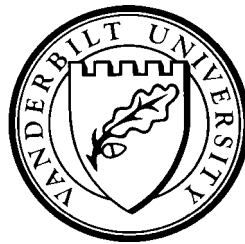


NICHOLAS GEORGESCU – ROEGEN AND THE FILIATION OF ECONOMIC IDEAS

by

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Working Paper No. 00-W18

June 2000

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Nicholas Georgescu-Roegen and the Filiation of Economic Ideas

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1. Introduction

The intellectual influences on Nicholas Georgescu–Roegen in his formative and mature years were many and various. They originated well beyond economics proper, covering a vast span that includes philosophy, mathematics, statistics, the physical and biological sciences, and the history of science itself. Even confining attention only to economists who had a significant influence on Georgescu–Roegen and those for whom he expressed great admiration would yield a sizeable manuscript, so that some selection is called for. This article focuses on two nineteenth-century German economists who provided significant inspiration for Georgescu–Roegen, Karl Marx and Hermann Heinrich Gossen. Karl Marx is the nineteenth-century economist whom he cites most frequently in his three books (Georgescu–Roegen, 1966, 1971, 1976). His attitude towards Marx was truly dialectical, creating an interesting contrast to the almost unreserved admiration he expressed for Gossen. Anyone with the slightest acquaintance with Georgescu–Roegen’s work knows that he was not a Marxian economist. But the ideas of Karl Marx and Friedrich Engels provided him with another major school of thought, besides neoclassical economics, with which he could contrast his own views of the economic process. In comparing Marxian to neoclassical economics, Georgescu–Roegen often adjudicated in favor of the Marxian school. But he found plenty to criticize in both schools of thought, and at times seemed to enjoy playing off one school against the other.

The reason why I chose Gossen as the second important thinker to discuss in relation to

Georgescu–Roegen’s work is that his longest single appraisal of an economist’s work, 130 pages long, was his 1983 essay titled ‘Hermann Heinrich Gossen: His life and work in historical perspective’, written as the introduction to the first English-language translation (by Rudolph C. Blitz) of Gossen’s *The Laws of Human Relations and the Rules of Human Action Derived Therefrom*. Gossen was a neglected genius in whom Georgescu–Roegen saw a kindred spirit. His lucid introductory essay shows that, well after writing *The Entropy Law and the Economic Process* (1971), Georgescu–Roegen maintained his early interest in consumer theory, choosing now to highlight the role of time in consumer welfare maximization.

These two economists, Marx and Gossen, by no means exhaust the intellectual influences on Georgescu–Roegen, even if we limit these to economists active in or after the nineteenth century. Several other economists molded his thinking or served as foils that he used to contrast his own distinctive world view. Among these, Robert Malthus, Alfred Marshall, Vilfredo Pareto and Joseph Schumpeter should certainly be added to the list of economists whom Georgescu–Roegen admired or to whom he felt intellectually indebted. Even with respect to such economists, however, he never hesitated to point out in what respects he considered their reasoning to be deficient. He reprimanded with even greater gusto those economists who served as foils for his own thinking, including W. Stanley Jevons, Léon Walras and Philip Wicksteed. Before turning to Marx and Gossen, some of these economists, beginning with Malthus, will be briefly considered.

Georgescu–Roegen has been labeled a neo-Malthusian, since both he and Malthus stressed the interconnection between the biological growth of the human species and the finite volume of natural resources available. Although he paid tribute to his insights, Georgescu–Roegen balanced this with a critique of Malthus’s ‘implicit assumption that population may grow beyond any limit both in number and time *provided that it does not grow too rapidly*’ (Georgescu–Roegen, [1975] 1976, p. 22). In other words, Malthus was too optimistic for his tastes! With a nice sense of justice, Georgescu–Roegen noted that those economists whose world view he otherwise deplored occasionally expressed views that approached his own. Thus, while he singled out Jevons as the archetype of the mechanistic dogma whose nefarious effects he repeatedly castigated, he pointed out that Jevons’s first book, *The Coal Question*, had the merit of drawing attention to what Jevons regarded as the imminent exhaustion of coal reserves in Great Britain.

