

## Referee's report on "Uncertainty: A Diagrammatic Treatment" by Sheila Dow

This article is problematic from several points of view. Although written by someone who is well known for her many contributions to the methodology of economics and her interest in uncertainty the main message is not quite clear.

What we are provided with is a careful review of the many different notions of uncertainty, from quantitatively probabilisable to unknown unknowns. We are also told with which notions certain economists are associated. Thus, for the author, the view of uncertainty is inextricably associated with the view of the way in which the economy functions. There is certainly a lot of truth in this and the extreme here would be to think of a specialist in quantum physics who, recognising, that the universe is essentially stochastic, tries to build a model of the economy on that insight. He would come up with the idea that the economy was a complex system full of unforeseen consequences and that the capacity to predict anything was essentially zero. Indeed, in trying to build his model at a more and more microscopic level he would run up against the Heisenberg uncertainty principle itself. This would be a far cry from mainstream economic models which envisage a well defined system of causal relations affected by exogenous random noise.

Whichever is the "right" view economists of different persuasions have and will continue to build their models on some patchwork of ideologically based theory, and a certain dose of empirical facts and the question raised here is which of these patchworks has done a good job in understanding the current crisis and remedying its consequences. The author claims that this turns essentially on their understanding of the uncertainty in the economy and how this can lead to more effective policy proposals. But this, in turn carries such strong echoes of the debate in physics as to the spillover from microscopic intrinsic uncertainty to macroscopic behaviour and whether the latter can reasonably be treated as deterministic that this might have been worth mentioning.

The debate in modern macroeconomics on the treatment of uncertainty has turned essentially on the notion of "rational expectations" and this has been the way of closing the model by treating the uncertainty in the economy as being defined by the stochastic process governing the evolution of the economy. Not only do individuals have the same view of that stochastic process but their view is consistent with the actual evolution of the economy. This has been the subject of intense debate and yet in the paper under review no mention is made of rational expectations as such.

What is discussed is the confidence that people have in expectations. But this could just mean that the underlying support of the distribution is larger or more restricted and could be captured in the realm of a very standard probabilistic approach.

When it is asserted that the system remains closed how would one classify David Hendry's approach here? Is the idea that the number of models under consideration is a priori limited or could the set of models from which to select evolve? In the latter case if new candidates appear over time we would seem to be more in the open situation that the author recommends.

The article is entitled "a diagrammatic treatment", although, one might almost say "pictorial", because the various figures illustrate the interrelationships with different areas assigned to each notion but the relationships are conceptual rather than quantitative. The approach is useful to get an overall impression as to the disagreement between the different approaches but there is always a danger in this sort of exercise. That is that people may share a vision and simply name it differently and if the latter is the case one might be led into a long discussion of differences that are more apparent than real.

But, and here we come to my main difficulty, the paper starts out with a discussion as to the role of uncertainty in the crisis and it is surely important to understand this. However, there are two issues here. First how did the aggregate uncertainty change with the onset of the crisis and second how did the uncertainty perceived by the very different actors change? Throughout the paper it is not clearly stated whether we are talking about the uncertainty in the system as a whole or whether we are talking about the uncertainty perceived by the individual actors. In the second case what is important is the contagion effect. As one individual changes his perception of the uncertainty this affects the others with whom he interacts. Furthermore, the problem of asymmetric information plays a role in individuals perception of uncertainty. As Marshall pointed out, in many markets we cannot expect individuals to have all the information necessary to make "rational" decisions. But then, what for some people is fundamentally uncertain may, for others, be known or at least susceptible to have probabilities attached. For example the sub-prime crisis was, in large part, due to the loss of available information to people or institutions trading the derivatives in question. What happened was that people who did not have the information continued to trade instruments which they thought they could sell, since the buyers were not checking on the underlying information. When the toxicity began to appear more banks started checking before buying and this finally led everyone in the market to check with a consequent collapse of prices.

Two things were involved, deciding how likely it was that buyers would check and the perceived probability of toxicity, a small increase in either could cause a collapse of the prices. But, how exactly does this fit into the framework developed in this paper? I do not see how this mixture of perceptions with different people having different attitudes can be placed in that framework but I am sure that the author will be able to answer this.

To sum up this paper presents an interesting and thorough account of uncertainty and the various conceptions of that notion, but it claims to help us to understand better the genesis and evolution of the crisis and I am not quite sure why this is the case. That the author provides an incisive criticism of standard macroeconomic theory is beyond doubt. However, what the pragmatic benefits of that criticism and the careful categorisation of the different versions and perceptions of uncertainty are, remains unclear to me.