Review of Behavioral Economics, XXXX, XX: 1–8

A Comment on Gintis and Helbing "*Homo Socialis*: An Analytical Core for Sociological Theory"

Paul Ormerod

Centre for Decision Making Uncertainty, University College London and Volterra Partners LLP, London, UK, p.ormerod@ucl.ac.uk

ABSTRACT

I consider first of all the usefulness of the concept of general equilibrium. Social and economic systems are dynamic, evolutionary processes, and for the most part, activity takes place in non-equilibrium situations. Most of my comments relate to behaviour out of equilibrium, which, Gintis and Helbing of course consider extensively. In essence, I make two key points. First, in general it is not reasonable to assume, as Gintis and Helbing do, that agents are able to construct probability distributions regarding future outcomes? This assumption ignores the role of radical uncertainty in the sense of Knight, Keynes, and, as I discuss, Alchian. Second, in general it is not reasonable to assume that agents' preferences are transitive out of equilibrium? The two points are of course connected, but I separate them for discussion purposes. The assumption of transitive preferences is central to the Helbing-Gintis model, and is very far from being the 'minimal' assumption of the authors' description of it. In general, the assumption of transitivity is not valid, which limits severely the applicability of the Gintis-Helbing structure.

Keywords: Out of equilibrium, Non-transitive preferences, Radical uncertainty

JEL Codes: A12, D03, D50, D81, Z13

1 Introduction

I want to preface my remarks by paying tribute to the scale and scope of the paper by Gintis and Helbing (GH). The general tenor of my comment is critical,

ISSN 2326-6198; DOI 10.1561/105.00000027

in the same way that it is of the model of Walrasian general equilibrium in economics, on which GH is patterned. But this does not detract from the intellectual achievement of either the Arrow-Debreu model or of that of GH. In addition, the erudition of the authors is enormous. It is precisely because of the achievements of the paper that it demands critical scrutiny.

I consider first of all the usefulness of the concept of general equilibrium. Social and economic systems are dynamic, evolutionary processes, and for the most part, activity takes place in non-equilibrium situations. Most of my comments relate to behaviour out of equilibrium, which GH of course consider extensively. In essence, I make two key points. First, how reasonable is it to assume, as GH do, that agents are able to construct probability distributions regarding future outcomes? This assumption ignores the role of radical uncertainty in the sense of Knight, Keynes, and, as I discuss, Alchian. Second, how reasonable is it to assume that agents' preferences are transitive out of equilibrium? The two points are of course connected, but I separate them for discussion purposes.

2 General Equilibrium

I begin my comments in reverse, as it were, by focusing on the conclusion of GH. They write: "A scientific discipline attains maturity when it has developed a core analytical theory that is taught to all fledgling practitioners, is accepted by a large majority of seasoned practitioners, and is the basis for intradisciplinary communication". They cite the achievement of economics of achieving such a theory, with the development of general equilibrium theory in the second half of the 20th century.

Mainstream economics is far from being an empty box. And it is not wrong in the sense that the Ptolemaic theory of the movement of heavenly bodies was wrong. There are circumstances in which the key assumptions on which it is based are reasonable approximations of reality, and the core model then yields valuable insights. But, equally, there are circumstances in which it is not just wrong, but positively harmful.

Consider the attempts in recent decades to put macroeconomic theory on these micro foundations, initially in real business cycle theory, and then more recently in dynamic stochastic general equilibrium theory (DSGE). This is not the place either for a full scale critique of DSGE models, or for a detailed discussion of their role in creating the financial crisis (Ormerod, 2010). The relevant point is that they encouraged economists to promote an intellectual climate in which both regulators and policy makers came to believe that the problems of business cycles had been eliminated. Lucas (2003) claimed that "the central problem of depression-prevention [has] been solved, for all practical purposes". Blanchard (2009), in a paper published initially

as an MIT Discussion Paper only a few weeks before the collapse of Lehman Brothers in September 2008, surveyed the evolution of macroeconomic theory in recent decades. He claimed that "For a long while after the explosion of macroeconomics in the 1970s, the field looked like a battlefield. Over time however, largely because facts do not go away, a largely shared vision both of fluctuations and of methodology has emerged... *The state of macro is good* [my italics]". Blanchard went on to say that "DSGE models have become ubiquitous. Dozens of teams of researchers are involved in their construction. Nearly every central bank has one, or wants to have one. They are used to evaluate policy rules, to do conditional forecasting, or even sometimes to do actual forecasting'. He concluded "macroeconomics is going through a period of great progress."

