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The Relevance and Prospects of Small Scale Industry in Colombia

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R. Albert Berry

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Abstract

As recently as 1970 a large majority of the labor force employed in Colombia's manufacturing sector was found in "cottage-shop" establishments, defined here as having less than 5 workers and less than 24,000 pesos output. The share of the labor force found in plants of 100 or more workers was only 20-25 percent. These facts by themselves make it of obvious importance that a policy for the industrial sector take into account the limitations--employmentwise--of the "factory" sector and the greater importance of the cottage-shop sector in this respect. This is especially true given that there appears to have been no significant change in the relative importance of the two subsectors over the last 20 years. It is of particular interest to note that during the 60s, a period of heavy emphasis of investment in highly capital intensive sectors like chemicals and petrochemicals, the share of all manufacturing employment in the factory subsector appears to have decreased--at least this is true for the post 1964 period.

As of the mid 60s labor productivity was an increasing function of plant size, being 8 or 9 times as high in the largest firms as for independent workers, and over 3 times as high in the largest plants as in ones of 5 to 9 workers. Output (value added) per horsepower is not related in any simple way to size; the highest ratio is found for firms in the 50-200 worker range with both the large st and the smallest plants ranking low. Horsepower is not, however, a good proxy for total capital stock; total capital per horsepower appears to be 2 or 3 times higher for the largest plants as for all other plants, implying (together with the output/horsepower figures) lower output/capital ratio for the largest plants (over 200 workers) than for all others taken together; though it is not possible to draw very solid conclusions as to how the value added/capital ratio varies among plants up to 200 workers, it seems reasonably

probable that this is a monotonically decreasing relationship, especially in the light of information from other countries, where such a negative relation seems invariably to be present.

Over time the composition of the cottage-shop and small firm sector has varied substantially; clothing is the industry where the most dramatic decline in relative importance of cottage-shop has occurred over time; it is the only sector which clearly had less cottage-shop workers in 1964 than in 1938. Relatively stagnant cases were tobacco, textiles, leather, non-metallic minerals. In a number of others there has been rapid increase, i.e., food, wood and products, metal and products--in particular transportation equipment manufacture and repair. These three branches, along with clothing and footwear, are the major cottage-shop employers at present; in 1964 they accounted for over three quarters of all employment of this type.

Trends in wages and labor productivity can only be traced out over the period 1953 and on; there appears to be no relationship between size of plant and change in labor productivity (although uncertainty is introduced by certain statistical problems in the post 1962 data for the small plants) but wages have clearly risen fastest in plants above 50 workers, an overall increase of perhaps 60 to 80 percent over 1953-66 as compared with an increase of probably 20 to 40 percent for plants of less than 50 workers.

More detailed attempts to measure relative social efficiency by plant size have been carried out by John Todd, and tend to indicate that the largest plants are either as inefficient as any other group or the least efficient of all; his estimates suggest that the most efficient plants are in the medium size range (50-200 workers) although it is possible that the smallest ones would emerge

on top if adequate measures of capital could be used.

There is little question that the large plants, corresponding to high capital intensity, generate an unequal income distribution; in petrochemicals, for example, the blue collar share is only about 9 percent and in chemicals about 15 percent, compared to an industry-wide average of about 30 percent and-at the other extreme-to such industries as wooden furniture (51 percent) non-metallic minerals (46 percent), transportation equipment (53 percent) and so on. The distributional characteristics of such industries are worriesome.

It is not clear whether large or small firms have a greater tendency to grow; the difference is in any case not dramatic; the percent of small firms which appear to be liquidated is, however, much higher than for large firms.

Given the pieces of evidence which suggest considerable efficiency on the part of small firms relative to large ones, coupled with similar evidence from other countries, it is suggested that firm size and plant size be taken seriously into consideration in policymaking; further analysis is clearly warranted with respect to the source of the particular inefficiency of the very largest plants (200 workers and up) and in general with the explanation of the differences observed. It is important to isolate the variables whose relation with plant size generates the dramatically varying factor proportions (even in the same industry) across plant size.

The Relevance and Prospects of Small Scale Industry in Colombia

R. Albert Berry

This study reviews some of the evidence available relating to the possible contribution which small scale industry can make in Colombia, discusses some of the factors which appear to have affected its growth (or stagnation), and takes a few tentative steps towards suggesting policies for fostering desirable growth in this area. The first part of the discussion below presents a brief description of small scale industry in Colombia and how it appears to have developed over the last years. The second section focusses on its performance in terms of (a) actual and potential "static" efficiency, i.e., the efficiency with which it converts resources into output at a given point in time and (b) employment and income distribution impact. The third section deals with its growth potential relative to larger scale industry (including a discussion of pertinent information on several other countries), and the fourth with possible strategies for its development.

The concept of "scale" is an ambiguous one; it seems natural to define "small scale" as corresponding to different absolute levels of firm size in different countries; further, since a complete spectrum of firm sizes exists in any country, any definition must be rather arbitrary. Cut-off points should be located, if possible, so as to distinguish firms which differ markedly in their efficiency of resource utilization, employment impact or income distribution impact; of course all these variables may be related smoothly rather than discretely to size. In this study some of the discussion will treat size as a continuous

variable; other parts will use a classification into (a) "cottage shop" industry defined as establishments (plants) with less than 24,000 pesos of output and less than 5 workers;[1] (b) small scale industry, with lower limit of 5 workers or 24,000 pesos output and upper limit of 19 workers; (c) medium scale industries of 20-99 workers;[2] and (d) large scale industry of 100 or more workers. While this division is in part forced by DANE's classification scheme, it does appear to aggregate groups of substantially differing characteristics. Before considering the details of overtime change, factor proportions, etc. it is useful to summarize some of the major differences across plant size.[3]

DANE data bring out some of the distinguishing characteristics of those plants with five or more workers and/or 24,000 pesos or more of gross output per year;[4] more limited data is available for smaller ones; Table 1 summarizes the author's best estimates for 1968. As observed in other countries average labor productivity rises rapidly with plant size;[5] this is partly (at least) due to a higher capital/

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[1] DANE conceptually includes in its surveys of the manufacturing sector all firms with a minimum of 5 workers and/or 24,000 pesos of output. This category is therefore the part of the manufacturing sector on which DANE does not collect statistics.

[2] Planeacion, in its study of small and medium industry (El Desarrollo de la Pequena y Mediana Industria a traves del Credito y Medidas Complementarias, Bogota, Noviembre, 1970) simply used the range 5-100 workers to describe small and medium industry and subdivided this range into several categories.

[3] In many respects it would be more useful to have data by firm rather than by plant. To date such information has not been produced by DANE. Some large firms in Colombia have 10 or more medium sized plants, so whatever firm size effects exist could be distorted or lost in the existing data.

[4] These data have a number of deficiencies, especially with respect to the smaller firms, where sampling is less complete than for the large firms and where accuracy is also probably less; these problems are referred to in detail later. Nevertheless the general outlines of size group characteristics may be gleaned from this data.

[5] That large plantshave greater average productivity per worker is not surprising; it seems to characterize all or almost all countries and would be expected on the basis of what is known about factor market imperfections, the relationship between size and the type of industry, etc.

Table 1

Selected Aspects of the Size Structure of Colombian Manufacturing, 1964

	Independent Workers (1)	Plants of 2-4 workers: Total (2) = (3) + (4)	Plants of 2-4 workers: (Not Reported by DANE) (3)	Plants of 2-4 workers: (Reported by DANE) (4)	Total: Plants of < 5 workers (5) = (1) + (2)
Number of Establishments				3,637	
Number of Workers	169,300	153,200–163,200	142,542–152,632	10,658	322,500–332,500
Number of Paid Workers		57,065–65,230	50,261–58,429	6,801	57,065–65,230
Number of Employers				2,930	
Value of Production					
Gross Value Added	1,072,684	1,036,371–1,100,301	903,146–967,076	133,225	2,109,055–2,172,985
Salaries (Including Fringe Benefits)		212,905–242,309	180,940–210,344	31,965	212,905–242,309
Fringe Benefits/Total Remuneration				6.320	
Salaries (Including Fringe Benefits)/Paid Workers		3697–3969	3,400–3,800	4,700	3,697–3,969
Horse-Power			n.a.	16,780	
Gross Value Added/Occupied Person	6,336	6,350–7,182	6,336	12.50[2]	6,343–6,738
Gross Value Added/Horse Power			n.a.	7,940	
Paid Labor Share of Gross Value Added		20.54–22.02	20.02–21.75	24.00	10.09–11.15
Percent of Total Value Added	8.41–8.55	8.13–8.77	7.08–7.71	1.05–1.06	16.54–17.33
Percent of Total Wages		5.68–6.60	4.82–5.73	0.87–0.85	5.68–6.60
Percent of Total Employed Workers	27.00	24.43–26.02	22.73–24.54	1.70	51.43–53.02

	Size of Plant (Number of Workers)									Total in Plants of > 5 workers	Grand Total (without unemployment)	Unemployed
	5–9	10–14	15–19	20–24	25–49	50–74	75–99	100–199	> 200			
Number of Establishments	6,100–7,635	2,133	480	348	869	315	167	261	823	10, 896–12,431		
Number of Workers	40,000–50,000	23,000	8,100	7,606	29,602	18,908	14,213	35,937	115,214	294,600–304,000	627,100	41,980
Number of Paid Workers	32,670–40,835	22,921	7,700	7,350	29,084	18,792	14,152	35,885	115,165	283,719–291,884	348,949	41,329
Number of Employers	6.55	11.721	16.87								34,000	452
Value of Production					2,359,240	1,911,419	2,085,790	3,906,439	1,098,722			
Gross Value Added	580,000–725,000	407,300	262,000	180,120	764,777	636,683	451,863	1,841,040	5,406,758	10,430,341–10,525,741	12,539,796–12,748,726	
Salaries (Including Fringe Benefits)	195,400–244,234	149,170	57,203	60,976	270,959	210,372	150,254	502,876	1,854,278	3,459,686–3,508,553	3,672,591–3,750,829	
Fringe Benefits/Total Remuneration	9.308	11.837	13.791	15.331	16.663	19.171	20.288	21.628	25.921	745,997		
Salaries (Including Fringe Benefits)/Paid Workers	5,981	6,508	7,429	8,295	9,316	11,205	11,182	14,013	16,101	11,853–12,366	10,523–10,748	
Horse-Power	55,877–69,840	43,850	16,367	16,406	95,368	44,343	30,546	121,118	579,783	1,003,656–1,017,419		
Gross Value Added/Occupied Person	14.50[2]	16.30[3]	20.00[1]	23.70	25.84	33.67	31.79	51.20	46.93	34,244–35,899	19,996–20,330	
Gross Value Added/Horse Power	10,380	9,293	9,898	10.979	8.019	14.358	14.789	15.200	9.325			
Paid Labor Share of Gross Value Added	33.69	36.61	35.31	33.85	35.43	33.07	35.02	27.31–14.44	34.30–43.12	33.17–82.96	28.81–29.91	
Percent of Total Value Added	4.63–5.69	3.20–3.25	1.27–1.29	1.42–1.44	6.00–6.10	4.99–5.08	3.54–3.60	14.68–13.41	42.41–49.44	83.15–93.54		
Percent of Total Wages	5.32–6.31	3.98–4.06	1.53–1.56	.63–1.66	7.22–7.38	5.61–5.73	6.22–4.31	15.69	50.49	94.70		
Percent of Total Employed Workers	6.38–7.97		1.29	1.21	4.73	3.02	2.27	5.73	18.37	46.97–48.57		

Footnotes for Table 1

[1]Adjusted down from DANE's figures (see Table A-1) to take account of the assumption that firms unreported by DANE had lower average value added per person than those included.

[2]Applying Todd's adjustment factors--and assuming that DANE's arrastre based downward bias was distributed among the years 1963-66 proportionally to the inflation in each year of that period. (Todd presents figures for 1962 and 1966) in order to convert those adjustment factors to 64 terms--value added/worker ratios of 14.31 and 15.93 were found for these two categories respectively. But it was assumed that the selection bias of DANE (referred to in the previous footnote) was greater with respect to the lower category so a greater downward adjustment was made in that case to take account of it.

[3]Todd's adjustment factor implied a value added/worker ratio of 16.3 here and was not altered.

[4]A salary of 2,600 pesos was assumed to make this calculation.

[5]Horse-power was reestimated for the smaller size categories, usually on the assumption that its true productivity was underestimated by DANE by about the same extent as was labor's.

Sources and Methodology - Table 1

My adjustments and attempted reconciliations of published figures take into account the following problems with the two official sources, the population census information on people working in the manufacturing sector, and DANE's industrial survey information published in the Anuario General de Estadistica.

1. I assume some under-enumeration of the labor force in manufacturing in the census (about 2 percent), somewhat less than the probable average underenumeration for the urban population of 10 and over, and well below the average underenumeration for the total population.

2. I assume an average rate of unemployment in the manufacturing sector of 6.4 percent, based on an overall unemployment rate reported in the 1964 population census of 6.8 percent for cabaceras (municipal seats) and 2.9 percent for other localities, and on the relationship-observed in Bogota in 1964 and in 8 cities in 1967 by CEDE's surveys between unemployment in manufacturing and unemployment in all urban activities. (CEDE, Empleo y Desempleo en Colombia, Ediciones Universidad de Los Andes, Bogota, 1968, and International Labor Office, Towards Full Employment, Geneva, 1970, p. 366). The figures listed for workers in various size categories therefore add up to the sum of the "employed" workers; depending on whether one believes this estimate of unemployment is too small or too great, the number of people in the residual category "less than 5 workers excluding independent workers" would have to be lowered or raised. The assumption that none of the unemployment falls in the "independent worker" category is arbitrary; 1967 CEDE information does not provide a breakdown of the unemployed by form of occupation. Only the occupied population is classified in this way. If in fact some independent workers are unemployed, then the residual category is underestimated.

3. Evidence from various sources points consistently to the conclusion that DANE's statistics on number of establishments, workers, etc., are underestimated for the smaller size categories. This is very plausible since updated information on these is much harder to obtain than for the larger firms; it is consistent with the fact that in general the number of firms reported in these categories varies over time according to the completeness with which samples are taken, and is supported also by a check provided between sample and census information. Table A-1, presenting unadjusted DANE data for 1964, would imply 6.3 employees per employer for the manufacturing subsector not reported in DANE's "factory" data, assuming that the unemployment rate is the same for employers and employees, and that all of the people reported as "unpaid proprietors or partners" in DANE's factory data are assumed to be counted as "employers" in the population census data. If all unemployment were of employees, these figures would imply an employee/employer ratio of 4.65. Thus, not even with this rather extreme set of assumptions could the figures be internally consistent (since adding the employers to the employees would imply a minimum of 5.65 workers per establishment).

Table 1 includes a somewhat arbitrary upward adjustment of the number of establishments and workers in the size categories for 5-24 workers, with a greater adjustment the smaller the plant size category. For full consistency between the census and sample information (as I understand it) these categories would have to be further upward adjusted, since the present figures, used in conjunction with the population census figures, indicate a ratio "paid workers" to "employers" of at least 5.5 for the firms falling below DANE's size cutoff--much higher than the ratio of 1.87 for the firms reported by DANE and having less than 5 workers in 1964. This suggests that too few firms may have been reclassified to higher size categories. It is possible, however, that there may be some small scale manufacturing firms whose employers are not classified as being in the manufacturing sector in the population census (if, for example, their main source of income is from some other sector). Unfortunately, the extent of this phenomenon is completely unknown to me.

Another consistency test involves relating the implied number of paid workers to total workers for this category; the ratio of about 0.60 is a little below that reported for the firms of less than 5 workers caught by DANE (0.638). It augers rather strongly in the same direction as the employee/employer ratio since in 1953 when DANE did sample a large subset of the plants not corresponding to its definition of "five or more workers or 24,000 or more pesos of gross output," this subset had a paid worker/total worker ratio of only 0.28. Thus sufficient confidence in the occupational category breakdown of the population census would lead us to the conclusion that more firms are in the small DANE categories than indicated here, and less firms and people are in the 2-4 range.

There is little other independent evidence of interest to this issue; in 1953 there were a few more independent workers than workers in the category "24,000 output and <5workers" and the figures here indicate, (if we assume, as is plausible, a particularly heavy under-reporting in DANE's smallest size category) a similar relationship, or perhaps even more independent workers relative to the next category. Overall these figures represent a compromise

between putting more confidence in the census breakdown of people by form of occupation, and putting more confidence in DANE's completeness of reporting for the small firm categories.

4. In general, value added per worker figures for the lower size categories reported on by DANE were based on Todd's upward adjustments to take account of the "arrastre" problem; Todd's figures were adjusted down a little. (For specifics, see footnotes.)

Data of assistance in calculation of value added and salary levels for the very small firms not covered in DANE's surveys is very limited. The most detailed analysis to date is that of Urrutia and Villalba (Miguel Urrutia Montoya and Clara Elsa Villalba, "El Sector Artesenal en el Desarollo Colombiano," Revista de Planeacion y Desarrollo, Volume 1, Octobre 1969, Numero 3). Some of the relevant information is the following. The 1953 Industrial Census presented data on a sizeable number of establishments below the size qualifications fitting DANE's industrial survey. These firms had an average persons/establishment ratio of 1.788 whereas DANE's smallest category (less than five workers; value of product $\geq$ 24,000 pesos) usually had an average of a little below 3 persons per establishment. Average value added per worker for this category relative to the category "5-9 workers and/or $\geq$ 24,000 pesos value of product" was 0.467 and average remuneration per paid worker relative to the same group was 0.641. (Data is not available separately for DANE's two smallest categories in 1953; but both in 1956 and in 1958 value added per person varied little between the smallest industrial survey category [less than 5 workers, $\geq$ 24,000 pesos value of product] and the second smallest [5-9 workers]). It seems plausible, therefore, to assume that the ratio of value added/person for these "cottage-shop" firms surveyed in 1953 to that of the smallest DANE category would have been about 0.47. Even apart from any reporting problems (likely in such small-scale operations), this ratio could not be used to represent all the cottage-shop workers in 1953, since only about one-half of the number probably employed in that subsector were surveyed. If value added/worker were indeed a monotonically increasing function of firm size throughout, these ratios would probably over-estimate the relative value added of all cottage-shop personnel compared to DANE's smallest category, since the production units not surveyed were probably smaller than the surveyed ones.

The second major piece of information comes from a comparison of incomes reported for workers in the manufacturing sector in 1967 by CEDE's unemployment surveys in 8 cities and the DANE factory sector data for those same cities. (See Rafael Isaza y Francisco Ortega, Encuestas Urbanas de Empleo-Desempleo, Apendice Estadistico, CEDE, July 1968). Urrutia-Villalba (op. cit.) used this information finding (see p. 66) that on average for the 8 cities the value added/capita for independent workers was 0.71 of the value added/capita in firms of the smallest DANE category in the same department as the given city. (The ratio varied markedly from one city to another [p. 78] but the same ratio held for Bogota [with respect to Cundinamarca] as for the other 7 cities taken together [with respect to their departments]). If large city urban independent workers earned more than smaller city ones, this would constitute an upward

bias on this coefficient as an indicator of the true "V.A. per cottage-shop worker/V.A. per worker in DANE's smallest category" ratio. Presumably Urrutia-Villalba included only labor income from the job in calculating value added--this may have led to a downward bias since value added is, even for very small workers, sometimes greater than income. Their methodology also restricted them only to independent workers--the smallest size category of the cottage-shop personnel; whether this constituted an upward or downward bias is difficult to ascertain--the independent worker is likely to have a certain amount of entrepreneurial and other skills so it is by no means clear that his average income would be below the average for the whole cottage-shop set[1] even though in general value added per worker is an increasing function of firm size. Finally, of course, there is the unknown and usually downward bias of people's underreporting their incomes in something like the CEDE surveys. Some further evidence (especially on the cottage-shop workers who are not "independents") might be obtained by comparing the income distribution, (according to CEDE information), of people working in the manufacturing sector in some of the cities, and the DANE data.[2] For Bogota (where in 1967 probably about 40-45 percent of the occupied labor force in manufacturing was in the non-factory subsector) the CEDE study showed the average income of roughly the bottom 45 percent of the population engaged in manufacturing to be about 62 percent of the estimated wage of workers in DANE's smallest size category. The latter figure was calculated by applying the national ratio of "average wage of category zero/average blue collar wage for all categories" to Bogota's average blue collar wage, which was available.) Since some true "artisans" would clearly have incomes above some or most of the blue collar employees in the factory sector, this figure does not suggest that the Urrutia-Villalba calculation of cottage-shop income and output was upward biased; it might more likely suggest the opposite.[3] As a result we accept the average artisan income figure implicit in the Urrutia-Villalba study, (see their Table 5B) which puts the average value added per artisan at 6.336 thousand 1964 pesos.[4,5]

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[1] Information on other countries would be relevant in this context.

[2] DANE data is available only by department but recently Bogota D.E. has been treated as a department; and Barranquilla constitutes almost the whole of urban Atlantico.

[3] However, the incomes reported in the CEDE study may include non-labor income; on the other hand they could be downward biased if the month in which the sample was taken did not involve the representative amount of prima, etc., or if the usual downward bias in such sample figures were present. Although further comparisons are clearly necessary, the initial impression of this data is that it tends to support the Urrutia-Villalba coefficient, or perhaps imply that it was a little low.

[4] This is only about 53 percent of our adjusted estimate of average value added in DANE's smallest category--just a little above the ratio holding in 1953 for a subset of the cottage-shop workers.

[5] Urrutia-Villalba made a series of alternative calculations of value added in the cottage-shop subsector for 1953 and 1964, corresponding to different methodologies: their 1953 estimates ranged from 20 to almost 100 percent above that

5. Still less information is available with which to guess at the salaries of people in the smallest size categories. In 1953, as noted above, the industrial census figures indicate that remuneration per person was about 64 percent as much in the cottage-shop sector as in the sector "5-9 workers and/or output $\geq$ 24,000 pesos". In 1956, the first year for which we have separate wage figures for the "below 5" and "5-9 workers" categories of the DANE survey, the latter registered a wage about 10 percent above the former, and this relationship seems to have held fairly systematically thereafter (though it had widened substantially by 1968, in 1964 it still held). If one could take the sample captured by DANE in 1953 as representative, and if one believes that the relative remuneration of the cottage-shop paid workers to paid workers in DANE's category "less than 5 workers" has been constant over time, then a coefficient of close to 0.7 would appear to be in order here. This implies an annual wage of 3,400 pesos. In 1953 the average wage in the surveyed cottage-shop subsector was 60 percent of value added per person; if this coefficient had remained constant, and the estimate of 6,336 is accurate for value added per person, average annual wage would be 3,800.[1]

Footnote 5 continued

used by the Banco de la Republica in the national accounts, and their 1964 estimates range from about 20 to something over 100 percent higher. The estimate we use here for 1964 corresponds to their second lowest. According to which estimate is used, their estimated share of total value added in cottage-shop is between 28.5 and 37.5 percent in 1953 and between 18.3 percent and 28.2 percent in 1964. The estimate of value added we use here implies only about 16 percent of total output, as we assume a smaller number of artisans than Urrutia-Villalba, and a higher factory output--see the discussion above.

[1]Both with respect to value added and wages, more accurate estimates could be achieved if it were possible to disaggregate the information to the industry level, and check its plausibility by ascertaining which industries appear to have small firm size differentials for remuneration and value added and which have large ones.

labor ratio in the larger firms; whether other factors (e.g., a better production function, economies of scale) also play a role is more difficult to ascertain since it requires more precise measurement of the variable "capital" than is possible with the data at hand. Value added per horsepower shows an erratic relation to plant size; up to plants of 50 workers it is rather stable, those with 50-200 workers have the highest ratio observed,and those of over 200 workers a slightly below average one. (As discussed below, however, horsepower does not appear to be a good proxy for total capital.) The question of how overall productivity of factors varies with plant size[1] and how relative social productivity as between large and small plants is moving over time is similarly difficult to judge. (See the discussion below.)

I. Recent Development and Structure of Small Scale Industry

The relative importance of small scale industry has, as might be anticipated, decreased over time--see Table 2. Changes in its relative importance do vary substantially by region, and probably also by industry; not enough information is available by industry to give a good picture. In general rural cottage-shop workers have decreased even in absolute numbers (see Table A-2) while urban cottage-shop appears to have risen a little faster than urban factory employment.[2]

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[1]This is discussed in detail by John Todd in "Size of Firm and Efficiency in Colombian Manufacturing" Research Memorandum #41, Center for Development Economics, Williams College, Williamstown, Mass., October 1971.

[2]Unadjusted figures indicate that urban cottage-shop has grown about 60 percent over 1953-64 and factory employment about 40 percent, but there are probably biases in the figures; in particular there may be a downward bias in the 1951 estimate of people employed in manufacturing related to (a) substantial underremuneration in the census of that year, which would probably be more severe for persons in rural and smaller town settings, and (b) the increase in the share of actually unemployed persons in the residual used to measure employment in the cottage-shop sector.

Table 2

Industrial Employment Over Time; "Factories" and Cottage-Shop"

	Total			Factory					
Year	Total Employment	Percent of Labor Force	Percent of Non-Agricultural Labor Force	Total	Men	Women	As Share of Labor Force	As Share of Non-Agricultural Labor Force	As Share of All Manufacturing
	(1)	(2)	(3)	(4)					
1938	449.0	13.91	37.75	80-100[3]	50-64	30-36	2.48-3.10	6.73-8.41	17.82-22.27
1944/45	464.0	12.91	31.66	148.5[1]	99.8[1]	48.7[1]	4.066	10.13	32.00
1951	474.7	11.82	26.36	185.5[2]	127.1	58.4	4.62	10.30	39.08
1953				199.1	126.5	62.6	4.77	10.14	44.84
1964	669.1	12.54	23.58	300-320[4]	219.7-234.4	80.3-3.85	5.62-5.99	10.57-11.28	
1970	840-900	13.4-14.4	23.4-25.1	330-350[6]			5.28-5.60	9.21-9.77	36.6-41.2
	[953]	[15.30]	[25.0]						
				"Cottage-Shop" Sector (Including Unemployed)					
1938				340.0-369.0	116.2-130.2	232.8-248.8	10.84-11.43	29.34-31.02	77.73-82.39
1944/45				315.5			8.64	21.53	68.00
1951				289.2	185.7	103.5	7.20	16.06	60.92
1964				349.1-369.1[5]	251.3-266.5	97.3-102.6		12.30-13.01	52.16-55.16
1970				490-570			7.84-9.12	13.68-15.91	58.3-63.3

[1]In estimating the total employment in the factory sector in 1945 (and attempting to use the same definition as in 1953, we essentially treated the 1953 manufacturing census as a standard of completeness) one must be concerned with (a) the failure of the 1945 figures to include unpaid workers, (b) the possible failure of that census to include all of the small firms which it should have, given the coverage attempted and (c) the possible non-equivalence of the two sets of conditions for inclusion of a firm; with respect to (c), note that the minimum of 6,000 pesos output in 1944/45 was substantially lower than the 24,000 minimum output in 1953; the blue collar cost of living index was at a value of 2.23 in 1953 relative to the earlier period, and the G.D.P. deflator at about 2.43. The minima in terms of numbers of workers were a total of five in 1953 and five paid workers in 1944-45. Since the output minimum was lower in 1944-45 and the employment minimum higher, it is unclear whether in fact the combined minimum condition was higher or lower. The output criterion was probably excluding more firms than the "number of workers" one and so the 1945 coverage was probably conceptually greater than that in 1953; possibly, however, this was just about offset by the effect of a better coverage in 1953 (i.e., a better actual/conceptual ratio). Comparison of the relative number of firms apparently in given size categories is not of too much help, though it is not inconsistent with similar coverage in the two years. We have opted for simply adjusting the 1945 figure to include unpaid members of the work force. In 1953 the reported number was 17,826 or about 1.5 per firm. The paid/total worker ratio is highly firm size specific and rather constant over time, for a given firm size. Using 1953 coefficients for "unpaid workers/firm" by size groups in 1945 yields an estimate of 13.3 thousand workers in this category. Since these ratios fell substantially between 1953 and 1956, one might posit that a similar fall occurred between 1945 and 1953; on the other hand the fall is so substantial in 1953-56 that one might guess that it included a random component--this would argue against assuming even higher coefficients in 1945. Though 13.1 is probably more likely to be below the true figure than above it, it seems unlikely to be off by more than say 2,000 people. The sex distribution of unpaid workers is based on that for 1953 (see Boletin Mensual No. 72, page 27), i.e., 73.6 percent are men.

