The Economic Journal on Nepal, Vol. 25, No.3, July-September, 2002 (Issue No. 99) © DOE-TU

Returns to Scale in Textile Industry of Nepal

*Govinda P. Koirala**

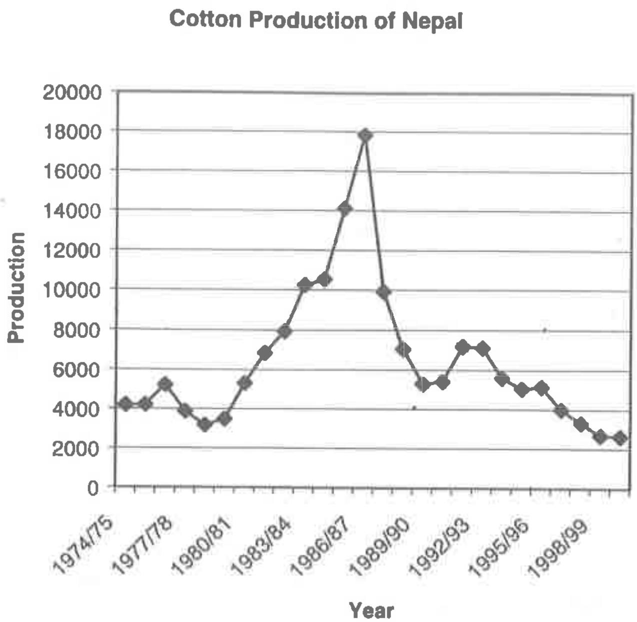
Abstract

Using plant level data from 1992 census and from 1997 census of manufacturing establishments in Nepal, a simple cubic cost function and a more general translog cost function are examined for the textile industry of Nepal. Homothetic, homogeneous and Cobb-Douglas cost functions are also estimated by imposing some appropriate restrictions on translog cost function. The study suggests that the industry has an increasing return to scale over the current production range. Most of the firms have not been able to exploit the economies of scale in this industry.

1. INTRODUCTION

Production of the textiles appeared to be very promising in the late seventies and early eighties in Nepal. The average growth rate of production during that time (1974/75 to 1986/87) was impressive at 12.6 per cent per year. From that time onwards it drastically dropped in the next few years till 1990 and stabilized a little for few years but continued dropping there after [Appendix I]. When Indian garment producers entered into Nepal to bypass the quota from the US in the late eighties, they brought their raw materials (cotton cloth is the raw material for garments) from India. At the same time Nepalese consumers of cloth and producers of garments also found cheaper and better imported clothes as an alternative to domestic clothes. The domestic producers lost their market even within the country. Chinese and Thai producers also have penetrated their market for cloth in Nepal. It seems that the Nepalese producers are in the losing battle. However, a closer look of current technology and prospects for the producers do not seem that disappointing. The question is whether Nepalese producers would be able to produce more efficiently at lower cost than the foreign producers. The answer lies in understanding of returns to scale in the industry and find whether there is room for improving efficiency and reducing cost of production.

* Dr. Koirala is associated with College of Business, University of Rio Grande, Rio Grande, Ohio, USA.



Today the producers must organize production so that the cost per unit is at a minimum level. This is especially significant to the producer of a cotton textile in Nepal, which is no more a closed economy.

Is there increasing returns to scale in cotton textile industry of Nepal? Have the cotton cloth producers exploited the economies of scale? These are the basic questions that this paper attempts to analyze. Determining the possible existence, nature and the production scale have important implications for the competitiveness of the cotton textile industry of Nepal.

A business that is expanding or contracting its operation needs to predict how costs will change as desired level of output changes. In this regard an empirical estimation of a long-run cost function can be useful. The long run cost function will help us to determine the existence and the nature of economies of scale in the industry. Estimates of future costs can be obtained from a cost function, which relates the cost of production to the level of output and other variables that the firm can control. The purpose of this study is to estimate a suitable long-run cost function of Nepal's cotton textile industry after applying various diagnostic checks to the estimated results.

