symmetry (and homogeneity) restrictions on /3, so that

(RR) (T12 — T21, Y13 — Y31, • - -IT(' 1)n Tn(n-1)L (69)

Then, under the null hypothesis of homogeneity and symmetry combined, *fi'RjR(*

f28(X'X) 1(70)

is the Wald test statistic which is asymptotically distributed as *?(/2n(n* - Apart from the calculation of W_1 itself, computation requires no more than OLS estimation. Alternatively, the symmetry constrained estimator $ given by (52) with $r = 0$, can be calculated. From this, restricted residuals *E* can he derived. and a new (restricted) estimate of fd, SI, i.e.

= (71)

The new estimate of Sd can be substituted into (52) and iterations continued to convergence yielding the FIML estimators of /3 and f2. Assume that this process has been carried out and that (at the risk of some notational confusion) /3 and 52 are the final estimates. A likelihood ratio test can then be computed according to

= *T* 1n{det i2/det 5d), (72)

and W_7 is also asymptotically distributed as X1/2„(„-17. Finally, there is the Lagrange multiplier, or score test, which is derived by replacing 3-2 in (70) by 52, so that

1.1(3 *(X`X)-1* Ril *1RA,* *(73)*

with again the same limiting distribution.

From the general results of Berndt and Savin (1977), it is known that W_1 W, L• W_I; these are mechanical inequalities that always hold, no matter what the configuration of data, parameters, and sample size. In finite samples, with inaccurate and inefficient estimates of 12, the asymptotic theory may be a poor approximation and the difference between the three statistics may be very large. In my own experience I have encountered a case with 8 commodities and 23 observations where W_1 was more than a hundred times greater than Meisner (1979) reports experiments with the Rotterdam system in which the null hypothesis was correct. With a system of 14 equations and 31 observations, W_1 rejected symmetry at 5% 96 times out of 100 and at 1% 91 times out of 100. For 11 equations the corresponding figures were 50 and 37. Bera, Byron and Jarque (1981) carried out similar experiments for *W2* and W_3. From the inequalities, we