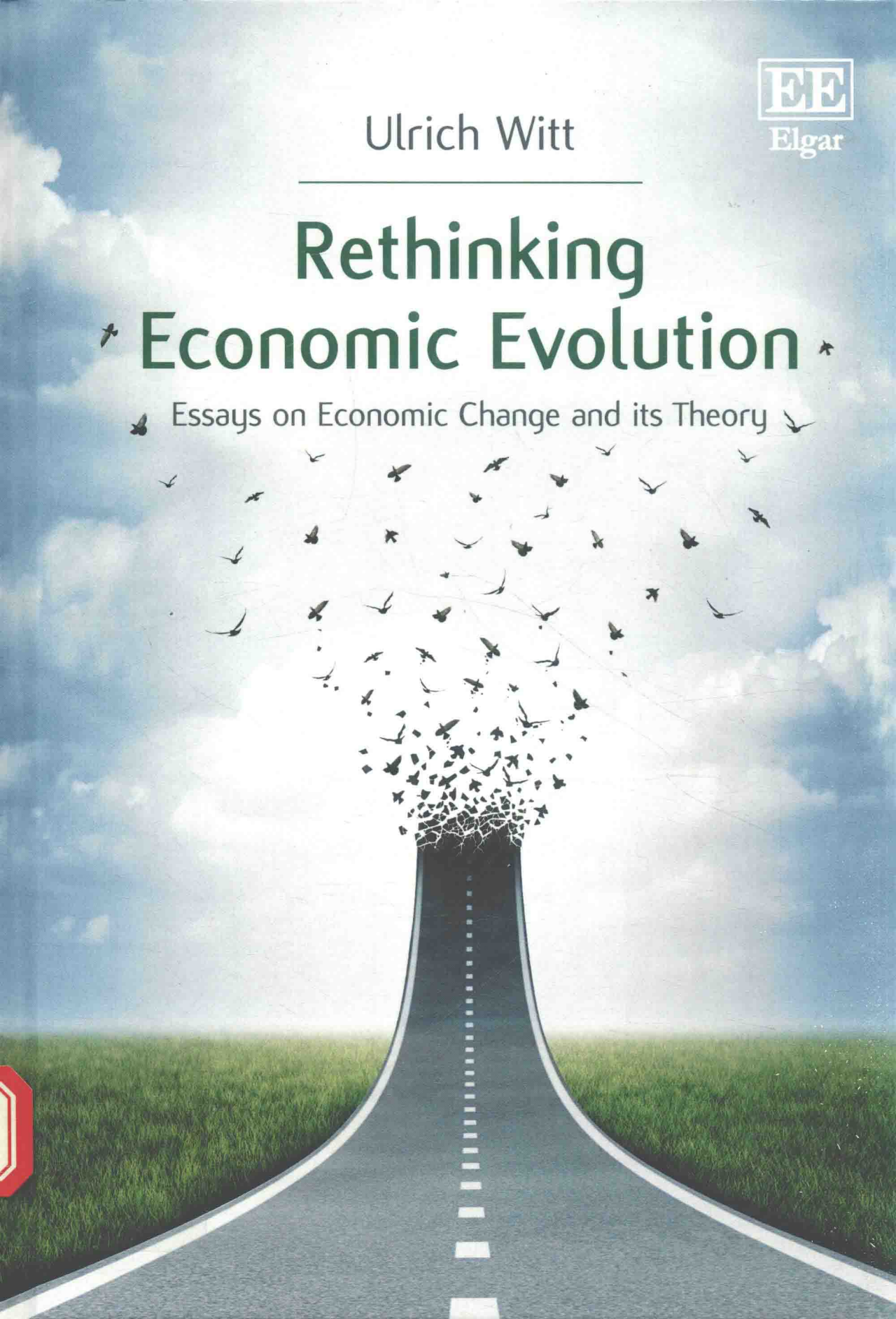
Ulrich Witt

Rethinking Economic Evolution

Essays on Economic Change and its Theory



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Introduction: The Evolutionary Way of Thinking in Economics[1]

Ulrich Witt

Can we gain new insights about the human economy, its long term development, and its future by putting on the looking glasses of the theory of evolution? More than a century ago, when the Darwinian theory of natural selection began to thrive, Thorsten Veblen (1898) suggested to do just this. In the study of the life sciences in general and the study of human behavior in particular, the Darwinian theory indeed provides a fruitful and by now generally accepted, overarching frame of reference for research (see Brown and Richerson 2014). Not so in economics. Canonical economic theory is committed instead to the rational actor model and the theory of general equilibrium (see, for example, Mas-Colell et al. 1995). Both notions are rooted in classical, Newtonian mechanics (Mirowski 1989) which pre-dated the Darwinian revolution in the sciences. Not surprisingly, in the canonical economic perspective, the economy is usually seen as a sphere of reality for which the theory of evolution has little, if any, significance. Can such a perspective do justice to the observable unfolding of the economy, its growth and incessant transformations?

