

Schumpeter's core works revisited

Resolved problems and remaining challenges

Esben Sloth Andersen

Version: 15th February 2012

Abstract This paper organizes Schumpeter's core books in three groups: the programmatic duology, the evolutionary economic duology, and the socioeconomic synthesis. By analysing these groups and their interconnections from the viewpoint of modern evolutionary economics, the paper summarises resolved problems and points at remaining challenges. Its analyses are based on distinctions between microevolution and macroevolution, between economic evolution and socioeconomic coevolution, and between Schumpeter's three major evolutionary models (called Mark I, Mark II and Mark SC).

Keywords Joseph A. Schumpeter · Grouping of works · Microevolution and macroevolution · Socioeconomic coevolution · Schumpeterian models of evolution

JEL B31 · B52 · E30 · L00 · O30

1 Introduction

Modern evolutionary economics can learn much from revisiting the older type of evolutionary economics that is found in Joseph Schumpeter's core works. He provided many of our core concepts and basic questions, and revisiting his works helps us to clarify these concepts and questions. We can also learn from what, in retrospect, might be considered wrong steps he took during his lifelong attempt to develop his version of evolutionary economics. These are major reasons why we celebrate the centenary of *Theorie der wirtschaftlichen Entwicklung*, which is the first edition of *The Theory of Economic Development*. However, he would probably have disliked this type of celebration of his book. In its preface, Schumpeter (1912c, vii) expressed two wishes. His first wish was that the 'facts and arguments' of his book would become acknowledged by economic theorists. His second wish was that these theorists

E.S. Andersen
Department of Business and Management, Aalborg University, Fibigerstraede 4, 9220 Aalborg, Denmark
E-mail: esa@business.aau.dk

would ‘as soon as possible’ make his book ‘surpassed and forgotten’. Nevertheless, there was no quick ‘surpassing’, since practically none of his contemporaries cared to think about the ‘facts’ of what we now call Schumpeterian dynamics and his ‘arguments’ for grasping the essence of economic evolution by means of his system of concepts. This situation changed with the emergence of a modern evolutionary economics that ranges from explicit Schumpeterian dynamics (relating to Nelson and Winter, 1982) to more abstract evolutionary game theory (relating to Maynard Smith, 1982). Through the increased efforts to analyze economic evolution, we seem to be approaching the point at which we have surpassed and can largely forget about Schumpeter’s works. However, we probably still need at least a couple of decades before we can say that the fulfilling of Schumpeter’s two wishes has been accomplished.

When revisiting Schumpeter’s works, we have to recognize two important facts. First, he was not the only great economist who confronted the difficulties of handling economic evolution analytically. We should also appreciate efforts that range from Adam Smith and Marx via Marshall and Menger to Veblen and Hayek. However, Schumpeter is exceptional since he, until very recently, was the only major economist who made evolutionary analysis the turning point of practically all his research efforts. These efforts reflect a second important fact: Since he felt nobody took his arguments seriously and surpassed his evolutionary theory, Schumpeter decided to perform the further development and application of this theory on his own. The consequence is that practically all his major research efforts can be depicted as the preparation for and the following up on his first formulation of his theory of economic evolution in *Entwicklung*. Thus, we have to move from celebrating the centennial of a single great book to the revisiting of an evolutionary research program that is presented and implemented in Schumpeter’s core works.

The appreciation of Schumpeter’s works is eased if we distinguish between his three different models of evolutionary processes. The Mark I model describes economic evolution as the outcome of the interaction between individual innovative entrepreneurs and routine-based incumbent firms. The Mark II model describes economic evolution as the outcome of the innovative oligopolistic competition between incumbent firms. The Mark SC model describes socioeconomic evolution as a coevolutionary process between the major sectors of society. Although all these models are important, Schumpeter’s efforts concentrated on developing Mark I. In contrast, he left Mark II and Mark SC as mere sketches. Furthermore, he developed the Mark I model in a one-sided way. This can be recognized by making the distinction between microevolution and macroevolution. Microevolution is the process of evolution that takes place within a population of entities that face more or less uniform selection pressures, such as the firms of an industry. Macroevolution is the long-term transformation of a complex system of evolving and branching populations. It is more difficult to analyze macroevolution than microevolution, but a formal analysis of Schumpeter’s different accounts of Mark I demonstrates that he focused on macroevolution—although this phenomenon is not described in any detail. The reason seems to be that he wanted to relate to Walras’s general equilibrium model and that he prematurely rejected Marshall’s industry-level analysis. Although the Mark I model could also have been developed for analyzing microevolution, his analysis of this process was largely postponed

to the sketchy Mark II model of oligopolistic competition. This peculiar use of his core models created many difficulties for Schumpeter—and still provide challenges for modern evolutionary economists.

2 Grouping Schumpeter's core books

Modern evolutionary economists find Schumpeter's core works among his books and not among his 200 papers (listed in Augello, 1990). He followed the old-fashioned rule that the size of a publication should reflect its scientific importance; his smaller papers are normally made for the occasion, while the longer papers present more ambitious research, and his major books present the core scientific contributions. By revisiting two of these books, we can find three more or less precisely described models of evolution. *The Theory of Economic Development* is dedicated to the presentation of a model that describes economic evolution as the interaction between new innovative firms and the system of economic routines. This model has been called Schumpeter's Mark I model. The second part of *Capitalism, Socialism and Democracy* from 1942 presents, much more sketchily, two additional models. The most obvious is the Mark II model that depicts economic evolution as a process that is driven by the innovative oligopolistic competition between larger firms. It is also possible to detect elements of a Mark SC model of the socioeconomic coevolution between the economic sector, the science sector, the family sector, and the political sector. These three evolutionary models are mentioned throughout this paper, but Mark II and Mark SC are primarily discussed in section 5.

To understand Schumpeter's evolutionary research program, we should revisit three more of his voluminous books (see Table 1). Between *Development* and *Capitalism*, Schumpeter in 1939 published *Business Cycles: A Theoretical, Historical, and Statistical Analysis of the Capitalist Process*. On the more than thousand pages of this book, he made very complex analyses of the process of economic evolution in capitalist economies. These analyses are normally considered failures, but *Cycles* includes many scattered but important discussions of the phenomenon of innovation, a restatement of the Mark I model, and the extension and application of this model for the analysis of waveform economic evolution. Furthermore, Schumpeter started his academic career by publishing his book on the essence and main contents of theoretical economics, which is still only available in German (*Das Wesen und der Hauptinhalt der theoretischen Nationalökonomie*, 1908). This book 'contains the statement of his fundamental views which constitute the basis of Schumpeter's whole scientific *weltanschauung* [world view]' (Leontief, 1950, 105). It is in *Wesen* that he analyzes the limits of Walrasian equilibrium economics and the need for complementing it with evolutionary economics. To understand how he developed the latter fundamental field of economics, we have to consider the first German edition of *Development* separately. Actually, the many pages of *Theorie der wirtschaftlichen Entwicklung* demonstrate that it can fruitfully be considered a distinct book rather than a first edition that was replaced by *Development*.

