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Exploring post-Schumpeterian economics  
-Nicholas Georgescu-Roegen as a stepping stone-

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Exploring post-Schumpeterian economics  
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Abstract

Joseph Alois Schumpeter (1883-1950) advocated for understanding as forgiveness and remained unaffiliated with any specific school of thought. Despite leading the “Harvard Circle,” he didn’t establish a distinct Schumpeterian school. However, his ideas significantly influenced modern evolutionary economics, leading to the emergence of the neo-Schumpeterian school. This prompts inquiries into the relationship between Schumpeter’s ideas and the development of the neo-Schumpeterian school. Recent concerns about the future of heterodox economics underscore challenges in theoretical development. This study seeks to reassess Schumpeter's concept of "economic evolution" and its resonance with the neo-Schumpeterian school, comparing it with Nicholas Georgescu-Roegen’s ideas. It aims to identify any disparities in the neo-Schumpeterian’s interpretation and discuss methodological and epistemological aspects of “post-Schumpeterian economics”.

*Key words:* economic evolution, Joseph Alois Schumpeter, Nicholas Georgescu-Roegen, bioeconomics, neo-Schumpeterian school

*JEL classification:* B15, B25, O33, O43

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## 1. Introduction

Joseph Alois Schumpeter (1883-1950) is widely known for his assertion, as stated at the beginning of Schumpeter ([1908] 2010), that “to understand is to forgive<sup>1</sup>”. He did not align himself with any particular school of thought, nor did he actively seek to form one, showing a general indifference to the formation of schools of thought<sup>2</sup>. The latter part of his academic career coincided with what has been called the “golden age” of the economics department at Harvard University (Tsuru, 1993), during which the “Harvard Circle”, a research group formed by Schumpeter together with his colleagues and students, came into being. However, unlike the Keynesian school that emerged directly from the Keynes Circus at Cambridge University, the Harvard Circle did not lead to the formation of a distinct Schumpeterian school. Schumpeter’s exceptional successors, led by Paul A. Samuelson, ventured into their own domains rather than strictly adhering to Schumpeter’s areas of study. As a result, Schumpeter has been classified as a unique heterodox economist, often described as a “lone wolf” (Ito and Nei, 1993).

Nevertheless, Schumpeter is regarded as one of the intellectual sources of modern evolutionary economics, with the term ‘Neo-Schumpeterian school’ already established to refer to discussions and scholars who incorporate his ideas and vision as core elements. Comparing the relationship between Schumpeter and the neo-Schumpeterian school with that between Keynes and the Keynesian school (especially the post-Keynesians), it can be said that while there is no continuity in terms of personal connections, sporadic references to

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<sup>1</sup> Schumpeter ([1908] 2010), p. ix.

<sup>2</sup> In Haberler (1950), for example, Schumpeter said in a lecture to students at the University of Bonn: “I have never tried to bring about a Schumpeter school. There is none and it ought not to exist. ... Economics is not a philosophy but a science. Hence there should be no ‘schools’ in our field” (p. 372).

Schumpeter are made in discussions of economic theory and policy, much like his disciples, the neo-Schumpeterian school has also diverged from Schumpeter to pursue its own development<sup>3</sup>.

This raises questions about the characteristics of the neo-Schumpeterian school: What is its relationship to Schumpeter's own achievements? Is Schumpeter's economic thought really inherited by the neo-Schumpeterian school? These questions were vigorously debated at the time of the emergence of the neo-Schumpeterian school, and there is a wealth of existing research on the subject. Although they appear to be historical points of contention, revisiting these questions may shed light on the future direction of the established Neo-Schumpeterian school.

Furthermore, recent concerns about the future of modern heterodox economics have been raised by Hodgson (2019). Hodgson suggests that a lack of theoretical development, particularly in relation to the theories associated with Nelson and Winter (1982), poses a challenge to contemporary evolutionary economics, including the neo-Schumpeterian school. While acknowledging the significant differences between Schumpeter's era of capitalism and the present, the contemporary relevance of the research findings of the neo-Schumpeterian school should be recognised. However, given Schumpeter's ambitious conception of an integrated economic system combining theory, history and statistics, and his ultimate goal of constructing "economic sociology" (the universal social science), it seems timely to re-evaluate Schumpeter's ambitious ideas as well as the "Schumpeterian thinking" that underlies the historical

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<sup>3</sup> Shionoya (1998) examines the research trends of the neo-Schumpeterian school to determine whether various concepts characteristic of biological evolution can be found in Schumpeter's theory of economic development. Shionoya himself concludes that this is not an economic system that can be interpreted through biological metaphors (pp. 188-189).

origins of the school.

