The present and future of game theory: strategic behavior and the financial crisis *

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The last decade of the 20th century was happy days for many economies as well as for academic economics. In January, 2003, in his Presidential Address to the American Economic Association, Robert Lucas [15] could proclaim macroeconomics a solved problem: "*My thesis in this lecture is that macroeconomics in this original sense has succeeded: Its central problem of depression prevention has been solved, for all practical purposes, and has in fact been solved for many decades. There remain important gains in welfare from better fiscal policies, but I argue that these are gains from providing people with better incentives to work and to save, not from better fine-tuning of spending flows.*"

A few years into the 21st century, the situation was very different. On September 6, 2010, in the Financial Times, Gideon Rachman [18] called for economists to get off their throne and make room for historians and political scientists: "*When Paul Krugman, a Nobel prize-winning economist, clashed with Niall Ferguson, a famous historian (and FT contributing editor), over how best to respond to the economic crisis, Professor Fergusons response was humorously humble. 'A cat may look at a king,' he wrote, 'and sometimes a historian can challenge an economist.' As the proud owner of a huge grey Chartreux cat, and a history graduate, I believe that it is time to overturn this implicit intellectual hierarchy. The cats must unsheath their claws and lacerate the kings, ripping away their regal pretensions. The vanity of economists needs to be challenged. Above all, their claim to scientific rigour — buttressed by models and equations — must be treated much more skeptically.*"

Two events defined developments from 2007 onwards: the collapse of Lehman Brothers in September 2008 and the request by the government of

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Greece for a stand by arrangement with the IMF in the Spring of 2010. Many dissertation shall be written in attempts to understand all that went wrong in Greece or in world financial markets. The question that we address is whether game theory, and economic theory more generally, as taught in doctoral programs, provide the tools necessary to understand and solve these problems or, better, foresee and prevent them. And, if solutions or preventions are too much to ask for, at least intuitions that shed light on events and provide hints about possible ways out.

It is tempting to take advantage of language and argue that this is indeed the case: Reputation or credibility are at the core of equilibrium analysis and strategic optimization in repeated games. Loss of credibility was the major problem the Greek government faced in the winter of 2009 and the Spring of 2010. Should PM Papandreou have admitted to his colleagues that he was PM of a corrupt state? What more strategic than default; should Greece have defaulted; if so, when?

It is often easy and, if not, challenging, to write equations, construct models, even compute optimal responses and equilibria. But have we learned something someone with no formal training in economics or game theory could not have figured out from first principles? Can we do better than practical experience and common sense? In 2001, Steven Weinberg [20] addressed the distinction between explanation and (mere) description in science: "if I had to give an a priori definition of explanation in physics I would say, 'explanation in physics is what physicists have done when they say Aha! But a priori definitions (including this one) are not much use." Can we *explain* the crisis in the Eurozone and the great recession?

Accomplished colleagues may not share this view, but academic economists have been absent from the public debate concerning either the debt crisis in the Eurozone or the crisis that disrupted financial markets and set off the great recession; when not, their contributions have failed the aha criterion; and the distinction between scientific research and journalism has been blurred: one wonders if Paul Krugman would have been warded the Nobel Prize in 2008 had he not, in time, shifted his focus from academic journals to the daily press.

What to make of this failure?

One way is to abandon what Frank Hahn called "grammatical thinking" in economics and the fascinating body of knowledge it has produced starting with the foundations of game theory and of the theory of competitive equilibrium more than half a century ago. But this will not do. Time and again rationality and equilibrium, rational expectations in particular, are held responsible for the failure of analytical macroeconomics to foresee and forestal the financial crisis and the recession. But, what is the rational expectations

hypothesis other than simply grammatical thinking? Syntactical discipline imposed, formally, on the agents in a model, but, in essence, on the modeler?

We should stick to our standards and methods; which is not to deny that the failure is real, of macroeconomics, monetary economics and financial economics in particular.

And this is where game theory comes in.

The Walrasian paradigm, with prices as the only signal across agents and and the imperative "ignore thy neighbor" operative, is too demanding on markets and prices; and it is adequate only for a very restricted class of pristine environments. Attempts to bootstrap asymmetric information and strategic interactions into a Walrasian framework can only go so far.

At a Nash-Walras equilibrium, the welfare of individuals depends on trades in commodities and assets that they choose, subject to budget constraints, and the profile of strategies across individuals.

There are two general situations in which markets fail and intervention is called for: economies with external effects or strategic interactions and economies with an incomplete asset market; together, they encompass economies with asymmetric information, moral hazard and adverse selection. Indeed, Dubey and Geanakoplos [7], Bisin, Geanakoplos, Gottardi, Minelli, and Polemarchakis [2] and Minelli and Polemarchakis [16] showed that many adverse selection and moral hazard problems, including the adverse selection in Akerlof [1] or Rothschild and Stiglitz [19], and the moral hazard in Mirrlees [17], can be recast in a more standard general equilibrium context.

Formally, *"markets fail"* or, equivalently, competitive allocations are constrained suboptimal if there exist Pareto improving interventions compatible with constraints that prevail – in particular, the constraints under which markets operate.

In Geanakoplos and Polemarchakis [9], with operative external effects, there is a way to make everybody better off than they would be under perfect competition: by taxing or subsidizing commodities anonymously (everyone pays the same tax) and redistributing the tax revenue anonymously. An alternative approach would be to ask which allocations can be implemented as strategic equilibria, through the design of mechanisms and an explicit recognition of incentive compatibility constraints, as introduced by Hurwicz [11, 12, 13] and developed in the theory of implementation; but, this does not focus , explicitly at least, on the functioning of competitive, anonymous markets.

The asset market is complete if all contracts for the transfer of revenue over time and across realizations of uncertainty are priced and traded, and all individuals can participate in this market for assets with no restrictions; other wise it is incomplete. With an incomplete asset market, constrained

(sub)optimality, defined by Diamond [6], was formally shown in Hart [10]; in Geanakoplos and Polemarchakis [8], it was shown to be robust or generic. In Carvajal and Polemarchakis [4], the argument was extended to economies subject to aggregate as well as uninsurable idiosyncratic risk, even if the asset market for the allocation of aggregate risks is complete.

Recent attempts to provide analytical foundations for Keynesian phenomena, most notably deficient aggregate demand and persistent unemployment, such as Chamley [5] without recourse price rigidities or ad hoc constraints on endogenous variables exploit precisely the strategic interaction of agents at Nash-Walras equilibria.

The demonstration that in empirically compelling situations are constrained suboptimal makes an important methodological point. Departures from laissez-faire are often said to be counterproductive because competitive equilibrium cannot be Pareto improved upon. Since constraints on the operation of perfect competitive markets (such as externalities, strategic interactions and incomplete asset markets) are ubiquitous, such a view is untenable. It remains an issue, evidently, whether policy makers know enough about the population distribution of fundamentals to intervene as in Carvajal and Polemarchakis [3] or Kubler, Chiappori, Ekeland, and Polemarchakis [14] or whether, as in Carvajal and Polemarchakis [3], ignorance supports the invisible hand.

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