

From the Schumpeterian entrepreneur toward modern evolutionary economics: Schumpeter's core works revisited

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Abstract: This paper argues that Schumpeter's core books are organised in three groups. The first of them is the programmatic duology that consists of his two early German books. The second is the evolutionary economic duology that consists of *The Theory of Economic Development* and *Business Cycles*. The third is the socioeconomic synthesis that is found in parts of *Capitalism, Socialism and Democracy*. The paper considers the internal logic of and the interconnections between these groups of works. This analysis is supported by the distinction between Schumpeter's three different models of evolutionary processes and by the distinction between microevolution and macroevolution. The Mark I model describes economic evolution as the outcome of the interaction between individual innovative entrepreneurs and routine-based incumbent firms. Mark II describes economic evolution as the outcome of the innovative oligopolistic competition between incumbent firms. Mark III describes socioeconomic evolution as a coevolutionary process between the major sectors of society. Two of these models can be used for the analysis of microevolution as well as macroevolution, but Schumpeter used them in an unbalanced way. Microevolution is the process of evolution that takes place within a population of entities that face more or less uniform selection pressures, like the firms of an industry. He studied the microevolutionary process by means of Mark II. Macroevolution is the long-term transformation of the complex system of evolving and branching populations. Schumpeter used Mark I for an abstract analysis of macroevolutionary processes. This unbalanced way of using the models created many difficulties for Schumpeter and still provides challenges for evolutionary economists.

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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 the wrong steps that 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 not have liked 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 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 something like 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 radically increased efforts to analyse economic evolution we seem to be approaching the point of time 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 recognise 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 great economist who made evolutionary analysis the turning point, or the pivot, 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 hand. 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 III model describes socioeconomic evolution as a coevolutionary process between

the major sectors of society. While all these models are important, Schumpeter's efforts concentrated on developing Mark I. In contrast, he left Mark II and Mark III as mere sketches. Furthermore, he developed the Mark I model in a one-sided way. This can be recognised 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, like the firms of an industry. Macroevolution is the long-term transformation of a complex system of evolving and branching populations. A formal analysis of Schumpeter's many accounts for Mark I demonstrates that it deals with 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 rejected Marshall's industry-level analysis. The Mark I model could also have been developed for analysing microevolution, but he only analysed this process by means of the sketchy Mark II model of oligopolistic competition. This limited use of his core models created many difficulties for Schumpeter—and still provide challenges for modern evolutionary economists.

2 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, 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 a process in which new innovative firms interact with the system of economic routines. This model can be 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 recognise elements of a Mark III model of the socio-economic 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 III are primarily discussed in section 5.

To understand the Schumpeter's evolutionary research program we should revisit three more of his voluminous books (see Table 1 on the following page). 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

Table 1 Schumpeter's core works

1908	<i>Das Wesen und der Hauptinhalt der theoretischen Nationalökonomie</i>	<i>Wesen</i> analyses 'The Essence and Main Contents of Theoretical Economics'. It focusses on the essence and limits of Walrasian equilibrium economics and it uses these limits to emphasise the necessity of developing the complementary evolutionary economics as a fundamental field of economics. Its 626 pages has not been translated.
1912	<i>Theorie der wirtschaftlichen Entwicklung</i>	<i>Entwicklung</i> presents on 548 pages the essence of Schumpeter's evolutionary economics with heavy emphasis on the personality of the innovative entrepreneur. Chapter 7 includes a sketch of the general theory of socioeconomic evolution. 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 translation on the 255 pages of the radically revised and shortened 2nd edition of <i>Entwicklung</i> (Schumpeter, 1926). Its focus on the basic modelling of the essence 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> is best understood as presenting a 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 an extension of the theory of economic evolution as well as the applications of a general theory of socioeconomic coevolution.

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 analyses 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, our revisiting of the many pages of *Theorie der wirtschaftlichen Entwicklung* demonstrates that it can fruitfully be considered another book than *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 a separate book. First, *Wesen* and *Entwicklung* form the duology of early programmatic books. This programmatic duology starts with defining economic theory in the most narrow sense, adds the analysis of economic evolution, and 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 The programmatic duology

The idea of considering *Wesen* and *Entwicklung* as Schumpeter's programmatic duology forces us to confront several terminological and theoretical 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 while Schumpeter is actually proposing an alternative to, for example, the Smithian and Marshallian theory of growth and evolution through the gradually increasing division of labour. However, the main problem is that the translated title ought to have been 'A Theory of Economic *Evolution*'. My argument is not that 'economic development' has later become 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 analysed. What Schumpeter analysed can better be described as 'evolution', that is, an open-ended process that combines innovation, behavioural inertia, and selection. He emphasised that such a process is characterised by a degree of indeterminateness that makes it impossible to predict its long-term outcomes, but it is possible to analyse scientifically the mechanisms of evolution. It was on these mechanisms that Schumpeter focussed, while he was uninterested in the predictable outcomes of processes of growth and development. Since the German word 'Entwicklung' can not 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'.