Numerous studies [Szprio and Cette (1974); Christensen and Greene (1976); Robidous and Lester (1992); Jha et al. (1993); Wu (1993); Bregman, Fuss and Rejev (1995); Truett and Truett (1996); Fikkert and Hason (1998); Ramchandran (2001)] have examined the nature of returns to scale in manufacturing sectors for many different countries. This study is focused to understand the nature of economies of scale in textile industry of Nepal.

Present study is organized as follows: models and their implications are discussed in section 2 followed by the discussion on the nature of data in section 3. The results of the analysis will be presented in section 4 and conclusion follows in section 5.

2. MODEL

Estimation of technological characteristics is based on the duality theorem between production and cost. Binswagner (1974a) has shown that it is better to estimate a total cost function than the production function. The cost function is estimated to study the nature of economies of scale. It is assumed that all inputs are employed at an optimum level to minimize total cost.

2.1 Cubic cost function:

A general cubic function of the following form may be estimated as a long run cost function. It is one of the most commonly used cost functions, mainly because, it gives rise to U-shaped marginal and average cost curves.

$$C = a_1Q + a_2Q^2 + a_3Q^3 \qquad (1)$$

Where, C: Total cost

Q: Gross output (in physical units)

a_i : Parameters associated with output variables

The average cost (AC) and the marginal cost (MC) functions respectively are then obtained from (1) as

$$AC = a_1 + a_2Q + a_3Q^2 \qquad (2)$$

$$MC = a_1 + 2a_2Q + 3a_3Q^2 \qquad (3)$$

If $a_1 > 0$, $a_2 < 0$ and $a_3 > 0$ then average and marginal cost curves both will be U-shaped.

2.12 Minimum efficient scale (MES) with cubic cost function

The minimum efficient scale, Q*, can be obtained at the level of output for which AC is minimum. AC will be minimum when

$$\frac{\partial(AC)}{\partial Q} = 0\Big|_{Q=Q^*}$$

That is, MES is given by,

$$Q^* = -\frac{a_2}{2a_3} \qquad (4)$$

2.2 Translog cost function

The shape of the average cost curve is important not only because of the implications for plant scale discussions but also because of the effects on the potential level of competition.

U-shaped cost relations are most common, but they are not universal. The cubic cost function restricts the average and marginal costs to be U-shaped. If the firms encounter first increasing, then constant returns to scale, an L-shaped long run average cost curve emerges. In this case, large plants will have no relative cost advantage or disadvantage compared with smaller plants that are producing at the beginning of the lower part of the L-shaped long run average cost function. Similarly, an asymptotically declining average cost function will indicate a larger plant has relatively more cost advantage than a smaller one. Hence a more general translog cost function can be examined.

A general total cost function in translog form will take the following form:

$$\ln C = a_0 + b\ln Q + \tfrac{1}{2}c(\ln Q)^2 + \Sigma d_i \ln P_i + \tfrac{1}{2}\left\{\Sigma\Sigma e_{ij}\ln P_i \ln P_j\right\} + \Sigma f_i \ln Q \ln P_i \qquad (5)$$

Where C is the total cost of producing output Q with m inputs whose prices are given by $P_1, P_2, \ldots, P_m$. In this model a_0, b, c, d_i's, e_{ij}'s and f_i 's are the coefficients to be estimated.

The advantage of this translog function is that the estimated model can provide information of other forms of technology used in the production. The cost function will be homothetic if f_i=0; it becomes homogeneous if f_i=0 and c=0; and it collapses to Cobb-Douglas if f_i=0, c=0 and e_{ij}=0 for all i and j. One of the weaknesses of the translog estimation, however, is that it may violate curvature conditions even for a properly shaped underlying technology (Parker, 1994). This leads us to impose some restrictions on the parameters of the function.

Sheppard's Lemma ensures that the cost minimizing level of utilization of any input is equal to the derivative of *lnC* with respect to *lnP* of that input (Jha et al., 1973). Then, S_i, the cost minimizing share of i[th] input that produces Q at price P_i, can be written as:

$$S_i = \frac{\partial \ln C}{\partial \ln P_i} = d_i + \sum_j e_{ij}\ln P_j + f_i \ln Q \qquad (6)$$

In order to represent a well-behaved cost function equation (5) must satisfy three properties, (Varian, 1984),

1. The cost function is increasing in factor prices. Therefore, $\partial LnC/\partial LnP_i = S_i \geq 0$. That is, the estimated cost share equation (6) be positive for each input i.
2. The cost function be homogeneous of degree one in input prices. Therefore, the derivatives of the cost function are homogeneous of degree zero in input prices.
3. The cost function is concave in input prices. Therefore, the matrix of the second derivatives of the cost function is a symmetric negative semi-definite matrix within the range of input prices.

