FACTOR INTENSITY IN KENYA'S INDUSTRIAL SECTOR: AN INPUT RATION ANALYSIS

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ABSTRACT

Three approaches - value added approach, capital consumption approach, capital cost approach - are utilised to assess the relative factor intensities in small and large firms in Kenya. We conclude that small scale firms are less skill intensive and less capital intensive than their larger counterparts.

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INTRODUCTION

This paper will give more scrutiny to the data in Tables 2 and 3 of a previous paper [11] and introduce more data in an attempt to be more definitive about the impact of firm size in labour absorptive capacity in Kenya's industrial sector.

Value Added Approach

Gross product is the sum of labour costs, interest payments, depreciation on fixed assets and stocks, and profit before tax. Since it equals output (sales) minus input (materials, fuels, water, transport), it measures the inputs of both human and physical capital. It is Value Added -- the aggregate flow of services[1] from the factors of production employed in the manufacturing process. Value added has two broad components, namely Labour Value Added and Non-labour Value Added.

Labour costs are a proxy for labour value added. If labour value added per person engaged is higher in one firm than in another, then the former must have used people with more or better skills so that they contribute more to value added and are paid more, other things remaining the same. The former is said to be more skill-intensive than the latter. Credibility to this measure is vouched by the study of Hal B. Lary [9]. With a sample of 59 U.S. firms, he found a correlation coefficient of 0.78 between annual earnings and the occupational index. The coefficient was significant at the 99% level of confidence. He also found a correlation coefficient of 0.76 between annual earnings and an educational index thus "attesting to the meaningful association between wages and skills across industries." [9,p.37].

Non-labour value added is capital's share i.e. interest, depreciation, profit. Non-labour value added per person engaged is a reasonable approximation of physical capital intensity. Lary's analysis of 276 U.S. firms revealed a correlation coefficient of 0.81 between non-wage value added per employee and physical assets per employee. [9,p.41] Similarly, with 115 Indian firms he found a correlation coefficient of 0.75 between non-wage value added and productive assets [9,p.46] That both these coefficients were significant at the 99% level of confidence provides support for the use of non-wage (or non-labour) value added per employee as a guide to inter-industry or inter-firm differences in the intensity of capital inputs.

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1. Making use of value of services by-passes the thorny problem of capacity utilization. This not withstanding, see the third section below.

Total value added per person engaged is a proxy for scarce factor intensity. If firm A has a higher value added per person engaged than firm B, this must have arisen because either A uses more skilled manpower (skill intensity) than B, or A uses more capital (capital intensity) than B, or both of these reasons.

Relevant calculations for the above entities are given in Table 1. Column 1 is to be compared with column 2, 3 with 4, and 5 with 6. In 12 cases labour value added per person engaged is higher for the large than for the small firms. The same applies for non-labour value added and the total value added per person; this applies in 11 cases each. Hence, in more than half of the cases given in Table 4.7 large firms' values exceed their corresponding small firms' values. The row labeled "Total" summarizes all the figures in this table. It reveals that labour value added, non-labour value added and total value added — all in terms of per person engaged — for large firms exceed those for small firms. Evidently, small scale manufacturing enterprises are, by and large and on average, less skill intensive, less capital intensive and less scarce factor intensive than large firms. In the context of an economy which is short of both physical and human capital, this is very impressive. It is a pointer that, judged by the foregoing indices of factor intensity, small scale industrialization may be the more optimal and therefore better pattern of development. This is further examined in the section that follows.

Capital Consumption Approach

In this section, we deal with two entities that have some relation to physical capital, namely, depreciation and fuel consumption.

Capital consumption is another name for depreciation i.e. that amount of capital used up in the production process. It is very hard to know exactly the amount of capital consumed, and approximations can vary, depending on the assumed life of the equipment and the method used. The straight line method, the diminishing balances method, and the sum-of-digits method would in general give different capital consumption estimates. Fortunately, tax laws in Kenya, like in many other countries standardize the method used. In Kenya a certain rate is applied to the yearly balances of the historical cost of capital. So the method is standard for everyone. Besides, unlike the other two methods, this is relatively neutral to the duration of the equipment.

Fuels — electricity, oil and gas — used in the production process are in the short run complementary to capital. The higher the degree of mechanization the larger the quantity of fuels consumed is likely to be.

