

Roots of Evolutionary Economics¹

Witold Kwaśnicki
Institute of Engineering Cybernetics
Technical University of Wrocław
Wyb. Wyspiańskiego 27
50 370 Wrocław
E-mail: kwasnicki@ictadmin.ict.pwr.wroc.pl

Abstract

An attempt to present genesis and understanding evolutionary approach to analysis of economic processes proposed by different authors in the last few centuries is presented in this article. Tradition of three main contemporary economic schools, namely Austrian School, neo-schumpeterians, and institutionalists is considered. It is shown that contemporary evolutionary economics has its roots in biology (Darwin, Wallace and Lamarck) as well as in the classical school of Smith, Hume and Ferguson. Impact of eighteenth and nineteenth centuries social sciences on emergence of Darwin/Wallace theory of biological evolution is suggested.

The evolutionary approach to economic analysis is not new one but its significance and popularity is essentially increasing in the last decades. Beside new approach to economic analysis, the evolutionary economics stipulates new, let us say meeker, attitude of economists concerning controlling abilities of economic process, its course and its prediction. Friedrich von Hayek wrote in *The Constitution of Liberty* (1960, p. 4): “I want to make it quite clear here that the economist can *not* claim special knowledge which qualifies him to co-ordinate the efforts of all the other specialists. What he may claim is that his professional occupation with the prevailing conflicts of aims has made him more aware than others of the fact that no human mind can comprehend all the knowledge which guides the actions of society and of the consequent need for an impersonal mechanism, not dependent on individual human judgments, which will co-ordinate the individual efforts.” Historical evidences, starting at least from the French Revolution, clearly indicate what could be negative social results of all human attempts to design social order and to achieve predetermined social aims. Naturally, all these attempts aim improvement of human conditions and are full of good will of the social designers (“social engineers”). Facing all civilization problems and keeping in mind all social experiences of our century we clearly see how little we do know about social and economic reality. Therefore the

¹ The work on this paper was initiated during my visit at International Institute for Applied System Analysis in May 1996, financed by Technology and Economic Dynamics project. The final version was written at Maastricht Economic Research Institute on Innovation and Technology in September 1996, during my visit financed by the Tempus-Phare programme (Individual Mobility Grant).

words of Hayek (1988, p. 76) seem to convey that essential truth: “The curious task of economics is to demonstrate to men how little they really know about what they imagine they can design”.

An orthodox economist, especially a neoclassical one, intends to discover laws of economic life and next, using that laws, tries to design human actions allowing to achieve predetermined goals. Different role of economist is seen by evolutionary researchers. In their opinion more important are cognitive needs to know human motivations, human decision making processes, to get knowledge of mechanisms governing economic process and to allow for better understanding of activity of economic agents. “Indeed, in a certain sense the activity that economics sets out to explain is not *about* physical phenomena but about people. Economic values are interpretations of physical facts in the light of the degrees of suitability of kinds of physical objects in particular situations for the satisfaction of needs. Thus one might describe economics ... as a *metatheory*, a *theory about* the theories people have developed to explain how most effectively to discover and use different means for diverse purposes.” (Hayek, 1988, s. 98). Economics ought to be very close to reality. In 1946 Ludwig von Mises noticed : “Economics must not be relegated to classrooms and statistical offices and must not be left to esoteric circles. It is the philosophy of human life and action and concerns everybody and everything. It is the pitch of civilization and of man’s human existence.” (Mises, 1966, str. 878).

The main aim of this article is to present genesis and understanding of adjective ‘evolutionary’ as it was applied by different authors to analyse economic phenomena in the last few centuries. Tradition of three main contemporary economic schools, namely Austrian School, neo-schumpeterians, and institutionalists, is presented in very schematic way in Figure 1. Arrows indicate only the main influences of different authors and researchers. More detailed description of those influences and different views of evolutionary economics will be presented in the following sections of the article. Here let us mention only that contemporary evolutionary economics has its roots in biology (Darwin, Wallace and Lamarck) as well as in the classical school of Smith, Hume and Ferguson. It is necessary to emphasize the influence of social sciences on emergence of Darwin/Wallace theory of biological evolution, based on the hypotheses of natural selection (what is indicated by arrows from Great Scots (Smith, Hume, Ferguson), Malthus, Babbage and Jones).

Evolution

Meaning of the words ‘evolution’ and ‘development’ are very similar and therefore frequently both are used interchangeably. ‘Evolution’ comes from Latin *evolutio* - unrolling of a manuscript, and *evolvere* - to unroll, open, unfold. In this sense this word was used for the first time in 1714 by Albrecht von Haller. Haller’s view was very close to the preformation school. According to this school all basic structures of adult organism preexist in a cell from which he

develops, and individual development (ontogeny) is unfolding ('evolution') of that build in complexity. In the eighteenth century evolution related the ontogenic development. It is worth to mention that two great evolutionists Jean Baptiste de Lamarck and Charles Darwin have not used this word frequently. In nineteenth century this term was popularized by Herbert Spencer. Darwin used this word in the 6th edition of his *Origin of Species*, and even after that he used it very rarely, instead of that he preferred to use the expression *descent with modification*. In 1836 Wilhelm von Humboldt (1977, III) applied this word to describe the development of natural languages. He wrote that "if one conceived of the formation of language, as is most natural, as successive, it become necessary to ascribe to it, as to all origin in nature, a system of evolution".²

Contemporary using of the word 'evolution' is associated very clearly with Darwinian idea of natural selection and its meaning is fundamentally different from that of Haller and even Spencer. Modern using of the term 'evolution' relates not to the individual, ontogenetic, development but to the changes observed at the level of population, so called filogenetic development.

In political and social sciences 'evolution' and 'revolution' are used for description of essentially opposite processes, although both words have the same Latin etymology. In spite of using them in the opposite meanings both relate to the unrolling or rolling movement.³ Modern use of these two words suggests existence of two opposite mechanisms of development what seems to be misleading. Evolutionary as well revolutionary processes are governed by the same mechanisms of development, the difference is only in the rate of changes – evolution is associated with slow, constant, gradual changes and revolution with relatively quick changes, in a proper time scale considered as instant changes.

The expression 'evolutionary economics' is used in many and in some cases very different, approached to analyse economic phenomena. In the most general understanding it is used to emphasize the role of changes in economic processes, what is done to indicate the opposition to the economic analysis focused on static and equilibrium properties. In a narrow sense it relates to economic analysis based on analogies and metaphors borrowed from theories of Darwin and Lamarck. Adverb 'evolutionary' is used in the last decades by a few distinguished economic schools, namely by:

- O economists calling themselves 'neo-schumpeterians'. Starting point of economic phenomena for this school is the work of Joseph Alois Schumpeter. By using the term 'evolution' or 'evolutionary' they indicate the importance of long-term economic development, importance of innovation for economic development, and the role of

² quotation following Hayek (1988, s. 147).

³ In this sense the word *revolutio* was used by Nicolas Copernicus in his fundamental work published in 1543 *De revolutionibus orbium coelestium*.

entrepreneur in economic process. According to this school, evolutionary process is dynamical, historical process which macroeconomic characteristics being the effect of activity of economic agents observed at the microeconomic level. Fundamental features of economic, evolutionary process are diversity and heterogeneity of behaviours. Selection and search for innovation are two basic mechanisms of development.

- O Austrian School is also called evolutionary. The work of the founders of this school, especially the work of Carl Menger and his theory of money and other social institutions formation, is clearly evolutionary. Friedrich von Hayek use frequently adjective 'evolutionary' for description of his approach (particularly in his latest books on spontaneity of development (e.g. *Fatal Conceit*), it allows to justify to call the Austrian School the evolutionary one.
- O institutionalist theory, initiated by the work of Thorstein Veblen, is called also 'evolutionary' (or 'post-Darwinian' economics, as Veblen sometime called it). Followers of Veblen and John Commons are also using the adjective 'evolutionary' but frequently this term means for them the same as 'institutional', and they use both term interchangeably.
- O from time to time many different mathematical approaches used to describe economic phenomena are named 'evolutionary', e.g. chaos theory, computer simulations based on selection and replicator dynamics, genetic algorithms and genetic programming, game theory.

In fact the term 'evolutionary economics' is used by many authors to describe approaches applying essentially different previews of economic phenomena. As Jacques Monod, one of the greatest modern biologists has said (and it can be used to economists also): "Another curious aspect of the theory of evolution is that everybody thinks that he understands it!". Many authors use this term without further explanation of its meaning, assuming that it is not necessary, because all understood it.

Mutual influences of biology and economics

If somebody asked what is the course of influences between seemingly highly separated sciences as biology (especially evolutionary biology) and social sciences (especially economics) than most answer would be that the inspirations go from biology to social sciences, not vice versa. Last decades witness growing interest in 'evolutionary approach' in many sciences. We hear about evolutionary epistemology, evolutionary psychology, genetic and evolutionary algorithms, and genetic programming in computer science, artificial life, evolutionary economics, etc. All

those disciplines draw their inspirations from biology, especially from Darwinian theory of evolution sometimes with elements of Lamarckian vision of evolution (because it is claimed that in social development we observe the phenomenon called by Jean Baptiste Lamarck in 1809 inheritance of acquired characteristics). It is true that current influences come from biology to social sciences. But was it always in the past?

As it turns out many herald words of evolutionary biology were derived from social sciences. The word 'genetic' is one of them. Its modern understanding is so biological that cultural transmission of customs, behaviours, rules, routines, etc. is now called 'extra genetical transmission'. But it was not a case 200, or even 100 years ago. Probably, for the first time this word was used in German in the form *genetisch*⁴ in the end of 17th century by at least three men. By philosophy historian, theologian and writer Johann Gottfried von Herder in his *Ideen zur Philosophie der Geschichte der Menschheit* (1784-91) where he presented his view on history of human civilization as evolution of nature and progress of reason.⁵ The second was Friedrich Schiller in his aesthetic writings (Schiller, 1793), and the third was professor at the Erfurt University Christoph Martin Wieland (1800). English using of this term was popularized by Scotch novelist and historian Thomas Carlyle (1795-1881). Frequent use of this word was in linguistics, especially after publication in 1787 of the work of Sir William Jones on common origin of Indo-European languages, and after publication in 1816 of the work of Franz Bopp, founder of comparative grammar of Indo-European languages. This term was also used by Wilhelm von Humboldt in his book published in 1836 (Humboldt, 1977, III, 389 and 418). In biology common using of this word dates since 1913 when William Bateson published his *Problems of Genetics*.

The history of an expression *oeconomy of nature* witness how intertwined are developments of biology and economics. This expression was used by both Adam Smith and Charles Darwin. Smith used it frequently in *The Theory of Moral Sentiments* (first published in 1759). But it was not invented by Smith, it was used many decades before Smith (see e.g. Brown, 1981). Carl Linnaeus published in 1751 one of the fundamental and very influential book, *The Oeconomy of Nature*. Both Smith and Darwin were familiar with the work of Linnaeus and probably from that source they borrowed this expression.

There are very convincing evidences that inventing his theory⁶ Darwin has taken inspiration

⁴ Schulze, 1913:I, 242; see also Hayek (1988, p. 147).

⁵ In 1772 Herder wrote an *Essay on the Origin of Language (Abhandlung über den Ursprung der Sprache)*.

⁶ As it is well known the modern development of theory of biological development dates since 1859 when Charles Darwin (1809-82) published his fundamental work *On Origin of Species by Means of Natural Selection*. In the same period, independently of Darwin similar idea was worked out by Alfred R. Wallace (1823-1913). In fact, from historical point of view both of them ought to be called founders of evolutionary theory. Darwin and Wallace was invited by Charles Lyell to present their theories at the meeting of *Linneaus Society* in London on the 1st of July, 1858. Wallace described his way of working

from the work of the Great Scots: David Hume, Adam Ferguson and Adam Smith. The Great Scots postulated the vision of *civil society*, which differs and is independent of the state. In the Scots understanding civil society consists of fully individual and noncompulsory relations while the state is based on public and political relations (*res publica*). The Great Scots assumed that the governing force of development are customs, routines, opinions and rules worked out during long historical process of cultural development and belonging to a tradition of a given society.

