2. Change in Economics

The general critique of neoclassical economics is that it neglects the underlying dynamics of economic change. It focuses on optimal behavior which induces a static state of equilibrium. By contrast, evolutionary economics reflects on aspects which make the economic process an ever-changing economic system. Simply looking at the basics of those two approaches shows that they address two methodological core issues relevant to the topic here: first, what prevents health care markets from adjusting to an optimal, socially desirable state, even if technological change is non-existent? Second, what are the endogenous sources of technological change that drive innovation in health? Only a combined answer can help to solve the puzzle of how much medical progress aligns with society’s wants. This not only is an important policy question, but essentially also a methodological one.

To the extent patients are incapable of making optimal decisions with regard to health issues, the resulting market-induced state, conceived as an equilibrium, will be as prone to suboptimality as any market-selected health innovation.

Therefore, a basic understanding of neoclassical and evolutionary concepts is required to build on a theory of innovation in health in later chapters. The following is meant to be an introductory section. An in-depth discussion of the history of economic thought is beyond the scope of this work and has been done elsewhere.

2.1 Neoclassics and the Structuring of Economic Thinking

It is a widely acknowledged merit of neoclassical economics that it has brought consistency to economic theorizing and that it has helped in structuring economic thinking. Classical economics constituted a comprehensive body of economic thought. It was versatile and combined different ideas, beyond modern neoclassical economics, such as conceptions of philosophical, moral and social values. However, inconsistencies remained which the neoclassical paradigm managed to resolve.
To give an example, value in general had already been a focal point in classical theory. The price of a commodity was taken to be a function of labor costs. But attaching value solely to an input factor caused a paradox in understanding the nature of prices. This paradox has become known as the 'water-diamond' paradox. Smith realized that there are two sides to the value of a commodity. There is a 'value in use' and a 'value in exchange'. Whereas water has a high value in use and a low value in exchange, diamonds are highly valued in exchange but their value in use is negligible. Smith and his contemporaries were not able to make a link between the value in exchange and the value in use. They agreed that consumers would draw utility from a commodity and that they would maximize utility; the price, however, was only attributed to labor input.

The major breakthrough in solving the paradox was accomplished by the 'marginal revolution'. Instead of looking at the total utility of a good, Jevons (1871), Menger (1871) and Walras (1874) considered the marginal utility of a commodity. The more units of a good consumed, the lower the marginal utility of a further unit consumed. Eating several burgers, the last one will deliver much less additional utility than the first. To increase total utility, one may buy something to drink instead of buying a tenth burger because the marginal utility of a first gulp will then be higher. The price of a commodity is determined by demand and supply, and the price determines how much utility money can buy. Introducing the marginal utility concept, utility is no longer constant but specific to the individual and diminishes with the amount of units consumed. Hence, the willingness to pay for a further unit of the same good will decline, too. To maximize total utility, the consumer buys a bundle of goods which renders the marginal utility of all goods equal.¹

Note that utility is essentially subjective to the individual. It does not allow comparisons among individuals. It cannot be measured, either on a cardinal or on an ordinal scale. At most, it is preferences that can be measured on an ordinal scale. Thus, maximization is subjective. No one can make optimal choices for others.²

The neoclassical approach reduced human behavior to an optimally behav-

¹Jevons (1871) and Menger (1871) attached the value of a good to subjective utility, the willingness to pay, and incorporated demand and supply into a consistent mathematical framework. At the same time, Walras (1874) was working on the 'Elements of Pure Economics, or the Theory of Social Wealth' and also accomplished a mathematical formulation of economic exchange, which motivated Edgeworth (1881) among others. Wicksteed (1992) offered a germane visualization and showed a graphical as well as a mathematical representation of production factors receiving their marginal revenue, which eventually would result in an optimum when marginal revenues equal marginal costs (Wicksell, 1934). Arrow and Debreu (1954) completed the system by proving the existence of a general equilibrium with all sub markets being simultaneously in equilibrium. With those accomplishments in the late nineteenth century, the neoclassical framework was complete.

²To make optimal decisions in health care provision, the physician, however, needs to know the patient's subjective utility when he decides what treatment is best.
ing Economic Man (Robbins, 1945). Neoclassical economists thus managed to achieve consistency at the cost of putting aside philosophical, social and moral values as discussed by classical economists. But this was considered as the Elements of Pure Economics (Walras, 1874).

There are many merits to this approach, as it is easy to transfer the mathematical maximization principles to other economic phenomena. The producer, for example, simply maximizes profits instead of utility. But a major demerit is that it winnows all personality-related human qualities from a purely economizing man, that is, a representative agent, which has become known as the ‘Homo Oeconomicus’ who drives the economic process into the optimal state of equilibrium.

2.2 Evolution in Economics

Much criticism has been put forward about neoclassical methodology. The most prominent critique in evolutionary or Neo-Schumpeterian economics, as mentioned above, is the lack of dynamics.