The way in which Schumpeter's five core books contribute to his evolutionary research program becomes clear if we group them in two duologies and an addi-

Table 1 Schumpeter's core works

1908	<i>Das Wesen und der Hauptinhalt der theoretischen Nationalökonomie</i>	<i>Wesen</i> analyzes 'The Essence and Main Contents of Theoretical Economics'. It focuses on the essence and limits of Walrasian equilibrium economics and it uses these limits to emphasize the necessity of developing the complementary evolutionary economics as a fundamental field of economics. Its 626 pages have not been translated.
1912	<i>Theorie der wirtschaftlichen Entwicklung</i>	<i>Entwicklung</i> presents on 548 pages the essence of Schumpeter's Mark I evolutionary economics with heavy emphasis on the personality of the innovative entrepreneur. Chapter 7 includes a sketch of a general theory of socioeconomic evolution (Mark SC). Translations of core parts are now available (Schumpeter, 1912b; 1912b; 1910).
1934	<i>The Theory of Economic Development: An Inquiry into Profits, Capital, Credit, Interest and the Business Cycle</i>	<i>Development</i> is the translation on the 255 pages of the radically revised and shortened 2nd edition of <i>Entwicklung</i> (Schumpeter, 1926). Its focus on the basic Mark I modelling of economic evolution is obtained by concentrating on the entrepreneurial function and by removing the last chapter of <i>Entwicklung</i> .
1939	<i>Business Cycles: A Theoretical, Historical, and Statistical Analysis of the Capitalist Process</i>	<i>Cycles</i> presents a Mark I theory waveform economic evolution that is used for a sketchy analysis of 200 years of capitalist economic evolution. For most purposes many of the 1077 pages can be skipped by reading the Rendigs Fels's excellent abridged edition (Schumpeter, 1964).
1942	<i>Capitalism, Socialism and Democracy</i>	<i>Capitalism</i> has, in the 1950 edition, 425 pages. Part 2 can be read as relating to the last chapter of <i>Entwicklung</i> as well as to some of the arguments in <i>Business Cycles</i> . Thereby it becomes clear that we are facing a Mark II extension of the theory of economic evolution as well as the applications of a general theory of socioeconomic coevolution (Mark SC).

tional book. First, *Wesen* and *Entwicklung* form the duology of early programmatic books. This programmatic duology starts by analysing economic theory in the narrow sense, then adds the analysis of economic evolution, and finally ends up with a proposal of an encompassing analysis of all aspects of socioeconomic evolution. Second, *Development* and *Cycles* can be called his evolutionary economic duology. *Development* streamlines the evolutionary economic theory of *Entwicklung* and ends with the announcement of a major application of this theory: the analysis of the waves of economic evolution. *Cycles* extends this theoretical analysis and complements it with historical and statistical analyses of long-term capitalist economic evolution. Finally, *Capitalism* can be interpreted as the socioeconomic synthesis that has roots back in the historical analyses of *Cycles* as well as in *Entwicklung*'s programmatic statement of a general theory of economic and social evolution.

3 Equilibrium economics and evolutionary economics

The name of the game: The idea of considering *Wesen* and *Entwicklung* as Schumpeter's programmatic duology forces us to confront several terminological and the-

oretical problems that do not stand out clearly when applying the standard focus on *Development* and *Capitalism*. Let me start by arguing that the title *The Theory of Economic Development* is not an adequate translation of *Theorie der wirtschaftlichen Entwicklung*. The most obvious problem is that the English title uses the definite article, whereas Schumpeter is actually proposing an alternative to, for example, the Smithian and Marshallian theory of growth and evolution through the gradually increasing division of labor. However, the main problem is that the translated title ought to have been 'A Theory of Economic *Evolution*'.

The argument for this title is not that 'economic development' later became connected to the transformation of underdeveloped countries. The argument is instead that the concept 'development' was, even when *Development* was published in 1934, denoting pre-programmed processes, and this is not the type of process that he analyzed. What Schumpeter analyzed can better be described as 'evolution', that is, an open-ended process that combines innovation, behavioral inertia, and selection. He emphasized that such a process is characterized by a degree of indeterminateness that makes it impossible to predict its long-term outcomes, but it is possible to analyze scientifically the mechanisms of evolution. It was on these mechanisms that Schumpeter focused, while he was uninterested in the predictable outcomes of processes of growth and development. Since the German word 'Entwicklung' cannot only be translated by 'development' but also by 'evolution', it seems clear that Schumpeter made the wrong choice of title for his 1934 book. This conclusion is supported by the fact that his large 1939 book, *Cycles*, only speaks of 'economic evolution'.

Synthesis and research program: Schumpeter developed his theory of economic evolution through a kind of synthesis between several sources (see Figure 1). The first source of his evolutionary synthesis is neoclassical economics. He was an Austrian who, by the members of Menger's Austrian School, was taught theoretical economics in a way that seems to have included considerations on economic evolution. But he, somewhat paradoxically, preferred an independent study of Walras's non-evolutionary formalization of equilibrium economics. The second source is the economic sociology and the historical analyses of the German Historical School, where he related to considerations on socioeconomic evolution by scholars such as Schmoller and Max Weber. The third source is the challenge provided by the ideas about long-term capitalist evolution by Marx and the so-called Austro-Marxist School. The fourth and final source is more difficult to grasp, but Schumpeter wanted to rescue what he considered the important messages of innovative leadership and resistance to change that he found in the elite theories of Pareto and Nietzsche.

Schumpeter combined these sources into an evolutionary vision and analysis. His evolutionary economics started from his theory of stationary and routine-based systems in which evolution has come to a halt. To this he added the theory of a type of economic evolution that is driven by innovative entrepreneurs, and, furthermore, he generalized the theory to cover the evolutionary processes in each sector of society and the coevolution between these sectors. However, Schumpeter's most important tools and more direct inspirations seem to have come from equilibrium economics; and he initially considered evolutionary statics and evolutionary dynamics to be at the very core of his research program.

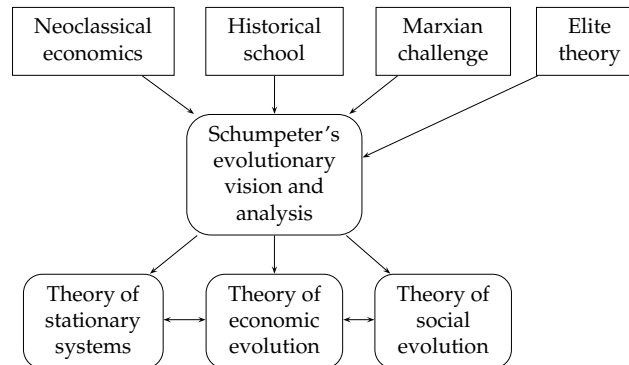


Figure 1 Main sources and components of Schumpeter's evolutionary theories (from Andersen, 2011, 91; modified from Andersen, 2009, 36).