An idea that an individual is the basic unit of society originated slowly in the historical process. For the first time this idea was popularized by Dutch Bernard de Mandeville (ok. 1670-1733) in the book published in 1714 and entitled *The Fable of the Bees, or Private Vices, Public Benefits*. Mandeville was a doctor of medicine, philosopher and satirist. Most of his life he lived in London. He pointed out that emergence of stable social institutions as law, language, market, knowledge is an effect of spontaneous development being the result of individual, sovereign and noncoercive actions of all members of a society. In Mandeville's opinion, natural, selfish attitudes of man, his greed and profit seeking makes the economic development quicker and makes societies wealthier. The Mandeville's vision was an alternative view for Thomas Hobbes (1588-1679) explanation of social order emergence presented in *Leviathan*. Not in the authority of governor and by admission of the power (as Hobbes proposed) but as an effect of decentralised, individual interactions of all members of a society.

It was the Great Scots who was the followers of the Mandeville's idea. They emphasized the importance of spontaneity of development. Adam Smith in *The Theory of Moral Sentiments* (1759) and in *An Inquiry into the Nature and Causes of the Wealth of Nations* (1776) presented his observations on the nature of a searching man, who leaded by an 'invisible hand', acting only for its own gain and benefits, even being not conscious of that, provides betterment of the whole society.⁷ In the *Wealth of Nations*, Smith tries to find answers for two basic questions. The first, how in the free society there emerge institutions providing stable social order, and the second about the nature of prices setting of all goods and services; The answer of these two questions

out the concept of natural selection in the book *This Wonderful Century. Its Successes and Failures* published in 1898.

⁷ "To the selfish and original passions of human nature, the loss or gain of a small interest of our own appears to be of vastly more importance, excites a much more passionate joy or sorrow, a much more ardent desire or aversion, than the greatest concern of another with whom we have no particular connection. His interest, as long as they are surveyed from his station, can never be put into balance with our own, can never restrain us from doing whatever may tend to promote our own, how ruinous soever to him. ...

When we are always so much more deeply affected by whatever concerns ourselves than by whatever concerns other men; what is it which prompts the generous upon all occasions, and the mean upon many, to sacrifice their own interest to the greater interest of others? It is not the soft power of humanity, it is not that feeble spark of benevolence which Nature has lighted up in human heart, that is thus capable of counteracting the strongest impulses of self-love. It is a stronger power, a more forcible motive, which exerts itself upon such occasions. It is reason, principle, conscience, the inhabitant of the breast, the man within, the great judge and the arbiter of our conduct." (Smith, 1759, p. 274-8).

allowed to find explanation of distribution ‘law’ of the whole social wealth into three social groups, namely workers, manufacturers, and landowners (landlords).

The well known metaphor of ‘invisible hand’ was used by Smith in *The Theory of Moral Sentiments* where he wrote that “The rich only select from the heap what is most precious and agreeable. They consume little more than the poor, and in spite of their natural selfishness and rapacity ... they divide with the poor the produce of all their improvements. They are led by an invisible hand to make nearly the same distribution of the necessaries of life which would have been made, had the earth been divided into equal portions among all inhabitants”.

David Hume, the friend of Adam Smith, was also an proponent of evolutionary vision of socio-economic development, especially in relation to emergence of law and customs. In his *Dialogues Concerning Natural Religion* (1779) we can find suggestions on natural selection mechanism in social development. He writes that “no form can persist unless it possess those powers and organs necessary for its subsistence: some new order or economy must be tried and so on, without intermission; till at least some order which can support and maintain itself, is fallen upon’ (Hume, 1886, vol. 2, p. 429). Hume extended his evolutionary view into the sphere of human morality. In *Treatise* (1739, II:235) he suggested that “rules of morality ... are not conclusions of our reason” but were worked out in the long, historical process of social development to provide coherence of social groups and their subsistence.

It is almost commonly accepted that evolutionary view of biological, social and cultural development governed by natural selection was initiated by the work of Charles Darwin. With the admiration of the great work of Darwin, who for the first time very clearly and precisely expressed the evolutionary principles and convincingly illustrated the action of natural selection and other evolutionary mechanisms within biological population, it is worth to say that the idea of evolution existed in social sciences for many decades before the publication of *Origins* in 1859.

The founders of theory of evolution in biology used the results of observation of social and cultural processes of human societies and get incentives from some theories of social development, especially those related to evolution of natural languages (see p. 8), evolution of law, emergence of money, development of markets, or evolution of moral law. Analysis of the notes made by Darwin suggests that he read Adam Smith in 1838 and 1839, i.e. in the crucial period of working out principles of his theory of evolution. In 1838 he read Smith’s *Essays on Philosophical Subject* (London: Cadell & Davies, 1795) together with accompanied biography and synopsis of Smith’s books by Dougal Stewart (*An Account of Life and Writing of the Author*). In this account Stewart provides description and discussion of *The Wealth of Nations*. But there are no evidences that Darwin has read *The Wealth of Nations* in original. After reading the *Essays on Philosophical Subject*, Darwin wrote in his notes that it was “worth reading as giving abstract of Smith’s views”. In 1839 Darwin read *The Theory of Moral Sentiments*. Smith

and the Scots School can not be seen as the only social scientists having influence on Darwin. In 1838 Darwin read also the famous book of Thomas Malthus *Essay on the Principle of Population* (1798) together with very influential review of this work done by Auguste Comte (Schweber, 1977; Hodge, Kohn, 1985). In the well known quotation, Darwin (1904, str. 120) explains himself how his theory of natural selection was inspired by the image of *struggle for existence* presented by Malthus in his *Essay*. It is interesting that in almost the same way the inspiration is described in 1898 by Wallace, the second founder of theory of evolution (Wallace, 1898, s. 139-40).

It is true that the influence of Malthus on crystalising the idea of natural selection can not be questioned, but it ought not to be overestimated. It is greatly surprising that both Darwin and Wallace writes about Malthus inspiration in very similar fashion. There arise the question: to what extend this opinion is the result of specific atmosphere of the second half of the 19th century and to what extend it was the real influence of Malthus?

Beside natural selection, the essence of Darwin/Wallace theory is the postulate of diversity and variety (variation and divergence) – on which the natural selection ought to work. For Smith and Hume, each men is born with very similar abilities and the observed variation of these abilities emerges in the course of man's development as the result of his life experiences, education and action. In *The Wealth of Nations* Smith writes that “the difference between the most dissimilar characters, between a philosopher and a common street porter for example, seems to arise not so much from nature as from habit, custom, and education” (1776, s. 28-9). Therefore skills are not “so much the causes as the effect of the division of labour”.⁸ Close relationship of Darwin with Charles Babbage could result in getting the knowledge of interrelationship between variety and division of labour. Darwin known Babbage rather well, they belonged to the same scientific circles and social societies in London. In 1832 Babbage published very influential book *On Economy of Machinery and Manufactures*. Darwin read this book (Schweber, 1980, s. 270). There are small differences of understanding the concept of

⁸ In 1949 Ludwig von Mises noticed in his *Human Action; A Treatise on Economics*, that biologists has borrowed the idea of division of labour from natural philosopher, and in the same place he notices the differences between social and biological processes:

The principle of the division of labor is one of the great basic principles of cosmic becoming and evolutionary change. The biologists were right in borrowing the concepts of the division of labor from social philosophy and in adapting it to their field of investigation. ... But one must never forget that the characteristic feature of human society is purposeful cooperation; society is an outcome of human action, i.e., of a conscious aiming at the attainment of ends. No such element is present, as far as we can ascertain, in the processes which have resulted in the emergence of the structure-function systems of plants and animal bodies and in the operation of the societies of ants, bees, and hornets. Human society is an intellectual and spiritual phenomenon. It is the outcome of a purposeful utilization of a universal law determining cosmic becoming, viz., the higher productivity of the division of labor. As with every instance of action, the recognition of the laws of nature is put into the service of man's efforts to improve his conditions”. (Mises, 1966, s. 145)

‘division of labour’ by Babbage and Smith. Babbage insisted the fact that each man has different levels of skills and abilities to work. He argues that advantages arises from appointing different workers to different aims, namely to those which they are more predestined. In contrast to Smith, Babbage division of labour is based on differences in skills and abilities; the diversity of skills is the cause of division of labour, not vice versa.

We have mentioned the Great Scots, Malthus, Babbage and other having significant influence on emergence of evolutionary theory in biology. Their main interest was ethical, moral, economic and political processes. There is another stream of social research having no less importance for emergence of evolutionary theory, namely the research on origin and evolution of natural languages. It is very difficult to image development of any civilization without prior emergence of a language for communication. Natural languages are one of those spheres of cultural processes being out of significant influences of any ‘central’ authorities. Spontaneity of development of natural languages can not be questioned, although it is possible to indicate cases in the past and in modern times when ‘central authority’ tried to impose some language patterns and tried to take care about the ‘purity of language’. Fortunately any such attempts have not succeeded. It is the spontaneity of languages development responsible for their richness and beauty. In 1786 Sir William Jones (1746-1794) noticed striking similarities between Latin and Greek, especially in relation to vocabulary. In his presidential discourse to the Asiatic Society for the first time he postulated the common ancestry of Sanskrit and Greek. In the next stage of his research he proved the cognation of German, Hindi and Persian. In the first half of 19th century the further progress on evolution of languages was observed. New phonological and syntactical methods were used to discover cognition of different languages and to build ‘genealogical tree of all human languages’. It is interesting to note that Sir William Jones was educated in law, interested in Orient culture and was active Wig, advocate of liberal idea of social development.

In opinion of Hayek (1978. p. 265) such writers as Johann von Herder, Wilhelm von Humboldt and Friedrich von Savigny “made the idea of evolution a commonplace in the social sciences of the nineteenth century long before Darwin”. He repeats this opinion a few years later writing that “[i]t was in the discussion of such formations as language and morals, law and money, that in the eighteenth century the twin conceptions of evolution and the spontaneous formation of an order were at least clearly formulated, and provided the intellectual tools which Darwin and his contemporaries were able to apply to biological evolution. ... A nineteenth-century social theorist who needed Darwin to teach him the idea of evolution was not worth his salt” (Hayek, 1982, vol. 1. p. 23). This contemptuous attitude to Darwin seems to be not fully comprehensible. In *Fatal Conceit* (1988, s. 26) Hayek smoothed his opinion on the Darwinian theory and wrote that this theory “is one of the great intellectual achievements of modern times” but still iterate the fundamental role of social sciences in formation of theory of evolution; he

wrote that “Darwin’s work was preceded by decades, indeed by a century, of research concerning the rise of highly spontaneous orders through a process of evolution” (Hayek, 1988, p. 24).

There is a number of works indicating diversified influences of different cultural and research investigation on emergence of Darwinian idea of evolution. The diversified influences on Darwin style of thinking was pointed out among others by Grubler (1985), Herbert (1971, 1977), Jones (1986, 1989), Kohn (1980, 1985), Ospovat (1979), Richardson (1981), Schweber (1977), Urbanek (1984). The picture which arises from this research is not clear, anyway one can draw conclusion from all these research, that Darwin’s and Wallace’s personal education really matter but their theory of biological evolution is the result, and synthesis, of long lasting tradition of Oxford, Cambridge and Edinburgh, i.e. places where the Great Scots, Malthus, Jones and many others social researchers studied and conducted their research. There are growing evidences that the Great Scots convinced Darwin in the opinion that complex phenomena flows out of numerous, unintentional actions of a great number of individuals. Silvan Schweber suggests that reading of Adam Smith and Dugald Stewart induced Darwin to “focus on the *individual* as the central element and unit of his theory and led him to accept the Scottish view of trying to understand the whole in terms of the individual parts and their interactions” (Schweber, 1977, pp. 233, and 277-8). In general it can be said that Jones, Smith and other Scots ‘prompted’ Darwin an idea of order and regularity which flies out of seemingly chaotic actions of individual elements, an idea of order resulting out of any intention or conscious design.

