

Method versus Methodology: A Note on *The Ultimate Resource*

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Science appears but what in truth she is,
Not as our glory and our absolute boast,
But as succedaneum, and a prop
To our infirmity. No officious slave
Art thou of that false secondary power
By which we multiply distinctions, then
Deem that our boundaries are things
That we perceive, and not that we have made.

—William Wordsworth, “The Prelude”

In discussing the thought of Albert Einstein in the second course of his Gifford Lectures at Edinburgh, Professor Stanley L. Jaki draws an important distinction between the great physicist’s method and his methodology. On the one hand, says Jaki, Einstein represented himself as an advocate of the “sensationism” of Ernst Mach, according to which view the existence of an objective cosmos underlying the subjective sensations of the physicist was expressly denied; whereas, on the other hand, the spectacular breakthrough represented by special (and later, general) relativity was the result of Einstein’s conviction of the existence of a universal natural order, which was intelligible to man in a manner quite independent of his cultural or historical position.¹ Thus, the manner of Einstein’s approach to reality (his method) was not at all consistent with his own reflection on the manner of his approach to reality (his methodology).

The possibility of such confusion as this is but one result of the fact emphasized by William James that the process of our consciousness is one thing and our critical reflection (through the vehicle of memory) on that process quite another.² Just as “systematic reflection on the consciousness is a late event in

the biography of [a] philosopher," as Eric Voegelin observed,³ so also, quite often, does method (the way people do things) antedate methodology (their understanding of the way they do things), both in the biographies of particular scholars as well as in the histories of scholarly disciplines. The resulting possibilities for confusion are considerably augmented nowadays by the equivocation of these two terms, which is nearly universal in popular usage. One will hear a new instructional technique, for example, described as "an interesting new educational *methodology*."

Indeed, the so-called social sciences are particularly liable to such difficulties. A particularly instructive example is to be found in Julian L. Simon's book, *The Ultimate Resource*. The goals of this essay are to demonstrate the existence of a glaring inconsistency between Professor Simon's method and his methodology, and then to draw out several important implications of this situation. In the process readers will gain some acquaintance with the concrete problems which Simon addresses as well as with his approach to the, both matters being important and instructive in and of themselves. More specifically, one will find (1) that Simon's optimistic conclusions concerning world resources are entirely justified, (2) that his method (from the Austrian perspective) is correct and appropriate, but, (3) that in discussing various methods he has given credit for his success to a method that he does not actually employ, a method which, (4) had he actually put it into practice, would have produced only the most complete confusion.

The next section briefly indicates the concrete issues with which Simon is primarily concerned. It also presents Simon's methodology, that is, his own understanding of the method he has employed to achieve his results. The following three sections, show that his methodology does not match his method. This will be accomplished through the successive examination of three technical concepts central to Simon's effort: the concepts of "scarcity," "resource," and "finiteness." I hope that my discussion of these terms will have value, not only in clarifying understanding of Simon's important work, but also as a contribution to future discussion of world resources. The final section offers concluding remarks.

Issues and Methodology

Popular opinion has it that mineral resources are becoming increasingly scarce. This claim, in common parlance, is not simply an assertion of the economic character of mineral resources,⁴ in which case it would be entirely unobjectionable, but rather, the prediction of their impending exhaustion.⁵ It is Simon's burden to refute this claim. (He also provides an illuminating analysis of world population growth and a survey of some of the rather irresponsible publicity techniques employed by proponents of population control. My purpose

will be best served by restricting attention to Simon's discussion of resources—particularly mineral resources.) He begins his assault by arguing that the proper standard for the scarcity of a mineral resource is its price, or, even better, the ratio of its price to some other benchmark such as wage rate or consumer price index. Then, in discussing trends in such resource prices, he asks whether data from the past can serve as a basis for prediction of future conditions. In the process of providing an affirmative answer, Simon says:

The question facing us is a problem in scientific generalization. A good general principle is that you should generalize from your data if you can reasonably regard them as a fair sample of the universe about which you wish to generalize. It is prediction that concerns us, however, and prediction is not quite the same as generalization. Prediction is a special type of generalization, a generalization from past to future. Prediction is always a leap of faith; *there is no scientific guarantee that the sun will come up tomorrow* (emphasis added).⁶

The "fair sample of the universe" he seeks to generalize from consists of the price trends he has been discussing, which (like the rising and the setting of the sun), it is implied, constitute the objective truth, the "truth with the bark on it," the unshakeable rock upon which he proposes to build his scientific house. Later, in a systematic discussion of the concept of "finiteness," to which I shall have occasion to return, Simon remarks that "scientific subjects [such as economics, he implies here] are empirical rather than definitional, as twentieth-century philosophers have been at great pains to emphasize." He goes on, "Mathematics [unlike economics] is not a science in the ordinary sense because it does not deal with facts other than the stuff of mathematics itself" (p. 48). The point is that Simon regards his discipline as an empirical natural science. He understands the "facts" of his subject to be the particular configurations (resource prices per unit wage rate, say) that he has identified in the marketplace, and his goal to be the construction of "scientific generalizations" based upon them.