The programmatic formulations in *Wesen* and *Entwicklung* relate to a peculiar intellectual situation within economics at the beginning of the twentieth century. On the one hand, Schumpeter emphasized that neoclassical equilibrium economics had provided much-needed clarity and many important results. On the other hand, he argued that neoclassical leaders such as Alfred Marshall (1898) had an unrealistic ambition when they wanted to move gradually from equilibrium economics toward the much more important and difficult topic of economic evolution (or transformative dynamics). A core formulation in *Wesen* (pp. 182–3) is: ‘Statics [equilibrium economics] and Dynamics [evolutionary economics] are completely different fields, they concern not only different problems but also different methods and different materials. They are not two chapters of one and the same theoretical building but two completely independent buildings. Only Statics has hitherto been somewhat satisfactorily worked up and we essentially only deal with it in this book. Dynamics [evolutionary economics] is still in its beginnings, is a “land of the future”.’ *Entwicklung* (p. 465) added that equilibrium economics is essentially the theory of a stationary economy. Its motto is: everyone adapts as good as possible under given conditions. In contrast, evolutionary economics is essentially the theory of the endogenous change of the routines of the economic system. Its main theme is that some economic agents create new routines, while other agents adapt to these routines.

The Walras connection: This way of defining the essence of equilibrium economics and evolutionary economics can most easily be understood respectively when we recognize that the early Schumpeter was a rebellious disciple of the economist he considered the greatest master of equilibrium economics, Léon Walras. Actually, Schumpeter (2000, 43–4) not only sent him a copy of *Wesen* but also a couple of letters in which he told Walras that it ‘is a book of a disciple’ and that he wanted to work under the Walrasian ‘leadership’. Schumpeter had carefully studied the logic of the Walrasian equilibrium system as well as of the tâtonnement process that, after an exogenous perturbation, brings this system back to equilibrium (Walras, 1954). It is the competition between Walrasian entrepreneurs (the W-entrepreneurs) that ad-

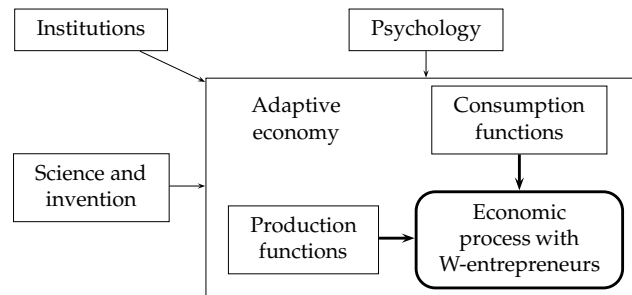


Figure 2 The exogenous determination of economic change in the Walrasian paradigm

just the economic system to changed production functions and changed consumption functions. We might add that the changes of production functions and consumption functions are produced by changes in psychology, scientific knowledge and institutions, but this would just imply a fuller account of the meaning of the exogenous factors (see Figure 2). It was not purely for analytical convenience that Walras made the assumption that any change in the Walrasian equilibrium system is the result of the change of exogenous factors. Schumpeter (1937, 166) later remembered that ‘Walras would have . . . said (and, as a matter of fact, he did say it to me the only time that I had the opportunity to converse with him) that of course economic life is essentially passive’. In other words, if the economic system ‘changes at all, it does so under influences that are external to itself’.

Schumpeter (1937, 166) strongly opposed the Walrasian idea that economic life is only an adaptive process: ‘I felt very strongly that this was wrong, and that there was a source of energy within the economic system which would of itself disrupt any equilibrium that might be attained.’ He implemented this idea in the Mark I model in which Schumpeterian entrepreneurs (the S-entrepreneurs) create innovation-based firms (see Figure 3). The creation of each innovative firm requires the will and energy of an S-entrepreneur as well as a loan from a banker who expects repayment from the profits of the entrepreneurial project. As soon as the routinized production of the new firm has become established, an S-manager is hired and the S-entrepreneur retires and spends the part of temporary profits left after repaying the loan. This behavior explains the conservatism of incumbent firms in the Mark I model. If all profits are shared between the retired entrepreneur and the banker, then the firm has no resources for expansion and for significant improvements of its knowledge. Even in the rare case where the firm has some degree of sustainable monopoly power, its surplus is extracted and it will sooner or later find its conservative place in the circular flow of economic life. This conservatism also implies that the firm will be driven to extinction by some future wave of innovation.

The evolutionary process of the Mark I model requires interplay between S-entrepreneurs who introduce new routines of production and consumption and the S-managers whose responses serve to adapt the economic system to the new routines. The analysis of the functioning of this model starts in an economic situation that comes close to the Walrasian general economic equilibrium. It is important to notice

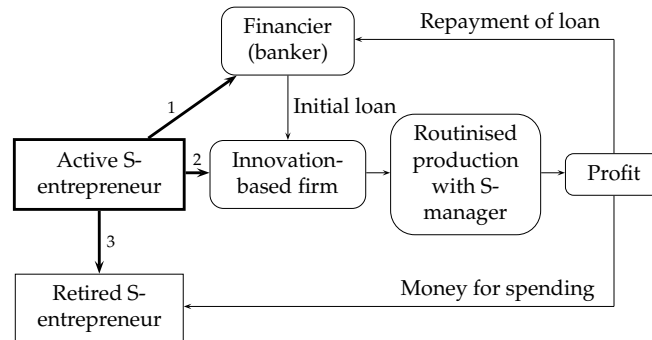


Figure 3 The creation of an innovation-based firm in Schumpeter's Mark I model (modified from Andersen, 2011, 59)

that we are facing a situation in which the stoppage of S-entrepreneurship and the competition between S-managers has brought evolution to a halt. Evolution is restarted by a new wave of S-entrepreneurs who, by means of borrowed money, establish new innovation-based firms and overcome the resistance against economic change. Thus, the entrepreneurs and the bankers are the drivers of Schumpeter's evolutionary process, but the system-level implementation of innovative change cannot take place without the adaptation of the routine behavior of the rest of the economic agents, that is, the S-managers, the workers and the consumers. These agents do not give up their routines willingly; their resistance is normally overcome in the capitalistic economic system. It is interaction between S-entrepreneurs and the routine-oriented agents that produces an evolutionary process. It is the analysis of this process that gives the new Schumpeterian meaning to core economic concepts such as profits, capital, interest, and credit and that might help explaining the business cycle phenomenon.

Toward socioeconomic coevolution: The macroevolutionary version of Schumpeter's Mark I model of capitalist economic evolution deals with a long-term historical process that does not take place within a given framework (see Figure 4). The process of economic evolution can change from a situation in which innovations are introduced by individual entrepreneurs to another situation in which innovations are primarily made by established firms. To reflect such a change he produced the Mark II model, which is only found in *Capitalism*. Furthermore, the process of economic evolution can be influenced by changes within the political sector, the family sector and the science sector. Some of these changes are clearly exogenous to the economic process. But many such changes seem to be propelled by changes in the economic sector, and the opposite direction of causation is also possible.