Mandeville, Ferguson, Hume and Smith supported Darwin but their metaphors have been related to mechanical world (what is not surprising, they lived in the period when the mechanical vision of the world has dominated) but not to evolutionary, organistic vision of the world development. They search for ‘motion laws’ of economic systems in a similar fashion as it was done in Newtonian physics. Invisible hand balanced supply and demand forces. Forces analogous to physical, gravitational ones and resulting form individual actions of selfish and egoistic economic agents.

Summarising their views it can be said that order and integrity of social life and nature do not flow out of any design (invented by a man or the God). The complex order results out of unintentional action of individuals. Coordination and prosperous development are achieved because of specialization and division of labour. These ideas created fertile soil for emergence of an idea of natural selection but naturally were not identical with this concept.

“Survival of the fittest”

Herbert Spencer (1810-1903) was one of a few making the idea of evolution popular in the second half of the 19th century. His popularity was equal to Darwin’s. He has its own original

contribution in developing the idea of biological evolution and also of evolutionary approach to analysis of ethical problems and social processes. In modern time the works of Spencer are not well known but are worth to remind especially for their remarkable influence on development of economics and other social sciences in the end of 19th and beginning of the 20th centuries. In economics his visible influence is seen in the work of such well known economists as Thorstein Veblen and Alfred Marshall. Indirect influences can be noticed in the development of the Austrian School economics.

Early Spencer was under influence of Thomas Hodgskin (1787-1869), anarchist and Godwinian. Most of Spencer's work has a sign of creative eclecticism. He has a gift of combining into a coherent unity many, sometime far distanced, concepts borrowed from physics, biology, psychology, sociology and ethics. His principle of common evolutionary pattern was partly borrowed from Samuel Taylor Coleridge (1772-1834). An idea of energy preservation, the core of his system, from James Joule (1818-1889) and other physicists. He acquired some evolutionary ideas from biologist Jean Baptiste de Lamarck (1774-1829) and embryologist Karl Ernest von Baer (1792-1857). He frequently used biological metaphors and analogies in his social research. Society in his view, was similar to living organism.

Few years before publication of *Origins* by Charles Darwin, in two essays of 1852 he presented his original idea of evolutionary development. In this essays, he understood evolution as "a change from an indefinite, incoherent homogeneity, to a definite, coherent heterogeneity through continuous differentiations"(Spencer 1892, p. 10). According to his understanding, evolution is a progress (what reflected the spirit of this period, for many scientists and writers an idea of progress was primary category of development). "Progress, therefore, is not an accident, it is a part of nature; all of a piece with the development of the embryo or the unfolding of a flower" (Spencer, 1851, s. 65). Evolution means exactly progress and growth of efficiency toward an ideal state. Evolutionary development is in opinion of Spencer a change from lower to higher forms of organization of life, from worse to better states. He argued that complexity is normally associated with more advanced and better adopted forms. Evolution for Spencer is a change from homogeneity into heterogeneity. As we shall see it is slightly different notion of evolution than the Darwinian natural selection. Both, Spencer and Darwin noticed the importance of diversity and variety.⁹ But meaning if these notions was different. For Darwin diversity was engine of development. In spite of well understanding of natural selection by Spencer, diversity for him was a result and aim of evolutionary process, not its fundamental property. Spencer saw

⁹ Treating an economic good as homogeneous is a kind of tradition in economics. Charles Babbage (1846, p. 134) was the first economist who noticed that goods treated by economists as homogenetic are in reality heterogenetic and diversified. He noticed that goods differs in quality, and that in 'some cases the goodness of an article is evident on mere inspection' but other goods, like tea or flour, quality can be worsened to such extend, that direct, and ongoing investigation if the good is of the highest quality can be difficult.

evolution as the process of approaching equilibrium and harmony. He called this process *equilibration*; “the changes which evolution presents cannot end until equilibrium is reached, and that equilibrium must at least be reached” (Spencer, 1890, s. 524). For Darwin diversity leads to antagonism and competition, in his understanding these mechanisms were advantageous for evolution. Contrary to Darwin’s view, for Spencer diversity does not lead to antagonisms and hostility. These antagonisms are the primary causes of disintegration and decay. It was van Baer’s idea of development which convinced Spencer to the concept of teleology in evolution. Two basic principles of development, frequently appearing in his works, contain the teleological idea; (1) “change from the homogenous to the heterogenous, is displayed equally in the progress of civilization as a whole, and in the progress of every tribe or nation; and is still going on with increasing rapidity” (Spencer, 1890, pp. 342-3), (2) “In every more or less separate part of every aggregate, integration has been, or is, in progress” (Spencer, 1890, p. 307).

These two principles relate to biological evolution as well as to socio-economic development. For Spencer (and also for Lamarck) environment is a fundamental cause of changes, and variety within populations is a function of environment in which biological organisms exist. Contrary to this view, Darwin inclined to a view that change is a result of cooperation of variety and environmental selection.

Spencer have noticed the existence of natural selection but he treat it as a secondary mechanism. It seems to be striking for a men who invented the famous expression of “survival of the fittest”. It is true that Spencer invented and made popular that slogan. An vulgar interpretation of this slogan clings the concept of “social Darwinism” to Spencer. It is not fair to claim it and it seems that this opinion is the result of intellectual folklore of the end of 19th and beginning of 20th centuries. It is worth to say that Darwin used (after the advice of Wallace) the sentence of “survival of the fittest” instead “natural selection” in 1866. Argument of Wallace was that ‘selection’ convey a hint of external agent (e.g. God) who makes the selection. If we look more carefully what the slogan in reality means we conclude that its primitive understanding is in contradiction to the idea of natural selection. According to the notion of natural selection, organisms which survive are not the best ones, but relatively good ones. Organisms does not optimize (maximize) their development and their behaviour. Organisms rather adapt to local environment to survive and to give offsprings. Similar idea has emerged in economics, survival of the fittest was related to the principle of profit maximization – firms which survive gain maximal profit. “Survival of the fittest” and profit maximization are in contradiction with everyday experience; firms which survive on the market gain not the maximal profit but relatively high profit. Herbert Simon suggest to replace the profit maximization principle by the concept of satisficing - firms behave to be satisfied of their position on the market and of their relatively large profit.

Selection in biology acts not only by mortality diversification but also by fertility

diversification. As Mayr (1985, s. 768) writes: “Selection is not merely mortality selection as reflected in the slogan ‘survival of the fittest’, but ‘success in leaving progeny’, as Darwin saw quite clearly and mentioned specifically as part of natural selection”. If the principle of ‘survival of the fittest’ have had to act in its extreme form than within one generation all diversity would have been lost. Therefore, putting it to an absurd, within one generation natural selection would have been unnecessary because there would be nothing to be selected. It seems that Darwin and Spencer have not understood this slogan in its primitive, extreme interpretation – they were inclined to understand it as a mental epitome.¹⁰

Importance of the Spencer publication of 1852 is not diminished by the fact that contrary to theory of natural selection of Darwin and Wallace, he did not proposed satisficing explanation of evolutionary process and description of mechanisms of its development. The work of Spencer made the idea of evolution very popular and for decades stimulated further research on this theory by biologists and social scientists. It is worth to note that Spencer thinking was shaped by laissez-faire concept of spontaneous development. As he wrote in his *Principles of Sociology*:

The turning of the land into a food-producing surface cleared, fenced, drained, and covered with farming appliances, has been achieved by men working for individual profit not by legislative direction. ... villages, towns, cities, have insensibly grown up under desires of men to satisfy their wants ... by spontaneous cooperation of citizens have been formed canals, railroad, telegraphs, and other means of communication and distribution. ... Knowledge developing into science, which has become so vast in mass that no one can grasp a tithe of it and which now guides productive activities at large, has resulted from the working of individuals prompted not by the ruling agency but by their own inclinations. ... And supplementing these come the innumerable companies, associations, unions societies, clubs, subserving enterprise, philanthropy, culture, art, amusement; as well as the multitudinous institutions annually receiving millions by endowments and subscriptions; all of them arising from unforced cooperations of citizens. And yet so hypnotized are nearly all by fixedly contemplating the doings of ministers and parliaments, that they have no eyes for this marvelous organization which has been growing for thousands of years without governmental help - nay, indeed, in spite of governmental hindrances.¹¹

Herbert Spencer was individualist. In some period he was very close to the Cobden’s teachings. After Cobden, he argued for limitations of the state as the lawmaker and order-imposer. But his later observations led him to more radical attitudes. He has postulated drastic limitation of a number of state bureaucrats, and in long-term perspective to liquidate the state. State is needed only in the transitory phase to provide “equal liberty” for all members of a

¹⁰ Selection is seen in economy at many levels; firms which survive on the market are not only those which offer the best products but firms which offer good products for relatively low price.

¹¹ quotation from: Jim Powell, ‘Herbert Spencer: Liberty and Unlimited Human Progress’, *The Freeman*, April 1995, s. 252-3.

society. He envisaged that in future compulsory role of the state will disappear and will be replaced by common cooperation.

Evolutionary economics in the turn of the centuries

Very clear and implicit declaration of a number of economists for the need of evolutionary approach to economic analysis can be noted in the end of 19th century. Paradoxically it happened during the same period when Stanley Jevons and Leon Walras founded basic principles of, rooted in mechanistic paradigm, neoclassical economics.¹² Carl Menger (1840-1921) was one of a few evolutionary economists of this period. In a similar fashion as it was done 100 years ago by the Great Scots, he used such phenomena as language, customs, morality, *common law* as an examples to show that regularities of development of human societies are the outcome of individual decisions and actions of all members of society. The idea initiated by Menger was further developed by other economists of the Austrian School, especially by Böhm-Bawerk, Mises, and Hayek. The main subject of Menger interest was theory of value and theory of money. In the later years he was engaged also in some methodological issues in economics and the humanities. Menger (1871 (1981), 1883 (1963), 1892) understood money as pragmatic, ‘organic’ social institution, similar to language or common law. But ‘organic’ for him did not mean the same as biological. In his understanding ‘organic’ means the same as being the product of spontaneous men’s activity, not the product of any rational project or design. We found the suggestion of evolutionary process leading to emergence of money in published in 1871 *Principles of Economics*: “The origin of money ... is entirely natural. ... Money is not an invention of the state. It is not the product of legislative act. Even the sanction of political authority is not necessary for its existence. Certain commodities came to be money quite naturally, as the result of economic relationships that were independent of the power of the state” (Menger, 1950, pp. 261-2).

Money are the outcome of unintentional cooperation of individuals and personal decisions and choices. “As *each* economizing individual becomes increasingly more aware of his economic interest, he is led by this *interest*, *without any agreement*, *without legislative compulsion*, and *even without regard to the public interest*, to give his commodities in exchange for other, more saleable, commodities, even if he does not need them for any immediate consumption purpose. With economic progress, therefore, we can everywhere observe the phenomenon of a certain number of goods, especially those that are most easily saleable at a given time and place, becoming, under the influence of *custom*, acceptable to everyone in trade, and thus capable of being given in exchange for any other commodity” (Menger, 1950, s. 260). In 1883 he published

¹² Stanley Jevons, 1871, *The Theory of Political Economy*; Leon Walras, 1874, *Éléments d'économie politique pure*.

Problems of Economics and Sociology, he suggested there that goods selected to be money were those “the most easily transported, the most durable, the most easily divisible” (1963, s. 154). Money originates as the result of selection. Because it is the selection at the level of customs, agreements and conventions, it can be disputable to what extent it is ‘natural selection’. It is interesting that Menger uses the term ‘genetical’ in his considerations, arguing that each economic theory “has primarily the task of teaching us to understand the concrete phenomena of the real world as exemplifications of a certain regularity in the succession of phenomena, i.e. genetically. ... *This genetic element is inseparable from the idea of theoretical science*” (1963, p. 94). In understanding of Menger, genetical means the same as causal.