Schumpeter developed his theory of economic evolution through a kind of synthesis between several sources (see Figure 1 on the next page). 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 included some considerations on economic evolution, but he somewhat paradoxically preferred an independent study of Walras's non-evolutionary formalisation 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 like 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

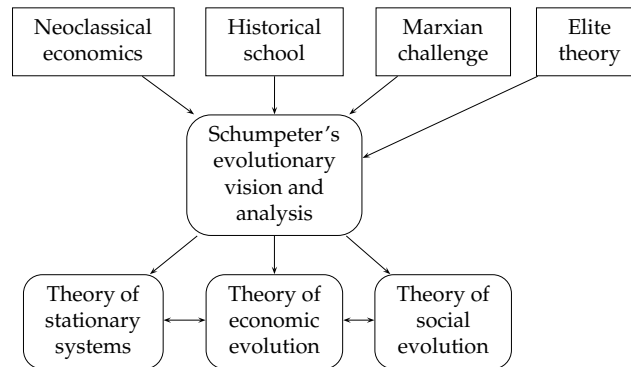


Figure 1 Main sources and components of Schumpeter's evolutionary theories (from Andersen, 2011, 91; modified from Andersen, 2009, 36).

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 generalised his theory to cover the evolutionary processes in each sector of society and the coevolution between these sectors. But Schumpeter's most important tools and inspirations came from equilibrium economics and he considered evolutionary statics and evolutionary dynamics to be at the very core of his research program.

The programmatic formulations in *Wesen* and *Entwicklung* relate to a peculiar intellectual situation within economics in the beginning of the twentieth century. On the one hand, Schumpeter emphasised that neoclassical equilibrium economics had provided much-needed clarity and many important results. On the other hand, he argued that neoclassical leaders like 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; and 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 motto is that some economic agents create new routines while other agents adapt to these routines.

This way of defining the essences of equilibrium economics and evolutionary economics can most easily be understood as when we recognise that the early Schumpeter

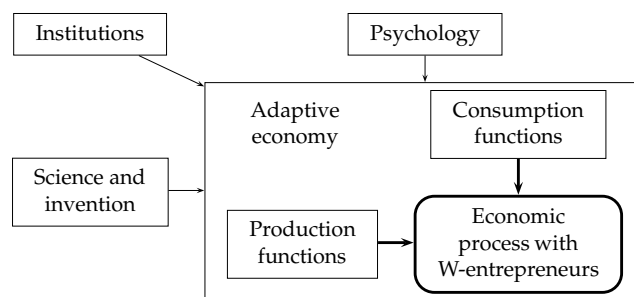


Figure 2 The exogenous determination of economic change in the Walrasian paradigm

was a rebellious disciple of the economist he considered the greatest master or 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 told 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 adjust 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 on the next page). 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 routinised 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 that is left after repaying the loan. This behaviour 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

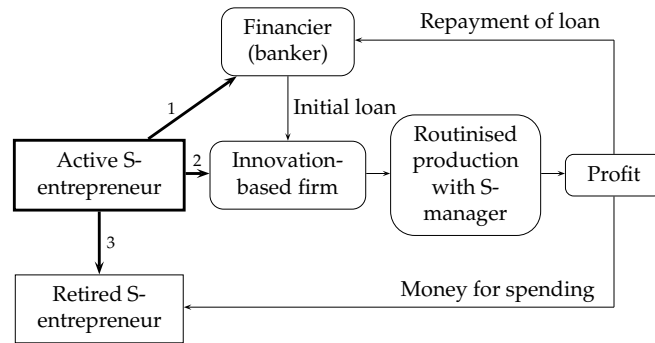


Figure 3 The creation of an innovation-based firm in Schumpeter’s Mark I model (modified from Andersen, 2011, 59)

and it will sooner or later find its conservative place in the circular flow of economic life. The 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 an interplay between S-entrepreneurs who introduce new routines of production and consumption and the S-managers whose responses serves 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 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. Then evolution is restarted by a new wave of S-entrepreneurs who, by means of loaned money, establishes new innovation-based firms and overcomes 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 behaviour 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, but their resistance is normally overcome in the capitalistic economic system. It is the difficult 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 like profits, capital, interest, and credit and that might help explaining the business cycle phenomenon.

