Science and Economics

By PAUL PEACH

IS economics a science? It would be difficult to find another question so charged with importance to the average man. If it is, we may reasonably hope that when its principles are sufficiently well understood we shall be able by their means to solve the problems of poverty, unemployment, and war. If on the other hand economics is a non-science it cannot help us in our striving for a good society, and our hope must be for something which transcends science, that is, a miracle. Therefore, if we desire to mitigate our economic distress, we must decide this question first and then hie us with all speed, either to the schoolroom, or to the church.

According to Webster's New International Dictionary (1939) a science is "a branch of study which is concerned with the observation and classification of facts, especially with the establishment of verifiable general laws, usually by induction and hypothesis." More briefly, it is a field of inquiry in which we scrutinize experience by the light of reason. It rests on assumptions which are taken on faith, because they can be neither proved nor disproved. Thus, I assume that I exist, and that the world exists. The opposite assumptions are equally legitimate, but if I assume that I do not exist, I have no excuse for behaving as if I did—for attempting to think and act. The scientist assumes further that there is no effect without a cause, and that by what he calls the "scientific method" he can learn something about the connection between cause and effect. This "scientific method" is essentially a very simple process, and its use is not confined to scientists. We see from Webster's definition that in its complete form it involves four steps:

(1) Observation
(2) Induction
(3) Extension
(4) Verification

Let us examine these steps one by one.

Observation, the starting point of science, rests upon another assumption: that, in spite of the limitations of our senses and the distortions introduced by the "personal equation" we can nevertheless make observations which have some bearing upon reality. In another paper ("The Data of Science") the writer has endeavored to justify this assumption; for the present, we note that it is only an extension of our postulate about cause and effect. For instance, if I see a mirage, I assume that something causes me to see it, though not necessarily that what I see is really there. I may or may not be able to learn what the cause is, but in the first step of the scientific method we do not concern ourselves with causes; we merely note what we see, and what other people see (if anything). These observations supply the data of science.

From these data we take our second step: Induction. We study our material and attempt to find in it some regularity which suggests the operation of a uniform cause. The gas laws of chemistry were discovered in this way. If we have a gas in a confined space and subject it to varying pressure, we may observe changes in its volume, and make the following table:

Pressure	Corresponding Volume
60 pounds	1 cubic foot
30 "	2 cubic feet
20 "	3 " "
15 "	4 " "
12 "	5 " "
10 "	6 " "
6 "	10 " "

This table contains our data. We notice first that the volume decreases as the pressure increases. Closer analysis reveals an exact mathematical relationship between pressure and volume; the product of two associated numbers is always 60. We make many more observations; others do the same; and we find that this regularity persists at all times, in all places, with all gases, for all observers. At last we summarize our findings in a generalization: "The volume of a gas varies inversely as the pressure." This generalization is the result of induction from our observations, and we call it a natural law.*

After we have discovered our natural laws we take our third step: Extension. We seek by the use of our reason and imagination to find explanations; to learn the cause of the observed effect. We attempt to proceed from the known to the unknown, from the observed to the unobserved, the possibly unobservable. Boyle's Law tells us how gases behave, but not why. The scientist proceeds now to reason thus: "If a gas is a continuous body of matter, compressibility is difficult to explain; but if it consists of myriads of particles flying about in space, the contraction under pressure seems the natural enough consequence of forcing the particles closer together. The behavior of a sponge when we squeeze it furnishes an analogy." Such an attempt to explain phenomena is called a scientific theory. Our ideas of molecules, atoms, and subatomic particles originated in this way; no one has ever seen an atom.