TABLE 1

Total Value Added and Its Components

per Person Engaged

I.S.I.C. Code	Labour Value Added per Persons (K€ '000)		Non-labour Value Added per Person (K€ '000)		Value Added per Person (K€ '000)	
	Large Firms 1	Small Firms 2	Large Firms 3	Small Firms 4	Large Firms 5	Small Firms 6
201,202,203	0.334	0.256	0.048	0.305	0.382	0.560
205	0.389	0.504	0.446	0.696	0.835	1.200
206,207,208	0.271	0.262	0.108	0.106	0.460	0.368
209	0.369	0.375	0.219	0.171	0.765	0.546
211,213,214,220	0.678	0.898	0.846	0.599	1.524	1.069
233	0.206	0.117	0.120	0.087	0.325	0.205
234	0.195	0.566	0.079	0.360	0.274	0.927
241,243	0.241	0.297	0.135	0.211	0.376	0.508
251	0.125	0.300	0.086	0.122	0.211	0.419
260	0.287	0.275	0.057	0.261	0.344	0.536
271,280	0.552	0.434	0.330	0,167	0.882	0.558
299,300	0.388	0.315	0.585	0.207	0.726	0.523
311,312,313,315	0.669	0.465	1.901	0.372	2.571	0.838
319	0.155	0.527	0.659	0.840	1.175	1.368
331,332,334,339	0.726	0.377	0.821	0.646	1.210	1.023
350	0.385	0.293	0.406	0.356	0.791	0.649
360	0.377	0.337	0.566	0.203	0.943	0.540
370	0.536	0.371	0.175	0.410	0.711	0.781
381,382,383	0.289	0.431	0.059	0.144	0.347	0.575
384	0.512	0.300	0.335	0.149	0.847	0.449
390	0.349	0.374	0.098	0.359	0.448	0.733
TOTAL	0.371	0.373	0.292	0.261	0.663	0.604

Source: Tables 2 and 3 in [11]. For ISIC Codes, see Table 1 in [11].

It is, therefore, reasonable to take depreciation and fuel costs per person engaged as a suitable index for capital intensity. "Indices" are all they can be because neither depreciation nor fuel costs can claim to be a "measure" of capital, though perhaps fuel figures are marred by fewer pitfalls than depreciation figures. However, it is reasonable to assume that such imperfections as appear in these figures are shared equally by large and small firms. Comparative data by firm sizes is given in Table 2.

According to Table 2, in 14 out of the 18 cases given, depreciation per person engaged in large firms exceeds the corresponding figure for small firms. Similarly in 10 cases in cost of fuels and in 11 cases for fuels and depreciation combined. A glance at the row labelled "Total" leaves no doubt as to the general picture: That larger firms are greater consumbers of capital and power per job created than their smaller competitors.

Neither of the two methods applied so far can give us a clue as to what is the capital cost of supplying one workplace. Both value added and capital consumption approaches are ordianl measures. In the next section we apply a method that gives us some measures with an element of cardinality.

Capital Cost Approach

Data on number of persons employed and fixed assets were gathered by the author for a total of 69 manufacturing firms in Kenya in 1972. Book values of historical accumulations of purchases of assets were taken as measures of capital in existence. True, capital in place is not necessarily capital in use as evidenced by excess capacity in many firms in Kenya [1], [8], [10]. But it should be remembered that unutilized capital imposes a cost on society in terms of the output and employment that should be forthcoming from it, but is not so forthcoming. This cost of idle capital is brought in the open by capital-labour ratio. Capital-labour coefficient should be higher in the firms with an excess capacity than in the firms without such excess capacity and this should be a caveat to halt such a development pattern.

Capital assets are acquired by the various firms over sometimes very vastly different time periods. The more recently acquired capital is in a sense more capital for it embodies a more efficient technology (vintage idea). In another sense it is less because the more recently acquired assets are usually purchased at higher nominal prices (inflationary trend). The adjustment of book values to a constant or current cost basis poses extremely difficult problems. For one thing, there is no published time series price deflator for fixed assets in Kenya. For another, such price indices as exist

TABLE 2

Depreciation and Fuel Costs Per Person

by Firm Sizes

I.S.I.C Code	Depreciation Per Person (K£'000)		Cost of Fuels Per Person (K£ '000)			Fuels and Depreciation (K£'000)
	Large Firms 1	Small Firms 2	Large Firms 3	Small Firms 4	Large FFirms 5	Small Firms 6
201,202,203	0.078	0.082	0.051	0.094	0.129	o.176
205	0.121	0.085	0.055	0.112	0.176	0.197
206,207,208	0.154	0.022	0.057	0.051	0.211	0.073
209	0.119	0.069	0.043	0.064	0.162	0.133
211;213,214,220	0.119	0.080	0.048	0.032	0.166	0.112
233;234	0.113	0.035	0.058	0.017	0.171	0.035
241;243	0.002	0.014	0.016	0.005	0.018	0.189
251;260,271,280	0.119	0.113	0.056	0.052	0.175	0.076
299;300	0.112	0.007	0.082	0.040	0.195	0.048
311;312,313						
315,321	0.314	0.051	0.134	0.029	0.448	0.080
319	0.120	0.198	0.116	0.036	0.236	0.233
331,332,334,339	0.187	0.102	0.459	0.049	0.646	0.150
350	0.059	0.021	0.040	0.022	0.099	0.043
360	0.045	0.036	0.017	0.079	0.062	0.115
370	0.145	0.128	0.010	0.040	0.155	0.168
381,382,383	0.020	0.019	0.003	0.016	0.023	0.035
384	0.143	0.028	0.010	0.010	0.153	0.037
390	0.059	0.090	0.019	0.027	0.078	0.117
TOTAL	0.085	0.052	0.047	0.027	0.132	0.079