In fact, however, despite Simon's confident suggestion of consensus, there remains considerable disagreement among "twentieth-century philosophers" as to the nature of the "empirical" natural sciences and even as to whether or not the natural sciences can be described as "empirical" in any meaningful way. Certainly, it poses no difficulty to find serious philosophers of science who would attach little value to the sort of naive inductive method Simon here attributes to natural scientists.⁷

On the other hand, there is no question that practicing members of the scientific community have long maintained that their method *is* this naive empiricism and have "urged the representatives of other disciplines to imitate [it]," with the result that "many social scientists are still trying to imitate what they wrongly believe to be the methods of the natural sciences."⁸ The situation presented by Simon's work, however, is slightly more complicated. For, as I shall

now proceed to argue, he does not actually “imitate . . . the methods of the natural sciences.” He merely says that he does. In the course of this discussion I employ the three phrases (“scarcity,” “resource,” and “finiteness”) mentioned in the introduction. One must now carefully inquire as to Simon’s understanding of these terms. In so doing one will find that Simon’s *method*—as opposed to his *methodology*—is unobjectionable from an Austrian perspective.

Scarcity

The crucial issue may be revealed by asking where Simon’s analysis of resource supply begins. If one agrees with him that his is an empirical method, then one must be able to argue that his “data” represents a bare-handed grasp of reality; in other words, that it is comprised of “facts” which are “other than the stuff of [economics] itself.” This, however, is clearly not true. His consideration of the data is preceded by his examination of “an unexciting but crucial matter, the *definition* of ‘scarcity’ ” (p. 17) (emphasis added). He goes on to say:

Upon reflection perhaps you will agree that a complete absence of the material will *not* be a sign of scarcity. We will not reach up to the shelf and suddenly find that it is completely bare. It is obvious that the scarcity of any raw material would only gradually increase. Long before the shelf would be bare, individuals and firms, the latter operating purely out of the self-interested drive to make future profits, would be taking steps to hoard supplies for future resale so that the shelf would never be completely bare. Of course the price of the hoarded material would be high, but there still would be some quantities to be found at some price, just as there always has been some small amount of food for sale even in the midst of the very worst famines.

The preceding observation points to a key sign of what we generally mean by scarcity: a price that has persistently risen. More generally, cost and price . . . will be our basic measure of scarcity.

It is only at this point, *having already decided what he is looking for*, that Simon turns to an examination of the data and concludes, inescapably it seems, that “raw materials have been getting increasingly available—less scarce—relative to the most important element of life, human work time” (p. 25). Now, Simon’s conclusion that the resource future is increasingly bright relies for its validity on his data, that is, on the trends in resource price he quotes. Readers are entitled, however, to reject his data and hence his conclusion, unless he can persuade them to accept his definition of “scarcity,” which he does, of course, very convincingly. How does he do this? By a further appeal to market data? Not at all. He asks, instead, that one *reflect* on the actions and motivations of people in the marketplace. Consider again some of the language with which he makes his appeal:

Long before the shelf would be bare, individuals and firms, the latter operating purely out of the self-interested drive to make future profits, would be taking steps to hoard supplies for future resale so that the shelf would never be completely bare.

He is arguing from the principles of praxeology—the science of human action.⁹ The point is that Simon has not only reasoned *from* his “data,” he has also reasoned *to* his data. His “facts” are themselves the result of economic theory. He has not simply discovered them or observed them; *he has created them.*¹⁰

It is instructive to consider here an analogy which Simon employs to clarify his line of argument, but in which, I submit, the same methodological confusion persists. He likens himself to a fellow making observations of the level of water in a communal tank. This fellow sees people steadily consuming, but not replenishing the water supply; he is accordingly surprised when each of his observations finds the water level higher than before. Simon asks of this situation:

Would not a prudent person, after a long train of rises in the water level, conclude that perhaps the process may continue—and that it therefore makes sense to seek reasonable explanations? . . . Whatever the real explanation, it makes sense to look for the cause of this apparent miracle, rather than cling to a simple-minded fixed-resources theory and assert that it cannot continue (p. 23).

It is Simon’s argument, and of course one ought to agree with him, that the rise in the water’s level is analogous to the fall in the price of a resource. Therefore, as one might expect, he goes on to suggest that:

The fall in the costs of natural resources decade after decade, and century after century, should shake us free from the idea that scarcity must increase *sometime*. Instead, it should point us toward trying to understand the way technological changes are induced by the demand for resources and the services they provide, and the way that such changes reduced scarcity in the past.

The crucial issue is that, while I agree that the two processes—the measurement of the water’s level and the computation of a resource’s price per unit work time—are analogous, they are not methodologically equivalent. The first is the action of an empiricist properly so called, requiring no a priori understanding whatsoever; whereas the second, as already shown, is the theoretically informed action of an economist. Indeed, Simon’s ability to present his analogy at all is contingent on his persuading readers that the two quantities measured—water level and resource price per unit work time—actually bear some relation to one another. One is therefore reduced, once again, to his argument for his definition of “scarcity.”

