18.

The Nonparametric Approach to Demand Analysis

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In Chapter 15 we showed the steps that are normally taken to reduce a very general consumer choice problem to a monetary asset choice problem. At this point, we are prepared to proceed and develop the microeconomic- and aggregation-theoretic literature on the demand for money and monetary assets. This is achieved by conducting the analysis within a microtheoretical framework, making use of a number of theoretical advances in a set of related theories — revealed preference, index numbers, duality, separability, and demand systems.

The standard approach to applied demand analysis is parametric, in the sense that it postulates parametric forms for the utility function and fits the derived demand functions to observed data. The estimated demand functions can then be tested for consistency with the utility-maximizing hypothesis underlying the model, used to estimate price and substitution elasticities, or used to forecast behavior for other price configurations. As Varian (1982, p. 945) puts it, this approach
“will be satisfactory only when the postulated parametric forms are good approximations to the ‘true’ demand functions.”

An alternative approach to demand analysis is \textit{nonparametric}, in the sense that it requires no specification of the form of the demand functions. This approach, fully developed by Varian (1982) in his article, “The Nonparametric Approach to Demand Analysis,” deals with the raw data itself using techniques of finite mathematics. It typically addresses three issues concerning consumer behavior: (i) consistency of observed behavior with the preference maximization model; (ii) the recovering of preferences, given observations on consumer behavior; and (iii) the forecasting of demand for different price configurations. However, there are also advantages and disadvantages of this approach to demand analysis, as we will discuss later in this chapter.

Let us now turn to a detailed discussion of the nonparametric approach to the demand for liquid assets, leaving a discussion of the parametric approach for the next chapter and the rest of this book.

\section{18.1 The Idea of Revealed Preference}

Consider the \( n \)-vector \( x \) of monetary assets and its corresponding \( n \)-vector of user costs, \( p \). Suppose also that we have \( T \) observations on these quantities and user costs. Let \( x^i = (x^i_1, \ldots, x^i_n) \) denote the \( i \)th observation of \( x \) and let \( p^i = (p^i_1, \ldots, p^i_n) \) be the associated user costs, \( i = 1, \ldots, T \). Let us consider the following definitions from Varian (1982, 1983).

\textbf{Definition 18.1.} An observation \( x^i \) is directly revealed preferred to a bundle \( x \), written \( x^i R^0 x \), if \( p^i x^i \geq p^i x \). An observation \( x^i \) is revealed preferred to a bundle \( x \), written \( x^i Rx \), if there is a sequence of observations \((x^j, x^k, \ldots, x^l)\) such that \( x^i R^0 x^j, x^j R^0 x^k, \ldots, x^l R^0 x \).

Note that revealed preference is a relation that holds between the optimal bundle at some budget and anything else the consumer could have bought at the given budget.

\textbf{Definition 18.2.} The data satisfies the Generalized Axiom of Revealed Preference (\textit{GARP}) if \( x^i Rx^j \) implies \( p^j x^j \leq p^j x^i \).

What this definition tells us is that the set of choices \( x^i \) is revealed to be preferred to \( x^j \) if the expenditures on \( x^i \) exceed or are equal to those on \( x^j \) evaluated at the original set of prices, where \( i \) and \( j \) refer to dates (not necessarily consecutive). Note from the above definition