Against this academic background, the aim of this study is to re-examine Schumpeter's concept of "economic evolution", which is a common element underlying the aforementioned questions, and to consider how to bridge this concept with the notion of "economic evolution" generally shared by the neo-Schumpeterian school. Adopting a perspective from the history of economics, this study hypothesises that Nicholas Georgescu-Roegen (1906-1994) is one of the successors who inherited Schumpeter's concept of "economic evolution" and developed his own economics (ultimately leading to contemporary ecological economics). Thus, the study compares and examines the concepts of "economic evolution" proposed by Schumpeter and Georgescu-Roegen on the basis of primary sources. Furthermore, this study hypothesises that there may be some misalignment or deviation between the neo-Schumpeterian school's understanding of Schumpeter's "economic evolution" and that of Schumpeter himself. Therefore, this study aims to discuss the methodological and epistemological research of "post-Schumpeterian economics", which seems to take a different direction from that of the neo-Schumpeterian school, based on the results of the comparison between Schumpeter's and Georgescu-Roegen's "economic evolution" carried out in this study.

In the following sections, we will first organise and compare Schumpeter's and Georgescu-Roegen's concepts of "economic evolution" on the basis of primary sources. Next, we will discuss the discrepancies or deviations in the neo-Schumpeterian school's understanding of Schumpeter's "economic evolution". Finally, based on the results of this study, we will comment on the methodological and epistemological research of "post-Schumpeterian economics", which seems to take a different direction from the neo-Schumpeterian school. Finally, we will briefly summarise the results of this

study.

## 2. Schumpeter and Georgescu-Roegen' s Personal Relationship

Born in 1883 in what is now the Czech Republic, Schumpeter developed his own economic system under the influence of the Austrian School of pure economic theory and the German Historical School. After experiences in academia at the University of Czernowitz and the University of Graz, as well as an excursion into politics and finance, he returned to academia at the University of Bonn. During his European years, he wrote works such as *The Nature and Essence of Economic Theory* (1908, hereafter '*Essence*') and *The Theory of Economic Development* (1912, hereafter '*Development*'), laying the foundations of economic theory early in his career. Despite briefly leaving academia due to failures in politics and finance, he emigrated to the United States in 1932 and became a prominent figure in the economics department at Harvard University until his death in 1950. During his time in the US, he wrote works such as *Business Cycles* (1939, hereafter referred to as *Business*) and *Capitalism, Socialism, and Democracy* (1942), attempting to integrate his established economic theory with statistics and history, while envisioning the establishment of "economic sociology" (a comprehensive social science), a goal that remained unfulfilled.

Born in Romania in 1906, Georgescu-Roegen began his research career in mathematics and statistics. He met Schumpeter by chance and was greatly influenced by him when he visited Harvard University in 1934 on a Rockefeller Foundation fellowship to apply his statistical methods to economic indicators. Although his stay at Harvard lasted only about a year and a half until 1936, Schumpeter's influence was significant. Georgescu-Roegen himself said in his autobiography that he was "the only true Schumpeterian, I believe. My only

degree in economics is from the Universitas Schumpeterriana” (Szenberg ed., 1992, p. 130)<sup>4</sup>. Schumpeter appreciated Georgescu-Roegen’s mathematical talents and offered him the co-authoring of a book on the theoretical apparatus of economics and an appointment at Harvard University. However, Georgescu-Roegen returned to his native Romania and Schumpeter’s plans did not materialise<sup>5</sup>. In Romania, Georgescu-Roegen became acutely aware of the inadequacy of neoclassical economic analysis in understanding agricultural economies and gained a new perspective on the importance of institutions in economic analysis<sup>6</sup>. His conception of bioeconomics (or institutional economics) can be said to have emerged from his experiences in his homeland. He returned to the United States in 1948 after the Second World War and spent 27 years at Vanderbilt University. His collection of essays, *Analytical Economics* (1966), included papers on mathematical economics written during his time at

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<sup>4</sup> Andersen (2009) sees Schumpeter’s system as more than just a school of economics, as Schumpeter expressed it in terms of a ‘university’ rather than a ‘school’. This perspective suggests that Schumpeter’s system goes beyond being categorised as just a school of economics, which relates to the use of the label ‘post-Schumpeterian economics’ in this study.

<sup>5</sup> The footnote to the preface of the German fourth edition of *The Theory of Economic Development* (1935) reveals plans to publish a ‘Theoretical Apparatus of Economics’ (‘Theoretischer Apparat der Ökonomie’) as a replacement for the second edition of *Essence* (Entwicklung, 4th edition, p. xiv. See also Shionoya 2004). Given Georgescu-Roegen’s time at Harvard, one can speculate that the co-authored work Schumpeter hoped for with him refers to this unrealised book.

<sup>6</sup> Kuwata (2015) also points this out (p. 103). Moreover, the following passage from Georgescu-Roegen (1976), quoted there, expresses it vividly: “What caused me to look at the economic process from an unorthodox viewpoint is the peculiar nature of the economy of my native country, Romania, at the time when I returned from my training in the Western schools with a formidable armamentarium of mathematical standard economics. To begin with, I despaired at discovering that that armamentarium could hardly help me penetrate the economic problems of that country. Romania’s institutions were not adapted to the Western principle of profit maximization, a fact which at first appeared to me and, most certainly, to any Western observer as crass organizational ineptitude” (p. xi).

