(5.7) $$\log pV/L = a + b \log pW - (b-1) \log p.$$

The estimation of (5.6) instead of (5.7) biases the slope of pW upward if the "true" elasticity of substitution is less than 1, since the slope of log p is positive in this case. Nerlove obtained the expression for this bias, which is

(5.8) $$E\,(\text{est. } b-b) = (1-b)\,\frac{\text{var} \log p + \text{cov}\,(\log W, \log p)}{\text{var} \log p}.$$

Thus, the bias appears if there is a positive correlation between the price index of output and the wage rates by regions. Since the existence of a positive correlation is more likely than a negative one, the estimate of b is likely to have a higher value than the true estimate.

One problem with the above explanation is apparent if we consider observations obtained for a single region, when the observations are classified by some other means, like asset sizes of establishments. This is the case of the estimates reported in this study. Does the price index for a given industry vary in accordance with the size of assets of the producing unit? This can only be true if the degree of aggregation is perhaps so large that different size-plants are in fact producing different outputs. Even in this case, it does not appear very plausible that price per unit and wage rates in a given cross-section in a specific region should be positively correlated. Thus, because of the ambiguity of a price index for the output of establishments with different asset sizes in a cross-section, we can assume that in fact the estimating equation (5.5), not (5.6), is being utilized.

In terms of the data utilized in the estimation of CES functions, it appears more plausible to refer to Solow's observations in comparing his estimates with those derived in the earlier ACMS study. Solow (1964) has observed that the international cross-section carried a wide variety of countries with different wage rates. The range of wage rates was such that the highest ran as much as twenty times the lowest wage rates. In his US regional samples, the variation was more limited, with "the highest wage as twice the lowest and almost always the range is much narrower."[6] This appears to be the case for Philippine manufacturing. In fact, in some of the observations, on the whole, the variations in wage rates (per man) are perhaps more narrow than the ones one

[6] Solow (1964), p. 118; cited also in Nerlove (1967).

would expect to find in the United States. It is probably fitting to describe the Philippine labor situation as a Lewis-type "labor-surplus" economy.[7] In view of this, there would tend to be less variations in wage rates, because of the pool of labor resources that can be attracted to enter the labor market in the industrial sector. Average labor productivity in value added terms (V/L) may have relatively much wider variations than the wage rates. Aside from productivity related wage levels, it is plausible to assume that as asset size increases, the value added per man would increase relatively faster than average wage rates in this situation because up to a point wage rates would tend to be pulled down by the large supply of labor notwithstanding the presence of minimum wage and social security legislation in the Philippines. At the lower level of wage rates are found establishments which have probably the lowest rate of compliance with these laws. Thus, it may be that the average payments per labor per year would be relatively nearer the equilibrium wage for labor for the economy. As the establishment size increases, the rate of compliance with these laws increases. It is among firms with relatively higher asset sizes where any strong effects of capital-labor substitution induced by these laws may be most felt, since

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[7]See W. Arthur Lewis (1954).

they are directly confronted with the burden of compliance. Moreover, in view of many industrial promotion incentives which cheapened the relative price of capital,[8] the inducements for capital-labor substitution have been strengthened. Thus, the rate of increase to higher value added labor productivity relative to wage rate variations among the observations per asset sizes is to be expected. On the one hand, the labor surplus economy explanation rules out any wide variation of wage rates even when labor productivity is decidedly much higher; on the other, the presence of minimum wage and social security legislation has tended to encourage the presence of more establishments which require relatively more capital per man and therefore higher value added productivity for labor.

Thus, the possibility that in the Philippines (and perhaps in other less developed countries) the elasticity of substitution may be close to estimates made available for other countries should not be ruled out. In Figure 5.2, we illustrate the possibility of a bias in the estimate of b. The narrow range of wage rates and the wider range of value of labor productivity leads to estimates of b which exceed the value of unity. Alternative scatters, represented by broken ellipses may represent the way the logarithms of V/L and W are observed. (The intersection of the two solid lines

[8] I shall report this in a lengthier study; however, see G.P. Sicat (1965).

drawn from both axes represent the point of means.)