One of the main problems with this equilibrium view of the world is that, even if an equilibrium exists, is unique and stable, economies spend most — indeed possibly all — their time in non-equilibrium situations. This was shown in the world of theory as long ago as 1969 by Atkinson, who demonstrated that the typical period of transition between two equilibrium paths in the Solow growth model is more than 100 years.

Modern economies and societies are dynamic systems, in which the environment in which agents take decisions is evolving constantly. "Constantly" here, of course does not mean "at a constant rate", but "all the time". In such non-equilibrium situations, GH recognise that agents will hold heterogeneous expectations: "Out of equilibrium, however, the content of social roles, including their material, social, and moral attributes, are statistical distributions over which individuals have subjective and networked probability distributions".

This corresponds to the problem that Hayek considered in his works on the business cycle. As I argue in Ormerod (2009), Hayek essentially believed that the starting point of business cycle theory should be the framework of general equilibrium. It was not sufficient, important though this might be, to point out empirical evidence on why this theory fails to explain the cycle. It was necessary to extend the theory in order to achieve an explanation.

Hayek (1937) wrote that "It appears that the concept of equilibrium merely means that the foresight of the different members of the society is in a special sense correct. It must be correct in the sense that every person's plan is based on the expectation of just those actions of other people which those other people intend to perform and that all these plans are based on the expectation of the same set of external facts, so that under certain conditions nobody will have any reason to change his plans". He argued that such individual plans might indeed have to be revised by external shocks. But, more importantly, the individual plans may not have been, indeed are unlikely to have been, compatible from the outset, so that revisions are inevitable. Heterogeneous agents in this view of the world are operating with limited knowledge of their environment and their foresight is imperfect.

Firms' expectations prove to be wrong and the unintended consequence is the emergence of an economic expansion that ultimately proves unsustainable. Individual firms may have complete information on their local circumstances, but they are unable to appreciate the collective consequences of their individual decisions. Second, firms do not learn from previous experience to avoid similar mistakes in the future, these false expectations are an inherent feature of the economic system. Third, the central bank does not learn how to offset these expectations in order to smooth out the cycle and restore equilibrium.

So in a Hayekian world, even though the Platonic ldea of an equilibrium lurks in the background, it is as if the economy, essentially because of inconsistent and evolving heterogeneous expectations, operates out of equilibrium. These same points apply exactly to the GH world in which "Out of equilibrium, however, the content of social roles, including their material, social, and moral attributes, are statistical distributions over which individuals have subjective and networked probability distributions". GH do not establish either uniqueness or stability of equilibrium in their model. Perhaps more importantly, they do not demonstrate that it is a useful concept in this context.

3 Behavioural Rules Out of Equilibrium

3.1 Uncertainty

The micro level rules of agent behaviour, on which GH base their analysis, are equally open to criticism. One important advance that they make on general equilibrium models in economics, however, is that, out of equilibrium, the role of subjectivity and the influence of others on the behaviour of an agent are recognised explicitly. The quote from the paper in the paragraph immediately above makes this clear.

Equally, however, the same quote raises an important problem with the GH model. In this model, agents face the future armed with probability distributions of the possible outcomes. The probability distributions may very well not be the 'true' ones, if these could ever be established (see Simon (1955a), for example, for very good reasons why even *ex post* in most situations they never can be), but they are probability distributions nevertheless.

The problem here is that, in many real life situations, agents must take decisions under conditions of radical uncertainty. In other words, situations in which the probability distributions of outcomes are themselves unknown. The concept was famously introduced by Frank Knight in 1921, although in practice, as Bloom (2014) for example, notes, many situations will be a mixture of both Knightian uncertainty and risk, which can be quantified via a probability distribution of potential outcomes. The same concept of uncertainty permeates the work of Keynes.