[2]The rate of growth of total factory sector employment, if we assume 148.5 thousand for 1944-45 and about 315,000 for 1964, is an almost identical 3.6 percent both over 1944-1953 and over 1953-1964. We therefore interpolated in the period 1944/45-1953 at that rate. Since growth over 1945-53 was a little faster for men, this difference was also assumed with respect to 1951-53.

[3]The estimate of modern sector factory employment in 1938 was based on information in the 1945 census as to the year of founding of the various firms, plausibility tests with respect to the rate of growth of firms existing in both years, and the information in the 1938 Anuario General de Estadistica with respect to certain of the presumably larger firms. Even the lower estimate of 80,000 would be upward biased if the 1,375 firms for which data (on workers, output, etc.) is available in 1938 were really the largest. My upper limit, however, remains well below the figure calculated by ECLA in its 1957 study.

[4]The difficulty of making a factory sector estimate for 1964 is based on

the probability, supported by some recent evidence, that DANE has increasingly missed some of the small firms. One might take as contrary evidence the substantial number of new firms included each year, and the fairly satisfactory looking procedures for becomine aware of new firms. Still, it seems difficult (see the discussion with Table), at least pending more detailed work by individual sector, to believe that the population employed in the smaller categories has not been underestimated; the very high estimate from DANE's family household 1970 sample for total manufacturing employment also argues in this direction. More detailed work may alter this conclusion.

[5]This figure is higher than that presented in Table 1, since no subtraction has been made to allow for unemployed persons. (See Sources and Methodology of this table.)

[6]Based crudely on the assumption that DANE will report about 315 thousand factory workers in 1970 (or would if its inclusion criteria remained the same) and that this will be underestimated by about as much as we assumed it was in 1964.

Sources and Methodology: Table 2

The data of Column 1 are based on population census information for 1938, 1951, and 1964,with slight upward adjustments of 3 percent, 3 percent, and 2 percent respectively to allow for census underenumeration. The 1944-45 figure is essentially interpolated between 1938 and 1951, and the 1970 figure in parentheses is a crude guess by the author based on an adjustment to the figure (953,000) from DANE's 1970 household sample survey; that figure would imply that the total number of people in manufacturing rose dramatically between 1964 and 1970. The surface implausibility of such a rapid growth is supported by the fact that the sample seems to have suffered difficulties with respect to the rural areas. The sample was apparently biased towards rural areas near towns rather than more isolated areas. As a result it shows a much higher figure for the rural industrial population than did the 1964 census; between 1951 (and 1964 (the trend in this variable was downward, and it seems unlikely that it changed direction dramatically in the last years. If the urban manufacturing figure is taken as accurate, and the overestimation in the rural areas is assumed to be

Note that the range 840-900 thousand implies a growth rate of between a little under 4 percent to a little over 5 percent, much more rapid than the 1951-1964 growth of about 2.8 percent.

The calculations of Columns 2 and 3 are based on total and non-agricultural labor force estimates which take into account census underenumeration. There may, however, have been some assymmetry with respect tc the agriculture and non-agricultural figures; the agricultural labor force data are from the author's study on agriculture, and the total labor force from figures calculated independently. The 1938 total labor force was based on the ECLA statistics

(United Nations, The Economic Development of Colombia, Statistical Annex, U.N., Geneva 1957) adjusted upward by the percent difference between their estimate and mine for 1945.

Since the estimate of people in the cottage-shop sector is a residual (total minus factory) it also captures the open unemployed (as of the population census date) who consider themselves to be "usually" working in that sector. Since average urban unemployment appears to have risen, at least between 1951 (say 2.5 percent) and 1964 (say 6.8 percent), this implies that these figures overstate the rise in cottage-shop workers over that period. No attempt was made to try to remove the unemployed in this table (as was done in Table 1) since it would not be possible to do so for the earlier years, leaving an asymmetry of treatment.

Meanwhile, small scale factories decreased in importance with respect to both large scale factories[1] and to cottage-shop sector.[2] In 1953 about 28 percent of factory workers were in plants of less than 15 workers and 36 percent in plants of less than 25; in 1964 the comparable figures appear to have been about 23-25 percent and about 27-29 percent.[3] Although cottage-shop is important in all the major factory manufacturing departments (Cundinamarca, Antioquia, Valle and Atlantico)[4] its relative importance is greatest where factory manufacturing is unimportant, and, correspondingly, where per capita productivity in industry is low, as in Bolivar, Magdalena, Nariño, Tolima, Caldas.[5] Diagram 1 shows this negative relationship between the share of total labor force in factory manufacturing and the share in cottage-shop. In 1964 only Antioquia, Cundinamarca, and Atlantico had more people in factory industry than in artisan industry, with Valle being about 50/50.

Departments with an above average percent increase in the number of factory

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[1]Note that this is not to say that small firms grew less rapidly; the more such firms tend to grow the more they graduate from the small size categories.

[2]This conclusion is subject to the possible underestimation of the number of plants and workers in the small size categories even after the upward adjustments reflected in Table 1, and the corresponding overestimate for the cottage-shop subsector.

[3]There is much less precision in the 1964 figures; see the methodology of Table 1. The official data on number of firms in the various size categories is presented in Table A-2a.

[4]Cundinamarca and Valle alone have over one-third of all the urban people employed in this subsector.

[5]But, as Urrutia and Villalba (op. cit., p. 50) note, where cottage-shop is relatively important it has tended to grow least. The substantial absolute decrease in Nariño appears to be related to the serious deficiency of electrical energy and the unresolved transportation problems. These authors assume that it is a factory-cottage-shop complementarity which explains the relatively fast growth of the latter where factory industry also grew fast, and which presumably also plays a role in its demise in places like Narino. Such complementarity can be observed in some industries. The discussion of complementarity-competition must be carried on in greater detail at the industry level to clarify the determinants of the observed changes.

workers between 1953 and 1964 had also above average increases in the number of cottage-shop workers. Thus, the four leading manufacturing departments showed a percent increase of 56.7 in factory employment versus 1.4 for the other departments, and an increase of 36.8 percent in cottage-shop employment as contrasted with 21.6 percent for the other departments. While far from conclusive, this is at least suggestive that the factory and cottage-shop subsectors may be more complementary than competitive.[1]

In the majority of departments which appear to have suffered sharp decreases[2] in the number of rural cottage-shop workers between 1951-53 and 1964 (Valle, Tolima, Huila, Bolivar, Caldas, Cundinamarca) there was a rapid increase in the absolute number of urban cottage-shop workers (Table A-2); only in Nariño--where there is a decrease for both rural and urban categories--was this not the case. Thus the data is consistent with the hypothesis that there has been some transfer of cottage-shop production from the rural to the urban setting,[3] possibly because of

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[1] Complementarity might be direct or indirect, with the latter type of relationship possibly working though an increased demand for cottage-shop goods associated with the high incomes due in part to the productivity of the factor sector.

[2] Note that the decrease in rural cottage-shop may be slower than indicated by the Urrutia-Villalba figures; their 1951 figure was 115.2 thousand. They assumed cottage-shop was the same percent of total for 1953 as for 1951 but since 1951-53 was a period of very rapid urbanization, perhaps spurred by the violencia, the ratio may well have fallen during these years. On the other hand it is quite probable that, since rural population in general was underestimated in 1951, the figure 115.2 is too low for 1951.

[3] It is not possible to demonstrate this, however, until there is information on which industries characterize the rural and urban settings and on the size of the migration process. As noted above the reasons for the different behavior of the number of cottage-shop workers and the share of all manufacturing workers in this subsector by rural-urban and by department can only be understood in conjunction with a view of developments in each industrial sector, in terms of competition or complementarity between large and small scale producers, elasticity of demand for the products in question, etc.

the better facilities in the latter.

Urban cottage-shop industry appears to be more market oriented than the rural counterpart; in a SENA study in Medellin (including surrounding municipios) 66 percent of the respondents had this activity as their exclusive source of income; for the rest of the municipios in Antioquia the figure was 46 percent.[1] The same study showed that the first group of artisans tended to have more expansion plans than the latter group.

A study of the Ubate Valley[2] indicates that in that region the great majority of the rural artisans are women, and that an important part of their production is for household consumption, with relatively few being full-time. The main products of this rural industry are textiles, woolen goods, ceramics, and leather and skin goods. Quite primitive systems are sometimes used. Urrutia and Villalba estimated that the annual value added per capita in the Rio Suarez area would be 60 percent of the salary of a rural agricultural worker. (One factor in this low figure is the part-time nature of the work.)

The Antioquia study also indicated that the urban cottage-shop worker has a much higher income than the rural one, due to more advanced techniques, better distribution channels, and a bigger market. (Still the average income is below that of workers in small factory industry.) Urrutia-Villalba concluded that the average urban cottage-shop income is more than twice that of the rural one, and that there is more growth potential in the cities. Cheap and sure electrical energy, better marketing conditions, the possibility of technical assistance, cheaper and safer supply of raw materials, and better credit conditions appear to

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[1] SENA, Artesania en el Departamento de Antioquia, Medellin, SENA, 1968.

[2] Rafael Prieto, Marco ReyesCarmona, and Bill Hanneson, Estudio Agro-Economico de la Hoya del Rio Suarez, Bogota, CEDE 1965.

be important factors.

In understanding the extent to which changes in the number of cottage-shop producers are the result of "push" or "pull" factors, it is particularly instructive to have data on employment and income and their changes in each two-digit sector. Table 3 presents evidence on the distribution by two digit industry of both factory and cottage-shop subsectors. As indicated there, over three quarters of all the cottage-shop workers in 1964 were in textiles, clothing and footwear, wooden furniture, transportation materials, and food and beverages.[1]

According to CEDE data which permits distinguishing of independent workers (though not of other members of the cottage-shop category), incomes of these own account workers vary widely by sector; the lowest are those of women working in confecciones and the highest those of mechanics in automobile repair shops.[2] Primitive techniques are used in clothing and furniture, and value added per person is low, so their growth potential might seem limited;[3] in food and automechanic technologies are relatively "modern."

Urrutia-Villalba present estimates of the change in average cottage-shop worker incomes between 1953 and 1964, by departments. In some departments where the factory industry grew least the Urrutia-Villalba figures indicate that the income of the artisans decreased, as in Caldas, Cauca, Tolima, and Norte de Santander. One would have to analyze the composition of both factory and artisan industry to know whether and how these relations

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[1]Since there was some evidence of an asymmetry in classification as between the population census and DANE's Industrial surveys for (a) textiles versus clothing and footwear and (b) food versus beverages, these groups are frequently aggregated here; beverages are not important, though textiles are, in the cottage-shop sector.)

[3]Though other evidence suggests the opposite for furniture.

[2]These results are reported in Urrutia-Villalba, op. cit.

Table 3

Employment by Plant Size and by Two-Digit Industrial Classification, 1964

	Size of Firm (Number of Workers)												Total Providing Information on Form of Employment	Total Including Those Not Providing Information on Form of Employment
	Independent Workers		2-4		5-24		25-100		> 100		Total ≥ 5			
	#	%	#	%	#	%	#	%	#	%	#	%		
(20) Food	8179	11.18	21487	29.38	19000	25.98	9555	13.06	14918	20.40	43473	59.44	73139	73889
(21) Beverages	476	2.54	1399	7.47	1174	6.27	2104	11.24	13569	72.48	16874	89.99	18722	19216
(20) + (21) Food and Beverages	8655	9.42	22886	24.91	20174	21.96	11659	12.69	28487	31.01	60320	65.66	91861	93105
(22) Tobacco	749	8.84	3687	43.54	1369	16.17	734	8.67	1930	22.79	4033	47.63	8469	8574
(23) Textiles	12517	20.17	5056	8.15	2794	4.50	4437	7.15	37266	60.04	44497	71.69	62070	62362
(24) Clothing and Footwear	78726	51.75	40472	26.60	14037	9.23	9073	5.96	9829	6.46	32939	21.65	152137	153265
(23) + (24)	91243	42.60	45528	21.25	16831	7.86	13510	6.31	47095	21.99	77436	36.16	214207	215627
(25) Wooden Products excluding Furniture	4000	27.13	4162	28.23	2959	20.07	1302	8.83	2319	15.73	6580	44.63	14742	14841
(26) Wooden Furniture	24399	38.96	32810	52.39	3078	4.91	1407	2.25	932	1.49	5417	8.65	62626	63404
(27) Paper and Products	195	3.51	207	3.72	526	9.46	1356	24.38	3277	58.93	5159	92.77	5561	5613
(28) Printing	1315	7.85	2779	16.59	4555	27.17	2637	15.14	5466	32.63	12658	75.56	16752	16935
(27) + (28)	1510	6.77	2986	13.38	5081	22.77	3993	17.90	8743	39.18	17817	79.85	22313	22548
(29) Leather + Products	2277	24.20	2675	28.43	1733	18.42	591	6.28	2132	22.66	4456	47.36	9408	9488
(30) Rubber and Products	358	4.57	538	6.87	450	5.75	821	10.49	5662	72.32	6933	88.56	7829	7885
(31) Chemicals	1742	6.83	3477	13.62	3424	13.42	5495	21.53	11383	44.60	20302	79.55	25521	25752
(32) Products of Petroleum and Coal	43	0.89	2721	56.30	186	3.85	187	3.87	1696	35.09	2069	42.81	4833	4880
(33) Products of Nonmetallic Minerals	2969	8.10	7036	19.19	7699	21.00	5567	15.18	13400	36.54	26666	72.72	36671	36907
(34) Base Metals	308	3.01	6250	61.03	288	2.81	281	2.74	3114	30.41	3683	35.96	10241	10295
(35) Metal Products excluding Machinery	5998	21.17	2337	8.25	5448	19.23	6928	24.46	7617	26.89	19993	70.58	28328	28713
(36) Nonelectrical Machinery	2680	15.03	9855	55.28	2289	12.84	1476	8.28	1527	8.57	5292	29.69	17827	18112
(37) Electrical Machinery	4999	31.89	1189	7.58	1891	12.06	2403	15.33	5195	33.14	9489	60.53	15677	15855
(36) + (37)	7679	22.92	11045	32.97	4179	12.47	3879	11.58	6722	20.06	14780	44.11	33504	33967
(38) Transportation Equipment	11579	18.39	35736	56.75	5130	8.15	3127	4.97	7397	11.75	15654	24.86	62969	63991
(30) + (38)	11937	16.86	36274	51.24	5580	7.88	3948	5.58	13059	18.45	22587	31.90	70798	71876
(39) Miscellaneous	1659	10.48	6214	39.26	2171	13.72	3242	20.48	2542	16.06	7955	50.26	15828	15984
Total	165168	25.44	190087	29.27	80201	12.35	1723	9.66	151171	23.28	294095	45.29	649350	655961

Sources and Methodology - Table 3

The employment for categories 25 and up was taken, without adjustment, from published DANE statistics (Anuario General de Estadistica). Figures for the range 5-24 took into account the upward adjustments to the official figures presented in Table 1. Unfortunately, although the evidence was strong that underreporting prevailed in the categories 5-9 workers and to a lesser degree in the larger ones, little evidence was available with which to allocate this underreporting by industry. Broadly, the figures presented here reflect the same percent upward adjustment for the size categories 5-9, 10-14, and 15-19 for all industries. This procedure, however, led to negative figures in the 2-4 range for paper and products, rubber and products (sectors 27 and 30 respectively), so further adjustments were made. Unfortunately misclassification in the population census between certain similar categories (like printing as opposed to paper and products; possibly rubber and products with transportation equipment) makes it unclear whether in fact these further adjustments are appropriate or not. The table must be still taken as substantially speculative with respect to the by-industry distribution of the employees in firms of less than 5 workers, and probably even to some extent for the independent worker.

Since some unemployed people are recorded in the population census, some of these are probably captured in our estimate of the 2-4 category (and possibly also some of the 5-24) due to the residual methodology. As estimated in Table 1, there were probably in the neighborhood of 41,000 unemployed in 1964 in manufacturing; since it seemed probable that the approximately 6.5 thousand who did not report an occupational category were largely unemployed, we excluded them from the calculations, but this still must have left about 35,000 unemployed.

reflect causality. On a cross-departmental basis there appeared to be little relationship between the percent increase in real factory wage and real artisan income, but this is not surprising.[1]

At present it is only possible to guess at the factory versus cottage-shop breakdown at the two-digit level in 1951, so conclusions as to which industries have shown the most rapid increases in employment in the cottage-shop sector over the 1951-1964 period must be somewhat speculative; the same goes for average incomes by sector. Table 4, presenting data from the 3 population censuses and the two industrial censuses is, however, suggestive with respect to employment. Table A-3 presents data for 3 of the 4 most industrialized departments (Antioquia, Atlantico, and Cundinamarca) for 1951 and 1964 and Tables A-4, A-5 and A-6 give detailed statistics for the food, clothing and footwear and wood products-wooden furniture sectors. The tables indicate that in general the cottage-shop industries of prime importance in 1964 (in terms of employment) were sectors of sigficant growth in cottage-shop employment, at least during the post 1945 period as a whole. In food and wood-furniture, cottage-shop employment grew markedly faster than factory employment during that period.[2] In metal and metal products both factory and cottage-shop grew very rapidly. Only in clothing-footwear was cottage-shop employment on the decline--an important factor of course since it was the largest single cottage-shop sector. Total employment had declined secularly since 1938, and factory employment was rising dramatically up to the early

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[1]Real wages in factory industry rose by 66 percent in 1953-1964, while those of cottage-shop rose by only 24 percent, on average.

[2]Probably such products as bakery, candy, panela, etc., were very important in food; wooden furniture was the "growth" part of the wood industries.

Table 4

Factory and Total Employment by Two-Digit Industries

1938-1964

Industry	1938	1944/5	1951	1953	1964
Food-Total	29,387		47,311		73,889
Factory	≥24,153	32,172	39,355	41,749	41,561
Cottage-Shop			7956		32,328
Beverages-Total	6,358		11,772		19,216
Factory	≥1,975	9,671	10,699	11,041	16,420
Cottage-Shop			1073		2,796
Tobacco-Total	10,167		10,654		8,574
Factory	≥5,059	8,560	7,099	6,612	1,803
Cottage-Shop			3,555		4,771
Textiles-Total	24,125		60,691		62,362
Factory	≥11,351[a]	29,961	35,127	36,849	44,099
Cottage-Shop			25,564		18,263
Clothing & Footwear					
Total	160,788		143,933		253,265
Factory	≥2,770	18,347	26,056	28,625	31,510
Cottage-Shop			117,937		221,755
Wood & Products					
Total	44,356		57,202		78,245
Factory	n.a.	10,154	8,804	8,354	10,989
Cottage-Shop			48,398		67,256
Wood & Cork-Total					14,841
Factory				4,251	6,076
Cottage-Shop					8,765
Wooden Furniture-Total					63,404
Factory				4,103	4,913
Cottage-Shop					58,491
Paper & Products-Total			1,798		5,613
Factory		610[a]	1,636	1,978	5,485
Cottage-Shop			162		128
Printing-Total	7,132		10,767		16,935
Factory	n.a.	5,552	7,263	7,833	11,812
Cottage-Shop			3,504		5,123
Leather & Products-Total					
Total	7,024[a]		8,006		9,488
Factory		3,609	3,867	4,019	4,482
Cottage-Shop			4,139		5,006
Rubber & Products					
Total			2,329		5,425
Factory		576[a]	2,280	2,848	6,900
Cottage-Shop			49		-1,475
Chemicals-Total	4,722				25,752
Factory	≥2761	5,890	11,146	9,980	19,819
Cottage-Shop			8,958		5,933
			2,188		
Petroleum & Coal Products					
Total			1,607		4,880
Factory		1,142	1,477	1,588	2,026
Cottage-Shop			132		2,854
Non-Metallic Mineral					
Products-Total	16,517		25,592		36,907
Factory	≥2,207	13,291	16,840	17,860	25,493
Cottage-Shop			8,752		11,414
Metal & Metal					
Products Total	25,226		55,754		139,426
Factory	≥1,417	9,414	15,179	17,100	51,549
Cottage-Shop			40,575		87,877
Base Metals					10,295
Factory		809[a]	1,266	1,148	3,640
Cottage-Shop					6,655
Metal Products Except for Machinery & Transport Equip.					28,713
Factory		2,236[a]	5,571	6,683	19,046
Cottage-Shop					9,667
Non-Electrical Machines-Total					18,112
Factory				1,572	4,883
Cottage-Shop					13,229
Electrical Machines					15,855
Total		6,368[a]	8,342[b]		9,147
Factory				1,807	6,999 3,708
Cottage-Shop					
Transportation & Equip.-Total					66,451
Factory				5,620	14,833
Cottage-Shop					51,618
Diverse-Total					15,984
Factory		2,475[a]	2,831	2,950	7,623
Cottage-Shop					8,361
Total	435.0		460.9[a]		655,961
Factory		151.7	185.5[a]	199.1[c]	283,571
Cottage-Shop			272.4[a]		372,390

[a] Greater than the sum of the figures in the column as it includes territories (non-departments) for which no attempt to break the employment down at the two digit level was made.

[b] Refers to factory employment in non-electrical machines, electrical machines and transportation and equipment.

[c] Some possibility of error, since category definitions were not the same in 1964/5 as in preceding years.

Sources and Methodology for Table 4.

The 1964 figures and the factory-artisan breakdown are those of Table A-2b; they are unadjusted figures from the 1964 population census (the two digit totals) and Anuario General de Estadistica (the factory employment). No adjustments of the type used for Table 1 were made to the published data, partly as it was unclear whether greater or smaller adjustments would have been necessary in the other years.

The 1953 factory employment data are from the official DANE statistics corresponding to the Industrial Census of that year and published in various issues of Boletin Mensual de Estadistica.

The 1944/5 factory employment data are from the Industrial Census of that year, with an upward adjustment to allow for unpaid workers.

The 1938 total employment figures are from the population census of that year. The factory figures (lower limits, as indicated) are based on a survey reported in the Anuario General de Estadistica, and designed only to give a feel for the possible magnitudes.

1951 proved a difficult year for which to make estimates at the two digit level since the national population census figures gave only the grand total in manufacturing. For 9 departments, that breakdown was available, for the other 6 estimates were made by interpolation between 1951 and 1964; a given industry was assumed to account for a percentage of the total manufacturing labor force in 1951 equal to the unweighted average of its percentages in 1938 and 1964. Total error introduced by this methodology would appear to be small.

Factory employment in 1951 was interpolated between the 1944/5 and 1953 values, assuming a linear growth path. The 1951 cottage estimates were then calculated as the residual between the total and factory estimates.

fifties.

Observation indicates that there is direct and vigorous competition between small and large scale plants both in this sector and in wooden furniture and other wood products, leather, and probably a few other industries. The aggregate figures indicate that except for clothing-footwear the small scale producer is not being "competed out," though conceivably his income may have been reduced over time in some cases--an empirical question much in need of study--and in other cases he may have had to "transform" himself, change production techniques, etc., in order to remain in business. The aggregate figures do not pick up whether any such processes in fact lead to a particular type of small scale producer going out of business and being replaced by another, or whether, on the contrary, the process is a relatively smooth one. If, as the aggregate figures seem to suggest, the share of manufacturing workers in cottage-shop rose between 1964 and 1970 it seems unlikely that larger scale industry is driving small scale out in many cases; if so, the growth of cottage-shop must have been extremely rapid in some other instances.

As of 1964 perhaps 110,000 people were engaged in the clothing-footwear sector, down from as many as 150,000 in 1938. There have always been many independent producers, primarily men in the case of footwear and primarily women in the case of clothing; about one-half (i.e., 80,000) of the total factory and cottage-shop employment in the sector in 1964 fell in this group. Overall employment of women in the cottage-shop sub-sector probably fell from about 115,000 in 1938 to 70,000 in 1964. The geographic distribution of the subsector (see Table 5) shows considerable numbers in some of the poorer departments (especially Nariño), but it remains true that the three most industrialized departments are leaders in

Table 5

Geographic Distribution of Cottage-Shop Production of Clothing and Footwear: 1964
(Absolute Figures in Thousands)

Department	Total Employment: 1964 (1)	Factory Employment 1967 (2)	Employment in Cottage-Shop (Rough Estimate) (3) = (1) - (2)	Share of Non-Agricultural Population (4)
Antioquia	18,146	7,611	13.5	3.40
Atlantico	9,781	3,726	6.0	5.45
Bolivar	8,339	491	7.8	5.03
Boyaca	4,654	238	4.4	1.94
Caldas	9,565	3,390	6.2	2.56
Cauca	1,851	60	1.8	2.14
Cordoba	4,033	36	4.0	7.4
Bogota	25,532	7,103	18.4	11.64
Cundinamarca		146		
Huila	3,003	43	3.0	4.69
Magdalena		109		
Meta	900	68	0.8	8.89
Nariño	14,263	266	14.0	10.77
Norte de Santander		395		
Santander	4,633	1,341	3.3	1.86
Tolima		140		
Valle	20,754	3,847	16.9	7.97
Total	153,265	29,037		

Sources: Departmental population censuses for 1964; DANE, Industria Manufacturera Nacional: 1967, for the factory employment in 1967. The latter statistic was not available for 1964 so this hybrid residual has considerable error in it. For the factory sector, DANE figures indicate that total employment fell from 31,510 in 1964 to 29,037 in 1967. Our estimates of cottage-shop must therefore be upward biased in some (or all) departments.

absolute numbers, and Bogota and Valle are well above average in terms of the share of non-agricultural labor force found in this cottage-shop sector.