If we were to rank the position that an economist occupied in Georgescu–Roegen’s hall of fame by the time span over which he published articles inspired by his work, the award would have to go to Vilfredo Pareto. Georgescu–Roegen’s first publication in economics was his ‘Note on a Proposition of Pareto’ of 1935. Half a century later he wrote the entry on ‘Ophelimity’ (Pareto’s synonym for utility) in the *New Palgrave Dictionary of Economics* (Georgescu–Roegen, 1987). Between these articles, Pareto figured prominently in Georgescu–Roegen’s articles on the theory of consumer behavior (such as those collected in Georgescu–Roegen, 1966) and on the integrability problem, and in other occasional

contributions such as his survey of utility theory (Georgescu–Roegen, 1968).

Alfred Marshall received high marks from Georgescu–Roegen for paying attention to the evolutionary aspects of the economic system and pointing out that ‘the Mecca of the economist lies in economic biology rather than in economic dynamics’ (Marshall, 1920, p. xiv).¹ Georgescu–Roegen (1966, p. 107) praised ‘the unique endeavor of Marshall to instill some life into the analytical skeleton of standard economics’, as well as his desire ‘to insist upon respect for relevance instead of succumbing to the temper of his age’, regarding these as important attempts to transcend the static framework of neoclassical economics. He added that ‘it was Marshall who showed in the most incontrovertible way that even such a basic concept as the supply schedule of an “increasing returns” industry slips through the analytical mesh because “increasing returns” is an essentially evolutionary phenomenon, necessarily irreversible and perhaps irrevocable as well’ (ibid.).

Evolutionary phenomena bring to mind an economist whom Georgescu–Roegen knew personally, and who had a profound influence on his thought and career, Joseph Schumpeter. In his autobiographical notes, after observing that his graduate training was in statistics, Georgescu–Roegen pointed out that it was Schumpeter who effectively turned him into an economist.² Schumpeter (1954) was fond of tracing for some of the best known economists what he called the ‘filiation of economic ideas’ (such as Petty-Cantillon-Quesnay). Another filiation of ideas that can be proposed is Marx-Schumpeter-Georgescu–Roegen, which will appear plausible after we have considered the influence of

Marxian thought on Georgescu–Roegen, whether directly or via Schumpeter. One of Schumpeter’s ideas which struck great resonance with Georgescu–Roegen was his emphasis on the distinction between ‘growth’ and ‘development’. In growth ‘the change is confined to a quantitative redistribution within a qualitatively invariant spectrum of commodities’, whereas ‘as Schumpeter defined it, development consists of a “spontaneous and discontinuous” change that comes from *within* the economic process because of the very nature of that process’. Moreover, ‘the spark that generates development ... is what Schumpeter called innovation—a term which has since become an important article of the economic trade’ (Georgescu–Roegen, [1974] 1976, pp. 243–244).

It is hard to think of two economists from the same country who differed as much from each other, in their personality, upbringing, *Weltanschauung* or global influence as Gossen and Marx. It is a tribute to Georgescu–Roegen’s catholic tastes and his insistence on finding merit wherever it can be found, that he fell under the spell of two such dissimilar thinkers and, for very different reasons, found much to admire in both.

2. A dialectical view of Karl Marx

In contrast to his lengthy essay on Gossen, Georgescu–Roegen’s remarks on Marx and Marxian economics are scattered in small doses throughout his writings.³ He was even-handed in his assessment of Karl Marx, mixing praise with criticism in about equal proportions. He frequently contrasted Marx’s view of the production process to that of the

rival neoclassical paradigm, which he referred to as ‘standard economics’. He noted approvingly that Marx did not consider the economic process as an isolated or closed system, and criticized the neoclassical paradigm for representing it as such, ignoring the absorption of low-entropy resources from the environment and their transformation into high-entropy waste.⁴ Instead of taking the unidirectional form that he believed to be the conceptually correct one, the neoclassical representation is reducible to a circular flow featuring neither irreplaceable inputs nor unwanted waste outputs.

