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ELASTICITIES Of SUBSTITUTION IN THE SMALL-SCALE MANUFACTURING INDUSTRIES OF THE PUNJAB

Nighat Kazmi
Staff Economist

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PAKISTAN INSTITUTE OF DEVELOPMENT ECONOMICS
POST BOX NO. 1091, ISLAMABAD
(Pakistan)

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INTRODUCTION

It is commonly argued that distorted factor markets in developing countries like Pakistan lead to the adoption of capital intensive production techniques not suited to the factor endowments of Pakistan. It is also argued that capital-intensive techniques of production are used in labour-abundant less developed countries because of their very high dependence on imports for meeting their capital goods requirement. Therefore, substitution possibilities between capital and labour themselves are limited in these countries. It follows that production techniques are adopted not only because factor markets are distorted but also because capital-labour substitution possibilities are rather limited. However, the conclusion that substitution elasticities are small in developing countries may not necessarily be true for the small-scale manufacturing industries, because they employ indigenous technology suited to the factor endowments of the country. Therefore, one would expect the technology set of small-scale industries to be more flexible. In this study we are going to find out whether substitution elasticities, in fact, exist in the small-scale manufacturing sector of the Punjab in Pakistan or not?

The possibilities of capital-labour substitution in different countries, both developing and the developed, have been explored in a number of studies, such as: Arrow, Chenery, Minhas and Solow (ACMS) {1}, Behrman {3} Berndt {4},Gaude{9} ,Feldstein{8} ,Katz{10},Kazi{12},Clague {5},Kemal{15},Herlihy{20},Rahman{22},Sato and Hoffman{24},Sicat{25} , Zarembka{28},and Zarembka & Dhrymes{29}. While most of these studies are for the developed countries, there are quite a few studies for the developing countries as well, e.g. Behrman, Katz, Kazi, Kemal, Herlihy, Rahman, Sicat and Clague.

Rahman {22} and Sicat {25} found significant substitution elasticities for Bangladesh and Phillipines respectively. However, as pointed out by Herlihy {20} estimates of the elasticity of substitution (σ) are biased upwards. Contrary to Rahman and Sicat's conclusions, Clague {9} found that substitution elasticities are strikingly low in the developing countries. Kazi {12} and Kemal {13} found low substitution elasticities in the case of large-scale manufacturing industries of Pakistan. However, in Kemal's study, for the manufacturing sector as a whole, elasticity of substitution is high and significant.

All the above mentioned studies, including the two on Pakistan, have been done for the large-scale manufacturing sector. In this study we focus on the small-scale manufacturing sectors in order to see whether the elasticity is low in this case as well. As said earlier, we may expect a higher elasticity because these industries use indigenous technology and as such there can be changes in production technique following input price changes.

The analysis in this paper is restricted to small-scale manufacturing industry groups of the Punjab because of the non-availability of the requisite data for the other provinces. Moreover, this study presents only cross-section estimates as the time-series of data relating to small-scale industries are not available.

The plan of the paper is as follows: The method of analysis and data problems are presented in Section I. Findings and their interpretation are shown in Section II. Limitations of the analysis and policy implications are highlighted in Section III and Section IV concludes the paper.

I. METHOD OF ANALYSIS

Two types of production functions viz. the Constant Elasticity of Substitution (CES) production function, developed by Arrow, Chenery, Minhas and Solow (ACMS) {1} , and the Variable Elasticity of Substitution (VES) production function developed by Lu and Fletcher {18}, Sato and Hoffman {24}, and Yeung and Tsang {27} are fitted to estimate the elasticity of substitution. exposition of the CES and VES production functions is being presented in this section.

The CES production function developed by ACMS is derived from the following empirical relation:

$$\text{Ln}\,\frac{V}{L} = a + b\,\text{Ln}\,w \qquad (1)$$

V/L is the value added per labourer.

w is the money wage rate.

From equation (1) ACMS {1} have derived the following production function:

$$V = \gamma\,\{\,\delta K^{-\rho} + (1-\delta)\,L^{-\rho}\,\}^{-1/\rho} \qquad (2)$$

Where

V = Value Added

K = Capital

L = Labour

γ = Efficiency parameter. It acts as the scale of the function and measures the volume of output available from given inputs.

δ = Distribution parameter and measures the capital intensity of the technology.

ρ = Substitution parameter and the elasticity of substitution between capital and labour is derived from ρ through the following relation

$$\sigma = \frac{1}{1+\rho}$$

It may be noted that in equation (1)

b is the elasticity of substitution, (σ).

$a = \sigma \text{ Ln } \{\gamma^{\rho} (1-\delta)^{-1}\}$ is a constant

Equation (2) is difficult to estimate directly because it is non-linear. We estimate the function indirectly, i.e. through equation (1) by assuming that the marginal product of labour is equal to the wage rate. Allowing for variable returns, we have the following relation:

$$V = \gamma\{\delta K^{-\rho} + (1-\delta) L^{-\rho}\}^{-\nu/\rho} \quad (3)$$

The ν parameter measures the degree of homogeneity of the function. If ν is greater than one, there are increasing returns to scale and if ν is less than one there are decreasing returns to scale. Katz {11} has derived the following indirect relation for the CES production function which is not constrained to constant returns to scale:

$$\text{Ln } \frac{V}{L} = a + b_1 \text{ Ln } w + b_2 \text{ Ln } V + u \quad (4)$$

$$a = \sigma \text{ Ln } \{\nu\gamma^{-\rho/\nu} (1-\delta)\}^{-1}$$

b_1 is an estimate of the elasticity of substitution (σ).

$$b_2 = \frac{(1-\sigma)(\nu-1)}{\nu}$$

By substituting the value of b_2 and σ in the above relation we can calculate the value of ν. Equation (4) differs from equation (1) because it contains the additional variable, Ln V.

In this paper cross-sectional estimates of equations (1) and (4) are presented. The advantage of the "indirect" estimations is that they allow the estimation of the CES production function without using capital-stock data. In this manner we avoid the problems associated with measurement of the capital stock.

The basic problem with equations (1) and (4), however, is that they depend on the assumption that the marginal product equals the return to production factors, which is not necessarily true. The assumption also implies perfect competition in factor markets. The estimates of σ obtained through the indirect equations (1) and (4) are, therefore, biased as has been shown by Katz {11} .

Kmenta {16} has developed a procedure for estimating the CES production function directly by linearising the CES production function. Expanding the CES production function in a Taylor series around $\rho=0$, we get:

$$\text{Ln } V \approx \text{Ln } A_0 + \nu\delta \text{Ln } L + \nu(1-\delta) \text{ LnK} - \tfrac{1}{2}\nu\rho\delta(1-\delta) \; (\text{LnK}-\text{LnL})^2 \qquad (5)$$

When we constrain the production function to constant returns to scale we obtain the following relation:

$$\text{Ln } V/L = \text{Ln } A_0 + (1-\delta) \text{ Ln } \frac{K}{L} - \frac{1}{2} \rho\delta(1-\delta) \; (\text{LnK}-\text{LnL})^2 \qquad (6)$$

Equations (5) and (6) can be directly estimated by OLS. However, since the Taylor series expansion is around $\rho=0$, the estimates of σ have an inherent bias towards unity.