It might be hypothesized in view of the secular decline in absolute number of workers, that the age distribution of persons in clothing and footwear would reflect "older" people, compared for example, to that of persons in all manufacturing.[1] But this is not noticeably the case; only 17.5 percent of the women in the clothing subsector were 45 or older in 1964 compared to 16.35 percent for women in all manufacturing. For men in footwear the percent was 18.58 compared with 17.99 in all manufacturing. It is possible that the probably fairly gradual decrease of the number of people in the cottage-shop sector (between 1951 and 1964) occurred primarily via a "retirement" process; if, as seems suggested by the figures, a decrease of perhaps 35 or 40 thousand workers occurred between 1938 and 1964, it would seem plausible that a large majority of these could have retired; others might have been incorporated into the "factory" sector as small scale firms moved up the size ladder, and others may have been forced to look for other occupations.

Vying for second among the important small scale industries (defined by employment) are wooden furniture and transportation equipment and repairs. As can be seen in Table A-4 it appears that there has been a gradual increase in the share of employment in small scale units in the production of wooden furniture, unlike clothing and footwear. Employment in the factory sector was probably a

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[1]Although age distribution is not given by two-digit sectors in the population censuses, it is given by occupations, and the category "tailors, sewers, and other people related to the manufacture of products based on cloth and leather" plus "shoemakers, repairers, and persons related to the production of leather products" included 177,000 people in 1964 and their age distribution was given. There were 156,000 in the clothing and footwear sector.

little but not much below 5,000 workers in 1945, (conceivably as low as 4,000), and only around 5,000 in 1964; this would imply that the cottage-shop labor force probably rose from somewhere around 30,000-35,000 in 1938 to around 55,000 in 1964. While the factory sector may have grown rather rapidly over the 1938-45 period, since then it has probably not grown any faster than the cottage-shop subsector. Over the 1958-64 period there appeared within the factory sector to be an increasing concentration in the largest plant size, though it is unclear whether this was a "passing over" phenomenon or really represented more rapid growth on the part of the largest plants. In any case, the historical evidence strongly suggests that this sector should be one of continued strength in the cottage-shop subsector.

The transportation equipment and repair subsector, appears to reflect substantial complimentarity between the small shop, which effects repairs and manufactures parts, and the large scale sector (whether it be abroad or domestic). The rapid historical growth of the use of automotive vehicles and the high income elasticity of demand in this sector suggests very high growth potential here.[1] Within the manufacturing sector it is clear that firms of over 50 workers have an unusually large share of total factory employment compared with the other sectors

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[1]It is not possible to isolate this sector in the 1938 census; the grand total of employment in the two categories "shops for mechanical and electrical repairs" and "metallurgy, manufacture of machines and other products of common metals" was 25,226; 1951 population census figures are also not yet available to give a feel for overall 1951-64 growth. There seemed to be little growth of the factory sector for combined "construction of transportation equipment" and "construction of machinery, and electric apparatus and articles" between 1945, when there were 5,688 employed personnel, and 1953 when there were 6,666 employed personnel. In 1953 about half of the employment was in repairs to automotive vehicles. In 1953 the industrial census listed 2,300 people in firms below its cutoff category. Information for the departments of Antioquia, Atlantico, and Cundinamarca suggest only a small employment in this sector in 1951. It suggests a growth for those three departments in the period 1951-64 of 15 fold. Like wooden furniture, this is an overwhelmingly male industry.

in which cottage-shop is very important.

Finally, the food industry has considerable importance within the cottage-shop subsector. Total employment has increased by almost 150 percent since 1938.[1]

At the moment, it seems safe to assume that the employment trends in these four industries will at least in the short run determine the overall trend of employment in cottage-shop industry. At the same time, it is of interest to observe the trends in the other subsectors, to see if any significant developments can be identified. Some of the other less important small scale lines, such as textile materials (18 thousands) construction and repair of machinery, (19.5) and non-metallic mineral products (11.2) could be of increasing importance. Here, unfortunately, information is insufficient to ascertain what developments have occurred over the last 10 or 20 years--both dramatic growth and dramatic decline can be ruled out, however. Among smaller industries--tobacco, leather, printing, chemicals--there appeared to have been an increase in cottage-shop employment since 1945 in tobacco (where factory employment dropped dramatically) as well as in printing and chemicals (where factory employment rose substantially); in leather (where total employment rose slowly), cottage-shop employment was about constant. Small scale industry (defined for the moment as firms of 5-24 workers, tends to be important in the same industries as cottage-shop production, with a few inter-

[1]The 1938 Anuario General reported firms in animal and vegetable oils and fats, chocolates, cookies and candy, sugar refineries (the largest category with almost 4,000 workers) grain milling, and other food products. The high figure reported in the 1945 industrial census suggests that many firms were probably missed in 1938 and that this sector already had a relatively high share of the labor force in the total "factory" sector at that time. One might plausibly assume that the cottage-shop sector in 1938 had about 12,000-20,000 workers; by 1964 the number was around 25-30,000. The picture here, as in some other cases, is confused over the 1945-64 period. Data for the three departments of Atlantico, Antioquia and Cundinamarca suggest moderate growth of cottage-shop in the 1951-64 period.

esting exceptions. In 1964 the major employers in this firm size range were food (19.0 thousand), clothing and footwear (14.0 thousand), nonmetallic minerals (7.7), metal products, excluding machinery (5.4), and transportation equipment (5.1). Wooden furniture--so important in cottage-shop production--is relatively unimportant in small scale industry (only 3.0 thousand in this size range).[1] For the size range 25-99 workers, food (9.6) and clothing and footwear (9.1) remain the most important sectors followed by metal products except machinery (6.9) nonmetallic minerals (5.6) and chemicals (5.5). For the whole range 5-99 workers, food comes first with 23.2 thousand, clothing and footwear (19.2) nonmetallic minerals (11.1), metal products except machinery (11.2), chemicals (8.0), and transportation equipment (6.9), and textiles (6.4). It is interesting to note that two industries with expanding cottage-shop sectors, transport equipment and wooden furniture, are not characterized by importance of small scale factories; this is especially true of wooden furniture, but rather marked for transport equipment as well. This may suggest that the growth process in these subsectors will, at least if it continues its historical route, involve horizontal expansion of the number of firms rather than the growth of cottage-shop firms into small scale factories. This seems very plausible in the transport equipment sector where much of the production involves repairs to automotive vehicles and in furniture as well, where there is little evidence of important economies of scale. The other two major cottage-shop subsectors--clothing and footwear and food are at the opposite end of the spectrum; small scale industry is important both in absolute terms and relative to the total factory employment in those sectors. This suggests that the gradual

[1]The figures used for the 5-24 worker category are those of Table 3, adjusted up from the DANE figures, as explained in that table.

decrease of cottage-shop employment in textiles may have been associated with the transfer of workers to larger firms or with the growth of cottage-shop firms into the larger categories, and that the apparent stagnation of cottage-shop employment in the food sector may at least be associated with similar relative ease of transfer.[1]

Differences in Labor Productivity and Wages by Firm Size

One frequently commented on difference distinguishing firms of different sizes is their labor productivity and wage levels when no allowance is made for possible differences in labor quality or mix; in 1964 labor productivity tended to increase fairly consistently with plant size up to the category 100-199 workers, then fell for firms over 200; labor productivity was probably about 4 times as high at its peak (for the group 100-199) as for firms with less than 5 workers but more than 24,000 pesos output. The wage rate was a positive function of firm size throughout, with inconsequential exceptions, and was probably a little over 3 times as high in the largest firm size category as in the smallest.[2]

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[1]The above is not to suggest that there have not been cases of extreme competition between large and small scale production; the most dramatic of these in Colombia's 20th century history is often alleged to have occurred within the tobacco industry; in 1938, 10,167 people were engaged in the sector--of whom 5,000 or a little more were already in the factory sector as reported in the 1938 Anuario General de Estadistica. By 1964 our estimate is that there were 4.7 thousand cottage-shop employees in this sector. This does not indicate a particularly rapid demise though other evidence indicates that, in certain regions and processes, the displacement effect was great.

[2]Note that the DANE figures (see Table A-1) indicate even wider differentials than those presented in Table 1; the explanation for the upward adjustments to labor productivity and wage rates to the smaller size category are explained in the methodology of Table 1.

It is possible that the figures of Table 1 may underestimate the wage rate differential across plant sizes and at the same time overestimate the labor productivity differential. DANE's definition of labor remuneration is rather narrow and appears not to include labor costs not paid at time accrued, in particular severance pay, provision for vacation, etc. These payments are particularly important for the large size firms, and a comparison between DANE information on

(Footnote 2 continued from page 28.)

the sociedades anonimas (corporations) and information published by the Superintendencia de Sociedades Anonimos suggests that the latter's definition of labor renumeration implies a level about 15-25 percent higher than DANE's. (Comparisons between DANE and Superintendencia data are dangerous since (as John Todd has pointed out to me) the latter's reporting for the manufacturing firms includes output, etc., in nonmanufacturing parts of a sociedad. In this case the value added data matched almost perfectly, though, so it appeared that the bases were comparable. The Superintendencia reported wages plus paid fringe benefits about equal to DANE, but also included in labor remuneration "provisions for severance pay, vacations, etc." DANE's questionnaire which refers to "fringe benefits caused during the year" suggests that these are not included in its figures. Here the issue is partly one of how one prefers to define deferred vages. Sociedades Anonimas generally tend to be large firms; these particular fringe benefits would be substantially smaller for small firms (and in many cases nonexistent). Inclusion of this factor could therefore imply that the more broadly defined labor remuneration averaged close to 4 times as high in those firms of over 200 workers as to those of less than 5 (and over 24,000 pesos output).

Value added may be overestimated for the relatively large firms as compared to the smaller ones due to DANE's failure to subtract out (as intermediate consumption) certain expenses such as advertising, contracted professional services, and a series of other items, most of which are probably more characteristic of the larger firm sizes than the smaller ones. The Banco de la Republica adjusted DANE value added figures down by about 13 percent in 1964 for its national accounts calculation. Probably, the downward adjustment would be 15 percent or more for the large firms and not more than half that for the smaller ones. This would increase the ratio of labor productivity for the smallest to the largest group from the approximately .27 of Table 1 to about .30. If the distribution of these expenditures were even more concentrated on the large firms, the ratio could be as high as .32.

A number of hypotheses have been put forward in interpretation of these firm size differentials. Perhaps the most obvious is the different mix of labor between small and large firms; it is clear that the very small firms (perhaps those with less than 10 workers) have almost no white collar labor--whose average wage, at any firm size, is presumably above the blue collar average--and it seems plausible to assume that many of the larger firms with more advanced technology actually need higher skilled workers. So a substantial "wage differential" could emerge, even in the presence of perfect labor markets, as a simple reflection of the greater scarcity of the type of laborers needed by the larger firms. And even if the technological processes were not much more complicated, in the presence of labor market imperfections--in particular union power--large firms which must in any case pay higher wages would naturally choose the cream of the workers. So, via one mechanism or another, it seems almost assured that the human capital in the paid labor force of the larger firms is greater per person than that of the smaller firms, and that the wage differential is therefore partly explained in terms of quality of resources involved.[1] With respect to the unpaid workers, while the mechanism just referred to may not be the relevant one, it seems plausible that on balance the managers of large establishments embody more human capital than the managers (or unpaid family workers) of small firms.

Other possible factors include the combination of greater efficiency on the part of the larger firms (either through economies of scale or through "better" technology) which makes it possible to pay higher wages, coupled with either substantial union pressure or other reasons why, given the capability of paying high

[1] More details are presented on differences in the labor mix by firm size in the next section.

wages, the firms actually do so.[1] Some observers focus on the imperfections of products markets and the market for other factors such as capital in explaining the ability of the large firms to pay higher wages; in an economy like the Colombian one, a high percent of the large firms have substantial monopolistic or oligopolistic power (and heavy tariff protection) which would permit them to pay high wages, and have high labor productivity (measured in terms of the local currency) even though their overall level of efficiency may not be high.

All of these explanations have moderate to high plausibility in the Colombian context, but lack of both data and analysis leave their relative importance as explanatory factors an open question.

Over time changes in labor productivity and wage rates are presented in Table 6; while revealing no systematic changes in labor productivity differentials, they tend to suggest that, if anything, these narrowed in the 1956-66 period for which the most detailed information was available;[2] for 1953-66 no general trend is ascertainable.[3] Over 1953-66 as a whole wages of the large plants (the top two categories) rose more rapidly than those of all other plant sizes; it is unclear whether the small or intermediate sizes showed the greater increase in this variable. As noted earlier (p. 19) wages may be underestimated

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[1] (Richard Nelson, A Study of Industrialization in Colombia, RAND Corporation, Santa Monica, 1968) emphasizes the technological advantages of the modern firms which tend, on balance, to be the large firms. Slighton (Robert L. Slighton, Relative Wages, Skill Shortages, and Changes in Income Distribution in Colombia, RAND Corporation, Santa Monica, November 1968) emphasizes the imperfections in the labor market as an important factor in why different wage levels are actually paid. Miguel Urrutia focusses also on this point, suggesting that the monopoly component of wages paid by large unionized firms may be subtracted. (See Miguel Urrutia, The Development of the Colombian Labor Movement, New Haven, Yale University Press, 1969, p. 164.)

[2] If all the appropriate corrections were made to the value added figures, (see p. 19) this result would probably emerge more clearly.

[3] As indicated in Table 6, the changes in these two variables for the smaller plants are not known with much precision, a fact which naturally detracts from the analysis.

Table 6

Coefficients of Changes in Average Labor Productivity and in Annual Wages, By Firm Size

Size Categories (# workers)	1953-66		1956-66	
	Labor Productivity	Average Wage	Labor Productivity	Average Wage
<5	1.56-1.70	1.21-1.32	1.39-1.52	1.18-1.29
5-9			1.58-1.92	1.36-1.64
10-14	1.35-1.85	1.11-1.52	1.33-1.82	1.14-1.57
15-19	1.45	1.20	1.31	1.16
20-24			1.49	1.23
25-49	1.48	1.24	1.50	1.27
50-74	1.57	1.83	1.24	1.31
75-99			.85	1.31
100-199	1.57	1.83	1.66	1.57
≥ 200			1.25	1.54

Sources and Methodology - Table 6

The basic sources of information are the publications of DANE, the Anuario General de Estadistica and the Bol etin Mensual de Estadistica. Wage statistics are deflated by the national blue collar cost of living series, and value added by the Central Bank's manufacturing value added price series.

Since information was not available separately for all ten size categories in 1953, broader categories are used for the 1953-56 calculations. Calculations for 1956-66 were possible for all size categories, but for the period 1966-68 only for the top 7, since Todd's adjustments for the "arrastre problem" are available only for 1966, and the published figures for the smallest 3 categories are not too helpful.

Todd's corrections, described elsewhere, are the basis of the estimates for the bottom 3 size groups; he made 2 estimates, in an attempt to remove the biasing effect of inclusion in DANE's figures of non-reporting firms, and the 2 estimates provided give us the lower and upper limits here. (This is not to imply that these numbers really give limits, but only to give a general feel for range.)

and average productivity overestimated for the larger firms in the latter years; these biases are probably greater than in the earlier years, therefore suggesting a more rapid increase in wages in the larger firms than actually shown here and a slower increase in labor productivity.

As noted earlier, the extent to which these changes in average labor remuneration correspond to increases in the wage of given occupations (given skill levels), to changes in the occupational structure, to changing composition as between white and blue collar, etc., has not been analyzed.

II. Social Efficiency of Colombian Industry by Size of Plant

The relationship among type of industry, size of plant, other relevant features and the variable "social efficiency"[1] is, needless to say, a complex one. In a country like Colombia three major market imperfections or disequilibria require the use of shadow prices to evaluate (a) the relative social efficiency of plants or firms and (b) the optimal directions of government policy. Note that these two questions are not the same; the fact that a plant may, overall, be a poor resource user does not mean that it should not receive preferential treatment if the factor(s) whose allocation the government can control has

[1] By the term "social efficiency" we here refer simply to the effect a given productive unit has on total national income. (We abstract from problems associated with evaluation of leisure, etc.) The term "social" is not used to imply the inclusion of income distribution or employment impacts of the plant's presence, but only its output impact. The term is used to distinguish "private" efficiency defined by the profit rate (or some similar variable) from measurement of the firm's contribution to total output. Social efficiency may also be thought of as total factor productivity, where each factor is evaluated at its social opportunity cost, i.e., the productivity it would have in its best alternative use. In a stationary economy (with no technological change or net capital formation) with perfect markets, and in the absence of external economies, etc., social efficiency of each economic entity is by definition equal.

(have) a higher marginal productivity in it than in other plants. The analysis below focuses on the first of these two questions[1]--overall social efficiency defined as the ratio of productivity of the set of factors used in the plant compared to their productivity elsewhere. This concept must be thought of in both static and dynamic terms, i.e., it should take into account such factors as the savings propensities of income recipients of different types of plants.

Information relevant to the evaluation of relative social efficiency of different sized plants is summarized in Table 8. As is generally known (and as is the case in all countries for which such studies have been done, to my knowledge) average labor productivity tends to be an increasing function of size for all the years in question; the relationship between value added and horsepower is less simple, but generally tends to be an increasing function of size up to the second largest group, then falls dramatically in the largest group to a level below the average for industry as a whole. Neither average labor productivity nor value added/horsepower are very valuable proxies for total factor productivity, though the latter is presumably more relevant than the former;[2] it would be a very interesting figure if horsepower were a good proxy for total capital. In the following sections we discuss sequentially additional elements pertinent to conclusions on relative social efficiency.

Evidence on the "Value Added/Capital" Ratio in Relation to Plant Size (Defined by Number of Workers)

As indicated in Table 8, the use of installed horsepower capacity as a

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[1]The second question--that of optimal public policy--is dealt with in the final section, though some reference is made to it here.

[2]To the extent that labor is in relatively abundant supply and is probably priced in the market at a value above its social opportunity cost, average labor productivity may be of almost no use as an indicator of total factor productivity.

Table 8

Labor and Horsepower Productivities by Plant Size, Selected Years

Firm Size (# Workers)	1953 Value Added / Worker	1953 Value Added / Horsepower	1958 Value Added / Worker	1958 Value Added / Horsepower ('000)	1964 Value Added / Worker	1964 Value Added / Horsepower	1964 Imported Raw Materials / Total Raw Materials	1968 Value Added / Worker	1968 Value Added / Horsepower
<5 workers; ≥24,000 pesos Value of output	3,469		5,787	4,536	12,500	7,940	7.7	n.a.	n.a.
5-9			5,678	5,434	14,500	10,380	10.9	n.a.	n.a.
10-14	4,398		6,725	5,027	16,300	9,293	10.4	n.a.	n.a.
15-19	5,015		7,428	5,029	20,060	9,898	9.5	30,160	12,459
20-24				6,160	23,700	10,979	17.0	29,565	13,612
25-49	6,861		10,616	5,728	25,840	8,019	14.5	44,541	11,845
50-74	10,036		17,767	7,645	33,670	14,358	18.0	41,652	20,225
75-99				6,284	31,790	14,789	24.9	61,021	19,272
100-199				7,579	51,200	15,200	23.2	83,028	24,797
≥200				4,042	46,930	9,325	26.2	79,665	15,505

Source: DANE, various copies of Anuario General de Estadistica and Boletin Mensual de Estadistica. 1953 and 1958 DANE figures are not adjusted in any way, which may imply that those corresponding to the small firms are slightly inconsistent with the 1964 figures, which are taken from Table 1. The data on imported raw materials are John Todd's unpublished statistics.

measure of capital would lead to the conclusion that, with the exception of firms of 200 workers and over, the output/capital ratio is an increasing function of plant size, and since average labor productivity is also an increasing function over that range, it would suggest that total factor productivity is higher in the large and medium plants,[1] and they have a higher level of social efficiency regardless of relative social opportunity costs of the two factors. It would remain to analyze, of course, why output/horsepower is so much smaller for the largest size category than for the others. Analyses performed to date, however, have not indicated such a systematic relationship between total capital stock and horsepower as to warrant its serious use in this context.[2] And considerable evidence suggests that the real capital (fixed capital plus inventories) to horsepower ratio is higher for large plants than for small ones.

One piece of evidence to this effect comes from an attempt to relate fixed investment occurring in the largest plants over that period to "change in horsepower" and comparing this

[1] The evidence would not be conclusive since it is clear that labor is not homogeneous by firm size; the relative social cost of small firm and large firm labor would still have to be evaluated.

[2] John Todd has indicated to me that extensive attempts to find some systematic relationship between DANE's "net investment" and "change in horsepower" figures have not borne fruit. Attempts included lagged and unlagged regression equations, aggregated and disaggregated figures, etc. While lack of the sort of relation such regressions would pick up does not prove that there is no defined (or perhaps even constant) long-run relationship between changes in fixed capital and changes in horsepower, it adds to the doubts in that respect. It remains plausible that unpredictable and varying lags between investment and "installed capacity ready to use" (the concept DANE uses for horsepower) would so confuse the actual relationship as to make it unidentifiable via regression analysis. When the investment figures are plotted against change of capacity figures on an annual basis at the two-digit level, the points for some industries suggest that lags may be disturbing an otherwise fairly systematic relationship. Even if a systematic relationship emerged for each two-digit sector, this would not, of course, indicate that there was a constancy of the ratio fixed capital/horsepower across firm sizes. The calculation of "total net investment/total change in capacity" over the 10-year period 1956-67 at the two-digit level indicates that the "cost of horsepower" in terms of fixed investment does vary substantially from one industry to another. But there are serious difficulties with such long-period analysis, too. (See footnote 2, next page.)

ratio to that of all other firms. A comparison between the largest 250 firms and all the others suggested a ratio of "net fixed investment[1]/change in horsepower about three times as high for those largest firms as for all other firms.[2]

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[1]Not counting inventories.

[2]This calculation (and the one including inventories) is extremely crude and open to some obvious fallacies of methodology. It could only be accurate if in fact the 250 largest plants in 1967 all existed in 1956. Error could have been introduced through the assumption in the earlier years, when there were less than 250 plants in the largest size category, that those found in the second largest category had the average net investment per plant and horsepower per plant figures of that category. Possible biases are so numerous as to make a complete discussion impossible, but some major considerations should be mentioned.

If all 250 plants did exist in 1956, one might argue that those not in the largest category (≥ 200 workers) were probably among the larger ones in the second largest category; this would mean that both our estimate of the horsepower for those firms and of the amount of investment undertaken by them are downward biased for 1956. If this were the case, the estimate of the net investment/change in horsepower ratio for these firms would also be downward biased. In general, however, it must be presumed that among the largest plants in 1967 there were some which were not particularly large in 1956; for these our estimate of the horsepower in 1956 would be upward biased while our estimate of the net investment undertaken by them might have the same bias (though not necessarily). Only with information on the growth paths of plants in terms of employees, horsepower, and net investment would it be possible to resolve this question. Rough sensitivity tests suggest that a considerable number of plants would have had to grow to the largest category with low net investment/increase in horsepower ratios en route to bring the accumulated net investment/change in capacity ratio of the largest plants close to equality with the others. On balance then, this evidence would seem to weigh towards the conclusion that the ratio "accumulated net investment/change in horsepower" is higher for the largest plants than for the rest lumped together. Another difficulty in the interpretation of these ratios, however, is that while the use of a fairly long period does tend to smooth out problems associated with one-or two-year lags between investment and change of capacity, it fails to remove a problem related to depreciation of capital; DANE's investment figure is essentially "purchases of fixed capital (including land, although this is not an important component) minus sales." It does not, as far as I can see, even allow for retirements--it is not clear how it could. And in fact, the number of years in which horsepower actually decreased in some of the two-digit sectors suggests that there must have been substantial retirement. In any case, since retirement and depreciation may be assumed to occur at different rates in different industries, one may not get a very good feel for the relationship "annual cost of fixed capital/horsepower" across such categories as industries, plant size, etc.

Inclusion of inventories lowers this ratio a little but does not alter it significantly.[1] Unfortunately it is not possible to use with any confidence the technique applied to reach this figure for subsets of the other plants;[2] thus the information provided by this calculation, which suggests that the largest category firms are even more capital intensive and have even lower output/capital ratios than suggested by the output/horsepower figures of Table 8, is rather redundant since it simply lends more evidence to the effect that this is relatively inefficient; it does not, unfortunately, throw any new light on how the ratio "output/capital" is related to size among the lower size categories.

It would be desirable, as well as having better information on fixed capital, to include all capital, i.e., inventories and other working capital as well as fixed. Limited evidence, discussed in Appendix B, suggests that the total capital/fixed capital ratio is higher for larger firms and plants than for small ones. Another methodological weakness involves the exclusive use of number of workers to measure firm size. Appendix C discusses the possible implications of the use of better measures.

Value Added/Capital at the Two-Digit Level

The relevance of differences in output/capital and labor/capital ratios across firm or plant size in a country is likely to be greater if the differences are present also at various levels of disaggregation. (If they

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[1] In 1964, the Sociedades Anominas, a disproportionate share of which are large, had an inventory/horsepower ratio of 0.48 while all other firms had a ratio of 0.36. Possibly the difference across size categories per se would be considerably greater than this.

[2] Since it becomes less plausible in the middle of the distribution to assume that firms are relatively stable in their relative position within the size, and toward the bottom of the distribution it is clear that a number of firms are dropping right out each year while others move up.

are not, the possibility of effecting the overall labor/capital ratio by manipulating size structure depends on their being sufficiently flexible in output composition, i.e., if it is desired to retain composition of industrial output more or less constant the existence of differences in output/capital, labor/capital and other ratios at disaggregated levels is key. Their presence or absence determines whether there really is the possibility of, say, increasing the labor associated directly with a given amount of capital by working on the size structure of plants. As suggested by the Colombian data, and indicated more conclusively by that of some other countries, it appears that these relationships do hold for disaggregation at least to the two-digit level and possibly farther. The relationship observed in Table 8 for "value added/horsepower" to be an increasing function of plant size up to the category 100-199--more precisely for plants in the range 50-199 workers to have higher horsepower productivity than either the smaller or the larger ones--holds generally at the two-digit level as well. (See Table 9.) But no attempt has as yet been made to measure output/fixed capital ratios by size for given industries. Undoubtedly the high fixed capital/horsepower ratio observed above for large firms in the aggregate would be found in some industries, but it remains to be seen whether the difference would be greater or smaller within the industry than in the aggregate.

