A Model of Primary and Secondary Waves in Investment Cycles

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Abstract. Schumpeter maintained that oscillations of macroeconomic variables are only the “secondary wave” of business cycles, a reflex of more fundamental “primary waves” at the microeconomic level caused by the innovative activity of entrepreneurs. Uniting Schumpeter’s concern for innovation with Keynes’ concern for uncertainty and expectations formation, this article focuses on the behaviour of entrepreneurs confronting uncertainty caused by innovation. Entrepreneurs’ behaviour is reconstructed by modelling the functioning of their cognitive processes when innovations appear. Recognition of the possibilities opened up by a successful innovation generates a state of optimism in the minds of single entrepreneurs, which eventually propagates to the whole economy triggering an investments upswing. Likewise, unsuccessful innovations can trigger a downswing.

Key words: biotech, cognitive maps, innovation, investments, uncertainty

JEL classification: D81; O30; E32

1. Introduction

Joseph A. Schumpeter maintained that business cycles cannot be understood by looking at macroeconomic variables only, since these are ultimately determined by the behaviour of entrepreneurs at the microeconomic level. Schumpeter referred to the investments undertaken by single entrepreneurs as the “primary wave” which, under favourable circumstances, can propagate throughout the whole economic system and generate the well-known “secondary wave” at the macroeconomic level (Schumpeter, 1939). There is some empirical evidence supporting this view. In fact, the large degree of independence of regional and sectoral economic variables with respect to their macroeconomic aggregates suggests that macroeconomic fluctuations are a consequence of microeconomic disturbances, rather than the reverse (Quah, 1994).

According to Schumpeter, the driving force of economic development is the introduction and diffusion of innovations that lower costs and restore profitability. However, while Schumpeter focused on the behaviour of single entrepreneurs and postulated the arrival of “innovations swarms” in order to explain cycles
(Schumpeter, 1911), modern Schumpeterians stress rather the role of diffusion processes in transforming a disordered innovative activity at the microeconomic level into a coherent macroeconomic wave (Silverberg and Lehnert, 1993, 1994).

This article investigates a particular aspect of the process of innovation adoption, namely the recognition of the worth of an innovation and the decision to invest on it. It focuses on the moment where an entrepreneur realises that an innovation is opening up new fields of activity while, at the same time, closing old ones. On these occasions, the emergence of an innovation affects the confidence that entrepreneurs attach to their actions, triggering bursts of optimism and pessimism that are essential to explain real investments. Rather than rational decision-making, this mode of behaviour is reminiscent of Keynes’s “animal spirits” (Keynes, 1936, 1937a,b).

This article moves from the conviction that “animal spirits” can only be understood if interpreted in cognitive terms, i.e. as deriving from the inadequacy of existing mental categories to capture novelties when they appear. Essentially, investment on innovations requires a confidence in the future that cannot be based on a long record of past performance. On the contrary, it is idiosyncratic convictions and scanty evidence that underpin the confidence upon which investments on innovations are carried out. Consequently, this confidence is prone to sudden changes as a consequence of single but unexpected news.

This article assumes that investments are decided on the basis of a cognitive map that specifies the causal relationships between the decisions to be made and the outcome to be expected. Confidence changes when a cognitive map does not work anymore, for instance because the mental categories it is based upon must be re-formulated in order to enlarge or restrict the possibilities that an individual is able to conceive. Consequently, by explicitly modelling the cognitive maps of entrepreneurs it is possible to formalise the arousal and crash of confidence states.

The model of confidence oscillation expounded in this article applies an algorithm for complexity evaluation that is based on the structural properties of cognitive maps (Fioretti, 1998, 1999). However, acquaintance with the general model is not required in order to understand this self-contained, simplified case.

Section 2 highlights the link between a decision to invest and the cognitive map of an entrepreneur. Section 3 stresses an important empirical feature of investing behaviour, namely, overconfidence. Section 4 entails the mathematical formalism of confidence evaluation. Section 5 presents simulations of the investment cycles produced by this model. Finally, Section 6 concludes.

2. Cognitive Maps

In general, investment models are not concerned with recognising the value of an innovation, i.e. with convincing oneself that success will accrue to him who will devote his resources to bring a particular innovation to the market. On this specific