Georgescu–Roegen recognized that Marx’s scheme of simple reproduction is also a circular one. It depicts a continual renewal or maintenance of depreciating capital goods, and corresponds to what is nowadays referred to as a steady state equilibrium. Marx’s scheme appears to have been inspired by François Quesnay’s *tableau économique*, a construct that Marx greatly admired.⁵ Even though Marx’s scheme of simple reproduction is not a flow-fund model of the type that Georgescu–Roegen favored, he gave Marx some credit for forming a view of the production process inspired by historical materialism, a doctrine that does not represent the production process as insulated from its surroundings by an artificial boundary: ‘whatever one may have to say about the other pillars of Marxism, one can hardly think of a plainer truth than that the economic process is not an isolated system’ (Georgescu–Roegen, 1971, p. 316).

Although Marx postulated that social conflict would disappear with the advent of communism, Georgescu–Roegen held the contrary view that social conflict is endemic to

human existence on earth, and therefore will not disappear as the human species evolves. He argued that the promise of eventual human bliss on earth is a 'tenet ... as unscientific as any religion known to man' (1971, p. 306). The reason that social conflict will extend into the indefinite future is not mankind's division into classes, but the looming struggle over low-entropy resources.

To the mechanistic paradigm underlying neoclassical economics, Georgescu-Roegen substituted a scheme inspired by the type of dialectical reasoning that Marx learned from Georg Hegel and modified in accordance with Ludwig Feuerbach's views. Only dialectical reasoning can adequately represent qualitative economic change, whereas the arithmomorphic concepts that are the stock in trade of neoclassical modeling are unable to portray it. Georgescu-Roegen maintained that 'in retrospect, it appears natural that denunciations of the sterility of the standard armamentarium should have come from men such as Marx and Veblen, who were more interested in distributive relations than in the efficient allocations of means.... [L]essons, perhaps the only substantial ones, on how to transcend the static framework effectively have come from Marx, Veblen, and Schumpeter'(1971, p. 321). Marx deserved credit also for incorporating the length of the working day as a significant feature of the production process, as Georgescu-Roegen himself does in his flow-fund model, whereas the neoclassical production function fails to recognize this important parameter.

Like Marx and unlike the neoclassicals, Georgescu-Roegen became convinced that the

institutional traits that characterize an economy should be an integral part of the schema used to portray it. This is particularly true of an agrarian society, for which models designed to portray an urban setting are singularly inept. Marx was well aware of the conflict that often characterizes the relations between town and country. In this respect he differed sharply from Adam Smith, for whom these relations were mutually beneficial. Georgescu–Roegen believes, however, that the contempt that Marx evinced toward the peasantry biased his view of the evolution of the agricultural sector. Marx invoked for it the same laws that he applied to the industrial sector, including a tendency toward an increasing concentration of income. This distorted view may have led him to make the mistake of believing that the royal road to economic development consists of the industrialization of the economy, as many policymakers from developing countries did after World War Two. Georgescu–Roegen labeled this the industrialization axiom. After examining the structure of agriculturally based economies in ‘Economic Theory and Agrarian Economics’ (Georgescu–Roegen, 1960a), he concluded that neither Marxian economics nor standard neoclassical theory could successfully meet the challenge of analyzing noncapitalist economies such as Romania’s before or after World War Two.

3. Hermann Heinrich Gossen: an ignored and misunderstood genius

Georgescu–Roegen’s 130-page essay on ‘Hermann Heinrich Gossen: His life and work in historical perspective’ (Georgescu–Roegen, 1983) was the introduction he wrote to the first

English-language translation of Gossen's *The Laws of Human Relations and the Rules of Human Action Derived Therefrom* (Gossen, 1983). Georgescu–Roegen's tour de force is even slightly longer than the extensive introduction he wrote to his articles collected in *Analytical Economics* (1966), and longer than his evaluation of any other economist's work. He followed this up with two further articles in which Gossen's consumption theory figures prominently (Georgescu–Roegen, 1985, 1994). To my mind there are two reasons why he chose, at a late stage of his career, to write this detailed appreciation of Gossen's work. First, it allowed him to re-evaluate, in the light of Gossen's book, some of his own work on consumer theory dating from the start of his career.⁶ Secondly, it gave him the opportunity to remark on the fate of a genius like Gossen, who was totally ignored in his lifetime and later frequently misunderstood. By speculating on the reasons for this treatment, perhaps Georgescu–Roegen wished, consciously or unconsciously, to draw an analogy to the way he felt his own work was received by mainstream economists.