As a matter of fact, ever new products, technologies, organizations, institutions are thought up and tried out. They fuel an endless competitive struggle in which earlier vintages are outcompeted and the extant natural and social environment is transformed. New firms, industries, and markets emerge and grow while others stagnate or decline. In a relentless collective adaptation, institutions are designed and redesigned under economic and political pressures and made new. All this looks like a process of evolutionary change, albeit one that has a genuine new quality: it is *cultural* evolution. Under the influence of human creativity and deliberation it transforms the economy at a much higher pace than natural selection could do. Indeed, in cultural evolution, reproductive success under natural selection is only a long term shaping force or – in the language of multi-level selection theory – selection criterion (see Wilson 2015). In the short run, other, human-made forces shape the unfolding of the economy.

Several questions thus arise when an attempt is made to use the looking glasses of an evolutionary theory for gaining new insights on the economy. What are the principles governing economic change? What relevance does the Darwinian theory have for these principles? How can these principles help to improve economic theory? The chapters in the present volume seek to provide answers to these and other questions, which an evolutionary approach to economics faces. To pave the ground for the discussion, Part I of the book (*Chapters 1 to 4*) addresses three challenges confronting the application of evolutionary thinking in the economic context. First we need to come to grips with the fact that, in the literature, a variety of sometimes incommensurable interpretations of an evolutionary approach to economics exist. A second, albeit related, challenge is to identify what particular conditions characterize economic evolution. Do these conditions imply that the overarching

evolutionary theory in the sciences is irrelevant for evolutionary theorizing in economics? The third challenge is to establish where and how evolutionary theorizing deviates from canonical (textbook) economics. Sections 1, 2, and 3 of this introductory chapter take up each of these three challenges in turn.

Sections 4 and 5 offer a preview of Part II of the book (*Chapters 5 to 8*). Center stage in this part is the role of novelty as a cause of evolutionary change. Section 4 outlines the epistemological and methodological problems, which the emergence of novelty implies for evolutionary theorizing. In the economic context, novelty comes in the form of discoveries, inventions, and innovations. Is their emergence to be treated as an exogenous shock or is it endogenous to the process of economic change? Accordingly the question is whether explaining the emergence is part of the task of economic theory. If so, what do we know about discoveries, inventions, and innovations and about how they come about?

Section 5 extends the perspective beyond the domain of economics. As argued later in the book, if novelty is a universal driver of evolution, its emergence and diffusion are abstract concepts – in fact, in a wider sense, Schumpeterian principles – by which the unfolding processes can be logically structured. However, especially the emergence of novelty plays a pivotal role also in the theory of self-organization. The point to be discussed then is how the emergence and diffusion of novelty relate to the principles of variation, selection, and replication which are often suggested for characterizing evolution in abstract terms. Put differently, given their shared interest in the emergence of novelty, it can be asked how self-organization and evolution – and the corresponding two paradigmatic interpretative frames in the sciences – relate to each other.

The subsequent Section 6 in this Introduction offers an outlook on Part III of the book (*Chapters 9 to 14*). This part sets out to show in an exemplary fashion what new insights an evolutionary way of thinking in economics can contribute. The cases to be discussed are taken from diverse research fields. Consumer behavior and the historical growth of consumption expenditures are discussed, as are the institutional conditions of cooperation and exchange. Further topics are the evolution of production technology, macroeconomic dynamics, and, last but not least, the theory of economic policymaking. Some conclusions are finally offered in Section 7.

1. Evolutionary economics – coping with the patchwork of concepts and theories

Evolutionary thought has been gaining more attention in economics in recent years (Silva and Teixeira 2009; Hodgson et al. 2014). However, the interpretation of the attribute 'evolutionary' and, correspondingly, the concepts and models that are used vary substantially. While canonical economics presents itself as a coherent paradigmatic theory of optimization and general equilibrium, the contributions to evolutionary thinking in economics take the form of a patchwork of different ideas diversely pursued by different authors. Many of them agree, though, in their rejection of exactly the notions of optimization and general equilibrium as unsuitable for evolutionary theorizing.[2] Agreeing on what needs to be rejected is, of course, no effective substitute for developing a coherent alternative. In this respect not much has changed since Veblen's (1898) initial plea for 'evolutionary economics' which he supposed to be the alternative to the neoclassical economic theory of his time.

Today 'evolutionary economics' is frequently associated with the Neo-Schumpeterian interpretation which is outlined in *Chapter 1* of this volume. The Neo-Schumpeterians belong

to those authors who oppose the rational choice framework and its focus on equilibrium states. Starting with Nelson and Winter (1982), they use a loose analogy to natural selection theory to instead describe the economy as being subject to an incessant transformation process. This process is argued not to be under rational control in any strict sense (see Nelson and Winter 2002; Metcalfe 2008; Winter 2014). The analogy to natural selection theory is based on a synthesis of two separate strands of thought. The first gives the school its name: it is Schumpeter's (1942) theory of innovative capitalism. Its thematic focus is on innovation competition, technical progress, and the growth of firms and industries.

