know that rejections will be less frequent, but it was still found that, with n large relative to $(T - k)$ both W_2 and W_3 grossly over-rejected.

These problems for testing symmetry are basically the same as those discussed for estimation in (2.3) above; typical time series are not long enough to give reliable estimates of the variance—covariance matrix, particularly for large systems. For estimation, and for the testing of within equation restrictions, the difficulties can be circumvented. But for testing cross-equation restrictions, such as symmetry, the problem remains. For the present, it is probably best to suspend judgment on the existing tests of symmetry (positive or negative) and to await theoretical or empirical developments in the relevant test statistics. [See Byron and Rosalsky (1984) for a suggested ad hoc size correction that appears to work well in at least some situations.]

2.7. *Non-parametric tests*

All the techniques of demand analysis so far discussed share a common approach of attempting to fit demand functions to the observed data and then enquiring as to the compatibility of these fitted functions with utility theory. If unlimited experimentation were a real possibility in economics, demand functions could be accurately determined. As it is, however, what is observed is a *finite* collection of pairs of quantity and price vectors. It is thus natural to argue that the basic question is whether or not these observed pairs are consistent with any preference ordering whatever, bypassing the need to specify particular demands or preferences. It may well be true that a given set of data is perfectly consistent with utility maximization and yet be very poorly approximated by AIDS, the translog, the Rotterdam system or any other functional form which the limited imagination of econometricians is capable of inventing.

Non-parametric demand analysis takes a direct approach by searching over the price-quantity vectors in the data for evidence of inconsistent choices. If these do exist, a utility function exists and algorithms exist for constructing it (or at least one out of the many possible). The origins of this type of analysis go back to Samuelson's (1938) introduction of revealed preference analysis. However, the recent important work on developing test criteria is due to Hanoch and Rothschild (1972) and especially to Afriat (1967), (1973), (1976), (1977) and (1981). Unfortunately, some of Afriat's best work has remained unpublished and the published work has often been difficult for many economists to understand and assimilate. However, as the techniques involved have become more widespread in economics, other workers have taken up the topic, see the interpretative essays by Diewert (1973a) and Diewert and Parkan (1978)— the latter contains actual test results— and also the recent important work by Varian (1982, 1983).

Afriat proposes that a finite set of data be described as cyclically consistent if, for any "cycle", a, *b, c,* *r, a* of indices, $p''- q' p''. q^b, p^{h'} q^h p^{h'} q''$,