Georgescu–Roegen hailed Gossen as the first individual who broke with the concept of value in terms of embodied labor espoused by the classical economists, including Karl Marx. The revolutionary alternative that Gossen presented had been adumbrated by Turgot and by writers of the Italian Enlightenment such as Galiani. It postulated that value is measured by the amount of pleasure an object or service provides. As Georgescu–Roegen stated, 'Gossen was the insurgent who achieved the fundamental rupture with the physicalist conception of economic value held by the reigning classical school. [He] completed the mutation to the

psychological basis of economic value not because he elucidated the new concept (which he well did), but because he built the first extensive analytical system on it' (1983, p. lxvi). Besides Galiani and Turgot, other anticipators of the marginal utility principle include William Lloyd and Jules Dupuit, whom George Stigler ([1950] 1965) once described as the 'unsuccessful discoverers' of the principle of diminishing marginal utility. Of innovators such as Dupuit and Cournot, some notice at least was taken of their work while they were still alive. Not so in Gossen's case. Georgescu-Roegen soberly observed that 'in the history of economics the only author of one of the most inspired contributions to remain completely unnoticed during his lifetime is Gossen. Moreover, the story of his life and contribution is even more tragic than those of the ill-fated Carnot, Galois, and Mendel'. He went on to echo Frank Knight's remark that Gossen's was 'the most pathetic fate' (1983, pp. xxiii–xxiv).

In the preface to the *Entwicklung*, as Georgescu-Roegen referred to *The Laws of Human Relations*, Gossen claimed: 'I believe I have accomplished for the explanation of the relations among humans what a Copernicus was able to accomplish for the explanation of the relations of heavenly bodies'. Moreover, 'my discoveries enable me to point out to man with unfailing certainty the path that he must follow in order to accomplish the purpose of his life' (1983, p. cxlvii). As regards his self-comparison to Copernicus, Georgescu-Roegen drily remarked that 'because of that self-glorification, we have often smiled at Gossen and even ridiculed him, but, given the exceptional value of his contribution, the persiflage should turn against the ridiculers' (1983, p. lxv). Gossen's mission was to indicate the paths

that humans ought to follow to improve their lives. If they only took his advice, **‘then there is nothing further wanting in the world to make it a perfect paradise’** (Gossen, 1983, p. 298; bold in the original). Georgescu–Roegen aptly noted that ‘the *Entwicklung* is dominated by an unlimited optimism, highly surprising in view of how tormented Gossen’s life was’. Moreover, ‘his optimism about the future of humanity is matched only by the present dogma of the cornucopian economists: Nature has an unlimited power to generate wealth: hence the human species will never cease to progress through art and science’ (1983, p. lxiv).

Part I of the *Entwicklung* contains the outline of consumer theory for which Gossen has now become justly famous. Georgescu–Roegen points out that ‘in the history of economic thought Gossen stands alone in many respects, but, strangely, one view that sets him apart has been overlooked completely While all [economists] have identified scarcity with some material shortage of some sort or another, Gossen alone saw that what is ultimately scarce is time alone. It was on that scarcity as a foundation that he erected the first pillar of his system: “Enjoyment must be so arranged that the total pleasure *during one’s entire life* should be a maximum”’ (pp. lxv–lxvi). In his book Gossen enunciated many other theorems and showed ‘mathematical acumen’ (p. lxx) by providing algebraic derivations of his consumer theory and illustrating his analytical findings with twenty-four diagrams. He argued that time is needed not only to produce commodities but to enjoy their consumption. In producing them, discomfort is incurred that Gossen set against the enjoyment derived

from the commodities themselves.

