certain characteristics: connectivity and diameter for example
- Stochastic interaction with a given graph of relations
- The dynamics of interaction on a fixed graph, Contagion and diffusion
- Stochastic graphs: in this case the graph itself is a random variable, connectivity in random graphs
- The emergence of networks; the choice of links to create or to destroy
- Strategic choice of links
- Emerging random graphs: the probabilities of links evolve over time
- An example: buyer seller networks.
- The identification problem

The highly concentrated network of ownership of Transnational Corporations

3rd Session:
In this session we will deal with markets as institutions and how their structure and organisation impinges on the allocations that they achieve. The main point here being that we cannot talk reasonably about market outcomes if we do not really specify how markets organise the interactions between the market participants. But this is largely absent from the theoretical literature. Following on from Douglas North’s remark,

“It is a peculiar fact that the literature on economics...contains so little discussion of the central institution that underlies neoclassical economics—the market.” (North, 1977, p.710)

and the same thing is echoed by Coase,

“Although economists claim to study the market, in modern economic theory the market itself has even a more shadowy role than the firm” (Coase, 1988, p.7).

We will take a rapid look at some well-known historical and anthropological studies of markets, Claire de Ruyt’s study of the agora in ancient Rome, its functioning, its structure and its rules, John Padgett’s study of some markets in Florence, his comparison of the differences between the markets for wool and silk, Clifford Geertz’s study of North African souks, Theodore Bester’s study of Tsukiji, the Tokyo fish market and Mitchel Abolafia’s study of Bond traders on Wall Street, Making Markets.

In particular we will concentrate on markets for perishable goods and a special example of these fish markets which have a long history in the economic literature and for which we have a lot of empirical data.

- Fish markets: historical background
• The Marseille fish market: the data (every transaction over three years) pairwise negotiation and no posted prices
• Market properties and individual behaviour
• Market organisation and its impact on price dispersion
• Price-quantity relations and their relation to “demand”
• A full-blown game theoretic approach??
• An approach in which agents follow simple behavioural rules
• The emergence of loyalty and trading relationships: a little formal analysis and some empirical evidence
• The Ancona fish market: 3 simultaneous Dutch auctions.
• Comparison with the results from Marseille
• Other perishable goods markets

4th Session:
This will be devoted to financial markets. We will take a look at the foundations of modern financial economics and in particular the extent to which those foundations are solid. We will also examine the role of financial networks and the problem of the fragility of interbank and international financial networks. Once we move away from the idea of a large anonymous market which processes all information efficiently we can see how phenomena of contagion and of bubbles and crashes can occur. We will examine examples of models in which agents switch between the rules that they use depending on the success of those rules and will show how this can lead to the sudden collapse of markets.

• The foundations of modern financial market theory: from Bachelier to Markowitz and Black and Scholes
• The efficient market hypothesis
• Criticisms: from Poincare to Keynes to Mandelbrot
• Financial market equilibrium
• Bubbles and excess volatility
• The predictability of asset prices
• Informational cascades and herd behaviour
• Switching between forecasting rules
• A different idea of equilibrium: the distribution of prices is stable in the long run but there is no convergence to a steady state.
• Prices are unpredictable in the short run

5th Session:
This will be devoted to two topics and some conclusions. The first is the public goods problem.

Public Goods
Many experiments have shown that individuals contribute more to public goods than game theory would suggest. The basic problem of externalities will be examined and the “tragedy of the commons” analysed. The game theoretic solution, the Nash equilibrium will be compared with the social optimum. What has then to be explained is that individuals when playing a public goods contribution game initially give much more than in the Nash equilibrium. However, their contributions decline over time. This has led to the
argument that they “learn to play Nash”. We will see that this conclusion fits the data at the aggregate level but not at the individual level.

- The basic public goods game
- A modified version with an interior solution
- The role of information
- Learning in games
- Results in different treatments
- The reinforcement learning model of Erev and Roth and the EWA model of Camerer and Ho
- Aggregate v. Group behaviour
- Group v. Individual behaviour
- The difficulty that these results pose for the Fehr and Schmidt model
- Individuals are noisy and do not base their behavior on a simple model of fairness

Schelling’s Segregation Model

Schelling’s analysis of racial segregation in urban areas is one of the pioneering articles in which there is a stark contrast between what he calls “micromotives” and “macrobehaviour”. When individuals have relatively moderate preferences in favour of neighbourhoods with their own colour and move in consequence the result can be total segregation. Worse, if people actually prefer mixed neighbourhoods segregation can still occur. We will examine the basis for these results and will analyse a physical analogy and some generalisations of the original model.

- The basic model
- Individuals on a grid acting on the basis of local information
- The original utility function and alternatives
- A physical analogy
- The income dimension
- Introducing a housing market
- Some empirical evidence

Some conclusions

The purpose of this course has been to examine the difficulties with current theoretical models of the economy, particularly macroeconomic models and to suggest an alternative approach. This would emphasise the importance of the direct interaction between individuals in the economy, and suggest that this is a central question not a peripheral imperfection. Coordination is a more important criterion than efficiency. Such an approach limits the degree of rationality attributed to individuals and emphasises the difference between individual and aggregate behaviour. This approach allows us to analyse large endogenous changes in the aggregate without resort to exogenous shocks and explicitly recognises the possibility of the endogenous formation of bubbles and crashes. Such models undermine the idea that markets self-organise in a stable and efficient way, and that they automatically attain equilibria, but they do have the merit of providing a basis for some of the most important economic phenomena of our time.

Assessment

Final Exam
Reading List

Some general references:

In the list below those articles or texts that everyone should try to read are marked **
The other readings are to complete your understanding of the course.

The basic text for the course is


Books which adopt similar approaches are the classic,


And a collection of earlier articles in


Just in case you might think that the crisis is new:


A sociological approach


The reactions of policy makers

Greenspan Alan, (2008), Testimony to House of Representatives Committee on Government Oversight and Reform, October 23rd 2008

**Trichet Jean-Claude (2010), « Reflections on the nature of monetary policy non-standard measures and finance theory » Speech by President of the ECB, Opening address at the ECB Central Banking Conference Frankfurt, 18 November 2010

Specific references for each session

Session 1


Session 2


Session 3


Session 4


Session 5


Conclusions