Harvard, criticising neoclassical economics on technical and epistemological grounds. It is important to note, however, that his intention was to show how mathematics should be properly applied to the study of human intentions and actions in economics, rather than to reject mathematics altogether<sup>7</sup>. In addition, his 1976 collection of essays, *Energy and Economic Myths*, reprinted work, particularly on bioeconomics and institutional economics, in response to his major work, *The Entropy Law and the Economic Process*, published five years earlier. Since the 1970s, his research has focused on the re-evaluation and concretisation of material economic cycles characterised by qualitative change and irreversibility, applying the second law of thermodynamics, making him one of the pioneers of modern ecological economics.

Although Schumpeter and Georgescu-Roegen had only a short period of direct contact at Harvard University, their research relationship on “economic evolution” seems to have been quite intimate, as can be seen from their biographies. Several similarities can be identified. First, both were deeply interested in the unique concept of “economic evolution” within economics. Although this is self-evident, both sought to transcend the mainstream economic theories of the time, such as general equilibrium theory or neoclassical behaviourism, and to establish their own dynamic theories (although not necessarily rejecting them outright), aiming to open up new fields of economic sociology and bioeconomics (particularly strong tendencies in Schumpeter’s case) through the practical application of a “new synthesis” to existing theoretical components of economics. On the other hand, both temporarily left academia and developed an understanding of the need for new fields by experiencing or observing the realities of economic society. In the case of Georgescu-Roegen, as noted above, his experiences in his native Romania

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<sup>7</sup> Georgescu-Roegen (1992), 155-156.



were a major turning point in his approach, while recent research suggests that Schumpeter, particularly his experiences in the financial industry in Vienna, had a significant influence on his ultimately unfinished theories of money and credit (Peneder and Resch, 2021).

### 3. Reconfirmation of Schumpeter's theory of economic evolution: literature tracking

There is already a wealth of previous research on Schumpeter's theory of economic evolution. In this study, we aim to reconfirm Schumpeter's theory of economic evolution by tracing the process of its establishment, picking up as much as possible on references to it in his major works.

First, we will examine Schumpeter's seminal work, *Essence*, published in 1908. In this work, Schumpeter clearly evaluates Marshall's biological analogy and rejects its application. This is articulated in the fifth part of the book, where the general epistemological and methodological aspects of pure economic theory are discussed in a coherent manner.

The only reason that compels him [Marshall] to give preference to the biological analogy over the mechanical one was the striving to bring the moment of development into our discipline. ... This is correct. But unfortunately, Marshall does not say that, but rather only indicates the motive that economy is a "science of life." (Schumpeter [1908] 2010, p. 393)

*Essence* discusses static theory within Schumpeter's dichotomy of economic analysis, relying heavily on Walrasian general equilibrium theory. Unsatisfied with this, however, Schumpeter alludes to the content to be discussed in depth in his next major work, and in the final part of the same book alludes to

Marshall's inspiration regarding biological analogy<sup>8</sup>. Marshall, like Schumpeter, was aware of the limitations of mechanistic reasoning, but ultimately failed to develop the biological analogy to overcome them. Both Schumpeter and Marshall wanted to develop a dynamic theory of development and growth over time, although they started from a static theory. The difference lies in Marshall's struggle to integrate mechanistic and biological analogies<sup>9</sup>, whereas Schumpeter remained relatively faithful to the dichotomy of static and dynamic. The following quotation seems to illustrate this well.

[O]ur discipline can still be very close to biology epistemologically, and neither receive stimuli from it, nor can it give such to it ... as long as a treatment of the economical phenomena by themselves and without going into their most inner being, is able to offer us more than such an entering, as long as an independent discipline of economy even therefore exists, is also independent, and suffices for itself. (ibid., p. 394)

Next we turn to Schumpeter's second major work, *Development*, published in 1911. Although this work does not contain direct and extensive references to biological evolution or evolutionary thought in the main text, Schumpeter is

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<sup>8</sup> Marshall's active emphasis on biological reasoning is evident in the following quote: "The Mecca of the economist lies in economic biology rather than in economic dynamics. But biological conceptions are more complex than those of mechanics; a volume on Foundations must therefore give a relatively large place to mechanical analogies ... But in fact it [the present volume] is concerned throughout with the forces that cause movement: and its key-note is that of dynamics rather than of statics" (Marshall [1890] 2013, pp. xxv-xxvi). "The main concern of economics is thus with human beings who are impelled for good and evil, to change and progress. Fragmentary statical hypotheses are used as temporary auxiliaries to dynamical - or rather biological - conceptions: but the central idea of economics, even when its Foundations alone are: under discussion, must be that of living force and movement" (ibid., p. xxvi).

<sup>9</sup> See Hodgson (1993a), (1993b) and Shionoya (1998) for discussions of Marshall's economic biology.

positioned as one of the pioneers of modern evolutionary economics. Furthermore, the basis for the neo-Schumpeterian school's adherence to Schumpeter lies in his theory of economic development. Thus, there has been a significant accumulation of diverse previous research on this topic<sup>10</sup>. In this study, we limit our focus to Schumpeter's reliance on Marx to reaffirm the evolutionary nature of Schumpeter's theory of economic development. This is because Engels, an ally of Marx, in his eulogy at Marx's funeral, praised Marx's achievements by comparing them to Darwin's theory of evolution, which seems to be a clue to the question of the link with Schumpeter's biological evolution of economic development, which was heavily based on Marx: "Just as Darwin discovered the law of the development of organic nature, so Marx discovered the law of development of human history ... the degree of economic development attained by a given people or during a given epoch form the foundation upon which the state institutions, the legal conceptions, art, and even the ideas on religion, of the people concerned have been evolved, and in the light of which they must, therefore, be explained, instead of vice versa, as had hitherto been the case<sup>11</sup>".