Thus the theory requires that the cost function specified in equation (5) be linearly homogeneous and symmetric in input prices. Hence, the following restrictions are imposed on the parameters a priori for the homogeneity and symmetry in input prices. (Choy, 1990)

$$e_{ij} = e_{ji},\ \Sigma d_i = 1,\ \Sigma e_{ij} = 0,\ \Sigma\Sigma e_{ij} = 0 \qquad (7)$$

2.21 Elasticity of cost and minimum efficient scale (MES) with translog cost function

The elasticity of cost with respect to output is given by:

$$\varepsilon_c = \frac{\partial C}{\partial Q} \times \frac{Q}{C} = \frac{\partial \log C}{\partial \log Q} = b + c \log Q + \sum f_i \log P_i \qquad (8)$$

Since ε_c is a function of Q and P_i, this suggests that the cost elasticity changes with the level of output and the input prices. We have an increasing returns to scale if $\varepsilon_c < 1$, a decreasing returns to scale if $\varepsilon_c > 1$ and a constant returns to scale if $\varepsilon_c = 1$.

The minimum efficient scale is the output level at which long run average costs are minimized.

The long run average cost $\frac{C}{Q}$ will be minimum when

$$\left.\frac{\partial (C/Q)}{\partial Q} = 0\right|_{Q=Q^*}$$

Thus for equation (5) MES is given by (See Appendix II),

$$Q^* = e^{\frac{1-b-\Sigma f_i \log P_i}{c}} \qquad (9)$$

In case of the cost function which is homogeneous in output or a Cobb-Douglas cost function, the constant elasticity coefficient is given by b (coefficient of lnQ in equation 5) while the MES will be undefined in these cases.

For homothetic cost function cost elasticity is given by

$$\varepsilon_c = b + c \log Q \qquad (10)$$

and MES is given by

$$Q^* = e^{\frac{1-b}{c}} \qquad (11)$$

Since ε_c is a function of Q, the cost elasticity in this model also changes with the level of output

3. DATA

The basic data are obtained from the last two censuses of manufacturing establishments in Nepal. The latest census was conducted by the government of Nepal in 1997. The earlier census was conducted in 1992. The Central Bureau of Statistics (CBS) was responsible for collecting data on manufacturing. The plant level data are used in this study. Only the firms for which the quantity of products by its product name (product codes) are available have been included in this study.

The total number of firms with complete information for the analysis in this data set is 184, of which 85 are from 1992 census. Appendix III provides definitions of the variables used in this study.

4. STATISTICAL RESULTS

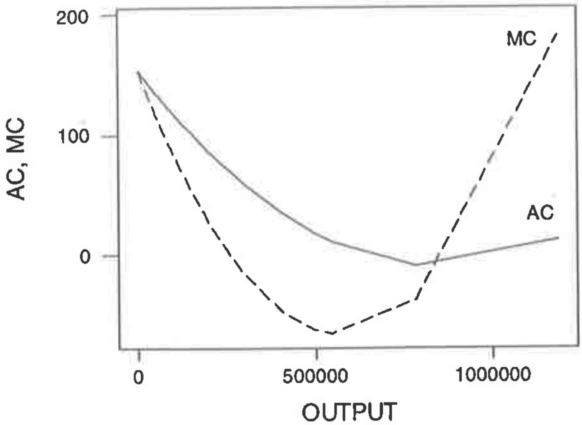
4.1 Estimates for cubic cost function:

The estimated cost function may be thought of providing a long run cost function if cross-section data are used (Hirshchey & Papas, 1996). Hence the cost function is estimated for equation 1 using ML estimate with constant term forced to zero. The results are presented in Table 1.