The second strand of thought is the behavioral theory of the firm. This theory goes back to March and Simon (1958) and Cyert and March (1963) and draws on their concept of bounded rationality. According to that theory, firms heavily rely on the use of rules-of-thumb and organizational routines in their daily operations rather than systematic, discretionary rational decision-making. Nelson and Winter start from the assumption that the routines which the firms use are organizational inertia. If so, the profits of the firms can be argued to depend on how well-adapted the routines are to the competitive conditions under which the firms operate. Moreover, if profit differences between firms translate into corresponding differences in the firms' growth rates, the better adapted routines can be expected to become more prevalent within the industry. This means that firms using the right routines also grow in market share. In contrast, firms using less well-adapted routines lose in market share and eventually exit the market – and with them their routines. What matters for explaining economic change is thus the population level rather than the individual level.

The connection to Schumpeter's theory of innovative capitalism is made by interpreting the innovative economic process as a process of variation of firm routines. This is in noteworthy contrast to Schumpeter's (2002[1912]) explicit rejection of any biological analogies. Nelson and Winter and their Neo-Schumpeterian followers conceptualize the innovative transformation process in terms of an analogy to the theory of natural selection. They submit that innovations change the composition of routines in the industry's overall 'routine pool' much like mutations in the gene code of an individual organism change the distribution in the gene pool of a species. Over time, the forces of market competition then discriminate against firms with less well adapted routines. These routines tend to be driven out of the 'routine pool' like natural selection winnows out less fit genes.[3] Changes in the composition of an industry's 'routine pool' are thus seen as adaptions not taking place at the firm level but at the industry level.

The loose analogy to natural selection models and algorithms and the corresponding 'population thinking' are the distinctive features of Neo-Schumpeterian approach (Metcalfe 2008). Whether, and, if so, how economic evolution relates to evolution on this planet more generally and cultural evolution in particular is not considered. The economic sphere of reality is treated as if it were a sphere of its own, distinct from the one for which the Darwinian theory of natural selection is directly relevant. Accordingly, no attempt is made to clarify what relevance the overarching interpretative frame of evolutionary research in the sciences might have for economics. Therefore, meaning which the attribute 'evolutionary' economics has for the Neo-Schumpeterians differs from, for example, that in evolutionary psychology and evolutionary anthropology.

As is argued in *Chapters 2* and *3* of this volume, it can of course be asked why the Darwinian theory of evolution – properly extended in order to reflect the significant influence of culture – should not be considered relevant for the economic domain. Humans as economic agents are

an outcome of evolution, after all. Why then not adopt the 'naturalistic' perspective on economic activities which the theory of evolution suggests?[4]

While not on the Neo-Schumpeterian agenda, this question was center stage in Veblen's (1898) version of 'evolutionary economics'. Veblen had been as critical of the rational choice assumption underlying the neoclassical theory of his time as Neo-Schumpeterians are of its present-day variants. But he drew different conclusions from his critique. The Neo-Schumpeterians seek to solve the problem at a rather formal level. Making metaphorical use of, or constructing analogies to, the Darwinian theory, they substitute population-based selection algorithms for the discarded individual optimization algorithm. In contrast, Veblen thought of directly bringing to bear the substance of the Darwinian theory to develop a new way of thinking about the human economy. More specifically, Veblen (1899, 1914) traced the determinants of economic behavior back to instinct (genetic influences) and habit (the influence of cultural learning) and explored their role in the evolution of economic institutions.[5]

Once a naturalistic approach has been adopted, long term economic evolution can be re-cast as a history of the creative struggle of a unique species trying to expand its natural niche. The roots of such behavior can accordingly be identified in innate survival strategies that emerged under natural selection pressure when the ancestors of modern humans had to adapt to the ancestral environment. Seeing evolutionary economic change in such a long term perspective, further contributions to evolutionary thinking in economics come to mind. Among them, for example, are Hayek's (1988) theory of societal evolution by group selection (see *Chapter 11* in this volume), North's (1997) particular brand of evolutionary institutionalism, and Georgescu-Roegen's (1971) work on the ecological constraints of economic evolution (see Gowdy 1994 for a discussion).

Chapter 4 in the present volume is devoted to drawing up a road map for an encompassing conception of evolutionary economics in which all these contributions have a place. For navigating purposes two criteria are introduced. The first concerns, what is called in the philosophy of science, the *heuristic* that an author uses. This refers to the interpretative frame that an author has in mind when she reflects on 'evolution'. This frame shapes the often tacit way in which she derives her 'evolutionary' hypotheses. As far as the heuristic is concerned, it turns out that one group of authors makes use of an abstract reduction of the Darwinian theory to three general principles: variation, selection, and replication. These principles provide a heuristic scheme originally suggested by Campbell (1965) for structuring evolutionary processes of whatever kind.