We might usefully consider the conditions under which radical uncertainty might be more important than risk. For example, many major investment decisions will lack suitable comparators, which, if they existed, could be helpful in assessing the costs and benefits. At the time of writing, for example, the largest investment project in Western Europe, Crossrail is under way. This consists of constructing new rail tunnels under the whole of Central London, a major world city. It is hard to find any comparable examples. A further distinguishing feature of large government and corporate investment decisions is that they are hard to reverse. The capital stock, to use the jargon of the growth theory of the 1960s, is "putty-clay". *Ex ante*, many configurations are possible. *Ex post*, it is very difficult to turn it into something else. Perhaps the most important aspect of investment decisions is that their impact takes place over many years. The environment can change in so many completely unanticipated ways that attempting to compute the optimal decision now is an exercise that makes very little sense.

Now, the above examples are set in an economic context. But it is easy to see how they translate into situations in which, say, agents are considering which social norms might emerge. Even without invoking directly these conditions, further difficulties exist with forming a probability distribution of the potential adoption of a new norm.

We can take the heroic step of assuming that agents know, purely for the purposes of illustration, that the percolation of a potential new norm across a network of agents is driven by the model of binary choice with externalities (Schelling, 1973; Watts, 2002). In this model, agents switch to a new alternative from the existing one by imitating the decisions made by agents to which they are connected. Their decision depends upon their inherent willingness to switch — how easy or difficult they are to persuade — and on the proportion of their neighbours who have already adopted the new norm. It is a simple but powerful model that gives insights into many real world situations, as the Schelling and Watts papers illustrate.

The assumption that we know the behaviour model of choice that agents use in this context is a massive one. They may instead use, say, preferential attachment (Simon, 1955b), or a more sophisticated development of it such as one based on the principles of cultural evolution (for example, Bentley et al., 2011, 2014). This by no means exhausts the list. Further, different agents may use different rules, so at any point in time several different decision rules will be in play.

However, in order to construct a probability distribution of the percolation of the potential new norm, even if we know the behavioural model used by agents in selecting such norms, we need to know the topology that connects the agents, the distribution of the degree of willingness to adopt a new norm across the agents, and have information on which agents are first to adopt the norm.

The principle of imitation as the "null" model of behavioural choice under uncertainty was advanced by Alchian (1950). By "null" is meant the principles underlying the basic model of behaviour, which can obviously be adapted and extended of necessary. The purpose of Alchian's paper was to modify economic analysis in order to incorporate incomplete information and uncertain foresight as axioms. He argues, in a way that is now familiar, that "uncertainty arises from at least two sources: imperfect foresight and human inability to solve complex problems containing a host of variables even when an optimum is definable".

Alchian recognises (Ormerod, 2014) that humans can imagine the future, act with purpose and intent and consciously adapt our behaviour. He postulates that, even in the face of uncertainty, at least a local optimum might be found if agents follow what we would now term a Bayesian learning process. However, for convergence to an equilibrium, he argues that two conditions need to be satisfied. A particular trial strategy must be capable of being deemed a success or failure *ex post*, and the position achieved must be comparable with results of other potential actions.

Alchian argues that it is unlikely that such conditions will hold in practice, for the simple reason that the external environment of a firm is not static but changing. Comparability of resulting situations is destroyed by the changing environment. An important paper in *Science* confirms this intuition (Rendell et al., 2010). Economic theory certainly contains models in which imitation is the main driver of behaviour in, for example, herding models. But these are seen as a special case compared to the more generally applicable model in which agents have fairly stable preferences and select on the basis of the attributes of the alternatives that are available. Alchian argues, all those years ago, that under changing external environments — under uncertainty — the model in which agents imitate the behaviour of others is the general principle of behaviour, and not just the special case.