Table 1: Estimates for Cubic Cost Function

Variables	Parameters	Estimate	P-value
Q	a_1	153.202	[.000]
Q^2	a_2	-.380E-03	[.000]
Q^3	a_3	.220E-09	[.000]
	MES	861958	[.000]
	Number of observations	184	
	Log likelihood	.791E+09	

Fig. 2: Estimated AC and MC curves



All the coefficients are found statistically significant at least at 1 percent level of significance. The parameter estimates have expected signs and indicative of U-shaped AC and MC curves. The average and marginal cost functions thus are estimated respectively as:

$$AC = 153.202 - 0.000380039\,Q + 0.000000000220451Q^2$$

and,

$$MC = 153.202 - 0.000760078\,Q + 0.000000000661353Q^2$$

The resulting AC and MC curves are presented in figure 2.
The estimated MES is given by

$$Q^* = 861{,}958 \text{ meters.}$$

The distribution of output indicates that there are a large number of firms at very low level of output. Comparing the average production the situation seems to have improved from 1992 to 1997. But as the first quartile shows 25% of the firms were producing less than 8400 meters of cloth in 1992, the value of quartile dropped to about 3600 meters showing that there were proportionately more number of smaller firms in 1997. Even though the maximum output produced by one of the firms is about 1.2 million meters, the median is just about 21 thousand meters in 1997. That is 50% of the firms are producing less than 21 thousand meters of cloth in a year. The value of third quartile shows that 75% of the firms are producing less than 90 thousand meters of cloth. The distribution of firms with respect to output is presented in figure 3 as histogram and the summary statistics is presented in Table 2.

Fig. 3: Histogram of output

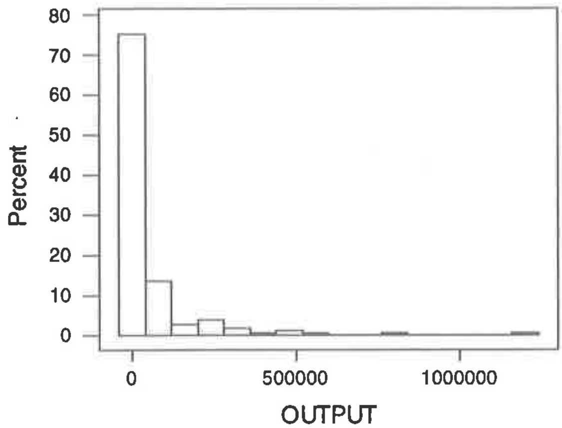


Table 2: Summary Statistics of Output

	OUTPUT	
	(1992 Census)	(1997 Census)
Number of firms	85	99
Mean	31024	82170
Standard deviation	62733	169075
Minimum	900	57
Maximum	491286	1185460
First quartile	8400	3600
Median	14286	20683
Third quartile	24072	90000
Sum	10771786	2637003

Average output from the industry was 82,170 meters of cloth in 1997. Since the cubic cost function forces the average cost function to behave as U-shaped curve, the estimated MES is suspected to be low particularly when the AC curve is actually decreasing in the range of current production (as indicated by translog model to be discussed below). Even in this case, MES is very large relative to the average output. MES is about 10.5 times the average output in the industry. This indicates that the textile industry is not competitive. Firms are expected to produce very close to the level of MES in a highly competitive market. It is observed that 97 percent of the firms are producing at less than 50 % of MES.

4.2 Estimates for translog cost function

The cubic function model was estimated that restricted the average cost function to generate a U-shaped curve. This actually estimated negative AC and MC for some of the firms, which cannot be accepted as such. That means cubic cost function could not capture the technology correctly. But the significance of most of the coefficients in a more general translog cost function presented in Table 3 (below) indicates that the translog cost function may be more appropriate than a cubic cost function. As we will see below, the average cost function is a decreasing function of output and not U-shaped as estimated by using cubic cost function.