Friedrich A. von Hayek (1899-1992) is one of followers of this idea. As he claimed, he was a continuator of Menger’s approach. Hayek frequently uses an expression ‘evolutionary approach’ especially in relation to “the evolution of systems of rules of conduct”.¹³ “The evolutionary selection of different rules of individual conduct operates through the viability of the order it will produce” and the “*transmission of rules of conduct takes place from individual to individual*, the natural *selection* of rules will operate on the basis of greater or lesser efficiency of resulting *order of the group*’ (Hayek, 1967, p. 67-8). Very clear reference to evolutionary biology we find in his essay on Bernard Mandeville (Hayek, 1978, s. 265). Similar incorporation of evolutionary concept to the analysis of socio-economic process is made in his three volumes *Law, Legislation and Liberty* (Hayek, 1982, vol. 1, pp. 9, 23-4, 152-3, vol. 3 pp. 154-9, 199-202). But the fullest expression of his evolutionary view is seen in the latest works, e.g. *The Fatal Conceit* (1988, pp. 8-9, 11-28, 147). Hayek postulates existence of the second basic mechanisms of social evolution, which is complementary to selection, namely generation mechanisms of new solutions. Institutions and practices which had “been adopted for other reasons, or even purely accidentally, were preserved because they enable the group in which they had arisen to prevail over others” (Hayek, 1982, vol. 1. p. 9).

Alfred Marshall (1842-1924) was the second economist in the end of 19th century who turned his attention toward evolutionary approach to economic analysis. In one of the editions of his basic work, *The Principles of Economics* (published for the first time in 1890) he has written that “the main concern of economics is ... with human beings who are impelled, for good and evil, to change and progress”(Marshall, 1961, s. xv). In the preface to *The Principles of Economics* we find the famous maxim that “the Mecca of economist lies in economic biology rather than in economic dynamics” (based on the mechanistic paradigm). But a comment, which appears just after this famous phrase, suggests that Marshall understood it only as very difficult to accomplish postulate. He writes that “biological conceptions are more complex than those of mechanics; a volume on foundations must therefore give a relatively large place to mechanical analogies; and

¹³ Hayek, 1960, pp. 57-61; and a number of essays written in 1960., e.g. Hayek, 1967, pp. 31-4, 66-81, 103-4, 111, 119.

frequently use is made of term equilibrium which suggests something of a statical analogy. This fact, combined with the predominant attention paid in the present volume to the normal conditions of life in the modern age, has suggested the notion that its central idea is 'statical' rather than 'dynamical'. In fact it is concerned throughout with the forces that cause movement; and its key note is that of dynamics rather than statics." (Marshall, 1948, p. xiv).

Marshall saw limitations of economic analysis based on mechanical analogies and therefore turned to biology to search for proper inspiration and fertile metaphors. In one of his article (Marshall, 1925) he evaluated the roles of mechanical and biological analogies. He wrote that there is "a fairly close analogy between the early stages of economic reasoning and devices of physical statics .. I think that in the later stages of economics better analogies are to be got from biology rather from physics; and, consequently, that economics reasoning should start on methods analogous with those of physical statics, and should gradually become more biological in tone".

Darwinian idea of evolution was neither dominant nor commonly accepted in the end of the 19th century, therefore Spencer was more close to Marshall thinking than Darwin. Marshall read eagerly all books of Spencer. After the death of Spencer he wrote that "there is probably no one who have as strong a stimulus to the thoughts of the younger Cambridge graduates thirty or forty years ago as he. He opened a new word of promise" (Marshall, 1904).

Unfortunately Marshall did not develop his proposition to buttress economic analysis with biological analogies. His *Principles* relates mainly to static analysis of economic process. He intended to write the second part which would concentrate on dynamics and would contain the concept of time as the fundamental notion of concern. Only partly he tackles this problem in the *Principles* and unfortunately they are not extensively discussed. Evolutionary thinking is fundamentally tied with population thinking. Marshall escapes from population thinking and base his ideas on the concept of 'representative agent' – fully theoretical creature, having no counterpart in reality. In the appendix to his *Principles* Marshall (1948, s. 637) wrote that "economics, like biology, deals with a matter, of which the inner nature and construction, as well as the outer form, are constantly changing", and therefore economy "is a branch of biology broadly interpreted".

Marshall died in 1924. In this period the dialog between economics and biology did not exist any more. Only in United States it was possible to notice rare references to biological ideas. The references were done by minority of economists following and quoting Thorstein Veblen (see below). During the Keynesian revolution all metaphors were based on mechanics, and therefore formal mathematical approach was much more popular.

In consequence an idea of "biological economy" ought to be treated as a watchword, catch phrase, not followed by deeper research rooted in evolutionary paradigm. In his books, articles and speeches Marshall took care mostly on dissemination of idea of market equilibrium,

description of optimally adapted agents to given economic environment and many other concepts of neoclassical economy.

But as it frequently happens in the history of idea, not the work itself but the way of its reading and re-reading by future generations of researchers matters. This was a case with the work of Marshall. In spite of its clear neoclassical sound, some of his pieces were named as strictly evolutionary and his willingness to search for biological analogies essentially influence styles of thinking of many future generations of economists.

Thorstein Veblen (1857-1929) was the next economist in the end of the 19th century who clearly declared for evolutionary approach to economic analysis. In his famous article of 1898 he stated the question *Why is economics not an evolutionary science?* Very important and fundamental question but he did not give a full answer for it. Similar like Marshall, Veblen has not proposed cohesive research programme based on evolutionary paradigm. In the Veblen tradition an adjective ‘evolutionary’ is used in the next decades by institutionalists for description of very specific kind of development based on selection principle, but without more detailed precision of selection mechanisms (as it was done by evolutionary biologists after Darwin). Veblen, like Marshall, saw in biology the way of finding fertile metaphors for better understanding of economic and social processes, especially those of technological change of capitalist economy. His proposition differs from that of Marshall’s in putting more attention to dynamics of change and without taking care on static analysis and analysis in the state of economic equilibrium (the neoclassical concepts of equilibrium and static analysis was clearly borrowed from physics, especially from classical mechanics). “The question is not how things stabilize themselves in a ‘static state’, but how they endlessly grow and change.” (Veblen, 1934, s. 8). He considered as much more important a postulate of better understanding of economic development and technological change. He wrote in 1898, “an evolutionary economics must be a theory of a process of cultural growth as determined by the economic interest, a theory of a cumulative sequence of economic institutions stated in terms of the process itself.” (Veblen, 1919, s. 77).

Veblen studied enormously biology, psychology, philosophy and social sciences. It is worth to mention that his second published article (in 1892) was a discussion with article of Spencer *From Freedom to Bondage*. In many articles he presented good knowledge of Darwinism, Mendel genetics, theory of mutation of Hugo de Vries. Using his biological knowledge and philosophical ideas of Charles Sanders Peirce and William James, Veblen has attempted to build evolutionary theory of socio-economic development. He has assumed that human behaviour is dominated by thought customs. Veblen tried to find causes of origin, emergence and further development of those thought habits. Being under the influence of instincts theory presented by Spencer in *Principles of Psychology* (1855) and ideas of William McDougall, presented in *Introduction to Social Psychology* (1908), Veblen has postulated that the roots of these customs

ought to be searched in human instincts. Emergence of human habits results from evolutionary adaptation of man to continuously changing environment in which he lives. Cultural changes, everyday experiences and technological changes shapes these thought customs. But still Veblen's approach missed an explanation how these mental customs become the heredity element of human nature. From his notion of instinct there was only a step toward working out his concept of institution. In opinion of Veblen (1919, p. 241) "institutions are outgrow of habit. The growth of culture is a cumulative sequence of habituation, and the ways and means of it are the habitual response of human nature to exigencies that vary incontinently, cumulatively, but with something of a consistent sequence in the cumulative variations that so go forward". Veblen saw analogies between institutions and genes. He interpreted socio-economic development in categories of Darwinian selection. "The life of man in a society, just as the life of other species, is a struggle for existence, and therefore it is a process of selective adaptation. The evolution of social structure has been a process of natural selection of institutions. The progress which has been and is being made in human institutions and in human character may be sat down, broadly, to a natural selection of the fittest habits of thought and to a process of enforced adaptation of individuals to an environment which has progressively changed with the growth of community and with the changing institutions under which men have lived. Institutions are not only themselves the result of a selective and adaptive process which shapes the prevailing or dominant types of spiritual attitude and aptitudes; they are at the same time special methods of life and human relations, and are therefore in their turn efficient factors of selection. So that the changing institutions in their turn make for a further selection of individuals endowed with the fittest temperament, and a further adaptation of individual temperament and habits to the changing environment through the formation of new institutions".(Veblen, 1899, p. 188)

Veblen has not gone further than verbal description of the process of socio-economic development. He has not worked out methodological base for formal treatment of this process, what would enable to build mathematical description of the process of economic change. There are a few reasons of limitations of further development of the idea of 'biological economics' in the first decades of the 20th century. Biological evolution was still young science, still defining itself. And although Darwin ideas influences significantly the work of social researchers all those influences were visible at the level of concept not at the level of formal, mathematical models of socio-economic phenomena. Research was focused on qualitative description and classification problems. Almost no progress was done in qualitative approaches which would allow to build mathematical models. In such circumstances application of well known and reliable mathematical tools borrowed from Newtonian mechanics, tools applied for decades by physicists, was much easier and more fertile (especially in the short-term perspective). One of the popular theme of those period was competition as the base force controlling economic processes. Competition was treated as a force analogous to Newtonian gravitation, allowing to

reach equilibrium, but not as a selective force, in the Darwinian sense. All these economic considerations missed almost completely the problems of technological change. Diversity of products and processes, diversity observed in the everyday economic life, is caused by the technological change. Up to 1950s all considerations of economic process in terms of evolutionary perspective was confined to a verbal description. Neoclassical models have an elegant, mathematically aesthetical form and this feature has helped to their popularity and common acceptance within economist societies. Most of these models was linear ones. Evolutionary models, to encompass an essence of evolutionary approach, ought to be nonlinear ones – this requirement has not allowed for their analytical treatment. Thanks to development of computer technology in 1950s and 1960s it was possible to build and to analyse behaviour of evolutionary models, especially because of developing of so called simulation approach.

Creative destruction

Joseph A. Schumpeter (1883-1950) was the first who formulated and presented fully matured (although still far from any formal approach and without applying any mathematical models) proposition of principles and goals of economic analysis in evolutionary spirit. He did it in 1912 in his *Theory of Economic Development* and in later publications, e.g., Schumpeter 1928, 1935, 1939, 1942, 1947. In the marginalist theory, dominating in the beginning of the 20th century, the causes of development were searched in factors exogenous for economic process. One of the founders of the marginalist school, J.B. Clark (*The Distribution of Wealth*, 1894) treated population growth, changes in consumers attitudes, changes of production methods (emerging out of the current, normal economic activity) as such exogenous factors. This view was challenged by Schumpeter who correctly pointed out that such factors ought to be searched in the economic process itself. In his opinion, capitalism never can be the process at equilibrium state and never can be treated as a stationary process. The essential element of his theory is the concept of recurring structural changes, what he called *gales of creative destruction*, followed by waves of expansion and rapid growth; “evolution is lopsided, discontinuous, disharmonious by nature ... evolution is a disturbance of existing structures and more like a series of explosion than a gentle, though incessant, transformation”(Schumpeter, 1939, vol. 1, s. 102). Persons responsible for those gales of creative destructions are, introducing radical innovations, pioneering entrepreneurs. Entrepreneurs search for new productive and trade combinations (innovations in the understanding of Schumpeter) to gain greater profit. The entrepreneurs profit flows from, what Schumpeter used to call, temporary monopoly position. Profit emerges in the situation of economic growth, in other words in dynamic economy. In opinion of Schumpeter profit is not always the primary motivation for entrepreneurs, frequently such motivation comes from entrepreneur personal will for artistic creation, outlet for his temperament, wish to show

his possibilities, just through initiation of novel actions.