3.2 The Preference Function and Transitivity

This brings me to the question of the assumptions made about the preference function of agents by GH. They state: "The first principle of rational choice is that in any given situation, which maybe time-, state-, and social-context dependent, the decision-maker, whom we will call Alice, has a real-valued preference function f over choices such that Alice prefers x to y if and only if $f(x) > f(y)$ The conditions for the existence of such a function, developed in Section A1, are quite minimal, the main point being that Alice's choices must be transitive."

The assertion that choices must be transitive is far from being "minimal". On the contrary, it is a very strong assumption to make, and one that is not in general warranted either empirically or theoretically.

Certainly, there is a literature in experimental economics, going at least as far as [illegible], Tversky (1969), which suggests that empirically non-transitive preferences are often observed. A later paper, which has also become something of a classic, concludes that "At the very least, this evidence, in conjunction with the regret theory that predicts it, provides good reason not to assume too readily that transitivity is a robust and indispensable principle of choice under uncertainty" (Loomes et al., 1991).

From a theoretical perspective, if we are in an out-of-equilibrium world in which imitation is the null model of agent choice, the principle of transitivity will be violated frequently. Indeed, in models of choice that are based on the principle of imitation, agents are not even required to learn preferences over time. The preferences of any given agent are not formed over time. At any point in time, the null model of choice is one in which an agent essentially makes a choice based simply on the choices made by others.

The assumption of transitive preferences is central to the Gintis-Helbing model, and is very far from being a "minimal" assumption. In general, it is not valid, which limits severely the applicability of the authors' elegant structure.

References

Alchian, A. A. 1950. "Uncertainty, Evolution and Economic Theory". *Journal of Political Economy*. 58 (3): 211–221.

Atkinson, A. B. 1969. "The Timescale of Economic Models: How Long is the Long Run?" *Review of Economic Studies*. 36 (106): 137–152.

Bentley R Alexander and Camila Caido and Paul Ormerod. 2014. "Effects of Memory on Spatial Heterogeneity in Neutrally Transmitted Culture". Evolution and Human Behavior. URL: http://dx.doi.org/10.1016/j.evolhumbehav.2014.02.001.

Bentley R Alexander and Paul Ormerod and Mike Batty. 2011. "Evolving Social Influence in Large Populations". *Behavioral Ecology and Sociobiology*. 65(3): 537–546.

Blanchard, O. J. 2009. "The State of Macro". *Annual Review of Economics, Annual Reviews*. 1 (1): 209–228.

Bloom, N. 2014. "Fluctuations in Uncertainty". *Journal of Economic Perspectives*. 28 (2): 153–176.

Hayek, F. A. 1937. "Economics and Knowledge". *Economica*. 4: 33–54.

Loomes, G., C. Starmer, and R. Sugden. 1991. "Observing Violations of Transitivity by Experimental Methods". *Econometrica*. 59: 425–439.

Lucas, R. E. 2003. "Macroeconomic Priorities". *American Economic Review*. 93 (1): 1–14.

Ormerod, P. 2009. "Keynes, Hayek and Complexity". In: *Coping with the Complexity of Economics*. Ed. by M. Faggini and T. Lux. Springer.

Ormerod, P. 2010. "The Current Crisis and the Culpability of Macroeconomic Theory". *21st Century Society*. 5: 5–19.

Ormerod, P. 2014. "The Economics of Radical Uncertainty". Institute for New Economic Thinking, Toronto Conference, April 2014.

Rendell, L. *et al.* 2010. "Why Copy Others? Insights from the Social Learning Tournament". *Science*. 308: 208–213.

Schelling, T. C. 1973. "Hockey Helmets, Concealed Weapons and Daylight Saving Time". *The Journal of Conflict Resolution*. 17 (3): 381–428.

Simon, H. A. 1955a. "A Behavioral Model of Rational Choice". *The Quarterly Journal of Economics*. 69(1): 99–118.

Simon, H. A. 1955b. "On a Class of Skew Distribution Functions". *Biometrika*. 42 (314): 425–440.

Tversky, A. 1969. "Intransitivity of Preferences". *Psychological Review*. 76 (1): 31–48.

Watts, D. J. 2002. "A Simple Model of Global Cascades on Random Networks". *Proceedings of the National Academy of Sciences*. 99 (9): 5766–5771.