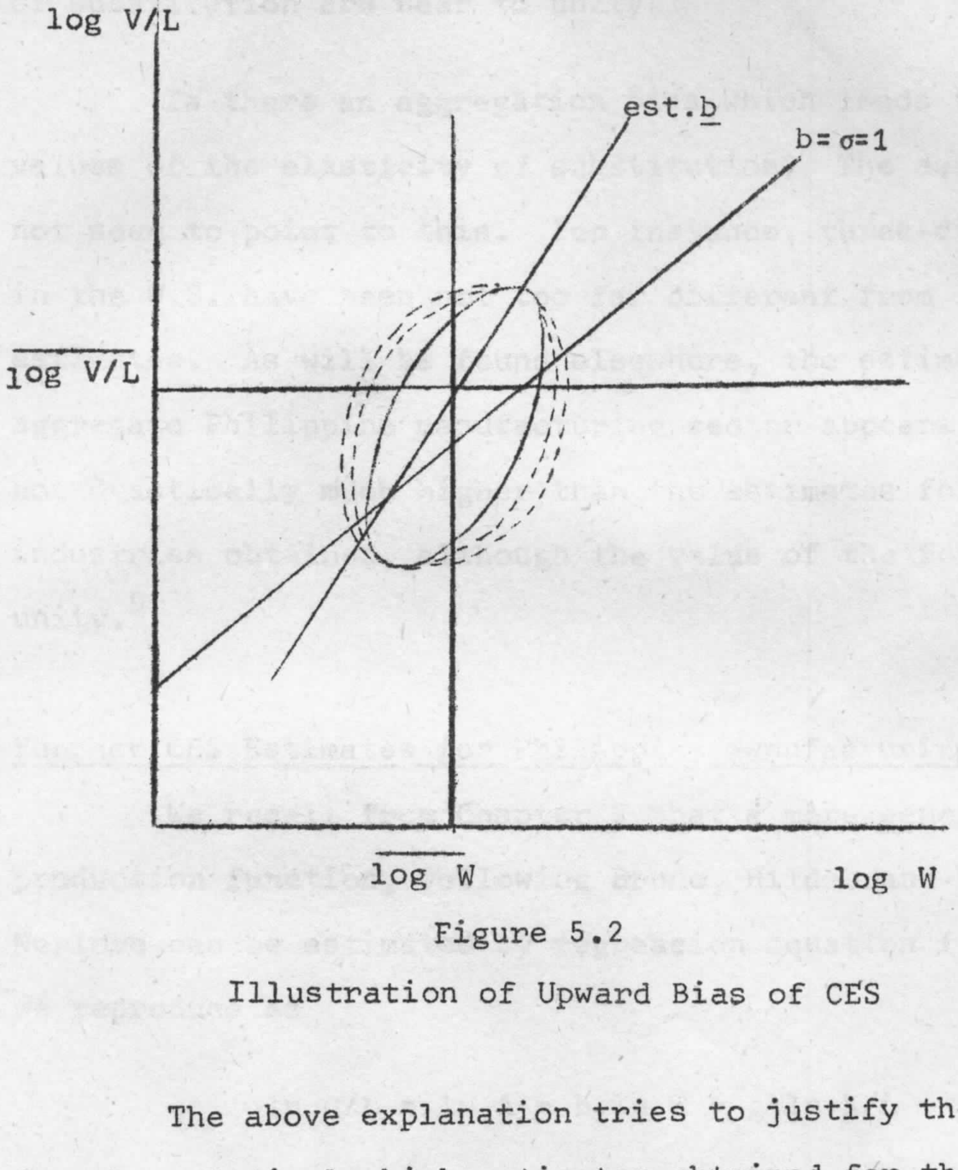

Figure 5.2

Illustration of Upward Bias of CES

The above explanation tries to justify the reasons for the relatively high estimates obtained for the manufacturing sector. The existence of upward bias is wellknown, and for the Philippines, this upward bias apparently exists. If indeed this is so, the estimates we have found do not seem to rule out the appropriateness of assuming simply a Cobb-Douglas production function with elasticities of the inputs summing to unity, since, on the whole, the elasticities of substitution are near to unity.