Gossen's consideration of time allowed to him to formulate, and illustrate graphically, what is sometimes denoted as the 'law of the recurrence of wants'. This was labeled 'the second law' by Georgescu-Roegen, who claims that 'there can hardly be any doubt that Gossen was the true discoverer of this law' (p. lxxxiv). It implies that after an interval of time the desire to repeat a past enjoyment occurs again. The enjoyment of this repetition is lower than before, unless a sufficient time interval has elapsed. Georgescu-Roegen's admiration for Gossen derives in part from the fact that Gossen's treatment of time in consumer welfare maximization is reminiscent of the importance of the time dimension in Georgescu-Roegen's own theories. Foster has argued that Mirowski (1988) was wrong in claiming that Georgescu-Roegen's utility theory was essentially neoclassical: in fact, 'Georgescu-Roegen's [concept of utility] subscribes to a Gossenian, not a Jevonian, view of utility maximisation. The latter neglects time, the former incorporates time and can deal, explicitly, with time irreversibility and evolutionary change' (Foster, 1993, p. 984).⁷

The term 'Gossen's second law' has been used in the literature to denote the theorem for which he has received the greatest praise, namely that money should be allocated '*between the various pleasures ... in such a manner that the last atom of money spent for each pleasure offers the same amount of pleasure*' (Gossen, 1983, pp. 108–109; theorem [7.11]; emphasis in the original). Georgescu-Roegen chooses instead to refer to the optimum allocation of money as Gossen's 'first fundamental theorem' (1983, pp. xc–xciv), while the 'second

fundamental theorem' (pp. xcv–cv) outlines the optimum allocation of time. He wonders 'why both [Gossen's] theorem about the optimal allocation of time and his ingenious diagram [Figure 2.4] have been ignored, although that theorem represents a far more profound finding than his other theorem [theorem 7.11], about the optimal budget' (p. cv). In one of the imaginative diagrams (Figure 3, p. xcvi) with which he complemented Gossen's own diagrams, each day is divided into three parts, the time of production of commodities, that taken to enjoy their consumption, and that for pure leisure. Georgescu–Roegen remarks that, in his previous work on utility (1968), 'I ignored the consumption time, a serious error of which I have become aware while preparing the present essay' (pp. cxxxviii–cxxxix).

Gossen devoted Part II of his book to the exchange economy. Six of its chapters treat the subject of rent, whether paid, received or payable. Georgescu–Roegen commented that 'of all Gossen's signal innovations his treatment of barter and exchange has been the last to be noticed and commended to the attention of the economic[s] profession' (p. cvi). He found Gossen's diagrammatic illustration of the influence of rent paid on the volume of work provided and on the consumption of commodities to be 'highly original' (p. cxiv), and observed that the step that Gossen took is 'to my knowledge, unique in the history not only of economics but of science in general. Gossen endowed each of the psychological coordinates of the feelings that the individual experiences during work performance with physical (mechanical) significance ... one of the strongest pieces of evidence of his

exceptional imaginative talent’ (p. cxv).

In Part III of the *Entwicklung* Gossen examined the application of the principles of his system to economic and social reform. Chapter 23, titled ‘A plan for the nationalization of land and its purpose’, anticipated ideas that came well after the *Entwicklung*. Léon Walras greatly admired the book that he called ‘one of most beautiful works of political economy that have ever been written’, and praised Gossen as ‘a man who has remained completely unnoticed and who, in my opinion, is the most remarkable economist that has ever lived’ (as cited in Georgescu–Roegen, 1983, pp. cxxi, lv). Walras occupies an important part in Gossen’s posthumous saga after Jevons called his attention to Gossen’s work. He even translated the *Entwicklung* into French, and in 1885 published an article whose title translates as ‘An unknown economist: Hermann Henri Gossen’.