Total Factor Productivity (Social Efficiency) with Non-homogeneous Labor and Non-homogeneous Capital

In simple labor surplus model where homogeneous labor is in excess supply

Table 9

Value Added/Horsepower by Industry and Plant Size 1964

Industry	Number of Workers <5	5-24	25-99	100-199	≥200	Total
Food	5,061	7,505	11,629	11,307	11,134	10,390
Beverages	1,378	4,252	17,459	22,338	11,327	14,254
Tobacco	173	163,174	88,973	103,716	131,957	123,894
Textiles	13,410	4,936	9,445	13,677	9,718	9,576
Clothing & Footwear	195,360	22,362	29,305	30,508	47,641	33,275
Wood & Products.	2,504	2,691	3,642	3,783	5,892	4,094
Wooden Furniture	5,635	8,470	9,419	17,584	14,050	10,559
Paper & Products	14,055	7,829	18,893	19,262	4,427	5,831
Printing	11,025	13,472	19,562	19,805	40,803	24,503
Leather	4,134	7,402	9,630	7,524	7,751	7,852
Rubber	5,813	8,815	8,218	--	9,370	9,257
Chemicals	30,589	23,350	7,743	44,509	9,614	11,891
Petroleum & Coal Products	684	9,777	2,710	21,460	5,216	5,455
Non-Metallic Minerals	n.a.	3,170	7,844	4,604	5,989	5,625
Basic Metals	8,182	7,319	6,367	4,908	3,492	4,220
Metal Products except Machinery	6,097	6,742	10,602	7,744	10,594	9,337
Non-Electrical Machinery	46,126	6,377	9,278	12,759	14,674	9,626
Electrical Machinery	10,629	12,128	24,331	11,959	27,665	20,591
Transport Equipment	4,999	11,256	11,760	18,531	15,238	13,886
Miscellaneous	13,634	12,710	19,483	19,270	18,983	18,360
TOTAL	7,288	8,572	10,885	15,200	9,325	10,202

Sources and Methodology - Table 9

Except for the size group "less than 5 workers," the figures are taken directly from DANE, Boletin Mensual de Estadistica, Number 224. The figures for " < 5" were calculated on the basis of residuals between DANE's totals presented in Anuario General de Estadistica and the totals for the firms of 5 workers and up presented in the aforementioned Boletin.

In some of the two-digit sectors, the ratio of value added to horsepower fluctuates rather wildly by firm size, somewhat but not dramatically more so as between the firms of less than 5 workers and the others. The calculations for the less than 5 group, by residual, are more subject to error than the others, this was confirmed when the deductions indicated a negative number of horsepower in sector 34.

Note also that, due to the downward biases in the 1964 value added figures in DANE's bottom three size categories (appearing here within the bottom two categories), average value added in the bottom category is, according to our estimates, about 10 percent too low in the "less than 5" category and 15-20 percent too low in the 5-24 category. It must be remembered that these figures are very much estimates, however, and limited faith should be placed in them.

so that its marginal social cost is zero and homogeneous capital is the only scarce resource, a good measure of a firm's social efficiency is its output/capital ratio.[1] Such extreme assumptions do not fit Colombia, however. It is generally plausible to assume that unskilled labor is relatively more overpriced in the market than is skilled labor, although this involves oversimplification, since some forms of skilled labor may well be overpriced as well.[2] In the case of capital, the overvaluation of the exchange rate generally implies that imported capital is underpriced; on the other hand some forms of domestic capital, especially ones producible in part with surplus labor, (this holds for example, for some forms of construction), could well be overpriced.

Information bearing directly on the relationship between plant size and the type of labor used is not available, but indirect evidence suggests that the share of hired labor in the white collar category is close to zero until a plant size probably substantially above 5 workers is reached; it may then level off (industry held constant) over some range of plant size and may thereafter decline.[3]

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[1] It is not a perfect measure, however, since what one really wishes to get at in appraising a firm is its "general equilibrium" impact on total output or income, and unless factor markets are perfect, different units of a homogeneous factor will not necessarily have the same social productivity in alternative uses.

[2] At least if unemployment of people with these skills is any indication--of course the unemployment may be due in part to the fact that the skill alleged to be there is in fact absent.

[3] Circumstantial evidence, although problematic, can be aduced by classifying plants by industry and/or region and observing the relation between average size and percent of paid labor in the white collar category. In the clothing-footwear sector, for example, the "average plant size-share of labor in white collar category" relationship is shown in Table A-8. The methodology of observing the relationship between the white collar/total paid labor ratio and plant size with one observation coming from each department in a given industry fails, of course, to normalize for a number of variables which may be the real source of the observed relationships. It is, for example, possible that the same factors which lead to the prevalance of larger plants go together with the greater supply of white collar help, etc. It is highly unlikely, though, that the correlation is entirely spurious, especially over the range 0-20 workers or so.

If it be assumed that white collar labor is a "scarcer" resource than blue (this seems plausible especially with respect to administrators, managers, etc.), then the observed positive relation between labor productivity and plant size is partly a result of the more extensive use of white collar labor in the larger firms; assuming that our interest is in an "output/input of scarce resources" ratio,the output/capital variable could be biased in favor of large (or perhaps medium and large) firms through failure to treat this labor as a scarce resource. If it were assumed that the wage correctly measures social opportunity costs of the white collar workers, then an interesting ratio is "value added minus white collar remuneration/capital." If it be assumed that there is no white collar labor for the small size category but that it constitutes 25 percent of the labor force and 50 percent of wages (the latter may be a little upward biased) for plants of 50-199 workers, then it can be seen that (using 1964 value added/ horsepower figures) the "value added minus white collar remuneration/horsepower" ratio would be only a little higher for these middle-sized firms than for the smallest ones. The value added per unit of scarce resources ratio could bell be substantially higher for the smallest firms than for the others.

It may be argued, of course, that there is much scarce human resource concentrated in the small plants in the form of management. Whether or in what sense this is the case is very difficult to judge without more information on who small scale producers are, what their alternatives are, etc. In any case, the very partial nature of the above calculation must be born in mind. Since the equilibrium wage of white collar workers is very much a function of the extension of larger scale industry, one could not use the existing wage rate as a measure of opportunity cost if a policy of extensive support to small scale (at the expense of large scale) industry were contemplated.

It is not possible, unfortunately, to present figures on the domestic and imported component of capital goods used at different firm sizes (nor even to have a good idea at the two-digit sector breakdown). The logical presumption is that larger scale firms, with better connections and better argued cases, get the lion's share of the imports of capital goods and have a higher imported/total ratio for capital goods purchased. Such a relationship is strongly apparent with respect to intermediate goods consumed, where in 1964 the smallest size group imported less than 8 percent of raw materials used whereas the largest group imported about 26 percent. This relationship has been present throughout the period 1956 and on, though in somewhat varying degree.

Thus it is not possible, with the data at hand, to make convincing overall estimates of the social efficiency of plants or firms by size category such as to take into account the use of scarce capital of various types, the use of scarce labor, etc.[1] Non-normalized labor productivity[2] is an increasing function of firm size; it seems probable that physical capital productivity decreases (a judgment based partly on the discussion of this section and partly on evidence from other countries presented in the next section); the ratio of output to use of imported raw materials is a decreasing function; and output/scarce human resources is an unknown function. It would therefore be conservative to say that there is no evidence that small producers are inefficient in the economic sense; it seems almost certain that the largest plants (200 workers and up) are on average inefficient; as between smaller plants and

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[1] For as thorough an analysis as possible under the data limitations, see John Todd, forthcoming Yale Ph.D. dissertation.

[2] I.e., with no allowance for quality differences in labor.

the medium size range (50-200 workers) relative social efficiency probably depend on the industry, but consideration of the market imperfections under which economic activity takes place suggests that many of the factors in the small plants would not be very productive with their alternative uses--i.e., that these firms are efficient resource users.

We turn now to other measures of performance of relevance to the comparison at hand, in particular income distribution as a function of firm size, localization of industry (related to distribution in part) and growth tendencies and potential.

Size of Plant and Income Distribution

Since income distribution is an important variable in Colombia, the relative performance of different size plants in terms of their impact on the overall income distribution of the country (i.e., the general equilibrium effects of the existence of a certain type of industry as opposed to tha alternative) is of interest. Since this impact cannot be observed directly, it is necessary to guess at it on the basis of proxies and indicators. Although it is not a logical deduction, it is plausible to assume that large scale industry, which tends to produce a relatively small number of high wage incomes and a relatively small number of quite high capital incomes[1] has the general equilibrium impact of raising the income of a relatively small number of high income people by a relatively large amount; correspondingly it is plausible to conclude that, since

[1]A possible exception is the widely owned corporation whose stockholders are not too high in the income distribution. If this phenomenon exists at all in Colombia, its importance is miniscule.

small scale industry produces a large number of relatively low wage payments and of relatively low capital incomes, its general equilibrium impact consists of relatively small increases in income for a relatively large number of people. It is also highly probable that the incomes raised by small scale industry would in its absence be lower than would those raised by large scale industry, in its absence. Under these circumstances one could conclude that the income distribution impact of small scale industry is more favorable than that of large scale industry. The several links in this chain of "plausibility" would each have to be analyzed empirically before firm conclusions could be drawn, but the level of doubt appears low.

Something can be deduced about the income distribution characteristics of different plant sizes by observing the wage rates, the wage share, and (to the extent available) the distribution of labor and capital income. Differences in average labor remuneration by plant size have already been referred to. Table 1 indicates that there is no systematic relation between the paid share of gross value added and firm size. If all desirable adjustments were made, a mild positive association would probably emerge.[1] Total labor share (including a plausible imputation for income of unpaid workers) appears to bear a mildly negative relationship to size, up to the middle size categories.

A more interesting statistic (vis-a-vis the income distribution question)

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[1] The figures of Table 1 are, as noted earlier, not adjusted for the probable underestimation for larger plants of labor remuneration in the form of fringe benefits not paid at time of rendering of the labor services, nor the overestimate of value added for the larger firms. Adjustments, therefore, would lower gross value added in the large plants more than the small ones and raise labor income in the former.

The relationship shown in Table 1 also suffers from the fact that a "gross value added" figure is used when the conceptually more interesting comparison is between labor payments and net value added; Table 10 shows an attempt to use a net value added figure. In order to calculate net value added and net income, it is necessary to subtract out depreciation and indirect taxes. It seems unlikely, however, that these adjustments would change significantly the relationship among plant sizes shown in Table 1.

Table 10

Functional Distribution of Gross and Net Income Generated by Factory Industry: Two Digit Breakdown

	Average Size of Plant (# workers) (1)	Value Added (DANE) (2)	DANE Overstated (3)	Value Added (Banco. Rep.) Estimate (4)	REMUNERATION DANE White Collar (5)	REMUNERATION DANE Blue Collar (6)	Total (7)	Gross Capital Y (8)	White Collar Y / Labor Y (9)	Blue Collar Y / Labor Y (10)	Labor / Gross V.A. (11)	Gross Capital Share (12)
Food	15.22	2,442,339	765,645	1,676,694	263,589	379,410	642,999	1,033,695	.410	.590	.384	.616
Beverages	72.04	2,072,431	381,357	1,691,074	208,139	223,245	431,384	1,259,690	.482	.518	.255	.745
Tobacco	21.68	609,684	27,365	582,319	17,382	59,766	71,148	511,171	.244	.756	.122	.878
Textiles	105.86	2,002,282	219,474	1,782,808	283,460	644,015	927,475	855,333	.306	.694	.520	.480
Clothing	16.46	643,810	78,791	565,019	61,746	195,740	257,486	307,533	.240	.760	.456	.544
Wood	15.68	150,313	21,472	128,841	17,775	50,415	68,190	60,651	.261	.739	.529	.471
Furniture	13.31	94,057	9,307	84,750	13,532	40,965	54,497	30,253	.248	.752	.643	.357
Paper	56.72	392,507	62,402	330,105	69,057	85,321	154,378	175,727	.447	.553	.468	.532
Graphics	24.97	477,671	91,617	386,054	83,135	129,487	212,622	173,432	.391	.609	.551	.449
Leather	16.58	167,581	9,924	157,657	17,130	42,265	59,395	98,262	.288	.712	.377	.623
Rubber	98.28	380,086	48,764	331,322	74,706	107,578	182,284	199,038	.410	.590	.550	.450
Chemicals	46.28	2,048,401	303,073	1,745,328	355,329	232,041	587,370	1,157,958	.605	.395	.337	.663
Petroleum & Coal Products	121.24	571,618	26,510	545,108	48,048	43,386	91,434	453,674	.525	.474	.168	.832
Non-Metallic Minerals	26.04	849,064	115,455	733,609	119,153	291,175	410,328	323,281	.290	.710	.559	.441
Metal	138.62	323,206	74,574	248,632	29,478	72,657	102,135	146,497	.289	.711	.411	.589
Metal Products	29.44	699,305	88,002	611,303	112,853	201,929	314,782	296,521	.359	.641	.515	.485
Non-Electrical Machinery	24.84	181,856	21,140	160,716	32,697	63,245	95,942	64,774	.341	.659	.597	.403
Electrical Machinery	40.11	492,294	81,223	411,071	87,383	115,483	202,866	208,205	.431	.569	.494	.506
Transport	23.91	395,963	36,716	359,247	48,954	165,102	214,056	145,191	.229	.771	.596	.404
Miscellaneous	30.76	411,955	30,554	381,401	61,359	93,962	155,321	226,080	.395	.605	.407	.593
Total		15,406,423	2,493,365	12,913,058	2,004,944	3,237,191	5,242,095	7,670,963	.382	.618	.406	.594

Table 10 continued

Indirect Taxes (13)	Gross Value Added Minus Indirect Taxes (14)	Depreciation (15)	N. V.A. (Gross V.A. - Indirect Taxes and Depreciation) (16)	Paid Labor Share of N.V.A. (8)/(16) (17)	Paid Blue Collar Share N.V.A. (7)/(16) (18)	Imputed Labor Income (1967) Estimate A (19)	Imputed Labor Income (1967) Estimate B (20)	Total Labor Income Estimate A (21)	Total Labor Income Estimate B (22)	Total Labor Income / N.V.A. Estimate A (23)	Total Labor Income / N.V.A. Estimate B (24)
27,843	1,648,851	188,793	1,460,058	.440	.260	19,639	39,275	662,638	682,277	.454	.467
277,445	1,413,629	186,933	1,226,696	.352	.182	913	1,826	432,297	433,210	.352	.353
412,939	169,380	7,682	161,698	.440	.370	506	1,012	71,654	72,160	.443	.446
19,422	1,763,386	157,579	1,605,807	.578	.399	2,673	5,346	930,148	932,821	.580	.581
8,691	556,328	16,739	539,589	.477	.363	12,758	25,516	270,244	283,002	.501	.524
1,834	127,007	10,307	116,700	.584	.432	3,039	6,078	71,229	74,268	.610	.636
1,411	83,339	3,390	79,949	.682	.512	4,797	9,594	59,294	64,091	.742	.802
6,005	324,100	40,350	283,750	.544	.301	820	1,640	155,198	156,018	.547	.550
4,872	381,182	39,073	342,109	.622	.378	3,680	7,360	216,302	219,982	.632	.643
2,011	155,646	9,133	146,513	.405	.288	2,810	5,620	62,205	65,015	.425	.444
3,421	327,901	18,814	309,087	.590	.348	404	808	182,688	183,092	.591	.592
49,571	1,695,757	114,096	1,581,661	.371	.147	2,953	5,906	590,323	593,276	.373	.375
8,574	536,534	39,247	497,287	.184	.087	19	38	91,453	91,472	.184	.184
14,179	719,430	88,048	631,382	.650	.461	5,354	10,708	415,682	421,036	.658	.667
5,430	243,202	41,176	202,026	.506	.360	125	250	102,260	102,385	.506	.507
5,944	605,359	44,686	560,673	.561	.360	4,837	9,674	319,619	324,456	.570	.579
2,291	158,425	11,784	146,641	.654	.431	2,452	4,904	98,394	100,846	.671	.688
7,680	403,391	32,984	370,407	.548	.312	1,627	3,254	204,493	206,120	.552	.556
4,356	354,891	42,447	312,444	.685	.528	4,921	9,842	218,977	223,898	.701	.717
4,490	376,911	21,998	354,913	.438	.265	2,736	5,472	158,057	160,793	.445	.453
868,409	12,044,649	1,115,259	10,929,390	.480	.296	77,063	154,126	5,313,155	5,390,218	.486	.493

Sources and Methodology:

The data of Cols. (1), (2), (5), (6), and (7) are directly from DANE. Cols. (3) and (4) are from unpublished data of the Banco de la Republica. Col. (13) is based on estimates of the Banco de la Republica, along with not fully consistent data from the Suprenintendencia de Sociedades Anonimas. Considerable guesswork was involved in the calculations shown here. Col. (15) is based primarily on the data of the Superintendencia de Sociedades Anonomas, and due to the conceptual differences which appear to exist between the legally admissable depreciation and the economic concept, may not be very accurate.

Two estimates of imputed labor income are presented in Cols. (19) and (20). That of Col. (19) assumes that imputed labor income per unpaid person in each industry was equal to the average wage of paid workers in DANE's smallest size bracket (less than 5 workers); that of Col. (2) assumes an imputed labor income twice as high.

is the blue collar labor share (paid and imputed). It is not available directly by plant size though the relation between this share and average plant size across two digit industries suggests that the white collar share is greater in industries of high average plant size.[1] (See Diagram A-4). The figures of Table A-8, where an attempt is made to get at the relationship between size of firm and share of the labor force which is white collar, are in accord with this conclusion.

According to both DANE and Central Bank estimates, the average paid labor share has been increasing over the last 15 years or so; Table A-10a suggests that this has been particularly true of the larger size firms. My estimate suggests an increase in total (paid and imputed) labor share for the factory sector from 36.6 to 39.5 over the period 1953-1966, and increases over the same period of 33.3 to 37.9 for the paid labor share and 22.5 to 24.0 for the paid blue collar share.

It is, of course, much more difficult to say anything about the recipients of capital income and its distribution by plant size, but at least for the smaller sizes it seems plausible to assume that most of the non-labor income goes to the individuals appearing in DANE's statistics as "unpaid workers." Even for a rather small plant, however, it seems difficult to believe that all the income goes to the individuals; if it did, the average income of proprietors, even of plants with less than 5 workers, would be higher than the wage rates of workers in the largest firms. (See Table A-11.) Based on very notional

[1]Note, however, that this is a place where the use of "number of workers" as the definition of firm size may create a particular distortion or bias. It seems probable, on the basis of somewhat impressionistic evidence, that firms with high capital/output ratios tend to have higher white collar/blue collar ratios and this in turn implies that if size were measured by amount of capital (not practical due to data difficulties), a stronger relationship between firm size and the white collar/total labor share might emerge.

concepts of the frequency distribution of wages to recipients in a given size category and for capital recipients in the small size categories, one can guess at the percent of people associated with firms in a given size category and whose annual income is below various cutoff points. It is also possible to guess crudely at the percent of capital income and thus of total income going to people below various levels. If we take 10,000 and 15,000 1964 pesos as relevant cut-off points (the former corresponds to the average income of workers in firms of about 50 workers and the latter the average income of workers in the 200 and up category--so that the former is a relatively satisfactory income and the latter a quite satisfactory income in Colombian terms) the data suggest strongly that whereas for the very smallest firms most of the income generated goes to people with incomes below 10,000 pesos, even by the category 10-14 the majority of the income is going to people with incomes over 15,000 pesos. For persons involved in firms of 2-4 workers, it appears that perhaps 60 percent goes to people with incomes of less than 10,000 and 80 percent to people with less than 15,000.[1]

An issue receiving considerable attention in Colombia at present is that of the distribution of urban population by size of city; there is a fear that the larger cities are growing too fast and a feeling that there would be some advantages to faster development of the intermediate sized cities. If indeed such a policy were to be taken seriously, it would be necessary to study in depth the actual and feasible relationships between type of industry and size of city. At present there is a clearly observable tendency for the larger establishments to be located in the larger cities (see Table A-12) and for average productivity

[1] It must be emphasized again that these figures are very much guesses, but that the relative values are probably more valid than the absolute ones.

and possibly average wages also to vary substantially by city size.

The relationship between cottage-shop and total manufacturing employment is not a simple function of city size, however; some of the larger cities are notably characterized by large cottage-shop sectors.[1]

Small Firms and the Growth Process

It is frequently argued that an important consideration in appraising the contribution which may be expected of small industries is their potential to grow. While the contention that growth potential is important must be borne out empirically, it is sufficiently plausible to warrant a summary of the scattered bits of information available on this issue for Colombia. And perhaps more relevant than the tendency of firms to grow or decline is their tendency to go out of business, with its possible implications for loss of previous investment--both in fixed capital and possibly in managerial talent as well.

Over the period 1953-68, DANE's industrial surveys indicate a marked increase in the number of plants in all the size categories from 25 workers and up (see Table A-2a);[2] the same holds also for the period 1944-45 and on. The number of plants in this range increased from 1,246 in 1953 to 2,017 in 1968; plants of 50 workers and up increased from 612 in 1953 to 1,125 in 1968,

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[1] It would be useful to know the extent to which this is a response to a real demand for such sectors as transportation equipment, and the extent to which it is in part disguised unemployment.

[2] Note, however, that if it were true that the number of plants in the categories 1-9 (5 workers and up) had risen, as seems likely (see the discussion with Table I of the underreporting problem for small firms in recent years) from around 6,900 in 1956 to around 9,000 in 1968, (and assuming that no plants with 25 workers) or over had gone unrecorded in 1968) then the percent of all plants with 25 workers or more (and again excluding those with less than 5 workers would not have changed significantly over this period; it would have been about 21.4 percent in 1956 and about 23 percent in 1969.

i.e., almost doubling.[1] Has most of this increase in the number of large plants resulted from growth of those already existing in 1953 or have there been important entrances of new ones into the various size categories, along with exits of others? Is growth more characteristic of large plants or smaller ones? The evidence on all these issues remains highly fragmentary; and in this context the absence of information on firm size as opposed to plant size is particularly problematic; growth of the former may well have been more rapid than that of the latter; it seems unlikely that a substantial number of firms 15 or 20 years ago had 5 or more plants, as a number do now.

John Todd's analysis of 4,496 plants by size classes in 1966 and 1962 (note that total employment reported by DANE grew by about 8.5 percent between these two years and that the plants Todd identified accounted for one-half of the total output) saw 387 (8.61) register an increase in their size category and 595 (13.23) a decrease between the two years. The plants toward the lower end of the size scale showed a greater tendency to decrease in size than the larger ones. Whether these figures indicate that more plants actually decreased than increased their number of workers (as opposed to size category) is not clear.[2]

An analysis of a few three digit sectors[3] is consistent with Todd's information in suggesting about the same number of plants decreasing their employment

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[1] As indicated in Table A-2a and elsewhere the completeness of DANE's coverage of the small scale plants has probably waned since the last complete industrial census of 1953, so the implication of the figures in this table that the percent of firms in the smaller brackets have decreased rapidly, and even that the absolute numbers have decreased, should not be taken seriously; it is probably not true. Certainly, however, there was an increasing share of value added, employees, etc., in the larger firms, through 1964. As discussed earlier, this trend, at least in terms of employees, may have been reversed since 1964 (see Table 2).

[2] Assuming that the size distribution is relatively smooth, plants tend to be grouped nearer the lower than the upper limit of any given size category, so the same percent movement downward would shift more plants into the lower size category than the corresponding movement upward would shift into the higher size category.

[3] With the help of DANE's 1959 and 1969 industrial directories which give the names, addresses, etc., of plants and their size category.

category as increasing it. It also suggests something about the "new entrant/existing plant exit" ratio. Of a sample[1] including 247 plants existing either in 1959 or 1969 or both, 102 were new plants, or more precisely were not locatable in 1959--this is presumably an upward biased figure since the technique used might not catch all plants which had moved geographically, changed address and name, etc.; 41 plants had apparently disappeared during the decade; 41 had increased employment category, 38 had decreased it and 25 remained in the same one. Thus of the 206 plants operating in these industries in 1969, only 104 could be located in 1959, and even if the implicit increase in plants is overestimated, it must have been substantial. A superficial reading of this information would be that most of the employment increase (in these industries at any rate) came from the new plants. Presumably a smaller share came from new firms, as branching out was undoubtedly occurring in some measure.

As shown in Table 11 about one-quarter of the plants in DANE employment categories 0-6[2] increased employment category over the period, only about 45 percent increased or stayed in the same category, and almost 30 percent went out of business as nearly as could be ascertained. There was relatively little difference between the categories 0-3[3] and 4-6 in terms of tendency to grow, etc., except that the category 4-6 plants were less likely to go out of business. Over one-third of the firms in 0-3 in 1959 apparently went out of business.[4] The

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[1] Not random, in that three-digit industries were selected primarily with a view to the ease of performing the exercice.

[2] Up to 50 workers.

[3] Up to 15 workers.

[4] Note that the difficulty of location of the same firm even though it actually existed in 1959 might be greater for these small firms, so this tendency may have been overestimated.

Table 11

Employment Growth and Decline, 247 Plants
1959-1969

Size Category in 1959	Grow (#)	Same (#)	Decline (#)	Termi-nate (#)	Grow / Decline or Termi-nate	Termni-ate/ Total	% which Grow	% not Falling
0-3	29	16	20	36	29/56	36/101	28.7	44.6
4-6	9	7	17	4	9/21	4/37	24.3	45.9
7-9	2	2	1	0	2/1	0	40	80

Sources and Methodology: A selection of industrial categories was chosen, including preparation and conservation of meats (201), manufacture of wood pulp, paper and cardboard (271), manufacture of paper articles (272), manufacture of bulbs (375) and manufacture of non-electrical machinery in Bogota (36). The objective was to match plants which existed in the two years; frequently plants had a different name but the owners had the same family name in 1969 as compared with 1959; sometimes, the name of the family was completely different but the address was the same; in either case it was assumed to be the same entity. In other cases undoubtedly a plant moved location and changed names, and in these cases it was counted as if a 1959 firm had gone out of business and a new firm had arisen by 1969. Hence the upward bias in the estimates of new plants and the demise of old ones. Nevertheless, it seems unlikely that this bias is too great, unless there is substantial movement across industrial categories. Most movement between departments was probably captured in the survey; it is more difficult to catch the other form of movement.

[1]Growth and decline are measured by movement into higher (lower) size categories, not simply by an increase or decrease in the number of workers.

number of firms in the largest size categories was too small to permit any conclusions.

Tentative Explanations of Different Behavior by Plant (Firm) Size

Before turning to information from other countries, it may be useful to review some of the more common hypotheses as to why plants and firms differ by size.

A number of factors probably combine to produce the positive relation between capital/labor and output/labor ratios and firm size and the (probable) negative relation between output/capital and size. One element determining the positive output/labor relation with size is the increasing quality of labor; but it seems clear that even if labor could be measured in efficiency units, the relations would go in the same direction. Broadly speaking, the factors involved would seem to be

(a) a non-homogeneous production function such that with fixed factor prices the optimal K/L ratio rises with the size;

(b) a positive relation between the variable "price of labor/price of capital" and firm size.

Element (a) is predictable, especially given (b), in that indivisibilities seem more frequently related to capital size than labor size and that if the price (or other costs) of labor are higher in large firms, these firms will push technology in a labor saving direction. The major factor which might work towards lower K/L and K/O ratios for larger firms is capacity utilization; number of turns seem usually to be positively associated with firm size. Recent information on this relation has been presented by F. Thoumi in a Planeacion study.