Is there an aggregation bias which leads to different values of the elasticity of substitution? The evidence does not seem to point to this. For instance, three-digit estimates in the U.S. have been not too far different from two-digit estimates. As will be found elsewhere, the estimate for the aggregate Philippine manufacturing sector appears on balance not drastically much higher than the estimates for 2-digit industries obtained, although the value of the former exceeded unity.[9]

Further CES Estimates for Philippine Manufacturing

We recall from Chapter 3 that a more generalized CES production function, following Bruno, Hildebrand-Liu, and Nerlove can be estimated by regression equation (2.9), which we reproduce as

$$\ln Q/L = \ln A + b \ln W + g \ln K/L + e$$

where K/L is fixed assets per man. The estimation of this equation was pursued, utilizing all the variations of the data inputs utilized in regression equations (5.1) to (5.4). Thus, the analogues of the said equations are as follows

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[9]On this point, see R. Boddy (1967), p. 132-3.

(omitting all subscripts):

(5.9) $$\ln V/L = \ln A + b_{w1} \ln w_1 + g_1 \ln K/L + e$$

(5.10) $$\ln G/L = \ln B + b^*_{w1} \ln w_1 + g^*_1 \ln K/L + e$$

(5.11) $$\ln V/L = \ln A + b_{w2} \ln w_2 + g_2 \ln K/L + e$$

(5.12) $$\ln G/L = \ln B + b^*_{w2} \ln w_2 + g^*_2 \ln K/L + e.$$

Tables 5.6 and 5.7 present the results of all these estimates. We eliminate all nonsignificant and negative coefficient estimates, but retain those which are found to be statistically significant among the regressions. We note that quite a few of the industries did not have any regression estimates worth reporting for the coefficient of K/L. Eight of the industries for which we made estimates had at least 7 estimates not for these coefficients which had to be discarded because they were either negative or not significant, mostly the latter. Only manufactured food (ISIC 20), tobacco (ISIC 22), metal products (ISIC 35) and nonelectric machinery (ISIC 36) had estimates of g which were all throughout significant. Beverages (ISIC 21), leather (ISIC 29), rubber (ISIC 30), and electric machinery (ISIC 37) had significant estimates for the g coefficients, whatever the regression model.

Table 5.6. GENERALIZED CES FUNCTION, BASED ON AGGREGATED DATA

SIC Code	Industry	Value Added				Gross Sales			
		b_{w1}	g_1	b_{w2}	g_2	b^*_{w1}	g^*_1	b^*_{w2}	g^*_2
0	Food	1.248	0.467	1.172	0.444	0.243	0.487	0.433	0.42
		(0.208)	(0.104)	(0.307)	(0.148)	(0.208)	(0.104)	(0.210)	(0.10
1	Beverages	1.701	n.s.	1.094	0.476	0.880	0.420	0.593	0.69
		(0.197)		(0.209)	(0.188)	(0.128)	(0.107)	(0.112)	(0.10
2	Tobacco	0.808	0.375	0.980	0.278	1.188	0.201	1.172	0.13
		(0.540)	(0.182)	(0.454)	(0.180)	(0.394)	(0.133)	(0.332)	(0.13
3	Textiles	n.s.	n.s.	n.s.	0.032	n.s.	0.166	n.s.	0.24
					(0.164)		(0.121)		(0.15
4	Footwear and apparel	0.436	n.s.	0.570	n.s.	n.s.	n.s.	0.742	n.s
		(0.336)		(0.306)				(0.731)	
5	Wood & cork	0.310	-0.394	0.728	-0.363	n.s.	-0.389	n.s.	-0.39
		(0.288)	(0.138)	(0.366)	(0.118)		(0.188)		(0.17
6	Furn. & fixtures	1.453	n.s.	1.281	n.s.	1.943	n.s.	1.683	n.s
		(0.301)		(0.166)		(0.335)		(0.173)	
7	Paper products	n.s.	n.s.	3.078	-0.490	n.s.	n.s.	2.656	-0.46
				(0.685)	(0.187)			(0.549)	(0.15
8	Printing	0.624	n.s.	n.s.	n.s.	0.460	n.s.	n.s.	n.s
		(0.272)				(0.251)			
9	Leather prod.	0.911	n.s.	n.s.	0.463	0.860	0.202	n.s.	0.51
		(0.696)			(0.233)	(0.389)	(0.158)		(0.16
30	Rubber prod.	1.349	n.s.	1.631	n.s.	1.168	n.s.	1.508	n.s
		(0.491)		(0.254)		(0.485)		(0.247)	
31	Chemical prod.	1.462	n.s.	1.388	-0.386	0.753	n.s.	0.707	-0.49
		(0.493)		(0.321)	(0.246)	(0.598)		(0.460)	(0.35
33	Nonmetallic min.	n.s.	0.519	1.641	0.235	n.s.	0.408	1.447	0.15
			(0.161)	(0.314)	(0.101)		(0.153)	(0.347)	(0.11
34	Basic metals	0.548	n.s.	1.662	-0.097	n.s.	n.s.	1.073	n.s
		(0.406)		(0.453)	(0.073)			(0.481)	
35	Metal products	1.411	n.s.	n.s.	n.s.	1.365	n.s.	n.s.	n.s
		(0.693)				(1.082)			
36	Machinery, non-electric	1.028	0.323	1.838	0.422	n.s.	0.321	1.226	0.38
		(0.953)	(0.209)	(0.500)	(0.144)		(0.216)	(0.670)	(0.19
37	Electric mach.	n.s.	0.360	0.733	0.285	n.s.	0.417	n.s.	0.37
			(0.099)	(0.382)	(0.098)		(0.111)		(0.11
38	Transportation	0.355	-0.230	0.609	-0.287	0.783	n.s.	1.121	n.s
		(0.196)	(0.151)	(0.278)	(0.136)	(0.339)		(0.516)	