Georgescu–Roegen began his introduction to Gossen’s book with a heading in the form of a question, ‘Are There Minds That May Think Above Their Time?’.⁸ He pointed out that the ‘sociology of knowledge’ propounded by Robert Merton and others claims that a discovery is inevitable when the existential basis for it has matured. Believers in the sociology of knowledge deny that anyone can write above one’s time since the existential basis for their discovery is not yet ripe, and point to the frequency of multiple discoveries as opposed to ‘singletons’. Georgescu–Roegen fervently believed the opposite, that ‘revolutionary discoveries come up as singletons rather than as multiples’ (p. xvii) thanks to exceptionally endowed individuals: ‘any discovery, small or great, must, by definition,

be in some sense above its time' (p. xviii). He denied, however, that 'the content of a discovery is unrelated, at least in part, to the existential basis of knowledge' (p. xix). In this connection, he could have cited Isaac Newton, who in a letter to Robert Hooke conceded that 'if I have seen further, it is by standing on the shoulders of giants'.

Georgescu-Roegen argued that Gossen's *Entwicklung* was idiosyncratic and independent of anything published before. He pointed out that 'Gossen is perhaps the only great figure in the history of economics who had absolutely no connection with scholars of his time' (p. cxxvi), and perceptively observed that 'potentially great minds were stirred to become actually great by some kind of conflict with their human environment' (p. cxxv). Gossen's dream to become a mathematician was thwarted by his father's desire to turn him into a bureaucrat in spite of himself. Thanks to his nephew Kortum, we know that 'Gossen would have not otherwise become interested in economics; it was his hatred of the bureaucratic environment that led him to fight its economic philosophy by formulating in opposition to it a new economic outlook' (ibid.).

Toward the end of his life Gossen, disappointed with the failure of his book in either sales or public notice, asked his publisher to withdraw all unsold copies from circulation. Georgescu-Roegen believes that this desperate act was a major mistake on his part, since it caused his book to become extremely rare after his death. The 'lesson of history' that Georgescu-Roegen drew from this can perhaps be applied to his own work:

Gossen must have forgotten what is perhaps history's only sure lesson: Great ideas may

be overlooked by accident, misunderstood at first because ‘they are above their time,’ or even (as has happened frequently especially in social sciences) covered by a systematic din intended to protect and preserve the old faith. But they cannot be buried forever; they will be heard, and will only be displaced eventually by other great ideas. (p. liii)

The reception of Gossen’s ideas in Germany itself was indeed cool. Georgescu–Roegen attributes this coolness to Gossen’s use of mathematics, which did not appeal to the cameralist-historical outlook of German economists at that time. As Spiegel (1968, p. 210) starkly noted, ‘the *Entwicklung* was “fundamentally un-German”’ (p. lviii). According to Georgescu–Roegen, ‘No one ... can write above one’s time. Gossen was no exception. The *Entwicklung* was not above the understanding of Gossen’s contemporary literati. Gossen did not write above his time. He only happened to write in the wrong country’ (ibid.).

Ten years earlier, Georgescu–Roegen ([1973] 1976) made a similar statement about another economist, Vilfredo Pareto, who also encountered tremendous resistance to his ideas and spent most of his working life in isolation, earning the epithet of ‘hermit of Céligny’. In that article he traced some interesting analogies between Pareto and Gossen:

Like Gossen, Pareto was well ahead of his own time and also was completely aware of this fact. Perhaps, also like Gossen, Pareto lived in the wrong place. Who in the whole German nation in 1854 would have seen any sense in using mathematics in political economy as Gossen proposed? Who in Lausanne or in all of Switzerland during Pareto’s life was interested in economic theory? (Georgescu–Roegen, [1973] 1976, p. 308)

Such analogies between scholars must always be made with great care, given the different circumstances that marked their lives. The analogy certainly cannot be extended to Georgescu–Roegen himself. In his lifetime the economics profession was already much more closely and globally integrated than in either Gossen’s or Pareto’s time. Geographic location is no longer crucial for a scholar to attain professional influence, particularly in the case of a well-traveled citizen of the world like Georgescu–Roegen. That he failed to acquire the influence that he richly deserved, especially among American mainstream economists, must be attributed to other causes.

