How volatility can arise from sudden change in conviction narratives

A recent body of work has focused on the importance of narratives in economic and financial decision making. Tuckett & Nikolic (2017) discuss conviction narratives and the necessity for investors to build consistent stories in order to make choices under radical uncertainty. Shiller (2017) discusses the impact of narratives on macroeconomic phenomena (depressions and political economy) and examines how they can spread and be measured. The Bank of England has started to collect data on individual narratives from businesses and investors around the UK. Much of this draws on a long tradition of psychological work going back to Bruner (1991) and before.

A separate strand of research in cognitive and computational neuroscience suggests that people and animals use predictive models to navigate their environments (Clark 2013). A specific model of prediction, the successor representation, suggests that each state of the world is mentally represented by the sum of the states that are predicted to follow it (Dayan 1993; Stachenfeld et al 2017). Organisms plan their future outcomes by simulating this series of states and mentally evaluating their progress through them. Neural evidence from animal studies (Schultz, Dayan, Montague 1997) suggests this process is important to learning and behaviour and provides a biological explanation of how it is implemented in the brain.

A third related area is the prospection literature; prospection is the process of psychologically simulating the future (Gilbert & Wilson, 2007) and has been proposed as a mechanism for decision making (Pezzulo & Rigoli, 2011). An important claim of prospection theory is that people enjoy simulating positive futures – the brain rewards us for the simulation, not just the actual experience (and correspondingly generates aversive feelings when we simulate negative outcomes).

In this paper we draw on this work, and on the causal mental models proposed by Sloman and Lagnado (2014), to create a formal model of how agents represent and act on narratives. We introduce the concept of an implication graph, a directed graph whose nodes represent concepts and whose edges represent causal or associative beliefs. The implication graph includes reward caches, which generate quantifiable reward as agents navigate the graph during mental simulation. Narratives are defined as fuzzy subgraphs of the overall implication graph, representing a specific set of nodes and edges that are activated at a given time, each with a degree of activation.

The reward generated during simulation explains both the choices that agents make, and also the narratives that they prefer. Reward caches are updated during learning, both from the external environment and from the consequences of mental simulation.

Social communication between agents provides a mechanism for the implication graph to be updated without direct experience of the world, introducing an important source of belief transmission, with an accompanying risk of agents adopting biased or false beliefs.

Applying the implication graph to a model of beliefs over financial objects with an inter-agent trading process, we simulate the outcomes of these processes and are able to show:
• The persistence of old narratives in the face of new evidence
• The existence of “phase changes” when one narrative is replaced with another, for a single individual or a population, and the conditions under which this occurs
• The consequences of these phase changes for financial volatility

We develop suggestions for how volatility can be understood and predicted in terms of available data about the narratives and causal beliefs held by consumers.