There is room for interpretation of this scheme, of course. Neo-Schumpeterians apply the three principles as inspiration for constructing their analogies between natural and economic selection (see Nelson 2006). For the proponents of Generalized Darwinism the three principles represent the analytical core of any evolutionary theory whatsoever (Hodgson and Knudsen 2010). In contrast to the group of adherents of Campbell's scheme, other authors like Schumpeter (2002[1912]) deny the Darwinian theory any relevance for understanding economic development. Schumpeter instead draws upon a heuristic frame originally developed in the 19th-century diffusionism (see Section 4 below). This frame focuses on the interplay of two other principles, namely the emergence and diffusion of novelty, in the evolution of human societies.

The second aspect dealt with in *Chapter 4* relates to the *ontological* assumptions often only implicitly made by the various authors. These assumptions determine how reality is represented

in a theory either by way of a monistic or a dualistic ontology. Roughly speaking, a dualistic ontology separates the sphere of nature from the sphere of cultural phenomena. The latter is given a distinct status: it is considered uniquely dependent on the exercise of the human mind. In contrast, a monistic ontology rejects the assumption of two separate spheres of reality. Schumpeter and the Neo-Schumpeterians make no statement of their ontological position. But by explicitly denying the Darwinian theory any relevance for the economic sphere (as Schumpeter does) or completely ignoring it (as the Neo-Schumpeterians do) they act as if they were ontological dualists. In contrast, authors like Veblen, Georgescu-Roegen, and, in his late works, Hayek take an explicit monistic position. For them, evolution in nature and the corresponding theory are relevant for understanding the evolution of the economy. Since ontology and heuristics are two independent features of evolutionary theories of economic change, the different combinations of these features are used in *Chapter 4* for developing a typology of these theories.[6]

2. Explaining economic evolution – how relevant is the Darwinian theory?

As discussed in the preceding section, whether and, if so, how evolution in nature and evolution in the economy relate to each other is a matter of controversy. So, too, is the question of whether or not the Darwinian theory applies to explaining evolution in the economy as the overarching scientific framework. If evolution in nature and evolution in the economy are two entirely different pairs of shoes, the Darwinian theory can at best be relevant for the economic domain as an inspiration for constructing analogies. (This is the Neo-Schumpeterian position.) However, analogies of this kind are not without problems. This has been pinpointed by Winter (1964) with his – rhetorical – question regarding the economic analogue: 'what are the genes?'[7] Of course, there is neither anything in the economy that is comparable to the genes of natural organisms. Nor do products, technologies, industries, or institutions 'reproduce' in the sense understood by biology. Evolution operates via very different transformation mechanisms in the biological and the economic domain. The question therefore arises how far one can expect to get in explaining economic evolution by constructing analogies to the theory of natural selection.

If, alternatively, evolution in nature and in the economy is understood as representing interconnected processes, a different perspective emerges. Its focus is not on seeking analogies but on recognizing the continuity of the evolutionary adaptation process on this planet. The process started with the evolution of living nature and continues with the co-evolution of nature and human culture. Even though cultural evolution seems to unfold and shape the human economy according to its own rules and adaptation criteria, this process is embedded in, and continues to be constrained by, the evolution of nature. Such a 'continuity hypothesis', discussed in more detail in *Chapter 3*, obviously implies a monistic ontology.

The reason why cultural or, for that matter, economic evolution seems to follow its own rules is the pervasive role played in these forms of evolution by human creativity, learning, deliberation, symbolic communication, and knowledge accumulation.[8] In the span of just one generation, multitudes of new products, technologies, industries, and institutions can now be purposefully created. Both creativity and knowledge that is being accumulated and broadly accessible are the basis of the human capacity to adapt to changing physical and social constraints in ever shorter periods of time. As a consequence, cultural/economic evolution has

a much faster pace than evolution guided by natural selection. It is also characterized by a much higher rate of variation.

Differences between the two forms of evolution also concern the criteria that govern their adaptation processes. In evolutionary biology, the adaption criterion is the value of the heritable characteristics of an organism or a population for enhancing survival and having offspring, in short called their 'adaptive value'. It is measurable in terms of reproductive fitness of the organism or population carrying those characteristics. In theories of cultural evolution, including evolutionary economics, the concept of adaption and, hence, the corresponding criterion is much less clear. What is being improved here in the process of evolution?

Consider human societies living in an environment that implies a relatively high selection pressure on their members. Under such conditions, the adaptation criterion also governing the cultural evolution of these societies is likely to be reproductive fitness, that is, whether and how culturally acquired characteristics of human behavior enhance survival and having offspring. However, owing to the accomplishments of their cultural and economic evolution, many societies have gained control over their environment to such an extent that selection pressure on their members has slackened. Once this happens, reproductive fitness can be expected to lose its predominant role as adaptation criterion. In its stead, room seems to open up for a multitude of domain-specific adaptation criteria of which many may themselves be culturally contingent.