No careful study of cost and capital differentials has been undertaken, though guesses have been advanced that the cost of an efficiency unit labor is 40-50 percent higher for large firms than small ones and that small firms pay on-third to one-half more for capital, making overall differential to around 2:1. If there is much elasticity of substitution, this would generate a quite substantial difference in the labor capital ratio. The possibility cannot be fully ruled out that most of the capital labor differential is, in fact, due to the difference in relative labor prices.

The relative social efficiency of different sized firms depends, among other things, on which sizes face factor prices closest to the social opportunity cost of the factors in question. To the extent that smaller firms have the efficiency advantage, as seems probably in Colombia, this must be attributed to the mispricing of factors to the larger firms; it is widely accepted on impressionistic grounds that those firms receive credit at below equilibrium interest rates and pay wages which are above equilibrium.

Differential access to and use of credit is difficult to ascertain from published information. But the evidence comes down clearly in support of the generally supposed easier access of the larger firms. Using Planeacion's estimates for credit received by small and medium firms (5-99) workers in 1969 together with Feldl's calculation of total credit available (see Planeacion, op. cit., page 208) one comes to the conclusion that the ratio of "credit/value added" for the small and medium firms vis-a-vis the large ones is in the range of .25-.37; in other words it is unlikely that the small and medium firms receive more than one-third as much credit per peso of value added as do the large firms. This in itself is difficult to interpret, since it is known that large firms extend net credit to smaller firms and it is even possible that this is a more efficient credit distribution system in some respects than direct bank

credit. This could be particularly true in situations where the large firms sell to or buy from the small and medium ones and have thus a common interest. Lack of credit for small and medium firms could be particularly damaging in the industries where they are in competition with larger ones. Without further information it is difficult to ascertain the meaning of the overall ratios just referred to.

Since the definition of small-medium is broad in the above comparison, the difficulties which the very small firms must be facing may be imagined; the small and medium credit recipients are probably toward the higher range of that category.

That larger plants and firms show a somewhat greater tendency to grow and a definitely greater tendency to survive is not surprising. Low cost credit and good access to it is more important in generating and permitting growth than in producing high total factor productivity.Low cost labor, on the other hand, is of little help in stimulating growth if capital is available. The general nature of this difference is too well known to warrant much discussion.

III. Evidence on Size Structure, Relative Efficiency of Different Sizes, etc. from Other Countries

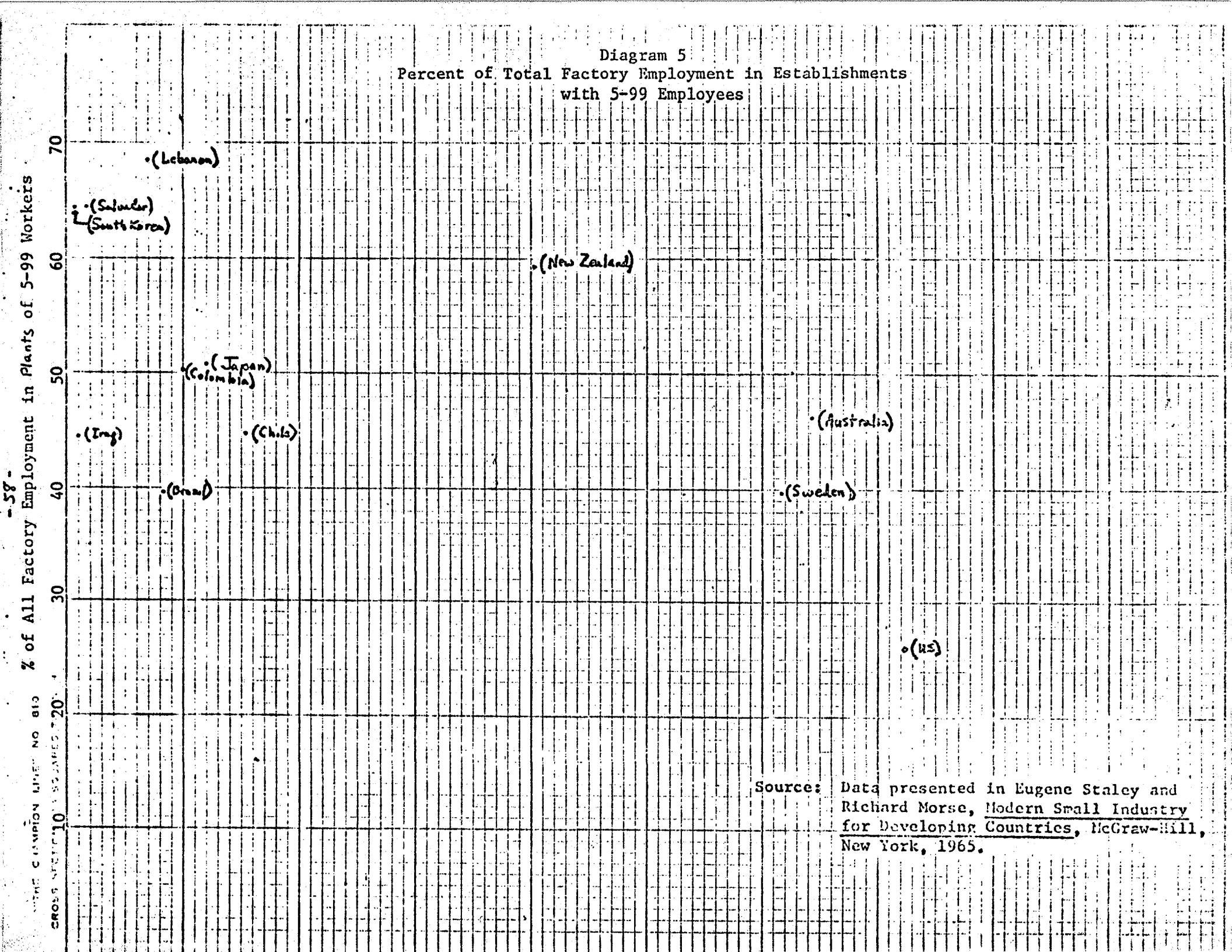
Even if it were possible to make much more precise and credible estimates of the relationship between total factor productivity and plant (firm) size in Colombia, this would inevitably constitute an incomplete picture in terms of information needed to frame policy. The relative efficiency of a given range of sizes (e.g., cottage-shop or small scale factories) would not necessarily imply that this form of production could be (or should be) expanded rapidly; it might be, for example, that given products are best produced in quite "size-specific" ways and that only for a relatively small number of products can wide substitution

be practiced; in such a situation it is not possible to change size structure substantially without changing composition of industrial output by a corresponding amount, and this may not be practical. Or it may be that, although at a country's stage of development it would have been better to concentrate more on small firms and less on large ones, there are natural and optimal trends towards large scale production of many items, and if the country is not already taking advantage of small scale production in a given line, it may be too late to reverse course, i.e., the past mistake may be best treated as a bygone. Cross-country comparisons are useful in suggesting hypotheses as to how "flexible" the firm size structure is, how it may be expected to evolve over time with the process of development, and what policy tools have been used to affect it, and with what success, in other countries.

It is useful, first, to review briefly some of the factors of importance in determining firm size structure; two important ones are the stage of development (perhaps more precisely the stage of industrialization, although this is not clear), and the size of the country.[1] The more developed the country, the greater the share of employment tending to be found in factory (as opposed to non-factory) industry, and in large scale as opposed to small scale factory production. The greater the population the higher the share of factory employment in large factories; it is not clear whether the size of the economy has any impact on the distribution of employment between factory and non-factory production. The relationship between per capita income and percent of factory employment in large scale factories (100 employees and up) is suggested in Diagram 5, for a selection of

[1]Presumably resource endowment has an effect on size structure via differences across industries in optimal size structure, as do institutional considerations, government policy, etc.

Diagram 5
Percent of Total Factory Employment in Establishments with 5-99 Employees



Source: Data presented in Eugene Staley and Richard Morse, Modern Small Industry for Developing Countries, McGraw-Hill, New York, 1965.

14 countries.[1] The relationship, as can be seen, is relatively close,[2] with the effect of size being particularly evident and interesting in the case of New Zealand and Brazil. As can be seen, the importance of the small and medium (5-99 workers) firms in Colombia is somewhat low relative to the other countries, given its industrial labor productivity.

Information is sparser on the division between factory and non-factory manufacturing employment and the figures are harder to interpret since the estimate of non-factory employment is frequently a residual and it may in some cases pick up a good deal of disguised unemployment. Diagram 6 shows the relationship between importance of cottage-shop (percent of manufacturing employment in plants of less than 5 workers or--in some cases--less than 5 employees) and importance of small scale factory employment within the factory sector (percent of workers in plants of 5 or more workers who are in plants of 5-50 workers). Without more data work and careful consideration or other variables which may bear on the relation, the diagram can only be suggestive. It is interesting that the Latin countries with the exception of Salvador--a very small country--along with Japan (1919-1920) and India lie below what would be the regression line. With the exception of Brazil, they were all slow growing countries. Japan, although developing fairly successfully throughout the whole of the 20th century, did not grow dramatically in the period before the Second World War;[3] and it is of interest to find it well

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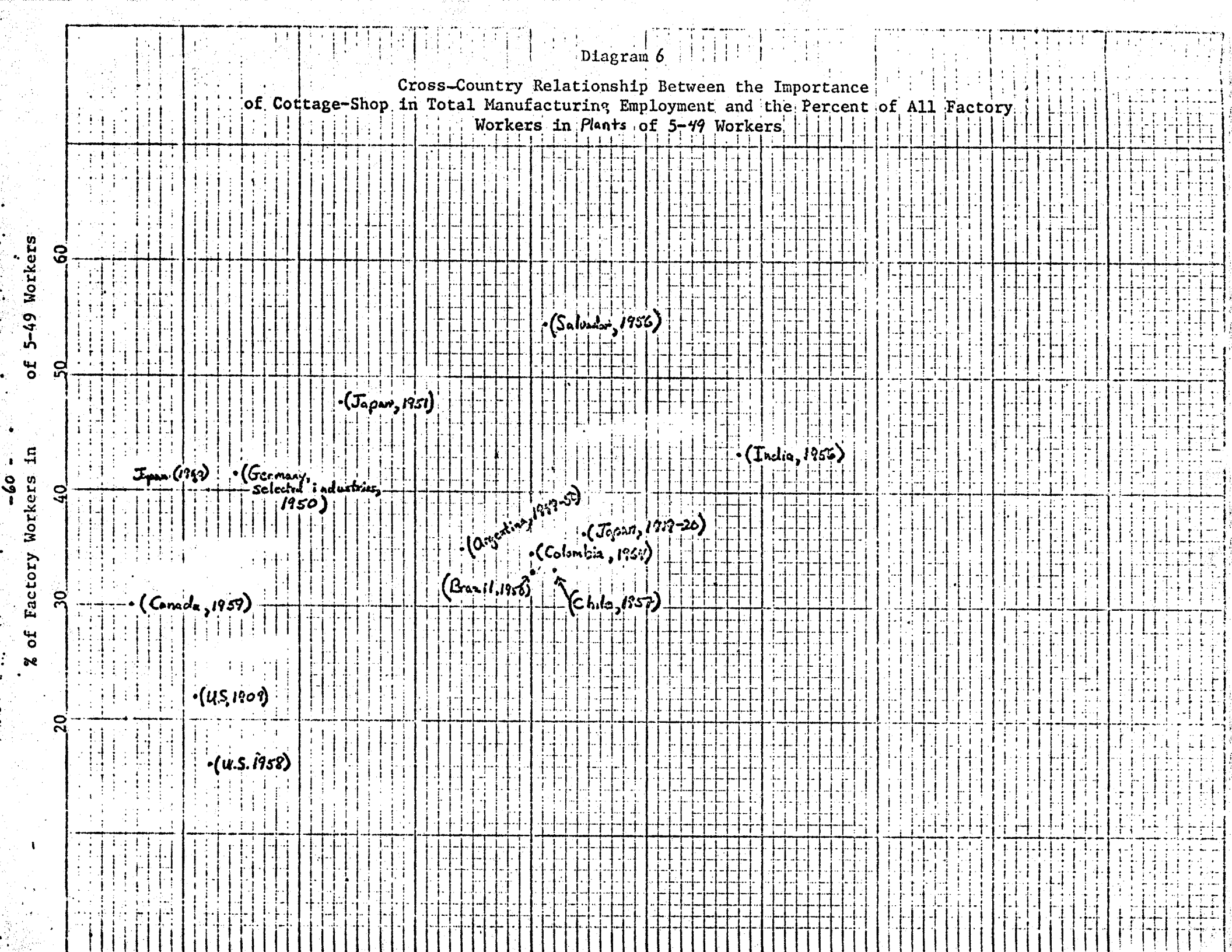
[1]Although average labor productivity in manufacturing rather than average income in the economy is used as the measure of development or increase here.

[2]It is interesting that the cross-country relationship between the importance of small factories in total factory employment and the level of income or development does not seem to show up systematically in the over time statistics available for a few countries, data difficulties may be involved here however, (see Staley and Morse, op. cit., pp. 20-21.

[3]Japan's low small scale/total factory ratio 1919-1920 may reflect also the fact that its high share of non-factory employment was in part a conscious and probably efficient public policy fostering dualism, maintaining traditional consumption habits, etc. It has been argued that the consumption and savings habits of the Japanese allowed the large scale and modern industry to "be built on a solid layer of non-economic relationships and traditional patterns of life"--the demonstration effect was very weak. The government helped to preserve this conservatism. The markets for the two sectors of industry were completely different

Diagram 6

Cross-Country Relationship Between the Importance of Cottage-Shop in Total Manufacturing Employment and the Percent of All Factory Workers in Plants of 5-49 Workers



above the "regression line" for the 1951 and 1960 observations, when its growth was very rapid.[1] There is little variation in the small factory/total factory employment ratio within the developed countries (the United States, Canada, Germany, and by 1960 Japan), but it is interesting to note that the faster growing countries, Japan and Germany, had a substantially higher share of their manufacturing employees in the small size range than did Canada and the U.S.[2]

Although the set of countries used may not be representative, Diagram 6 does suggest (whatever its implications may be), that Colombia is characterized by relative concentration of workers in large scale factories, given the share of

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During the earlier part of the post-restoration century, Japan focused considerable government support on certain large scale industries and was characterized by an extreme degree of industrial, banking, and other economical concentrations. One objective of the post World War II occupation--associated with the desire to leave a functioning democracy--was to decrease this level of concentration. As a result there was an extensive land reform, large industrial complexes were broken up, etc. How much this had to do with decreasing the observed concentration of workers in large scale factories is unclear since it would not, by itself, be expected to lead to a breakup of plants--as opposed to large scale firms (with more than one plant) and conglomerates.

[2]It is possible, of course, that a high stage of development is essentially "the cause" of both the high level of concentration in the manufacturing sector and the slow rate of growth; since Canada and the U.S. have higher per capita incomes than Germany and Japan, this could explain the observed points. Further, when the observation on Germany was taken it was still in the rather atypical postwar boom period, and Japan is, of course, something of a special case, so the sample may not be a good one.

Strong Marxist leanings of many Japanese economists and the typical pessimism with thich they have viewed Japan's future development have frequently given them a negative tone in discussion of Japan's dual industrial structure. Other economists such as Ohkawa and Rosovsky, have felt that this dualism was an important ingredient in Japan's high rate of growth. (See Seymour A. Broadbridge, Industrial Dualism in Japan, Aldine Publishing Co., Chicago 1966, p. 5). Some students have felt that the dual structure is deeply rooted in the economy and society and will not terminate naturally even when the economy develops at a high rate, current developments make this prediction a poor bet. The use of secondhand machinery has been given as one possible reason that the small enterprises have been able to keep pace with large ones so effectively. Also the saving rate of individual proprietors is very high, running to between 20 and 30 percent.

manufacturing workers in cottage-shop production; to put it another way, it is characterized by a relatively high degree of dualism in the manufacturing sector (as are, according to the Diagram, a number of the Latin countries).

Of equal interest with the information from other countries on size structure of manufacturing establishments is that on the relationship between firm size and factor productivity, especially capital productivity. Here there are substantial similarities across the countries for which information was gathered--the output/capital ratio is generally a decreasing function of firm size, sometimes decreasing rapidly, sometimes more gradually. This conclusion emerges from the information for Japan, Pakistan, Mexico and India.

It is systematically true that value added per worker and average wage rate are increasing functions of firm size; it is less clear whether this is uniformly the case within relatively narrowly defined industries, and in general little analysis has gone into ascertaining the precise reasons for the differentials. Differentials tend to be a decreasing function of the level of development of the country; they are, for example, wider in Japan than in the U.S. and wider in Colombia than in Japan.

Information on value added/capital ratios is summarized in Table 12--it should be noted that the measure of capital is not always the same one. The Japanese figures for 1956 and 1961 reveal a strikingly higher "output/fixed capital" ratio for the smaller firms, about 2:1 comparing the group 4-9 workers to the "over 1000" size in 1956 and 3:1 in 1961.[1]

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[1]Perhaps the widening of this ratio had to do with the increasing concentration of industry, the increasing labor scarcity, etc., which made it necessary for small firms to increase their capital productivity to remain competitive. During these years the wage differential diminished; the value added per person differential showed no general widening or narrowing.

Footnote 3 continued from previous page.
and the traditional consumption habits drew on the traditional output lines. In housing, furniture, food, drink and clothing the markets were varied and quite narrow, so they dictated small scale production.

Table 12

Output/Capital Ratios by Size of Firm, Selected Countries

Japan				India		Pakistan		Mexico	
Size (# of workers)	1956 Index of Output/ Fixed Investment (1)	1961 Index of Output/ Fixed Investment (2)	1957 Output/ Total Assets (3)	Size	1964 Output/ Fixed Capital (4)	Size (# of workers)	1960 Output/ Real Capital (5)	Size (# of workers)	1965 Output/ Capital (6)
4-9	1.59	2.50	2.70[1]	"small" (average of 36 persons)	1.18	0-9	1.16	0	1.39
10-29	1.36	2.22	3.70			10-19	0.33	1-5	1.17
30-99	1.24	1.38	3.64	"medium" (average of 311 persons)	0.95	20-49	0.37	6-15	.63
100-299	0.98	0.94	2.86			50-99	0.42	16-25	.53
300-999	0.84	0.85	2.05	"large" (average 1,484 persons)	0.32	≥ 100	0.28	26-50	.50
≥ 1,000	0.88	0.81	1.50			Total	0.29	51-75	.48
Total	1.00	1.00	1.79					76-100	.50
								101-250	.46
								251-500	.46
								≥ 500	.47
								Total	0.487

[1] Includes firms of 1-9 employees.

Sources: Columns 1 and 2 for 1956 and 1961 respectively come from Broadbridge, op. cit., p. 61. Capital stock presumably excludes inventories and working capital.

Column (3) is from Bert F. Hoselitz, op. cit., p. 44, taken from the comprehensive basic survey of small-medium

enterprises of 1957. The assets were standardized in terms of the valuation used for tax purpose, this being neither a book value nor a replacement cost; since Japan had suffered severe inflation in the post-war period, book values were far out of date and an attempt had been made to revise them. Since larger firms apparently revise thei figures upward more systematically than small ones, the data used here probably lead to some bias in cross-size comparisons, i.e. the downward bias in the measure of capital is presumably greater for small than for large firms.

The Indian data are from Central Statistical Organization (Industrial Statistics wing), Department of Statistics, Government of India, Calcutta, Annual Survey of Industries: 1964: Capital, Employment, Output Estimates for Factory Sector by Capital Size, New Delhi, January 1968. In this report size is defined by amount of fixed capital with "small" being defined as those of fixed capital (method of depreciation) up to and including RS 5 Lakhs; medium--those with fixed capital depreciation over RS .5Lakhs but not exceeding RS 25Lakhs, and large those with fixed capital net of depreciaiton over RS 25Lakhs (page iii). Figures relating to establishments working entirely on leased o rented fixed assets were shown separately along with a few factories in respect of which no fixed capital details were available.

Column (5) is from Gustav Ranis, "Production Functions, Market Imperfections and Economic Development," The Economic Journal, Vol. LXXII, No. 286, June 1962, p. 345. Here capital includes the depreciated fixed capital stock, equipment, land and buildings as well as average inventory holding.

The Mexican data (Col. 6) are from Saul Trejo, Industrial Production and Manufacturing Employment Growth in Mexico, Unpublished Yale PH. D. dissertation, 1971, p. 77. The definition of capital is presumably inclusive, although it is not clear.

The comparisons effected here suffer inevitably both from the difficulty of getting good capital estimates for a single country, and the further problems of cross-country comparisons, where the capital variables differ by country, quality of data collection differs, etc. It is not possible here to recount even the major biases which could present in these data. A few, mentioned by the authors of the studies from which these figures came, may be worth mentioning. For Japan, Shinhara (in Hoselitz) noted that in the relatively smaller firms the proportion of land residence for personal use in the fixed assets is larger, producing an upward bias in the small firm figure relative to large firms. The relative shares of second-hand machinery in total fixed investment is higher in small factories.

Column 3, which shows the relationship between value added and a measure of total assets for 1957, indicates the same general relationship except that the smallest size category (which includes some smaller firms than those included in the smallest size group in 1956 and 1961) has a lower output/capital ratio than the medium size categories; one hypothesis with respect to this phenomenon might be that inventories and working capital tend to be a larger share of total assets for these firms and are used relatively less efficiently by them than the fixed capital.[1] The lower output/capital ratio of the smallest firms relative to the next size category is a general phenomenon for all industries for which data is presented (see Hoselitz, op. cit., p. 47). The output/capital ratio reaches its maximum at a wide range of firm sizes, according to the industry, though most frequently in the range 10-99 workers. Even for firms of 1,000-2,000 workers the ratio is not below the overall industry average either in wood and wood products or in printing and publishing. So, although the general trend holds clearly across industries, there are substantial divergences in specified cases.

The Indian data, while involving less categories (only 3) than others and being also somewhat non-comparable in that the size was defined by amount of fixed capital, show the usual general pattern. The decline in the output/fixed capital ratio between small and medium factories is not dramatic--it appears to be very similar to the decrease which the Japanese figures would show if the same group were isolated. The large firms, on the other hand, have an output/fixed capital ratio only about one-third that of the medium ones; in this case they are very large indeed, but it is striking that output/fixed capital falls

[1] Uncertainty with respect to this data suggest one not speculate too far, however.

much more dramatically for India than for Japan over the comparable range of firm sizes.[1,2]

The story told by Table 12 is unfortunately incomplete in one respect--the relative output/capital ratios for small firms (of, say, less than 10 workers) to the next higher size category. Both the Mexican and the Pakistani data indicate that the most important single dividing line is here, with the small firms having much higher output/capital ratios than all the rest; the Japanese output/fixed investment data suggests that these firms have somewhat (but not greatly) higher output/capital ratios than the next category (though much higher than the totals) whereas the Japanese value added/total assets data suggests that medium size firms (10-99 employees) have substantially higher output/capital ratios than the smallest ones; even this series indicates that the smallest firms have much higher output/capital ratios than the overall average. The Pakistan and Mexico data (Columns 5 and 6) show the usual relation with the smallest firms having an output/capital ratio two or more times that of the next largest group, although

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[1]Since neither the Pakistani nor the Mexican data have categories isolating firms 1,000 and up, it is not possible to say whether they would be more akin to the Indian or the Japanese patterns, but at least the average value added/capital figure in Mexico suggests that the ratio could hardly decrease really dramatically with firm size (unless there were very few firms of very large size). Since the large size plants are very important in Indian manufacturing (they accounted for 65 percent of the value added in manufacturing in 1964--excluding cottage-shop undoubtedly), this provides a hypothesis for India's stagnation--extreme capital intensity of a very important large scale sector.

[2]Though it seems unlikely to be playing a very important role here, it should be noted that the classification by capital would, as pointed out earlier, be expected to lead to a more dramatic decrease in output/capital over firm size than when the measure is number of workers.

[3]The information for Pakistan refers to four industries (textiles, light engineering, plastics, and leather and leather goods); the data was based on a sample survey of 530 industrial establishments carried out in Karachi in about 1960. These four industries comprised about 80 percent of Karachi industrial capacity.

with remarkably little variation in the ratio for firms 6 (Mexico) and 10 (Pakistan) workers on up; only the very small firms have much higher capital productivity than the average. This result does not contradict the Japanese information (Column 5) since the highly productive size groups in Mexico and Pakistan were smaller than the smallest in the Japanese case. In all of the cases presented the output/capital ratio of firms of less than 10 workers is indicated to be at least 50 percent greater than that of the average for the industrial sector as a whole; the uncertainty surrounds the relative output capital ratios of the smallest and next to smallest categories.

The most common explanation of the higher output/capital ratio characterizing small firms is the higher capital price/labor price ratio they tend to face in the market.[1] It is interesting that excess capacity is widely reported in the case of small scale industry, and is usually attributed to lack of either working capital or of raw materials or both; lack of demand is also frequently mentioned. But it is interesting that, despite the long array of "problems," the small scale firm remains apparently an efficient user of capital.[2]

In Table 13 the consistent tendency for large scale firms to have higher capital/labor ratios is clear. All the countries included, with the exception of Korea, show extreme ranges (a minimum of 4:1) between firms over 100 (300 in the case of the Japan "assets/labor" ratio) workers and the smallest size

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[1]Analysts who feel that economies of scale are important, or that larger firms tend to have "better" production functions, would argue that the different price ratio might not be a sufficient condition to generate a higher output/capital ratio--the factor price ratio would have to be sufficiently different across firm size to offset the counteracting effect of the other factors mentioned.

[2]It can be argued that the difficulty of acquiring capital is, in fact, the cause of its high productivity in these firms.