The CES production function allows the substitution elasticity to vary between industries, but for a given industry the substitution elasticity is a constant. It does not vary with the changes in the capital-labour ratio. To incorporate effects of changes in the capital-labour ratio on σ the VES production function has been developed by Lu and Fletcher {18}, Sato and Hoffman {24}, and Yeung and Tsang {27}. These authors have developed different variants of VES by starting from different basic relationships. Lu and Fletcher have started with the following empirical relation:

$$\text{Ln}\,\frac{V}{L} = a + b\ \text{Lnw} + c\ \text{Ln}\,\frac{K}{L} + u \qquad (7)$$

From the above relation they have derived the following VES production function:

$$V = \{\beta K^{-\rho} + \alpha\eta L^{-\rho}\ (K/L)^{-c(1+\rho)}\}^{-1/\rho} \qquad (8)$$

Where

$$\rho = \frac{1}{b-1}$$

$$\eta = \frac{1-b}{1-b-c}$$

$$\alpha = a^{-1/b}$$

β is the constant of integration. By setting $\alpha=(1-\delta)\gamma^{-\rho}$ and $\beta = \delta\gamma^{-\rho}$ in equation (8) we obtain:

$$V = \gamma\{\delta K^{-\rho} + (1-\delta)\ \eta(K/L)^{-c(1+\rho)}\ L^{-\rho}\}^{-1/\rho} \qquad (9)$$

This production function is similar to the CES function. It may be seen that $L^{-\rho}$ is multiplied by $(K/L)^{-c(1+\rho)}$. If c equals zero, the VES function reduces to the CES function and if in addition ρ=0, this function reduces to the Cobb-Douglas function.

Equations (7), (8) and (9) are versions of the VES function under constant returns to scale. In equation (7) the elasticity of substitution is represented by the following relation:

$$\sigma = \frac{b}{1-c\left(1+\frac{WL}{rK}\right)}$$

Yeung and Tsang {27} present a variable returns to scale version of the VES production function by starting off from the following empirical relation:

$$\text{Ln } V/L = \text{Ln } a + b\text{Lnw} + c\text{Ln}K/L + d\text{Ln } L + u \quad (10)$$

Here $d = (\nu-1)\ (1-b)$

Equation (10) differs from equation (7) since it contains the additional Ln L variable. From equation (10) the following VES function has been derived:

$$V = \{\beta K^{-\rho} + \alpha\eta L^{-\rho}(K/L)^{-h}\}^{-\nu/\rho} \quad (11)$$

Equation (11) is homogenous of degree ν and $h = c/b$.

The indirect equations (7) and (10) are going to be used in our estimation of the VES production function since equations (9) and (11) are very difficult to estimate directly. In this paper elasticities of substitution obtained from equations (1), (4), (5), (6), (7) and (10) are going to be presented.

$$\text{Ln } \frac{V}{L} = a + b \text{ Lnw} + u \quad (1)$$

$$\text{Ln } \frac{V}{L} = a + b_1 \text{ Lnw} + b_2 \text{ LnV} + u \quad (4)$$

$$\text{Ln } V = \text{Ln } A_o + \nu\delta\text{LnL} + \nu(1-\delta)\text{ LnK} - \tfrac{1}{2}\nu\rho\delta\ (1-\delta)\ (\text{LnK} - \text{LnL})^2 \quad (5)$$

$$\text{Ln } \frac{V}{L} = \text{Ln } A_0 + (1-\delta)\text{ Ln } \frac{K}{L} - \tfrac{1}{2}\rho\delta\ (1-\delta)\ (\text{Lnk} - \text{LnL})^2 \quad (6)$$

$$\text{Ln } \frac{V}{L} = a + b \text{ Lnw} + c \text{ Ln } \frac{K}{L} + u. \quad (7)$$

$$\text{Ln } \frac{V}{L} = a + b \text{ Lnw} + c \text{ Ln } \frac{V}{L} + d\text{LnL} + u. \quad (10)$$

In order to estimate both CES and VES production functions, we required data on value added, capital and labour. They have been obtained from the Census Report on Small and Household manufacturing establishments 1975-76 published by the Punjab Small Industries Corporation. The Census gives data for both the small scale establishments and the households separately[1]. Since the production functions of small scale establishments are not expected to be the same as for the biased estimates. Therefore, we estimate production functions separately for small establishments and households. Some of the industry groups were not included because sufficient number of observations are not available for them.

II. RESULTS

In this section we shall present the elasticity of substitution estimates obtained by fitting directly and indirectly the CES production functions and fitting indirectly the VES production functions. These estimations have been carried out by both restricting the returns to scale to unity and by allowing for variable returns to scale. We shall also make a comparison of the elasticity estimates obtained in this study with the estimates of elasticity for the large-scale establishments. In addition to the elasticity estimates, we shall also present the returns to scale estimates. Two sets of estimates will be presented - one set will be for household units and the other for small-establishments. We have reported estimates for 11 small establishments and 5 households in table 1.

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[1]A small scale establishment is defined as a manufacturing firm under single or joint ownership or control engaged in any kind of manufacturing activity for economic benefits at a single physical location whose fixed investment does not exceed two million rupees. A household establishment is the one where a member or members of the household is/are engaged in a manufacturing activity for economic benefit.

Table I shows estimates of the elasticity of substitution obtained through the CES production function by the indirect method under constant returns to scale. Table 1 also shows that the elasticity of substitution, in general, is low in small-scale manufacturing. For the small establishments, the elasticity of substitution exceeds unity in only 3 out of 12 cases. In addition to being low, the elasticity of substitution is also insignificant. If we take 5% to be an acceptable level of confidence, the elasticity parameter is significant only in 4 cases out of 12 for small scale establishments. In the case of wooden products the elasticity parameter is perverse in sign. For households substitution elasticity is less than one in all cases. The elasticity estimate is statistically significant for only carpets and rugs industry. When we look at the results for households, the elasticity parameter is lower than the corresponding parameter for small establishments in 4 out of 5 cases for which elasticity estimates have been presented for households.

Table II shows the indirect estimates of the substitution elasticities obtained through the CES production function under NCRTS. Table II is in conformity with table I in that the elasticity estimates are, in general, low. For small-scale establishments, the elasticity of substitution, in general, is lower under the non-constant returns to scale specification. For households, however, σ is lower in only two cases. Both for small establishments and households the elasticity of substitution is less than one in all the cases. If we take 5% to be an acceptable level of confidence then small establishments and households both display two significant estimates each. The number of elasticity estimates with perverse signs increases in the NCRTS specification. For small-scale establishments the elasticity parameter is perverse in sign in

Table I

Estimates of σ through the CES Production Function Indirect Method CRTS

Industry	Substitution Elasticities for Small-Scale Establishments	Households
1. Processing of Agricultural Produce including all food and feed industries	0.5839	0.5576[c]
2. Textiles	0.0792	0.5131
3. Carpets and Rugs	0.7174[a]	0.5845[a]
4. Leather and Leather Products	1.8825[b]	0.0515[d]
5. Wooden Products	-0.1045	-
6. Engineering industries including all metal products machinery/plants and electrical equipment appliances	0.9052[b]	-
7. Ceramics and Mineral Products	1.3470[c]	-
8. Printing Presses and Stationery	0.3747	-
9. Chemical Industries	0.5100	-
10. Plastic and Rubber Products	1.5849	-
11. Handicrafts	0.5730	-
12. All Industries	0.7362[a]	0.0675[d]

[a]significant at 1%

[b]significant at 5%

[c]significant at 10%

[d]significant at 20%

the case of wooden products, printing presses and stationery and chemical industries. For households the elasticity parameter is perverse in the case of textiles. However, neither of the estimates with perverse signs is statistically significant. An analysis of tables I and II shows that the indirect estimates of the CES production function yield elasticities of substitution that are, in general, low and insignificant.