What can be said more specifically about the criterion governing the adaptation processes in economic evolution? Is it possible at all that there is one unique criterion, given that these adaptation processes represent the multitude of individually pursued attempts to accomplish one's goals -- whatever these goals are? An answer to the question confronts the same challenge that economic theory faces with the task of substantiating the notion of welfare as a single criterion for economic progress. To derive more specific information we can take recourse to the continuity hypothesis and explore some aspects of human behavior that evolved in human phylogeny and now shape and constrain the paths that cultural and economic evolution can take.

The point of departure thus is the hypothesis that the human genetic endowment includes some motivational dispositions, that is, inclinations to act (drives, needs, emotions, see *Chapter 9*), that have emerged in ancestral times under selection pressure. These innate motivational dispositions are likely to have had adaptive value, in those times, in the sense of reproductive fitness.[9] The motivational dispositions are still present, and widely shared (with the usual genetic variance), within the human population today. They can be expected to influence the goals that are pursued in the individual adaptation strategies in economic evolution even where reproductive fitness itself is no longer of overriding importance.

From an economic point of view, these innate motivations to act seem to have a significant consequence in common. More or less, the actions they induce come down to a striving for command over resources. This striving was clearly instrumental for enhancing survival and reproduction chances of the human species in times of severe resource shortage. As a consequence of cultural/economic evolution, living conditions in the highly developed modern economies with their relative resource abundance are now much different. Yet, the motivational dispositions and striving for raising income or wealth, which they imply, are still present and seem to establish an independent adaptation criterion for economic evolution. Where behavior

generating greater resource command once meant being able to better adapt to the environment and have more offspring, behavior generating greater resource command now seems to have become a goal in its own right.[10]

However, under the present condition, motivational dispositions that were once functional may now not only have lost their functional status. They may become dysfunctional. The result then is what biologists call 'evolutionary mismatch'. Indications of such mismatch can indeed be found in the economic domain in recent times precisely because the implied striving for greater command over resources can increasingly better be satisfied. Examples are innate consumption motivations and time discounting attitudes that tend to favor excessive resource consumption behavior wherever it becomes feasible. Such behavior was functionally advantageous for reproductive success under the ancestral scarcity conditions. With the present relative resource abundance it creates problems such as, for instance, obesity at the individual level and resource depletion and environmental degradation at the collective level (see *Chapters 9* and *10*).

Economic evolution can thus be claimed to unfold according to its own rules and adaptation criteria. This hypothesis is neither meant to imply that the unfolding is disconnected (in the sense of an ontological dualism) from the evolutionary process that continues to transform nature. Nor should the hypothesis be misinterpreted to postulate an end of co-evolutionary interactions between the human economy and nature. To the contrary, the evolving economy remains subject to the fundamental constraints of the co-evolving ecosystem in which it is embedded (see van den Bergh 2007 for an illuminating discussion). In the long run, the presence of these constraints means that human societies, if not the human kind in total, and the ways in which they run the economy are not exempted from the process of natural selection. This may only go unnoticed because, measured in human time scales, the pace of the latter process is extremely slow.

3. Why deviate from the canonical economic paradigm?

The notions of optimization and general economic equilibrium are core elements of the canonical economic paradigm (see, for example, Mas-Colell et al. 1995). As already mentioned, they are frequently criticized by the advocates of an evolutionary approach to economics. As far as the critique of the optimization hypothesis is concerned, it is neither new nor based on genuinely evolutionary arguments. In the form of the rational actor model, the optimization hypothesis is a heuristic that devises a template for explaining the actors' empirically observed behavior. The behavior is reconstructed – or rationalized – by means of 'situational logic' (Popper 1960, Chapter 31) as an instance of optimal decision-making. The underlying assumption is that choices are made rationally. This assumption, in turn, means: (1) the actors' choices are made deliberately; (2) the alternatives are represented sufficiently well by the subjective perceptions of the actors; and (3) their preferences are transitive and cover the complete set of alternatives.

The critics – among them many Neo-Schumpeterians – have argued long since that all these assumptions are a far cry from how, and on what basis, choices are actually made. More recent research in behavioral economics is now able to support the critique experimentally. Regarding (1) the deliberation assumption, it has been found that many choices are made on the basis of an automated decision system and, hence, without deliberation (Kahneman 2003; Loewenstein 2004). In the case of choices that are deliberately made, such deliberation can be biased by

intervening emotions and wishful thinking. Decision-making then falls short of the standard of well-structured, logically-consistent thinking.[11]

Turning to (2) the subjective perceptions, the following finding is relevant. Due to constraints on time and cognitive resources, at any point in time, spontaneous individual information processing can cover only a limited number of alternatives potentially available. The individuals' perceptions therefore tend to represent more complex choice situations with a greater degree of imperfection. In response to this finding, Simon (1955) proposed the notion of *bounded* rationality more than half a century ago. More recently it has been noted that these constraints may be the reason for why intuitive thinking uses a set of 'fast and frugal' decision heuristics (Gigerenzer and Goldstein 1996). They obviously do not match the standard of full rationality.