An equilibrium suggests a static state and assumes Pareto-efficiency. No one will deviate from such a point of optimality. Schumpeter (1911) perceived the equilibrium concept as timeless and static. Given that all the plans of all producers and consumers coincide, the economic system will no longer change. But as a matter of fact, all economic systems are subject to change. Change has to be considered endogenous to economic behavior. Schumpeter identified the entrepreneur as the dynamic element that brings along economic change. If there ever is an equilibrium, entrepreneurs will not be satisfied. They will introduce new combinations to the economic system: (a) new products or new product qualities, (b) new production methods, (c) new markets, (d) new sources of semimanufactures or raw materials and (e) new organizations. Entrepreneurs initiate what Schumpeter labelled creative destruction. The heroic figure of the Schumpeterian entrepreneur destroys existing economic structures and at the same time creates novelty. The entrepreneur is no economic man weighing marginal costs against marginal utility, but rather he has ‘the dream and the will to found a private kingdom (...) to prove oneself superior to others, (...)’ (Schumpeter, 1934, p. 94). Optimization cannot be the driver of entrepreneurial behavior.

Optimal behavior might be feasible in a well-structured and repetitively experienced situation, where an economic actor may have complete information and capabilities to make optimal decisions. This is not so with regard to forward-looking decisions. Entrepreneurs do not have complete information.

3See for example Hunt (2002) for a brief overview.
4For further inquiry on the role of the entrepreneur see Hébert and Link (1982), Barreto (1989) and also Grebel (2004).
and capabilities to make optimal decisions. Decision-making is not limited to buying the cheapest bread in town. Although some future events might be predictable to a certain extent, the future generally remains blurry and rather unpredictable. All possible future outcomes cannot be known, nor can all probabilities be known to calculate expected outcomes. It is true uncertainty (Knight, 1921) that impedes optimal choice. If an ex-post optimal outcome occurs, it is by accident.

Consequently, the dynamic path of economic change cannot follow optimality. When suboptimal decisions create artefacts, future decision-making will have to take historic events into account. Investment decisions once set into practice tend to be irreversible. This renders economic evolution path-dependent (Liebowitz and Margolis, 1995; David, 1985; Arrow and Fisher, 1974) and it will be unlikely that history walks on the optimal path of equilibrium.

The critique of the optimality postulate of equilibrium regularly led to a dismissal of neoclassical methodology, putting more emphasis on dynamics. Marshall (1920, p. xiv) suggests looking at biological concepts, saying that 'the Mecca of the economist lies in economic biology rather than in economic dynamics'. Many authors since then have engaged in this venture. Many have tried to frame an evolutionary concept to gain insights into the dynamics of the economy. However, a comprehensive evolutionary framework which unifies all heterodox theorists does not exist.

In the following, a small selection of those scholars who have influenced evolutionary thinking will be named. The list will not be complete, but simply addresses some major sources in the various strands of the evolutionary economics literature. This will provide a basic understanding and will suffice to understand better later chapters.

**Veblen and Darwin**

With the neoclassical paradigm just completed, Veblen (1898) called for a modern science. He adopted an evolutionary perspective and put the role of institutions at its heart. Veblen's evolutionary concept has roots in his fascination with Darwin's evolutionary theory as expressed in *On the origin of the species by means of natural selection* (Darwin, 1859). Therein, Darwin describes the biological evolution of species according to the principles of variation, inheritance and selection. In fact, it comprises five theories: (1) the theory of evolution, which states a steadily changing nature and organisms that are transformed over time; (2) the theory of common descent which argues that every group of organisms descended from a common ancestor; (3) the theory of the multiplication of species which explains organic diversity - species split into daughter species by ecological specialization or by establishing geographically isolated founder populations that evolve into new species;
(4) the theory of gradualism stating that evolutionary change takes place through the gradual change of populations; and (5) the theory of natural selection, which shows that evolutionary change comes about through the emergence of organic variance, with the surviving individuals passing on well-adapted sets of inheritable characters.5

These five theories were primarily built to explain biological evolution, although Darwin already saw natural selection at work in human language and individual organisms. So the idea to use Darwinism on a more general basis was implicit to Darwin's writings itself. Successive scholars made use of the theories' potential and have expanded Darwinism to other fields: Bagehot (1872) applied it to social and political evolution, James (1880) identified parallels of Darwin's concept with social evolution, and even ethical evolution was investigated as manifested in Alexander (1892) and Ritchie (1896), long before Darwinism became part in evolutionary economics.6

In the economic literature, Hodgson and Knudsen (2006) advocate a 'generalized Darwinism'. They claim that the Darwinian principles of 'variation', 'inheritance' and 'selection' are as real and relevant in cultural, and particularly, in economic evolution as in biological evolution. For the time being, however, modeling applications that show how generalized Darwinism ought to be translated into economic modeling are still awaited.

