Irreducible Uncertainty and its Implications: A Narrative Action Theory for Economics.

David Tuckett (University College London)
(d.tuckett@ucl.ac.uk)

At the heart of economics is a theory of action. It reflects views about how human beings make economic decisions and leads to an analysis of aggregate consequences.

As we know, despite the insights of pioneering figures like Adam Smith, Alfred Marshall and Maynard Keynes, the story of economic analysis, until very recently, is in essence that economic action rests on the conclusions of deductive logic machines not human judgment. However the history of AI (despite successes) shows that logic machines don't do well with irreducible uncertainty. The present state of human knowledge and its achievements, on the other hand, shows that humans are biological, sentient, reflexive, social and imaginative beings who as a species are highly specialised and successful at adapting to uncertainty.

Today I want to argue that the difference I have drawn between how machines and humans handle uncertainty matters a lot. In fact, in reality all the big decisions in economic life – investment in innovation, capital goods and future projects, all finance and all large scale economic and organisational management, for instance – require action under that condition and it is highly consequential.

Uncertainty

Before going further I want to define what I mean when I say the future is irreducibly uncertain. I start with the three rather different kinds of uncertainty described by Lane and Maxfield (2005).

Truth (or Epistemic) Uncertainty refers to a situation in which actors are uncertain about whether well-defined propositions (statements about future consequences which can be measured on a probability scale) are true or not. This is the only kind of uncertainty that Savage's (1954) decision theory and most of what came after in Economics admit. In that theory the point at which actors "act" is conceived as a kind of "present" moment – one which actually contracts to a single point. At that moment entities called agents (they could as well be machines) are conceived to interpret the information available to them individually without reference to each other in their context and to use it to determine alternative sets of prescriptions for available actions and to evaluate the possible consequences that might follow from each of the prescribed actions.

Given such uncertainty the problem for agents at the moment of choice is to decide which of the possible consequences associated with their available actions they believe is most likely to occur. From Savage on agents are usually conceived to solve this by evaluating how

likely each is to happen, as well as how attractive each will be, should it happen - based on Bayesian probability updating. In my view the behavioural trend in economics deals with the only remaining problem in this kind of "uncertain" world – namely the not insignificant implementation problems that are not mentioned in the Savage system, including cognitive and computing limitations, information asymmetry etc.

Semantic Uncertainty refers to a situation in which agents have become human actors capable of interpretation so that their problem is that they are uncertain about what the various propositions facing them actually mean.

The key point is that given semantic uncertainty the problem for actors at the moment of choice is to establish the meaning of the information available to them. The problem extends far beyond questions of the asymmetric distribution of information – the fundamental question is what the information to hand actually means for the beliefs actors have about futures which are yet to happen. Once any kind of complexity is introduced this is a major issue. To model actors faced with semantic uncertainty means to face the fact that they can understand the same information differently and so can reach different equally valid conclusions across an empirically defined range with the implication rational agents would be interested in and interact with each other..

Ontological uncertainty refers to a situation in which interpretively able and interacting actors are also uncertain because the future is yet to happen. They recognise it may not look like the past. In this case the future depends upon **actors' beliefs** about what kinds of entities inhabit their world, the interactions these entities can have among themselves & how the entities and their interaction modes change as a result of these interactions. Rapid change would mean actors cannot generate stable ontological categories valid for the time periods relevant to assessing the outcome of their actions.

The key point is that whereas with the first two types of uncertainty actors' current experience of their world is perhaps sufficient to equip them with beliefs to foresee the kinds of things that can happen in the future, when there is **Ontological Uncertainty** matters are entirely different – data has to be selected and interpreted and future beliefs about the world depend crucially on how the future is imagined.

How Actors Act at All

For the last eighty years, insofar as we are discussing the big decisions mentioned earlier which require proper treatment of irreducible uncertainty, economics has in some senses gone backwards.

