On the Role of Data and Measurement in Agricultural Economics Research

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Agricultural economics was established as an empirical science Its capacity, credibility, and resources are attributable to its capability as an empirical science and to its relevance to society's needs This tradition and our reputation as agricultural economists are based on a balanced emphasis of (1) theory (including disciplines other than economics), (2) statistical and other quantitative measurement techniques, and (3) data This is the three-legged stool that supports empirical tradition

I believe that our profession has increasingly celebrated and rewarded theory and statistical methods while ignoring data (Bonnen, 1988) [1] Consequently, we are undermining our capacity as an empirical science and as a profession

Claiming a body of inquiry to be a science depends on the grounds on which its knowledge is asserted Empirical science depends on a theoretical statement of causation supported (or, more properly, not disproved) by empirical evidence That evidence is formed around the same concepts as the theoretical explanation of causation Data must be defined in the same terms as the theory being supported or negated For the empirical test to be valid, the act of measurement must be logical, consistent, and appropriate to the measurement problem faced

Agricultural economics appears to have devoted far too little attention to its data in relation to its theory and formal measurement processes The ultimate basis of acceptance of a scientific theory is consensus, which occurs when theory is consistent, tests are valid, and empirical results are supportive Consensus depends on the way a theory squares with a real world described by its data The specification of that data requires the same underlying causal logic and rigor demanded of economic theory and statistical methods (Churchman)

Types of Research

Research serves multiple purposes and its products take many forms For such purposes as research design, funding strategies, and data collection and management, it is convenient to distinguish three broad classes of research—disciplinary, subject matter, and problem solving

Disciplinary research is the theory, empirical measurement, and the measurements techniques and methods used to explain a fundamental class of phenomena of concern in such disciplines as chemistry microbiology, economics, or philosophy Expanding such knowledge increases the capacity of a discipline to explain nature and human behavior Data are necessary to any consensus about theories that make up a discipline

Two other types of research are of an applied, multidisciplinary nature Subject matter research combines different disciplinary products into knowledge useful to a set of decisionmakers who face a common set of problems Agriculture is not a discipline but a subject matter, as are its subsets, such as animal science, agronomy, agricultural economics, and farm management Practical decisions are often difficult to make based on general subject matter knowledge A better informed decision depends on problem-solving research that further processes disciplinary and subject matter information into information more directly relevant to the specific problem on which a decision must be made Problem-solving knowledge takes a form that is relevant to a single decisionmaker (or set of decisionmakers) who has a specific practical problem on which action is necessary The processing of data and information produces a continuum in which distinctions differ in degree and purpose

Problem-solving research differs from disciplinary and subject matter research in that it always seeks prescriptions, that is, "should" or "ought" statements that depend on values as well as on relatively value-free knowledge Value data are frequently missing from agricultural economics research, and additional attention both to the content and form of value data would do much to enhance the quality of research and usefulness of the prescriptions The acceptance of a production innovation, for example, may depend more on the values of producers or consumers, or on the rules that structure and govern the decision process, than on the technical qualities of the innovation

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[1]See complete citation at end of article

The Nature of Data, Information, and Knowledge

Data are symbolic representations of concepts, quantities, and actions and are the direct product of measurement or counting Information is more It usually combines data from different collection processes and subject matters always within some analytic interpretation Interpretation may range from little more than formatting of data for presentation, to encoding in an index or scale, to modeling complex economic, engineering, and biological phenomena Information is data that are processed, organized, interpreted, and communicated The information's usefulness aids decisionmaking or subject matter evaluation, whether in science or in the practical world (Bonnen, 1977)

Finally, when one speaks of a body of (disciplinary or subject matter) knowledge, one is referring not just to tested (validated) information but tested information around which a scientific/professional community consensus has formed Until a broad consensus of appropriate scientists accepts the validity of an information set, it is not generally treated as part of the corpus of knowledge in that discipline or subject matter

Philosophies of Knowledge

Data, information, and knowledge, in a sense, form a continuum ranging from raw sense experiences to carefully catalogued wisdom [2] A researcher's view of the role of data arises from that researcher's philosophy of knowledge The positivists' concept argues that the only descriptive knowledge that can be objective and therefore scientific is value-free knowledge Philosophers discredited extreme forms of positivism decades ago, rejecting the possibility of totally value-free knowledge Physical scientists and most biological scientists have since cast off the limitations of logical positivism but, paradoxically, it persists in the social sciences and still tends to dominate agricultural economics (Castle)