In the passages just quoted, one encounters a further difficulty. In both cases, it is suggested that the observation of persistently recurring configurations (“a long train of rises in the water level” and “the fall in the costs of natural resources decade after decade, and century after century”) comes first and persuades (or should persuade) readers to seek out a suitable mechanism to explain them (“to look for the cause of this apparent miracle” and “[to try] to understand the way technological changes are induced by the demand for resources and the services they provide”). This suggestion of an advance from knowledge of stable or recurrent configurations to the elucidation of an explanatory mechanism evokes the global procedure of a natural scientist, but it cannot be the procedure of an economist and, in particular, it is not the procedure which Simon has employed himself. For, he cannot have drawn any conclusions from his price data until he knew the price of a resource to be the proper measure of its scarcity. He cannot have known *that*, however, prior to understanding the action of people in the face of rising resource prices. That is, in what constitutes an exact reversal of the normal procedure of a natural scientist, Simon has advanced from his knowledge of market process (or mechanism) to a correct identification of stable market configuration.¹¹

A still more subtle distinction to be made between the methods of the natural and social sciences is nicely illustrated by Simon's effort. This lies in the fact that, contrary perhaps to popular perception, the natural scientist endeavors to “explain the known in terms of the unknown.”¹² By way of illustration, an organic chemist will elucidate his familiar experience of various chemical reactions in terms of reaction mechanisms which will draw heavily from existing formulations, or he will elicit new formulations in physical chemistry and theoretical physics which will be relatively less familiar or even somewhat unintelligible to him. Social scientists, on the other hand, are confronted with problems of such immense complexity as to “require a reversal of what has been described as the standard procedure of [natural science]; [they] have to proceed in [their] deductions, not from the hypothetical or unknown to the known and observable, but—as used to be thought to be the normal procedure [in natural science]—from the familiar to the unknown.”¹³ In particular, Simon's discoveries, and arguments for the relevance, of stable configurations in the marketplace have flowed from his knowledge of the characteristics of human conduct of which he has a relatively more intimate knowledge.

It is in this light that the perplexity of the fellow at the water tank seems somewhat misplaced. Simon seems to require that this poor fellow oppose his intuitive understanding with a somewhat paradoxical and logically untenable induction;¹⁴ whereas, it is in fact Simon's own praxeological analysis that persuades his readers not only that his price trends *are* stable configurations, but that readers should have expected this to be true from the very beginning. One is confronted, after all, not with the mysterious machinations of an inanimate universe, but with the purposeful conduct of human beings within the “life-world”

(*Lebenswelt*).¹⁵ (One also encounters here the issue of “teleology,” to which I shall return.) Unless one expects some radical transformation of the nature of humankind, therefore, one may safely dispense with Simon’s leap of faith. Herein lies the advantage of treating man anthropomorphically.¹⁶

Thus, by way of summary, one finds that Simon’s praxeological analysis of the meaning of “scarcity” yields conclusions in which one can have great confidence, while, at the same time, rendering rather problematic his methodological claim of empiricism.

Resources

It is manifestly of the greatest importance, in such a discussion as this, that there should be agreement as to the meaning of “resource.” Despite the fact, moreover, that there seems to be no explicit definition of this word in *The Ultimate Resource*, there does seem to prevail among all parties a general understanding as to its meaning. How has this understanding been effected? Why is it that copper, say, is regarded as a mineral “resource”—and no questions asked? In consideration of its color? Or its specific gravity? Or perhaps its spectral properties? Is there—in short—some empirical procedure that will yield an objective classification of copper as a “resource”? Hardly. In point of fact, as Hayek has written,

[S]uch things as tools, food, medicine, weapons, words, sentences, communications, . . . acts of production [and, I may add, resources], or any one particular instance of any of these . . . are all instances of what are sometimes called “teleological concepts,” that is, they can be defined only by indicating relations between three terms: a purpose, somebody who holds that purpose, and an object which that person thinks to be a suitable means for that purpose. If we wish, we could say that all these objects are defined not in terms of their “real” properties but in terms of opinions people hold about them.¹⁷

And, of course, one understands the “opinions people hold” about the objects of their action through knowledge of their action itself. Simon’s last hope for an empirical understanding of “resource,” therefore, is that it may prove possible to assign some objective meaning to one’s observations of people’s action. Alas, the hope is in vain. For, as Hayek continues:

[I]n discussing what we regard as other people’s conscious actions, we invariably interpret their action on the analogy of our own mind: that is, . . . we group their actions, and the objects of their actions, into classes or categories which we know solely from the knowledge of our own mind. We assume that the idea of a purpose or a tool, a weapon or food, is common to them with us, just as we assume that they can see the difference between different colors

or shapes as well as we. We thus always supplement what we actually see of another person's action by projecting into that person a system of classification of objects which we know, not from observing other people, but because it is in terms of these classes that we think ourselves.¹⁸