Standard errors of coefficients in parentheses.

Table 5.7. GENERALIZED CES ESTIMATES BASED ON SAMPLED DATA

SIC Code	Industry	Value Added				Gross Sales			
		b_{w1}	g_1	b_{w2}	g_2	b^*_{w1}	g^*_1	b^*_{w2}	g^*_2
20	Food	0.720 (0.328)	0.367 (0.082)	1.106 (0.321)	0.231 (0.089)	0.956 (0.257)	0.219 (0.065)	1.104 (0.297)	0.11 (0.08
21	Beverages	1.014 (0.194)	n.s.	1.097 (0.237)	n.s.	0.696 (0.134)	0.102 (0.100)	0.701 (0.182)	0.25 (0.10
22	Tobacco	1.480 (0.428)	n.s.	1.534 (0.314)	0.148 (0.124)	1.666 (0.400)	n.s.	1.635 (0.304)	0.13 (0.12
23	Textiles	n.s.	0.281 (0.213)	n.s.	0.226 (0.219)	n.s.	n.s.	n.s.	n.s
24	Footwear and apparel	0.597 (0.269)	n.s.	0.602 (0.208)	n.s.	0.662 (0.339)	n.s.	0.618 (0.281)	n.s
25	Wood & cork	0.844 (0.279)	n.s.	1.207 (0.146)	n.s.	0.547 (0.236)	0.158 (0.153)	0.842 (0.158)	n.s
26	Furn. & fixtures	1.054 (0.405)	n.s.	1.322 (0.283)	n.s.	1.008 (0.411)	0.262 (0.214)	1.300 (0.284)	n.s
27	Paper products	0.564 (0.493)	n.s.	1.152 (0.356)	n.s.	0.873 (0.385)	-0.442 (0.326)	1.244 (0.241)	-0.26 (0.20
28	Printing	0.819 (0.247)	n.s.	0.789 (0.630)	n.s.	0.855 (0.295)	n.s.	1.397 (0.636)	n.s
29	Leather products	1.216 (0.500)	n.s.	n.s.	n.s.	0.874 (0.301)	0.199 (0.115)	n.s.	0.32 (0.18
30	Rubber products	1.411 (0.703)	n.s.	1.833 (0.325)	n.s.	1.456 (0.629)	n.s.	1.666 (0.338)	n.s
31	Chemical prod.	n.s.	n.s.	1.819 (0.446)	-0.266 (0.158)	n.s.	n.s.	0.797 (0.706)	n.s
33	Nonmetallic min.	1.190 (0.263)	n.s.	1.248 (0.248)	n.s.	0.940 (0.281)	n.s.	0.982 (0.275)	n.s
34	Basic metals	n.s.	n.s.	1.051 (0.864)	n.s.	n.s.	n.s.	n.s.	n.s
35	Metal products	0.581 (0.574)	0.390 (0.124)	0.986 (0.748)	0.271 (0.157)	n.s.	0.434 (0.103)	n.s.	0.38 (0.13
36	Machinery, non-electric	1.578 (0.781)	0.260 (0.217)	1.552 (0.560)	0.346 (0.200)	1.496 (0.851)	0.261 (0.236)	1.164 (0.698)	0.28 (0.24
37	Electric mach.	0.440 (0.273)	0.439 (0.118)	n.s.	0.426 (0.140)	n.s.	0.463 (0.170)	n.s.	0.44 (0.19
38	Transportation	n.s.	n.s.	0.598 (0.336)	n.s.	n.s.	n.s.	0.888 (0.489)	n.s

Standard errors of coefficients in parentheses.

