see also Gallant (1975) and the survey by Srivastava and Dwivedi (1979) for variants. *Consistency* of estimation of /3 in (47) is unaffected by the choice of *0;* the MLE's of /3 and 12 are asymptotically independent, as calculation of the information matrix will show. Al] this is standard enough, except possibly for computation, but the use of standard algorithms such as those of Marquardt (1963), scoring, Berndt, Hall, Hall and Hausman (1974), Newton-Raphson, Gauss-Newton all work well for these models, see Quandt (1984) in this Handbook for a survey. Note also Byron's (1982) technique for estimating wry large symmetric systems.

Nevertheless, there are a number of problems, particularly concerned with the estimation of the covariance matrix *0,* and these may be severe enough to make the foregoing estimators undesirable, or even infeasible. Taking feasibility first, note that the estimated covariance matrix 0 given by (48) is the mean of ***T*** matrices each of rank 1 so that its rank cannot be greater than *T.* In consequence, systems for which (n -1) > *T* cannot be estimated by FIML or SURE if the inverse of the estimated f is required. Even this underestimates the problem. In the linear case (e.g. the Rotterdam system considered below) the demand system becomes the classical multivariate regression model

$$Y = XB + U, \tag{49}$$

with Y a *(T X(n* -/-1)) matrix, *X* a *(T X **IC)*** matrix, ***B*** *(k X(n -1))* and *U(T X(n* -1)). (The nth equation has been dropped). The estimated variance-covariance matrix from (48) is then

$$D = y^{-\prime}(/ - \text{grxrixly}. \tag{50}$$

Now the idempotent matrix in baskets has rank *(T - k)* so that the inverse will not exist if n -1 > *T - k.* Since *X* is likely to contain at least n +2 variables (prices, the budget and a constant), an eight commodity system would require *at least* 19 observations. Non-linearities and cross-section restrictions can improve matters, but they need not. Consider the following problem, first pointed out to me by Teun Klock. The AIDS system (19) illustrates most simply, though the problem is clearly a general one. Combine the two parts of (19) into a single set of equations,

$$w_{it} = (a, - AG, ao) + \text{Ain } xe\, E(ri_1 - BitOn\ Pie$$

$$lfi_e E \sum_m yk,,,\ln \text{Pkrin}\, p_{me} + u_{,,}. \tag{51}$$

Not counting a_o, which is unidentified, the system (without restrictions) has a