A notable starting point is therefore the "Preface to the Japanese Edition" (1937). Schumpeter states the purpose of the book and makes it clear that the intentions and ideas of his theory of development are exactly the same as those of Marx's economic thought: "I was trying to construct a theoretic model of the process of economic change in time, or perhaps more clearly, to answer the question how the economic system generates the force which incessantly transforms it<sup>12</sup>".

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<sup>10</sup> Apart from those mentioned in the text, see e.g. A Navigational Guide in Dopfer et al. eds. (2024), Introduction and Part 1 in Hanusch and Pyka eds. (2007), and for a more concise and comprehensive review see Fagerberg (2003).

<sup>11</sup> Engels (1883), pp. 467-468.

<sup>12</sup> Schumpeter ([1937] 2006), p. 165.

[W]hat distinguishes him from the economists of his [Marx's] own time and those who preceded him, was precisely a vision of economic evolution as a distinct process generated by the economic system itself. (Schumpeter [1937] 2006, p. 166)

This passage, probably the most frequently quoted extract, underlines Schumpeter's belief that within static equilibrium there is a force inherent in the economic system itself which disturbs the equilibrium achieved. He believed that there must be a pure theory of economic change, distinct from the pure theory of steady state that he found in Marx's economic theory. The following passage seems to encapsulate this idea most clearly.

The only major attempt at the problem of development is that of Karl Marx. .... Apart from this achievement, Marx alone has another to show with regard to 'development'. He attempted to treat the development of economic life itself with the means of economic theory. His theory of accumulation, his theory of pauperisation, his theory of collapse really do arise from purely economic thought processes and his gaze is always directed towards the goal of conceptually penetrating the development of economic life as such and not merely its cycle at a certain point in time. But the bases of his theory are nevertheless of a thoroughly static nature - after all, they are the bases of the classics. And even if the tone breathes development and the moment of statics recedes in terms of representation, the classical building remains in his hands what it is by nature. (Schumpeter [1911] 1987, p. 84-85, translated by author)

This passage can be read as a tribute to Marx's method of theoretical construction, which aimed to develop a process of development that emerged

endogenously from the static theoretical framework of classical economics, as Schumpeter himself had sought to do. Thus, building on the static theory constructed in his earlier work, *The Essence*, Schumpeter sets out to explore the endogenous factors of development. Recent research suggests that Schumpeter's goal of an endogenous growth theory was understood as a theory in which "the process of self-transformation of the socio-economic system that is reflected both in quantitative and qualitative changes and in changes in the *modus operandi* of the system as a whole". The actors that make up such a system are the "entrepreneurs" who practice innovation and initiate the process of creative destruction, the "bankers" who take risks to provide funds for innovative practices, the "producers and hedonic consumers" who adapt to innovation and trigger waves of imitation, the "workers" who react passively to the changes they face, the "intellectuals" who interpret the socio-economic system and make judgements, and the "government" that intervenes in the economic process (Kurz 2024, p. 12). Through the interaction of their actions in the irreversible flow of time, the economic process evolves quantitatively and qualitatively, forming the framework of Schumpeter's theory of development.

From the above, it would seem that Schumpeter's concept of economic evolution is not derived from biological evolution, but in particular from Marx's vision of capitalist development. Witt (2002), who examined how evolutionary Schumpeter's theory of development is, confirmed that evolutionary thought itself is a product of philosophical and social scientific debates of the late eighteenth and early nineteenth centuries. He suggests that modern evolutionary concepts, based on Darwin's theory of natural selection and its successful extensions in biology, should be discussed on the basis of generalised evolutionary concepts rather than attempts at evolutionary economics, which characterise evolutionary approaches in economics while referring to Darwin's theory (p. 9). His general definition of evolution is "self-transformation through

the passage of time of the system under consideration”. He goes on to list three specific conditions that evolutionary theory in any academic field should meet: “dynamic”, “historical” and “self-transformation explanation” (p. 10). In the light of such arguments, it can be said that Schumpeter, unlike Marshall before him, is not bound by Darwin’s theory of evolution or biological analogy, and that he made his own breakthrough in addressing the dynamic issues with which Marshall struggled.

Finally, *Business*, published in 1939, is seen as the culmination of Schumpeter’s economic theory. Five years before the publication of this book, in 1934, Schumpeter published the English edition of *Development*, with new footnotes relating to his vision of ‘economic evolution’.

[W]hat we are about to consider is that kind of change arising from within the system 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 [1934] 2021, p. 79, n. 6)

The approach to development outlined here led to a specific change in terminology from ‘development’ to ‘evolution’ explicitly in *Business*. Yagi (2008) examines in detail the transition in Schumpeter’s usage from “development” to “evolution”, which became explicit from the mid-1930s onwards, based on literature and materials, as Schumpeter, who had been cautious about using biological analogies, began to use “evolution” explicitly instead of “development”. Of course, “evolution” in this context does not refer to biological evolution or its analogy, but to a concept specific to the economic and social sphere.