Rather than trying to tackle how human beings make decisions under irreducible uncertainty and the implications for an economy when they do so, uncertainties have been modelled *as if* they are truth uncertainty. In that condition optimal choices can be determined by calculating future possibilities using probability theorems *as if* the situation is

analogous to well-defined gambles or calculating the proportion of blue or green marbles in a bowl.[1] An additional approach would be to focus on the processes that determine how, given uncertainty and the threat of failure, economic agents actually manage to act at all.

As Dow, Davidson and others have stressed, in the *General Theory* Keynes focused on just this problem. He diagnosed the need to understand when actors would or not "act" as central. As now his society was then mired in inactivity. In that context he stated firmly that big decisions of the kind mentioned result from a "spontaneous urge to action rather than inaction" and are not "the outcome of a weighted average of quantitative benefits multiplied by quantitative probabilities" but, of "the state of confidence… to which practical men play the closest attention".

A few pages later he sets out his idea that it is "conventions" (extrapolating the present forward), "Animal Sprits" (psychic drives)[2] and "innate optimism" which drive action and long-term investment. His ideas on these topics were only sketched out in a few words – his interest at the time was to question the idea that lowering interest rates significantly would provoke action and to stress instead the need for an adequate level of aggregate demand.

To develop beyond Keynes' nascent ideas I argue we must bring in thinking from psychology, neurobiology, sociology, organisational theory, social anthropology and anywhere else relevant to bear on understanding how decision-makers manage to act at all, when they cannot be certain what it is best to do and do not know the consequences of what they do[3].

Narratives

My team[4] has been seeking to understand decision-making in financial markets. We focus on the role of narrative, specifically conviction narratives, in enabling economic actors to create pictures of the future and their capacity to benefit from it and so provide the

[1] Some more ingenious schemes have tried to include "Knightian uncertainty". Abdellaoui et al, 2011 explored betting on coloured beans and temperatures to demonstrate experimentally that subjects' aversion to taking risk was reliably and independently influenced by different information sources. They considered situations where agents have to make choices to act but are given more and less certain baskets of information on which to decide. The model assumes that the "uncertain" information will carry less weight in determining how to act and experimental evidence supports it. Ingenious and painstaking as this work is, conclusions drawn from it the underlying context was well-defined and not one of ontological uncertainty and the fact that uncertainty can create opportunity and attraction as well as aversion is overlooked.

[2] What he meant by "Animal spirits" is controversial. The phrase was in currency early Edwardian England and so even used by P.G. Wodehouse (Chick, personal conversation). Based on a conversation I once had with the historian and former King's College Provost Noel Annan I think it likely he is referring to the Latin term anima which is the Lain translation of the Greek term Psyche. Keynes, through Bloomsbury and the Stracheys' who were Freud's translators, publishers and followers was likely to know Freud's "drive" theories rather well.

[3] As suggested when discussing Truth Uncertainty, the answer here does not lie in Behavioural Economics, which has adopted the rather limited task of studying the difficulties in applying Savage type decision theory.

[4] Loosely comprising Kimberly Chong (social anthropologist), Rickard Nyman (computer scientist), Claudia Ruatti (psychologist), Robert Elliot Smith ((computer and artificial intelligence scientist) and Paul Ormerod (economist). Kimberly Chong and David Tuckett are supported by grants from INET.

emotional support to act under uncertainty. The approach seeks to expand the decision-making literature in Brain sciences (Tuckett and Ruatti).

Our argument is that financial actors act by constantly and actively managing to modify in *their minds* the threat uncertainty poses to their operations and ontological security. They do this by creating, proclaiming and maintaining what we call **conviction narratives**. Such narratives relate past and present to the future in an emotionally believable way and so manage day-to-day the cognitive and emotional elements necessarily and irreducibly created by decision-making under uncertainty. Constantly, but always tenuously, such actors have to create a sense of conviction as to their expertise, capacity to act and skill. They do it through developing stories told to themselves and others which combine (a) to exploit the opportunity element in uncertainty while (b), at the same time, to hold any doubts at bay (Chong and Tuckett).

