

Ivan Moscati  
University of Insubria, Department of Economics  
email: [ivan.moscati@uninsubria.it](mailto:ivan.moscati@uninsubria.it)  
web: [www.uninsubria.it/docenti/ivan.moscati](http://www.uninsubria.it/docenti/ivan.moscati)

***Measuring Utility:  
from the Marginal Revolution to Neuroeconomics***

Under contract for Oxford University Press; expected publication: 2015

<i>Index</i>	<i>Pages</i>
General outline	2
Table of contents	5

## General outline

Since the so-called “marginal revolution” of the 1870s, the economic theory of choice has been based on the notions of utility and, later on, preference. In current economic analysis, individuals have preferences over the alternatives available to them, these preferences can be represented by a utility function, and individuals choose their most preferred alternative, i.e., the alternative that maximizes their utility.

The concepts of preference and utility, however, have been – and still are – the subject of controversy within economics. Preferences and utility, to begin with, cannot be observed and measured in a straightforward way. This circumstance has generated a number of discussions and developments in economics. Some economists, for example, have argued that economics should be freed from preferences, utility and other psychological concepts and should be concerned only with observable variables such as choices. Others have instead devised empirical methods to measure preferences and utility that, however, rely on controversial assumptions.

To complicate the picture, over the course of time the very notions of preference, utility, and measurement, as well as the measurement techniques available to economists, have changed. Thus, while early marginalists in the late nineteenth century talked primarily of utility and conceived it as an expression of preference intensity, in the early twentieth century economists considered the notion of preference as more fundamental than that of utility, focused on the ranking of preferences rather than their intensity, and conceived of utility as a numerical index expressing the individual’s preference ranking in a convenient way. After World-War-II, economists acknowledged that preference intensity plays a role in a number of important economic theories and readmitted it into economic analysis. Moreover, while early economists univocally associated measurement with the identification of a unit, later economists have endorsed the view that there are different types of measurement, many of which do not depend on the availability of a unit. According to this later and more flexible view of measurement, to state whether preferences and utility are measurable or not, it is necessary to specify what kind of measurement one refers to. Finally, recent developments in experimental economics and the introduction of cognitive-science technologies into economics have broadened the set of methods that can be used to elicit psychological magnitudes, re-awakening old issues concerning the measurement of preferences and utility.

In the book, I study utility and preference measurement from a historical and methodological perspective.

At the *historical* level, I reconstruct the intricate and multifaceted history of utility and preference measurement from the marginal revolution of the 1870s to the recent attempts in neuroeconomics to measure utility through the neural activity of the brain. The first phase of this history, namely from 1870 to 1945, is covered by several narratives of the evolution of utility theory. However, the historical reconstruction I carry out in this book is the first that digs into the measurement aspects of utility analysis between 1870 and 1945, and brings into focus the interplay between the understanding of measurement of utility theorists and their utility theories in that period. Among other things, this new focus on measurement allows me to show that the dichotomy between cardinal utility and ordinal utility, which is usually used to tell the history of utility analysis between the marginal revolution and

World-War-II, is too threadbare and barren to illuminate the problems that utility theorists actually faced in that period.

The history of utility theory in the post-1945 period is almost completely uncharted waters in existing reconstructions of the history of microeconomics. Therefore the book fills a severe lacuna in the current state of the history of economic thought, and moves the current frontier of the history of microeconomics significantly forward in terms of chronology.

The history told in the book is innovative also in terms of its interdisciplinary approach. Since Aristotle, in fact, issues related to measurement have been widely discussed in a number of disciplines, such as philosophy, mathematics, physics and psychology. While existing histories of utility theory tend to neglect the interdisciplinary dimension of measurement issues, in the book I investigate understandings and practices of measurement beyond economics and discuss whether and how they have influenced utility theorists.

The second dimension of the book is the *methodological* one. In fact, economists dealing with preference measurement often addressed questions such as: What does it mean to measure a thing? Which empirical data can be legitimately used to measure utility? Can self-reports be considered reliable data or, on the contrary, can preferences be inferred only from observed choices? What is the role of monetary incentives in the elicitation of preferences? By discussing how these challenging questions have been addressed in the history of utility and preference measurement, the book contributes to the methodological understanding of past and present economics practices.

The book is divided into four parts. Parts One, Two and Three deal with the measurement of utility and preferences in the period 1870-1970 and are predominantly historical in character. As Part Four covers the post-1970 period and examines recent theories that do not lend themselves as yet to proper historiographical study, it has chiefly a methodological nature.