This is not to say that such knowledge as this is divorced from our experience of the external world (which assertion would contradict the results of the previous section). It is in fact Hayek himself who has elsewhere asserted that such knowledge as this "constitute[s] the truly empirical factor in the social sciences."¹⁹ It is simply that such knowledge as this—knowledge of "the relations between men and things or the relations between man and man"—is qualitatively different from knowledge of "the relations between things."²⁰ The latter may be understood as "empirical" in the sense in which Simon has employed the term; while the former, though referred to by Hayek as being "empirical," may perhaps be better described as "intersubjective." It is a part, not of one's knowledge of the world of objects standing over against one, but of one's "lived-experience" (*Erlebnis*).²¹ Thus, while people may continue to locate the basis of economic science in their ("lived") experience, and hence to regard it as "empirical" (in the intersubjective sense), it remains true that people are very far indeed from the empirical method Simon claims to have borrowed from natural science.

Once again, however, this claim is not consistent with Simon's practice. For he notes himself that in understanding the availability of a resource, the crucial consideration is not the supply of a particular mineral, but one's ability to achieve particular goals:

What is relevant to use is not whether we can find any lead in existing mines but whether we can have the services of lead batteries at a reasonable price; it does not matter to us whether this is accomplished by recycling lead, by making lead batteries last forever, or by replacing lead batteries with other contraptions (p. 49).

As suggested above, one is faced here with one's irredeemable inability to classify a substance as a resource without reference to those human purposes for the achievement of which somebody regards the material as a suitable means. This recognition by Simon of the relevance of "purpose" to his analysis clearly demonstrates the radical discontinuity between his actual praxeological method and his methodological claim of empiricism.

Furthermore, in recognizing the teleological dimension of his undertaking, Simon has implicitly denied the applicability of the techniques of natural science generally speaking (that is, over and above the more specific issues of what one may or may not directly observe). For not only, as argued above, are the sciences of human society *necessarily* teleological, *the sciences of nature cannot be*. Jaki has shown that the assumption, at various times in the history

of science, of purchase immanent in the workings of nature has invariably led to a scientific blind alley. As in the case, he says, of the classical Greek philosophers, teleologists have “built ways to the ultimate in intelligibility, only to find themselves at the end of those ways.”²²

Finally, Simon has made it his purpose to remind readers—may it henceforth be shouted from the rooftops!—that “the ultimate resource,” the fountainhead of all other resource, is the human imagination. In his introduction (pp. 9–10), he describes himself in 1969, in Washington, D.C., discussing with an Agency for International Development official a project intended to lower fertility rates in less developed countries.

I arrived early for my appointment, so I strolled outside in the warm sunshine. Below the building's plaza I noticed a sign that said “Iwo Jima Highway.” I remembered reading about a eulogy delivered by a Jewish chaplain over the dead on the battlefield at Iwo Jima, saying something like, “How many who would have been a Mozart or a Michelangelo or an Einstein have we buried here?” And then I thought, Have I gone crazy? What business do I have trying to help arrange it that fewer human beings will be born, each one of whom might be a Mozart or a Michelangelo or an Einstein—or simply a joy to his or her family and community, and a person who will enjoy life?

Is it possible that it is here, so far removed from the austere machinery of empirical science, that one at last finds the true beginning of Simon's analysis?

I have now carefully examined the conceptions of “scarcity” and “resource.” Three results have emerged: first, that the problems with which readers are concerned properly demand a praxeological method for their solution; second, that Simon has in fact successfully undertaken such a praxeological analysis of these problems; and therefore, third, that he may be regarded as an empiricist (according to his own use of this term) in a Pickwickian sense only. Further confirmation of these results emerges in the following examination of the concept of “finiteness.”

Finiteness

Simon seeks to deny that supplies of resources are finite, with which conclusion readers ought to agree. It is in the course of his analysis of this issue, as I noted earlier, that he claims his method is “empirical rather than definitional,” with which one ought not to agree. In order to clearly locate the point of departure for this erroneous methodological claim, it will be necessary to follow the sequence of Simon's argument in some detail. It will become quickly apparent, once again, how crucial is a proper understanding of the concepts of “scarcity” and “resource.”

Simon begins by suggesting that people are misled in using “finite” by the term's own inherent ambiguity:

The word "finite" originates in mathematics, in which context we all learn it as schoolchildren. But even in mathematics the word's meaning is far from unambiguous. It can have two principle meanings, sometimes with an apparent contradiction between them. For example, the length of a one-inch line is finite in the sense that it is bounded at both ends. But the line within the endpoints contains an infinite number of points; these points cannot be counted, because they have no definite size. Therefore the number of points in that one-inch segment is not finite (p. 47).