Table 13

Capital Intensity by Firm Size,

Selected Countries

Japan				India:1964		Korea: 1968		Pakistan:1960		Mexico:1965	
						Mining and Manufacturing					
Size # of Workers	Index of Fixed Investment/ Worker (1956) (1)	Index of Fixed Investment/ Worker (1961) (2)	Assets/ Worker (1000 yen) (1957) (3)	Size # of Workers	Fixed Capital/ Worker (4)	Size # of Workers	Fixed Assets/ Worker (5)	Size # of Workers	Real Capital/ Worker (6)	Size # of Workers	Capital/ Worker (7)
										0	4.3
								0-9	0.74	1-5	10.5
4-9	0.32	0.17	69[1]			5-9	.289				
10-29	0.46	0.28	78			10-19	.361	10-19	2.61	6-15	31.5
						20-49	.381	20-49	3.23	16-25	48.6
										26-50	57.5
30-99	0.66	0.55	98	small	1.82	50-99	.391	50-99	3.34	51-75	62.1
										76-100	63.8
100-299	1.21	1.06	181			100-199	.371	≥ 100	4.08	100-250	80.4
						200-499	.567				
										251-500	96.2
300-999	2.00	1.67	362	medium	3.66	≥ 500	.729			≥ 500	104.8
≥ 1000	2.18	2.40	≈625	large	15.41						
Total	1.00	1.00	289				na		3.88		67.9

[1]Firms of 1-9 employees

Sources and Methodology: Cols. (1)-(4), (6) and (7) are from the same sources cited in Table 12. Column 5 is from Gustav Ranis, "Industrial Sector Labor Absorption" Yale Economic Growth Center Discussion Paper No. 116, July 1971, page 32.

group.[1]

The wage differentials (see Table 14) show widely varying patterns across the countries included, which range from quite developed to quite poor. The U.S. and the U.K. clearly form one group (and apparently represent a typical pattern for the developed countries); differentials are quite small relative to the other countries. If, to facilitate cross-country comparisons, we roughly approximate the ratio "wage in firms of 100-250 workers/wage in firms of five workers," the differential in the U.S. and the U.K. would be about 10-20 percent. Japan, India, and Pakistan appear to form another group with the ratio being typically a little less than 2:1, with a rather surprising similarity among the three countries. Mexico and Colombia form a third group, with a ratio on the order of 3:1. On the labor productivity side, the U.S. and the U.K. again show the smallest differential, less than or about equal to 10 percent in each case. Data are not available for India; Japan's labor productivity differential is on the order of 2.5:1 while that of Pakistan appears to be less than the wage differential (note that wages were defined in hourly terms in Pakistan), and perhaps as low as 30 percent. Again Colombia and Mexico stand out with the largest differentials; Mexico's is in this case less than 3:1, perhaps 2.5:1, while Colombia's appears to be the widest of all, between 3:1 and 4:1.[2]

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[1]Shinohara (op. cit. in Hoselitz) distinguished three groups of two-digit industries in terms of the firm size-capital intensity relationship, with food and beverages, textiles, wood and wood products, printing and publishing and rubber products having relatively low association; paper and pulp, chemicals, glass and ceramics, primary metals and metal products on the other hand had a steep curve. Machinery, electrical machinery and transportation equipment had moderately steep curves--all very similar. These patterns are quite similar to those of the horse-power/worker ratio in Colombia, with only a few exceptions. (See Table A-10.)

[2]This figure is somewhat deceptive, in that Colombia's labor productivity--firm size relationship is not monotonic, and the size category 100-199 has the highest labor productivity, unlike the other countries. Also, as pointed out elsewhere, the increase of labor productivity with firm size is overestimated in the figures of Table 1.

Labor Productivity and Wage Differentials by Firm Size, Selected Countries

Japan							India		Pakistan			Mexico		Colombia		U.K.		U.S.A.		
	1956		1961		1957			1909		1955		1960		1965		1964		1949		1947	1958	
Size # of Workers	Labor Productivity	Annual Wage (thousands of yen)	Labor Productivity	Annual Wage (thousands of yen)	Labor Productivity	Annual Wage (thousands of yen)	Size # of Workers	Daily Wage (sen)[1]	Daily Wage of Men	Size # of Workers	Wages Index[3]	Size # of Workers	Labor Productivity	Average Hourly Wage	Size # of Workers	Labor Productivity	Annual Wage	Size # of Workers	Labor Productivity (Indices)	Wage[3]	Size # of Workers	Wage[3] Index	Labor Productivity (Indices)	Wage
															0	6.0								
															1-5	12.3	4.2	> 5[5]	12.5	4,700				
4-9	212	91	343	144	186[1]	114	4-9	34.2[2]	43.0[2]			0-9	0.86	58	6-15	19.8	8.1	5-9	14.5	5,981				
10-29	262	116	439	189	289	136	10-29	33.2	46.0	10-19	47	10-19	0.85	76	16-25	25.7	10.9	10-19	17.2	6,740	10-19		84			
										20-49	51	20-49	1.18	89				20-24	23.7	8,295	20-49	92[4]	83			
															26-50	28.5	12.2	25-49	25.8	9,316						
30-99	345	140	579	223	386	152	30-49	31.7	47.7						51-75	30.0	13.6	50-74	33.7	11,205	50-99	94	84			
							50-99	32.5	49.4	50-99	55	50-99	1.40	96	76-100	31.7	13.9	75-99	31.8	11,182						
100-299	498	172	759	250	518	177	100-499	34.0	50.5	100-249	72	≥ 100	1.13	100	101-250	36.5	15.6	100-199	51.2	14,013	100-199	96	85			
										250-499	86															
300-999	704	218	1,042	299	741	218	500-999	32.5	49.5	500-999	88				251-500	44.0	17.6	≥ 200	46.9	16,101	200-499	97	86			
															≥ 500	48.7	20.0				500-999	98	87			
≥ 1,000	810	295	1,485	392	≈950	≈310	≥ 1,000	34.4	53.5	≥ 1,000	100										≥ 1,000	100	100			
																			≈35.0	≈12,000						
Total	462	171	805	258	516	194							1.14	80												

1. 100 sen = 1 yen.
2. For firms of 5-9 workers.
3. No reference to whether daily or annual.
4. Firms of 1-9 workers.
5. Less than 5 workers but ≥ 24,000 pesos value of production.

Sources - Table 14

For the years 1956, 1957 and 1961, the Japanese data are from the sources indicated in Table A-12. The 1909 data comes Shinohara, op. cit., page 311.

The data for India, the U.K. and the U.S. (1957) comes from Hoselitz, op. cit., page 147. The Pakistani and Mexican data come from sources cited in Table 12. The Colombian data comes from Table 1.

[The U.S.A. (1958) data come from Broadbridge, op. cit., page 51].

Consistent with the cross-country comparison of wage differentials by size is the evidence of a recent dimunution in the differential for fast growing Japan; according to Shinohara,[1] the decrease has been substantial since 1951; in 1965 the wage in category 4-9 was about 52 percent or 53 percent of the "1,000 and over" category, where in 1951 it was 42.3 percent.[2]

Sumiya noted, with respect to 1960, that the wage differential by size of establishment in Japan was large only for the older workers, and was quite small for workers of less than 25 years of age; this hypothesis is of general interest

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[1] Miyohei Shinohara, Structural Changes in Japan's Economic Development, Kinokuniya Book Store Company, Ltd., Tokyo, Japan 1970, p. 308.

[2] Shinohara makes the interesting speculation, on which virtually no information is available, that today's LDC's may have had their large differential only since World War II. (P. 312.) But in Japan of 1909, when the overall figures showed no differential between the 5-9 and the 1,000 and above groups, there was a 24.4 percent differential for males only across the same categories By 1914 when an overall 9.9 percent differential had appeared, the differential for males was 38.8 percent. It may have been that widening differentials were occurring at this time even with most variables normalized for; in any case it is clear that the 1909 data does not provide evidence that differentials were ever absent if age, sex, etc., had been normalized for. (See Shinohara, p. 311.)

The overall differential has fluctuated considerably over time in Japan, and its sources have received much discussion in the literature. In 1909 an overall firm size differential was not apparent though, as noted above, there was a differential for men taken separately; by 1925 it was noticeable and by the outbreak of the second World War still larger. The large firms tended to choose young and adaptable (particularly important when change and growth were rampant) people and pay them well--especially when the pattern of using rather systematic increases over the worker's career is taken into account; they selected the best young workers for permanent jobs--permanent until the comparatively early retiring age in Japan.

Nakamura explains the widening differentials at the end of World War I as due to the fact that big firms in heavy industry were obliged to employ skilled workers under the lifetime commitment system and when prices fell (1920-31) equilibrium wages fell in the smaller industries but were constrained by the previous commitment in the larger ones.

but seems to remain open to question in the Japanese context.[1]

Differentials in the Cost of Capital and in the "Wage/Cost of Capital" Ratio

Differentials in the cost of capital, or the price of purchase of capital goods--has received much less attention on a cross-industry or cross-firm size basis than have wages--the price of labor.[2] Data complexities again plague interest rate comparisons, since care must be taken to include all the hidden components of the total interest charge. One study in Japan found an interest rate differential of 11.5/17.4 for corporations with capital over 100 million yen compared to the ones with capital below 2 million yen. This probably understated the differential.[3] Putting this differential together with the wage differential

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[1]The ratio of wages in firms of more than 1,000 employees to wages in firms of 10-99 was 1.76, the ration was only 1.11 for people 18-20 years of age, and 1.28 for people 25-30 years; it was 1.77 for the age group with the widest differential, 40-50 years. Sumiya concludes that the fact that the overall differential is as high as that of the "widest differential" age means that in the large firms the proportion of older workers (with relatively higher wages) is greater. Thus if age were normalized across firms, he concludes that the differential would have only been 20 percent or so. Shinohara notes, however, that Sumiya considered only regular wages and when bonuses are included there may be a much wider differential by size. (The figures presented also apparently include temporaty wages.) Expenses for welfare facilities, and such items are apparently three times higher in large than in the smallest firms. The wage factor is, in any case, hard to interpret in Japan, since newly employed workers in large firms are primarily under a lifetime commitment with a steeply rising wage curve as a function of the length of their service while the workers in small enterprises are in a rather unstable condition as a result of the menace of firm bankruptcy, so the wage curve is not as steep. Even at age 18-20, the "permanent income" of the large firm employee may be much farther above that of the small firm worker than the figures indicate.

[2]As has become clear already, however, the substantial attention to the wage differential issue has not yet thrown too great light on the extent to which different firms pay different amounts for the same quality labor. So in fact the situations are not so asymmetrical as might at first appear.

[3]This study is referred to in Shinohara-Hoselitz, op. cit., p. 52. It is noted that the understatement may be due to the fact that the calculation was made by dividing interest paid on "total borrowing plus debentures" by companies; but in Japan it is customary for banks to retain a considerable part of a loan as a deposit, with this ratio being higher for smaller businesses.

found in the corporate enterprise survey, Shinohara concludes that the "by size" differential of the interest rate/wages ratio was 100:26. (This study refers to a postwar year--unspecified.) Another study indicated that the by size difference in the ratio at which loan applications were accepted was substantial, that ratio being over twice as high for firms of 200-299 workers as for firms with 5-29.

In a study in India it was reported that small firms pay as much as three times what large firms pay for power, the price being particularly high in rural areas where they are often encouraged to establish themselves. In general there appears to be a raw materials problem, which leads to excess capacity in these firms.

Scattered Evidence on the Growth and Change of Small Firms

A rather comprehensive study of the development of technology in small plants in Japan[1] indicated that the increasing use of electricity permitted small industries to employ electric motors instead of steam engines, and that the trend toward mechanization then became decisive. Technical progress in small plants was found to be more marked in the producer goods industries than in the consumer goods industries, in the export industries than in domestically oriented ones, and in mechanized industries than handicrafts. It proceeded much more rapidly in the six big cities than in local or rural areas and in implanted industries rather than indigenous ones. The postwar dissolution of the zaibatsu and the increasing competition among big firms led to greater pressure on the subcontracting small and medium plants to advance their technological level. The persistent existence of the putting out system in the prewar period had deterred the dissolution of petty handicrafts and stagnated technical progress in small-medium industry, but its weakened position after the war made capital accumulation and equipment improvement possible in this size range. Increasing labor costs were a factor and public policies toward small-medium enterprises were more comprehensive in the postwar period; from the 1920s on financial

[1]Referred to by Shinohara, op. cit., p. 58, reference in Japanese.

measures were introduced to save small industry during crises and in the postwar period the small-medium enterprise agency and the few small business financial institutions were set up. These may have contributed to the acceleration of technical progress.

Relations Between Large and Small Firms

In Japan especially, the relationships between smaller and larger firms have been the object of extensive study. The prevalence of sub-contracting and its presumed importance in explaining the relatively large role of small-medium industry at present in Japan raises the hypothesis that the special characteristics of the Japanese case would make such close ties between small and large firms difficult to duplicate; and it might be difficult to duplicate the relative success of the small firms without it.

Many of the small firms have been and are complementary to the large ones in Japan. While the heavy reliance of big companies on sub-contracting does exist elsewhere, the Japanese economists have argued that it rests on different economic and social foundations in Japan. Many of the older workers of the large plants establish their own small enterprises when they retire, producing or processing parts for their former employers. The large companies have always been

willing to give contracts to many tiny, small and medium-sized units.[1]

The employment conditions of the temporary and sub-contracted labor are completely different from those of the regular labor force of the large firms--the only ones really characterized by the paternalistic welfare state image frequently drawn for Japan. There is little or no flow of labor from the small firm to the large--except for temporary or sub-contract employment--but a considerable flow in the opposite direction. There is often heavy turnover in the small and medium firms, though not generally as a result of dismissals. At an earlier time small firm labor was more or less forced to be mobile. An important form of rural exodus of farm labor was into household income supplementing activities, as in the case of female workers in textiles, etc. Such employment rose in prosperity and fell in depression, with people then returning to the villages. This labor was highly mobile and lacked a permanent attachment to one enterprise; one result was that inter-firm or inter-industry trade unions could not easily be set up. It is generally agreed that there is a large enterprise labor market and a small enterprise labor market, with insufficient mobility in considerable part because of the existence of strong enterprise

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[1]The story (see Broadbridge, op. cit., p. 69) of how a subordinate subcontractor producing for the large vehicle producer Isuzu got started is indicative. Although the company used mutual loans and bank funds for investment, one-third of its loans were guaranteed by Isuzu. The individual started his business on the basis of a verbal statement of the larger company that it would give him contracts. In spite of heavy borrowing the company remained dependent on Isuzu for the loan of some of the more expensive machines, with the right to purchase after a few years. This machine-renting system presumably has advantages for both companies--it gives the assembler some control over the kind of machines used in the smaller company and makes technical assistance to it easier and more effective. (The accelerated depreciation tax system gives the big firms a big incentive to get rid of their machinery quickly in Japan.)

Typically a firm like this one, subcontracting for a very large one, would have still smaller subcontractors working for it. The inter-firm flows are quite complex.

unions in the large enterprises.

Shinohara says[1] that before the Second World War, from the point of view of the larger firm, the purposes of using the subcontracting system were to avoid the dangers of economic fluctuations and to indirectly utilize cheap labor. the big corporations were not seriously concerned with how to reorganize or rationalize the production process of their subordinate enterprises; since the war, however, with new technology from abroad being introduced at an accelerated rate and interfirm and international competition intensified, this upgrading has become an urgent problem and has received much attention from the large firms.

An interesting explanation of some subcontracting is that the very small scale plant does work which is too intensive and dirty to fit into the operations upon which the larger plant concentrates--the contrast of general working conditions would be too great.

Kitihara analyzed the competitive and complementary nature of small and large, according to whether there was competition, vertical interfirm hierarchy, or indirect donation of monopoly capital.[2] He found that in the textile industry technical progress in subcontracting plants tremendously surpasses that in non-subcontracting plants. In the postwar period there has been a great decline in the position of merchant capital in response to the increase in the supremacy of industrial capital in financing the small scale operator.

The inter-firm size flows for 1951 (see Table A-14) are interesting in showing the importance of the large firms as a source of inputs for the small ones, but the much smaller importance of the small firms as a source of inputs

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[1]See Miyohei Shinohara, A Survey of the Japanese Literature on Small Industry, in Bert F. Hoselitz, The Role of Small Industry in the Process of Economic Growth, Moutont Co., The Hague, 1968, p. 17.

[2]Shinohara, op. cit., p. 75.

for the large ones. Much more of small firm output (44.9 percent) went to final demand than of large firm output (25.5).

IV. Policy Lines Toward Small Scale Producers

The existing industrial structure, the potential of larger scale industry, and the changing demand composition of the population all affect both the optimal and the actual extent and nature of small scale industry. With respect to each type of product the increasing availability of capital should make possible a gradually increasing capital/labor ratio and this is likely to be associated (at least it has historically been associated) with larger scale firms; the optimal rate of this transition obviously depends on the nature of technological change as well as the increasing availability of capital, in particular on whether those changes tend to increase more the potential productivity of large scale or of small scale firms. For many reasons, the "actual" size distribution of firms or plants may not follow the same path as the optimal distribution, so the displacement of handicraft by factory production may lag or lead the optimal, as may the decrease (if it occurs) in the importance of the small scale factory relative to the larger one.[1]

Among the important trends in the structural change in industry in Colombia are (a) a probable decrease in importance of small scale plants within the factory sector;[2] (b) overall, a probable decrease in both relative and absolute

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[1]There is little issue in the literature as to whether handicrafts are displaced in development; but specialists note that small scale factories do not necessarily suffer any relative decline. See Staley and Morse, op. cit.

[2]As observed earlier, the data are not yet available to ascertain whether there has been increasing concentration in large firms over the post-1953 or post-1956 period; but it seems probable that some increase has occurred.

terms of employment in the cottage-shop subsector over a period including 1938-51 (with a particularly dramatic decrease in the number of women in cottage-shop industry during the 40s and early 50s) followed apparently by a leveling off or increase in the late 50s and the 60s; (c) a substantial long-run decrease in the importance of rural cottage-shop production and a rapid increase in urban production; finally, (d) substantial shifts in the two digit composition of small scale production, (especially cottage-shop but also small scale factory), sometimes associated with its displacement by large scale producers.[1]

In the structuring of a policy toward small scale factory and cottage-shop production, one must take into account: (1) the size of the small scale subsector in a given industry in relation to its optimal size; (2) the projected future trend of the optimal share of small scale producers in the industry;[2]

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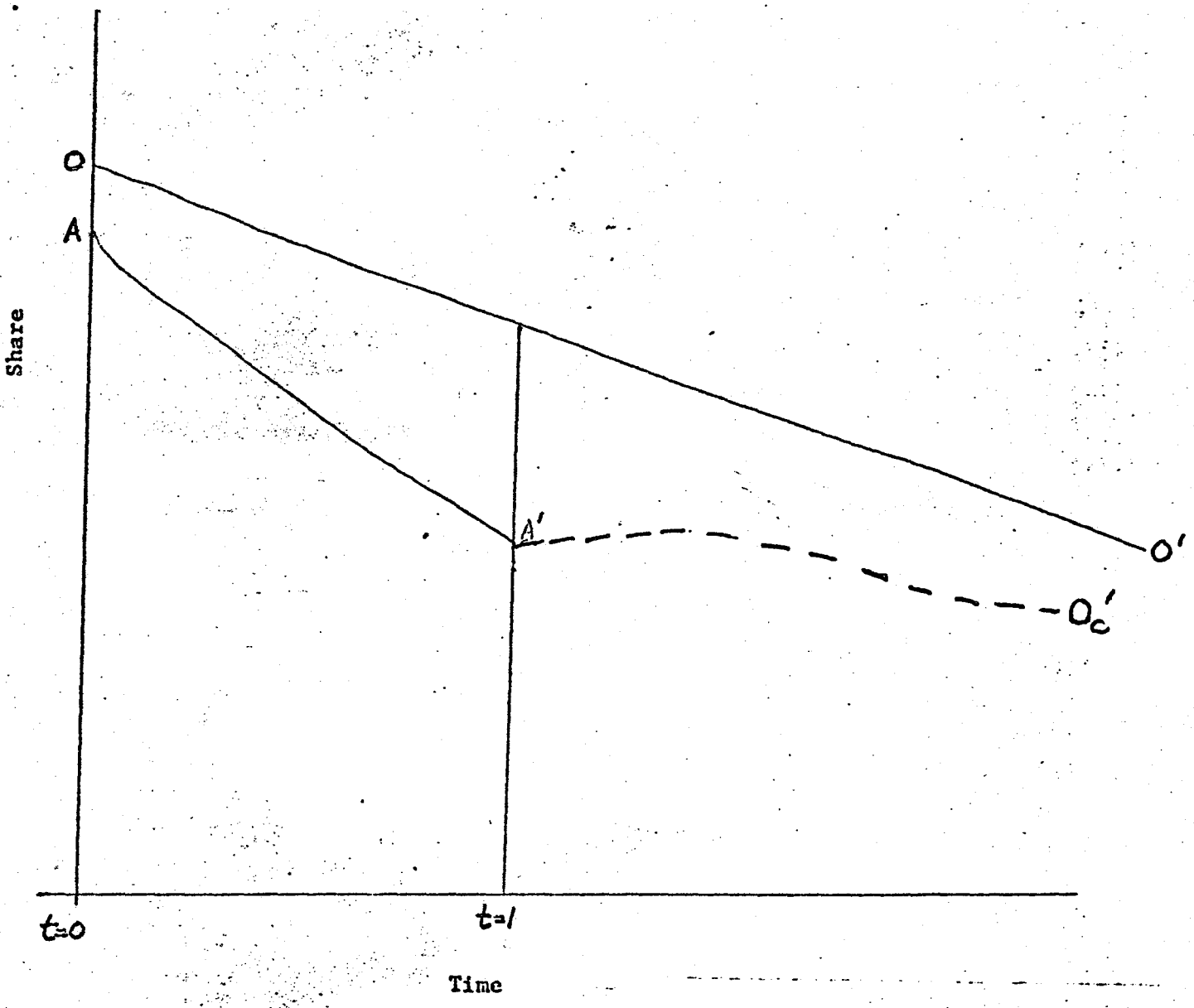
[1] e.g., declining importance of clothing-footwear and rapid increases in transportation equipment, wooden furniture, and other subsectors.

[2] Consider Diagram 10, representing the situation of a product which will, optimally, be increasingly produced in large scale plants as development proceeds, either because there are economies of scale in the production process itself, or because of the greater ease of organization in larger plants when the capital/labor ratio is high (organizational economies of scale). The optimal share of production in small scale plants is given by the curve 00'. Suppose the actual production in the small scale sector between t=0 and t=1 is shown by the path AA'. Then the policy question at point of time t=1 is how much (if at all) and by what steps to move actual output closer to the long run optimal output.

Since the optimal path for any such economic variable from a given point in time on is generally affected by its historical path, the only unequivocal way of defining the path of the optimal small scale share over time involves the assumption that no policy mistakes are made at any point in time. And it does not follow from the fact that the actual share is below that indicated by 00' (indicating that mistakes have been made) that policy should be directed to raise the small scale share to the optimal level, so defined. One must consider a conditional optimal path starting at t=1--conditional on what has already happened. (e.g., the dashed line $A'O_c$); it is probable that this optimal curve will never touch 00'; especially in situations where the long range trend of the optimal path is down, and where there are substantial costs to revitalizing the small scale sector, the short period over which gains can be reaped may make large

Diagram 10

Optimal and Actual Paths of the Small Scale
Share of Production-Employment



(3) the best policy steps to move the production and employment in the small scale sector toward the optimal level where "optimal" presumably takes into account whatever criteria are relevant for the decisionmakers, including maximization of total output, improvement of income distribution, employment, etc.

The optimal share of the small scale sector in the output of a given product depends both on the technologies available for small scale production and also those available and/or typically used in large scale production, with particular importance attaching to the feasible range of the capital/output ratio in the large scale sector and possibly its skilled labor/ output ratio.[1]

If it may be assumed, as seems plausible, that the small scale sector should receive positive attention (to expand it or prevent encroachment by the large scale) then a number of points are worth making in the formulation of a strategy to improve its situation. First, different scales of production will be appropriate in different industries. It is characteristic of the clothing and footwear and the textiles subsectors that a high share of all cottage-shop production is by independent workers; a high share (perhaps around 50 percent) characterizes the wooden furniture branch, and a lower share (perhaps a third) the food subsector, with this component being smaller for most of the rest of the small scale industries, among which are found those with probably greatest promise

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Footnote 2 continued from p. 80.

organizational and infrastructural expenditures inadvisable, even though they would have otherwise been appropriate. And in the short-medium run, of course, competing large scale industry will be disposed (if forced) to sell at variable costs--as opposed to the total costs which it would take into account in setting up production--making survival in the short run more difficult for a rapidly expanding small scale sector.

[1]This is important in evaluating the potential for the natural alternative method of achieving higher output capital ratios--trying to encourage large scale firms to be more labor intensive.

for long-run growth.[1] Policy required to deal with independent workers, firms with a few--say three or four workers--and those with say five to twenty-five might well be quite different.

Secondly, it is important to analyze carefully the reason for the superiority of small scale production in certain lines in order to assure that the impact of policy is not, at the same time that it benefits small scale producers, to make them less efficient from a social point of view. One reason, for example, for the good output/capital ratios may simply be the high price of capital; a credit policy which lowered this price might lower their social efficiency.[2]

Third, policies whose primary objective is to increase the number of firms and those whose primary objective is growth of existing firms could be quite different, and this is an important question of strategy. An aspect of the policy of increasing the number of firms involves avoiding the failure of firms which start out and collapse for "artificial" reasons--artificial in the sense that they do not imply productive inefficiency on the part of the firm.

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[1]For the sectors not mentioned, taken together, the ratio of independent workers to all cottage-shop workers is about 30 percent. The transport equipment sector has only a little over one-fifth of its cottage-shop total as independent workers. It appears that the independent worker tends to be a creature of the production of consumer goods (although machinery is a not insignificant exception) and of older technologies; but more in-depth analysis would be necessary to defend such a relationship.

[2]The issue is, of course, more complicated than this may imply but the general point should not be disregarded. If the capital market can be correctly described as dualistic, improving it would involve raising the price of capital to large firms and lowering it to small ones; the natural result of this would be raised output/capital ratios for the larger firms and lowered ones for the small ones, there is likely to be gain of overall effiency of capital use. In other words, there is loss of overall efficiency when a small firm O/K ratio falls towards the average as part of a redistribution of capital which also raises a large firms O/K ratio towards the average.

Some Expert Judgments on the Role of Small Scale Industry in LDC's

Before turning to aspects of small scale development more or less specific to Colombia, it is worth noting briefly the general attitude of students of small industry to its future role, and the reasons for their beliefs. Staley and Morris[1] observe that over time the outlook is for artisan industry to be transformed, household industry to be replaced and small but modern factories to be developed.[2] Artisan opportunities will be no less in the modernized economy but they will be different so that government policy should stress adaptation of the artisan to the newly emerging conditions. Household industry has many drawbacks but some measures are appropriate for making use of it during a transitional period. There is some predictability in the kind of product which small factories are gradually able to undertake successfully so experience of other countries can be useful.

In the latter part of the nineteenth century both liberal economists and

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[1] Staley and Morris, op. cit. p. 23.

[2] Staley and Morris distinguish small industry in terms of its relatively low specialization and management, close personal contacts, handicaps in securing [illegible] capital and credit, and large numbers of such units--this latter implying different development techniques--and the large group techniques especially used for small industry development. (Eugene Staley and Richard Morris, Modern Small Industry for Developing Countries, McGraw Hill, New York 1965.) They distinguish modern from the traditional small industry in terms of output, product and product design, physical technology of production, and social technology of organization and management. Another key distinction is that between non-factory and factory forms of small industry.

The factory is distinguished from artisan industry by a greater division of labor and production and as a result the manager rather than the craftsmen or artisan is the central figure. The intermediate putting out system has considerable importance in newly industrializing countries and its remnants or special aspects exist in highly industrialized countries.