Schumpeter’s Mark I model of the macroevolution of a capitalist economy deals with a long-term historical process that does not take place within a given framework (see Figure 4 on the facing page). 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 of these changes are clearly exogenous to the economic process. But Schumpeter thought that many such changes

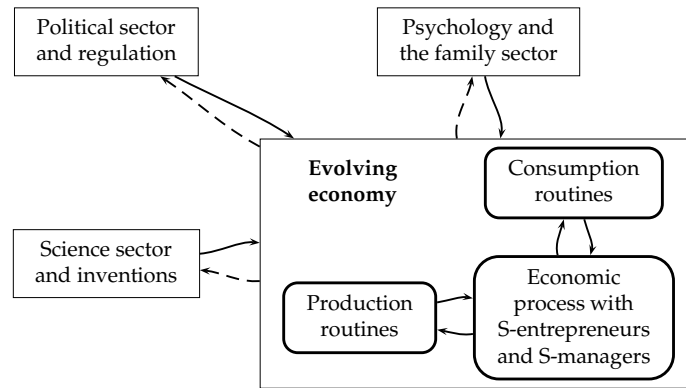


Figure 4 The evolving Schumpeterian economy, where the S-entrepreneurs innovate the routines while S-managers are forced to adapt (modified from Andersen, 2011, 44)

are propelled by changes in the economic sector. Although his 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 III 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 evolutionary process in which innovators interact with agents that merely adapt. Given such sectoral processes, we can study the coevolutionary processes between the sectors. However, the overall process of socioeconomic evolution is characterised 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.

4 The evolutionary economic duology

The evolutionary economic duology consists of *The Theory of Economic Development* and *Business Cycles*. *Development* is largely the translation of the second edition of *Entwicklung*. In the middle of the 1920s, Schumpeter (1926) produced this edition of *Entwicklung* because he wanted to produce a book that is strongly focussed on his Mark I model. He removed the broad discussions of heroic entrepreneurship and socio-economic coevolution. He also streamlined the exposition of the model and totally rewrote what had now become the last chapter of the book: the interpretation of business cycles as reflecting waves of economic evolution. Thereby he explicitly pointed at *Cycles*, but the integration with *Development* by the fact that both books rely on the cyclical functioning of the Mark I model. What is added in *Cycles* is emphasised by its subtitle: *A Theoretical, Historical, and Statistical Analysis of the Capitalist Process*. This subtitle emphasises three of the fundamental fields of evolutionary economic analysis: evolutionary economic theory, evolutionary economic statistics, and evolutionary economic history. One of the tasks of *Cycles* was to provide an extension of the Mark I model

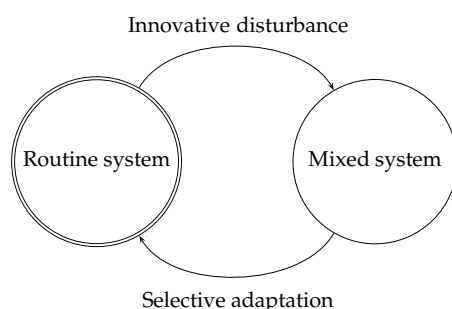


Figure 5 Schumpeter's cyclical Mark I scheme of economic evolution (modified from Andersen, 2009, 149)

in a way that supported the statistical and historical analysis of 200 years of capitalist economic evolution. But it is not surprising that his integration of the different fields of evolutionary economic analysis was considered unconvincing because even the extended version of Mark I was inadequate for its purpose. Furthermore, it is no big surprise that Schumpeter abstained from including evolutionary economic sociology in his analyses since this would have increased the complexity of his task considerably. However, the handling of 200 years of capitalist economic evolution can hardly be preformed convincingly without including the economic sociology of the change of institutions, social psychology, and societal knowledge (Figure 4 on the previous page).

According to the basic Mark I model (see Figure 5), evolutionary analysis starts from a situation in which evolution has reached an initial halt and where routine behaviour 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 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 something like an economic equilibrium.