But this is an error. In fact, there is only one criterion of finiteness employed in the example Simon provides, namely, if a positive real-valued quantity, or function, is finite, then one can display, among the positive integers, say, an upper bound. (The contrapositive, of course, is that if one cannot display an upper bound, then one cannot claim finiteness.) In the first case, he observes that the length, or "Lebesgue measure," of the one-inch line is finite (since its value is a positive real number and there exists a plentiful supply of upper bounds) and, in the second case, that the number of elements, or "counting measure," of the same set is infinite (since one cannot display an upper bound).²³ That which is different in these two cases is not the criterion of finiteness, but the definition of the "measure" of the set to which the criterion is applied: Lebesgue measure, in which case the criterion is satisfied, and counting measure, in which case the *same* criterion fails to be satisfied.

There is, moreover, no reason for "finite" to be any less applicable to a discussion of resources. Indeed, among other things, Simon says, "[A] reason that the term 'finite' is not meaningful [in a discussion of resources] is that we cannot say with any practical surety where the bounds of a relevant resource system lie, or even if there are any bounds" (p. 48). But, the inability to say "where the bounds of a relevant resource system lie" does not imply the meaningless or ambiguity of "finite" in such a context; it simply implies that the criterion of finiteness is not satisfied. This point may be reinforced by considering a brief passage from a delightful afternote to chapter 3, entitled "A Dialogue on 'Finite'" (p. 51), where Simon writes:

PS [*Peers Strawman*]: Finite means "limited."

HW [*Happy Writer*]: What is the limit for, say, copper?

PS: I don't know.

HW: Then how can you be sure it is limited in quantity?

Precisely so. If Strawman cannot display an upper bound on the quantity of copper, much less on the ability to provide the services of copper, he cannot claim to have satisfied the criterion of finiteness. There is no ambiguity here: Strawman is unambiguously wrong.

Now, however, Simon seems to change his ground. He argues that ambiguities in discussions of resource supply have resulted from the different means of measuring resource supply to which the concept of finiteness has been applied

(which, in the mathematical context, is essentially what I suggested above). There are, he says, two principal methods of making such measurements, the “technologic” and the “economic.” The first of these, the technologic method, consists of the effort to determine the quantity of a particular mineral physically extant in the earth’s crust, or, of what is slightly more sophisticated, the effort to determine the quantity of the material recoverable given certain assumptions about available technology. Having made such a determination, the technologist, by means by some extrapolation of current rates of usage, computes the “years of consumption” remaining.

But against this technologic method Simon favors the economic method, the attempt to predict the availability of a resource in the marketplace *at different price levels*. Since the price of a particular mineral will be affected by one’s ability to achieve its services by other means, this economic method automatically takes into consideration countless possibilities of substitution of which people can have no personal knowledge. Under Simon’s expert tutelage, moreover, this economic perspective reveals gaping holes in the technologic analysis. The technologist remains stubbornly unaware of the fact, that the availability of a resource is dependent on its market price, and *that the resource worth looking for will invariably be found*.

Indeed, the technologist’s own estimates of the supply of a material is dependent on the willingness of various people to search for it—which is to say, dependent on the demand for the mineral in the marketplace—which is to say, dependent on the price of the mineral. In any case, what is important is not how much of a particular mineral there is, but the extent to which, in some way or another, the services it performs can be provided at a given price. (To reinforce an earlier point, the foregoing analysis clearly reveals the methodological confusion in Simon’s “water tank” analogy. This may now be described, using Simon’s own terminology, as the confusion of the *technologic* measurement of the water’s level in the tank with the *economic* computation of the water’s price per unit work time.)

It is in continuing this argument for his economic method of measurement that Simon makes his “empirical rather than definitional” claim. The technologists’ mistake, he says, is to have “define[d] the subject of discussion suitably, and sufficiently closely [via technologic measurement] so that [the supply of resources] can be counted.” (p. 50), and hence, has the appearance of being finite. His response is to deny the applicability of such definitions to the subject matter by claiming that the proper method is one of empiricism.

That this response is an overreaction is demonstrated (as if any further demonstration is required) by Simon’s restatement of his “economic” or “operational” definition of the quantity of a resource:

A satisfactory *operational* definition of the quantity of a natural resource, or of the services we now get from it, is the only sort of definition that is of any

use in policy decisions. The definition must tell us about the quantities of a resource (or of a particular service) that we can expect to receive in any particular year to come, at each particular price, conditional on other events that we might reasonably expect to know (such as use of the resource in prior years) (pp. 47–48).

Once again, I have no difficulty in agreeing with his definition and the conclusion he draws from it, namely, that the supplies of mineral resources are without bound. At the same time, I can see little use in his asserting the necessity of an “operational *definition* of the quantity of a natural resource,” and then going on to argue, *on the same page*, that economics is “empirical rather than *definitional*.” In reality, the technologist’s problem is not that he “defines the subject of discussion,” but that he does so erroneously.

I return, therefore, to the first three of the four conclusions asserted in the introduction: (1) I have agreed with Simon’s conclusion; (2) I have agreed with Simon’s method; and (3) I have shown that his method is not what he says it is. Having now introduced the technologic measure of resource supply, I am in a position to establish my fourth conclusion.