We have also estimated the linearised CES production function. The CES production function is expanded in a Taylor series around the value of ρ which is equal to zero. This biases the estimates towards unity. Therefore, linearised estimation is not of much interest in itself. The estimates have been reported in tables III and IV just for the sake of completeness.

Tables III and IV confirm that the estimates are biased towards unity. Table III presents estimates of the substitution elasticity under constant returns to scale. Most of the estimates are very close to unity. Table IV presents the estimates under variable returns to scale. Estimates in general are lower under the variable returns to scale specification.

As already mentioned, the CES production function assumes that the capital labour ratio does not affect the substitution possibilities between capital and labour. If in reality, the elasticity of substitution is affected by changes in the capital-labour ratio, then the elasticities estimated through the CES production function will be biased. It is worthwhile, therefore, to test whether the coefficient of the K/L variable is significant in the VES production function. The VES production function allows for changes in the elasticity of substitution following a change in the capital-labour ratio. Since the function is highly non-linear, it has been estimated indirectly and the results are reported in tables V and VI.

Table II

Estimates of a through the CES Production Function
Indirect Method NCRTS

Industries	Substitution Elasticities for Small Scale Establishments	Substitution Elasticities for Households
1. Processing of Agricultural Produce including all food and feed industries	0.4686	0.7238[b]
2. Textiles	0.0660	-0.0089
3. Carpets and Rugs	0.6348[a]	0.6067[a]
4. Leather and Leather products	0.6789[c]	0.0584
5. Wooden products	-0.3265[c]	-
6. Engineering industries including all metal products, machinery/plants and electrical equipment/appliances	0.4044	-
7. Ceramics and mineral products	0.9820	-
8. Printing presses and stationery	-0.1137	-
9. Chemical industries	-0.1915	-
10. Plastic and rubber products	0.6796	-
11. Handicrafts	0.4677	-
12. All industries	0.3258[a]	0.0625[c]

[a]significant at 1%

[b]significant at 5%

[c]significant at 10%

[d]significant at 20%

Table VII

Estimates of the Elasticity of Substitution Through the CSS Production Function Direct Method CRTS

Industry	Substitution Elasticities for Small-Scale Establishments	Substitution Elasticities for Households
1. Processing of agricultural produce including all food & feed industries	1.0338	1.0629[c]
2. Textiles	0.9736[c]	1.0685[d]
3. Carpets and rugs	1.1301	1.0702[d]
4. Leather and leather products	1.0305[b]	0.8624[a]
5. Wooden products	0.9064	-
6. Engineering industries including all metal products, machinery/plants and electrical equipment/appliances	1.0184[d]	-
7. Ceramics and mineral products	0.9694[d]	-
8. Printing presses and stationery	1.0373[d]	-
9. Chemical industries	0.9745[b]	-
10. Plastic and rubber products	1.9810	-
11. Handicrafts	2.2202	-
12. All industries	1.4728[d]	1.0571[a]

[a]significant at 1%

[b]significant at 5%

[c]significant at 10%

[d]significant at 20%

Table IV

Estimates of the Elasticity of Substitution Through the CES Production Function Direct Method NCRTS

Industries	Substitution Elasticities for Small-Scale Establishments	Substitution Elasticities for Households
1. Processing of agricultural produce including all food and feed industries	0.6553[d]	1.0715[d]
2. Textiles	0.9649	1.0544[d]
3. Carpets and rugs	1.2244	1.0710
4. Leather and leather products	1.0481[c]	0.8745[b]
5. Wooden products	0.9380	-
6. Engineering industries including all metal products, machinery/plants and electrical equipment/appliances	1.0283	-
7. Ceramics and mineral products	0.9719[d]	-
8. Printing presses and stationery	1.1027	-
9. Chemical industries	0.9776[b]	-
10. Plastic and rubber products	1.8379	-
11. Handicrafts	0.8849	-
12. All industries	0.7966	1.0569[a]

[a]significant at 1%

[b]significant at 5%

[c]significant at 10%

[d]significant at 20%

The VES production functions, in general, give higher substitution elasticities than the ones obtained from the CES production function. However, because the substitution parameter has been obtained as a quotient of two parameters, it becomes difficult to test the significance of the estimates. We have taken only those estimates to be statistically significant where both the parameters, on the basis of which the substitution elasticity has been estimated, are significant.

Table V presents estimates of the substitution elasticity under constant returns to scale. For small-scale establishments the substitution elasticity is greater than one in 5 out of 12 cases. In the case of wooden products the elasticity parameter is perverse in sign. For households, the elasticity parameter is greater than one in 4 out of 5 cases. A comparison between columns (1) and (2) shows that in 4 cases out of 5 the elasticity estimates are higher for households.

Table VI presents VES substitution elasticities under non-constant returns to scale. In the case of small-scale establishments the number of cases with negative substitution elasticities increase. This happens in four cases, namely, processing of agricultural produce, textiles, leather and leather products and wooden products. In 6 out of 12 cases, the elasticity of substitution is greater than unity. In the case of households substitution elasticity is greater than one only for textiles.

At this point, it is of great importance to examine whether the VES specification of the function is appropriate. In order to see whether the CES elasticity estimates are biased we have to look at the coefficient of K/L in the VES function. If it is significant then the estimates of σ obtained through the CES function are biased due to the omission in the CES

Table V

Estimates of the Elasticity of Substitution Obtained Indirectly Through the VES Production Function CRTS

Industries	Substitution Elasticities for Small-Scale Establishments	Substitution Elasticities for Households
1. Processing of agricultural produce including all food and feed industries	0.8284	4.8403
2. Textiles	0.7739	2.1160[b]
3. Carpets and rugs	0.6938	0.4439[c]
4. Leather and leather products	5.3011[a]	14.3382
5. Wooden products	-0.4398	-
6. Engineering industries including all metal products, machinery/plants and electrical equipment/appliances	0.8992	-
7. Ceramics and mineral products	1.1819	-
8. Printing presses and stationery	1.0312[d]	-
9. Chemical industries	0.7092	-
10. Plastic and rubber products	1.7948[d]	-
11. Handicrafts	2.5691[d]	-
12. All industries	0.7682[a]	3.6381[a]

[a]significant at 1%

[b]significant at 5%

[c]significant at 10%

[d]significant at 20%

Table VI

Estimates of a Obtained. Indirectly Through the VES Production Function NCRTS

Industries	Substitution Elasticities for Small-Scale Establishments	Substitution Elasticities for Households
1. Processing of agricultural produce including all food and feed industries	-0.9734	0.9268
2. Textiles	-2.4616	1.9117[b]
3. Carpets and rugs	0.6541	0.4736[c]
4. Leather and leather products	-3.3017[b]	0.3798
5. Wooden products	-0.8547	-
6. Engineering industries including all metal products, machinery/plants and electrical equipment/appliances	1.4103	-
7 Ceramics and mineral products	5.9528	-
8. Printing presses and stationery	0.3951	-
9. Chemical industries	9.6161	-
10. Plastic and rubber products	8.1288	-
11. Handicrafts	3.9734[d]	-
12. All industries	6.0014[a]	0.2760[a]

[a]significant at 1%

[b]significant at 5%

[c]significant at 10%

[d]significant at 20%

function of the K/L variable. In the case of small-scale establishments, an examination of appendix Table AI.5 reveals that 7 out of 12 coefficients are statistically significant if we take 10% to be an acceptable level of confidence[1]. In the NCRTS specification also, as revealed by table AI.6, 7 out of 12 coefficients of the K/L variable are statistically significant. In the case of households, an examination of table AII.5 reveals that in 3 cases out of 5, the coefficient of K/L is statistically significant[2]. In table AII.6, we see that in the NCRTS specification also the coefficient of the K/L variable is significant in 3 cases out of 5. The above examination of tables AI.5, AI.6, AII.5 and AII.6 implies that the CES function produces biased estimates of the elasticity parameter. Thus, the elasticity estimates obtained through the VES function are more relevant than those obtained through the CES function.