The cyclical evolutionary process of Mark I can be interpreted in two ways. On the one hand, it can be seen as a stylised version of a real macroscopic process of economic evolution that by necessity progresses in waves and produces a type of business cycles that starts from evolutionary resting points. This assumption, to which we shall return below, 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 say that Schumpeter's focus on the short-term stops of evolution and the related combination of equilibrium and evolution was an error. On the contrary, any analysis of evolution requires a notion of a state where the evolutionary process has come to a halt. But he failed to emphasise the radical difference between Walrasian

equilibrium and his evolutionary halts. More importantly, he failed to distinguish clearly between the analysis of the macroevolutionary process (depicted by Figure 5 on the preceding page) and the more fundamental study of microevolution.

Microevolutionary processes takes place within a population with similar selection pressures, like the firms of an industry. In retrospect, it can be argued that Schumpeter's main problem was that he lacked a statistical operationalisation of such microscopic processes. When Schumpeter worked on his evolutionary economic duology this operationalisation 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.

Schumpeter hardly paused to analyse such microevolutionary processes. Instead, he used his Mark I model to directly confront macroevolution, that is, the long-term transformation of a complex system of evolving populations. There are no statistically operational ways of measuring the long-term macroevolutionary process. We might more modestly think of the statistical variances of all the evolutionarily relevant characteristics of all 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. *Cycles* treated some of these interactions in the voluminous chapters on economic history.

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 favourite 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

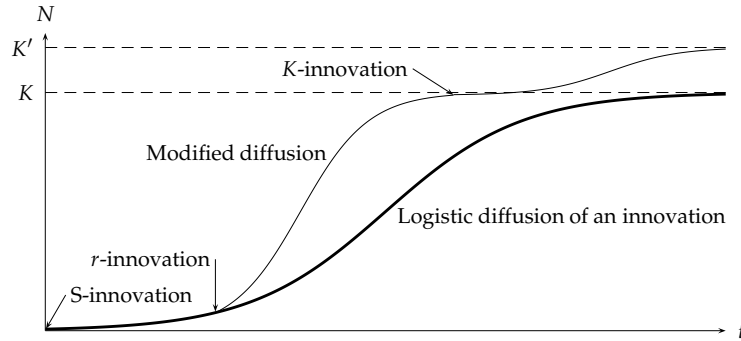


Figure 6 Logistic industrial dynamics with added types of minor innovation (from Andersen, 2011, 200; modified from Andersen, 2009, 432)

gradualism that was 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 define the agenda and the selection pressures for an 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 6). 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, we during the early stages of railroadization recognise 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 formalise 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 ma-

turity 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.’

The three types of innovations—*S*-innovations, *r*-innovations, and *K*-innovations—helps us to understand microevolutionary processes in terms of the density of the populations in which they took place. Thereby we are able to reinterpret important materials that are presented in *Cycles*. Actually, the term ‘innovation’ occurs on 185 pages of *Cycles* (while it is only found on 11 of the pages of *Development*). But Schumpeter’s Walrasian inspirations (see section 3) hindered him in developing many of his insights. Instead he continued to base his analysis on the evolutionary halt in the circular flow and the major innovations that were able to disturb this state of affairs. As a consequence he focussed on macroevolution rather than on the more fundamental processes of microevolution. These analytical biases might explain 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’.

If it is true that microevolution has to be analysed carefully before we can turn to solid macroevolutionary analyses, then it might be argued that we should initially ignore the basic analytical scheme of the Mark I model. We should instead search Schumpeter’s evolutionary economic duology for its scattered microevolutionary insights. However, there are at least three reasons why this strategy is not effective. First, all the arguments of *Development* and *Cycles* are organised by means of some version of the macroevolutionary scheme of Figure 5 on page 10. This means that we cannot orient ourselves in these works without understanding Schumpeter’s different versions of the scheme. Second, we have to confront the fact that the microevolutionary processes in different industries are interdependent (the ‘mesoevolution’ of Dopfer and Potts, 2008). Finally, we should recognise that the ultimate goal is to be able to analyse macroevolution convincingly and that a strong microevolutionary bias might lead us to forget this goal. In any case, we have to face the Schumpeterian challenge by developing abilities to combine microevolutionary and macroevolutionary analyses.