Although Schumpeter's evolutionary analyses (except those in *Capitalism*) were based on the Mark I model, he occasionally pointed out feedbacks from the economic sector to the other sectors. These remarks point at his ambition of developing what might be called the Mark SC model of socioeconomic coevolution. This model is sketched in the last pages of chapter 7 of *Entwicklung* (see Schumpeter, 1912a, 208–18). The starting point is the proposition that every sector of social life has an evol-

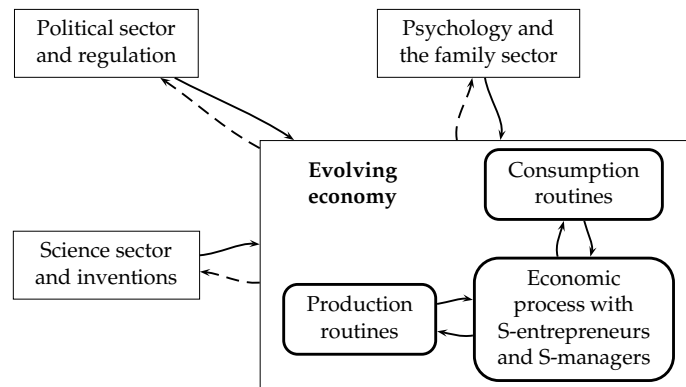


Figure 4 The evolving Schumpeterian economy, where the S-entrepreneurs innovate the routines while S-managers are forced to adapt (modified from Andersen, 2011, 44)

utionary process in which innovators interact with agents who merely adapt. Given such sectoral processes, we can study the coevolutionary processes between the sectors. However, the overall process of socioeconomic evolution is characterized by the different speeds of the individual sectoral processes. The consequence of these asynchronous sectoral processes is that the outcomes of overall societal evolution are highly indeterminate.

After having published *Entwicklung*, Schumpeter did not move directly to the analysis of the transformation of the mechanisms of economic evolution and to socioeconomic coevolution. On the contrary, he largely postponed these important topics to the socioeconomic synthesis of *Capitalism*. Instead, he chose to dedicate *Development* and *Cycles* to the further development and application of his Mark I model.

4 Combining macroevolution with microevolution

The evolutionary economic duology consists of *Development* and *Cycles*. The former book excludes *Entwicklung*'s broad discussions of heroic entrepreneurship and socioeconomic coevolution. It also streamlines the exposition of the Mark I model and contains a total rewrite of what now is the last chapter of the book: the interpretation of business cycles as reflecting waves of economic evolution. Thereby the book explicitly points at *Cycles*, but it is the fact that both books rely on the cyclical functioning of the Mark I model that is most important for the coherence of the duology. Actually, Schumpeter tried to use extensions of this model to explain why 200 years of capitalist economic evolution had been characterized as business cycles. This explanation has been considered shaky ever since Kuznets (1940) presented his devastating criticism of *Cycles*. In retrospect, the shortcomings of this book can be traced back to its depiction of macroevolution as a sequence of circular flows. This is probably the reason why Freeman (1990, 28) suggested that 'it was Schumpeter's misfortune that he attempted to marry it [Walrasian equilibrium theory] with his own theory of dynamic destabilizing entrepreneurship'. However, we should not ignore the import-

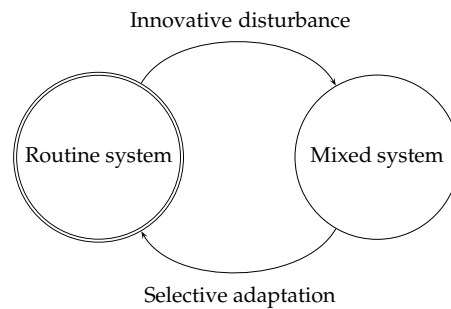


Figure 5 Schumpeter's cyclical Mark I scheme of economic macroevolution (modified from Andersen, 2009, 149)

ant materials that are presented in *Cycles*. We should especially notice the important but scattered contributions to the understanding of microevolution. For instance, the term 'innovation' occurs on 185 pages of *Cycles*, while it is only found on 11 of the pages of *Development*.

Waves of evolution and business cycles: According to the macroevolutionary version of the Mark I model (see Figure 5), evolutionary analysis starts from a situation in which evolution has reached an initial halt and where routine behavior reigns in the circular flow of economic life. Then, evolution is restarted because of the innovative disturbance by a smaller or larger swarm of Schumpeterian entrepreneurs. The evolutionary process is continued by a phase in which selection (or adaptation) dominates and where we see the creative destruction of old routines. This selective process not only serves to adapt the routine system but also to bring the evolutionary process to a new halt. Then the process is restarted by another swarm of entrepreneurs. Thus, the routine system evolves through repeated rounds of innovative disturbances, mixed and evolutionarily unstable situations, and processes of selective adaptation that bring the system to the 'neighborhood' of an economic equilibrium (according to *Cycles*).

Schumpeter thought he could easily introduce an explicit time dimension into the cyclical scheme of the Mark I model. The result is depicted by Figure 6. Here, waves of evolution and related business cycles still start from non-evolving routine systems, the circular flows. Then prosperities are interpreted as innovation-based upswings, whereas recessions are periods of enforced adaptation. It is assumed that the next business cycle cannot start before the economic system has reached another equilibrated routine system. The main problem of this cyclical scheme is that it is very difficult to define an operational wave indicator. Actually, we need two different indicators: one for macroeconomic conditions and one for economics evolution. Some measure of the price level might reflect the 'pressure' of the system of economic activity. However, among the many wave indicators considered in *Cycles* (e.g. pp. 14–17), not any single one directly measures the underlying evolutionary process.

Cycles is based on a stepwise refinement of the Mark I scheme of Figure 6. This scheme represents Schumpeter's first approximation with its simple application of the circular flow, the innovative disturbance, and a process selective adaptation. His second approximation adds oligopolistic competition and macroeconomic mechan-

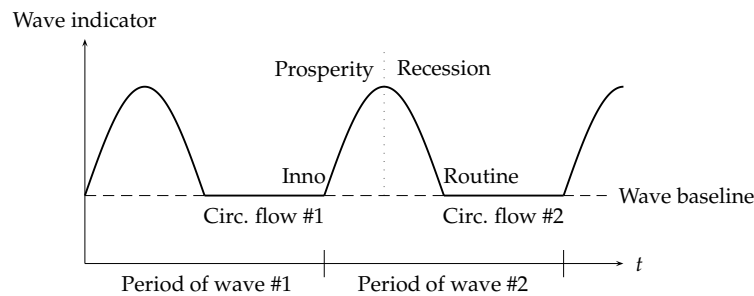


Figure 6 Two-phase waves with innovation-based prosperity and adaptation-based recession (from Andersen, 2011, 161; modified from Andersen, 2009, 219)

isms. The result is, from an evolutionary viewpoint, that the upswing is not only characterized by innovative investment but also by derived investments that will in the long run show up as 'erroneous'. Therefore, the system's return to a new circular flow not only requires the adaptive recession of the first approximation but also a depression and recovery that serve to get rid of 'erroneous' investments. Even here Schumpeter ought to have paused to handle a lot of very difficult questions on the relationship between evolutionary waves and the macroeconomic business cycles. Nevertheless, he moved directly to his third approximation that is based on the realistic assumption that different types of innovation require different time spans for being embedded in the economic system. This is the background for the famous three-cycle version of the Mark I model. He used this version to decompose the history of capitalism into long Kondratieff waves that consist of several Juglar cycles which in turn consist of Kitchin cycles of even shorter length. We can simplify by recognizing that it is only Kondratieff waves and Juglar cycles that are connected with the process of economic evolution.

