

**G. Leclerc, C. A. S. Hall (eds), Making world development work: scientific alternatives to neoclassical economic theory**

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This book presents a systematic collection of up-to-date essays and analyses studying the operation and development of human societies from the biophysical perspective. The authors compare the biophysical approach with mainstream neoclassical economic theory, both theoretically and empirically. The theoretical part is discussed in the first six chapters of the book. The authors show that neoclassical theory is not consistent with many laws of nature while the biophysical theory is directly derived from the laws of nature. In the rest of the book, many different authors, including the editors, show in great empirical detail how economic development is extremely strongly correlated with the use of energy and other resources, while neoclassical explanation of economic development is disconnected from a consideration of resources required and hence is generally full of errors, externalities, and exceptions.

Given the clear superiority of the biophysical economic theory over the neoclassical economic theory, at least in my opinion, one is tempted to ask why the neoclassical theory is still the dominant theory and why so few people have even heard about the biophysical theory. The most important reasons, as pointed out by the authors, appear to be that economists are not sufficiently trained in the natural sciences and that the neoclassical theory serves the current establishment well. Another reason is that some major improvements need to be made on the research of biophysical theory to make it more attractive to broader audience. This book shows that these improvements often can be made simply by consistently and thoroughly applying the principles of biophysics to different practical problems.

Some of the improvements presented in various chapters of this book are, first, that authors in biophysical theory often have doubt themselves about the generality of their own theories. For example, mainstream economists use the successful development of some resource-poor countries, such as Japan and South Korea, to dismiss the importance of natural resources. In the past, researchers in biophysical economic theory rarely disputed this claim. In this new book it is shown clearly that, as Japan and Korea achieved their very high living standards, they were as dependent upon energy and other resources per unit of economic

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output as other countries, the difference being that they imported them. People in resource-poor countries may have to work extra hard to compensate for the cost of importing natural resources. This reduces the amount of time and energy they have to take care of the next generation. As a result, the fertility rates of highly developed but resource-poor countries, such as Japan, Singapore, and Korea, have dropped to the lowest level in the world and are far below the replacement level. This means that successful development without a large ratio of resource to population is not sustainable. Hence the examples of Japan and South Korea confirm, instead of refute, the generality of the biophysical principles.

Second, the authors pointed out that natural resources are much more fundamental than money in an economic system. Hence resources, especially energy, should have at least equal weighting in economics as money, which should be considered as a derivative from resources. Charles Hall (p. 13) states:

I am not interested in putting a market price on land or resources (hence moving nature inside the economics “box”) but rather in putting the entire discipline of economics inside the “box” of the natural world, without which it could not exist.

This represents a great departure from the mainstream thought in ecological economics, which tries to put ecosystem services inside the box of economics by, for example, a dollar value on the service rendered by ecosystem. This change of reference system makes it much easier to analyze some of the fundamental problems facing our human society, such as sustainability; for example, under conventional economic theory, the increase of capital expenditure, or investment, will enhance the sustainability of the economic system. However, from the resource perspective, the increase of capital expenditure in most cases will increase the consumption of natural resources and accelerate resource depletion.

Using natural resources as the basic focus in economics enhances our understanding not only of long-term trends of the human society but also of short-term monetary and policy patterns. Gregoire Leclerc states that, “The debt crisis in 1980, following and caused largely by the oil crisis, left the door open to neoliberal interventions.” (p. 41). Charles Hall and others have shown consistently that economics can be understood much better by including an energy perspective. They raise the issue that, as the energy required to get energy has been and is likely to continue to increase, there will be a smaller surplus to run the rest of the economy. Because many poor tropical countries are increasingly dependent upon cheap energy to increase agricultural output in order to feed growing populations, this issue may be especially important in the developing world.

Third, the various authors attempt to apply the principles of physics and biology systematically in much of the book, especially in Chapters 1, 3 and 4, to expose the fact that neoclassical economic theory’s attempts to be a real science are but a pretense. For example, in Chapter 1, the authors review how, in the early part of the last century, neoclassical economists believed that, for economics to become a “real” science, the problems of wealth and income distribution, which are “subjective,” should not be part of the discussion. Instead, they said, a real science should consider only how to maximize the total wealth for human society. They did this even while divorcing economics from any particular consideration of the resources, including energy, upon which any economy must rest. The authors of the book are keenly aware of the distributional implication from this basic perspective in neoclassical economics, which rather than making economics more scientific, simply made it less responsible, for example (p. 620):

It is our opinion that many unscrupulous people hide behind neoclassical economics to justify their exploitation of others. Given the power of establishment economics in our universities, it is hard to see how to change this, but it is probably our first priority.

As a reviewer, I wish this exposé would have been even more vigorous; for example, the criticisms offered here would be much stronger if the authors had pointed out that the claim that distribution is outside the realm of a real science is scientifically indefensible. Indeed, it is the central problem in ecology to study how different species occupy different niches in the distribution and transformation of resources. Even the issue of wealth maximization for human society generally is itself a resource distribution problem in the context of a larger ecosystem. By necessity, increasing the human niche in ecological system decreases the available resources for other species. It is not a coincidence that the prosperity of *Homo sapiens* is accompanied by the large-scale extinction of many other species. In the human societies, the flourishing of liberty in a particular social group was often the result of military conquest and expansion of slavery (Colinvaux 1980; North 1981). Thus the problem of resource distribution should be as central in economics as in ecology.

There are many other perceived deficiencies of biophysical theory that have been expressed in the literature but that can be resolved easily by systematically applying good biophysical analysis. Most of the solutions have already appeared here or there. However, there has been no public forum specialized in distributing research results in biophysical economics, which make it very difficult for researchers in this area to see what others have been up to or to communicate their own findings. The editors of the book have done the research community a great service by putting so many of the theories and applications in one place. This book should be a standard reference for all researchers who believe that social science can become a science in reality and not just in name.

Because of the advance in the research of biophysical theory, we are at the dawn of a new scientific revolution, a revolution that will transform social science into an integral part of biological science, and biological science into an integral part of physical science. This book, a systematic synthesis of the biophysical theory, is the newest step toward a full-scale biophysical economic theory. For several decades, Charles Hall and others have worked tirelessly, with little recognition from the scientific community, to establish social sciences on a firmer foundation than I believe is the case for neoclassical economic theory. I believe their contribution will soon be recognized by the broad research community in economics, biology, and physics so that the biophysical approach to economics can be presented in an even more systematic manner.

## References

- Colinvaux, P. (1980). *The fate of nations*. New York: Simon and Schuster.  
North, D. (1981). *Structure and change in economic history*. New York: Norton.