There are stronger arguments for ignoring Schumpeter’s long and complex argument that waves of economic evolution provide the explanation of the phenomenon of business cycles. This explanation has been considered shaky ever since Kuznets (1940) presented his devastating criticism of *Cycles*. The reasons are obvious. We have already seen that Schumpeter could not measure macroevolution. This means that he could not prove that it proceeds in a waveform manner. Even if he had been able to do so, the problem of proving that the waveform macroevolutionary processes in some sense causes business cycles are enormous. Nevertheless, this is the core proposition of *Cycles*; and many of his microevolutionary insights emerged in relation to his attempts to defend the proposition. Furthermore, all the historical materials are organised according to his theory of waves and cycles.

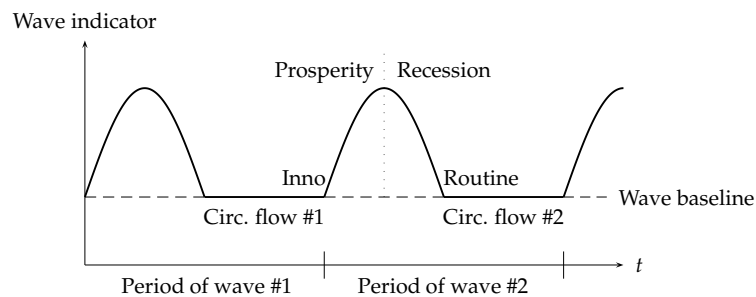


Figure 7 Two-phase waves with innovation-based prosperity and adaptation-based recession (from Andersen, 2011, 161; modified from Andersen, 2009, 219)

The basic form of the theory of *Cycles* is largely obtained by introducing the time dimension into the cyclical scheme of the Mark II model (see Figure 5 on page 10). The result is depicted by Figure 7. Here the waves of evolution and the related business cycles start from non-evolving routine systems, the circular flows. Then prosperities are interpreted as innovation-based upswings while 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. For instance, some measure of the price level might reflect the ‘pressure’ of the system of economic activity. But among the many wave indicators that he considered in *Cycles*, there is not anyone that directly measures the underlying evolutionary process. The above discussion of the difficulties of measuring macroevolution suggests that this is not surprising.

Cycles is based on a stepwise refinement of the Mark I scheme of Figure 7. This scheme represent Schumpeter’s first approximation with its simple application of the circular flow, the innovative disturbance, and a process selective adaptation. It might be considered a highly stylised account of the process of railroadization. His second approximation added oligopolistic competition and macroeconomic mechanisms. The result is, from an evolutionary viewpoint, that the upswing is not only characterised 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. Instead he moved directly to his third approximation that is based on the realistic assumption that different types of innovation require different spans of time 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 very long Kondratieff waves that consist of several Juglar cycles that consist Kitchin cycles of even shorter length. When we recognise that it is only Kondratieff waves and Juglar cycles that can be connected with the process of economic evolution, it is not difficult to recognise that we are primarily facing a gener-

alisation of the history of railroadization with its long-term trend and its smaller manias of railroad investment.

5 The socioeconomic synthesis

Capitalism largely ignores the Mark I model. This is done without explicit argument, but we get the impression that Schumpeter 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 III model of societal macroevolution as determined by the coevolution between the economic sector, the science sector, the family sector, and the political sector.

The Mark I model describes an evolutionary process in which established firms are conservative upholders of unchanging routines and are in the long run replaced by new innovation-based firms—like when mail-coach firms are 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 analyse macroevolution, while 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* demonstrate that he knew that it is 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 it was impossible to produce a realistic oligopoly model of macroevolutionary dynamics, but Schumpeter 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. While innovation-based firms of the Mark I model quickly becomes conservative (Figure 3 on page 8), the growth of Mark II firms is influenced by feedback loops (see Figure 8 on the following page). If we apply a pure-labour model, the Mark II firm largely uses any positive profits to expand its workforce. This means a firm with a sustainably 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 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.

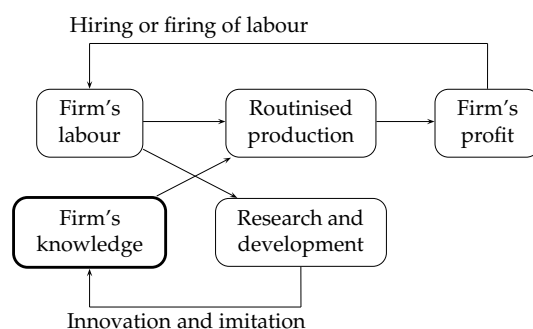


Figure 8 Feedback loops of an incumbent firm in the pure-labour version of the Mark II model (modified from Andersen, 2011, 208)

If this is not sufficient, he could have added the international dimension of economic 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). They 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 started in the late nineteenth century when it in a few industries became a competitive necessity for firms to have departments of research and development; and since then this type of competitive 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*, 223–30).