Estimates of the returns to scale parameter have been obtained both for the CES and VES functions. The estimates for the CES function are reported in table VII. For small-scale establishments, nearly all the estimates of the scale parameter show slightly increasing returns to scale. For households, for indirect estimation we have slightly increasing returns to scale in nearly all the cases. For direct estimation we have near constant returns to scale in all the cases.

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[1]Table AI.5 shows that in 3 cases the coefficient of K/L is significant at 1%. In 2 cases the coefficient is significant at 5%, in 2 cases it is significant at 10% and in 2 it is significant at 20%.

[2]Table AII.5 shows that in 2 cases the coefficient of K/L is significant at 1% and in one case the coefficient is significant at 10%.

Table VII

Estimates of the Scale Parameter for the CES Production Function

Industries	Indirect Estimation: Small-Scale Estab-lish-ments	Indirect Estimation: Households	Direct Estimation: Small-Scale Estab-lish-merits	Direct Estimation: Households
1. Processing of agricultural produce including all food and feed industries	6.0181	0.6102	1.1354	0.8804
2. Textiles	1.0535	1.2815	1.1464	0.9256
3. Carpets and rugs	1.4188	1,0383:	1.2341	1.0038
4. Leather and leather products	-13.3792	1.0086	1.2029	0.9791
5. Wooden products	1.1222	-	0.9447	-
6. Engineering industries including all metal products, machinery/plants & electrical equipment/appliances	1.3348	™	1.1592	-
7. Ceramics and mineral products	-0,1070	-	0.9745	-
8. Printing presses and stationery	1.1622	-	1 1494	-
9. Chemical industries	1,2512	-	0.9398	-
10. Plastic and rubber products	2.0038	.	1.1560	-
11. Handicrafts	1.1323	-	1.0533	-
12. All industries	1.3858	1.1211	1.1305	0.9965

Table VIII

Estimates of the Scale Parameter for the VES Production Functions

Industries	Indirect Estimation: Small - Scale Establishments	Indirect Estimation: Households
1. Processing of agricultural produce including all food and feed industries	1.2388	0.6556
2. Textiles	0.9999	0.9824
3. Carpets and rugs	1.3823	0.9133
4. Leather and leather products	0.4595	0.4495
5. Wooden products	0.9691	-
6. Engineering industries including all metal products, machinery/plants & electrical equipment/appliances	1.4286	-
7. Ceramics and mineral products	0.5564	-
8. Printing presses and stationery	1.1654	-
9. Chemical industries	0.8440	-
10. Plastic and rubber products	44.1923	-
11. Handicrafts	1.0582	-
12. All industries	1.1521	0.9918

Table VIII presents estimates of the scale parameter for the VES function. In the case of small-scale establishments 6 industry groups demonstrate slightly increasing returns to scale, two demonstrate near constant returns to scale and one demonstrates less than constant returns to scale. For plastic and rubber products, the scale parameter is abnormally large. In the case of households we get near constant returns to scale in 3 cases and less than CRTS in 2 cases.

The above discussion clearly brings out that under the CES function the elasticity parameter is low and insignificant. However, an examination of the VES function shows that the CES function is subject to the specification bias. Even though we cannot say anything categorical about the significance or otherwise of the elasticity parameter under the VES specification, in most cases the value of the elasticity parameters is higher for the VES function than it is for the CES specification. The VES function seems to describe the production relationships in Punjab's small-scale manufacturing more accurately.

We will now compare our results with those for large-scale manufacturing sector reported by Kazi {12}. Comparison is not made with Kemal {15} because Kemal's study is a time-series study and this is a cross-section study. We also compare the results for the CES and VES functions.

Our results are not strictly comparable with Kazi's results since Kazi's study is for the whole of Pakistan and our study is for the Punjab only. However, since the technology across different provinces is not very different and all the provinces face the same input prices there should not be that much of a problem in the comparison.

In table IX we make a comparison between the indirect CES estimates of this study and those of Kazi's study. We can make a comparison with Kazi's study for 8 industry groups and for all industries. Under CRTS our estimates are lower for all the industry groups than those reported in Kazi's study. In Kazi's study, the elasticity of substitution is greater than one in seven out of 13 cases. In addition it is insignificant in inly 4 out of 13 cases. In the variable returns to scale specification our estimates are lower than Kazi's in 5 out of 8 cases.

In table X, we make a comparison between the substitution elasticities obtained under the CES and VES specifications under constant returns to scale. Table X shows that for small establishments the VES function gives higher estimates in 10 out of 12 cases. For households the VES function gives higher elasticity estimates in 4 out of 5 cases. In table XI, we compare the CES and VES elasticities under variable returns to scale. For small scale establishments, the VES function yields higher elasticity estimates of the correct sign in 8 cases. For households once again the VES function yields higher elasticity estimates in 4 out of 5 cases.

An examination of Appendix Tables AI.5, AI.6, AII.5 and AII.6 reveals that the coefficient of the K/L variable is significant in many cases. Therefore, we come to the conclusion that elasticity estimates obtained through the CES function are biased since the CES function does not include the K/L variable. We consider the VES function to be a closer approximation to production relationships in Punjab's small-scale manufacturing. Therefore, we regard the elasticity estimates obtained through the VES function to be the more appropriate estimates and conclude

Table iX

CES Elasticity Estimates Comparison

Industries	CRTS This Study (1)	CRTS Kazi's Study (2)	NCRTS This Study (3)	NCRTS Kazi's Study (4)
1. Processing of agricultural produce including all food and feed industries	0.5839	-0.3 [a]	0.4686	-0.96 [a]
2. Textiles	0.0792	0.18	0.0660	0.35
3. Carpets and rugs	0.7174	-	0.6348	-
4. Leather and leather products	1.8825	0.46 [b)] 0.71 [c)]	0.6789	-0.01 [b)] 0.37 [c)]
5. Wooden products	-0.1045	-	-0.3265	-
6. Engineering industries including all metal products, machinery/plants and electrical equipment/appliances	0.9052	1.29 [d)] 1.02 [e)] 0.81 [f)] 0.97 [g)]	0.4044	0.53 [d)] 0.93 [e)] -0.62 [f)] 0.90 [g)]
7. Ceramics and mineral products	1.3470	1.64	0.9820	0.87 [h]
8. Printing presses and stationery	0.3747	1.73 [i]	-0.1137	0.81 [i]
9. Chemical industries	0.5100	1.86	-0.1915	0.75
10. Plastic and rubber products	1.5849	1.79 [j]	0.6796	-0.72 [j]
11. Handicrafts	0.5730	-	0.4677	-
12. All industries	0.7362	1.17	0.3258	0.72

[a] Food
[b] Manufacture of leather and leather products
[c] Footwear
[d] Basic metals
[e] Metal products
[f] Electrical machinery
[g] Non-electrical machinery
[h] Non-metallic minerals
[i] Printing and publishing
[j] Rubber

Table X

Comparison of a Obtained Under the CES and VES Production Functions Constant Returns to Scale