The premises of a positivistic philosophy of knowledge influence the data collected and its interpretation Excessive positivism has not only resulted in a deficiency of value-oriented data, but it has narrowed the interpretation of available data Observing the level of investment in soil conservation measures, for example, reveals only evidence of purchase and installation as relevant and objective measurements, not the farmer's attitudes, understanding, peer pressures, and goals

Descriptive, positivistic knowledge is partially acquired through the five senses and is analytic (logical and conceptual) as well as synthetic (descriptive) It combines theory (statements of causation) with undefined primitive terms known through experience and interaction to produce contingent descriptive (empirical) statements about the perceived reality of nature and human and other behaviors (Johnson pp 41-53)

There are several other philosophic positions of consequence in social science research, including normativism and pragmatism Clearly, one's philosophy of knowledge will dictate what is considered admissible as scientific evidence A strictly positivistic approach will tend to exclude normative statements about what is good or bad, even if such statements are descriptive and, thus, factual

Normative statements (about goodness and badness) can be regarded as empirical or descriptive statements Thus, both positive and normative philosophic positions require data appropriate to their causal theories Like value-free knowledge, value knowledge can be viewed as experiential, acquired through the five senses Consequently, the same tests of truth used in positivism can be applied to knowledge of goodness and badness to support the claim of an objective, descriptive knowledge of values These tests assess correspondence (experience), logical coherence (internal consistency), and clarity (the proposition to be tested is not ambiguous or vague and thus can be tested) (Johnson, pp 41-64)

Both positive (relatively value-free) and normative (value) knowledge ultimately depend on a leap of faith that the five senses reflect something real in nature and are not perceptual illusions Thus, both knowledges depend on philosophic "primitives " undefined terms known from experience (for example, good/bad, hot/cold) Neither value nor value-free knowledge may be regarded as knowable with certainty All knowledge is contingent in science and thus subject to revision A modern or balanced view would allow both positive and normative statements to be tested empirically for relations to theory

Another view, that of the pragmatist, argues that value-free and value knowledge are interdependent in their consequences and that attempts to establish a clear distinction between them are arbitrary and mistaken The truth of knowledge is viewed as dependent on its practical consequences Thus, truth is instrumental and dependent on the use of knowledge The ultimate test of truth is workability, although

[2] This section is an edited version of a similar discussion in (Bonnen 1989) In both versions, a major intellectual debt is owed to Glenn L Johnson who has contributed greatly to my education and others' in the philosophy of science and philosophic value theory

coherence and clarity are relevant *ex ante* tests of pragmatic prescriptions, the form in which most pragmatists frame any inquiry This philosophic value position tends to be held by most experienced policymakers and, within the colleges of agriculture, by most extension staff and some problem-oriented teachers and researchers Indeed, it is the typical philosophic value position of problem-solving (Johnson, pp 65-75)

In my view, the philosophic ground on which one chooses to stand to address a particular inquiry should depend not only on the specific purpose of the inquiry, akin to pragmatism, but also on different philosophic positions which should be combined as appropriate to address various parts of complex inquiries (Johnson, pp 22-7, 221-35) Many of the arguments among agricultural economists, even alleged disputes over empirical evidence, arise out of differences (often unconscious) in their philosophic views We need to be more conscious of these differences and their advantages and disadvantages in different kinds of inquiries

The Value of Research

The value of information from research is derived from its value in decisionmaking, whether in science or in practical problems The value of information in a decision depends on the extent to which it is news to the decisionmaker The value of new information is the value of the decision made with that information minus the value of the decision without it and minus the cost of the new information (Bonnen, 1977) Data collected as news has utility in decisions, with most of the utility going to the market participant who acts first

Some Bad Habits

Research from an information system point of view acknowledges complexity and seeks balanced attention to all elements of inquiry Failure to acknowledge the interdependence of all the elements of inquiry can result in some bad habits, which can be destructive of effective research and professional performance These bad habits include