Nothing can be more clear than that Simon’s technologist adversaries have been led into error precisely by the practice of the empirical method Simon has (wrongly) claimed for himself. The scientist who insists on confronting these questions of resource supply *as a scientist* will proceed by making precisely those technologic measurements which, as Simon has phrased it, have so “muddle[d] public discussion and [brought] about wrongheaded policy decisions” (p. 47). Desiring, for example, to forecast the future availability of copper, he will begin by determining how much copper there is. Why should a good empiricist begin anywhere else? Having subsequently “observed” the rate at which this “finite” supply is being consumed, he will conclude that copper is becoming increasingly “scarce” and go on to forecast its imminent exhaustion. Notice again how crucial is a proper understanding of “scarcity” and “resource.”

Again, the problem is not the presence of definitions, but the presence of definitions (and methods) that are inappropriate to the subject matter. There is a sense in which the technologist’s problems stem from his having *not* “define[d] the subject of discussion suitably, and sufficiently closely.” He will have missed all those considerations to which Simon will have been led by his praxeological analysis to attach the most significance. For example, although there will be more than one means of achieving the services of copper, most of these opportunities for substitution will lie beyond the technologist’s knowledge, and even beyond his interest.²⁴ He will not see them because he did not begin by knowing that he should look for them. Also, since his effort fails to be graced by an economic theory that tells him to do so, there is no reason to expect him to consider the price of copper—much less,

the price of copper per unit work time—much less still, decades (or centuries) long trends in the price of copper per unit work time.

Indeed, understanding himself to be a scientific empiricist, it is precisely the technologist who will insist that to admit such considerations into his analysis would be to impose abstract and artificial definitions on his subject matter. “Scientific subjects,” he will gravely explain, “are empirical rather than definitional.” And precisely because he “disdains to make use of the models worked out for him by the theorists, he is almost certain to come to grief.”²⁵

Thus I have used Simon’s critique of his technologist adversaries to establish my fourth conclusion. By simply glancing around at the innumerable technologic studies of resource supply, one sees how dismal the results could have been had Simon really put into practice the empirical method demanded by his methodology. (There remain many other starting points for the practical realization of Simon’s empirical methodology, one of which I shall now discuss.)

Conclusion

It is clear that Simon’s topic is an important one and my objections to his methodology notwithstanding, that his contribution to a proper understanding of these issues is extremely valuable. It remains, however, by way of conclusion, to show how important it is that a praxeological method be matched with a praxeological methodology.

But perhaps it is still unclear how a divergence between method and methodology is possible. How is it possible, it might still be asked, for an empirical methodology to be conjoined with a praxeological method? How is it possible for a single mind to do one thing and yet understand itself to be doing quite another? One may ask this question without doubting that what it refers to is characteristic of most of one’s thought throughout one’s life.

An adequate discussion of this general issue is beyond the scope of this brief review, but I can offer the following warning against what William James called the “psychologist’s fallacy.”²⁶ The foregoing references to Simon’s praxeological method will have brought to the attention of Austrian minds the complex of praxeology-as-a-method-consciously-chosen. They will have called to economists’ attention, that is, their own reflective knowledge of praxeology as they have learned it from the method and methodology of the great Austrian teachers. And it is in this form in which the praxeological method absolutely precludes an empirical methodology. The psychologist’s fallacy results when one projects one’s understanding of praxeology-as-a-method-consciously-chosen into Simon’s thought, where it does not actually exist. In fact, Simon’s praxeological knowledge must be said to exist, not as the result of a-method-consciously-chosen, not as something of which he is methodologically self-aware, but as a part of his “tacit”²⁷ or “common-sense”²⁸ knowledge. As I have

shown, moreover, Simon's possession of praxeology as "tacit knowledge" has not prevented him from deploying it with extraordinary power. Nevertheless, I will now seek to show the importance of entertaining such knowledge as this at the level of *methodology* as well.

In the first place, a praxeological methodology would strengthen several of Simon's concrete arguments. It would reinforce, as I have shown, Simon's analysis of all three of the concepts discussed in the three previous sections. Indeed, in more than one instance, little remained to be done after the terms of discussion had been suitably clarified through praxeological analysis. This clarity, however, was achieved *in spite of* Simon's claim of empiricism.

Finally, a praxeological methodology would lessen the possibility that readers of *The Ultimate Resource* might take Simon's claim of empiricism more seriously than they do the context of praxeological analysis from which his results have emerged. Nor is the method of technologic measurement discussed in the previous section the only, or even the most immediate, fashion in which Simon's empirical methodology could be translated into practice. For, recall that the "facts" that Simon understands to be the irreducible basis of his "empirical" analysis are the trends in resource prices that he reports (as opposed to technologic measurements of resource "reserves"). In other words, he has presented stable and recurrent configurations—never mind, just now, how they have been discovered—and advocated the construction of "scientific generalizations" based upon them.

Now, given these stable and recurrent configurations (and ignoring their praxeological grounding), the next step in the logic of empirical scientific procedure is to attempt a symbolization, perhaps through mathematical methods, of the process that produces these configurations. Simon, of course, has not actually taken this step, but this would not prevent someone else from taking up the "empirical" task where he left off. One can easily imagine, for example, someone seeking to understand the graph of the price of a particular resource plotted with respect to time as the graph of a "price function," itself an eigenfunction of a "price equation," and so on. Indeed, for one having some training in mathematics, the temptations presented by such a situation might well prove irresistible.