Although relations are far from close, the authors suggest that industrial firms with as many as 100 employees generally require a substantial amount of specialization within management and therefore this figure is a reasonable upper limit for small industry. In the Colombia study carried out by the Stanford Research Institute, the authors observed that the beginnings of specialization in management could be seen in a number of firms of 35-40 employees and more in firms of 65-75. (See Stanford Research Institute--Small and Medium Industry in Colombia's Development, Banco Popalar, 1962, Bogoa.

Marxists expected progressive elimination of the artisan by factory competition; these predictions have proved false, with this group actually showing a long-run increase according to evidence from a number of industrialized countries.

While the artisan in industrially advanced countries has been pushed out of the production of shoes, ceramic wares, textiles, eating utensils, furniture, and tools for farmers and mechanics, there have been expanded opportunities for repairing these articles; installation opportunities, frequently coupled with sales, fall in the same category. New products and technologies and changing income distribution have brought new sources of employment.

In Germany where artisanry has been well organized since the middle ages (and for which there are very good statistics) there has been a long range upward trend in the number of artisans per 1,000 inhabitants. For a long time the competitive struggle was the dominant relationship between artisanry and industry, but there is now a basically mutual complementarity.

The optimistic predictions with respect to small factories are based to a large extent on the history of these in the developed countries. The share of small factories in manufacturing employment demonstrates a surprising stability since the first World War in most of the industrialized countries, including the U.S.[1] The authors suggest that for present day LDC's one might expect that for a variety of reasons the large factories would develop ahead of small ones; at this stage there is an excluded middle until indigenous private enterprise itself turns to modern small scale manufacturing. And until this happens the efficiency of the whole industrial complex suffers.[2] In such situations the small factories

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[1] See Staley and Morris, Figure 2.

[2] It is interesting that in West Germany, U.K. and the U.S. the percent of manufacturing employees in firms of less than 100 employees is around26-27 and the percent of manufacturing output around 23; one might hypothesize that there is a sort of equilibrium level to which the relative labor productivity in small factories (vis a vis large ones) approaches as development proceeds. In no case is value added per worker much below that of large industry for the particular developed countries shown.

can be expected to gain an increasing share of output and employment over time and they should wind up with a bigger role that that currently played in the highly industrialized countries.

The policy maxims of these authors are to promote modernization, selective growth, management improvement, technological improvement and complementarity, in the different types and sizes of industry. They argue that government policy should neither reward nor penalize smallness as such; special concessions should be approached with caution. Major types of developmental measures begin with the management improvement triad of (a) industrial counselling services, (b) training for entrepreneurial managers and supervisory personnel and (c) industrial research services.

One mistake to be avoided is the introduction of obsolete crafts, as in the case of handloom weaving in Ceylon in the 30s. In Equador a 1953 "law for the defense of the artisan" shields him from taxation and in so doing discourages him from enlarging his enterprise or mechanizing it, either of which could cause him to lose the exemption. The vocational and adult training system in Ecuador helps to perprtuate the poverty of the artisans by producing each year hundreds of people to enter already depressed fields such as dress and shoe making, while training few or none in the expanding fields like radio repair, typing, and hairdressing.

An occupational advisory service closely connected with the office responsible for general manpower planning could perform the function of steering individuals toward the expanding sectors. There is usually a real shortage of people to repair radios, pumps, etc., in many rural areas of developing countries. A counciling service should be useful with respect to these service trades.

Experience shows that the weakness of many artisans who work alone or operate a small shop is not so much in technical proficiency as in the finding and management of their enterprises.

A promising avenue for moderate numbers of artisans is artistic handicrafts; even in generally poverty stricken countries like India the increasing urban incomes create a substantial demand. Both artistic sense and quite good business--especially marketing--sense are required here. Many countries have ruined promising export opportunities by things like flooding a particular market or by supplying poor quality goods.

It is a moot point the extent to which traditional craft skills are helpful in the shift to factory production; the concensus seems to be that there is not much carryover for traditional artisan skills and the artisan may even be worse off than the farmer since he has more to unlearn.

The history of industrial development in England, Europe and America shows that artisans, especially master craftsmen who are already small entrepreneurs, were an important source of entrepreneurial talent in the development of the factory system, perhaps next in significance after merchants. There is evidence that this group is an important source at present in the LDC's also.

Promising Sectors for Small Factory Growth, as Judged by Patterns in More Developed Countries

Hopefully some feel for the path of optimal small scale share in various sectors of production is provided by the statistics from more developed countries. To choose likely candidates for small scale expansion, it is necessary to analyze at a disaggregated level, but broad patterns are still of some interest. Table A-15 shows the share of small factories (here defined as establishments with 10-99 employees) in total factory employment in a selection of countries; while the

figures include what would be more appropriately called medium sized factories in Colombia, they are somewhat indicative. A comparison of Colombia's small-medium share with that of other countries indicate a few sectors in which Colombia is well below the median country (Colombia is at about the median level of income of the set of countries included); these are beverages, furniture and fixtures, leather and leather products, and textiles. The relative importance in Colombia of the small-medium sector is above the median in a few industries, especially in tobacco products and fabricated metal products.

In a study referring to Latin America, ECLA notes that the small scale producers' (here meaning plants of say 5 to 25 or 5 to 50 workers) contribution to total factory employment and value added is consistently important for food, wearing apparel and footwear, wood and cork, furniture and fixtures, printing, publishing and allied industries, non-metallic minerals, and metal products.[1] Chemical products and transport material are also sometimes quantitatively important. Typically quite unimportant are tobacco, textiles, pulp and paper, rubber, petroleum products, and basic metals. Small scale industry's contribution to employment and value added seems to remain stable or grow as development progresses in printing and publishing, metal products, and machinery. For furniture and fixtures it seems to decline sharply in the more developed countries according to this study. Labor productivity increases notably with firm size in beverages, tobacco, pulp and paper, chemicals, non-metallic minerals, and basic metals, while tending to be independent of size or in some cases diminish in textiles, wearing apparel and footwear, wood and cork, furniture and fixtures,

[1] See "Small Scale Industry in the Development of Latin America," Economic Bulletin for Latin America, Vol. 12, No. 1, May 1967, United Nations, New York, 1967, p. 69.

leather and hides, and transportation equipment.

The similarity of the patterns in Colombia with those referred to as typical for Latin America as a whole are striking. The share of small-medium plants in factory employment is already high in Colombia in the three sectors cited as ones where that share typically remains stable or grows with development, i.e., printing and publishing, metal products, and machinery.

Alternatives for Improving the Perspectives of Cottage-Shop and Small Scale Producers

What policy initiatives would best permit the economy to take more advantage of underutilized potential in the small scale sectors? Among the candidates are the following: (1) more credit, (2) relieving problems of technology, difficulties of ascertaining the best production process and other aspects of organization, and adaptation, (3) improved management capacity and training, (4) improved infrastructure, i.e., electricity, etc., (5) better markets.[2] Problems of factor and product market conditions are frequently referred to in surveys of small scale industry.

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[1]To some extent, though not entirely, this is the reverse side of the coin from "what problems do small scale producers have?" The two are not the same since some of the problems of small scale producers may in fact have no resolution. This could be the case re the frequently mentioned "lack of demand" that some producers face; if in fact there are not many alternative lines for small producers to go into, or existing lines are not growing, they may crowd heavily into monopolistically competitive sectors where the addition of a new producer reduces the demand for and output by other producers, so that all perceive a situation of "lack of demand." Other problems, too, may have something of this element in them, e.g., "lack of credit"; when credit is given at subsidized rates, many people feel that it would be better to have more but this "need" may have no meaning in an aggregate sense since there is simply not enough credit to go around without creating inflation.

[2]Where a marketing problem is defined as a situation in which a potential market for a firm's product exists, but for some reason it is difficult to get access to that market, or where the raw materials needed exist, but it is difficult to get them.

Another way of classifying approaches to the strengthening of small scale production is to distinguish (a) policies to promote the growth of promising existing firms, (b) policies to prevent firms going out of business, and (c) policies to promote an increasing number of small scale firms.

Finally, one may distinguish policies which focus on weaknesses in government policies (infrastructure, etc.), policies which focus on difficulties in the firm (technology, management, etc.), and policies which focus on problems in markets, by which one might broadly include the problems the small firm may have in competing with large scale oligopolists or near monopolists, the lack of complementary relationships between small and large scale firms, etc.[1]

Opinions have varied with respect to which are the most important obstacles and potential areas of improvement in terms of benefitting the small scale producers. In a major study done for the Banco Popular in the early 60s, the Stanford Research Institute analyzed the potential of small and medium industry.[2] The study classified industries both according to growth prospects (metal products, transport equipment including repairs, chemicals and chemical products, machinery including repairs, clothing and footwear, and food products

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[1]Note that, at least judging from the statistics available from 20 years ago in Japan, the interrelationship between large and small firms was sufficiently significant so that if large firms preferred neither to buy from nor to sell to small ones, this would have directly affected up to 35-40 percent of the output of those firms (calculated crudely as the sum of inputs purchased by small firms from large ones and the sum of outputs sold by small firms to large ones). The total effect could be greater or less than this, depending on whether the same firms bought from and sold to large ones, and on indirect effects.

[2]Stanford Research Institute and Banco Popular, Small and Medium Industry in Colombia's Development, June 1962. Their definition of small industry was firms with 10 or more workers and assets of less than 500,000 pesos--at that time the official exchange rate was between 7 and 9 pesos to the U.S. dollar; medium industry was defined as firms with less than 100 persons and assets of 500,000 to 2 million pesos. This particular sub-set of industry had grown rather rapidly in the period 1953-1959 but still accounted for a minority of all people engaged in the industrial sector at the time.

came out highest--see p. 39) and according to "priority for development assistance" which allowed also for importance in the development process but which includes basically the same list of industries plus non-metallic mineral products and electrical machinery and apparatus.[1] The majority of the 120 firms interviewed had quite high growth potential, and the study in general supported the conclusion that Colombia was not short of good entrepreneurial talent at this level. At the same time the importance of a development assistance corporation to specialize in general and specific help on production and financing problems was felt to be very important. Shortage of finance itself was said to be the key problem for many of the firms; for example, of the 70 firms judged to have great growth potential, about 60 percent were thought to be capable of expanding with financial assistance alone. Overall, the picture drawn was one of great potential; many firms would be able to progress substantially just with credit,[2] while at the same time some form of technological assistance would also be quite productive.

In general it was felt that growth prospects were a negative function of current size so that small firms with assets of less than 200,000 pesos had less potential; the authors noted that most of the high potential growth firms in percentage terms were, nevertheless, likely to be found in this category.

This Stanford Research Institute study focussed on the small and medium factory sector--not on household or artisan industry (in the sense of Staley-Morris). It should thus be born in mind that these conclusions do not refer to firms of below say 10 or 15 workers, the category on which we have placed much emphasis here.

The ILO mission felt that there were three chief obstacles to the development of small scale industry (by which term they referred to the 5-200 workers category).[3] Most important was the lack of access to credit, especially for working capital.

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[1] Op. cit., p. 41.

[2] This conclusion must be tempered by the fact that when credit is sufficiently subsidized, some inefficient firms would be able to grow and prosper if they could get enough of it.

[3] See ILO, A Program for Full Employment, Geneva, 1971.

Second was the need for technical assistance, especially in the choice of technologies, in management, and in organization. Finally, the need for assistance to help small entrepreneurs identify the lines of activity which would fit the development needs of the economy was cited. The last two points, they felt, could become the responsibilities of some agency specialized in the problems of small industry; while SENA has contributed in the question of technical assistance on management techniques and organization, they felt that much more is needed in this respect. The mission strongly supported the idea of an institute of technical assistance to small industries.

Planeacion, in its survey of small-medium industry[1] also concluded that credit was the most promising route to help the sector.

A survey carried out by Acopi ascertained the felt needs of small and medium producers. The most frequently cited need was working capital (over 70 percent of the firms), but this is frequently a deceptive response, as is the second most frequently mentioned "high cost of production." "Sales" was third and each of "organization," "transportation," techniques of production," and "skilled personnel" received between 35 and 42 percent response as problems. The results of this survey are very difficult to interpret as a result of lack of precision in the questioning.

Existing Institutions of Relevance

A number of organizations dot the scenario of small scale industry in Colombia, but overall there is little evidence that they have constituted much of a force in its favor. It is perhaps useful to classify the institutions into (a) basically credit givers, (b) organizations mainly involved in research

[1] Planeacion Nacional, El Desarrollo... op. cit.

and extension, and (c) pressure groups. Various combinations of these functions may characterize specific organizations, but most tend to fall primarily in one category.

Credit Institutions

The major sources of credit to this subsector have been discussed at length in Planeacion's study; in 1969 these loans were estimated to be 460-600 million, of which 200 million were from official institutions,[1] 90 million was from the financial corporations, and 270-460 from the private commercial banks. While the availability of credit remains much inferior for the small and medium industry to that of the large, it appears to have improved markedly in the last 5 years with the creation of the Fondo--now the biggest source of official credit for small and medium industry--and the replacement of the Banco Popular's role in this regard by the Corporation Financiera Popular.

It seems safe to say that, at least up until 3 or 4 years ago, the banking system as a whole gave short shrift to the budding small scale producer. The problems are demonstrated in part in the rather abortive histories of two programs designed to benefit small scale industry--that of Banco Popular, and the Caja Agraria's small industries program. The Banco Popular was founded during the Rojas dictatorship, and had at that time something of a popular image--an image which subsequently waned.

While the distribution of its credit has been different from that of the

[1]Of the 200 million of official credit in 1969, the 3 major sources were the Corporation Financiera Popular (56.6 million), Fondo Financiero Industrial (105 million, corresponding to a total generation of new loans of 161 million via the 2/3-1/3 system) and the Caja Agraria (54.7 million).

commercial banks as a whole, the term "popular" is misleading with respect to this bank, whose mentality has unfortunately never differed significantly from that of the regular commercial banks in terms of either function--to loan in a profit-making way to bankable projects or individuals without taking into consideration the productivity or distributional impact of the loans--or banking technology--essentially an accounting technology which focuses more on the insurance provided by the assets of the firm against any loss on the bank's part than on the productivity which the loan may have to the individual or society, as measured by the worth of the project, the quality of the manager etc. When the Rojas government terminated, the other large banks wished to have an end of the Banco Popular but Alfonso Lopez, Sr., argued strongly against this; the Banco de la Republica made a large loan to the Banco Popular and gave it such special conditions (no taxes or required payment of dividends, no forced investments, etc.) that it could hardly fail as a bank. But, as mentioned above, its "popular" image has waned.

The Caja Agraria's program represents the oldest attempt of the official institutions' to help small and medium industry--in this case especially industry related rather closely to the agricultural sector. It began in 1964, supported by AID, with the goals of improving productivity, keeping the rural worker in the country, and helping industrial decentralization. One condition of most of the loan program is the acceptance of direction from the Caja in the use of the credit.

The Caja program has been promising in some respects. Eleven percent of all firms in the medium and small sectors were attended by it in 1969; an estimated 13 percent of the loans went to firms of less than 5 workers. But total

loans from the program have decreased in real terms from 1965 to 1969, a rather inauspicious trend considering the founding was only in 1964. Both the number of advisors and the resources allotted have apparently been limited.[1] Yet the program seemed to show promise in a number of respects.[2]

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[1]Planeacion, op. cit., p. 64. The Caja program has had a problem with bad debts, one source of its reputation as a somewhat unsuccessful program, and presumably of its scaling down over the years. Some observers feel, however, that his relatively unsuccessful experience is not necessarily generalizable, due to the small range of types of industries (largely processing of agricultural products), and may be partly explained by the perhaps less than average skills of the entrepreneurs who go into these lines; the firms are frequently located in rural areas and small towns, where entrepreneurial talent for small and medium scale industry may be more limited than in the larger cities.

[2]An analysis of the program (see E. D. Coolige y Otros, Informe Sobre el Programa de Credito Industrial Dirigido, Caja de Credito Agrario, Industrial y Minero, Bogota, febrero, 1969) shows the typical pattern--good growth potential of many firms, and none for others. In a sample of 178 companies very successful overall growth seemed to be occurring; the average employment growth was 9 percent, sales 19 percent, profits 17 percent; fifty percent of the companies showed a strong growth potential. But about 20 percent did not grow or decreased in size.

Since they are beneficiaries of a credit program it is to be expected that this set of firms perform somewhat better than appears to be the general case for small firms; the results may be interpreted as suggesting that expansion of credit programs would pay off very well.

A study of the Caja's smaller "under 20,000 pesos" loan program throws a little light on how typical or atypical the recipients may have been. This study (see Frederick C. Riebe, Analisis del Programa de Prestamos Industriales Menores de 20,000, Caja de Credito Agrario, Industrial y Minero, 1970) showed that in 1969 the users had an average of 2.7 obreros per firm, and average net sales of 58,000 pesos, total assets of approximately 68,000 and an average credit request of 7.5 thousand. In 1968 even the firms with 5-9 workers and an average of 5.25 paid workers (presumably almost all obreros) had average value of product of only 46.7 thousand pesos. It appears that the typical firm with about 2.7 workers might have had sales (in 1969) of say, 30,000 pesos. In other words, the credit recipients were well above average in capital/worker and output/worker.

The Corporacion Financiera Popular and the Fondo Financiera Industrial show much more favorable trends in their loans but they deal with larger firms than the Caja program.

The median size of firms attended in the Caja directed-credit program (excluding the "less than 20,000 pesos program") was probably around 10 employees, and perhaps 325,000 pesos of total assets; for the Corporacion Financiera Popular, the median total assets of credit recipients was 700,000; for the Fondo Financiera Industrial it was 1.2 million. For the Fondo, the median loan was recieved by a firm with about 25 workers. Since the Fondo is the biggest of the three credit institutions, it seems likely that over half of all credit from the three went to firms with more than 25 workers.

Apart from the difficulty of attending successfully to the needs of so many small firms, there have been a number of "institutional" obstacles to a successful program in this area to date. One director of the Corporacion Financiera commented that it is often dangerous to give either too much credit or too little to the small producer, the former may lead to or imply a switch to a larger and different type of organization which may innundate the man whose experience and expertise does not run along those lines; too little can fail for obvious reasons.

Even though this manager felt that the small firms have plenty of potential, he noted that if traditional banking rules are followed, it often appears that there is no one to loan to; the Corporacion Financiera has had to go out looking. The need to physically visit the small firm is fairly obvious (it parallels the agricultural extension workers' need to visit farms) but difficult to get through to people of the traditional banking mentality.

In Colombia access to credit is a privilege (and has substantial wealth

effects). Typically the manager of a bank takes care of friends and people he likes or feels responsible to; someone from the other end of the social stratum does not expect or look for credit--his past experience with the credit institutions has often been unsuccessful both from the financial point of view and from the social point of view (i.e., in terms of the way he is treated). He may react negatively as soon as he sees the typical, somewhat luxurious, office of a fairly large bank.

The Corporacion Financiera Popular has recently been trying to change its credit giving techinques, to focus more on the antecedents and characteristics of the individual seeking credit--the things which should determine his potential as a successful producer--and less on the financial or accounting side. Even in the range of 300,000 to one million pesos of gross assets and 20 to 100 workers, where the Corporacion focuses its efforts, many of the firms do not have accounting, and loaning is difficult both by old banking standards and newer ones.

A further problem of the credit institution revolves around the definition of small scale industry; the definition must be a careful one--there are a good number of subsidiaries of larger firms in the small size categories, and there are firms owned by people with substantial other interests. It is most important to try to ascertain all such connections. No study has as yet been done on the lines of control running between small firms and the rest of the economy. In the context of regional diversification, a serious complication is the possibility that giving credit in a place like Pasto may be the stimulus which leads the firm--now expanding, needing a bigger market, generating higher income for the manager who therefore desires to live in some affluence--to move

to a larger city like Cali.

Institutions Primarily Focussing on Research and Extension

In this to date relatively underdeveloped field are found the Instituto de Investigaciones Tecnologicas, FICITEC, SENA and several others.

The Instituto de Investigaciones Tecnologicas--an autonomous public institute established to undertake investigations leading to the use of new techniques--was founded in 1955 as a dependency of the Caja Agraria, then made autonomous in 1958. It has undertaken a number of research projects on technology, feasibility, markets, etc., including a number of studies on the possible industrial uses and processing of agricultural, industrial, and chemical products, the use of sub-products, etc. Some have had a real potential usefulness to small scale industry, while others have not; the former probably predominate, at least in the number of studies done. In 1968, for example, the biggest research effort was on the technology for regional popular nutritious foods for human consumption.[1] The Institute has offered technical assistance to the extent of its ability, especially to those sectors related with industrial use and management of agricultural products and particular industrial products (especially chemicals, metallurgical and metal mechanical items). A pilot collaboration project with the Corporacion Financiera Popular was undertaken in 1968 to give integrated technical assistance to a firm producing valves and other metal products; the post-assistance evaluation indicated that production had risen by about 60 percent, production per man-hour by about 60 percent, yield of raw materials substantially, machine utilization by something like 50 percent, and profits on fixed capital by about 100 percent.

[1] See Instituto de Investigaciones Tecnologicas, Realizaciones y Programas 1968, Botota, p. 6.

The real question is the feasibility of this form of extension service on a sizeable scale.

FICITEC has as goals improving the administration and management of Colombian business enterprise and providing them with a better storehouse of technological information. Over the near term, Miguel Bermudez, the director, plans to operate with foreign and Colombian consultants but over the long run to develop a competent staff at the Foundation itself. The first objective was to undertake in depth studies of five typical Colombian enterprises, with a view to making recommendations for managerial and other improvements.

SENA is already a large scale institution with secure financing and a good reputation for work in the technical training area. I have not seen reviews of its work in management training; it has the advantage of establishment, organization, and reputation. It is planning (already is engaged in?) a large program to advise 4,000 firms over four years. There is some feeling on the part of observers that SENA may be suffering from overfinancing (it receives support from a business payroll tax and now manages a very large budget) leading to somewhat inadequate planning and preevaluation of projects.

Producers' Organization

It has been a general maxim in Colombia that people can do more for themselves than the government can do for them; this pattern raises the question of whether the most promising avenues for change are not via the private groups. The most important of these, in some respects at least, is Acopi (Associacion Colombiana Popular de Industriales). It was founded in 1951 when a group of small and medium producers (representing food, leather, rubber products, and several other industries) decided to create an association which would legally represent the interests of medium and small scale firms. Acopi is frequently criticized for being nothing more than a pressure group; unlike some of the

other interest groups it has not become significantly involved in implementing technological change or trying to make its members more competitive.

Firms in Acopi range from as few as 3 employees to over 100 (although very few are above 100).[1]

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[1] In a sample of members in 9 cities, the average workers per firm was about 25.

Summary and Conclusions

The electic (hodgepodge) approach to the evaluation of Colombian small scale industry adopted in this paper reflects the fact that information is scanty, in view of which it seemed relevant to review (a) the historical development (with special emphasis on the last 20 years) of small scale production, with the idea that what happens in the market may be a crude indicator of competitive potential; (b) analysis of single and total factor productivities of plants by size with a view to measuring relative static efficiency; (c) consideration of the little evidence now available on growth tendencies of individual plants and firms over time according to their size; (d) evidence from other countries on the role of small and medium industry over time, and its relative factor productivity compared to larger industry; (e) observations of possibly knowledgeable observers and information on the institutional context in Colombia which might bear on the potential success of this form of production.

Despite the attempt to aggregate information from these various sources, no very persuasive answer can be given to the question "what role should small scale industry play in Colombia's industrial development from this point on, and how should it best be handled by policy tools?" There seems relatively little doubt but that small and medium plants have on average higher output/capital ratios than larger ones, but the difficulty of ascertaining appropriate shadow prices for unskilled labor and various forms of skilled labor makes it difficult to judge in how many cases the overall social factor productivity is higher. Much more work is required in this area. Still less information is available at present on dynamic aspects of efficiency, i.e., savings tendencies out of income generated by firms or plants of different sizes, relative adaptation to socially productive technological changes, external economies generated, and so on.

The other broad questions which must be analyzed in much greater depth to permit serious policy suggestions of a general type are (a) the nature and extent of interaction of small and large plants (or firms) and (b) the relationship between plant size and firm size. The analysis in this paper has, because of the limitations of the data, been restricted to the use of the variable plant size, but many though not all of the arguments which would suggest differential factor productivities would seem to apply more to firm size. With respect to (a), it must be ascertained among other things whether the small and large firms (or plants) are in a complementary or a competitive relationship; in the former case it makes no sense to talk in terms of substituting one for another. Colombian statistics do not at present permit analysis of these interactions although impressionistic evidence suggests that such interaction is becoming increasingly common and is probably more than meets the eye.

The other possible limitation on extensive substitution by firm size would be the presence of a number of industries in which only large scale technology is feasible; it is clear that such industries exist, but it is not clear, without analysis, that they form part of the optimal set of industries. While this argument obviously implies caution, it is not necessarily an overpowering one, given the possibilities of trade. Needless to say, no one would argue that an economy can be exclusively focussed on leather products, wooden furniture, and the other outstanding labor intensive candidates, but in the tracing out of policy pertinent, say, for a period of 5 or 10 years, even if new investment were focussed heavily on the labor intensive sectors, the overall industrial structure would not alter very dramatically; while the gradual structural change implied in a fairly sharp reorientation of the direction of new investment was occurring it would be possible

to evaluate the potential success of pushing the policy further.

It is clear that in some industries the large scale capital intensive producers are inefficient[1] and yield a low return to capital as well as generating little unemployment.[2] From this observation it seems fairly safe to say that, were it possible to retrace steps and alter policies taken in the past, an attempt should have been made to avoid some of the large capital intensive firms and industries and to focus more in industries with higher capital productivity; given the tight relationship existing between large size and low output/capital ratio it seems probable that the alternative would have involved smaller scale producers. It is not so obvious that, beginning now, a policy of heavy focus on the small scale sector is appropriate, (although it obviously must receive serious consideration and, until more evidence is in, probably has more to recommend it than the opposite). There arises the difficult question whether a system geared to aiding large scale firms, financing them, and so on can quickly learn to be an efficient complement to small scale producers.

The broad alternative to achieving high employment generation and high capital productivity by focussing on small firms is to try to make large firms more productive in these respects than they have historically been. It may well be argued

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[1] It may not be their being large scale, but their being in those industries which makes them inefficient.