The next step is to revise the estimates of the elasticity of substitution in accordance with the corrections contained in formula derived by Nerlove-Bruno.[10] The computation scheme is demonstrated in Nerlove. These computations are dependent on the estimate of the capital share, and we have made some remarks concerning this point in the previous chapter. Table 5.9 contains the estimates of Hildebrand-Liu as recomputed by Nerlove (1967) and a simple average found for the Philippines, based on Table 5.8.

The results that we derive tend to exaggerate the value of the elasticities of substitution, much more than we observe for the comparisons with simple estimates of the CES for the US, as computed by Griliches and Solow. As we note g>0, and in accordance with the formula utilized in getting the corrected elasticity of substitution, this would cause the direct estimate derived from <u>b</u> to be understated. Thus, we observe a relatively higher set of elasticities of substitution.

However, considering the relative poorness of these statistical results, we are more comfortable with the direct estimates of the elasticity of substitution. But as we have pointed out, too, there appears to be no strong reason why

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[10] See Chapter 2, above, pp. 2-14 to 2-15.

Table 5.8. "GENERALIZED CES ESTIMATES"

ISIC Code	Industry	Based on Aggregated Establishments				Based on Sampled Establishments			
		Value Added		Gross Sales		Value Added		Gross Sal	
		σ_{W_1}	σ_{W_2}	$\sigma_{W_1^*}$	$\sigma_{W_2^*}$	σ_{W_1}	σ_{W_2}	$\sigma_{W_1^*}$	σ_W
20	Manufactured Food	2.959	2.597	0.609	0.916	1.318	1.548	1.311	1.2
21	Beverages	*	2.755	1.880	4.237	*	*	0.799	1.0
22	Tobacco	1.592	1.548	1.613	1.429	*	1.901	*	1.9
23	Textiles	*	*	*	*	*	*	*	*
24	Footwear & apparel	*	*	*	*	*	*	*	*
25	Wood & cork	0.175	0.425	*	*	*	*	0.793	*
26	Furniture & fixtures	*	*	*	*	*	*	2.075	*
27	Paper products	*	1.832	*	2.075	*	*	0.541	0.9
28	Printed & published mats.	*	*	*	*	*	*	*	*
29	Leather products	*	*	1.332	*	*	*	1.344	*
30	Rubber products	*	*	*	*	*	*	*	*
31	Chemical products	*	0.925	*	0.430	*	1.351	*	*
33	Nonmetallic mineral	*	2.451	*	1.862	*	*	*	*
34	Basic metal	*	1.441	*	*	*	*	*	*
35	Metal products	1.653	*	*	*	1.420	1.675	*	*
36	Machinery, nonelectric	*	5.102	*	2.976	2.604	3.268	2.475	2.0
37	Electrical machinery	*	-1.489	*	*	1.277	*	*	*
38	Transportation	0.250	0.400	*	*	*	*	*	*

Table 5.9. COMPARISONS WITH RESULTS FOR THE U.S.

ISIC Code	Industry	Hildebrand-Liu-Nerlove	Average for Phil.
20	Manufactured Food	2.1524	1.567 (8)
21	Beverages		2.140 (5)
22	Tobacco		1.541 (6)
23	Textiles	1.6526	*
24	Footwear & apparel	1.4253	*
25	Wood & cork	0.9955	0.464 (3)
26	Furniture & fixtures	0.9206	2.075 (1)
27	Paper products	1.0618	1.339 (4)
28	Printed & published materials		*
29	Leather products	0.7867	1.338 (2)
30	Rubber products	1.4465	*
31	Chemical products	1.2450	0.902 (3)
33	Non-metallic mineral products (stone, clay, etc.)	1.2783	4.313 (2)
34	Basic metal	0.9860	1.441 (1)
35	Metal products	0.6959	3.073 (2)
36	Machinery, non-electric	0.5988	2.707 (8)
37	Electrical machinery	0.7848	-0.106 (2)
38	Transportation	2.0060	0.325 (2)
39	Miscellaneous Manufactures	1.2433	

Source: Nerlove (1967), Table 5, p. 80 for the Hildebrand-Liu-Nerlove elasticities.

the assumption of a Cobb-Douglas production function, implying unit elasticity of capital-labor substitution, does any injustice to Philippine manufacturing two-digit industries, considering these results.