The waveform evolutionary process of Mark I and the related business cycles can be interpreted in two ways. On the one hand, it can be seen as a stylized version of a real macroscopic process of economic evolution that by necessity progresses in waves and produces a type of business cycle that starts from evolutionary resting points. This unproven assumption caused Schumpeter much trouble in *Cycles*. On the other hand, we can consider Mark I as a tool that provides an analytically convenient starting point for the study of evolutionary process. Even if we do not make the assumption that real evolution starts and ends at resting points, we still can learn much by thinking in such terms. In this context, we can hardly consider Schumpeter's focus on the short-term stops of evolution and the related combination of equilibrium and evolution an error. On the contrary, any analysis of evolution requires a notion of a state where the evolutionary process has come to a halt. Furthermore, the use of the Schumpeterian scheme for analytical convenience does not necessarily imply any endorsement of strong coupling of evolutionary waves with business cycles. In addition, we can emphasize the radical difference between Walrasian equilibrium and Schumpeter's evolutionary halts. Finally, we can try to develop an indicator of the waves of evolutionary change that he failed to deliver. Such an indicator will probably have to be based on explicit microevolutionary analysis.

The statistical approach to microevolution: Schumpeter failed to distinguish clearly between the analysis of the macroevolutionary process (depicted by Figure 5) and the more elementary study of microevolution. Microevolutionary processes take place within a population with similar selection pressures, such as the firms of an industry. In retrospect, it can be argued that Schumpeter's main problem was that he lacked a statistical operationalization of such microscopic processes. When Schumpeter worked on his evolutionary economic duology, this operationalization was actually being delivered by the great statistician and evolutionary biologist R. A. Fisher (1930), but most biologists and all economists ignored this fact. Today, the situation has changed (see e.g. Andersen, 2004). We can simply define the total microevolutionary change as the change of the statistical average of an evolutionarily relevant characteristic of a population of, e.g., firms. If we only study incumbent firms, we can easily decompose total evolutionary change into the selection effect and what I call the 'innovation' effect. Then it becomes clear that we arrive at the stop of evolution through a process that reduces both the innovation effect and the selection effect to zero. It should be mentioned that it is also possible to include the evolutionary effects of the entry of new firms and the exiting of old firms to provide a fuller description of the Schumpeterian process. (See the mathematical treatment in Andersen, 2009, pp. 436–45.)

Schumpeter hardly paused to analyze such microevolutionary processes. Instead, he used his Mark I model directly to confront macroevolution, that is, the long-term transformation of a complex system of evolving populations. There are no statistically operational ways of measuring long-term macroevolutionary processes. We might more modestly think of the statistical variances of some of the evolutionarily relevant characteristics of the firms of the whole economy. We might also define the Schumpeterian circular flow as a situation in which these variances are zero (or very low), while at least some of them are increased by the innovative disturbance—and again reduced during the process of selective adaptation. But the highly complex and multidimensional nature of the macroscopic process of economic evolution suggests that we can never produce statistical indicators that are relevant for long periods of evolution. Furthermore, we have no chance of tracing the movement from one circular flow to the next because of the complex and changing 'ecological' interactions between the many individual populations of firms. Nevertheless, *Cycles* treated some of these interactions in the voluminous chapters on economic history.

The ecological approach to evolution: Given the difficulties of macroevolutionary analysis, it seems obvious that the Mark I model can be used most convincingly for cases where macroeconomic evolution is relatively closely connected to the microevolutionary process of a single industry. Furthermore, the analysis is eased if the industry-level evolution is dominated by a single major innovation. This explains why Schumpeter's favorite example of macroevolution is based on the replacement of horse-driven mail-coaches by railroads in the nineteenth century (Andersen, 2002). He saw this replacement as the core of the process of 'railroadization of the world', which produced a wave of change of the routines of whole economic system. Schumpeter provocatively used this example to reject the evolutionary gradualism that was

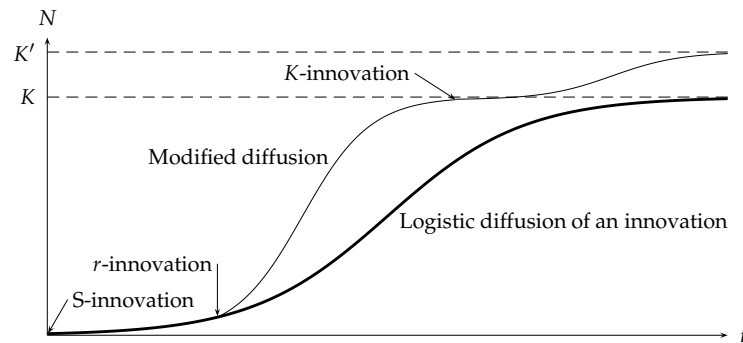


Figure 7 Logistic industrial dynamics with added types of minor innovation (from Andersen, 2011, 200; modified from Andersen, 2009, 432)

preferred by most economists. However, his account for innovative jump that was related to the railroad innovation demonstrates that he did not embrace the idea of the sudden emergence of ‘Hopeful Monsters’, which is rightly rejected by evolutionary biology. The railroad was already prepared, and it mainly needed a new combination of existing elements to emerge as a major innovation that served to define the agenda and the selection pressures for a long evolutionary trajectory.

The core microevolutionary process of railroadization can be described as the diffusion of the railroads. This diffusion roughly takes the form of an S-shaped logistic curve. By using the standard notation of evolutionary ecology, this curve of the replication of an innovation describes the movement of the number of its applications, N . The increase of N —for instance, the number of standard-length railroads—can be described by the logistic differential equation that includes two parameters, r and K . Thus, the equation is

$$\frac{dN}{dt} = rN \left(\frac{K - N}{K} \right).$$

The starting point is the basic railroad innovation, which I call an S-innovation (see Figure 7). Initially the speed of diffusion is solely determined by its ‘potency of spread’, r . But the diffusion slows down because of the increasing closeness to the temporary ‘carrying capacity’ of the economic system, K .

Although it is primarily the diffusion of an S-innovation that is used to explain the long Kondratieff wave of the nineteenth century, the historical part of *Cycles* add many complications. Of special importance is that the diffusion of the railroad innovation induced a lot of minor innovations, which are obvious when we compare the early railroads with the later ones. Two types of additional innovations can be understood in relation to the logistic diffusion process. On the one hand, during the early stages of railroadization, we recognize r -innovations that speed up the diffusion process. On the other hand, we see K -innovations that increase the demand for railroad services. These K -innovations are made when the industry has come close to the (temporary) maturation of demand. They seem to formalize parts of Schumpeter’s (1939, 497) remark that ‘no industry can go on expanding output at the rate of its [S- and r -] innovation stage. Each reaches maturity in the sense that it finds its place in

the economic organism and the amount of output beyond which it cannot profitably go, unless that amount be increased by some further [*K*-] innovation within it or in some ‘complementary’ industry and by the general effects of . . . Growth.’