Conviction narratives manage the problem of prediction and commitment to action when agents are faced with irreducible uncertainty and its threats. We can show this is as true for the individual decisions made by the "value" or growth" stock-pickers we studied as it is for the overall investment processes used by all types. Put in its simplest terms fund managers must tame uncertainty and to do so they need a self- and other- convincing story which simultaneously combines grounds for becoming attracted to an opportunity for gain and grounds for avoiding doubt and the prospect of loss.

Conviction narratives, therefore, ordinarily contain two elements

- Something to make the object attractive.
- Something to manage any doubts that this might not be the case.

We have demonstrated this is so by analysing the decision narratives of 40 managers seen in 2011 to explore how far attractors or doubt-repelling elements were evident within their accounts. Six types of element were identified within their stories in one way or another creating attraction and/or managing doubt. We found (after defining the details carefully) that one or more of these factors were a feature of every narrative. In fact nine out of ten respondents mentioned at least one attractor, eight out of ten at least one doubt-repellor and seven out of ten at least one in both categories.

Narrative is an evolved human capacity combining emotional and cognitive functions - perhaps adapted precisely to develop conviction in individuals and groups as to the sense of pursuing imagined futures.

Conviction Narratives and Phantastic Object Narratives

In reality, given uncertainty, doubt is always irresolvable. The function of conviction narratives is to support action in this context.

But one consequence of decision by narrative is that in managing doubts and emphasising attraction all doubts can get lost.

The evolved human capacity to achieve the mental state I call "divided" – allowing individuals to make themselves unaware of some of their thoughts so that some individuals can get taken over by a wish to pursue or others can dream of good life when the conditions for living are intolerable or others can into battle rather than be paralysed by the likely consequences - can create difficulties.

A special class of shared conviction narrative*,* what I term a *phantastic object narrative,* can develop which both creates and amplifies *divided states*. Some leaders, ideas or objects can become so idealised and attractive they capture the thinking and desires of a group so that the underlying attractor in a conviction narrative becomes exponentially intoxicating and/or doubt as to its truth diminishes substantially or vanishes entirely. A divided state in a group is termed *groupfeel* (Tuckett, 2011).

Phantastic object narratives dominated the housing market, banking and finance sectors leading up to 2008 and can in small ways all the time. Eventually of course – it can take a long time – there is no alternative for the reality of objects to return with force so that the "divided state" supporting such narratives gives way to disappointment and revulsion at the object.

Tracking the Emergence of Divided States

Based on this theoretical approach, understanding how narratives are formed in the human mind and how particular narratives are evolved, transmitted and imposed through networks in society becomes a crucial matter.

As part of this effort, we have developed algorithms to analyse narrative sentiment in over fourteen million Reuters News[5] stories published between 2003 and 2013 (Tuckett, Smith, and Nyman).

I will end by describing one set of findings recently achieved in which we think we can show how in the case of Fanny Mae, an institution crucial to the issuing and valuing of the derivative instruments that were so desired in the period before the financial crisis, conviction narratives were a crucial part of what happened leading to 2008. In the key period they were not influenced by economic fundamentals at least until these became overwhelming.