Industries	Small-Scale Establishments		Households	
	CES (1)	VES (2)	CES (3)	VES (4)
1. Processing of agricultural produce including all food and feed industries	0.5839	0.8284	0.5576	4.8403
2 Textiles	0.0792	0.7739	0.5131	2.1160
3. Carpets and rugs	0.7174	0.6938	0.5845	0.4439
4. Leather and leather products	1.8825	5.3011	0.0515	14.3382
5. Wooden products	-0.1045	-0.4398	-	-
6. Engineering industries including all metal products, machinery/plants and electrical equipment/appliances	0.9052	0.8992	-	-
7. Ceramics and mineral products	1.3470	1.1819	-	-
8. Printing presses and stationery	0.3747	1.0312	-	-
9. Chemical industries	0.5100	0.7092	-	-
10. Plastic and rubber products	1.5849	1.7948	-	-
11. Handicrafts	0.5730	2.5691	-	-
12. All industries	0.7362	0.7682	0.0675	3.6381

Table XI

Comparison of σ Obtained Under the CES and VES Functions Variable Returns to Scale

Industries	Small-Scale Establishments CES (1)	Small-Scale Establishments VES (2)	Households CES (3)	Households VES (4)
1. Processing of agricultural produce including all food and feed industries	0.4686	-0.9734	0.7238	0.9268
2. Textiles	0.0660	-2.4616	-0.0089	1.9117
3. Carpets and rugs	0.6348	0.6541	0.6067	0.4736
4. Leather and leather products	0.6789	-3.3017	0.0584	0.3798
5. Wooden products	-0.3265	-0.8547	-	-
6. Engineering industries including all metal products, machinery/plants and electrical equipment/appliances	0.4044	1.4103	-	-
7. Ceramics and mineral products	0.9820	5.9528	-	-
8. Printing presses and stationery	-0.1137	0.3951	-	-
9. Chemical industries	-0.1915	9.6161	-	-
10. Plastic and rubber products	0.6796	8.1288	-	-
11. Handicrafts	0.4677	3.9734	-	-
12. All industries	0.3258	6.0014	0.0625	0.2760

that elasticities of substitution are fairly high in Punjab's small-scale manufacturing. Thus, in general, we conclude that elasticities of substitution are not as low in Punjab's small-scale manufacturing as implied by the CES production function.

III. LIMITATIONS OF THE ANALYSIS AND POLICY IMPLICATIONS

The foregoing analysis is subject to a number of limitations. The indirect equations of both the CES and the VES production functions are based on the assumptions of perfect competition in product and factor markets, and that the marginal product of labour is equal to the wage rate. To the extent there is no perfect competition elasticity estimates will be biased. However, the extent of the bias would be smaller for small-scale industries than it would be for large-scale industries, since the former industries have a smaller influence on the prices of inputs and outputs. As the VES estimates show that capital-labour ratio changes do affect the elasticity, the CES estimates are biased.

Therefore, we should draw policy implications, keeping in view these limitations. We have found that substitution elasticities in the small scale sector are low when we use the CES production function to estimate them. However, when the VES function is used, which we have concluded is preferable to the CES function substitution elasticities are fairly high. This shows the existence of substitution possibilities in the small-scale sector and as such the previous development of indigenous technology. Since there have been suggestions from a number of quarters that the small-scale activities should be encouraged we must remove distortions from the market because otherwise the indigenous technology development will not be in accordance with the factor endowments of Pakistan.

The substitution possibilities in the small-scale sector also point to the possibilities of developing indigenous technologies which the government must encourage.

The fact that substitution elasticities for small-scale manufacturing as a whole are not low also points to the need for correction of price distortions because this affects the allocation of resources between different activities. For example, if labour becomes cheaper relative to capital, resources move from capital-intensive industries towards labour-intensive industries. Thus, even if a low substitution elasticity in individual industries constrains the movement of production from capital-intensive to labour-intensive techniques in response to changes in the factor-price ratio, there is little restriction on the movement of resources from capital-intensive to labour-intensive industries. Thus, in order to make small-scale industries more efficient and more labour-intensive, there is need to follow two courses of action. Firstly, factor prices should be made to move in such a way that resources should automatically shift to labour-intensive industries. Secondly, small-scale industries should be encouraged to develop labour-intensive techniques of production.

IV. CONCLUSIONS

In this paper interest has focused primarily on the elasticity of substitution between capital and labour in the small-scale manufacturing industries of the Punjab. Two types of production functions have been estimated. These are the CES production function and the VES production function. For the CES function both direct and indirect estimates of the function have been presented. In the direct estimation the elasticity of substitution parameter has an inherent bias towards unity, and therefore, has been disregarded.

For the CES function even though the elasticity estimates are less than one in most cases, they are not discouragingly low. In most cases, the elasticity estimates are greater than 0.5. However, in most of the cases, estimates are not statistically significant. For the manufacturing sector as a whole the elasticity estimates are fairly high and significant.

The elasticity estimates obtained through the VES function are hi higher in most of the cases, than the estimates obtained through the CES function. The elasticity estimates are influenced by changes in capital-labour ratio and this confirms Kemal's {15} results. On the whole the results obtained for small scale manufacturing in the Punjab are not discouraging. A comparison with a previous study done for large-scale manufacturing in the whole of Pakistan {12} shows elasticity estimates that are lower than the estimates obtained by Kazi {12} . However, there is no need for discouragement on that account since Kazi's estimates are CES estimates and we have already concluded that the VES estimates are the more appropriate estimates. Even though small-scale industries have received scant attention in the past, they have, it seems, developed some amount of indigenous technology suited to the factor endowments of Punjab. There is, therefore, need to promote further research on the techniques of production used by small industries.

In conclusion, we can say that elasticities of substitution in small-scale manufacturing in the Punjab are low and insignificant according to the CES function but that in no way implies the absence of substitution possibilities since the VES function shows better results.

APPENDIX AI

RESULTS FOR SMALL ESTABLISHMENTS

Table AI. I: CES Production Functions Indirectly Estimated Under Constant Returns to Scale. (Small Establishments)

Industry	Intercept	LN W	R^2	F	DW	DF
1. Processing of agricultural produce including all food and feed industries	3.8821 (0.5216)	0.5839 (0.4447)	0.0122	0.198	0.864	16
2. Textiles	5.8003 (2.8447)	0.0792 (0.2261)	0.0042	0.051	2.266	12
3. Carpets and rugs	2.0748 (3.1268)	0.7174 (5.5345)	0.6863	30.631	1.920	14
4. Leather & leather products	-3.8010 (-0.7998)	1.8825 (2.1654)	0.2162	4.689	1.691	17
5. Wooden products	7.0242 (2.5863)	-0.1045 (-0.2928)	0-0050	0.886	1.105	17
6. Engineering industries including all metal products machinery/plants and electrical, equipment/appliances	1.3838 (0.4810)	0.9052 (1.8151)	0.1801	3.295	1.669	15
7. Ceramics and Mineral products	-0.6641 (-0.1290)	1.3470 (1.4360)	0-1284	2.062	1.451	14
8. Printing presses and stationary	4.0890 (1.4480)	0.3747 (0.7284)	0.0460	0.531	2.191	11
9. Chemical industries	3.9226 (1.0562)	0.5100 (0.7380)	0.0329	0.545	2.751	16
10. Plastic and rubber products	-2.3019 (-0.3670)	1.5849 (1.3840)	0.1755	1.915	2.765	9
11. Handicrafts	2.9543 (0.7351)	0.5731 (0.7545)	0.0595	0.569	1.604	9
12. All industries.	2.4104 (3.0300)	0.7362 (5.0020)	0.1324	25.938	1.466	170

Figures in parentheses are t ratios

Table AI. 2: CES Production Functions Indirectly Estimated Under Variable Returns to Scale. (Small Establishments)