Conclusion

This chapter presented results of estimates for the CES production functions, utilizing different sets of data. These results point out that in general the two-digit industries appear to be no different from corresponding estimates for the US. A plausible reason, based on industrial policies in the Philippines, is utilized to explain these relatively high estimates, although the upward bias of CES estimates is not ruled out. Some attempt at deriving relatively more general results for CES elasticities are made, but as pointed out these do not appear superior to the more direct estimates.

The problem with CES cross-section estimates which we have made here is that they are based on a production model, which includes restrictive assumptions such as marginal product pricing of the inputs. In the previous chapter we have concluded that there is indeed some deviation from the "ideal" marginal productivity theory as could be seen from the differences between observed factor shares and the Cobb-Douglas factor share estimates. Interesting experiments on the CES production functions have been conducted by Dhrymes (1965)for the United States and Bruno (1967) for Israel which have attempted to shed off the unusually restrictive assumption of perfect markets. But these experiments require data which are far beyond the scope of the special tabulation from the 1960 annual survey of manufactures analyzed in this study. Dhrymes utilized compatible data for several US cross-sections, while Bruno's model depended on time series data. J. Williamson[11] has experimented on dynamic CES production functions and his preliminary results tend to show relatively the same degrees of elasticities of substitution such as those reported here.

Lastly, it is repeated that in view of the results, it appears that the use of Cobb-Douglas production functions for two-digit Philippine manufacturing industries, which is simpler in many respects than the CES production function, is appropriate.

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[11]Based on personal discussion.

Chapter 6. OTHER ESTIMATES OF PHILIPPINE MANUFACTURING PRODUCTION FUNCTIONS AND AN INTERNATIONAL COMPARISON OF SOME COBB-DOUGLAS PRODUCTION FUNCTIONS

This chapter will report other production functions which I undertook to estimate at the time the 1963 study was written. The results were not reported then because the data basis of the estimates was considered rather weak. With the estimation of two-digit production functions reported in this study, it becomes useful to make these estimates available to the profession.

A second part of this chapter will be concerned with an international comparison of some of the Cobb-Douglas production functions estimates.

Other Production Function Estimates for Philippine Manufacturing

The production function estimates are in accordance with those made in the 1963 production functions -- unrestricted Cobb-Douglas and CES. The data utilized were temporal cross-sections for three years, from 1957-1963, from the published Surveys of Manufactures. Each year had observations for different three- or four-digit industries. These observations became the raw data for the production function regressions. Whenever a 3-digit industry had no further 4-digit breakdowns, the observation for the former were utilized; whenever 4-digit disaggregations were available, the 3-digit observations were not used. Thus, it was possible to generate observations for 2-digit industries. But single year cross-sections could not provide enough observations, except in the case of food (ISIC 20). Following the earlier finding that the pooled production functions for the whole manufacturing sector for cross-sections were not statistically different from the yearly estimates of production functions, the author felt confident in aggregating the available cross-sections data for every 2-digit industry. While reasoning for the whole manufacturing sector need not necessarily apply to smaller aggregates, the above results yield at least some comfort, if not complete confidence, to the researcher.

Two-Digit Manufacturing Production Functions

Unlike the 1963 study, regressions were performed only for 2-digit industries involving aggregated data for establishments with at least 20 workers. Moreover, two different concepts of capital measures were utilized. The first is the book value of fixed assets in the year concerned. The second capital measure is equivalent to book value of fixed assets in the year concerned plus capital expenditures during the year, or gross fixed capital.

The following regression estimates (dropping all subscripts) were performed:

(a) For the unrestricted Cobb-Douglas production functions:

$$(6.1)\quad \ln V = A + \alpha_K \ln K + \alpha_L \ln L + e$$

$$(6.2)\quad \ln V = A + \alpha_{K*} \ln K^* + \alpha_L \ln L + e$$

(b) For CES production functions:

$$(6.3)\quad \ln V/L = A + b \ln W + e$$

where V is gross value added, K book value of fixed assets, $K^* = K$ plus capital expenditures during the year (i.e., gross fixed capital), L manyears of labor input, W the payroll per employee, and e the stochastic random term. There were no estimates made using gross sales as the output indicator.