An exclusive or excessive emphasis on one of the three legs of the empirical tradition in science to the exclusion or detriment of the others The most common is an excessive focus on theory development without an adequate empirical test of the theory Some use no data at all They just publish mathematical proofs of the logical consistency of the theory Others use inappropriate secondary data formed for a different purpose around concepts that differ significantly from those to be tested Sophisticated econometric technique is then used in an attempt to compensate for the weaknesses (Leontief)

The growing lack of experience with primary data collection in agricultural economics The rising economic value of time and the labor-intensive nature of data collection are part of the reason for the lack of experience But often the only accurate way to test a concept is with data collected specifically for the purpose [3] The profession is slowly losing touch with the problems involved in the designing and processing of data, which in turn are critical elements needed in selecting and modifying appropriate data for modeling

Lack of extensive hands-on experience with agricultural subject matters This was not a problem in earlier times Most agricultural economists then grew up in rural communities or on farms and brought some substantial command of agronomy, animal science, and other relevant fields and disciplines to graduate training in agricultural economics This is no longer the case Few modern agricultural economists see any need to learn much about complex multidisciplinary subjects before modeling or doing other types of research on them One cannot use the research of other disciplines or collaborate effectively with scientists in other fields without adequate understanding of the relevant fields and disciplines The capacity to judge accurately the correspondence between concepts and reality is not what it used to be in agricultural economics This, however, is offset somewhat by greater knowledge in other areas, but there is a limit to the substitution possibilities

Failure to do sufficient preliminary data analysis in preparing for modeling, forecasting, and other analytic processing of data That is, economists do not work directly with the microdata sets sufficiently to learn the strengths and weaknesses of the data they are preparing to use Rather, they plunge ahead working with various (usually secondary data) aggregates that often obscure many of the weaknesses and characteristics of the data

Excessively narrow and inflexible philosophic commitment (to logical positivism, for example, or a narrow normativism) This limits one's view of the world and choice of data and methods in research Failure to let research purpose guide epistemological choices can constrain and distort the quality of one's research as well as one's judgment of other research

[3] See (Bonnen 1988) for a discussion of possible reasons for this decline in primary data collection

The common but arrogant belief that the only legitimate, respectable, or useful research role for agricultural economics is disciplinary research. All else (subject matter and problem-solving research) is second-rate science—a view common to the elitism of some basic scientists This attitude has produced an equally erroneous reaction in some agricultural economists who will tell you that the only legitimate role is limited to subject matter and problem-solving research Both views destroy the balance of commitment needed for effective performance in agricultural economics research This lack of balance is not limited to agricultural economics and is undermining the capacity of and commitment to the land grant idea in many colleges of agriculture The large number of institutions in trouble with their legislature and clientele attest to this and other difficulties

The output of agricultural economics that generated our resources and societal support included disciplinary, subject matter, and problem-solving information. We now tend to focus so much on the discipline of economics that the profession's incentives and capacity for producing subject matter and problem-solving information is slowly eroding. With this comes an erosion of relevance to society's needs and eventually the support of research The profession needs the multidisciplinary capability to produce subject matter and problem-solving knowledge

References

1. Bonnen, James T. "Improving the Socioeconomic Data Base," *Agriculture and Rural Areas Approaching the 21st Century: Challenges for Agricultural Economics*. eds. James Hildreth, Katherine Lipton, Ken Clayton, and Carl O'Conner Ames: Iowa State University Press, 1988, pp 452-83.

2. ———— "Assessment of the Current Agricultural Data Base: An Information System Approach," *A Survey of Agricultural Economics Literature* Vol. 2, eds. Lee R. Martin and George G. Judge, and others Minneapolis. University of Minnesota Press, 1977, pp 386-407.

3. ———— . "Role of the Social Sciences in the Policy Arena: Implications for Agricultural Economics," *Southern Journal of Agricultural Economics.* Vol 21, 1989

4. Castle, Emery N "Economic Theory in Agricultural Economics Research," *Journal of Agricultural Economics Research*. Vol. 41, No. 3, U.S. Dept Agr., Econ Res Serv, Summer 1989.

5. Churchman, Wes. *The Design of Inquiring Systems*. New York: Basic Books 1971.

6. Johnson, Glenn L. *Research Methodology for Economists.* New York: Macmillan Co 1986.

7. Leontief, Wassily W "Theoretical Assumptions and Non-Observed Facts," *American Economics Review*. Vol 75, 1971, pp. 293-307.