Given the data available, the estimating translog model is:

$$\ln C = a_0 + b\ln Q + \tfrac{1}{2} c(\ln Q)^2 + \Sigma d_i \ln P_i + \tfrac{1}{2}\{\Sigma\Sigma e_{ij} \ln P_i \ln P_j\} + \Sigma f_i \ln Q \ln P_j + d_0 T + U \qquad (12)$$

with cost minimizing share equation given by (6) and is rewritten here as equation (13).

$$S_i = \frac{\partial \ln C}{\partial \ln P_i} = d_i + \sum_j e_{ij} \ln P_j + f_i \ln Q \qquad (13)$$

Here U is the random error term assumed to be distributed as $N(0, \sigma^2)$. The variable T is used as a dummy variable which takes a value of 0 for census year 1992 and 1 for census year 1997. In a way, it reflects Hick neutral technical change, if any between two census years. P_i represents price of the ith input. In particular, the variable P_1 represents the wage rate of production workers, P_2 the wage rate of non-production workers, P_3 the per unit cost of capital and P_4 the price of major raw material (price of cotton thread). Similarly, S_i is the cost share of ith input in total cost, C is total cost in money terms, and Q is output in physical units. The variables are transferred into natural logarithm for the estimation as indicated by the model.

The parameters of the system of equations (12) and (13) are estimated as maximum likelihood estimates using TSP routine. To make the translog model a well behaved cost function restrictions (7) are also imposed.

Table 3 presents the estimates of the parameters of these cost equations along with respective probability values on t-statistics for the estimates.

In order to test the appropriateness of the translog cost function some additional restrictions are imposed so that homothetic, homogeneous and Cobb-Douglas cost functions can be estimated. Furthermore, to see whether these models are more appropriate than the general translog model in describing technology of garment industry, likelihood ratio test is performed. The likelihood ratio, λ is obtained as,

$$\lambda = \frac{L(\text{ constrained model})}{L(\text{Unconstrained model})}$$

where L denotes the value of likelihood function. The test statistic -2logλ, is asymptotically distributed as $\chi^2(q)$, where q is the number of restrictions imposed on the unconstrained function (Theil, 1971).

Table 3: Estimates for translog and other restricted cost functions

Parameter	Translog Estimate	Translog P-value	Homothetic Estimate	Homothetic P-value	Homogeneous Estimate	Homogeneous P-value	Cobb-Douglas Estimate	Cobb-Douglas P-value
a0	2.5043	[.325]	2.6954	[.281]	1.2464	[.042]	2.6827	[.000]
b	-0.0539	[.918]	-0.1405	[.782]	0.1620	[.009]	-0.0350	[.565]
c	0.0143	[.802]	0.0312	[.549]				
d1	0.3962	[.000]	0.2496	[.000]	0.2509	[.000]	0.3001	[.000]
d2	0.1697	[.000]	0.1609	[.000]	0.1611	[.000]	0.0471	[.000]
d3	0.0047	[.933]	0.0562	[.029]	0.0562	[.029]	0.1052	[.000]
d4	0.4294	[.000]	0.5332	[.000]	0.5318	[.000]	0.5476	[.000]
e11	0.1274	[.000]	0.1237	[.000]	0.1228	[.000]		
e12	-0.0221	[.000]	-0.0224	[.000]	-0.0225	[.000]		
e13	0.0122	[.018]	0.0124	[.017]	0.0125	[.016]		
e14	-0.0890	[.000]	-0.1028	[.000]	-0.1027	[.000]		
e22	0.0562	[.000]	0.0562	[.000]	0.0560	[.000]		
e23	-0.0018	[.237]	-0.0018	[.242]	-0.0018	[.243]		
e24	-0.0203	[.000]	-0.0211	[.000]	-0.0211	[.000]		
e33	0.0092	[.084]	0.0090	[.091]	0.0090	[.091]		
e34	-0.0152	[.026]	-0.0102	[.040]	-0.0103	[.039]		
e44	-0.0566	[.000]	-0.0429	[.000]	-0.0420	[.000]		
f1	-0.0209	[.004]						
f2	-0.0013	[.529]						
f3	0.0070	[.309]						
f4	0.0192	[.110]						
d0	0.4991	[.014]	0.5422	[.006]	0.5750	[.002]	0.34173	[.074]
Number of observations	184		184		184		184	
Log likelihood	429.54		425.319		425.145		214.274	
Value of X2 for (-2logλ)			8.44206	[0.038]	8.788578	[0.067]	430.532	[000]

Most of the parameter estimates are found to be statistically significant. However, the parameter estimates of the translog cost function do not convey any direct economic meaning (Kalirajan and Tse, 1989). The statistical significance of the coefficient for dummy variable, d_0, indicates that there was a change in basic production technology in textile industry that had resulted a significant change in cost structures of the firms between two census periods of 1992 and 1997.