Schumpeter was so convinced of evolutionary character of capitalistic economy that in 1942 he wrote: “The essential point to grasp is that in dealing with capitalism we are dealing with an evolutionary process. It may seem strange that anyone can fail to see so obvious a fact which moreover was long ago emphasized by Karl Marks.” (Schumpeter J.A., 1943, *Capitalism, Socialism and Democracy*, London, Allen & Unwin, p. 82). But it is necessary to mention that Schumpeter’s understanding the adjective ‘evolutionary’ is slightly different than these of Darwinian or Lamarckian. Economic development, as all evolutionary processes, is historical one in which future development is determined by the past pathway of changes as well as by the current state of this process. “Every concrete process of development finally rests upon preceding development ... Every process of development creates the prerequisites for the following” (Schumpeter J.A., 1934, p. 64). Innovations in economic process, as mutations in biological evolution, are essential element of development. In 1939 he wrote that economic evolution is equivalent to “changes in the economic process brought about by innovation, together with all their effects, and the responses to them by economic system” (Schumpeter, 1939, vol. 1 s. 86). In opinion of Schumpeter, those changes “illustrate the same process of industrial mutation – if I may use that biological term – that incessantly revolutionizes the economic structure *from within*, incessantly destroying the old one, creating a new one. This process of Creative Destruction is the essential fact about capitalism” (Schumpeter, 1942, s. 84).¹⁴

We can find elements of selection and search for innovations in those statements, i.e. the most essential mechanisms of evolutionary processes. But in his later works his understanding of evolutionary process is different than that in his early works. “The term evolution may be used in a wider and in a narrower sense. In the wider sense it comprises all the phenomena that make an economic process non-stationary. In the narrower sense it comprises these phenomena minus those that may be described in terms of continuous variations of rates within an unchanging framework of institutions, tastes, or technological horizons, and will be included in the concept of growth” (Schumpeter, 1954, s. 964). It means that for Schumpeter ‘evolution’ in wider sense is almost the same as ‘change’ and in the narrower sense is equivalent to economic growth.

Notion that economic changes comes ‘from within’, not exogenously for economic process, seems to be one of the most important contributions of Schumpeter’s theory. This notion shaped future development of evolutionary approach to economic analysis. The Schumpeter’s vision

¹⁴ Few decades earlier Schumpeter (1912 (1934)) expressed it as follows: ”By ‘development’ ... we shall understand only changes in economic life as are not forced upon it from without but arise by its own initiative, from within.” (p. 63) „Development in our sense is a distinct phenomenon, entirely foreign to what may be observed in the circular flow or in the tendency toward equilibrium. It is spontaneous and discontinuous change in the channels of flow, disturbance of equilibrium, which forever alters and displaces the equilibrium state previously existing.” (p. 64)

leads to diminishing the role of analysis of economic process in the state of equilibrium and makes the analysis in the states far from equilibrium and analysis of transition processes much more important. Schumpeter's approach to economic analysis stresses qualitative changes as much more important. Although it is very difficult to encompass them in mathematical models or by any formal approach. Qualitative changes and generation of economic diversity are the central categories of long-term perspective of economic changes. Therefore for Schumpeter the most interesting are those changes "which so displaces its equilibrium point that the new one cannot be reached from the old one by infinitesimal steps. Add successively as many mail coaches as you please, you will never get a railway thereby" (Schumpeter, 1912 (1934) p. 64).

As we mentioned, for Schumpeter the essential is innovation introducing (or as he wrote in 1912 (p. 65): "To produce means to combine materials and forces within our reach. To produce other things, or the same things by different method, means combine these materials and forces differently." By innovation he understood: "(1) the introduction of a new good ... or a new quality of good. (2) The introduction of a new method of production ... (3) The opening of a new market, ...(4) The conquest of a new source of raw materials or half-manufactured goods ... (5) The carrying out of the new organization of any industry ..." (Schumpeter, 1934, p. 66).¹⁵

In 1947 he related innovation to historical and non-reversible changes, repeating the phrase of 1912 he wrote: "This historic and irreversible change in the way of doing things we call 'innovation' and we define: innovations are changes in production function which cannot be decomposed into infinitesimal steps. Add as many mail-coaches as you please, you will never get a railroad by so doing" (Schumpeter, 1947).

Schumpeter pointed out very essential feature of capitalistic economy, feature being in fact general for all evolutionary processes, namely that effective development strongly depends on diversity and that diversity is the basic source of innovation and can be named evolutionary engine. Diversity leads to diminishing current quality of systems performance, therefore from the short-term perspective is disadvantageous. But it is beneficial in the long-term perspective. As Schumpeter wrote (1942, p. 83): "A system ... that at *every* point in time fully utilizes its possibilities to its best advantage may yet in the long run be inferior to a system that does so at *no* given point in time, because the latter's failure to do so may be a condition for a level or speed of long-run performance."

In the end of description of Schumpeter's influence on development of evolutionary economics it is honest to mention some paradoxical fact. Schumpeter is considered as one of the founder of evolutionary approach to economic analysis, and in such a way are re-read his works

¹⁵ He repeats this opinion in *Capitalism, Socialism, Democracy*: "The fundamental impulse that acts and keeps the capitalist engine in motion comes from the new consumer's goods, the new methods of production or transportation, the new market, the new forms of industrial organization that capitalist enterprise creates" (Schumpeter, 1942, p. 83).

in the last decades. But Schumpeter commenting the possibility of using biological analogies to analysis economic phenomenon wrote that “no appeal to biology would be of the slightest use” (Schumpeter, 1954, p. 789). And this opinion seems to be stable in his thinking. In 1912 he wrote not very salutary words on evolutionary approach in economics. To excuse Schumpeter we can suppose that this opinion was based on very specific, seemingly wrong, understanding of transmission of biological ideas to economic analysis, and from very personal Schumpeter’s attitude to some streams of economic analysis at the beginning of the 20th century. At the beginning of the chapter on *The fundamental phenomenon of economic development* he wrote:

Closely connected with the metaphysical preconception ... is every search for a “meaning” of history. The same is true of the postulate that a nation, a civilization, or even the whole of mankind, must such a matter-of-fact mind as Roscher assumed and as the innumerable philosophers and theorists of history in the long brilliant line from Vico to Lambrecht took and still take for granted. Here, too, belong all kinds of evolutionary thought that centre in Darwin – at least if this means no more than reasoning by analogy – and also the psychological prejudice which consists in seeking more in motives and acts of violation than a reflex of the social process. But the evolutionary idea is now discredited in our field, especially with historians and ethologists, for still another reason. To the reproach of unscientific and extra-scientific mysticism that now surrounds the “evolutionary” ideas, is added that of dilettantism. With all the hasty generalisations in which the word “evolution” plays a part, many of us have lost patience. (Schumpeter, 1912 (1934), s. 57-8).

Very specific methodological appeal, which stresses importance of long term changes of economic process and the attempt to understand economic development within a wider, general view, build on assumed general theoretical program, distinguishes Schumpeter’s approach from the neoclassical one. It was also the proposition of Schumpeter to treat economic agent not as maximizing his behaviour in any thinkable manner, but rather as a subject aiming for betterment his situation on the background of all others.

Routines, searching for innovation and selection

One of the specific feature of capitalists systems is presence of relatively high diversity of products. Chamberlain (1962/1933, see also Robinson, 1933) proposed a model of monopolistic competition with the product diversity included. Proposition of Chamberlain was to combine an idea of monopoly and competition using an analogy of chemical synthesis processes. Chemical processes from their nature require continuous flow and changes of conditions in which they proceed. The nature of this processes allows to identify both static and dynamics characteristics. Although Chamberlain’s model was still rooted in neoclassical paradigm it includes an evolutionary elements, namely it focused attention to importance of products diversity and wide

spectrum of selection of different products to be selected for ongoing production.

In spite of its dynamical features, the Chamberlain's model is not based on evolutionary grounds. Armen A. Alchian was the first who did it almost two decades later. Alchian searched for the way to replace neoclassical maximization principle by biological concept of natural selection. Possibility of application of 'natural selection' idea to describe firm's behaviour was discussed by Alchian in 1950 and by Penrose two years later (Alchian, 1950; Penrose, 1952). As Alchian argued, competition is not described by the motive of profit maximization but by "adaptive, imitative, and trial-and-error behaviour in search for profit" and therefore "those who realize *positive profit* are the survivors; those who suffer losses disappear". Alchian vision is clearly concordant with the Darwinian proposition (Alchian, 1950, s. 211-3). The work of Alchian was the first very important step toward building mathematical models of economic development on the base of evolutionary metaphors. In one place he states that "[t]he economic counterparts of genetic heredity, mutations, and natural selection are imitation, innovation, and positive profits" (Alchian, 1950, s. 220). In very suggestive way he presents the way of analysing of firms' behaviour in competitive environment.

A useful, but unreal, example in which individuals act without any foresight indicates the type of analysis available to the economist and also the ability of the system to "direct" resources despite individual ignorance. Assume that thousands of travelers set out from Chicago, selecting their roads completely at random and without foresight. Only our "economist" knows that on but one road are there gasoline stations. He can state categorically that travelers will *continue* to travel only on that road; those on other roads will soon run out gas. Even though each one selected his route at random, we might have called those travelers who were so fortunate as have picked that road wise, efficient, foresighted, etc. Of course, we would consider them the lucky ones.

In this article he have not considered one very important element of firms' behaviour, namely the searching processes of competing firms for technological innovation. In similar neoclassical fashion Alchian treated technological changes as coming from outside. It seems that the main aim of Alchian article was not to show virtues of evolutionary approach but to point out some consequences of using maximization principle treated as the primary motive of economic agent's actions.

The proposition of Alchian and Penrose was developed, and fully rooted in evolutionary paradigm, by Nelson and Winter in their numerous articles and books – e.g. Nelson (1968), Winter (1964, 1971), Nelson and Winter (1973, 1977, 1980, 1982). The primary interest of Nelson and Winter was situation of competing firms searching for innovation. Each firm is characterised by a set of routines on which firms base their behaviour in different, heterogenous environment in which they act during the time of the firm's development. By routines Nelson and Winter (1982, p. 14) understood "regular and predictable behavioral patterns of firms".

Routine means “a pattern of behavior that is followed repeatedly, but is subject to change if conditions change” (Winter 1964, p. 264n). Routines encompass “technical routines for producing things ... procedures of hiring and firing, ordering new inventory, stepping up production of items in high demand, policies regarding investment, research and development, advertising, business strategies about product diversification and overseas investment” (Nelson, Winter 1982, p. 14). Search for innovation and ways of proceeding research are, to some extent, also governed by routines. “Routines govern choices as well as describe methods, and reflect the facts of management practice and organizational sociology as well as those of technology” (Winter, 1984). Each firm search for new routines and new combination of routines for improving its situation when compare to its competitors. In contrast to neoclassical approach, firms in Nelson and Winter’s model do not optimize their behaviour. Firms “cannot optimize in any formal sense because their decision problems are too complicated for them to comprehend fully. The actions of our model’s firms at any time are governed by a set of decision rules, and we do not regard these rules as deducible from any ‘optimization’ calculations. However, as evolutionary theorists, we expect the rules actually employed to be sensible and plausibly responsive to conditions in the firms’ environment” (Nelson, Winter, 1978).

Each routine, and all sets of routines characterising a firm, can change if environmental conditions in which firms act changes. “As a first approximation .. firms may be expected to behave in the future according to the routines they employed in the past ... it is quite inappropriate to conceive of firms behavior in terms of deliberate choice from a broad menu of alternatives that some external observer considers to be ‘available’ alternatives. The menu is not broad but narrow and idiosyncratic” (Nelson, Winter, 1982, s. 134).