Industry	Intercept	LN W	LN V	R^2	F	DWI	DF
1. Processing of agricultural product including all food and feed industries.	-1.7710	0.4686	0.4431	0.5869	10.653	1.233	15
	(-0.3342)	(0.5341)	(4.5676)				
2. Textiles	5.2733	0.0660	0.0474	0.0312	0.177	2.371	11
	(2.2863)	(0.1826)	(0.5534)				
3. Carpets and rugs	1.3250	0.6348	0.1078	0.7898	24.430	1.930	13
	(2.0808)	(5.5277)	(2.5308)				
4. Leather and leather products	-1.2367	0.6789	0.3451	0.6434	14.434	1.542	16
	(-0.3685	(1.0225)	(4.3782)				
5. Wooden products	0.6421	-0.3265	0.1445	0.1253	1.145	1.200	16
	(3.3166)	(-0.8680)	(-1.4830)				
6. Engineering industries including all metal products machinery/plants and electrical equipment/appliances .	2.3100	0.4044	0.1494	0.4205	5.079	2.292	14
	(0.9121)	(0.8406)	(2.4097)				
7. Ceramics and mineral products	-0.8964	0.9820	0.1862	0.3380	3.319	1.275	13
	(-0.1924)	(1.1323)	(2.0290)				
8. Printing presses and stationary	5.1417	-0.1137	0.1554	0.6272	8.414	1.692	10
	(2.7490)	(-0.3165)	(3.9488)				
9. Chemical industries	4.7369	-0.1915	0.2392	0.2355	2.311	2.451	15
	(1.3791)	(-0.2640)	(1.9938)				
10. Plastic and rubber products	1.0071	0.6796	0.1605	0.3917	2.576	2.635	8
	(0.1667)	(0.5792)	(1.6864)				
11. Handicrafts	2.8724	0.4677	0.0622	0.0859	0.376	1.631	8
	(0.6830)	(0.5677)	(0.4811)				
12. All industries.	2.4105	0.3258	0.1877	0.3810	52.012	1.572	169
	(3.5769)	(2.4644)	(8.2391)				

Figures in parenthes are t ratios

Table AI. 3: CES Production Functions Directly Estimated Under Constant Returns to Scale (Small Establishments)

Industry	Intercept	Ln K/L	$(LnK/L)^2$	R^2	F	DW	DF
1. Processing of agricultural produce including all food and feed industries	2.0637 (0.0666)	0.6076 (0.0872)	-0.0039 (-0.0099)	0.2053	1.938	1.091	15
2. Textiles	-16.2900 (-1.4285)	5.1335 (1.8389)	-0.2878 (-1.6965)	0.4299	4.148	2.883	11
3. Carpets and rugs	6.5780 (2.4665)	-0.2547 (-0.3685)	0.0184 (0.4214)	0.0219	0.146	0.772	13
4. Leather and Leather products	19.8780 (2.7220)	-4.7506 (-2.1194)	0.4047 (2.3804)	0.5579	10.096	1.823	16
5. Wooden products	4.7709 (0.2310)	0.1561 (0.0301)	0.0068 (0.0210)	0.1348	1.247	1.029	16
6. Engineering industries including all metal products, machinery/plants & electrical equipment/appliances.	30.1520 (1.3540)	-6.2408 (-1.0841)	0.4082 (1.1059)	0.0962	0.745	1.964	14
7. Ceramics and mineral products	-12.5050 (-0.8807)	5.1744 (1.2972)	-0.3417 (-1.2393)	0.1923	1.548	0.985	13
8. Printing presses and stationery	16.0300 (1.3585)	-2.6307 (-0.9402	0.1719 (1.0384)	0.2672	1.823	1.736	10
9. Chemical industries	-16.4140 (-1.7377)	5.3434 (2.3728)	-0.3042 (-2.2869)	0.3200	3.529	2.748	15
10. Plastic and rubber products	2.8272 (0.7012)	0.7869 (0.7381)	-0.0415 (-0.6034)	0.1727	0.835	2.443	18
11. Handicrafts	1.7871 (0.8389)	0.8564 (1.3032)	-0.0338 (-0.6744)	0.7592	12.611	2.340	8
12. All industries.	2.6403 (1.7953)	0.7371 (1.9021)	-0.0311 (-1.2298)	0.1896	19.767	1.301	169

Figures in parentheses are [illegible] ratios

Table AI.4: CES Production Functions Directly Estimated under Variable Returns to Scale (Small Establishments)

	Industry	Intercept	LnL	Ln K	(Ln K/L)^2	R^2	F	DW	DF
1.	Processing of Agricultural Produce including all Food & Food Industries	3.5270 (0.1127)	1.0385 (0.1467)	0.0969 (0.0137)	0.0233 (0.0588)	0.7422	13.436	1.171	14
2.	Textiles	4.1310 (2.6036)	1.0021 (2.5079)	0.1443 (0.4083)	0.0023 (0.1189)	0.9766	139.229	2.287	10
3.	Carpets and rugs	4.8918 (3.4382)	1.4592 (3.0217)	-0.2251 (-0.5732)	0.0244 (0.9141)	0.9178	44.651	0.870	12
4.	Leather and Leather Products	14.6240 (1.9336)	4.6272 (2.0849)	-[illegible].4243 (-1.5167)	0.3022 (1.7609)	0.9153	54.005	1.954	15
5.	Wooden Products	4.1093 (0.1947)	0.5482 (0.1033)	0.3965 (0.0748)	-0.0076 (-0.0228)	0.8763	35.415	1.000	15
6.	Engineering Industries including all metal products machinery/plants and electrical equipment/appliances	6.9966 (3.3741)	1.3578 (3.6055)	-0.1986 (-0.5952)	0.0032 (0.1622)	0.9390	66.676	2.053	13
7.	Ceramics and mineral products	-13.3050 (-[illegible].3784)	-4.4459 (-1.0299)	5.4204 (1.2659)	-0.3575 (-1.2140)	0.8727	27.432	0.980	12
8.	Printing Presses and Stationery	7.7256 (0.9046)	1.9518 (0.9745)	-0.8024 (-0.3984)	0.0634 (0.5323)	0.9383	254.188	1.116	9
9.	Chemical Industries	-17.2210 (-1.7529)	-4.6744 (-1.9458)	5.6142 (2.3664)	-0.3200 (-2.2849)	0.8555	27.658	2.653	14
10.	Plastic and rubber products	1.7149 (0.4422)	0.2646 (0.2634)	0.8914 (0.8854)	-0.0465 (-0.7168)	0.9392	36.013	2.782	7
11.	Handicrafts	3.2824 (1.9262)	0.7759 (1.8327)	0.2774 (0.6349)	0.0133 (0.4327)	0.9633	62.150	2.357	7
12.	All industries	4.5415 (6.6585)	1.0515 (5.7266)	0.0790 (0.4526)	0.0094 (0.8416)	0.9145	598.827	1.440	163

Figures in parentheses are t ratios

Table AI. 5: VES Production Functions Indirectly Estimated under Constant Returns to Scale (Small Establishments)