Although such transitions in the units and mechanisms of evolution are the results of microevolutionary processes, they clearly influence macroevolution. Three characteristics can be recognised 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 artisan workshops. Second, major transitions in both natural and economic evolution influence the possible types of mutations and innovations. In economic life, artisan workshops only have 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 artisan workshops to Mark I firms was accompanied by an immediate increase in

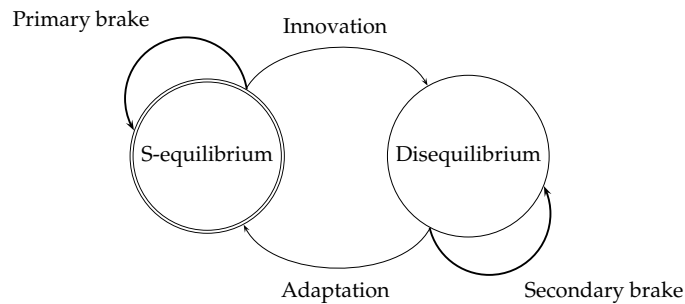


Figure 9 Adding two brakes on the Mark I model of economic evolution (from Andersen, 2011, 222)

the average speed of evolution within industries and a long-term increase in the number of industrial specialisations. 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.

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 routinised equilibria and innovative disturbances that challenges pre-existing routines. He dramatised the socio-economic 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 specialisation. They instead often perish in the evolutionary 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 III 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 routinised 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 emphasises 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 organised in each of the sectors. This can be understood by considering *Capitalism's* (pp. 273–83) two models of political evolution. The Mark I model is based on innovations by individual political 'entrepreneurs', like in the classical British parliamentary system. The Mark II model is based on the minor innovations and marketing by oligopolistic political parties, like in the USA. The latter model seems more likely to evolve policies that make use of the brakes on economic evolution.

Although Schumpeter probably returned to the Mark III 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 on the facing page) 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 capitalism 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 characterise recent processes of globalisation. 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 organised. However, the uneven internationalisation 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 socioeconomic coevolution. Since the processes of coevolution are immensely complex and still beyond the reach of solid analysis, we have to consider an alternative stepwise procedure. This procedure becomes clear when we realise 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

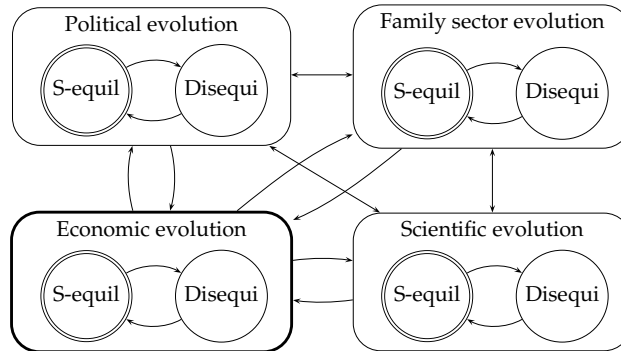


Figure 10 The Mark III model of sectoral coevolution (modified from Andersen, 2011, 226)

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 III modelling of socioeconomic coevolution.

6 Conclusions

This paper 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 has in all respects been surpassed by modern evolutionary biologists, Schumpeter's core books still seem to contain important challenges for modern evolutionary economists. Furthermore, we cannot appreciate his efforts by reading a single great book like the *Origin of Species*. The paper suggested that we instead can organise 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 the paper analysed the internal logic of and the interconnections between these groups of works.

The analyses of the paper were supported by the distinction between Schumpeter's three different models of evolutionary processes and by the distinction 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 analyse 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 operationalise the concept of macroevolution. When this is done, we should be able to combine the microscopic and macroscopic aspects of something like a Mark I process of economic evolution. *Capitalism's* well known Mark II model of oligopolistic competition describes a microevolutionary process. The remaining question is how Mark II in detail influences macroevolution. Furthermore, Schumpeter also presented the major 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 III model that describes socioeconomic evolution as a coevolutionary process between the major sectors of society. It is a major challenge to develop Mark III 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.

The paper has three general conclusions. First, it makes sense to revisit Schumpeter's core books on the basis of modern evolutionary economics. Second, we have already resolved many of the problems and apparent paradoxes that relate to these books. Finally and most importantly, Schumpeter's works still provide important challenges for ambitious researchers.

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