To complete the picture it is necessary to mention other trends of modern economic analysis conductive to the research on economic processes within evolutionary paradigm like behavioralists (among them Herbert Simon, Richard M. Cyert and James G. March), managerialists (W. J. Baumol and Oliver E. Williamson) and observations of Nicholas Kaldor, especially his *Economics without Equilibrium* (Kaldor, 1985). According to Kaldor, market is never balanced in the sense of Walras. Business people know it and take into account this qualitative fact in their activity, introducing innovations and fulfilling orders. In spite of theoretical postulates, we do not observe any tendency to price uniformization (toward the equilibrium price), quite contrary, through introducing innovations, and in response to ongoing changes on the market, economic agents contribute to emergence of high diversity of prices. The pervasive mode of price setting is mark-up pricing, and only from time to time, when the business is not going on as expected, the margin of price is modified. The industrial development is a historical process in which an important role is played by phenomena known under the title of *cumulative causation*.

In the theory of firm by Coase (1937), Penrose (1959), Cyert and March (1963), Simon

(1955...1988) the basic notion is that firms knowledge is far from being complete and everlasting. Firms can not be called *maximizers*. They aim to satisfy some general criterions of firm's behaviour, and therefore it is better to call them *satisficers*. Man's rationality is not full, the reality is too complex to take into account all influences, constraints and prerequisites to make optimization. Human action, and firms' behaviour, are governed by rules of behaviour, worked out during long processes of men development and firms growth. Therefore Herbert Simon speaks about *bounded rationality* of human being. Similar opinion was expressed by Cyert and March (1963), who also argue that for firm to act properly it is not necessary to have clear and precision criterion. In most cases those criterions are fuzzy, they exist in verbal forms only, not in a form of any set of well defined equations.

Managerists pointed out that, in contrast to the orthodox view of economic analysis, profit is not dominant category influencing managers decisions. Propositions of Baumol and Williamson were the first which postulated the change of our opinion in that matter. Baumol (1959) proposed to use revenue with the profit rate constraint instead of merely profit. Williamson's proposition (1964) goes into more general frame of managerial utility maximization.

Final remarks

Modern evolutionary economics can be characterized as an analysis of economic process focused on analysis of economic development in short- and long term perspectives, on searching for causes and identification of mechanisms of industries emergence and persistence, on research on motivations of economic agents and on understanding of their actions.

The scope of research of modern evolutionary economics encompass such fields as:

- O influence of technological and organizational innovations on aggregate characteristics of economic activity and attempts to understand economic processes applying notions of Darwinian processes of selection and mutations (Schumpeter, 1928, 1947, Dosi 1983, Haag, Weidlich, Mensch 1987, Kleinknecht 1987, Silverberg 1987, Freeman 1990, Verspagen 1993);
- O behaviour of industries and firms under the pressure of technological and price competition, searching for evolutionary mechanisms of acting at the levels of industry and firm, research on diversification of behaviour of economic agents (routines, institutions), (Alchian 1950, Winter 1971, 1975, Nelson and Winter 1980, 1982, Iwai 1984a, 1984b, Matthews 1984, Gowdy 1985, Kwaśnicki, Kwaśnicka 1992, Kwaśnicki 1994/1996);
- O market as an institution seen in the evolutionary perspective (Hayek 1948, 1978, Witt 1985, Metcalfe 1989);
- O uniqueness of economic development (*path-dependence, irreversibility, cumulative*

- causation*) (David 1985, Arthur, Ermoliew, Kaniovski 1987, Kuran 1989, Lesourne 1991);
- O knowledge development and mechanisms of emergence of social behaviour and institutions inducing changes of structure of economic system (Simon, 1959, 1979, 1984, Polanyi, 1962, 1967, Hayek 1937, 1945, 1967, Boyd, Richardson 1980, Hirshleifer 1982, Vanberg 1986, Sugden 1989, Kwaśnicki 1994/1996))
 - O technological change and its influence on long-term social development and on human civilization (Marchetti 1980, Boulding 1981, Day, Walter 1989, Faber, Proops, 1990);
 - O research on personal, psycho-developmental factors encouraging man to imposing changes and forwarding him to improving his/her situation and encouraging man to search for innovation (Loasby 1983, Dopfer 1986, Witt 1989, Mises, 1966).

Evolutionary economics is still at the initial phase of development. Evolutionary paradigm in economic analysis is far from the matured formulation but development of evolutionary economics in the last decades allows to conclude that the description of economic process and behaviour of economic agents at the micro- level as provided by researchers working within evolutionary paradigms is far more completed and more closer to reality than the description proposed by orthodox economists. But there is no satisfactory description of evolutionary view of macroeconomic processes, there exist only relatively good and satisfying macroeconomic evolutionary description at the verbal level. There is general lack of evolutionary models describing development of national or global economies. The first approaches based on the bottom-up approach lead to large scale models of national economies. The models of this kind are very difficult to follow and there are problems with full understanding what is going on behind them. The advantage of neoclassical models is that they exist, although highly aggregated and with very unrealistic assumptions they are relatively easy to use and to understand their structures.

Further development of evolutionary economics require efficient and very specific tools of formal analysis. As Kenneth Boulding (1991) writes: “one of the great opportunities ... for the next few decades is the development of a mathematics which is suitable to social systems, which the sort of 18th-century mathematics which we mostly use is not. The world is topological rather than numerical. We need non-Cartesian algebra as we need non-Euclidean geometry, where minus minus is not always plus, and where the bottom line is often an illusion. So there is a great deal to be done”. Simulation approach, mostly used in analysis of nonlinear, evolutionary models in economic analysis, seems to be very useful but it does not completely fulfill the requirements to be considered as good and fully appropriate tool of formal analysis.

Using evolutionary approach to analysis of socio-economic processes has many advantages over the orthodox, mechanistic approach, e.g. contrary to the orthodox view, the problems of irreversibility (‘time arrow’) lays in the centre of interest of evolutionary economists.

Evolutionary economics focuses on dynamic, not static, view of economic processes. Transitional stages, processes in far-from-equilibrium states are considered as much more interesting and closer to reality. Observations of real economic processes suggests that socio-economic environment in which economic agents acts changes all the time and this only fact causes that in most real situation the equilibrium state can never be reached. But evolutionary approach allows to investigate economic processes also at the equilibrium state and to compare its results with those of neoclassical approach. In most cases, evolutionary economics confirm well known results of neoclassical analysis. Qualitative as well as quantitative changes are also placed within the frame of interest of evolutionary economics. Far more satisfying and more close to reality are the results of evolutionary research of human decision making processes.

One of the important criterions used by researchers to apply one or another approach is the potential of further development of given theory or approach. It seems that neoclassical paradigm has approached limits of its further development, but evolutionary paradigm, although as old as the neoclassical one and which has been developing much slower in the last 100 years, still has wide possibilities of its further development.

References

- Aghion P., Howitt P. (1990), *A Model of Growth Through Creative Destruction*, NBER Working Paper, 3223.
- Alchian A.A. (1950), Uncertainty, Evolution, and Economic Theory, *Journal of Political Economy*, 58, 211-21.
- Arthur W.B., Ermoliev Y.M., Kaniovsky Y.M. (1987), Path-dependent Processes and the Emergence of Macro-structure, *European Journal of Operational Research*, 30, 294-303.
- Arrow K.J. (1962), The Economic Implications of Learning-by-Doing, *Review of Economic Studies*, vol. 29, 155-173.
- Babbage, Charles (1846), *On the Economy of Machinery and Manufactures*, (1st edition 1832), 4th edition London: John Murray.
- Baumol, W. J. (1959), *Business Behavior, Value and Growth*, New York: Macmillan.
- Boulding K.E. (1981), *Evolutionary Economics*, Beverly Hills: Sage Publications.
- Boulding K.E. (1991), What is evolutionary economics?, *Journal of Evolutionary Economics* 1(1), 9-17.
- Boyd, Robert, Richerson, Peter J. (1980), Sociobiology, Culture and Economic Theory, *Journal of Economic Behavior and Organization* (1, 97-121.
- Brown, Theodore (1981), *The Mechanical Philosophy and Animal Oeconomy*, New York: Arno.
- Chamberlain E. (1962) *The Theory of Monopolistic Competition*, Cambridge, Mass., Harvard University Press (the first edition in 1933)
- Clark N., Juma C. (1987), *Long Run Economics: An Evolutionary Approach to Economic Growth*, London, Pinter Publishers.
- Coase R. (1937), The Nature of the Firm, *Economica*, 4, pp. 386-405.

- Cyert R., March J. (1963), *A Behavioral Theory of the Firm*, Englewood Cliffs, N.J.: Prentice-Hall.
- Darwin Charles, 1904, *The Descent of Man*, 2nd ed., New York: Hill
- David P.A. (1985), Clio and Economics of QWERTY, *American Economic Review*, 75, Papers and Proceedings, 322-7.
- Day R.H., Walter J.-L. (1989), Economic Growth in the Very Long Run, on the Multiple-Phase Interaction of Population, Technology, and Social Infrastructure, in W.A. Barnett, J. Geweke, K. Shell (eds), *Chaos, Sunspots, Bubbles, and Nonlinearity*, Cambridge: Cambridge University Press, 253-89.
- Dopfer K. (1986), Causality and Consciousness in Economics: Concepts of Change in Orthodox and Heterodox Economics, *Journal of Economic Issues*, 20, 509-23.
- Dosi G. (1983), Technological Paradigms and Technological Trajectories. The determinants and directions of technical change and the transformation of the economy. in Freeman Ch. (ed), *Long Waves in the World Economy*, London, Butterworths.
- Dosi Giovanni, Freeman Christopher, Nelson Richard R., Silverberg Gerald, and Soete Luc (eds.) (1988), *Technical Change and Economic Theory*, London, Pinter Publishers.
- Faber M., Proops J.L.R. (1990), *Evolution, Time, Production and the Environment*, Berlin: Springer.
- Freeman, C. (1990), Schumpeter's Business Cycle Revised, in Heertje, A., Perlman, M. (eds), *Evolving Technology and Market Structure - Studies in Schumpeterian Economics*, Ann Arbor: Michigan University Press.
- Georgescu-Roegen Nicholas (1971), *The Entropy Law and the Economic Process*, Cambridge, MA, Harvard University Press.
- Gordon Wendell, Adams John (1989), *Economics as a Social Science: An Evolutionary Approach*, Riverdale, Md, Riverdale.
- Gowdy J.M. (1985), Evolutionary Theory and Economic Theory: Some Methodological Issues, *Review of Social Economy*, 43, 316-24.
- Grossman G.M., Helpman E. (1989), *Growth and Welfare in a Small open Economy*, NBER Working Paper, 2970.
- Grossman G.M., Helpman E. (1990), Comparative Advantage and Long Run Growth, *American Economic Review*, vol. 80, 796-815.
- Grossman G.M., Helpman E. (1991a), Quality Ladders in the Theory of Growth, *Review of Economic Studies*, vol. 58, 86-91.
- Grossman G.M., Helpman E. (1991b), *Innovation and Growth in the Global Economy*, Cambridge Mass: MIT Press.
- Gruber, Howard E. (1974) *Darwin on Man: A Psychological Study of Scientific Creativity, together with Darwin's Early and Unpublished Notebooks*, transcribed and annotated by Paul H. Barrett, New York: E.P. Dutton & Co., Inc..
- Haag G., Weidlich W., Mensch G. (1987), The Schumpeterian Clock, in D. Batten, J. Casti, B. Johansson (eds), *Economic Evolution and Structural Adjustment*, Berlin: Springer, 187-226.
- Hanusch H. (ed.) (1988), *Evolutionary economics: application of Schumpeter's ideas*, Cambridge University Press.
- Hayek Friedrich A. (1937), Economics and Knowledge, *Economica*, 4, 33-54.
- Hayek Friedrich A. (1945), The Use of Knowledge in Society, *American Economic Review*, September.
- Hayek Friedrich A. (1948), *Individualism and Economic Order*, Chicago, University of Chicago Press.
- Hayek, Friedrich (1960), *The Constitution of Liberty*, London: Routledge.