Toward macroevolutionary modelling: The idea of *S*-innovations, *r*-innovations, and *K*-innovations helps us to understand microevolutionary processes in terms of the density of the populations in which they take place. They also point at the important of the ecological interactions between different industries (the ‘mesoevolution’ of Dopfer and Potts, 2008). They even point at the way macroeconomic change influences microevolution through fluctuations of the carrying capacity for individual industries. It is, however, obvious that the ecological approach serves to complicate the task of combining microevolution and macroevolution in the analysis of the relation between waves of evolution and business cycles. Here we probably need an aggregative analysis that focuses on the role of the financial sector. The ecological approach suggests that this role cannot solely be analyzed in terms of the externally financed innovations of the Mark I model. Since *K*-innovations are largely implemented by means of the internal finance of incumbent firms, we have include some aspects of the Mark II model (of *Capitalism*). The discussion of the feasibility and characteristics of more complex models is beyond the scope of the present paper. However, it should be noted that even those who consider the model of *Cycles* insufficient and misleading can learn much from searching Schumpeter’s evolutionary economic duology for its scattered but important microevolutionary insights. Furthermore, we should recognize that the ultimate goal is to be able to analyze macroevolution convincingly and that a strong microevolutionary bias might lead us to forget this goal.

5 The socioeconomic synthesis

In *Capitalism*, Schumpeter largely ignored the Mark I model. This was done without explicit argument, but we get the impression that he thought that Mark I hindered the further development of his evolutionary economics. Having freed himself of this straitjacket and having chosen an informal writing style, he could quickly solve two tasks that he had previously defined (e.g. in Schumpeter, 1912a, 1928, and 1939). On the one hand, he could present the Mark II model of a microevolutionary process that is driven by the innovative oligopolistic competition between larger firms. On the other hand, he could present some of the elements the Mark SC model of societal macroevolution as determined by the coevolution between the economic sector, the science sector, the family sector, and the political sector.

Innovative oligopolistic competition: Microevolutionary interpretations of the Mark I model describe an evolutionary process in which established firms of an industry are conservative upholders of unchanging routines and are, in the long run, replaced by new innovation-based firms—such as when mail-coach firms were replaced by railroad companies. In contrast, the Mark II model describes established firms as combining two activities: they replicate given routines; and they engage in innovative moves and counter-moves. Schumpeter used Mark I to analyze macroevolution, while

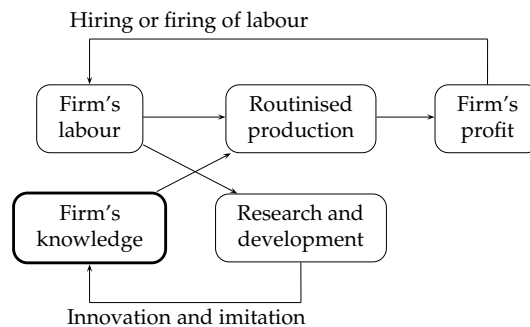


Figure 8 Feedback loops of an incumbent firm in the pure-labor version of the Mark II model (modified from Andersen, 2011, 208)

Mark II is a microevolutionary model. It is unclear whether Schumpeter really wanted to delimit his model of innovative oligopolistic competition in this way. But *Cycles* demonstrates that he knew that it was possible to produce a large number of different models of non-evolutionary oligopolistic competition and that the emergence of collusive monopoly is often plausible. Adding innovation and imitation would simply increase the number of models and add the possibility that monopoly emerges from the oligopolistic process. Thus, for Schumpeter it probably seemed impossible to produce a realistic oligopoly model of macroevolutionary dynamics, but he did succeed in describing the microevolutionary process of Schumpeterian competition that tended to increase productivity and the quality of goods.

The core of the Mark II process can be understood from the viewpoint of individual firms. Whereas innovation-based firms of the Mark I model quickly become conservative (see Figure 3), the growth of Mark II firms is influenced by feedback loops (see Figure 8). If we apply a pure-labor model, then the Mark II firm largely uses any positive profits to expand its workforce. This means a firm with a sustainable productivity lead will ultimately take over the whole industry. The evolutionary process becomes more complex when we add the possibility that the firm uses part of its workforce to produce innovations and imitations. But unless imitation is unrealistically easy, we have strong feedback loop between innovative performance and the growth of the firm. The informal writing style of *Capitalism* meant that he did not feel obliged to explain why monopoly in the strict sense is not the rule but rather the exception. However, an easy answer could have been made by combining the Mark II model with the Mark I model: the individual entrepreneurs might be those who undermine established monopolies. If this is not sufficient, he could have added the activities of the firms of other industries and the international dimension of economic evolution.

Major transitions in evolution: It is hardly necessary to discuss most aspects of the microevolutionary Mark II model since it has been widely applied and extended by evolutionary economists since Nelson and Winter (1982). These pioneers even produced a Mark II model of economic growth, but, according to the present interpretation, this growth model is a microevolutionary model for a whole economy.

However, there is one aspect of Schumpeter's use of the Mark II model that relates to macroevolution in the sense of the long-term transformation of the complex system of evolving populations. This is Schumpeter's (1928, 384–5) idea that there has been a real historical transition from the firms and mechanisms of the Mark I model to the firms and mechanisms of Mark II. This transition became obvious in the late nineteenth century when, in a few industries, it became a competitive necessity for firms to have departments of research and development. Since then, this type of innovative investment has spread to more and more industries. Another major transition had taken place a few centuries earlier when credit-based Mark I firms largely replaced artisan workshops (*Cycles*, pp. 223–30). What was gradually replaced can also be described as the Mark Zero model of guild-based artisan production, which had been shaped under feudalism. Thus Mark I marked a transition that started from a model in which the replication of routines was emphasized and major innovative change were actively discouraged.

Although such transitions in the units and mechanisms of evolution are the results of microevolutionary processes, they clearly influence macroevolution. Three characteristics can be recognized by comparing with the major transitions in the units and mechanisms of biological evolution (Maynard Smith and Szathmáry, 1997). First, the transition from single-cell organisms to multi-cell organisms did not mean that single-cell organisms became extinct. Similarly, we see the continued coexistence of Mark II firms, Mark I firms, and even some artisan workshops of the Mark Zero type. Second, major transitions in both natural and economic evolution influence the possible types of mutations and innovations. In economic life, the artisan workshops of Mark Zero had only room for incremental innovations, while radical innovations became possible through the independence and external finance of Mark I innovators. The innovative oligopolistic competition of the Mark II model does not exclude such innovations, but it seems clear that the bulk of the activities of R&D departments concerns minor innovations. Third, the emergence of multi-cell organisms led to a radical increase in the speed of macroevolutionary change. Similarly, the transition from Mark Zero workshops to Mark I firms was accompanied by an immediate increase in the average speed of evolution within industries and a long-term increase in the number of industrial specializations. Further increases in the speed of macroevolutionary change followed the emergence of Mark II firms; and the step-wise increases in the level of R&D that is needed for operating in most industries means that we have reached the present astonishing speed of macroevolution.

