5. Data and Estimation Technique

Data

The data sets used in this study are all from the 1986-7 Census of Manufacturing published by the Central Bureau of Statistics. Six different types of energy are consumed by the manufacturing sector, namely, wood, diesel, coal, kerosene, and electricity. The cost of each type of energy borne by the firm and quantity of each energy type consumed are also available. The cost divided by quantity gives the unit price of each energy type.

The census gives information on about 51 establishments or industries. However, information on all these industries is not complete. We have included a total of 38 industries in our analysis. Energy costs per firm have been used in our analysis. Where some firms did not report using some energy types, the average price has been used, i.e., the independent variables (prices) are non-zero across all observations. For such firms, the dependent variable (energy shares) will nevertheless be zero reflecting non- consumption of a particular type of energy.

It is also important to point out that the data set used is a cross-sectional sample. Cross-sectional data characterise a long-run situation in which producers have been able to select their plant size and the technology within the context of resource constraints faced by them. In the short run, new firms enter industries that have excess profit and some that have suffered losses have quit the industry. As a result, cross-sectional data are characterised to depict a long-run equilibrium situation.

Estimation

Ordinary least square (OLS) cannot be applied to estimate the system. This is because budget share equations imply that their sum must equal one and as a result, the sum of the error terms should equal zero. The model contains a system of equations and should therefore be treated as such. An efficient approach to estimate the parameters of the model is to utilise the technique known as the seemingly unrelated regression equations. Therefore, for the purposes of stochastic estimation, additive disturbance terms are appended to each of the four equations in the multivariate system. The disturbance term captures errors caused by firms failing to behave in a cost-minimising manner. The estimation procedure employed is Zellner's iterative technique (Kmenta and Gilbert 1968). This iterative estimation gives results that are equivalent to the maximum likelihood parameters and are invariant to the equation deleted from the dual system. The disturbance terms in the cost function and the cost-share equations are assumed to be normally distributed, contemporaneously correlated for individual firms, but uncorrelated across firms.

Furthermore, because of the homogeneity constraint, only n-1 cost-share equations are linearly independent. Thus, one cost-share equation must be deleted from the system to avoid problems associated with linear dependency. The full dual system includes the translog cost equation and four cost-share energy equations which are estimated as a simultaneous system. The other restrictions implied in Equation (5) also need to be imposed. The SHAZAM econometric package has been used for estimation.