(a) Cobb-Douglas Production Functions

Tables 6.1 and 6.2 present the estimates of unrestricted Cobb-Douglas production functions involving the two measures of capital for 2-digit manufacturing industries, respectively. N refers to the total number of pooled observations. It is seen that the multiple correlation R is quite high and there are only three cases in each table where the coefficient estimates for either inputs appeared statistically not different from zero. However, most of the

Table 6.1. COBB-DOUGLAS PRODUCTION FUNCTIONS TEMPORAL CROSS-SECTIONS, 1957-1959, CAPITAL MEASURE K = FIXED ASSETS

ISIC Code	Industry	N	Constant	α_K	α_L	R	$\alpha_K + \alpha_L$
20	Food	38	.749 (.475)	.704 (.089)	.296 (.098)	.940	1.000 (0.187)
21	Beverages	10	-.926 (.621)	1.232 (.265)	n.s.	.991	n.s.
22	Tobacco	9	-.128 (.349)	.159 (.048)	1.077 (.079)	.997	1.236 (0.127)
23	Textiles	33	.831 (.453)	.297 (.090)	.726 (.141)	.961	1.023 (0.231)
24	Footwear & apparel	36	.619 (.347)	.248 (.092)	.773 (.122)	.972	1.021 (0.214)
25	Wood and cork	24	.342 (.336)	.315 (.129)	.747 (.168)	.982	1.062 (0.297)
26	Furniture & Fixtures	23	1.290 (.634)	.360 (.188)	.561 (.176)	.902	0.921 (0.364)
27	Paper products	15	1.524 (.760)	.260 (.142)	.753 (.150)	.948	1.013 (0.292)
28	Printing	16	1.564 (.312)	.526 (.086)	.386 (.096)	.987	0.912 (0.182)
31	Chemical products	33	2.196 (.791)	n.s.	1.187 (.206)	.917	n.s.
33	Non-metallic mineral	27	-.122 (.458)	.474 (.100)	.678 (.163)	.973	1.152 (0.263)
35	Metal products	39	1.089 (.505)	.399 (.089)	.619 (.126)	.919	1.018 (0.215)
36	Non-electric machinery	27	-.683 (.741)	.476 (.154)	.537 (.196)	.900	1.013 (0.350)
37	Electric machinery	13	-.491 (.830)	.545 (.158)	.715 (.147)	.964	1.260 (0.305)
38	Transport equipment	17	.198 (.941)	n.s.	2.330 (.364)	.920	n.s.
39	Miscellaneous manufactures	34	.821 (.518)	.525 (.099	.480 (.149)	.924	1.005 (0.248)

Standard errors of coefficients in parentheses.

n.s. - not significant

Table 6.2. COBB-DOUGLAS PRODUCTION FUNCTIONS POOLED TEMPORAL CROSS-SECTION REGRESSIONS, 1957-1959, CAPITAL MEASURE IS K^*

ISIC Code	Industry	N	Constant	α_K	α_L	R	$\alpha_K + \alpha_L$
20	Food	38	.401	.639	.404	.929	1.043
			(.547)	(.092)	(.098)		(0.190)
21	Beverages	10	-.582	1.364	n.s.	.992	n.s.
			(.587)	(.266)			
22	Tobacco	9	-.127	.167	1.065	.996	1.232
			(.372)	(.055)	(.089)		(0.144)
23	Textiles	33	.813	.310	.703	.964	1.013
			(5.773)	(.209)	(.129)		(0.338)
24	Footwear & apparel	36	.517	.217	.815	.970	1.032
			(.348)	(.096)	(.125)		(0.221)
25	Wood and cork	24	.250	.330	.736	.982	1.066
			(.326)	(.140)	(.178)		(0.318)
26	Furniture & Fixtures	23	1.185	.352	.576	.904	0.928
			(.645)	(.172)	(.162)		(0.334)
27	Paper products	15	1.217	.306	.730	.961	1.036
			(.663)	(.106)	(.116)		(0.222)
28	Printing	16	1.435	.310	.641	.969	0.951
			(.527)	(.111)	(.119)		(0.230)
31	Chemical products	33	2.169	n.s.	1.194	.917	n.s.
			(.762)		(.217)		
33	Non-metallic mineral	27	-.377	.388	.814	.962	1.202
			(.531)	(.125)	(.200)		(0.325)
35	Metal products	39	.976	.413	.607	.917	1.020
			(.515)	(.095)	(.132)		(0.227)
36	Non-electric machinery	22	.604	.347	.695	.874	1.042
			(.875)	(.180)	(.212)		(0.392)
37	Electric machinery	13	-.468	.572	.655	.964	1.227
			(.821)	(.164)	(.159)		(0.323)
38	Transport equipment	17	.594	n.s.	2.194	.898	n.s.
			(1.044)		(.423)		
39	Miscellaneous manufactures	34	.683	.613	.375	.940	0.988
			(.464)	(.093)	(.137)		(0.230)