Socioeconomic coevolution: Although the microevolutionary analyses of *Capitalism* are based on the Mark II model, Schumpeter still mainly thought of the macroscopic evolution of the routine system in terms of the Mark I model. He assumed the alternation of routinized equilibria and innovative disturbances that challenges pre-existing routines. He dramatized the socioeconomic meaning of this process by means of two related concepts. 'Creative destruction' is the selecting out of firms (or their routines) by the pressure from radical innovations; and 'the process of creative destruction' is the combination of this kind of selection and the innovative activities that drives the process. Many of the old firms cannot make a smooth upgrade of their competencies and switch their areas of specialization. They instead tend to perish in the evolutionary

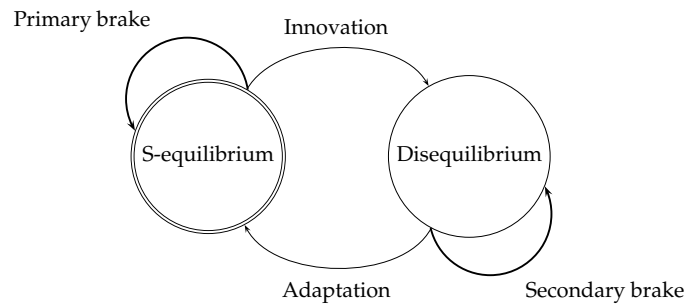


Figure 9 Adding two brakes on the Mark I model of economic macroevolution (from Andersen, 2011, 222)

process; and their employees face great stress and significant welfare losses, which to them seem more obvious than the long-term advantages of economic evolution. The reactions of the old firms and their employees can, directly or indirectly, slow down the process of economic evolution. This effect can be depicted by adding two brakes on the Mark I model (see Figure 9). The primary brake functions by making conditions for innovation more difficult. The secondary brake concerns the avoidance of creative destruction for those involved; its use implies that the selective adaptation of the routine system is slowed down.

The idea of adding brakes on the Mark I model of economic evolution seems to have brought Schumpeter back to his early idea of developing a Mark SC model of socioeconomic coevolution. We have already (in section 3) seen that *Entwicklung* suggested that every sector of social life has an evolutionary process analogous to that of economic evolution. *Capitalism* (chapter 22) implemented this idea in relation to its analysis of the functioning of democratic political systems. Here, politicians are competing for votes. Most of them do so in a routinized manner, but there are also innovators who create new parties or modify the policies of established parties. The resulting process can be depicted by models of political evolution. Here we can start from a situation in which the evolution of the routines of political life has stopped. Then innovative politicians produce an evolutionary disequilibrium, while the process of selective adaptation brings the political system to a new Schumpeterian equilibrium.

An obvious area for political innovation is the use of the two brakes during long periods that are dominated by the destructive part of the economic process of creative destruction. The major reason is that, during the same depressive periods, the evolution of the family sector emphasizes the norm of stable and secure standards of life. Thus, we have a major example of the coevolution between the family sector, the political sector, and the economic sector. However, it is not easy to develop the analysis of coevolution, since it depends on the way the evolutionary process is organized in each of the sectors. This can be understood by considering *Capitalism's* (pp. 273–83) two models of political evolution (see Andersen, 2009, 174–80). The Mark I model is based on innovations by individual political 'entrepreneurs', such as in the classical British parliamentary system. The Mark II model is based on the minor innovations and marketing by oligopolistic political parties, such as in the USA. The

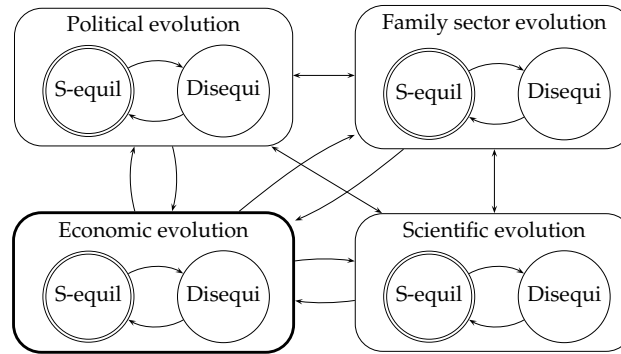


Figure 10 The Mark SC model of sectoral coevolution (modified from Andersen, 2011, 226)

latter model might be more likely to evolve policies that make use of the brakes on economic evolution.

Although Schumpeter probably returned to the Mark SC model of his youth because he was interested in the problem of the brakes on economic evolution, we are actually facing a model that can be used for many analytical purposes. For the sake of generality, it is helpful to add the science sector to the already mentioned economic sector, political sector, and family sector. The general process of coevolution between these sectors (see Figure 10) is hardly analytically manageable unless we, for a specific historical period, are able to reduce the number of significant interactions and to consider the selected sectoral interactions asymmetric. The previous discussion of the use of the brakes is based on a sequential logic. We started with the influence of economic evolution on family sector evolution. Then the family sector defined an agenda for political evolution. Finally, the political sector tried to brake economic evolution. However, Schumpeter's standard case is capitalist economic evolution with little braking. This implies an alternative sequence of sectoral interactions. During the upswing of the long wave of railroadization, it was economic evolution that largely provided the circumstances to which the other three sectors adapted. Furthermore, the politicians promoted the spread of the railroads and did not bother to save the mail coaches. A similar sequence of causations seems to characterize recent processes of globalization. More generally, it seems to be the most internationally exposed sectors (the economy and science) that tend to dominate the sectoral coevolution with the political sector and the family sector, which are largely nationally organized. However, the uneven internationalization of the sectors seems to be a major source of global instabilities.

The above discussion of the sequences of asymmetric causation has reduced analytical complexity at a high cost: the result can hardly be called an analysis of socio-economic coevolution. Since the processes of coevolution are immensely complex and still beyond the reach of solid analysis, we have to consider an alternative step-wise procedure. This procedure becomes clear when we realize that most of our analyses of economic evolution are made under the assumption that the other sectors do not evolve. We can approach the coevolution between two sectors by gradually

changing this assumption. We first study the evolutionary process of one sector under different assumptions of the state of the other sector. Then we do the same for the other sector. Finally, we try to study the simultaneous evolutions within the two sectors. By gradually adding more and more sectoral processes of evolution, we might in the end obtain some analytical clarity about the overall process of socio-cultural evolution. This seems to be the way Schumpeter wanted to approach the Mark SC modelling of socioeconomic coevolution.

Economic evolution and the natural environment: There is no reason to constrain modern evolutionary models to those developed or suggested by Schumpeter. On the contrary, it seems important to start developing a family of 'Mark NE models' that he rather discouraged than promoted. This label might be used to denote models that include the impact of the natural environmental on economic evolution, and vice versa. Environmentally oriented models have tended to ignore economic evolution. This was at least the case when Christopher Freeman in 1973 contributed to a book called *Models of Doom* (Cole et al., 1973). Here he characterized much of the contents of the famous report called *The Limits to Growth* as 'Malthus with a Computer' (Freeman, 1973). The problem was that the report ignored the evolutionary responses to the challenges from the environment and population growth. Freeman later promoted the analysis of the evolutionary responses of the capitalist engine to environmental challenges. However, the challenge to evolutionary researchers is to develop a family of more formal models of these issues. For convenience, this family of models might be called 'Schumpeter Mark NE'. Mark NE modelling can start from either Mark I or Mark II. But ultimately these Mark NE models have in some way to deal with the complexities of socio-economic coevolution, and thus they become developments of the Mark SC model.