- Hayek Friedrich A. (1967), Notes on the Evolution of Systems of Rules of Conduct, in F.A. Hayek, *Studies in Philosophy and Economics*, London: Routledge and Kegan Paul, 66-81.
- Hayek Friedrich A. (1971), Nature vs. Nature Once Again, *Encounter*, 36, 81-3.
- Hayek Friedrich A., (1978), Competition as a Discovery Procedure, in F.A. Hayek, *New Studies in Philosophy, Politics, Economics and the History of Ideas*, London: Routledge & Kegan Paul, 179-90.
- Hayek F.A. (1978) *New Studies in Philosophy, Politics, Economics and the History of Ideas*, London: Routledge and Kegan Paul.
- Hayek F.A. (1982) *Law, Legislation and Liberty*, 3-volume combined edition, London: Routledge and Kegan.
- Hayek, Friedrich (1988), *The Fatal Conceit. The Errors of Socialism*, Chicago: The University of Chicago Press.
- Hayek F.A. (1991) *The Trend of Economic Thinking: Essays on Political Economists and Economic History*, London: Routledge.
- Herder, Johann G. (1784/1821), *Ideen zur Philosophie der Geschichte der Menschheit*, Leipzig: J.F. Hartknoch, the second edition 1821).
- Hodge, M.J.S., Kohn, D. (1985), The Immediate Origins of Natural Selection, in Kohn (1985), s. 185-206.
- Hicks J.R. (1932), *The Theory of Wages*, New York, Macmillan.
- Hirschleifer J. (1977), Economics from a Biological Viewpoint, *Journal of Law and Economics*, vol. 20, no. 1. 1-52.
- Hirschleifer J. (1982), Evolutionary Models in Economics and Law, *Research in Law and Economics*, vol. 4, pp. 1-60.
- Humboldt, Wilhelm von (1977), *Über die Verschiedenheit des menschlichen Sprachbaues und ihren Einfluss auf die geistige Entwicklung des Menschengeschlechtes*, (published in 1836 by Druckerei der Königlichen Akademie der Wissenschaften) in 1977 published in *Gesammelte Schriften*, eds. A. Flitner i K. Giel, Darmstadt
- Hume, David (1739), *A Treatise of Human Nature*, in Hume (1886), Vol. I i II.
- Hume, David (1779), *Dialogues Concerning Natural Religion*, the first edition around 1757, published in David Hume, *Philosophical Works*, Vol. III, eds. T.H. Green i T.H. Grose, London: Longmans, Green, in 1886r.
- Hume, David (1886), *Philosophical Works*, eds. T.H. Green i T.H. Grose, London: Longmans, Green.
- Hodgson Geoffrey M., Screpanti Ernesto (eds) (1991), *Rethinking Economics: Markets, Technology and Economic Evolution*, Edward Elgar.
- Hodgson Geoffrey (1993), *Economics and Evolution: Bringing Life Back into Economics*, Cambridge: Polity Press.
- Hodgson Geoffrey M, Warren J. Samules, Marc R. Tool (eds.), 1994, *The Elgar Companion to Institutional and Evolutionary Economics*, Edward Elgar, str. 896, dwa tomy
- Hodgson Geoffrey M (ed.) 1995, *Economics and Biology*, Edward Elgar str. 608
- Iwai K. (1984a), Schumpeterian dynamics: an evolutionary model of innovation and imitation, *Journal of Economic Behavior and Organization*, 5 (159-90).
- Iwai K. (1984b), Schumpeterian dynamics, part II: Technological progress, firm growth and 'economic selection', *Journal of Economic Behavior and Organization*, 5, 321-351.
- Kaldor Nicholas (1934), A classificatory note on the determinateness of equilibrium, *Review of Economic Studies*, 1(1), February, 122-36, re-published in Targetti, Thirlwall (1989).
- Kaldor N. (1957), A Model of Economic Growth, *Economic Journal* (patrz Kaldor 1980)
- Kaldor N. (1966), *Causes of the Slow Rate of Growth of the United Kingdom*, Cambridge:

- Cambridge UP.
- Kaldor N. (1970), The Case for Regional Politics, *Scottish Journal of Political Economy*, vol. XVII (in Kaldor 1978)
- Kaldor N. (1972), The irrelevance of equilibrium economics, *Economic Journal*, 82(4), December, 1237-55 (in Targetti, Thirlwall (1989), and Kaldor (1978))
- Kaldor N. (1961), Capital Accumulation and economic growth, in Lutz F. (ed.) *The Theory of Capital*, London, Macmillan, Reprinted in Kaldor 1978A.
- Kaldor Nicholas (1972), The Irrelevance of Equilibrium Economics, *The Economic Journal*, 82(4), December, pp. 1237-55.
- Kaldor N. (1978), *Further Essays on Economic Theory*, London: Duckworth
- Kaldor N. (1980), *Essays on Economic Stability and Growth*, 2nd ed. London: Duckworth.
- Kaldor N. (1985), *Economics Without Equilibrium*, University College Cardiff Press.
- Kamien M., Schwartz N. (1982), *Market Structure and Innovation*, Cambridge University Press, Cambridge, U.K.
- Kennedy C. (1964), Induced Bias in Innovation and the Theory of Distribution, *Economic Journal*, vol. LXXIV, 541-547.
- Kleinknecht, A. (1987) *Innovation Patterns in Crisis and Prosperity*, London: Macmillan.
- Kohn, D. (ed.) (1985), *The Darwinian Heritage*, Princeton: Princeton University Press.
- Kuran T. (1989), Sparks and Prairie Fires: A Theory of Unanticipated Political Revolution, *Public Choice*, 61, 41-74.
- Kwaśnicka, H., Kwaśnicki, W. (1992), Market, Innovation, Competition. An evolutionary model of industrial dynamics, *Journal of Economic Behavior and Organization*, vol. 19, 343-68
- Kwaśnicki, W. (1994/1996), *Knowledge, Innovation, and Economy. An Evolutionary Exploration.*, Wrocław: Oficyna Wydawnicza Politechniki Wrocławskiej; the second edition in 1996 by Edward Elgar Publishing Limited; Cheltenham, UK, Brookfield, US.
- Lesourne J. (1991), *Économie de l'ordre et du désordre*, Paris: Economica.
- Loasby B.J. (1983), Knowledge, Learning, and Enterprise, in J. Wiseman (ed.), *Beyond Positive Economics?*, London: Macmillan, 104-21.
- Lucas R.E.B. (1988), On the Mechanisms of Economic Development, *Journal of Monetary Economics*, vol. 22, 3-42.
- Marchetti C. (1980), Society as a Learning System: Discovery, Invention, and Innovation Cycles Revised, *Techn. Forecasting and Social Change*, 18, 267-82.
- Marshall, A. (1904), On a National Memorial to Herbert Spencer, *Daily Chronicle*, 23 Nov.
- Marshall A. (1925), Mechanical and biological analogies in economics, in A.C. Pigou (ed.) *Memories of Alfred Marshall*, London, Macmillan, p. 314
- Marshall A. (1948), *Principles of Economics*, 8th edition, London: Macmillan (the first edition in 1890)
- Marshall A. (1961), *Principles of Economics*, 9th edition, London: Macmillan.
- Matthews R.C.O. (1984), Darwinism and Economic Change, in Collard D.A, Helm D.R., Scott M.F.G., Sen A.K. (eds), *Economic Theory and Hicksian Themes*, Oxford: Clarendon Press, 91-117.
- Mayr, Ernst (1985), Darwin's Five Theories of Evolution, in Kohn (1985).
- McDougall, William, (1908) *Introduction to Social Psychology*, London: Methuen.
- Menger Carl (1871/1950/1981), *Principles of Economics*, New York: New York University; (1950) *Principles of Economics*, Edited by James Dingwall and Bert F. Hoselitz. Glencoe, Ill.: Free Press.
- Menger Carl (1883/1985), *Investigations into the Method of the Social Sciences with Special Reference to Economics*, New York: New York University Press.

- Menger Carl (1963), *Problems of Economics and Sociology*, Urbana:: University of Illinois Press. trans. F.J. Nock from the German edition of 1883 with an introduction by Louis Schneider, Urbana, IL: University of Illinois Press.
- Menger, Carl (1892), On the Origin of Money, *Economic Journal*, 2(2), June, pp. 239-55.
- Metcalf S. (1989), Evolution and Economic Change, in Silberston (ed.), *Technology and Economic Progress*, London:Macmillan, 54-85.
- Mirowski Philip (ed.) (1986), *The Reconstruction of Economic Theory*, Kluwer-Nijhoff, Boston.
- Mirowski P. (1988), *Against Mechanism - Protecting Economics from Science*, Totawa, N.J.: Rowman & Littlefield.
- Mirowski Philip (1989), *More Heat than Light: Economics as Social Physics, Physics as Nature's Economics*, Cambridge, Cambridge University Press.
- Mises Ludwig von (1966), *Human Action: A Treatise on Economics*, 3rd rev. ed. Chicago: Henry Regnery (the first edition in 1949, New Haven: Yale University Press).
- Nelson Richard R. (1968), A 'Diffusion' Model of International Productivity Differences in Manufacturing Industry, *American Economic Review*, 58, 1219-48.
- Nelson Richard R. (1987), *Understanding Technical Change as an Evolutionary Process*, Amsterdam, North-Holland.
- Nelson R.R., Winter S.G. (1973), Toward an Evolutionary Theory of Economic Capabilities, *American Economic Review*, Vol. 63, 440-449.
- Nelson Richard R., Winter Sidney G. (1977), In Search of Useful Theory of Innovation, *Research Policy*, 6(1).
- Nelson R. and Winter S. (1978), Forces generating and limiting concentration under Schumpeterian Competition, *Bell Journal of Economics*, 9, no. 2.
- Nelson Richard R., Winter Sidney G. (1980), Firm and Industry Response to Changed Market Conditions: An Evolutionary Approach, *Economic Inquiry*, XVIII (2), April, 179-202.
- Nelson Richard R., Winter Sidney G. (1982), *An Evolutionary Theory of Economic Change*, Harvard University press, Cambridge, MA.
- Penrose E. T. (1952), Biological analogies in the theory of the firm, *American Economic Review*, vol. 42, no. 5, 804-19
- Penrose, E.T. (1959), *The Theory of Growth of the Firm*, New York: Wiley.
- Phelps E.S. (1966), Models of Technical Progress and the Golden Rule of Research, *Review of Economic Studies*, vol. 33, 133-145.
- Polanyi Michael (1962), *Personal knowledge: Towards a Post-Critical Philosophy*, Harper Torchbooks, New York.
- Polanyi Michael (1967), *The Tacit Dimension*, Doubleday Anchor, Garden City, N.Y.
- Powell, Jim (1995), Herbert Spencer: Liberty and Unlimited Human Progress, *The Freeman*, April, str. 252-3
- Robinson J. (1933), *The Economics of Imperfect Competition*, London, Macmillan.
- Romer P.M. (1986), Increasing Returns and Long Run Growth, *Journal of Political Economy*, vol. 94, 1002-1037.
- Romer P.M. (1990), Endogenous Technological Change, *Journal of Political Economy*, vol. 98, S71-S102.
- Sahal D. (1981), *Patterns of Technological Innovation*, Addison-Wesley Publishing Company, Inc.
- Schiller, Freidrich J.C. (1793), *Über die ästhetische Erziehung des Menschen in Sämtliche Werte*, Studtgart und Tübingen: J.G. Cotta, 1812-15, Vol. 8; ponownie wydane jako *Über die ästhetische Erziehung des Menschen in einer Reihe von Briefen*, Kurt Hoffmann, ed., Bielfeld: Velhagen & Klasing, 1934.