The changes in the economic process brought about by innovation, together with all their effects, and the response to them by the economic system, we shall designate by the term Economic Evolution. Although this term is objectionable on several counts, it comes nearer to expressing our meaning than does any other, and it has advantage of avoiding the associations suggested by the cognate term Progress, particularly the complacency the latter seems to imply. (Schumpeter [1939] 1964, p. 61)

Yagi (2008) also points out that while Schumpeter warned that the use of “evolution” should be distinguished from “progress”, it remains unclear whether he was consciously avoiding associations with biological “evolution” altogether. However, given the lack of active references to biological evolution, it would be natural to understand Schumpeter’s “evolution” as synonymous with “development” or economic evolution.

The following quotation highlights another perspective that is worth noting.

[F]irst, if we deal with, say, the organism of a dog, interpretation of what we observe divides readily into two branches. We may be interested in the processes of life going on in the dog, such as the circulation of the blood, its relation to the digestive mechanism, and so on. But however completely we master all their details, and however satisfactorily we succeed in linking them up with each other, this will not help us to describe or understand how such things as dogs have come to exist at all. Obviously, we have here a different process before us, involving different facts and concepts such as selection or mutation or, generally, evolution. (ibid., p. 14)

This extract illustrates the kind of analysis that is possible when the dog is studied. Even if one is well versed in the details of an organism such as a dog

as an organisation, including its internal blood circulation or the structure of its digestive system and its connections, this does not help in describing or understanding how dogs came to be. This suggests that no matter how detailed the observation of the functional differentiation of the internal organs or tissues of a dog (viewed through the lens of biological evolution), it does not explain anything about the organism itself as a unified entity, how it came to be. This understanding of functional differentiation and its integration suggests that, in Marshall's case too, he was trying to explain it by biological analogy, whereas Schumpeter used examples from zoology not to explain biological evolution but to suggest a logic for explaining the existence of the economy as an organism. In *Business*, he agreed to use "economic evolution", but this does not mean that it should be explained by biological analogy.

I'll end the literature review of Schumpeter's view of economic evolution here, because with *Business*, Schumpeter's unique economic evolution, as distinct from biological evolution, and economic evolution would be used extensively thereafter. I'd like to briefly mention the other major work after *Business*. *Capitalism, Socialism and Democracy*, published in 1942, is considered to be a discussion of economic sociology, the ultimate goal of Schumpeter's research plan. For example, Shionoya (1997) positions this work as an elaboration of the economic evolution introduced in *Business* as a theory of systemic transformation, while *Development*, which is often referred to by the neo-Schumpeterian school and proponents of evolutionary economics, is seen as an "intermediate point" of Schumpeter's economic system based on economic evolution.

In connection with *Business*, although it is not Schumpeter's main work, I would also like to mention his article "Historical Approach to the Analysis of Business Cycles" (1951), when considering the content of his view of economic



evolution. As its subtitle indicates, *Business* aims to apply the theoretical framework integrating the static and dynamic theories constructed in *Essence* and *Development* to the reality of economic society. Schumpeter's methodological analysis of economic evolution seems to emerge from his attempt to integrate his own theory with statistical analysis and historical considerations. In this work, the role of historical investigation is particularly emphasised, as will be seen below.

It seems to me important, scientifically and practically, to bring out that all these phenomena are accidental in the sense defined, yet play a role that may very well decide the fate of capitalism. Since this can be done only by detailed historical case studies, the argument for the historical approach to business-cycle research seems established. In reality, however, we have established only half of it and, so far as the scientific aspect is concerned, the less important half. For historical research is required not only to elucidate the nature and importance of the nonessentials dealt with so far, but also to elucidate the underlying cyclical process itself. This underlying process, as depicted in the more important time series, suggests indeed dynamical schemata that may be framed in such a way as to fit practically any contour. (Schumpeter 1951, p. 152)

For Schumpeter, the accumulation of models of economic evolution (dynamic models) and historical analysis are two indispensable elements, and the relationship between them is characterised by the concepts of shock and its propagation. The addition of statistical analysis allows the results of historical analysis to be filled in with long-term time series data, thus revealing the overall mechanism. In particular, historical analysis, according to Schumpeter, "filling the bloodless theoretical schemata and statistical contour lines with live facts and toward making our meaning clearer and more vivid" (Schumpeter

[1939] 1964, p. 179), thus emphasising it more than theory and statistics<sup>13</sup>. In this way, Schumpeter's theory of economic evolution, whatever its success or failure<sup>14</sup>, can be seen as completed in the analysis of business cycles, allowing for a comprehensive view.