Further evidence for distortions in subjective perceptions relative to the standard of full rationality is provided by the fact that the representation of the choice set is always context-dependent (see, for example, Glimcher 2015). Finally, regarding (3) the decision-makers' preferences, it is far from proven that the completeness and transitivity assumptions are satisfied. Especially when the set of potentially available alternatives is large and complex their complete and consistent representation in preference orders is doubtful. Yet, when the representation of the alternatives during the decision process is volatile, this can undermine the transitivity condition.

What consequences are to be drawn from this critique for the evolutionary approach to economics? As it seems, two alternative strategies can be chosen. One corresponds to the Neo-Schumpeterian recipe of creating an evolutionary economic theory by means of analogies to natural selection theory. The strategy is to react to the critique by doing away not only with the particular rational actor heuristic, but also with methodological individualism in its entirety. Both are replaced by the methodology of selection models founded on population thinking (Nelson and Winter 1982; Metcalfe 2008). Accordingly, the focus shifts from explaining why individuals adapt their behavior to changing circumstances to instead explaining how selection mechanisms winnow out some variants of inert behavior ('routines') rather than others.

However, shifting focus from the individual level to that of the population means that, by the same token, evolutionary economic theorizing loses touch with the behavioral foundations of economics. This may appear as no great loss if, as in the Neo-Schumpeterian approach, the Darwinian theory is considered relevant for the economic domain only as a source of inspiration for analogy constructions. But if, in the spirit of the continuity hypothesis and its monistic ontology, the Darwinian theory represents the overarching scientific frame of reference, it is precisely in the behavioral foundations that insights derived from the Darwinian theory are most important. The neglect by evolutionary economic theorizing of the individual level would therefore come at a high cost. For this reason, the consequence to be drawn from the critique of the canonical optimization paradigm should be a strategy that maintains the individualistic perspective for evolutionary economic theorizing. Accordingly, the second strategy requires going beyond the rational actor heuristic and adopting a 'naturalistic' explanatory approach to economic behavior. More specifically, this means to elaborate an *evolutionary* behavioral economics as outlined by Burnham et al. (2015).[12]

The other core element of the canonical economic paradigm, the notion of general equilibrium, is tied to the following condition. The economy is said to be in a state of general equilibrium if, at a certain point in time, neither excess demand nor excess supply exists in any

of its constituent markets. It is assumed that, in making their demand or supply decisions, the market participants have optimally accounted for their respective constraints. The general equilibrium condition then implies that *all* agents in the economy are not only able, but also have no reason to seek something better than, to realize their plans. However, as an empirical hypothesis such a claim is difficult to accept at least for modern economies. In these economies it can be observed that, at all times, at least some agents in the economy do seek to do better by pursuing innovations that would change their constraints. How can the general equilibrium hypothesis be defended against the implications of this observation? Is it at all possible to verify whether or not an economy is presently in a state of general equilibrium?

In view of these questions, a brief look at the history of the notion of general economic equilibrium is informative. In the works of classical writers like Adam Smith (1976[1776], Book I, Chapter 7), the notion of general equilibrium represented a logical construct. It described the fictitious end state of a process that would occur if all market participants had enough information and time to complete their coordination efforts. Owing to its fictitious status, this end state was not characterized with any great accuracy. It was recognized that, whether by market entry or exit, investment or disinvestment, variations in demand or supply, and so on, the actions of some market participants would always disrupt the coordination process before it reaches the end state.

The neoclassical revolution in economics at the end of the 19th century discarded this somewhat elusive classical conception of general equilibrium. Guided by the ideal of Newtonian physics, an attempt was made to replace it by what was considered a more exact interpretation. The latter was based on the calculus used in classical mechanics for physical systems such as the planetary system. By means of that calculus, a state of equilibrium can be determined as a state in which all free energy is dissipated. The calculus was analogously applied in economics to determine the general equilibrium in the markets as a state in which all excess demand and/or supply has vanished (Mirowski 1989). In contrast to the classical understanding of general economic equilibrium as a fictitious end point of the coordination process in the markets, the neoclassical interpretation holds that the general equilibrium state is reality. Modern canonical economic theory seems to subscribe to that claim (see, for example, Mas-Colell et al. 1995).