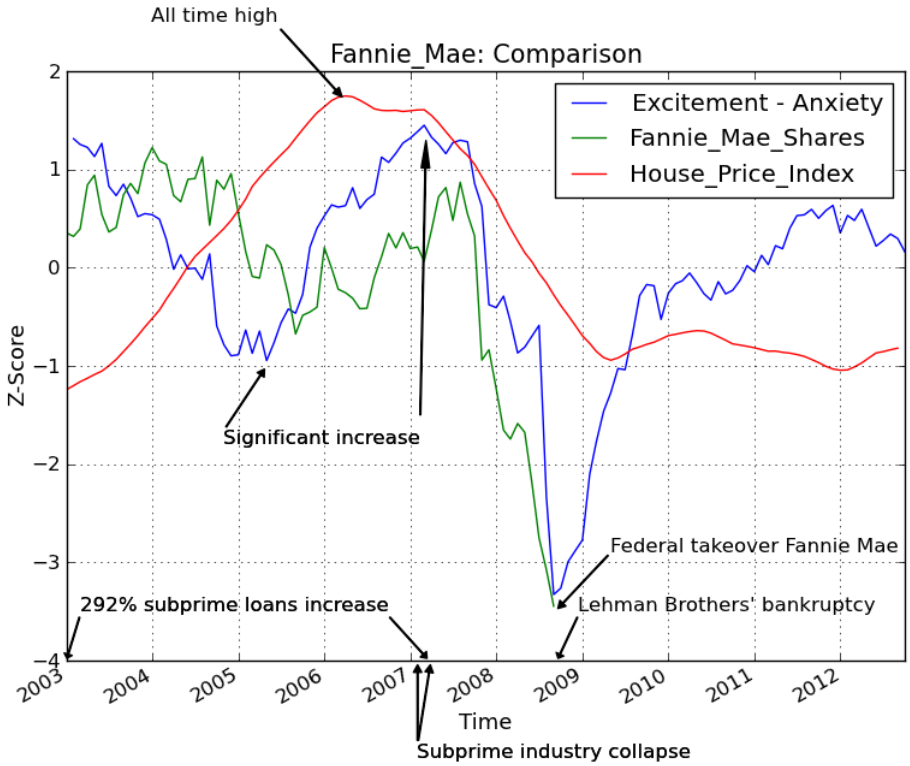
Our theory predicts that in the period leading to the financial crisis the housing finance business and the various complex derivatives resting on it became a *phantastic object* perceived by investors in a *divided state*.

[5] I am grateful to Thomson Reuters and particularly Chrystia Freeland, Richard Brown and Maciej Pomalecki for arranging access for us to the Reuters News archive.

If this was so, we would expect that some measure of 'sentiment' within articles surrounding Fannie Mae (an entity deeply involved with housing finance) would allow us to detect significant growth in exciting attraction and/or a decline in anxiety and doubt in stories about it, or similar entities, during the relevant period.

We would also expect this excitement not to be correlated or even to be increasingly negatively correlated for a substantial period before a correction induced by the objective facts or fundamentals.

This is what we find.



Conclusion

At the heart of economics is an unrealistic theory of action by agents, at least insofar as what we need to do is to understand the outcomes of how human decision-makers act under irreducible uncertainty.

Humans are highly adapted to act in such situations because they have feelings and imagination and the capacity to act on narrative truth – capacities which have allowed innovators to try and some to succeed with dramatic consequences, despite a very high failure rate.

Conviction narratives combine human capacities and allow individuals to act individually and collectively no matter they do not have the calculable grounds for doing so. Narratives that

are “felt” convincing are also mediated by other evolutionary adaptations such as felt relations to others (groupfeel) and to culturally relevant constructs such as “likely” stories – that is narratives that belong to time and place.

Conviction narratives manage uncertainty and allow action but because ontological uncertainty remains irreducible and so future interactions between actors have many unexpected outcomes, they will frequently create *divided states*, overshooting and error.

Machine-learning techniques may help us to understand and even predict possibly unstable developments in conviction narratives and the emergence of phantastic object attraction and divided states. They may, therefore, allow us both to model economies as containing human beings and to ground these models in empirical data. Of course, any such knowledge itself will be part of the next unexpected adaptation.

References

Lane, David A. and Maxfield, Robert R. (2005) Ontological uncertainty and innovation J Evol Econ **15**: 3–50. DOI: 10.1007/s00191-004-0227-7

Tuckett, D. (2011). *Minding The Market*s Palgrave Macmillan.

_____and Chong, Kimberly (Forthcoming) Constructing Conviction through Action and Narrative: How Money Managers Manage Uncertainty and the Consequences for Financial Market Functioning.

_____and Ruatti, Claudia (Forthcoming) Radical Uncertainty and Decision-Making Theories: Towards an Action Framework

_____ Smith, Robert Elliot and Nyman, Rickard (Forthcoming) Phantastic Objects & Divided States: A computer algorithmic investigation of *conviction narratives* in unstructured data sources.