Industry	Intercept	Ln W	Ln(K/L)	R^2	F	DW*	DF
1. Processing of agricultural produce including all food and feed industries	0.6499 (0.0918)	0.3161 (0.2588)	0.5307 (1.9308	0.2088	1.980	1.127	15
2. Textiles	1.3260 (0.4959)	0.2276 (0.7323)	0.4375 (2.2296)	0.3142	2.520	2.769	11
3. Carpets and rugs	2.1795 (2.9640)	0.7271 (5.3451)	−0.0222 (−0.3901)	0.6899	14.464	1.913	13
4. Leather and leather products	−6.5868 (−1.8022)	1.7234 (2.6274)	0.5479 (3.7398)	0.5818	11.128	1.914	16
5. Wooden products	5.3972 (2.5828)	−0.2267 (−0.6549)	0.2876 (1.7008)	0.1574	1.494	1.143	16
6. Engineering industries including all metal products, machinery/plants and electrical equipment appliances	1.4364 (0.4642)	0.9169 (1.6690)	−0.0147 (0.0525)	0.1803	1.540	1.663	14
7. Ceramics and mineral products	0.3646 (0.0636)	1.0076 (0.8366)	0.1146 (0.4711)	0.1430	1.085	1.335	10
8. Printing presses and stationery	0.7782 (0.2437)	0.5158 (1.0798)	0.3003 (1.7667)	0.2729	1.877	2.231	10
9. Chemical industries	2.2482 (0.5723)	0.5124 (0.7510)	0.2054 (1.1883)	0.1161	0.985	2.721	15
10. Plastic and rubber products	−2.7771 (−0.4473)	1.4728 (1.2972)	0.1344 (1.1093)	0.2854	1.598	2.786	8
11. Handicrafts	0.5420 (0.2631)	0.5020 (1.3214)	0.4132 (5.2932)	0.7911	15.148	2.562	8
12. All industries.	1.7762 (2.3597)	0.5416 (3.8634)	0.2186 (5.1148)	0.2487	27.969	1.416	169

Figures in parentheses are t ratios

Table AT. 6: VES Production Functions Indirectly Estimated Under Varibale Returns to Scale (Small Establishments)

Industry	Intercept	Ln W	Ln (K/L)	Ln L	R^2	F	DW	DF
1. Processing of agricultural product including all food and feed industries	−0.2956 (−0.0403)	0.3837 (0.3079)	0.4801 (1.6627)	0.1472 (0.7041)	0.2359	1.441	1.125	14
2. Textiles	1.3263 (0.4716)	0.2277 (0.6954)	0.4375 (2.1134)	−0.0001 (−0.0014)	0.3142	1.527	2.768	10
3. Carpets and rugs	1.2635 (1.4822)	0.6898 (5.4056)	0.0495 (0.7462)	0.1136 (1.7838)	0.7549	12.322	1.933	12
4. Leather and leather products	−5.7295 (−1.6829)	1.3900 (2.2072)	0.5300 (3.9081)	0.2108 (1.9384)	0.6656	9.950	1.812	15
5. Wooden products	5.2364 (2.4320)	−0.1682 (−0.4261)	0.2892 (1.6809)	−0.0361 (−0.3444)	0.1640	0.981	1.091	15
6. Engineering industries including all metal products, machinery/plants and electrical equipment/appliances	2.7151 (0.8507)	0.7380 (1.3274)	−0.1344 (−0.5392)	0.1123 (1.2695)	0.2707	1.609	2.125	13
7. Ceramics and mineral products	−0.0049 (−0.0008)	1.0834 (0.8457)	0.0814 (0.2896)	0.0373 (0.2603)	0.1402	0.696	1.332	12
8. Printing presses and stationery	2.7321 (1.1730)	0.0834 (0.2308)	0.2723 (2.2639)	0.1515 (3.3274)	0.6740	6.202	1.272	9
9. Chemical industries	1.8058 (0.4279)	0.6462 (0.8173)	0.2101 (0.1769)	−0.0552 (−0.3695)	0.1247	0.665	2.695	14
10. Plastic and rubber products	−0.8083 (−0.1223)	0.9974 (0.7954)	0.1588 (1.2704)	0.1123 (0.9300)	0.3640	1.335	3.047	7
11. Handicrafts	0.5173 (0.2388)	0.4625 (1.1348)	0.4267 (4.9241)	0.0313 (0.4860)	0.7979	9.213	2.558	7
12. All industries.	2.0120 (2.7183)	0.4285 (3.0131)	0.2062 (4.9116)	0.0860 (2.9594)	0.2861	22.447	1.458	168

Figures in parentheses are t ratios

Table AI. 5: VES Production Functions Indirectly Estimated under Constant Returns to Scale (Small Establishments)

Industry	Intercept	Ln W	Ln(K/L)	R^2	F	DW	DF
1. Processing of agricultural produce including all food and feed industries	0.6499 (0.0918)	0.3161 (0.2588)	0.5307 (1.9308)	0.2088	1.980	1.127	15
2. Textiles	1.3260 (0.4959)	0.2276 (0.7323)	0.4375 (2.2296)	0.3142	2.520	2.769	11
3. Carpets and rugs	2.1795 (2.9640)	0.7271 (5.3451)	−0.0222 (−0.3901)	0.6899	14.464	1.913	13
4. Leather and leather products	−6.5868 (−1.8022)	1.7234 (2.6274)	0.5479 (3.7398)	0.5818	11.128	1.914	16
5. Wooden products	5.3972 (2.5828)	−0.2267 (−0.6549)	0.2878 (1.7008)	0.1574	1.494	1.143	16
6. Engineering industries including all metal products, machinery/plants and electrical equipment appliances	1.4364 (0.4642)	0.9169 (1.6690)	−0.0147 (0.0625)	0.1803	1.540	1.663	14
7. Ceramics and mineral products	0.3646 (0.0636)	1.0076 (0.8366)	0.1146 (0.4711)	0.1430	1.085	1.335	10
8. Printing presses and stationery	0.7792 (0.2437)	0.5158 (1.0798)	0.3003 (1.7667)	0.2729	1.977	2.291	10
9. Chemical industries	2.2482 (0.5723)	0.5124 (0.7510)	0.2054 (1.1883)	0.1161	0.985	2.721	15
10. Plastic and rubber products	−2.7771 (−0.4473)	1.4728 (1.2972)	0.1344 (1.1093)	0.2854	1.598	2.786	8
11. Handicrafts	0.5420 (0.2631)	0.5020 (1.3214)	0.4132 (5.2932)	0.7911	15.148	2.562	8
12. All industries.	1.7762 (2.3597)	0.5416 (3.8634)	0.2186 (5.1148)	0.2487	27.969	1.416	169

Figures in parentheses are t ratios

Table AT. 6: VES Production Functions Indirectly Estimated Under Varibale Returns to Scale (Small Establishments)

Industry	Inter-cept	Ln W	Ln (K/L)	Ln L	R^2	F	DW	DF
1. Processing of agricultural product including all food and feed industries	-0.2956 (-0.0403)	0.3837 (0.3079)	0.4801 (1.6627)	0.1472 (0.7041)	0.2359	1.441	1.125	14
2. Textiles	1.3263 (0.4716)	0.2277 (0.6954)	0.4375 (2.1134)	-0.0001 (-0.0014)	0.3142	1.527	2.768	10
3. Carpets and rugs	1.2635 (1.4822)	0.6898 (5.4056)	0.0495 (0.7462)	0.1136 (1.7838)	0.7549	12.322	1.933	12
4. Leather and leather products	-5.7295 (-1.6829)	1.3900 (2.2072)	0.5300 (3.9081)	0.2198 (1.9384)	0.6656	9.950	1.812	15
5. Wooden products	5.2364 (2.4320)	-0.1682 (-0.4261)	0.2892 (1.6809)	-0.0361 (-0.3444)	0.1640	0.981	1.091	15
6. Engineering industries including all metal products, machinery/plants and electrical equipment/appliances	2.7151 (0.8507)	0.7380 (1.3274)	-0.1344 (-0.5392)	0.1123 (1.2695)	0.2707	1.600	2.125	13
7. Ceramics and mineral products	-0.0049 (-0.0008)	1.0834 (0.8457)	0.0814 (0.2896)	0.0373 (0.2693)	0.1402	0.696	1.332	12
8. Printing presses and stationery	2.7321 (1.1730)	0.0834 (0.2308)	0.2723 (2.2639)	0.1515 (3.3274)	0.6740	6.202	1.272	9
9. Chemical industries	1.8058 (0.4279)	0.6462 (0.8173)	0.2101 (0.1769)	-0.0552 (-0.3695)	0.1247	0.665	2.695	14
10. Plastic and rubber products	-0.8083 (-0.1223)	0.9974 (0.7954)	0.1588 (1.2704)	0.1123 (0.9300)	0.3640	1.335	3.047	7
11. Handicrafts	0.5173 (0.2338)	0.4625 (1.1348)	0.4267 (4.9241)	0.0313 (0.4860)	0.7979	9.213	2.558	7
12. All industries	2.0120 (2.7183)	0.4285 (3.0131)	0.2062 (4.9116)	0.0860 (2.9694)	0.2861	22.447	1.458	168

