Available online at www.sciencedirect.com
SCIENCE DIRECT®
Measurement 38 (2005) 275–284
Measurement
www.elsevier.com/locate/measurement

Measurement in economic systems

Marcel Boumans *

Department of Economics, University of Amsterdam, Roetersstraat 11, 1018 WB Amsterdam, The Netherlands

Available online 24 October 2005

Abstract

The metrology literature neglects a strong empirical measurement tradition in economics, which is different from the traditions as accounted for by the formalist representational theory of measurement. This empirical tradition comes closest to Mari's characterization of measurement in which he describes measurement results as informationally adequate to given goals. In economics, one has to deal with soft systems, which induces problems of invariance and of self-awareness. It will be shown that in the empirical economic measurement tradition both problems have been on the agenda for a long while, and that the proposed solutions to these problems provide clues for the directions in which one could develop a measurement theory that takes account of soft systems.

Keywords: Econometrics; Economic model; Invariance; Macroeconomics; Passive observation; Soft system

1. Introduction

In economics, there exist two different and separate traditions of measurement. Ignoring one of these traditions would mean understanding only half of how economics proceeds as a science. To emphasize the distinction between these two traditions, I would like to label them as the formalist and the empirical approach. The first tradition is the one most often referred to in the metrology literature when discussing economics and will therefore only briefly discussed. The second, in metrology more neglected, tradition deserves more attention because it shows how measurement formulae maintain empirical significance.

The representation theory of measurement with its landmark publication [1] and its most recent publication [2] only provides a partial understanding of measurement practices in economics. Because most of its major contributors have been mathematicians and psychologists, it has undoubtedly been influential in the field where economics and psychology overlap, namely in the field where decision, choice and game theories flourish, and which is more or less adequately covered by the more general label microeconomics. Beside these often-referred applications, e.g. [3], I would also like to mention the axiomatic index theory, particularly as developed by Eichhorn [4], which is based on Pfanzagl [5].

However, the representational theory as a formalist theory of measurement does not provide an adequate understanding of a lot of other measurement practices to be found mainly in macroeconomics, econometrics, and its combination

* Tel.: +31 20 525 4197; fax: +31 20 525 4254.
E-mail address: m.j.boumans@uva.nl

0263-2241/$ - see front matter © 2005 Elsevier Ltd. All rights reserved.
doi:10.1016/j.measurement.2005.09.003

macroeconometrics. Measurements of important macroeconomic indicators like inflation, business cycle, unemployment and GDP are not adequately described by the representational theory of measurement. It will appear that we need to revise this theory by taking into account the more practical oriented GUM approach [6]. The account of measurement in economics presented here is closely related to Mari's [7] final answer he gave to the problem of what characterizes measurement with respect to generic evaluation. Mari discusses three different characterizations of measurement: ontological (measurement is an evaluation able to determine those numbers that are essential properties of things), formal (measurement is an evaluation producing symbols that can be formally dealt with in a well definite way), and informational (measurement is an evaluation whose results are informationally adequate to given goals).

2. Characterization of economic measurement

The first position is that measures are inherent properties of the measured things. Beside the reasons Mari gives, this position cannot be maintained (at least in economics) because it is often not 'things' that are measured but 'phenomena'. To clarify the principle difference between both, Woodward's [8] distinction between data and phenomena is helpful. According to Woodward, phenomena are relatively stable and general features of the world and therefore suited as objects of explanation and prediction. Data, that is, the observations playing the role of evidence for claims about phenomena, on the other hand involve observational mistakes, are idiosyncratic and reflect the operation of many different causal factors and are therefore unsuited for any systematic and generalizing treatment. Woodward characterizes the contrast between data and phenomena in three ways. In the first place, the difference between data and phenomena can be indicated in terms of the notions of error applicable to each. In the case of data the notion of error involves observational mistakes, while in the case of phenomena one worries whether one is detecting a real fact rather than an artifact produced by the peculiarities of one's instruments or detection procedures. A second contrast between data and phenomena is that phenomena are more 'widespread' and less idiosyncratic, less closely tied to the details of a particular instrument or detection procedure. A third way of thinking about the contrast between data and phenomena is that scientific investigation is typically carried on in a noisy environment, an environment in which the observations reflect the operation of many different causal factors. Underlying the contrast between data and phenomena is the idea that theories do not explain data, which typically will reflect the presence of a great deal of noise. Rather, an investigator first subjects the data to analysis and processing, or alters the experimental design or detection technique, in an effort to separate out the phenomenon of interest from extraneous background factors. It is this extracted signal rather than the data itself which is then regarded as a potential object of explanation by theory. As noted in GUM [6], to obtain facts about a phenomenon, we need a mathematical model that transforms the set of repeated observations into the measurement result. In other words we only obtain reliable information about a phenomenon by the mediation of a mathematical model. As a result, this kind of model is located on the theory-world axis, mediating between facts about phenomena and data, see Fig. 1. The dotted line in Fig. 1 represents the indication that theories do not provide facts about phenomena. For example, theories tell us that metals melt at a certain temperature, but not at which temperature (Woodward's example); or they tell us that capitalist economies give rise to business cycles, but not the duration of recovery.

Mari's second characterization of measurement [7] is that measures are results of operations that preserve the relations observed among measured things. This position is most explicitly taken by the representational theory of measurement as presented by [1,2]. The main reason why this position cannot be maintained to understand measurement

Theory

↓

Phenomenon

Facts about the phenomenon

↑

Model

↑

Observations

Fig. 1. Position of models on theory-world axis.