Standard errors of coefficients in parentheses.

n.s. - not significant

constant terms are not statistically different from zero. The coefficient estimates resulting from the two different sets of regressions involving two capital concepts in general appear almost identical. Why should they be different?

These production function estimates are comparable with the results of value added regressions of production functions in Table 4.1. The results contrast markedly with the estimates reported there. In many respects, these pooled estimates resemble more the pattern of the statistically "best" Cobb-Douglas estimates reported in Table 4.12. When we discard the (poor) estimates derived for beverages (ISIC 21), chemicals (ISIC 31), and transport (ISIC 38), there are only few results where these unrestricted Cobb-Douglas production functions differ from those we have chosen as statistically best restricted Cobb-Douglas production functions in Chapter 4. Some results suggest evidence of increasing returns to scale in some industries. We shall reserve discussion of this later.[1]

(b) CES production functions

The pooled 2-digit CES production functions are reported in Table 6.3. Because the measure of capital is not

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[1]See below, p. 6-24.

Table 6.3. CES PRODUCTION FUNCTIONS POOLED TEMPORAL CROSS-SECTIONS, 1957-1968

Code	Industry	N	Constant	b	R
20	Food	38	-3.834 (1.266)	1.665 (.168)	.855
21	Beverages	10	-8.810 (1.673)	2.295 (.212)	.967
22	Tobacco	9	-7.071 (3.741)	2.131 (.509)	.846
23	Textiles	33	1.734 (1.112)	.876 (.151)	.722
24	Footwear & apparel	36	3.227 (0.624)	.643 (.090)	.774
25	Wood & cork	24	-2.035 (3.336)	1.343 (.455)	.533
26	Furniture & Fixtures	23	-1.582 (8.011)	1.295 (.410)	.567
27	Paper products	15	4.805 (1.500)	.545 (.193)	.616
28	Printing	16	1.238 (1.252)	.927 (.161)	.839
31	Chemical products	33	3.800 (1.525)	.686 (.192)	.540
33	Non-metallic mineral	27	-4.540 (2.600)	1.693 (.340)	.706
35	Metal products	39	- .302 (2.796)	1.166 (.367)	.463
36	Non-electric machinery	22	- .775 (2.555)	1.175 (.331)	.622
37	Electric machinery	13	.078 (5.910)	1.143 (.771)	.408
38	Transport Equipment	17	-1.570 (1.701)	1.263 (.221)	.828
39	Miscellaneous manufactures	34	.760 (1.445)	1.011 (.189)	.686

Standard errors of coefficients in parentheses.

used in these estimates, there is only one set of CES estimates. These estimates are for the manufacturing 2-digit industries with 20 or more workers. The estimates for b, the elasticity of substitution as in the previous chapters, tend to be greater than 1. The constants are generally not different from zero, as their standard errors will reveal. Some investigation of the estimates for CES functions in which the output concept used is value added per man, as shown by the results of Tables 5.1 and 5.2, indicate that many of these estimates tend to be relatively close in values, except for chemicals (ISIC 31) and transport equipment (ISIC 38). Thus, in a sense, we may conclude that the CES we obtained by pooling cross-section observations for a specific industry may reflect, in general, the elasticity of substitution estimates for capital and labor.

Production Functions by Type of Business Organizations

One of the interesting sets of information in the Annual Survey of Manufactures concerns data on business organizations. Utilizing 2-digit ISIC manufacturing industries as observations, Cobb-Douglas and CES production functions were estimated.

(a) Cobb-Douglas Production Functions by Business Type

Tables 6.4 and 6.5 show the unrestricted Cobb-Douglas production function estimates. The first set of