6 Conclusions

This paper has argued that evolutionary economists can still learn much from revisiting the type of evolutionary economics that Joseph Schumpeter started to develop one hundred years ago. Actually, we can fruitfully explore and exploit his evolutionary economics in largely the same way as biologists have used Charles Darwin's evolutionary biology for 150 years. However, while Darwin in all respects has been surpassed by modern evolutionary biologists, Schumpeter's core books still contain important challenges for modern evolutionary economists. Furthermore, we cannot appreciate his efforts by reading a single great book such as the *Origin of Species*. I suggested that we instead can organize Schumpeter's books in three groups. The first of them is the programmatic duology that consists of his two early German books (*Wesen* and *Entwicklung*). The second is the evolutionary economic duology that consists of *Development* and *Cycles*. The third is the socioeconomic synthesis that is found in parts of *Capitalism*. Then I analyzed the internal logic of and the interconnections between these groups of works.

My analyses of these groups of books were supported by the distinction between Schumpeter's three different models of evolutionary processes and by the distinc-

tion between microevolution and macroevolution. The Mark I model of the interaction between individual innovative entrepreneurs and routine-based firms dominates in *Entwicklung, Development and Cycles*. Inspired by Walrasian economics, he used this model to analyze the macroscopic evolution of the system of economic routines—and neglected the analysis of the microevolution that takes place within individual industries. Today an important task is to operationalize the concept of macroevolution by adding microevolutionary processes that includes both innovation and selection. When this is done, we might be able to combine the microscopic and macroscopic aspects of something like a Mark I process of economic evolution. However, we should in this connection not ignore *Capitalism's* well known Mark II model of oligopolistic competition. This model describes a microevolutionary process, and the remaining question is how Mark II in detail influences macroevolution. Furthermore, Schumpeter presented the major historical transition from Mark I to Mark II. The analysis of such transitions in evolution is still an important challenge for evolutionary economics. *Capitalism* also contains elements of the Mark SC model that describes socioeconomic evolution as a coevolutionary process between the major sectors of society. It is a major challenge to develop Mark SC into something that can rightfully be called a model. Since such a model would include political evolution, family-sector evolution, and scientific evolution, its development presupposes transdisciplinary research. This is even more important for the development of Mark IV models of the interaction between economic evolution and the natural environment.

Acknowledgements This paper is based on my presidential address presented at the 13th International Schumpeter Society Conference, Aalborg University, 21–24 June 2010. A revised version was presented at the European Association for Evolutionary Political Economy Conference on Schumpeter's Heritage, Vienna, 27–30 October 2011. I wish to thank for useful comments given by participants of these conferences. I also thank Palgrave Macmillan for permission to reproduce and modify figures from Andersen (2011) and Anthem Press for permission to modify figures from Andersen (2009).

References

- Andersen ES (2002) Railroadization as Schumpeter's standard example of capitalist evolution: An evolutionary-ecological account. *Industry and Innovation* 9:41–78
- Andersen ES (2004) Population thinking, Price's equation and the analysis of economic evolution. *Evolutionary and Institutional Economics Review* 1:127–148
- Andersen ES (2009) *Schumpeter's Evolutionary Economics: A Theoretical, Historical and Statistical Analysis of the Engine of Capitalism*. Anthem, London
- Andersen ES (2011) *Joseph A. Schumpeter: A Theory of Social and Economic Evolution*. Palgrave Macmillan, Basingstoke and New York
- Augello MM (1990) *Joseph Alois Schumpeter: A Reference Guide*. Springer, Berlin
- Becker MC, Knudsen T, Swedberg R (eds) (2011) *The Entrepreneur: Classical Texts by Joseph A. Schumpeter*. Stanford University Press, Stanford, Calif.
- Cole HSD, Freeman C, Jahoda M, Pavitt KLR (eds) (1973) *Models of Doom: A Critique of The Limits to Growth*. Universe Books, New York
- Dopfer K, Potts J (2008) *The General Theory of Economic Evolution*. Routledge, London and New York
- Fisher RA (1930) *The Genetical Theory of Natural Selection*. Clarendon, Oxford
- Freeman C (1973) Malthus with a computer. In: Cole et al (1973), pp 5–13
- Freeman C (1990) Schumpeter's *Business Cycles* revisited. In: Heertje A, Perlman M (eds) *Evolving Technology and Market Structure: Studies in Schumpeterian Economics*, University of Michigan Press, Ann Arbor, Mich., pp 17–38

- Kuznets S (1940) Schumpeter's *Business Cycles*. American Economic Review 30:257–271
- Leontief W (1950) Joseph A. Schumpeter (1883–1950). *Econometrica* 18:103–110
- Marshall A (1898) Distribution and exchange. *Economic Journal* 8:37–59
- Maynard Smith J (1982) *Evolution and the Theory of Games*. Cambridge University Press, Cambridge
- Maynard Smith J, Szathmáry E (1997) *The Major Transitions in Evolution*. Oxford University Press, Oxford
- Meadows DH, Meadows DL, Randers J, Behrens WW (1972) *The Limits to Growth*. Universe Books, New York
- Nelson RR, Winter SG (1982) *An Evolutionary Theory of Economic Change*. Harvard University Press, Cambridge, Mass. and London
- Schumpeter JA (1908) *Das Wesen und der Hauptinhalt der theoretischen Nationalökonomie*. Duncker & Humblot, Leipzig
- Schumpeter JA (1910) On the nature of economic crises [in practice a translation of Chapter 6 of *Entwicklung*]. In: Boianovsky M (ed) *Business Cycle Theory: Selected Texts 1860–1939*, Pickering & Chatto, London, vol 5, 2005, pp 5–50
- Schumpeter JA (1912a) The economy as a whole [translation of Chapter 7 of *Entwicklung*]. In: Becker et al (2011), pp 79–154
- Schumpeter JA (1912b) The fundamental phenomenon of economic development [translation of Chapter 7 of *Entwicklung*]. In: Becker et al (2011), pp 155–226
- Schumpeter JA (1912c) *Theorie der wirtschaftlichen Entwicklung*. Duncker & Humblot, Leipzig
- Schumpeter JA (1926) *Theorie der wirtschaftlichen Entwicklung: Eine Untersuchung über Unternehmergewinn, Kapital, Kredit, Zins und den Konjunkturzyklus*. Duncker & Humblot, Munich and Leipzig
- Schumpeter JA (1928) The instability of capitalism. *Economic Journal* 38:361–86
- Schumpeter JA (1934) *The Theory of Economic Development: An Inquiry into Profits, Capital, Credit, Interest and the Business Cycle*. Harvard University Press, Cambridge, Mass.
- Schumpeter JA (1937) Preface to Japanese edition of 'Theorie der wirtschaftlichen Entwicklung'. In: *Essays: On Entrepreneurs, Innovations, Business Cycles, and the Evolution of Capitalism*, Transaction, New Brunswick, N.J. and London, 1989, pp 165–8
- Schumpeter JA (1939) *Business Cycles: A Theoretical, Historical, and Statistical Analysis of the Capitalist Process*. McGraw–Hill, New York and London
- Schumpeter JA (1942) *Capitalism, Socialism and Democracy*, 1st edn. Harper, New York
- Schumpeter JA (1964) *Business Cycles: A Theoretical, Historical, and Statistical Analysis of the Capitalist Process*, Rendigs Fels's abridged edn. McGraw–Hill, New York
- Schumpeter JA (2000) *Briefe/Letters*. Mohr, Tübingen
- Walras L (1954) *Elements of Pure Economics or The Theory of Social Wealth*. Allen and Unwin, London