The last step in the scientific method is Verification, usually by prediction and further observation. We have

*For the purpose of illustration, this discussion of Boyle's Law has been considerably simplified.

arrived at a theory, but until we have some confirmation of its validity it is no more than a conjecture. Accordingly we ask ourselves whether this theory suggests logical consequences, not necessarily connected with our original data; whether, in other words, it can lead us on to new knowledge. If, for example, gases consist of swarms of particles flying about in space, it seems probable that they will leak out of a cracked container at different rates; that heavy gases, composed presumably of large or heavy or slow-moving particles, should find their way through a crack with difficulty, and that light gases should leak out rapidly. We try the experiment, and find that gases do indeed behave in exactly this way; that the heavy gas chlorine can be kept for some time in a cracked bottle, while the light gases, hydrogen and helium, cannot. In sciences which do not permit laboratory experiments (such as astronomy) we attempt to find new regularities previously unsuspected, to learn new facts, to discover other laws. Thus we justify our theory, and no theory has any scientific standing until it has been justified in this way. And from this point we begin applying the scientific method all over again from the beginning, assured that if we pursue it diligently we must find new riches of knowledge.

Now that we understand what science is and how it works we return to our principal question: is economics a science? The field of economics includes the study of how men seek to gratify those desires which for their satisfaction demand the expenditure of human labor. Our question can now be rephrased: in this field of economics, is it possible to apply the scientific method? If yes, economics is or can be a science; if no, it is not and cannot.

Can we make economic observations? Of course we can and do. Indeed, it is here that the modern economist really distinguishes himself; he is an observer, a statistician,* if he is nothing else. But every one of us is an economic observer in his own way; we observe the people about us, and become aware of their ways of acting. Since the beginning of recorded history men have been making economic observations, and even in earlier times men who wrote nothing yet left records which we can interpret. All this mass of material, from prehistoric stone hammers to tomorrow's newspaper, supplies the data of economics. It cannot be denied that most of these observations are strongly colored by the prejudices of the observer, but this is a reason for sifting the data—an everyday scientific process—not for rejecting them. Economists may find it difficult to maintain an attitude of scientific detachment in their studies, but this is a limitation upon the scientist, not upon the science. In another paper ("The Humble People") the writer has shown how other scientists have broken away from superstition and prejudice; economists must do the same.

We can, then, observe economic phenomena, and have gone one step towards answering our question. Can we take the second step? Can we make valid generalizations of our data? Can we analyze them by the inductive method? Remember our assumption about cause and effect. Our data are not unrelated facts; they are links in the endless chain of causation. But if this is true, then somewhere in our material do homogeneities and symmetries lie hidden. Once more the limitation is upon the scientist: the relationships must be there, but he may not be mentally capable of finding them. Yet even the layman can make some economic generalizations; for example, he arrives inductively at the obvious but important conclusion that merchants seek to sell their wares at a profit. Are there other laws to be found, less obvious perhaps? Could careful analysis such as has developed the great abstractions of modern mathematics accomplish nothing in economics? We need not labor the point; if cause and effect mean anything, scientific induction cannot be fruitless. The beginning we have made is but a shadow of great discoveries which wait only for the insight of a clear mind.

The deductive Extension of economic laws is another commonplace. For instance, manufacturers constantly tell us that with them profit is a secondary motive, and service to the public their first desire. Reasoning deductively from generalizations based upon observation and experience, we arrive without difficulty at the conclusion that all such declarations are hypocritical falsehoods. We cannot read men's minds, but we can and do know something about how those minds work.

Attempts to extend our economic knowledge by this method have not been wanting; the various theories of money, value, depressions, and the like, are examples. We could arrive inductively at Gresham's Law ("Bad money drives out good money") because we can see how people behave toward money; but only by the deductive method have we learned about the nature and functions of money itself, simply because money itself is in its major aspect an abstraction which cannot be observed. Indeed, while we may doubt that scientific induction has been adequately resorted to by economists, we cannot say this of deduction; economic theories are a lush growth: mostly weeds. Unfortunately, a theory which has no sound background in observation and induction is of little practical value; it is a guess, nothing more.

Are we then to believe that fruitful economic theories cannot be deduced, merely because most contemporary efforts are sterile? Surely not; surely we must admit rather that in this step, as in the first two, the fault has been, not in the soil of our garden, but in our own failure to till it.

*It is not contended that any existing statistics have been compiled scientifically.