The point is, of course, that there is no need—and indeed, no room—for a fresh symbolization of the process that has produced these configurations. Readers already know the process, having *begun* by knowing the process. It is Simon's analysis of human action that has revealed these configurations in the first place, *and it is this underlying praxeological context that must be asserted at all costs*. Let this context once be dropped, as it would be Simon's claim of empiricism were allowed to stand—let these price trends once assume the appearance of self-contained, freestanding, empirical "data"—and there will be no end of "models," "scientific generalizations," and "mathematical methods" offered by those far more consistent and ambitious than Simon in pursuing practical applications of his empirical methodology.

On the other hand, let the praxeological context of “the facts of the social sciences” be recognized and preserved—let praxeological method be matched with praxeological methodology—and the superimposition of such superfluous and inconsistent layers of process will henceforth be undertaken with only the most embarrassing results. For there shall then be *two* layers of process: one underlying and engendering the configurations, which is symbolized praxeologically; and another overlaying and purporting to explain these same configurations, symbolized (probably) through mathematical formalism. The former shall be known with great “warmth and intimacy”²⁹ and the latter only rather dimly and at (at least) two removes from immediate experience.

Accordingly, one shall have the right to ask the empiricist what relation his second layer of process has to the first and more fundamental layer. In so doing, one shall merely be translating into economic terms the requirement known in physics as the “correspondence principle.”³⁰ It will simply be required that the two symbolizations of process, being descriptions of the same reality, be continuous with one another. It will be most interesting to learn, for example, how the empiricist’s differential equations can help thinkers to interpret their experience of the “life-world.” And when they find, as they must, that these equations are of no help at all, then the path shall lie clearly ahead, and readers shall not hesitate to reject this scientific deformation of economic reality.

The motto must be (with apologies to Edmund Husserl): “To the facts themselves!” For if economists clearly understand the nature of the facts of economic science, then they shall have occupied the high ground, from which, though pitifully few, they shall turn back hosts.

Notes

1. Cf. S.L. Jaki, *The Road of Science and the Ways to God* (Chicago: University of Chicago Press, 1978), pp. 182f. See also M. Polanyi, *Personal Knowledge* (Chicago: University of Chicago Press, 1962), pp. 9f.

2. Cf. William James, *The Principles of Psychology*, vol. 53 of *Great Books of the Western World*, R.M. Hutchins, ed., 54 vols. (Chicago: Encyclopedia Britannica, 1952), especially chap. X.

3. E. Voegelin, “On the Theory of Consciousness,” in *Anamnesis*, G Niemeyer, trans. and ed. (Notre Dame, Ind.: Notre Dame University Press, 1978), p. 33.

4. Cf. Carl Menger, *Principles of Economics*, James Dingwall and Bert F. Hoselitz, trans. (New York: New York University Press, 1981), especially pp. 101f. See also L. Robbins, *An Essay on the Nature and Significance of Economic Science*, 3d ed. (London: Macmillan, 1984), pp. 13f.

5. Cf., for example, D.H. Meadows, et al., *The Limits of Growth* (New York: Universe Books, 1972), pp. 55f.

6. J.L. Simon, *The Ultimate Resource* (Princeton, N.J.: Princeton University Press, 1981), p. 22. All references to this work will be given, parenthetically, in the body of the review.

7. Cf., for example, K.R. Popper, *The Logic of Scientific Discovery*, 2d ed. (New York: Harper and Row, 1968), especially chaps. 1, 3, 5. For a readable and succinct discussion of the methodological debate and its relation to the social sciences, see Homa Katouzian, *Ideology and Method* (New York: New York University Press, 1980), especially chaps. 2-4.

8. F.A. Hayek, *Studies in Philosophy, Politics, and Economics*, Midway Reprint (Chicago: University of Chicago Press, 1980), p. viii.

9. This concrete situation is illustrative of the "aprioristic" character of praxeological knowledge: one is unable even to conceive of some market "data" which could shake one's confidence in Simon's use of market price as the measure of resource scarcity. That is, "we cannot think of the truth of its negation or of something that would be at variance with it" (L. von Mises, *The Ultimate Foundation of Economic Science: An Essay on Method*, 2d ed. (Kansas City: Sheed, Andrews, and McMeel, 1978), p. 4; see also, by the same author, *Human Action*, 3d rev. ed. (Chicago: Contemporary Books, 1966), especially pp. 38-41, 64-69.

Note, however, that this does not necessarily deny "the broadly empirical nature of the praxeological axioms" (M.N. Rothbard, "Praxeology: The Methodology of Austrian Economics,") in E.G. Dolan, ed., *The Foundations of Modern Austrian Economics* (Kansas City: Sheed and Ward, 1976), p. 26.