#### 4. Georgescu-Roegen's Biophysical Economics Concept: A Comparison with Schumpeter

Georgescu-Roegen's research seems to be divided into two main periods: an early period (mainly in the 1930s) characterised by a rigorous critique of the use of mathematical tools in the field of mathematical economics<sup>15</sup> and a departure from neoclassical economics based on observations of the agrarian economy in Romania, and a later period (from the 1970s) focused on a systemic and institutional understanding of the relationship between the natural environment and the economy from the perspective of the law of entropy. While the latter aspect, especially its connection to recent discussions in ecological economics, has been acknowledged and explored, a re-examination of Georgescu-Roegen's work in the light of a Schumpeterian perspective on

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<sup>13</sup> In Schumpeter's posthumous work *History of Economic Analysis* (1954), while maintaining the traditional view that Darwin's theory of evolution had little influence on the social sciences, he highly valued the historical sketches added in the third edition of Charles Darwin's *The Origin of Species* (Schumpeter 1954, p. 419, n. 19).

<sup>14</sup> As is well-known, *Business* received a critical but quite accurate review from Kuznets (1940).

<sup>15</sup> Georgescu-Roegen wrote the following four articles during his Harvard years in the 1930s: "Note on a proposition of Pareto," *Quarterly Journal of Economics*, XLIX (August 1935): 706-14; "Fixed coefficients of production and the marginal productivity," *Review of Economic Studies*, (October 1935): 40-9; "Marginal utility of money and elasticities of demand," *Quarterly Journal of Economics*, L (May 1936): 533-9; "The pure theory of the consumer's behavior," *Quarterly Journal of Economics*, L (August 1936): 545-93. All have been published in top journals.

“economic evolution”, which is the subject of this study, suggests a focus on the period or periods when his ideas on biophysical economics emerged, probably during a transitional phase from the early to the later period. Therefore, this section aims to clarify Georgescu-Roegen’s evolutionary thinking by focusing on two points: (1) what did Georgescu-Roegen absorb from Schumpeter? and (2) what is the nature of his biophysical economic concept constructed from this absorption? Building on previous research, we seek to elucidate his evolutionary thought.

#### (1) Acceptance of Schumpeter’s theory of economic development

Let us first confirm Georgescu-Roegen’s direct assessment of Schumpeter. Although there is no explicit discussion in the form of a separate paper or chapter, Schumpeter is referenced throughout Georgescu-Roegen’s work. From what I have read, there seems to be no instance where he refers to Schumpeter in a negative light. It is therefore evident that Georgescu-Roegen fully accepts Schumpeter’s claims and often cites them to support his own arguments after interpreting them. For example, Georgescu-Roegen (1988) discusses notable aspects of Schumpeter’s theory of economic evolution in a manner similar to the tracing of Schumpeter’s works in the previous section.

However, the new microbiology theory based on DNA explained only how from a single cell, the fertilized ovum, an immense number of other cells can be obtained to form a complete organism. Too bad that the new theory not only does not help us to explain the development process, that is, how cells differentiate into muscles, nerves, kidneys, and so forth, but it also actually constitutes a stumbling block on our way. (p. S294)

This argument corresponds to Schumpeter’s case for the dog as an organic entity. And it suggests that Schumpeter was the first to propose the elements

that underpin development. That is,

[a]ccording to him, economic development constantly occurs because of the constant flow of inventions that are the result of the normal activity of our minds and serve as basis for practical innovations. This is how we have passed from mail coaches to railway engines, to automobiles, and to rockets. (p. S295)

This is an extension of Schumpeter's example of the evolution from stagecoaches to railways to modern times, demonstrating the contemporary relevance of Schumpeter's theory of economic evolution. Also,

after completing the classification of the general types of innovation, Schumpeter pressed the point that innovation must not consist of a small, insignificant change. And to the dissatisfaction of all positivists of all walks of life, he argued that "small innovation" cannot possibly be defined analytically any more than "entrepreneur" - another famous Schumpeterian concept - can. Evolution, which is what economic development actually is, needs saltations, needs the emergence of successful "monsters"<sup>16</sup>. (ibid.)

From the above, we can define what has been inherited from Schumpeter to Georgescu-Roegen with regard to economic development, as both repeatedly use the following passage to define it: "Economic life is a unique process that goes on in historical time and in a disturbed environment"<sup>17</sup>.

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<sup>16</sup> This is a term coined by the biologist Richard Goldschmidt, which echoes similar arguments made by Schumpeter.

<sup>17</sup> Schumpeter (1951), p. 149.

## (2) Link with the concept of biophysical economics

The genesis of Georgescu-Roegen's concept of biophysical economics can be traced back to the realisation that the economic theories he had encountered mainly in the United States (although he did not accept them uncritically) were completely inapplicable to his subsequent experiences in his native Romania (see, for example, Bobulescu (2012), sec. 3 and Kuwata (2015), sec. 2). He reflects on this as follows.

[T]he fact is that only in the lands of plenty does the marginal principle maximize a complex of product proper and chosen leisure. In the lands of scarcity, however, people must work as long as they can, to the point of zero marginal productivity of labor, as illustrated by the splendid institution, not too old, of the gleaners. In conditions of scarcity, income distribution is made not according to marginal pricing, but according to some institutional rules. (Georgescu-Roegen 1992, p. 133)

From his observations in Romania, Georgescu-Roegen found evidence of the reality of agrarian societies without economic theory and the existence of economic theories without reality. He also found evidence that underlying economic behaviour are institutional backgrounds that vary with time and place. Contrary to Schumpeter's expectations, his experience on returning to his homeland seems to have strengthened his appreciation of Schumpeterian evolutionary thinking. Learning from history, or relying on history, can be understood in terms of the legacy of Schumpeter's theory of economic evolution, especially his analytical method of *Business*.

