Reply to Egmont Kakarot-Handtke

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Axiomatic Theory of Economics (Aguilar, 1999) is based on three axioms:

1) One's value scale is totally (linearly) ordered:

- **i)** Transitive; $p \leq q$ and $q \leq r$ imply $p \leq r$
- **ii)** Reflexive; $p \leq p$
- **iii)** Antisymetric; $p \leq q$ and $q \leq p$ imply $p = q$
- **iv)** Total; $p \leq q$ or $q \leq p$

2) Marginal (diminishing) utility, u(s), is such that:

- **i)** It is independent of first-unit demand.
- **ii)** It is negative monotonic; that is, $u'(s) < 0$.
- **iii)** The integral of $u(s)$ from zero to infinity is finite.

3) First-unit demand conforms to proportionate effect:

- **i)** Value changes each day by a proportion (called $1+\varepsilon_j$, with j denoting the day), of the previous day's value.
- **ii)** In the long run, the ε_j's may be considered random as they are not directly related to each other nor are they uniquely a function of value.
- **iii)** The ε_j's are taken from an unspecified distribution with a finite mean and a non-zero, finite variance.

Professor Egmont Kakarot-Handtke has taken me to task on axioms #1 and #2:

> *Utility is a nonentity like angels, epicycles or unicorns. The shortest possible form of my argument is: Any axiom set that contains a behavioral notion like utility does not work. Utility is psychology and psychology cannot be axiomatized. This is the fundamental flaw from my point of view.*

This statement was made in private correspondence, which I discontinued a few days later when Kakarot-Handtke called me a "pudding head." Kakarot-Handtke said this because I believe that people's actions in the market are guided by their personal value scales. The example I gave is of a person in a candy store who must choose between 89¢ in his pocket and

a chocolate bar on the store shelf and consults his personal value scale to make this decision. It is not that Kakarot-Handtke has any other explanation for what motivates people's market behavior (Messages beamed to them by aliens, perhaps?) but only that he prefers to collect statistics on the actions taken by large numbers of people and then run all those "facts" through statistical software to generate "theories." And, conveniently, Kakarot-Handtke has proposed some "axioms" (actually guidelines) like the following one to define how accountants are to collect those statistics.

> *Total income of the household sector Y in period t is the sum of the wage income, i.e. the product of wage rate W and working hours L, and distributed profit, i.e. the product of dividend D and the number of shares N.*

To deny the existence of utility (value) because one cannot put it in the pan of a laboratory balance is like denying the existence of dinosaurs because we do not have any of their bones; those things displayed in museums are actually fossils. But a fossil is a three-dimensional image of a bone and, similarly, one's actions in the marketplace are a reflection of the values one places on phenomena. So, yes, it is entirely possible to base a science entirely on the images of things, not on the things themselves.

Has anybody ever seen a black hole? No – they are black – and as invisible to physicists as utility is to Kakarot-Handtke. Even more invisible, in fact, because it was many decades after black holes were deduced from the fundamental axioms of physics that astronomers obtained the most tenuous indirect evidence of their existence, while even a casual observer of the marketplace has indirect evidence of utility.

Stephen Hawkings (*A Brief History of Time*, 1988) writes:

> *Black holes are one of only a fairly small number of cases in the history of science in which a theory was developed in great detail as a mathematical model before there was any evidence from observations that it was correct.*

Hawkings is wrong when he says that there are only a small number of such cases in the history of science. In fact, this is the norm. Paul R. Weissman (*Scientific American*, Sept. 1998) writes:

> *We have never actually "seen" the Oort cloud. But no one has ever seen an electron, either. We infer the existence and properties of the Oort cloud and the electron from the physical effects we can observe. In the case of the former, those effects are the steady trickle of long-period comets into the planetary system.*

So, again, we see that it is entirely possible to base a science entirely on the observable effects of things, not on the things themselves. Inferring the existence and properties of the Oort cloud based on observations of long-period comets that are knocked out of it to plunge inwards towards the Sun is similar to how economists can infer the existence and properties of utility by observing those rare occasions when value motivates people to go out and buy something.

Indeed, the Oort cloud is actually a better analogy for utility than black holes because, while we cannot see the black hole itself, we can see phenomena very close to it, specifically the x-rays emitted by matter as it accelerates to near light speed in its plunge towards oblivion, as well as the frantic movement of nearby stars. But we will never have a telescope powerful enough to see objects in the Oort cloud. We have only observed a few hundred long-period comets that approached the Sun close enough to have a tail and are known to have come from some 44,000 astronomical units away. Yet from these few observations, astronomers are agreed that there are about 1.4 trillion comets in the Oort cloud with a total mass about 1.9 times that of Earth.

Similarly, there are some trillion items on my value scale, including such unlikely purchases as a rock of crack from my neighborhood dope dealer, which I would not buy at any price; a bowl of banosh, which is good stuff, though the Carpathians are a long way to go for dinner; or a plate of foie gras, which probably tastes good, though I abhor the practice of force feeding birds. Yet economists can state with certainty that all trillion of these items conform to the three axioms listed at the beginning of this paper, though they have only observed the few purchases that I actually make every week, mostly of mundane items like eggs for my breakfast.