Figures in parentheses are t ratios

APPENDIX A.II

RESULTS FOR HOUSEHOLDS

Table AII. I: CES Production Functions Indirectly Estimated Under Constant Returns to Scale. (Households)

Industry	Intercept	Ln W	R^2	F	DW	DF
1. Processing of agricultural produce including all food and feed industries	3.1071 (1.5867)	0.5576 (1.4927)	0.1984	2.228	2.240	9
2. Textiles	3.3577 (0.7669)	0.5131 (0.6355)	0.0301	0.404	1.548	13
3. Carpets and rugs	2.6690 (4.5311)	0.5845 (4.8573)	0.6820	23.593	2.227	11
4. Leather and leather products	5.4518 (12.0320)	0.0515 (0.9284)	0.0874	0.862	1.296	9
5. All industries	5.4971 (15.2690)	0.0675 (1.1211)	0.0255	1.257	1.472	48

Figures in parentheses are t ratios

Table AII 2: CES Production Functions Indirectly Estimated Under Variable Returns to Scale (Household)

Industry	Intercept	Ln W	Ln V	R^2	F	DW	DF
1. Processing of agricultural product including all food and feed industry	3.9098 (2.1837)	0.7238 (2.1081)	−0.1764 (−1.8531)	0.4392	3.132	2.038	8
2. Textiles	3.5853 (0.9660)	−0.0089 (−0.0124)	0.2216 (2.4597)	0.3570	3.331	1.698	12
3. Carpets and rugs	2.7132 (4.2716)	0.6067 (4.0856)	−0.0145 (−0.2807)	0.6845	10.848	2.192	10
4. Leather and leather products	5.4724 (6.4911)	0.0584 (0.2423)	−0.0080 (−0.0297)	0.0875	0.384	1.292	8
5. All industries	4.4696 (8.1554)	0.0625 (1.0878)	0.1013 (2.4054)	0.1323	3.584	1.726	47

Figures in parentheses are t ratios

Table AII. 3: CES Production Functions Directly Estimated under Constant to Scale (Households)

Industry	Intercept	Ln (K/L)	$[Ln (K/L)]^2$	R^2	F	DW	DF
1. Processing of agricultural product including all food and feed industry	10.9610 (2.8886)	-1.9365 (-1.6493)	0.1682 (1.8932)	0.5109	4.178	1.515	8
2. Textiles	10.2950 (1.4288)	-2.1032 (-0.9967)	0.2092 (1.3711)	0.7582	18.812	1.589	12
3. Carpets and rugs	9.9220 (2.8230)	-1.4535 (-1.1141)	0.1170 (0.9966)	0.2211	1.419	1.701	10
4. Leather and leather products	-0.1501 (-0.0748)	2.0151 (2.9341)	-0.1631 (-2.9423)	0.5292	4.496	1.252	8
5. All industries.	11.861 (6.8144)	-2.2122 (-3.9685)	0.1918 (4.3989)	0.4337	17.998	1.306	47

Figures in parentheses are t ratios

Table AII. 4: CES Production Functions Directly Estimated Under Variable Returns to Scale (Households)

Industry	Intercept	LnL	LnK	[Ln (K/L)]^2	R^2	F	DW.	DF
1. Processing of agricultural product including all food and feed industry	10.024 (2.8678)	2.3261 (2.0642)	-1.4457 (-1.3074)	0.1274 (1.5127)	0.9581	53.312	1.504	7
2. Textiles	11.9470 (1.6263)	3.4676 (1.6292)	-2.5420 (-1.18661)	0.2453 (1.5759)	0.9697	117.539	1.913	11
3. Carpets and rugs	9.8369 (2.1020)	2.4306 (1.5202)	-1.4268 (-0.8664)	0.1145 (0.7723)	0.9530	60.860	1.730	9
4. Leather and leather products	-0.2686 (-0.1258)	-1.1100 (-1.4632)	2.0891 (2.8230)	-0.1699 (-2.7702)	0.9826	131.729	1.257	7
5. All industries	11.8790 (6.7198)	3.2099 (5.6635)	-2.2134 (-3.9179)	0.1919 (4.3442)	0.9456	266.757	1.298	46

Figures in parentheses are t ratios

Table.All. 5; **VES** -Production Functions **Indirectly** Estimated **Under** Constant Returns to Scale- (Households)

	Intercept	Ln W	Ln K/L	R^2	F	DW	DF
1. Processing of agricultural product including all food and feed industry	2.9322 (1.5412)	0.2880 (0.6849)	0.2144 (1.2589)	0.3310	1.979	1.671	8
2. Textiles	5.2084 (2.6501)	-1.111 (-2.6303)	0.9668 (7.3213)	0.8226	27.819	2.298	12
3. Carpets and rugs	3.4917 (4.7467)	0.5575 (4.9433)	-0.22[illegible] (-1.6699)	0.7514	15.109	2.651	10
4. Leather and leather products	5.0347 (6.4967)	0.0615 (1.0403)	0.0608 (0.6747)	0.1365	0.632	1.224	8
5. All industries.	3.0422 (4.8608)	0.1550 (2.8445)	0.2944 (4.4893)	0.3180	10.956	1.495	47

Figures in aprentheses are t ratios

Table **All. 6: VES** Production Functions Indirectly Estimated Under Variable Returns to Scale **(HOUSEHOLDS)**

Industry	Intercept	LnW	Ln(K/L)	LnL	R^2	F	DW	DF
1. Processing of agricultural product including all food and feed industry	3.2719 (2.1996)	0.4902 (1.4530)	0.1074 (0.7707)	−0.1756 (−2.4895)	0.6452	4.242	1.761	7
2. Textiles	5.1036 (2.5172)	−1.0929 (−2.5111)	0.9963 (6.8996)	−0.0368 (−0.5989	0.8282	17.675	2.472	11
3. Carpets and rugs	3.4851 (4.6434)	0.5918 (4.8034)	−0.1085 (−1.5949)	−0.0354 (−0.7790)	0.7671	9.879	2.603	9
4. Leather and leather products	4.1461 (5.2057)	0.3497 (2.2902)	0.0397 (0.5119)	−0.3580 (−1.9996)	0.4504	1.912	1.716	7
5. All industries.	3.0660 (4.7365)	0.1552 (2.8176)	0.2954 (4.4408)	−0.0069 (−0.1728)	0.3184	7.163	1.479	46

Figures in parentheses are t ratios

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