Schumpeter and Non-Darwinian Change

Evidently, there are many parallels between Darwinian evolutionary approaches and the concept Schumpeter identified in his writings. Though biological metaphors generally dominate evolutionary concepts, Schumpeter, by contrast, did not explicitly refer to biological metaphors. Some seem to spot such a conception in Schumpeter's work (Kelm, 1997), whereas others, exponents of a Darwinian approach, deny that Schumpeter had any biological analogies in mind (Hodgson, 1997a).

The evolutionary concept in Schumpeter's work is build on innovation. As pointed out above, the entrepreneur is the endogenous element of economic change in his Theory of Economic Development. A population perspective as in Darwinian theories was not on his mind. Even though he rejected the static state of equilibrium, he was fascinated by what he called methodological individualism7 in neoclassical economics, which builds on the behavior of individ-

6Hodgson (2008a) offers further insights into the history of Darwinian approaches.
7Schumpeter coined the term 'methodological individualism', although it is not quite clear what is meant by this term as it is generally used in economics. Is it the attempt to explain economic phenomena just by the individual alone without considering the individual's social context? Or is it simply the idea of starting from the individual when explaining? According to Hodgson (2007), the former has not yet been achieved. Hodgson gathers various interpretations and stresses the
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ual actors. In this respect, Schumpeter's entrepreneur concept can be seen as being the product of an individualistic approach. In contrast to Veblen (1898), Schumpeter did not mention any Darwinian mechanisms in his work (Kelm, 1997). Hence, depending on the economists' background, evolutionary economics may be interpreted either from an institutional, Darwinian perspective or from a Schumpeterian stance, such as that employed by Nelson and Winter, whose concept will be addressed in the following.

**Nelson and Winter**

Inspired by the work of Schumpeter, Richard Nelson and Sidney Winter focused on the role of technological change and routines in the business process. In their seminal work, *An Evolutionary Theory of Economic Change* (Nelson and Winter, 1982), they develop an evolutionary theory of the capabilities and behavior of business firms that operate in a market environment (Nelson and Winter, 1982). Often, they are considered the fathers of evolutionary economics (Marengo and Willinger, 1997). They start out with a critical view of orthodox theory, criticizing optimizing behavior and advocating bounded rationality (Simon, 1959, 1979) when investigating the decision-making process in business organizations. Business processes are much too complex to understand completely and this is what mainstream economics ignores. Knowledge does not play a role, even though firms are obviously not able to make optimal choices. They act according to routines, which at most will be overcome by entrepreneurs who destroy them when innovating. But it is not optimal behavior that drives either entrepreneurial or firm behavior.

Routines play a central role in Nelson and Winter's work. Firms consist of individuals, who behave according to their skills and their learnt capacity to cope with the world's complexity. Daily business forms routine behavior and routines become the representation of the organizational memory. Consequently, firm behavior is a learnt routine behavior and not optimal behavior. Hence, learning and knowledge have to be central in evolutionary theorizing.

### 2.3 Challenges in Evolutionary Economics

As yet, the task remains to consolidate the multitude of eclectic approaches in evolutionary economics to a common understanding. The sources of evolutionary thinking have been addressed above. A commonly accepted definition of evolutionary economics is still missing (Witt, 2008; Hodgson, 2000). Recent findings by Silva and Teixeira (2007) even suggest that there is a further divergence of the various paths in evolutionary economics.

necessary to define this term. The individualistic approach favored here is the latter, which starts out from the individual and also takes into account relations to others.
The common denominator seems to be the focus on endogenous change. A look at the topics which are discussed in evolutionary economics supports this view: (a) economic growth and technical change (Nelson and Winter, 1982; Dosi, 1988; Conlisk, 1989; Silverberg and Verspagen, 1994), (b) diffusion of innovations (David, 1985; Silverberg et al., 1988; Arthur, 1988), (c) historical studies of technical change (Freeman, 1982; Mokyr, 1990) and its path dependence (David, 1975), (d) industrial case studies (Pavitt, 1984; Utterback and Suarez, 1993; Buenstorf and Klepper, 2004), (e) individual and organizational learning processes (Marengo and Willinger, 1997; Cimoli and Dosi, 1995) and (f) evolutionary game theory (Brenner, 1999a,b).

The critique of neoclassical equilibrium analysis is explicit in most works in evolutionary economics. Optimization, perfect rationality, homogeneity of goods and actors, etc. are harsh assumptions to support the idea of equilibrium and compromises a lot of real world aspects of human behavior. The short discussion in this chapter shows that a rejection of a neoclassical approach does not suffice to develop a convincing evolutionary theory. It hinges on two aspects: first, to elaborate a convincing ontological foundation on which to build a theory, and second, to find the appropriate methodological tools or techniques to model economic change.

Health economics faces many of the methodological and ontological questions addressed in evolutionary economics. The next chapter will lay out selected topics in health economics to illustrate the challenges when investigating health in the context of economics. This will take up the discussion here, and moreover, it will underline the propositions with respect to methodology and ontology when trying to develop a theory of innovation in health economics.