Part One focuses on the period 1870-1910. I first review the understanding of measurement in a variety of non-economic disciplines in that period, and argue that in all of them measurement was univocally associated with the identification of a unit and the assessment of the numerical ratio between the unit and the object to be measured. I label this unit-based understanding of measurement the “classical” concept of measurement. I then move to utility theory, contend that William Stanley Jevons, Carl Menger, Léon Walras and the other early marginalists understood measurement in the classical fashion, that they applied this classical conception of measurement to utility measurement, and that therefore they were non-cardinalists in the current sense of the term associated with the uniqueness of the utility function up to positive linear transformations. In particular, I illustrate the tension between the classical understanding of measurement of these economists and their scientific practices.

Part Two covers the years 1910-1945. I show that this period was characterized not only by the ordinal revolution and the rise of the notion of ordinal utility, then labeled “immeasurable utility”, but also by the parallel definition and stabilization of the notion of cardinal utility as utility unique up to positive linear transformations. In particular, I study the discussions of the 1930s about whether cardinal utility could be considered measurable, and contend that in the course of these discussions some utility theorists began to abandon the classical conception of measurement. However, these economists did not provide a full-fledged new definition of measurement. In effect, in the period 1910-1945 a new

conception of measurement was elaborated outside economics by a number of physicists, philosophers and psychologists. According to this new conception, labeled as the “representational” view of measurement, measurement consists of assigning numbers to objects in such a way that the relations among the assigned numbers represent the relevant relations among the objects. I analyze the discussions leading to the elaboration of the representational conception of measurement outside economics in the second chapter of Part Two.

Part Three studies the 1945-1970 period. I argue that utility theorists embraced the representational understanding of measurement and applied it to the measurement of utility only in the 1950s, and that this happened by way of a discussion of the nature of the individual utility function featuring in John von Neumann and Oskar Morgenstern’s Expected Utility Theory. I then study the experimental attempts to measure utility that took place in the period 1950-1970 and which were often based on Expected Utility Theory. Finally, I investigate the rise of the axiomatic approach to utility measurement that began in the mid-1950s and was carried out by economists, psychologists, and analytical philosophers. In the axiomatic approach, various sets of axioms on preferences are related to various measurability features of the utility function.

Part Four discusses the post-1970 period, characterized first by the rise of behavioral economics and, more recently, neuroeconomics. Far from constituting a new unitary paradigm, behavioral economics has produced inconsistent insights that range from the claim that preferences are inextricably intertwined with the context-dependent process through which they are elicited, and therefore are immeasurable, to the idea that utility, when defined as “experienced utility” or “happiness”, can be measured through questionnaires, reports of current subjective experience, or physiological indices. Also some neuroeconomists have argued that utility is measurable. These neuroeconomists contend that the traditional economic concept of utility has a precise neural correlate, namely the firing rate of a specific population of neurons. The measure of this firing rate would provide an indirect but classical measure of utility in the strong sense of the preference intensity that early marginalists gave to it. In Part Four I discuss, mainly from a methodological viewpoint, the new wave of ideas on utility measurement that behavioral economics and neuroeconomics put into circulation.

Two final specifications about the scope of the book as a whole are in order. First, the book focuses on the measurement of individual utility rather than collective welfare. In economic theory, collective welfare is typically conceived as a function of individual utility, and the measurability of collective welfare depends on assumptions concerning the measurability of individual utility and the possibility of comparing the utilities of different individuals. In the book I concentrate on issues concerning the measurement of individual utility, and deal with the interpersonal comparability of individual utilities and the measurement of collective welfare only in so far the latter issues are relevant to the former. Second, the book does not address the measurement of other-regarding or social preferences such as altruism or inequality aversion. Social preferences have been an important topic of research in the last few years, but the measurement of social preferences raises a number of specific and quite complex issues that might well be the subject matter of another book.

**Table of contents**

***Measuring Utility and Preferences:  
from the Marginal Revolution to Neuroeconomics***

Introduction

PART ONE. 1870-1910

1. The Classical Understanding of Measurement in Philosophy, Psychology, Mathematics and other Disciplines
2. Why Jevons, Menger and Walras were not Cardinalists
3. Classically Measurable Utility in the Work of other Early Marginalists

PART TWO. 1910-1945

4. How Cardinal Utility entered Economic Analysis during the Ordinal Revolution
5. The Rise of the Representational View of Measurement outside Economics

PART THREE. 1945-1970

6. The Debate on the Measurability of von Neumann and Morgenstern's Utility Function
7. Experimental Measurements of Utility and Preferences
8. The Axiomatization of Utility Measurement

PART FOUR. AFTER 1970

9. Measuring Utility or Dissolving Utility? Contrasting Views on Utility Measurement in Behavioral Economics
10. Utility Measurement in Neuroeconomics

Conclusion