Let's now examine whether the Schumpeterian evolutionary thinking accepted by Georgescu-Roegen is related to his concept of biophysical economics in the way described above. Since Kozo Mayumi, who studied directly under

Georgescu-Roegen, has identified two pillars of biophysical economics, we can confirm the Schumpeter connection on this basis. Mayumi (2009) points out that the first pillar concerns external human evolution and qualitative, irreversible changes in economic processes.

The first aspect of external evolution, inspired by the biologist A.J. Lotka, represents a transition to an entirely new evolutionary style for humans, beyond biological evolution and dependent on resources and currencies generated from external energy. Georgescu-Roegen's approach to this reality through biophysical economics suggests that human existence is not determined solely by biology or economics, but rather by the internal logic inherent in institutions such as markets, money (credit) and corporations, which emerge in response to the gradual evolution of human external nature. Biophysical economics is therefore not just a new field within economics, but is conceived as a "new synthesis" that integrates evolutionary economics, institutional economics and biophysical analyses such as energy (Mayumi, 2009, p. 1237). Schumpeter's influence on this first pillar of biophysical economics can be seen in his consideration of institutions, which form and evolve over historical time, adapting to change.

Regarding the second pillar of qualitative and irreversible changes in economic processes, it is worth noting Georgescu-Roegen's direct reference to Schumpeter in the section entitled "Biophysical Economic Evolution" in Georgescu-Roegen (1992). Georgescu-Roegen first mentions Marshall, who is often associated with economic biology, alongside Schumpeter for similar reasons. He then focuses on Schumpeter as an economist who developed a framework not only for economics but for understanding evolution in all fields. Georgescu-Roegen explains Schumpeter's vision of economic evolution as constantly driven by discontinuous new axes of human ingenuity, and contrasts

it with the concept of growth by quantity addition. Schumpeter was the first to use the term “development” in contrast to the concept of growth by quantity addition, and he conceived of economic evolution as being constantly driven by discontinuous innovations, products of the continuous inventive capacity of the human mind. Schumpeter’s influence on the economic development discussed here is undeniable. According to Georgescu-Roegen, the continuous qualitative and structural changes in economic processes due to the emergence of new axes of reference require the dialectical integration of Schumpeter’s discontinuous concepts into traditional analysis in order to truly understand reality.

From these considerations it can be concluded that Schumpeter’s theory of economic evolution and Georgescu-Roegen’s biophysical economics are remarkably consistent in their evolutionary thinking, and it may be reasonable to assume that the latter encompasses the former. As for the subsequent developments that built on this foundation, while Schumpeter (perhaps) aimed to construct an economic sociology but left it unfinished, Georgescu-Roegen went on to develop a systemic methodology and model-building capable of analysing both the economy and the environment through the construction of flow-fund models. Although their specific interests may differ, Georgescu-Roegen can be considered one of the heirs of post-Schumpeterian economics in her anticipation of the construction of a field that includes not only economics but also peripheral areas.

##### 5. Comments on Gallegari’ s Concept of “Post-Schumpeterian Economics”

As noted above, the term 'post-Schumpeterian economics' is used in this study to distinguish it from contemporary neo-Schumpeterian economics. Although the term has been used in subtitles before, e.g. in Andersen (1994), it seems to emphasise the importance of modern evolutionary economics (Nelson and

Winter (1982) and its extensions) since the 1980s. Therefore, according to the hypothesis of this study, it does not aim at bridging the "gap" between Schumpeter and the neo-Schumpeterian school. In contrast, Beniamino Callegari's "Foundations of Post-Schumpeterian Economics" (20-21), discussed in this section, advocates the contemporary development of the Schumpeterian school through a reaffirmation of its Schumpeterian foundations from an ontological, analytical and methodological perspective, deliberately using the term "post-Schumpeterian" in an era where the label "neo-Schumpeterian" is already established. This awareness of these issues is also evident in this study. At the beginning of his work, Callegari states the following<sup>18</sup>:

Being founded more than thirty years after Schumpeter's passing, neo-Schumpeterian economics initially held a weak connection to the original contribution. While most founders were well acquainted with Schumpeterian thought, the actual analytical use of the Schumpeterian framework was sparse, with original approaches being more prominent. Schumpeter provided inspiration, and a degree of common ground, but analytical heterogeneity dominated. Furthermore, the object of study of the young neo-Schumpeterian school was limited in comparison to Schumpeter's, sporting a clear focus on technological innovation and micro competitive dynamics, both analyzed primarily from an evolutionary perspective. Monetary and financial aspects of development, in particular, were conspicuously missing, leading to a rather partial revival of the original contribution. (ibid., p. 1)

In order to reconstruct the ontological, analytical and methodological foundations of post-Schumpeterian economics, Callegari focused on three

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<sup>18</sup> Callegari further calls them 'spurious neo-Schumpeterian' immediately after this quote.



evolutionary thinkers: Schumpeter himself, Georgescu-Roegen and the French philosopher Henri Bergson. His emphasis was on clarifying the relationship between Schumpeter and Bergson, finding a Bergsonian foundation in Schumpeter's ideas and locating it clearly. Georgescu-Roegen, on the other hand, is positioned as an important mediator connecting them (ibid., p. 6)<sup>19</sup>. However, the positioning of Georgescu-Roegen in this study is different. In this study, Bergson is not mentioned at all, and due to the interests and preparation of the author, I would like to refrain from commenting on Callegari's new concept of post-Schumpeterian economics at this point.

