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Innovation, qualitative change and economic development—Special issue in honour of Pier-Paolo Saviotti

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1. Introduction

For many years, Paolo Saviotti has made key contributions to the development of evolutionary economics. Few people have been as active in promoting evolutionary thought in economics, through his presenting, writing, editing, hosting, supervising and mentoring work. This issue of *Structural Change and Economic Dynamics* is a special issue in honour of Paolo Saviotti and marks the occasion of his 65th birthday.

Paolo has contributed to many theoretical and empirical fields of enquiry. While it is difficult to summarise the breadth and depth of his contribution, we highlight three main intellectual branches, each of which is firmly based on a neo-Schumpeterian view of the economy as a self-transforming evolving system. This short summary also serves as a rough guide for (young) scholars interested in learning more about his work.

One branch of research which Paolo is perhaps most frequently associated with, is his seminal contribution to the product characteristics literature. Working with colleagues at Manchester, he was a founding father of what has subsequently come to be known as the 'Manchester School' of innovation. Paolo was the first to distinguish between technical and service characteristics of products. Technical characteristics are the focus of inventive activity by firms while service characteristics are the object of interest, and ultimately choice, by consumers (Saviotti and Metcalfe, 1984; Saviotti, 1988, 1996). Using the approach, Paolo constructed a systematic theoretical and empirical research program on the nature of innovation, the measurement of product variety, and the mapping of the evolution of product technologies along technological trajectories. Empirical applications of Paolo's 'twin characteristics approach' date back to the first half of 1980s, with studies of tractors (Gibbons et al., 1982), aircraft (Saviotti and Bowman, 1984), and cars (Saviotti, 1985). These provided a platform for a series of subsequent empirical studies by Paolo and other authors that include helicopters (Saviotti and Trickett,

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1992), aircraft, helicopters, motorcycles and microcomputers (Frenken et al., 1999), steam engines (Frenken and Nuvolari, 2004), refinery processing (Nguyen et al., 2005), the camera industry (Windrum, 2005) and a recent special issue of the Journal of Evolutionary Economics (2009) that was co-edited by Paolo (Fontana et al., 2009), and includes studies of skis (Corrocher and Guerzoni, 2009), solar cells (Haller and Grupp, 2009), cars (Los and Verspagen, 2009; Alkemade et al., 2009), tanks (Castaldi et al., 2009) and mobile phones (Windrum et al., 2009).

A second line of research in which Paolo has made significant contributions (and which illustrates further the distinctive neo-Schumpeterian perspective that underpins his work) is the role of knowledge in innovation and industrial dynamics. This line of research was mainly pursued after he moved from Manchester to Grenoble in the mid-nineties. Key contributions include theoretical and empirical studies in the economics of knowledge (Saviotti, 1998, 2004, 2007; Nesta and Saviotti, 2005, 2006; Grebel et al., 2006), innovation networks (Pyka and Saviotti, 2002, 2005; Saviotti and Catherine, 2008), and the role of mergers and acquisitions (M&As) for knowledge management (Saviotti et al., 2005). This body of work contributed to the role of codification and appropriability conditions in industrial dynamics, the importance of variety and coherence of knowledge bases, and the evolution of R&D networks along an industry's lifecycle.

The third line of Paolo's research involves the development of a theory of economic growth and structural change based on the saturation of demand in old industry sectors, and the creation of new sectors through innovation. Here Paolo has been led by work of Luigi Pasinetti on economic growth (Pasinetti, 1981, 1993), and by the insights gained through his own work on product characteristics (Saviotti and Metcalfe, 1984), variety (Saviotti, 1996) and demand (Saviotti, 2001), which cumulated into a family of simulation models (Saviotti and Mani, 1995; Saviotti and Pyka, 2004a,b, 2008a,b), and a first attempt at empirical validation (Saviotti and Frenken, 2008). Two key hypotheses have been put forward. First, that growth in variety is a necessary requirement for long-term economic development. Second, that the growth of variety, leading to new sectors, and productivity growth in pre-existing sectors, are complementary and not independent aspects of economic development. Throughout this research trajectory, these two hypotheses have become more firmly based on micro-founded, multi-sector industry life cycle models with selection of firms being based on product competition in characteristics space and price competition based on efficiency improvements.

The various contributions contained in this special issue address various aspects of Paolo's work. Here we consider each contribution, in order of appearance.

The paper by Marengo and Valente provides a theoretical contribution that is based on the NK-model by Kauffman (1993). The model operationalises Paolo's distinction between technical and service characteristics, enabling a useful representation of products and product innovation to be obtained. By doing so, the authors can theorise about the effect of various search strategies on product innovation and its effects on industrial dynamics. With most innovation models still being limited to process innovation (including those based on the NK-model), this approach marks an important step forward. Although the model in its present form remains rather stylised, the framework clearly demonstrates the potential of the NK-modelling approach for theorising about product innovation and industrial dynamics.

Paolo's emphasis on the role played by demand in innovation is picked up in Witt's paper. Witt adds an additional dimension to Paolo's research on product characteristics and qualitative change, emphasising the subjective dimension of consumers' decisions and the mutual influences that occur within groups of consumers. Symbolic consumption and the possibilities of signalling go hand-in-hand with particular consumption activities, leading to emergent phenomena involving shared appreciations of specific consumption patterns. Behind these emerging patterns, Witt identifies the capacity of socially embedded cognitive learning.

The Malerba and Orsenigo paper provides a model of user–producer interactions, and their effect on the dynamics of industry evolution. This is an elaboration of their research history-friendly models in which there is a co-evolution of component and final-product industries (Malerba et al., 2008). The results show that, in general, the gains from interactions tend to increase industrial concentration and the rate of technical change. Yet the precise effects are shown to depend on the nature of contractual relationships between users and producers (length and exclusivity)—an issue that is underexplored in evolutionary models thus far. The model is rich in its results. One important finding is that exclusive relationships tend to constrain firms' growth, technological change, and industry concentration. The results also support the intuition that long-term contracts better support user–producer relationships.

Roberto Fontana and Lionel Nesta pick up Paolo Saviotti's research on industrial dynamics and the role played by knowledge, complementary assets, diversification by innovation and selection. In their case study on the Local Area Network Switch Industry they work out the dynamics caused by early entry of small specialized companies, the subsequent competitive advantage of diversifying companies and the effects on firm survival and exit this has. This study emphasis the important role played by complementary assets for industry dynamics as it can be found also in other industries (e.g. Pyka and Saviotti, 2005 for biopharmaceuticals). The important role of complementary capabilities manifests itself in the co-existence of persistence of incumbent firms and the novelty-driven emergence of new entrants which in some cases in the long run could lead to a replacement of incumbents.

To detect the dynamics of knowledge production, knowledge can be analyzed as a co-relational network structure where proximity and distance effects affect cross-fertilization of different areas of knowledge (Saviotti, 2009). Antonelli, Krafft and Quatraro in their contribution to this Festschrift elaborate the knowledge network in