10. Cf. F.A. Hayek, "The Facts of the Social Sciences," in *Individualism and Economic Order*, Midway Reprint (Chicago: University of Chicago Press, 1980), p. 72:

[The theories of the social sciences] are not *about* the social wholes as wholes; they do not pretend to discover by empirical observation laws of behavior or change of these wholes. Their task is rather, if I may so call it, to *constitute* these wholes, to provide schemes of structural relationships which the historian [or the economist] can use when he has to attempt to fit together into a meaningful whole the elements which he actually finds.

11. Cf. F.A. Hayek, *The Counter-Revolution of Science: Studies in the Abuse of Reason*, 2d ed. (Indianapolis: Liberty Press, 1979), pp. 102-3:

In biology we do indeed first recognize as things of one kind natural units, stable combinations of sense properties, of which we find many instances which we spontaneously recognize as alike. We can, therefore, begin by asking why these definite sets of attributes regularly occur together. But where we have to deal with social structures, it is not the observation of the regular coexistence of certain physical facts which teaches us that they belong together or form a whole. We do not first observe that the parts always occur together and afterward ask what holds them together; but it is only because we know the ties that hold them together that we can select a few elements from the immensely complicated world around us as parts of a connected whole.

12. K.R. Popper, quoted in Hayek, "Degrees of Explanation," in *Studies*, p. 5.

13. Hayek, *ibid.*, p. 9.

14. "Logically untenable," that is, as presented here. Cf., for example, K.R. Popper, "Two Faces of Common Sense," in *Objective Knowledge: An Evolutionary Approach*, rev. ed. (Oxford: Clarendon Press of Oxford University, 1979), especially pp. 81f.

15. Cf. M. Natanson, *Edmund Husserl: Philosopher of Infinite Tasks*, Northwestern University Studies in Phenomenology and Existential Philosophy, J.M. Edie, ed. (Evanston, Ill.: Northwestern University Press, 1973), chap. 7.

16. Cf. Hayek, "The Facts of the Social Sciences," in *Individualism*:

The tendency [of the development of scientific thought in modern times] has been correctly described as one toward the progressive elimination of all "anthropomorphic" explanations from the physical sciences. Does this really mean that we must refrain from treating man "anthropomorphically"—or is it not rather obvious, as soon as we put it this way, that such an extrapolation of past tendencies is absurd? (p. 65).

17. *Ibid.*, pp. 59–60.18. *Ibid.*, p. 63.19. Hayek, "Socialist Calculation I: The Nature and History of the Problem," in *ibid.*, p. 126.20. Hayek, *Counter-Revolution*, p. 41.

21. Cf. A. Schutz, *The Phenomenology of the Social World*, Northwestern University Studies in Phenomenology and Existential Philosophy, J. Wild, ed. (Evanston, Ill.: Northwestern University Press, 1967), chaps. 2, 3; "Common Sense and Scientific Interpretation of Human Action," in *Collected Papers, vol. I: The Problem of Social Reality*, M. Natanson, ed. (The Hague: Martinus, Nijhoff, 1962), pp. 3–40; "Phenomenology and the Social Sciences," in *ibid.*, pp. 118–39; "The Dimensions of the Social World" in *Collected Papers, vol. II: Studies in Social Theory*, A. Brodersen, ed. (The Hague: Martinus Nijhoff, 1976), pp. 20–63.

22. Jaki, *Road of Science*, p. 33. See also E.A. Burtt, *The Metaphysical Foundations of Modern Science* (New York: Doubleday, 1954), especially pp. 18f.

23. These are but two of many examples of measures. Lebesgue measure is due to the French analyst, Henri Lebesgue, and has the property that it extends the usual notion of length. That is, while it is applicable to a much larger class of subsets of the real line, Lebesgue measure assigns to each interval its usual length. The counting measure of a set, on the other hand, coincides with the number of elements, or cardinality, of the set. For a thorough treatment of measure theory, see Edwin Hewitt and Karl Stromberg, *Real and Abstract Analysis* (Berlin: Springer-Verlag, 1965), especially chap. 3.

24. Cf. Hayek, *The Constitution of Liberty* (Chicago: University of Chicago Press, 1960):

We know little of the particular facts to which the whole of social activity continuously adjusts itself in order to provide what we have learned to expect. We know even less of the forces which bring about this adjustment by appropriately co-ordinating individual activity (p. 25).

25. Hayek, "The Facts of the Social Sciences," in *Individualism*, p. 72.26. Cf. James, *Principles*, pp. 128–29.27. Cf. Polanyi, *Personal Knowledge*, pp. 62–63.28. Cf. Voëgelin, "About the Function of Noesis," in *Anamnesis*, pp. 211f.

29. The defining characteristic, for William James, of "the stream of consciousness." Cf. *Principles*, 213.

30. This is the requirement, first explicitly stated by Niels Bohr, that the postulates of quantum mechanics must yield classical results when applied to classical systems (mechanical systems for which the quantum number, n , is large). Cf. J.D. McGervey, *Introduction to Modern Physics* (New York: Academic Press, 1971), pp. 80f.