Source: Computed from data in the 1967 Census of Industrial Production (Nairobi: Ministry of Finance and Economic Planning, 1972), various tables.

(Nairobi's Lower and Middle Income Indices of Consumer Prices) do not take improvements in efficiency into account and would understate the efficiency units of real capital.

The author is painfully aware of these deficiencies. But in the final analysis we are concerned with the cost of creating one job; and we want to know what that cost actually is rather than what it would have been had, say, prices remained constant! Despite their several shortcomings, the capital estimates used below are an invaluable source for the empirically oriented economist who is willing to recognize their deficiencies.

In keeping with the rest of the study, we classify firm size according to the number of persons engaged, but instead of just dichotomizing we trichotimize the data so that a firm with 50 employees or less is "small", one with 51-100 employees is "medium", and one with over 100 employees is "large". The following average capital-labour ratios were obtained (Table 3).

TABLE 3

Relation Between Firm Size
and Capital Intensity in Manufacturing:
Kenya

Size of Firm By No. of Persons Engaged	Capital/Labour Ratio (K£)
≤50	1,759
51 - 100	2,716
Over 100	3,518

Source: See Text

The conclusion is inescapable that capital labour ratio tends to rise as size of firm increases. The evidence from Kenya data is corroborated by studies on Japan, Korea, Mexico and Pakistan (See Table 4). Though the class boundaries are not internationally uniform, it is unmistakable that

TABLE 4

Capital Intensity by Industrial Firm Sizes in Selected Countries

JAPAN: 1957		KOREA: 1968		MEXICO: 1965		PAKISTAN: 1960	
ize by No. f Workers	Capital per Worker ('000 yen)	Size by No. of Workers	Index of Fixed Capital per Worker	Size by No. of Workers	Index of Capital per Worker	Size by No. of Workers	Index of Capital per Worker
1 - 9	70	5 - 9	0.289	1 - 5	10.5	1 - 9	0.74
10 - 50	80	10 - 19	0.361	6 - 15	31.5	10 - 19	2.61
50 - 500	180	20 - 49	0.381	16 - 25	48.6	20 - 49	3.23
500 - 1000	408	50 - 99	0.391	26 - 50	57.5	50 - 99	3.34
All Industry	290	100 - 199	0.371	51 - 75	62.1	⩾ 100	4.08
		200 - 499	0.567	76 - 100	63.8		
		⩾500	0.729	100 - 250	80.4		
				251 - 500	96.2		
				500	104.8		

Sources: For Japan, Gerald Karel Boon, Economic Choice of Human and Pyysical Factors in Production (Amsterdam: North Holland Publishing Company, 1964), Table 3. 18, P. 97. For the other countries, R. Albert Berry, "The Relevance and Prospects of Small Scale Industry in Colombia." Discussion Paper No. 142, Economic Growth Centre, Yale University (April, 1972), Table 13, p. 68.

the smaller the firm, the more labour intensive it is.

The data presented in this section so far do not give comparative analysis of capital/labour ratios based on industrial classes and firm size. Data for Kenya is unavailable to accomplish this purpose. However, a look at Pakistani data gives a picture which is more likely than not to be replicated elsewhere - not so much in the actual figures, but in their relative magntudes. The figures appear in Table 5.

TABLE 5

Capital/Labour Ratios
in Palistan Manufacturing ('0000 Rupees)

Industry	Small Scale	Large Scale
Cigarettes	0.6	11.5
Cotton Textile	1.3	15.4
Transport Equipment	2.6	15.6
Rubber Products	3.4	16.2
Basic Metals	3.8	13.4
Leather Products	1.8	4.1
Machinery	3.7	8.0
Metal Products	1.6	8.2
Wood Products	1.9	7.4

Source: Azizur Rahman Khan, "Capital-Intensity and the Efficiency of Factor Use: A Comparative Study of the Observed Capital-Labour Ratios of Pakistani Industries," The Pakistan Development Review, Vol. 10 (Summer, 1970), pp, 232-63.