Verification involves the prediction, either of future events, or of the discovery of new laws. It cannot be taken unless the first three steps have preceded it—unless we prophesy under divine inspiration. An uninspired prediction which has no factual and theoretical foundation can obviously have no value. Economics, alas, has such predictions galore. The most lamentable feature about them is that, because there is always some prophet for every possible point of view, many of these oneiromantic utterances "come true" and the fortune teller acquires a reputation for knowledge and wisdom. After every event there arises a clamorous horde shouting "I told you so!" But nevertheless, if we have the patience to winnow these prophecies, we can find an occasional genuine scientific prediction. Would there were more wheat in this field of chaff!

To show in detail the application of the scientific method in a particular instance is beyond the scope of this paper, but it is possible to indicate the process in outline. We may take, for example, statistics of savings bank deposits and insurance policies in relation to interest rates. We find that in "prosperous" years interest rates have been comparatively high, and the volume of savings large. In depression years interest is low; but while there is sometimes a decline in the volume of savings, such a decline is apparently not invariably a consequence of falling interest rates, and there have been such times when savings actually increased. The accumulation and arrangement of these facts completes our first step.

For our second step we draw the obvious inference that falling interest rates of themselves do not inevitably arrest the tendency to save, though of course they may discourage it. If we prefer positive assertions to negations, we may state our law thus: "Men have a tendency to save which is not eradicated by falling interest rates."

We know now what men do; we ask next why they do it. What motive induces men to save, when the incentive of interest is taken away? A consideration of possible explanations, assisted perhaps by an examination of our own motives, may lead us to adopt as the most probable the hypothesis that men save in order to accumulate a reserve fund against some future contingency. If we concede that the hope of receiving interest is also an incentive, we may now formulate our theory of capital accumulation: "The motives which impel men to save are (1) the desire to collect interest and (2) the desire to postpone consumption of their wealth until some future time." This completes Step Three.

We continue by noting that the two motives recognized in our theory are independent of each other, that each can operate without reference to the other, and that both operate in the positive direction. It follows that while both motives may have combined to produce our present capital fund, there would be some accumulation of capital even if one of the motives were absent. Moreover, since each motive operates in the positive direction, there will exist for each some opposing desire which will diminish but not nullify its effect. On the strength of these considerations we make our prediction: "There will be some accumulation of capital, even if interest disappears. This accumulation will persist in a lesser degree if interest becomes slightly negative (i. e., paid not by the borrower to the lender, but by the lender to the borrower), and will vanish only when negative interest equals the estimated cost of storing or hoarding wealth in whatever form involves the least foreseeable risk and expense."

This prediction will be tested by the future, but even now a partial confirmation is at hand: short term obligations of the United States Government are selling at a premium, which completely offsets the interest payable. If further confirmation is obtained, we may with greater confidence use our theory as a point of departure for new economic researches; if not, we must re-examine our data and our reasoning, assured that there is meaning in all things.

The rebuilding of economic science is a formidable task. Only clear heads and penetrating minds will discern the unbroken thread of cause and effect in the tangled skein of history. Economic variables can seldom be separated, and nations are not guinea pigs; and (as if these natural difficulties were not enough) the nomenclature of economics includes many terms (such as capital, labor, socialism, monopoly and the like) which evoke powerful emotional responses and make scientific thinking incredibly difficult. Yet men have overcome obstacles no less than these, though none in fields where the reward was so great. For in this balance hangs humanity itself; no other failure can entail so much suffering, no other success so liberate the nobler qualities of man. And though we grope in darkness, we may yet hope to see the dawn when men of good will shall possess the earth in comfort and peace.

Facts in Pseudo-Science

(Reprinted from *The New York Sun*)

TWO practical business men, Lammot du Pont and Floyd L. Carlisle, have put the professors of economics to their defenses. In their talks at Teachers College they attacked some of the bases on which the so-called science of economics rests. Mr. du Pont said:

> Can it be that the repeated attack by educators and others on so-called "classical" or "orthodox" economics is chiefly to cover up looseness of think-