- Schulze, H., (1913), *Deutsches Fremdwörterbuch*.
- Schumpeter J.A. (1912), *Theorie der Wirtschaftlichen Entwicklung*, Leipzig: Duncker und Humbolt, English edition in 1934, *The Theory of Economic Development. An Inquiry into Profits, Capital, Credit, Interest, and the Business Cycle*, Cambridge, Mass.: Harvard University Press (translated by Redvers Opie).
- Schumpeter J.A. (1928), The Instability of Capitalism, *Economic Journal*, XXXVIII (151), September, 361-86.
- Schumpeter J.A. (1935), The Analysis of Economic Change, *Review of Economics and Statistics*, 17, 2-10.
- Schumpeter J.A. (1939), *Business Cycles: A Theoretical, Historical, and Statistical Analysis*, 2 volumes, New York: McGraw-Hill Company.
- Schumpeter J.A. (1942), *Capitalism, Socialism, and Democracy*, New York: Harper & (1950, Oxford University Press, Oxford, reprinted Harper Colophon, 1975).
- Schumpeter J.A. (1947), The Creative Response in Economic History, *Journal of Economic History*, VII (2), November, 149-59.
- Schumpeter J.A. (1954), *History of Economic Analysis*, Oxford University Press, New York.
- Schumpeter J.A. (1960/1912), *Teoria wzrostu gospodarczego*, PWN, Warszawa (Polish edition; original: 1912, *Theorie der wirtschaftlichen Entwicklung*, Leipzig, Duncker & Humbolt.)
- Schweber, S.S. (1980), Darwin and the Political Economists; Divergence of Character, *Journal of History of Biology*, 13 (2), Fall, pp. 195-289.
- Shell K. (1967), A Model of Inventive Activity and Capital Accumulation, in Shell K. (ed.), *Essays on the Theory of Optimal Growth*, Cambridge Mass.: MIT Press, 67-85.
- Schweber, S.S. (1977), The Origin of the *Origin* Revised, *Journal of the History of Biology*, 10(2), Fall, pp. 229-316.
- Silverberg G. (1987), Technical Progress, Capital Accumulation and Effective Demand: A Self-Organizational Model, in D. Batten (ed.) *Economic Evolution and Structural Change*, Berlin-Heidelberg-New York, Springer-Verlag.
- Simon Herbert A. (1955), A Behavioral Model of Rational Choice, *Quarterly Journal of Economics*, 69, pp. 99-118. (reprinted in Simon (1957)
- Simon Herbert A. (1957), *Models of Men*, New York: Wiley.
- Simon Herbert A. (1959), Rational Decision-Making in Business Organization, *American Political Science Reviews*, September.
- Simon Herbert A. (1959a), Theories of Decision-Making in Economics, *American Economic Review* 49, 253-283.
- Simon Herbert A.. (1979), Rational Decision Making in Business Organizations, *American Economic Review*, 69, pp. 493-513.
- Simon Herbert A.. (1965), *Administrative Behavior*, 2nd ed. Free Press, New York.
- Simon Herbert A. (1984), The Behavioral and Rational Foundations of Economic Dynamics, *Journal of Economic Behavior and Organization*, 5, pp. 35-55.
- Simon Herbert A.. (1986), On behavioral and rational foundations of economic dynamics, in Richard H. Day, Gunnar Eliasson (eds.) *The dynamics of market economics*, Elsevier Science Publishers]
- Simon Herbert A. (1988), Human Nature in Politics: The Dialogue of Psychology with Political Science, in *Between Rationality and Cognition: Policy-making under Conditions of Uncertainty, Complexity and Turbulence*, M. Campanella (ed.), Torino: Albert Meynier (11-34 (first published in *American Political Science Reviews*).
- Smith, Adam (1759/1911), *Theory of Moral Sentiments*, London: G. Bell and Sons, pierwsze wydanie (1759), London: A. Millar.

- Smith, Adam (1776/1976), *An Inquiry into the Nature and Causes of the Wealth of Nations*, Oxford: Oxford University Press.
- Smith, Adam (1954), *Badania nad naturą i przyczynami bogactwa narodów*, Warszawa.
- Solow R.M. (1956), A Contribution to the Theory of Economic Growth, *Quartely Journal of Economics*, vol. 70, 65-94.
- Solow R.M. (1957), Technical Change and the Aggregate Production Function, *Review of Economics and Statistics*, Aug., 39, 312-320.
- Sollow R.M. (1970), *Growth Theory: An Exposition*, Oxford: Oxford UP.
- Spencer, Herbert (1851), *Social Statics*, London:Chapman.
- Spencer, Herbert (1855), *The Principles of Psychology*, London: Williams and Norgate.
- Spencer, Herbert (1890), *First Principles*, 5th edn, London: Williams and Norgate.
- Spencer, Herbert (1892), *Essays Scientific, Political and Speculative*, New York: Appleton.
- Sudgen Robert (1989), Spontaneous Order, *Journal of Economic Perspectives*, 3 (4), Fall, 85-97.
- Targetti Ferdinando, Thirlwall Anthony P. (eds) (1989), *The Essential Kaldor*, New York: Holmes & Meier.
- Urbanek, Adam (1984), Powstawanie "Powstawania ..." - darwinowska koncepcja doboru naturalnego jako odkrycie naukowe, *Nauka Polska* 1, 3-29.
- Uzawa H. (1965), Optimum Technical Change in an Aggregative Model of Economic Growth, *International Economic Review*, 18-31.
- Vanberg Victor (1986), Spontaneous Market Order and Social Rules: A Critical Examination of F.A. Hayek's Theory of Cultural Evolution, *Economics and Philosophy*, 2 (1), April, 75-100.
- Veblen T. (1898), Why is economics not an evolutionary science?, *Quartely Journal of Economics*, vol 12, 374-97.
- Veblen, T. (1899), *The Theory of the Leisure Class: An Economic Study of Institutions*, New York: Macmillan.
- Veblen T. (1919), *The Place of Science in Modern Civilisation and Other Esseys*, New York: Heubsch. Reprinted in 1990 with a new introduction by W.J. Samuels, New Brunswick: Transaction.
- Veblen T. (1934), *Essays on our Changing Order*, ed. W.C. Mitchell, New York: Augustus Kelley.
- Verspagen Bart (1993), *Uneven Growth Between Interdependent Economies. An evolutionary view on technology gaps, trade and Growth*, Averbury.
- Vorzimmer, P.J. (1977) *Charles Darwin: The Years of Controversy; The Origin of Species and its Critics, 1859-1882*, Philadelphia: Temple University Press.
- Wallace A.R. (1898), *The Wonderful Century. Its Successes and Failures*, New York.
- Wärneryd K. (1990), *Economic Institutions - Essays in Institutional Evolution*, Stockholm: Gotab.
- Weissmahr J.A. (1992), The Factors of Production of Evolutionary Economics, in U. Witt (ed.), *Explaining Process and Change - Approaches to Evolutionary Economics*, Ann Arbor: University of Michigan Press, 67-79.
- Wieland, Christoph Martin (1800), *Aristipp und einge seiner Zeitgenossen*, Leipzig: B.G.J. Göschen.
- Williamson Oliver E. (1964), *The Economics of Discretionary Behavior: Managerial Objectives in a Theory of the Firm*, Englewood Cliffs, N.J.: Prentice-Hall.
- Winter S.G. (1964), Economics "Natural Selection" and the Theory of the Firm, *Yale Economic Essays*, Vol. 4, 225-272.
- Winter S.G. (1971), Satisficing, Selection and the Innovating Remnant, *Quarterly Journal of Economics*, 85, 237-61.

- Winter S.G. (1975), Optimization and Evolution in the Theory of the Firm, in R. Day, T. Groves (eds), *Adaptive Economic Models*, New York: Academic Press.
- Witt U. (1985), Coordination of Individual Economic Activities as an Evolving Process of Self-Organization, *Economie Appliquee*, 37, 569-95.
- Witt U. (1986), Firms' Behavior under Imperfect Information and Economic Natural Selection, *Journal of Economic Behavior and Organization*, 7, 265-90.
- Witt U. (1989), Subjectivism in Economics - A Suggested Reorientation, in K.G. Grunert and F. Ölander (eds), *Understanding Economic Behavior*, Boston: Kluwer, 409-31.
- Witt Ulrich (1991), Reflections on the Present State of Evolutionary Economic Theory, in Hodgson, Screpanti (1991).

Acknowledgments

I would like to thank Karol I. Pelc for his very useful comments on the first version of this paper. Naturally, all errors and omissions are still mine.

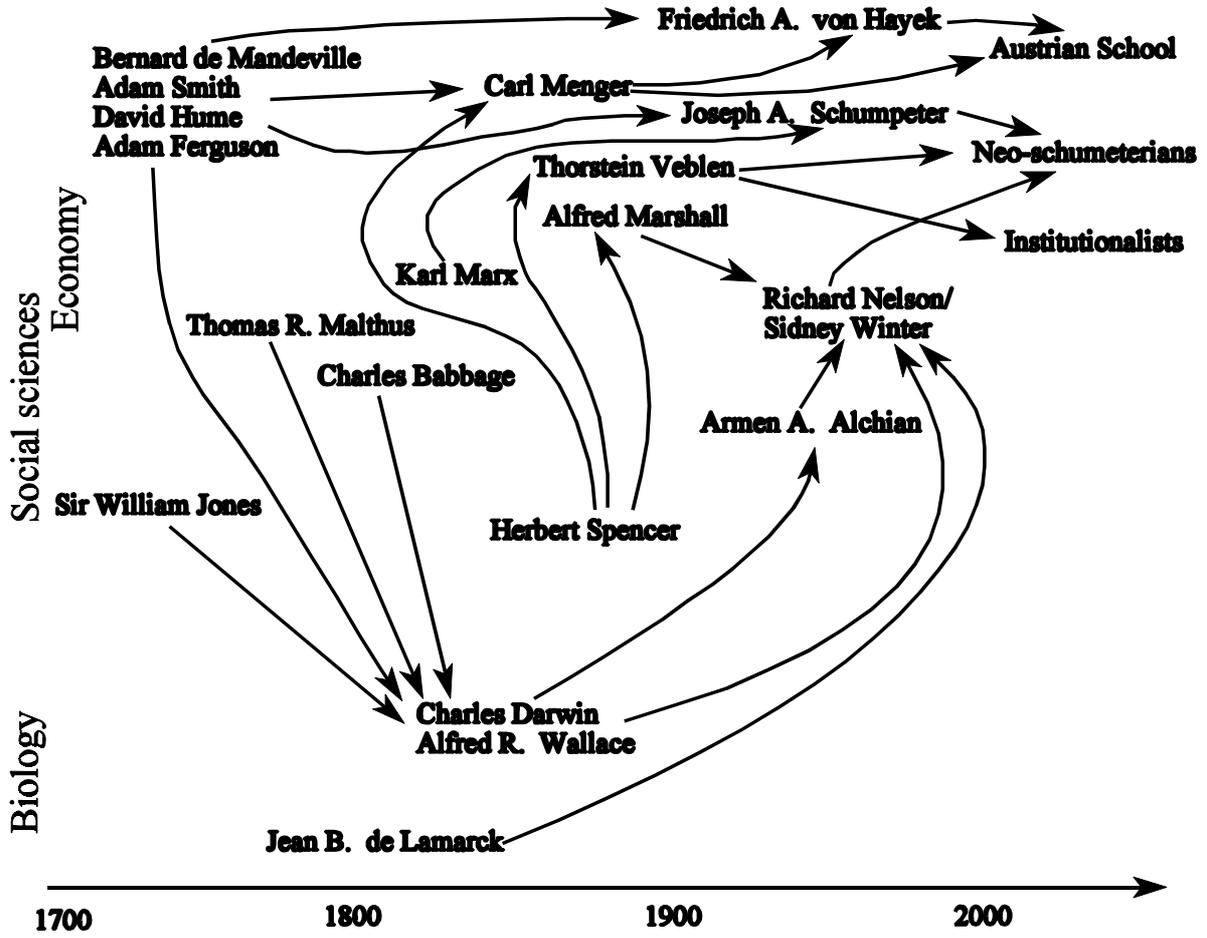


Figure 1. Roots of evolutionary economics