Summary and Conclusions

All available evidence point to the fact that small firms are less demanding of scarce resources (skilled manpower, capital, power, and, to the extent that most capital is imported, foreign exchange) than large-firms. Of particular relevance in an economy with widespread unemployment is that to create one job in a small firm is cheaper than to create that job in a large firm. It follows that, in an employment-oriented development strategy, a lot of emphasis has to be put on small scale industrialization, if industrialization is an intergral part of the development program. Up to now small industries have been relatively neglected in Kenya as Table 6 brings out.

Manufacturing establishments employing less than 100 workers each accounted for 87% of all establishments in the manufacturing sector in 1963. This is the second lowest share among the ones shown in Table 6 and 12 points lower than the highest ranking country, Japan.

Yet, besides being better instruments for a policy of fuller employment, there is evidence that small manufacturing enterprises are just as efficient per labourer as large enterprises. From Table 6, it is evident that small firms contributed 32% of total industrial sales and employed 32% of the industrial labour force; in other words, output per man was the same for both small and large establishments in 1963. More recently, in 1967, firms employing up to 49 persons each employed 19.5% of the industrial workers and produced 18.1% of the industrial output-meaning that efficiency was roughly uniform across firm sizes. In fact the World Bank report cited below Table 6 noted that in Kenya.

> .... the largest establishments with 500 or more employees accounted for a much higher share of total employment than they did in gross sales or value-added. The data suggest these firms are less efficient than smaller firms in terms of output or value-added per worker [5, vol. 4, p.5]

In so far as we are concerned about choices of scale and technology particularly as they relate to the employment problem, we are implying concern about some scarce factor-usually capital, with foreign exchange and skilled labour being close contenders. Taking capital as the common denominator, there is some indication that capital productivity declines as the size of the

TABLE

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Share of Small Scale Manufacturing Establishments in Output, Number of Establishments and Employees.

Country	Year	Percent of all Manufacturing Establishments	Percent of All Manufacturing Employees	Percent of All Manufacturing Output
Australia	1955	97	50	n.a.
Japan	1952	99	59	37
Kenya	1963	87	32	32 (Sales); 29 (Value Added)
Norway	1963	97	50+	50-
Puerto Rico	1954	91	41	38
Tanzania	1966	79	35	36
Uganda	1965	87	38	32
United Kingdom	1954	95	33	n.a.
United States	1958	91	27	23
West Germany	1953	89	27	23

n.a. means "not available"

\+ indicates slightly more than

\- indicates slightly less than

Figures cover establishments with up to 100 workers.

Sources: For Kenya, Tanzania and Uganda—International Bank for Reconstruction and Development (IBRD) and International Development Association (IDA), Industrial Development in East Africa: Progress, Policies, Problems and Prospects, Report AE-12, Vol. 2, p. 5, Vol. 3, p. 4, and Vol. 4, p. 4 (April, 1971).

For Norway— Zvi Griliches and V. Ringstand, Economies of Scale . . . [4, p. 18]

For the rest of the countries — Eugene Staley, "The Place of Small and Medium Industry in Development," in Richard J. Ward (ed), The Challenge of Development (Chicago: Aldine Publishing Co., 1967), Table 1, p. 304.

enterprise and the capital intensity increase.[2] An International Labour Office mission to Kenya found that, contrary to expectations it is the smaller and medium-sized rather than the larger establishments that are most efficient in terms of value added in relation to both fixed capital and inventory stocks [6, p. 138].

For Colombia, John E. Todd observed that

> Small and medium size establishments generate more output per unit of scarce resources than large establishments . . . . the labor-capital ratio is also higher in the small and medium size firms. Therefore, in terms of static efficiency . . . . both output and employment would be higher if the small and medium size firms could acquire a larger share of the scarce resources and markets [13, pp. 1&2].

In other words, an average unit of capital in the smaller and medium size firms is associated with both more employment and more output than a unit of capital in the larger firms.

To cash in on these opportunities, positive measures that make for the flourishing of small enterprise should be instituted. Such measures fall into two broad categories:

1. those that are designed to help in reducing, overcoming or eliminating competitive disadvantages that result from smallness, e.g. equalization of the availability and the cost of capital;

2. those measures that provide new services which, although available to all firms, are likely to be of more benefit to the smaller firms, e.g. development of industrial co-operatives to distribute and encourage standardization of products in order to reap economies of marketing that individual firms might miss.

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2. This is not surprising when the following identity holds:-

$$\frac{Q}{K} = \frac{Q}{N} \cdot \frac{N}{K}$$

Given that Q/N is roughly constant across firm sizes, then Q/K and N/K vary directly. Hence, the higher the capital intensity (K/N), the lower capital efficiency (Q/K).

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