Judging from the value of χ^2, the restricted models (homothetic, homogeneous or Cobb Douglas models) are rejected over general translog cost model. However, the insignificance of the coefficients *b* and *c* (coefficients of output and its squared terms) in translog and homothetic models and insignificance of coefficient *b* in Cobb-Douglas model while their significance in homogeneous model made us to consider homogeneous be more appropriate for textile industry of Nepal.

4.21 Estimates of cost elasticity and MES

From homogeneous model, the cost elasticity is found to be equal to 0.1620 and is statistically significant at least at one percent level of significance. Cost elasticity of less than one indicates that this industry has increasing returns to scale. This suggests that for every 10% increase in output, the costs would increase by only about 1.6% and, hence, per unit cost of production declines. The MES is undefined in this case. Homogeneous cost function leads to an ever decreasing average cost function. This would be true at least for the current level of production. This would simply mean that firms in general have not shown yet to be around MES level. The cubic model, which forced the AC to be U-shaped in the given range of production, also estimated a lot higher MES relative to average level of production. This simply means that there are too many small firms producing at very high per unit costs.

4.3 Cost shares

In the process of estimating cost function we calculated the cost shares of various inputs in total cost. Table 5 presents the summary statistics of these cost shares of various inputs in garment industry of Nepal.

Table 5: Summary Statistics of cost shares

	Cost shares			
	Labor	*Administrative*	*Material*	*Capital*
Mean	0.2975	0.0468	0.5497	0.1061
Median	0.2622	0.0314	0.5282	0.0663
Standard Deviation	0.1727	0.0497	0.2088	0.1048
Range	0.7911	0.2688	0.8401	0.5104
Minimum	0.0065	0.0009	0.0934	0.0006
Maximum	0.7976	0.2697	0.9335	0.5110

Most of the cost appears to go to acquire raw materials in this industry. On an average 56% of the total cost is associated to raw materials with a standard deviation of about 21%.

Highest share from raw material is observed to be as high as 93% of the total cost. The lowest share of raw material is found to be 15% of the total cost. The median material cost share is about 53% of the total cost. Next to material cost, labor also occupies a large share in the total cost in this industry. On an average this cost comprises of about 30% of the total cost with a standard deviation of about 17%. But for some firms, labor cost share is seen to reach as high as 80%. Administrative cost is found to be only about 5 percent of the total cost, even though it has reached to about 27% of the total cost in a firm that has the highest share of administrative cost.

5. CONCLUSION

The possible existence of unexploited economies of scale in Nepalese textile industry has important implications for the development of efficient and competitive firms in the market. Textile industry appears to be highly inefficient. These firms have not been exploiting the economy of scale that exists in the textile industry of Nepal. These firms are less productive and are using resources inefficiently. If these firms were to move more seriously by expanding their production, they would be more efficient and be able to provide substitute for imports of cotton cloth that the garment industry has been importing as its raw material.

Cost cutting measures also could be done to remain competitive, but along with cost cutting measures, movement towards MES level could be beneficial to the firms in the long run. The country also will be in a better position by shifting resources from low to high productivity industries. Many firms have to consolidate to become larger to exploit economies of scale. Even though it may seem that the firms will be heading towards becoming monopoly, but ensuring more open economy these firms cannot be monopoly. They have to compete more fiercely with producers from other countries. There seems to be a slight indication towards this direction but a lot more is needed to improve the performance of the firms.