It is not clear, though, how to prove the claim. Except for highly-organized trading places it is very difficult, if not impossible, to empirically observe whether at a certain point in time all excess demand/supply has vanished and, hence, whether the markets are in a state of equilibrium or disequilibrium. In fact, it is usually simply assumed without further proof that the economy is in a state of general equilibrium – an assumption that is invoked not least for reasons of mathematical convenience. The unproven assumption is hard to accept for the adherents of an evolutionary approach. Instead, they consider Schumpeter's (1942) 'perennial gale of creative destruction' the adequate description of modern economies. Innovative as these economies are, they experience permanent structural change. This implies that, at any point in time, there are disequilibrium states at least in some of the markets.[13]

The theory of general economic equilibrium is often thought necessary for demonstrating the coordinating power of the price mechanism. However, as explained elsewhere (Witt 1985), general equilibrium theory represents the state of coordination in a highly idealized way as one with a *perfect* degree of coordination. The actual conditions under which the coordinating power of the price mechanism would have to be demonstrated are quite different. They are

characterized by the presence of some excess supply or demand in the market system, for example, as a consequence of false expectations or the disruptive impact of innovative activity. As a consequence, the actual degree of coordination is not perfect.

Instead, the price mechanism is able to generate a *viable* degree of coordination in the sense that it suffices for most of the market participants to be able to get along in their economic affairs. Most firms will remain profitable. Most of existing labor supply will remain employed. Consumers will be able to obtain most of the goods and services which they demand. Very likely, though, the frustration of the plans of some agents by the market process may motivate those agents to pursue opportunities for innovative change on their part. Thus, the fact that some of the individual plans must remain unfulfilled if the degree of coordination is only 'viable' may disappoint some theoretical expectations. At the same time, however, it appears to be a constitutive element in keeping the market system innovative.

While in an evolutionary perspective the theory of a *general* economic equilibrium does not make sense, there is certainly room for a different notion of equilibrium in an evolutionary approach. Theories inquiring into evolutionary dynamics can, for example, be confronted with situations in which several processes of change interact in such a way that they produce a (temporary) stalemate between them. In that case, it is possible to conceptualize the ensuing situation using the equilibrium notion.

Equilibria of this kind obviously represent a rather special, transitory, state of affairs. In multi-layered, complex adaptive systems, such equilibria can typically be attained at one layer while the continuing developments at other layers prevent their adjustment dynamics from reaching equilibria simultaneously. As a result, the evolutionary way of thinking expects a stalemate situation at some layer to be disrupted sooner or later by the uneven pace of adjustments at other layers. For the complex adaptive system as a whole the disruption of equilibrium states is thus endogenously caused. The observation of an equilibrium at some layer of a complex adaptive evolutionary system – some part of the economy, say – should therefore alert the observer of processes at different layers which may already develop the potential for disrupting the equilibrium state.

4. Schumpeter's 'diffusionism' as an incomplete approach to economic evolution

In modern capitalism, products, production technologies, firms, markets, and other institutions are at all times in the process of being transformed more or less rapidly. The transformations ultimately result from the incessant pursuit and creation of novelty. The merit of having placed this insight on the agenda of economics belongs to Schumpeter and his theory of economic development (1934[1912]). He introduced the novel analytical concepts of innovation and imitation and elaborated the role that entrepreneurship plays for them. He argued that it is through the imaginative power and ability of pioneering entrepreneurs that major, sometimes even path-breaking, innovations come into existence.

The activities of these entrepreneurs involve establishing major new product lines, revolutionizing technologies and the structure of entire industries, mobilizing means to tap into and utilize new types of resources, and opening up the potential of new markets. When successful in their efforts, innovators can earn huge fortunes. For the transformation of the economy to be completed, it is necessary, though, that the success of the pioneering entrepreneurs encourages subsequent imitation processes. They require growing numbers of 'ordinary' business people whose imitate activities allow for the innovations to be diffused throughout the economy with more or less delay.

The exalted view of entrepreneurial leadership promoted by Schumpeter was not unusual in the intellectual circles of early 20th-century Vienna to which he belonged (Streissler 1982). Also his interpretation of economic development as driven by the emergence and diffusion of novelty used a theoretical template then enjoying certain popularity. It figured prominently in the diffusionism school in social and cultural anthropology founded by the German geographer Friedrich Ratzel and in the 'Kulturkreis' doctrine of ethnologists Frobenius and Graebner.

The diffusionism school focused on how the development of homogenous cultural areas – a notion boosted, inter alia, by the discovery of language families – followed the patterns of regional emergence and diffusion of novelty. The school was understood as opposition to 19th-century stage-evolutionism and its tenet that all human societies develop along the same lines, namely progressing from lower to ever higher stages. An influential branch of the school was associated with the research of Vienna social anthropologists Wilhelm Koppers and Wilhelm Schmidt. Although there is no record of a personal encounter between Schumpeter and these social scientists, his familiarity with their approach is evident.[14] As Kobayashi (2014) has argued, it therefore seems plausible that Schumpeter's innovation-cum-imitation conceptual framework of economic development may have been inspired by the diffusionism school.