Regarding the relationship between Bergson and Schumpeter, references can be found in Leontief (1950), Briefs (1960), Stolper (1994), but they mostly offer intuitive observations that Schumpeter's economic evolution is closer to Bergson's creative evolution than to biological evolution, without delving further. As a relatively recent precursor study, we can mention Kusuki (2024), who provides a literature-based argument for the proximity of the two from a creativity perspective, focusing on one aspect of Schumpeter's economic evolution. Andersen (2009) also discusses Bergson's influence on Schumpeter, noting that Bergson's ideas about time and consciousness seem directly relevant to understanding Schumpeterian entrepreneurs and how to incorporate them into cyclical flow models. However, Andersen also argues that Schumpeter avoided applying mathematics to the theory of development because of the influence of Bergson's ontology, so Schumpeter's contributions

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<sup>19</sup> However, in another passage, Andersen explained the relationship between the three as follows: "Bergson, considering the analytical, arithmomorphic approach a necessary and, properly supported, fertile analytical passage, proposed to support it with philosophical discourse. Georgescu-Roegen is the most critical of the three, arguing for a radical methodological shift, bringing dialectical reasoning to the fore and limiting the role played by arithmomorphic concepts and analytical similes. Schumpeter's own position is in the middle" (ibid., p. 33).

were “hidden in the cloud of semi-philosophical issues that emerged from Schumpeter’s reference to Bergson’s strange book on Creative Evolution” (ibid., p. 314). The construction of Schumpeterian models using modern methods developed by the neo-Schumpeterian school is understood as a theoretical development in the direction obstructed by Bergson.

Callegari himself, while proposing to clearly position Bergsonian ontological considerations within the foundation of post-Schumpeterian economics, does not seem to provide a direct and clear demonstration of the relationship between Bergson and Schumpeter. But what does he mean by the Bergsonian foundation for Schumpeter?

He begins by rejecting the commonly understood dichotomy (dualistic ontology) as characteristic of Schumpeter's analytical approach, drawing on the literature. He points out that Schumpeter's "separation of social and natural science is more instrumental than necessary, more analytical than ontological", implying that Schumpeter saw a monistic essence beyond the dualistic approach. This applies to the dichotomies found in Schumpeter's analysis, such as between static and dynamic, creative and adaptive phenomena, and the evolution of the economy and the evolution of nature. Schumpeter saw a monistic essence beyond the dualistic approach. Thus, Schumpeter's *Business* embodies Callegari's monistic ontology, including the confirmation of this essence from the perspective of statistics and history.

After Schumpeter, Callegari moves on to Georgescu-Roegen, whom he positions as a bridging figure between Schumpeter and Bergson. As mentioned in the previous section of this study, Schumpeter's dichotomous analytical approach corresponds to what Georgescu-Roegen calls dialectical concepts. In this respect, it can be said that Callegari and this study share the same view. But

how can this lead to Bergson?

Callegari suggests that while Schumpeter and Bergson differ in their approaches to evolutionary economics and philosophy, they converge in their creative interpretations of evolutionary processes. He notes that both thinkers saw systemic approaches not as intellectual artefacts but as manifestations of natural tendencies common to mind and matter. All phenomena, including economic and social phenomena, can be seen as part of a monistic natural process. Such processes include “two great tendencies, one, systemic order, and another, creative evolution” (ibid.). Therefore, “despite a monist foundation, the analytical process should accommodate a dualistic structure, reflecting both analytical and actual tendencies” (ibid.). This is what Callegari calls the Bergsonian foundation of post-Schumpeterian economics. In contrast, Georgescu-Roegen's later scientific approach (Georgescu-Roegen 1971) could be associated with a dialectical approach between closed and open systems.

The trio chosen by Callegari to lay the foundations of post-Schumpeterian economics can indeed be seen as consistent in their analytical approach. Having laid this foundation, Callegari moves on to examine creative agents, characterised by various imperfections, and their rationality. Furthermore, he delves into the study of evolving systems due to their inherent imperfections. With the exception of Bergson, the two economists discussed in this study undoubtedly shared a vision similar to the one outlined above. However, they envisioned the study of systems beyond the economy, encompassing culture, society and even the global scale. Their methods of analysis included concrete historical processes (such as institutions and institutional change) for Schumpeter, and also included systemic modelling for Georgescu-Roegen. I'd be happy to prepare a separate manuscript discussing these connections with the contemporary neo-Schumpeterian school.

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