4. Conclusion

Nicholas Georgescu–Roegen was often mentioned as a possible candidate for the Nobel Prize in economics, given the novelty and perceived importance of his contributions. That he never received this Prize may well be due in part to the heterodox ideas he displayed in the latter part of his professional life, that set him on a collision course with the mainstream economics establishment. His frequent diatribes against those he referred to as ‘standard economists’ clearly did not aid his cause. His somewhat irascible personality led to the bitter feelings he expressed in the last years of his life.⁹

After reviewing the intellectual influence of past economists on him, it is natural to speculate on the place that Georgescu–Roegen himself will occupy in the filiation of economic ideas. His name is now closely associated with the fields of bioeconomics and

ecological economics. Bioeconomics was a term that he first introduced in his writings in ‘Energy and economic myths’ (Georgescu–Roegen, [1975] 1976) and further expounded in Georgescu–Roegen (1977).¹⁰ His research into the biophysical implications of economic activity inspired the creation of the International Society for Ecological Economists and the founding of its journal *Ecological Economics*.¹¹ Georgescu–Roegen was thus not only heavily indebted to several economists who preceded him, but continues in turn to inspire the work of present-day social scientists. This ensures that his name will be remembered for years to come.

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Endnotes

1. On the connection between Marshall and Georgescu–Roegen, see Foster (1993).
Historians of thought have debated whether biology was fundamental to Marshall’s thought. Thomas (1991) and Hodgson (1993) present reasoned arguments for the view that a thorough integration of biology and economics was left for a second volume of Marshall’s *Principles of Economics* which he never completed. Hence ‘economic biology remained promise rather than substance’ (Thomas, 1991, p. 11).
2. Georgescu–Roegen’s respect for Schumpeter was almost filial in nature. In his introduction to Georgescu–Roegen (1976, p. xi), he called him ‘my master’, and in Georgescu–Roegen (1992, p. 183) he stated that at Harvard University ‘by mere chance I met the man who was to have the most decisive influence on my further thinking, Joseph A. Schumpeter’. With the group of young Rockefeller Fellows ‘who met weekly under Schumpeter’s guidance as well as from the private luncheons I often had with him, I turned into an economist with a degree from “Universitas Schumpeteriana”’.
3. An exception to this is Georgescu–Roegen’s idiosyncratic development of certain Marxian themes, such as Georgescu–Roegen ([1960b] 1966).
4. Georgescu–Roegen (1971, p. 281) absolved from these strictures ‘those economists who, like Marshall, have been fond of biological analogies and have even contended that economics “is a branch of biology broadly interpreted” [footnote reference to Marshall’s *Principles*]’.
5. The Physiocrats’ influence on Marx suggested to Georgescu–Roegen (1971, p. 263)

that ‘in all probability, the process Marx had in mind in setting up his diagram [of simple reproduction] was an agricultural, not an industrial process’.

6. In mid-career, Georgescu–Roegen (1968) also wrote a survey article on ‘Utility’ for the *International Encyclopedia of the Social Sciences*.

7. For a similar critique of Mirowski, see Gowdy and Mesner (1998, p. 140). They correctly argue that ‘Georgescu considered Gossen’s work to be a precursor to many of his own ideas, especially the importance of the time factor in establishing preference relations’ (p. 143).

8. This question inspired Silvana de Gleria (1995) to write a thoughtful appreciation of his work.

9. Maneschi and Zamagni (1997, p. 705).

10. Georgescu–Roegen approached the Princeton University Press with the intention of writing a book on bioeconomics, but never completed this project.

11. According to Hodgson (1993, p. 273), the term ‘bioeconomics’ first appeared in Reinheimer (1913). As Gowdy (1987) points out, it is used in different senses by mainstream or “Chicago school” economists and by “social” or ecological economists. Perhaps this explains why the latter named their journal *Ecological Economics* rather than *Bioeconomics*. A special issue of *Ecological Economics* appeared in September 1997 in honor of Georgescu–Roegen. On Georgescu–Roegen’s bioeconomic paradigm, see also *inter alia* Dragan and Demetrescu (1991), Gowdy (1998), and the introduction and preface by Grinevald and Rens to a collection of Georgescu–Roegen’s (1995) essays.