Econophysicists seem a lot more concerned about equities than about eggs (which I discuss in detail), and in this realm they have observed an inverse power law distribution of price fluctuations, which is an easy corollary of my theory. So we see that, like astronomers who can only view comets that have fallen in close to the Sun, axiomatic economics too has found empirical support from observation of those phenomena for which statistics are available.

Weissman notes that we have never seen an electron. Indeed, the science most similar to economics is quantum mechanics.

Nobody has ever seen an electron and nobody ever will; it is smaller than the wavelength of light one would have to bounce off of it to get an image in one's microscope. There is not going to be some new kind of light that we can shine at electrons and reflect onto the film in our cameras. And there is not going to be some new kind of laboratory balance that will weigh the values people assign to things. It is just not going to happen.

But, in spite of routinely talking about something they have never seen, physicists actually know quite a lot about electrons. The breakthrough came when they stopped trying to draw pictures of the atom and just focused on deducing theorems from the axioms that they had settled on. The image of raisins imbedded in pudding was not helping; the image of ping pong balls orbiting a conglomerate of rocks was not helping; no image was helping. When I studied quantum mechanics, the weaker students would come to me saying, "The math is so hard, just draw a picture of an atom for me so I can understand this." I would tell them, start with the axioms and prove lemmas and then theorems and you will reach the results as unerringly as a stone falling through the water reaches the bottom of a pond; but to draw a picture of a probability wave, this is a task too hard for me or any man.

Of course, the axioms of quantum mechanics, like the axioms of any genuine science, were derived in a feedback between empirical observation and theory. How physicists came up with the idea that an electron is a probability wave, I do not know. I assume it just came to someone in a flash of insight, in the same way that my economic axioms came to me. I remember the day clearly: I was sitting at a wooden picnic table in the backyard of a house whose basement I was renting. I remember the sunlight filtering through the tree above me; I remember the overgrown grass that I was supposed to be mowing; I remember the gray block wall of the house; I remember everything except what led me to my axioms.

But productive they were; thirty years later I am still proving theorems deduced from those axioms and from nothing else. Unlike some economists who are always borrowing from other fields (like entropy[†], the fad *du jour*), my science is entirely self-contained. And Debreu's set of axioms, which were still a matter of controversy thirty years ago, have crumbled to dust. Today, I alone stand for the axiomatic method in economics; though it is great that Kakarot-Handtke has proposed some guidelines for the compiling of such important statistics as national income, which I hear is of interest to accountants.

So I will leave it to the bean counters to review Kakarot-Handtke's paper and verify that he has not overlooked anybody's beans while tallying up national income. I have made it clear here and elsewhere that I find aggregate economic statistics to be wholly meaningless, particularly employment statistics, which Kakarot-Handtke seems so infatuated with. Note.

[†] Chemistry professor Frank L. Lambert writes, "The only best-selling book on entropy ever published, filled with errors leading to absurd statements, was written by a person with degrees in economics and international affairs but no scientific background."

Incidentally, Kakarot-Handtke is wrong to list epicycles with angels and unicorns. The question that divided the followers of Ptolemy and Copernicus was not methodological. Each man proposed a set of axioms and deduced theorems from them in a sincere attempt to explain real phenomena, planets, observable by anyone who looked to the sky on a dark night. So both men were true scientists, unlike those who speak of angels and unicorns, who are fabulists.

But, while Ptolemy was a true scientist, he was not a very good one; his theory was abandoned in favor of Copernicus' theory, because the latter works better. In economics, the person most similar to Ptolemy is Nassau Senior. He too is a true scientist; I would never be so unkind as to smear him with association to fabulists, as Kakarot-Handtke has attempted to smear me. Like Ptolemy, Senior proposed a set of axioms[‡] and deduced theorems from them in a sincere attempt to explain real phenomena, utility, observable by anyone who has consulted their value scale to make a decision in the market. But, also like Ptolemy, Senior was not a very good scientist. Just as Ptolemy's theory was superseded by Copernicus' theory, Senior's theory was superseded by mine.

REFERENCES

Aguilar, Victor. 1999. ***Axiomatic Theory of Economics.*** Hauppauge, NY: Nova Science Publishers, Inc.

Stigum, Bernt. 1991. ***Toward a Formal Science of Economics: The Axiomatic Method in Economics and Econometrics***. Cambridge, MA: MIT Press

[‡] Stigum (1991, p. 4) records Senior's axioms:

1. Every "man desires to obtain additional Wealth with as little sacrifice as possible."
2. The "Population of the World… is limited only by moral or physical evil, or by fear of a deficiency of those articles of wealth which the habits of the individuals of each class of its inhabitants lead them to require."
3. The "powers of Labour, and of the other instruments which produce wealth, may be indefinitely increased by using their Products as the means of further Production."
4. Agricultural "skill remaining the same, additional Labour employed on the land within a given district produces in general a less proportionate return…."