Appendix I: Textile Production in Nepal

(Thousand Meters)

Year	production	Production Index
1974/75	4200	100
1975/76	4211	100.26
1976/77	5225	124.4
1977/78	3889	92.6
1978/79	3185	75.83
1979/80	3489	83.07
1980/81	5317	126.6
1981/82	6862	163.38
1982/83	7966	189.67
1983/84	10240	243.81
1984/85	10533	250.79
1985/86	14118	336.14
1986/87	17822	424.33
1987/88	9914	236.05
1988/89	7057	168.02
1989/90	5286	177.98
1990/91	5421	
1991/92	7207	
1992/93	7139	
1993/94	5619	
1994/95	5060	
1995/96	5160	
1996/97	4000	
1997/98	3329	
1998/99	2678	
1999/2000	2630	
2000/01*	2485	
2001/02*	1700	

Source: Economic Surveys (Various Issues. For earlier years only index was available. So index was converted to production level) His Majesty's Government of Nepal, Ministry of Finance.

APPENDIX II: Derivation of MES in translog model

Given the translog model:

$$\ln C = a_0 + b \ln Q + \tfrac{1}{2} c(\ln Q)^2 + \sum d_i \ln P_i + \tfrac{1}{2}\left\{\sum\sum e_{ij} \ln P_i \ln P_j\right\} + \sum f_i \ln Q \ln P_i$$

OR, $C = e^{[\ ]}$ where [ ] represents the right hand side of the translog model.
Average cost is:

$$\frac{C}{Q} = \frac{e^{[\ ]}}{Q}$$

$$\frac{\partial(C/Q)}{\partial Q} = \frac{Q\frac{\partial C}{\partial Q} - C\frac{\partial Q}{\partial Q}}{Q^2}$$

$$= \frac{Q e^{[\ ]}\frac{\partial[\ ]}{\partial Q} - C}{Q^2}$$

$$= \frac{e^{[\ ]}[Q\frac{\partial[\ ]}{\partial Q} - 1]}{Q^2}$$

The long run average cost C/Q will be minimum when

$$\left.\frac{\partial(C/Q)}{\partial Q} = 0\right|_{Q=Q^*}$$

We have,
Since

$$\frac{e^{[\ ]}}{Q^2} \neq 0,$$

$$\frac{\partial(C/Q)}{\partial Q} = 0$$

implies that

$$[Q\frac{\partial[\ ]}{\partial Q} - 1] = 0$$

But,

$$\frac{\partial[\ ]}{\partial Q} = \frac{b}{Q} + c\frac{\ln Q}{Q} + \sum f_i \frac{\ln P_i}{Q}$$

$$= \frac{(b + c\ln Q + \sum f_i \ln P_i)}{Q}$$

Hence,

$[Q \frac{\partial[\ ]}{\partial Q} - 1] = 0\Big|_{Q=Q^*}$ means that

$$(b + c\ln Q^* + \sum f_i \ln P_i) - 1 = 0$$

OR,

$$\ln Q^* = \frac{1 - b - \sum f_i \ln P_i}{c}$$

OR,

$$Q^* = e^{\frac{1 - b - \sum f_i \ln P_i}{c}}$$

APPENDIX III: DEFINITION OF VARIABLES

Total production, Q

Total output in meters of cotton clothes produced by a firm in a given year.

Total cost, C

Total cost is the sum of wage payments to the production and non-production workers, costs of materials & supplies and energy costs. The wages of active owners and their family members are also assigned average wage of production and non-production workers, and are included in the wage payments for total cost calculation. If there are two or more family members working in the firm, only one member is included as non-production worker and the others are included as production worker for cost calculation.

Wage rate of production workers, P_1 :

The wage rate of production workers is equal to the total wage bill divided by the number of production workers.

Wage rate of non-production workers, P_2 :

The wage rate of non-production workers is equal to the total wage bill for administrative and technical manpower divided by the number of these non-production workers.

Price of capital, P_3:

Cost of capital is taken as the residual of total cost after finding out a total wage bill of the employees (adjusted for family members as discussed in total cost calculation) and cost of all raw materials. A total amount of capital is calculated as the value of total assets. Price of capital is then calculated as the price per unit of an asset (Capital cost divided by the value of an asset).

Price of major raw material, P_4:

Data for total cost of individual raw materials are provided in the census. Major raw material for cotton textile industry is cotton thread. Its price per quintal is calculated by dividing the total cost of cotton thread by total amount (in quintal) purchased.

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