However, as is explained in *Chapter 5* of the present volume, Schumpeter's grasp of the emergence and diffusion of novelty is in one respect incomplete. He argued that innovations spring 'from within' the economy, but failed to inquire into how their origin depends on inventive activities and their contingencies. Where Schumpeter (1934[1912]) did mention inventions this was just to distinguish them from innovations and to claim that, since inventions are always abundantly available, no further explanation of them is required. By making this claim, it became possible for Schumpeter to portray the economic transformation process exclusively as interplay of innovation and imitation.[15]

However, successful innovations do not only elicit imitative activities. The innovator's success also puts increasing competitive pressure on established businesses. This creates incentives for these businesses to explore possibilities for their own inventions in order to escape the rising competitive pressures. Because of his neglect of inventive activities, Schumpeter did not recognize the feedback loop between innovations and inventions that keeps the economic transformation process going. Instead, he simply postulated that ever new 'swarms of innovations' will occur. In effect, Schumpeter thus treated newly invented products, techniques, and practices as 'falling from heaven'. Their occurrence is tantamount to an exogenous shock.

Such an interpretation of emerging novelty is, of course, more congenial to the conceptual frame of canonical economics than many Neo-Schumpeterians would be prepared to admit. When the occurrence of newly invented products, techniques, and practices is treated as an exogenous shock and their characteristics are assumed to be immediately known to the decision-makers, the way is paved for the use of optimization and equilibrium analysis. It is not surprising, therefore, that a variety of 'Schumpeterian' models were eventually developed in canonical economics exactly along these lines. They suggested optimal strategies for 'innovation' races, optimal investments in 'innovations', and the determination of market equilibria or even equilibrium growth paths arising from exogenous 'innovation' shocks (Reinganum 1985; Aghion and Howitt 1992). Aside from their Schumpeterian diction there is not much difference between these models and models of conventional investment calculus and comparative-statics game-theory.

Returning to the connection between Schumpeter's theory of economic development and the diffusionism school in anthropology that opposed 19th-century stage-evolutionism, a more general question can be raised. That school had promoted a theory of cultural change that was independent of the contemporary Darwinian interpretations of cultural development. Schumpeter had a similar attitude and consequently denied that the principle of natural selection had any relevance for explaining economic development (Schumpeter 2002[1912]). It may therefore be asked how diffusionist principles for characterizing historical change at the most abstract level are comparable to selectionist principles. This topic is the subject matter of *Chapter 6* in the present volume.

Since Campbell (1965) it is frequent practice to refer to variation, selection, and retention or replication as the abstract principles of the Darwinian theory. Whether or not the abstract representation makes sense for the Darwinian theory is controversial (see Levit et al. 2011). Nonetheless, the very same principles figure prominently in many attempts to formulate a generally applicable theory of evolutionary change. In Universal Darwinism (for example, Dawkins 1983, Hull 2001) and Generalized Darwinism (Hodgson and Knudsen 2010) these principles are claimed to properly account for all evolutionary processes, whether occurring in natural or cultural contexts. However, these principles have been attained through abstract reduction of the domain-specific elements of evolutionary biology. It is not evident that they would similarly result, if it would really be tried to distill abstract principles from observing evolutionary change in domains other than biology. How do the core concepts of diffusionism, that is, the principles of emergence and diffusion of novelty, by comparison fare. Are they able to characterize evolution (broadly understood as systematic historical change) in abstract terms in a manner that is not specific to any particular domain?

A reason for answering the question in the affirmative is that the principles of emergence and diffusion of novelty appear to be very general indeed. While not derived from the Darwinian theory, these principles are compatible with that theory, because variation, selection, and replication can be shown to be special cases. Variation of already existing elements is a particular, but not the only possible, way of generating novelty. Likewise, selective replication is the result of particular, but not the only possible, diffusion processes in which several variants compete for diffusion success. Further, the principles of emergence and diffusion of novelty are also compatible with constitutive properties of self-organization. Self-organization theory makes a distinction between two types of processes. These are (temporarily) self-amplifying processes which foster the emergence of new structures and self-stabilizing processes (Jantsch 1980) including the diffusion of new types or structures stabilizing their (co-)existence. Via the principles of emergence and diffusion of novelty, the two scientific paradigms of natural selection and self-organization can thus be connected in an advantageous way.

5. Novelty and the epistemological bounds of economic theorizing

Important as the process of emergence of novelty is for both evolution and self-organization, what happens in this process is poorly understood. As far as the economy is concerned, the emergence of novelty, coming in the form of new technologies, new products and services, or new organizations and institutions, is the mainspring of development and growth. Yet, economic theory usually treats their occurrence as exogenous shock which amounts to admitting that no explanation can be offered. It seems worthwhile therefore to more generally