[2] The only condition that I can think of in which this would not be an accurate (and obvious) description of the Colombian case would be one in which complementarities between a given industry and other industries--the others having much higher social rate of return and being higher employment generators--are of the sort which make it necessary to view the industry in question as part of a larger package, i.e., it is not meaningful to use a measure like the social rate of return to capital for the industry in question, by itself. Arguments with respect to external economies of permitting engineers and workers to learn complicated technologies and so on are usually unconvincing when it is by no means clear that the use of those technologies is appropriate in the first place.

that large firms are not unproductive per se, but that this is a result of bad policy and the bad signals they receive in the market. Would they be more labor intensive and less capital intensive if the wage/rental ratio changed substantially? Could their monopolistic tendencies in a small and highly protective market be erroded somewhat by an effective international trade policy? Much more research into these questions, and a careful look at experience in other countries is necessary to come to useful conclusions. Most observers tend to be pessimistic, feeling that a given firm or given type of firm has relatively little technological flexibility; granted that engineers and businessmen invariably understate the medium or long run flexibility which faces them, the differences in capital intensity by size are so large as to make it very doubtful that even under the most perfect factor markets which could be plausibly conceived in a country like Colombia the large firms would approach the labor intensity of the smaller ones. (It must be remembered, of course, that with better factor markets--including better access to capital--many small firms would become less labor intensive.) If a fair degree of labor intensity could be achieved a necessary prerequisite would seem to be very considerable innovative and adaptive ability on the part of entrepreneurs; since their major technological sources tend to be more developed countries, they would have to be aware of the need to and able to modify these technologies to more appropriate labor capital ratios.

As is so frequently the case in policy questions like this one, the relative payoffs to pursuit of various possible avenues to taking greater advantage of small scale firms and in general to attaining higher labor intensity and higher capital productivity, and the optimal mix are not obvious, but it seems plausible that involves moving in most of the directions cited; the desirability of

moving in most of those directions is the more obvious, since in doing so more may be learned about the potential payoffs to further movement. Capital market improvements should have high priority in any general policy package; other initiatives which would give the large firms more incentive to be labor intensive should also be considered; tax exemptions on investment are presumably counterproductive and unless powerful arguments to the contrary can be generated they should be terminated and tax exemptions by amount of labor used instituted in their place; development organizations designed to aid the small firm in technological choice, industry choice, and so on, should receive high priority.

Since one of the major permissive conditions which leads to inefficiency of large scale firms is the protection they receive as import substitutors, it seems likely that trade policy could be a major contributor to improved factor proportion choice and overall factor productivity; it would prevent the monopolistic highly capital intensive firms from pursuing their present tendencies, either by forcing them to be more efficient or forcing them to give way to more efficient firms. In this context, since Colombia's comparative advantage, other things being equal, lies in industries which are labor intensive and which are in turn (as amply documented above) industries composed of small plants and firms, the need to focus on an efficient marketing system for potential exports coming from this sector, as well as a system of quality control, standardization, and so on, takes on particular importance.

Possibly no single one of the initiatives mentioned here would, by itself, contribute greatly to the desired goals but it seems plausible that if all could be undertaken the overall impact would be significant.

Table A-1

Selected Aspects of the Size Structure of Colombian Manufacturing, 1964
(Official DANE Statistics)

	Size of Firm (Number of Workers)											Total reported in DANE Industrial Survey	Popular Census Total
	<5 (reported by DANE)	Total <5 (Implicit)	5-9	10-14	15-19	20-24	25-49	50-74	75-99	100-199	>200		
Number of Establishments	3,637		3,681	1,721	452	348	869	315	167	261	223	11,674	
Number of Employers												9,241	34,452
Number of Workers	10,658	382,778	24,109	20,072	7,625	7,483	29,602	18,908	14,213	35,957	115,214	283,841	655,901
Number of Paid Workers	6,801	165,802	19,690	18,403	7,249	7,237	29,084	18,792	14,152	35,885	115,165	272,458	431,459
Workers/Establishment	2.930		6.55	11.721	16.87								
Value of Production	394,193		845,163	1,050,427	639,264	667,886	2,559,240	1,911,419	1,085,790	3,906,439	1,098,722	24,047,040	
Gross Value Added	122,977		256,693	285,457	158,228	177,325	764,777	636,683	451,863	1,841,040	5,406,758	10,101,300	
Salaries (Including Fringe Benefits)	25,998		86,475	104,493	55,871	60,030	270,959	210,572	158,254	502,874	1,854,278	3,329,804	
Fringe Benefits/Total Remuneration	6.320		9.308	11.837	13.791	15.331	16.663	19.171	20.288	21.628	25.921	745,997	
Salaries (Including Fringe Benefits)/ Paid Workers	3,823		4,392	5,678	7,707	8,295	9,316	11,205	11,182	14,013	16,101	11,731	
Horse-Power	16,577		34,319	35,938	15,986	16,151	95,368	44,343	30,544	121,118	579,783	990,137	
Gross Value Added/Occupied Person	11.49		10.65	14.22	20.75	23.70	25.84	33.67	31.79	51.20	46.93	35,588	
Gross Value Added/Horse Power	7.288		7.480	7.943	9.898	10.979	8.019	14.358	14.769	15.200	9.325		
Paid Labor Share of Gross Value Added	21.14		33.69	36.61	35.31	33.85	35.43	33.07	35.02	27.31	34.30	32.97	

Sources: Table A-1

The information is from DANE, Anuario General de Estadistica 1964, Tomo IV for the information for the "factory" sector, and DANE, Censo Nacional de Poblacion (Julio 15, 1964): Resumen General, Imprenta Nacional, Bogota, 1967, for statistics on total employment and distribution by occupational position (employers, independent workers, etc.). The calculations with respect to number of firms with less than 5 workers are based on the assumption that there are no data errors in either the population census or the industrial survey data and that everyone is fully employed.

Table A-2

Number of Rural and Urban Cottage-Shop Workers

1953-1964

Departments	Urban			Rural		
	1953	1964	Percent Increase	1953	1964	Percent Increase
Antioquia	14.183	19.258	36	12.589	12.720	1
Atlántico	13.966	19.287	38	660	871	32
Bolívar	4.533	16.508	368[b]	10.021	5.066	-13[b]
Boyacá	11.860	6.599	-44	8.039	9.138	14
Caldas	15.925	25.675	61	6.157	3.301	-46
Cauca	3.788	4.374	15	3.709	3.786	2
Cordoba	a	5.717	b	a	3.610	b
Cundinamarca	36.422	58.159	60	11.493	8.489	-26
Chocó	644	996	55	717	759	6
Huila	4.572	6.673	46	2.876	1.748	-39
Magdalena	6.522	10.233	57	4.647	4.684	1
Meta	a	2.321	--	a	245	--
Narino	13.853	12.461	-10	27.848	22.160	-20
Norte Santander	6.278	9.241	47	1.717	2.624	53
Santander	11.282	17.519	55	6.314	5.930	-6
Tolima	6.993	12.227	75	5.469	3.373	-38
Valle del Cauca	17.729	39.324	122	16.566	10.967	-34
Intend y Comis.	1.698	3.794	--	1.832	2.283	25
Total	169.978	270.366	59	120.656	101.754	-16

[a]These departments did not exist in 1953.

[b]The figure for Bolivar includes data of Cordoba for 1964.

Source: The table is taken from Urrutia and Villalba, on. cit., p. 49. The original source for the information was special tabulations from DANE of the people employed in manufacturing industry in the 1951 and 1964 censuses, broken down by rural and urban. The 1951 information was "extrapolated" to 1953 to match the information (on factory employees) which was not published until that year.

Table A-2a

Firm Size Structure, 1944/5-1968

Year	Total # Firms	< 5 employed	5-9	10-14	15-19	20-24	25-49	50-74	75-99	100-200	> 200
		6,207			544			426			
1944/5*	7,853+	2,584	3,623	845	329	215	383	140	99	114	73
		7,959			849			612			
1953	11,243			1,190			634	(236)	(114)	(152)	(110)
		6,338			915			700			
1956	9,835	2,977	3,361	1,124	582	333	758	259	123	184	134
1958	11,125	3,475	3,641	1,276	689	435	825	294	123	204	163
1959	10,572	3,184	3,366	1,224	696	406	835	320	132	228	181
1960	10,446										
1961	10,555										
1962	11,082										
		8,098									
1963	11,296	3,505	3,514	1,559	512	379	855	338	157	260	217
1964	11,674	3,637	3,681	1,721	452	348	869	315	167	261	223
1965	11,959	3,668	3,806	1,839	384	373	892	312	171	274	240
1966	11,797	3,714	3,687	1,734	388	365	869	315	189	288	248
1967	10,873	3,546	3,177	1,177	583	428	910	341	184	283	244
1968	11,062	3,566	3,312	1,339	421	410	892	396	175	287	267

1. Less than 5 workers but above 24,000 pesos output.

+Includes 762 plants with production < 6,000 pesos.

Sources and Methodology: The figures for the years 1956-1968 inclusive are taken directly from various copies of DANE's

Table 2A-a (cont.)

Anuario General de Estadistica. The 1953 figures are based on the 1953 industrial census, published in various issues of DANE's Boletin Mensual de Estadistica. Figures were not presented specifically on the size breakdown, but percentages were shown in Boletin Mensual No. 77. From these the figures presented here were deduced. 1944-5 figures are based on Controlia General de la Republica Primer Censo Industrial de Colombia--1945: Resumen General, Bogota, 1947. Since that census classified firms by the number of employees rather than the total number of workers, adjustments were made to attempt to achieve comparability with the data for the other years.

No corrections are made in the table for the apparent underreporting of small firms by DANE since 1962.

Table A-2b
Employment in Cottage-Shop and Factory Industry
by Two Digit Classification
1964

	Cottage-Shop							Factory						Total Providing Information on Form of Employment	% of Total in Cottage Providing Information on Form of Employment	Total Including Those Not Providing Information on Form of Employment
	Total	Independent Workers	Employers & White Collar	Employers	White Collar	Blue Collar Hired	Family Workers	Total	Employers & White Collar	Employers	White Collar	Blue Collar Hired (including apprentices)	Family Workers			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
(20) Food	31,578	8,179	15,078	2,070	13,008	7,432	889	41,561	9,711	2,466	7,245	30,984	866	73,139	43,175	73,689
(21) Beverages	2,302	476	4,600	195	4,405	-2,795	21	16,420	5,808	88	5,720	10,587	25	18,722	12,296	19,216
(20 + 21) Food + Beverage	33,880	8,655	19,678	2,265	17,413	4,637	910	57,981	15,519	2,534	12,985	41,571	891	91,861	36,882	93,105
(22) Tobacco	4,666	749	1,845	178	1,667	1,826	246	3,803	537	119	418	3,216	50	8,469	55,095	8,574
(23) Textiles	17,971	12,517	8,785	901	7,884	-7,587	4,256	44,099	6,720	288	6,432	37,230	149	62,070	28,953	62,362
(24) Clothing + Footwear	120,627	78,726	22,463	5,615	16,838	13,176	6,262	31,510	5,003	2,090	2,913	26,109	398	152,137	79,288	153,265
(23 + 24)	138,598	91,243	31,248	6,516	24,722	5,589	10,518	75,609	11,723	2,378	9,334	63,339	547	214,207	64,703	215,627
(25) Wooden Products Excluding Furniture	8,666	4,000	1,964	681	1,283	2,201	501	6,076	929	303	626	5,108	39	14,742	58,784	14,841
(26) Wooden Furniture	37,713	24,359	10,025	4,328	5,697	21,843	1,446	4,913	841	377	464	4,109	53	62,626	92,155	63,404
(27) Paper and Products	76	195	1,037	15	1,072	-1,173	17	5,485	1,364	61	1,303	4,111	10	5,561	1,367	5,613
(28) Printing	4,940	1,315	8,871	566	8,305	-5,303	57	11,812	2,869	403	2,466	8,882	61	16,752	29,489	16,935
(29) Leather + Products	4,926	2,277	1,793	537	1,256	630	226	4,482	821	264	557	3,596	65	9,408	52,360	9,488
(30) Rubber + Products	-1,531	358	768	124	644	-2,689	32	6,900	1,642	41	1,601	5,252	6	5,369	-28,516	5,425
(31) Chemicals	5,702	1,742	7,651	763	6,888	-3,871	180	19,819	7,743	306	7,437	11,988	88	25,521	22,342	25,572
(32) Products of Petroleum and Coal	2,807	43	2,543	24	2,519	213	8	2,026	572	6	566	1,454	—	4,833	58,080	4,880
(33) Products of Nonmetallic Minerals	11,178	2,969	4,274	938	3,336	3,275	660	25,493	3,865	795	3,070	21,510	118	36,671	30,482	36,907
(34) Base Metals	6,601	308	3,483	188	3,295	2,777	33	3,640	523	15	508	3,116	1	10,241	64,457	10,295
(35) Metal Products Excluding Machinery	9,282	5,998	3,918	1,137	2,781	-985	351	19,046	3,560	477	3,083	15,425	61	28,328	32,766	28,713
(36) Nonelectrical Machinery	12,744	2,680	5,667	1,074	4,593	4,432	165	4,883	909	180	729	3,946	28	17,827	72,609	18,112
(37) Electrical Machinery	6,530	4,999	4,544	933	3,611	-3,118	105	9,147	2,247	172	2,075	6,879	21	15,677	41,653	15,855
(36 + 37)	19,474	7,679	10,211	2,007	8,204	1,314	270	14,030	3,156	352	2,784	10,825	49	33,504	58,124	33,967
(38) Transportation Equipment	50,596	11,579	17,048	4,163	12,885	21,130	839	14,833	2,686	556	2,130	12,075	72	65,429	77,330	66,451
(39) Miscellaneous	8,705	1,659	6,531	740	5,791	-90	105	7,623	1,733	234	1,499	5,859	31	16,328	53,313	15,984
Total	365,779	165,168	132,888	25,211	107,677	51,324	16,399	283,571	60,083	9,241	50,842	221,616	2,142	649,350	56,330	655,961

Sources and Methodology -- Table A-2b

Column 16 presents the 1964 population census figures on the number of people employed in each of the two digit sectors. Column 14 presents the total number of people who also reported occupational position (i.e. form of employment). Columns 8-13 present figures from ANE's Anuario General de Estadishia for the factory sector (firms with $\geq$ 5 workers or $\geq$ 24,000 pesos output). Columns 1-7 are based on subtractions of columns 8-13 from the corresponding figures in the population census from, i.e. They are derived as residuals, with the exception of column 2 "independent workers" who are all by definition, in the cottage-shop sector.

Table A-6a

Employment in Factory and Cottage-Shop Manufactures By Department, 1953-1964

	People Occupied In					
	Factory		Cottage-Shop		Total	
Departments	1953	1964	1953	1964	1953	1964
Antioquia	47.278	68.811	26.772	31.978	74.050	100.789
Atlantico	18.344	25.660	14.626	20.158	32.970	45.818
Bolivar	6.852	5.811	19.899	21.574	26.751	27.385
Boyaca	3.340	5.683	14.554	15.737	17.894	21.420
Caldas	12.134	13.123	22.084	28.976	34.218	42.099
Cauca	1.550	1.500	7.497	8.160	9.047	9.660
Cordoba	(a)	572	(a)	9.327	(a)	9.899
Cundinamarca	47.857	87.696	47.915	66.648	95.774	154.344
Choco	132	143	1.361	1.755	1.493	1.898
Huila	1.010	971	7.448	8.421	8.458	9.392
Magdalena	1.390	1.659	11.169	14.917	12.559	16.576
Meta	(a)	702	(a)	2.566	(a)	3.268
Nariño	2.772	3.395	41.431	34.621	44.203	38.016
Norte de Santander	3.451	2.654	7.995	11.865	11.446	14.519
Santander	12.471	12.123	17.596	23.449	30.067	35.572
Tolima	5.181	3.024	12.462	15.600	17.643	18.624
Valle del Cauca	34.729	50.045	34.295	50.291	69.024	100.336
Intenden. y Comis.	633	269	3.530	6.077	4.163	6.346
Total	199.126	283.841	290.634	372.120	489.760	655.961

(a) These departments had not yet been created at the time of the 1953 industrial census.

Source: Urrutia: Villalba, op. cit., p. 47. Originally based on DANE, Censo Industrial, 1953, and Muestra Industrial, 1964. Data of the 1964 population census were used for the totals in 1964 and that of the 1951 population census to obtain a projection of the total to 1953.

Table A-7
Number of Workers by Size of Plant, By
Department, 1963

	Total	5	5-9	10-14	15-19	20-24	25-49	50-74	75-99	100-199	200	
Total	280,520	10,260	22,992	18,125	8,667	8,264	29,057	20,344	13,340	35,638	113,795	
Antioquia	69,691	1,605	3,284	3,014	1,439	1,539	5,210	3,674	2,547	5,064	41,228	Antioquia
Atlántico	25,840	372	981	1,216	603	707	3,135	2,313	1,191	3,577	11,745	Atlantico
Bolívar	5,058	253	772	556	133	175	830	386	252	819	882	Bolivar
Boyacá	5,801	660	1,140	334	99	23	138	346	97	498	2,469	Boyacá
Caldas	12,991	889	1,329	1,067	389	433	1,321	1,213	798	1,687	3,865	Caldas
Cauca	1,490	109	212	173	36	85	36	55	89	439	256	Cauca
Córdoba	595	149	250	82	18	-	34	62	-	-	-	Córdoba
Cundinamarca	86,439	2,196	6,563	6,113	3,561	2,908	11,300	7,594	4,732	13,939	27,511	Cundinamarca
Chocó	163	25	19	14	17	-	88	-	-	-	-	Chocó
Huila	923	110	222	235	70	63	106	-	-	119	-	Huila
Magdalena	1,513	175	312	238	109	70	83	-	86	470	-	Magdalena
Meta	727	115	275	110	52	-	47	-	98	-	-	Meta
Nariño	3,102	320	512	323	191	87	291	360	181	176	661	Nariño
Norte de Santander	2,464	390	771	473	82	44	263	188	-	253	-	Norte de Santander
Santander	11,682	836	2,065	1,150	475	369	1,057	806	941	509	3,474	Santander
Tolima	3,015	552	613	461	118	149	574	-	57	521	-	Tolima
Valle del Cauca	49,811	1,420	3,563	2,556	1,245	1,612	4,518	3,387	2,271	7,567	21,702	Valle del Cauca
Intendencias y Comisarías	209	52	109	10	10	-	28	-	-	-	-	Intendencias y Comisarías

Source: DANE Anuario General de Estadistica, 1963

Table A-8

Clothing and Footwear; Average Size of Plant and Share of Paid Labor Which is White Collar, by Departments, 1967

Department	Average Size of Plant	Paid Labor Force	White Collar Total Paid
Antioquia	21.38	7,185	13.15
Atlantico	41.40	3,624	11.78
Bolivar	17.56	445	7.64
Boyaca	4.85	160	1.88
Caldas	11.89	582	12.20
Cauca	3.53	41	0.0
Cordoba	2.77	22	0.0
Bogota, D.E.	17.67	6,617	12.27
Cundinamarca	3.40	102	1.00
El Cesar	3.67	15	0.0
Magdalena	6.21	73	9.58
Nariño	4.43	202	0.50
N. Santander	5.81	306	4.25
Quindio	6.56	170	10.59
Risaralda	33.55	2.489	7.59
Santander	9.65	1,162	13.60
Sacre	3.40	12	0.0
Tolima	4.24	107	1.87
Valle	16.44	3,581	10.83
All departments with average plant size of			
< 5	4.09	661	1.36
5-10	8.04	1,711	11.46
> 10	20.95	24,523	11.69
> 25	37.81	6,113	10.08

Source: Based on data from DANE, Industria Manufacturera, 1967.

TABLE A-9

Fixed Assets and Inventory/Total Assets
by Firm Size for Sociedades in Selected Secotrs: 1963

Industry	Total Assets/Firm	Fixed Assets Inventories/Total Assets
Food	22.61 M	59.17
Milk products	16.60	74.19
Mills & Thrashers	12.32	56.24
Sugar Refineries & Trapiches	62.82	46.42
Chocolates & Candy	30.53	55.78
Other Food Industries	18.64	71.84
Beverages	83.87	43.94
Beer & Malt	178.89	42.32
Alcohol & Soft Drinks	13.26	62.10
Tobacco	89.77	55.39
Textiles	53.07	62.25
Yarns, etc.	65.81	61.6
Tejidosde Punto	13.73	64.5
Furniture	14.60	66.85
Rubber Products	55.76	61.87

Source: Data from Superintendencia de Sociedades Anonimas, Division de Investigaciones Economicas, La Industria Manufacturera, Bogota, November 1969.

Table A-10

Horse Power/Employed Persons: Aggregate and Two Digit Levels

1964

	Firm Size (# Workers)					
	≤5	5-24	25-99	100-199	≥200	Total
Total	1.555	3.496	2.734	3.368	5.032	3.488
Food	2.41	2.67	3.86	4.48	5.23	3.75
Beverages	9.85	5.89	4.20	5.84	7.23	6.43
Tobacco	0.07	0.09	0.31	1.92	2.01	1.09
Textiles	3.55	3.47	2.24	1.72	3.48	3.23
Clothing and Footwear	0.12	0.25	0.48	0.48	0.49	3.79
wood (excluding furniture)	0.749	3.68	3.60	4.20	4.49	3.93
wood furniture and a esories	1.61	1.17	1.52	1.25	2.30	1.46
paper and paper products	1.00	2.34	1.71	1.94	17.67	8.68
publishing and rel. indus.	0.30	0.88	1.14	1.31	0.93	1.01
leather (excluding footwear)	2.34	1.80	2.49	3.21	5.35	3.27
rubber goods	2.00	1.76	3.15	-	4.67	4.31
chem. products	3.77	1.34	6.51	1.39	6.31	4.48
petrol and carbon derivatives	11.33	9.96	33.86	9.60	29.91	26.93
non-metallic products	0.80	1.24	3.19	6.56	8.99	5.48
basic metal industries	6.67	5.32	4.31	14.46	12.78	11.95
metal prod. excluding mach. + trans.	2.12	1.95	2.39	3.29	2.88	2.55
non-electric machinery	2.70	2.60	2.14	2.24	2.17	2.34
electric mach. + articles	0.92	1.22	1.16	2.96	1.65	1.66
transport materials	1.62	0.95	1.47	1.17	1.40	1.28
other manufacture industries	0.80	1.13	1.75	1.97	2.00	1.67

Source: Based on data in DANE, Boletin Mensual de Estadistica, #224, Marzo, 1970.

Table A-10a

Paid Labor Share of Gross Value Added,

by Industry and Firm Size, 1963-67

Industry and Firm Size	1.963	1.964	1.965	1.966	1.967
20 Food					
5-24	0.26	0.24	0.25	0.20	0.22
25-99	0.27	0.25	0.25	0.23	0.21
100-199	0.26	0.27	0.28	0.18	0.23
200 y más	0.27	0.29	0.29	0.30	0.36
21 Beverages					
5-24	0.33	0.31	0.32	0.31	0.29
25-99	0.23	0.19	0.26	0.30	0.23
100-199	0.14	0.17	0.11	0.16	0.12
200 y más	0.23	0.22	0.22	0.24	0.24
22 Tobacco					
5-24	0.31	0.17	0.22	0.32	0.34
25-99	0.24	0.31	0.22	0.35	0.79
100-199	0.10	0.09	0.10	0.12	0.13
200 y más	0.14	0.12	0.11	0.13	0.12
23 Textiles					
5-24	0.28	0.36	0.27	0.36	0.33
25-99	0.43	0.41	0.33	0.44	0.48
100-199	0.40	0.46	0.39	0.43	0.40
200 y más	0.39	0.44	0.43	0.45	0.47
24 Clothing					
5-24	0.44	0.44	0.43	0.42	0.39
25-99	0.47	0.46	0.39	0.38	0.42
100-199	0.53	0.58	0.45	0.45	0.37
200 y más	0.40	0.41	0.41	0.36	0.41
25 Wood Products excluding Furniture					
5-24	0.45	0.46	0.45	0.43	0.44
25-99	0.51	0.53	0.45	0.42	0.44
100-199	0.59	0.59	0.57	0.52	0.51
200 y más	0.45	0.43	0.38	0.40	0.46
26 Wooden Furniture					
5-24	0.51	0.49	0.45	0.51	0.51
25-99	0.56	0.57	0.65	0,56	0.60
100-199	0.47	0.37	0.41	0.44	0.47
200 y más	0.44	0.46	0.39	0.43	0.70
27 Paper and Products					
5-24	0.43	0.42	0.42	0.34	0.35
25-99	0.39	0.38	0.31	0.26	0.30
100-199	0.39	0.37	0.33	0.33	0.45
200 y más	0.25	0.27	0.40	0.33	0.43
28 Printing					
5-24	0.54	0.53	0.53	0.52	0.47
25-99	0.47	0.50	0.51	0.50	0.45
100-199	0.49	0.50	0 51	0.55	0.55
200 y más	0.45	0.44	0.42	0.38	0.42
29 Leather and Products	0.42	0.39	0.40	0.41	0.38
25-99	0.38	0.44	0.39	0.40	0.41
100-199	0.50	0.42	0.37	0.29	0.35
200 y más	0.33	0.34	0.30	0.31	0.35

Table A-10a (continued)

Industry and Firm Size	1.963	1.964	1.965	1.966	1.967
30 Rubber and Products					
5-24	0.41	0.45	0.46	0.43	0.57
25-99	0.49	0.44	0.37	0.41	0.51
100-199	-	-	-	-	0.27
200 y más	0.32	0.44	0.41	0.45	0.48
31 Chemicals					
5-24	0.24	0.22	0.25	0.26	0.26
25-99	0.28	0.28	0.25	0.24	0.25
100-199	0.22	0.28	0.27	0.24	0.26
200 y más	0.29	0.29	0.35	0.28	0.34
32 Products of Petroleum					
5-24	0.09	0.12	0.11	0.18	0.18
25-99	0.25	0.23	0.25	0.20	0.29
100-199	-	0.12	0.19	0.22	0.11
200 y más	0.22	0.27	0.33	0.22	0.15
33 Products of Nonmetallic					
5-24	0.47	0.47	0.47	0.44	0.46
25-99	0.46	0.42	0.44	0.44	0.47
100-199	0.36	0.43	0.49	0.43	0.52
200 y más	0.46	0.49	0.46	0.43	0.48
34 Base Metals					
5-24	0.34	0.39	0.30	0.30	0.33
25-99	0.34	0.35	0.39	0.43	0.22
100-199	0.17	0.21	0.25	0.20	0.23
200 y más	0.16	0.20	0.56	0.40	0.36
35 Metal Products excluding Machinery					
5-24	0.44	0.45	0.45	0.44	0.47
25-99	0.45	0.44	0.41	0.41	0.45
100-199	0.46	0.44	0.44	0.37	0.36
200 y más	0.43	0.46	0.44	0.45	0.50
36 Nonelectrical Machinery					
5-24	0.39	0.39	0.41	0.44	0.41
25-99	0.53	0.56	0.42	0.54	0.53
100-199	0.67	0.46	0.52	0.42	0.68
200 y más	0.52	0.37	0.46	0.51	0.54
37 Electrical Machinery					
5-24	0.46	0.45	0.47	0.39	0.42
25-99	0.37	0.36	0.39	0.29	0.32
100-199	0.37	0.32	0.36	0.40	0.31
200 y más	0.31	0.33	0.34	0.33	0.49
38 Transport Equipment					
5-24	0.49	0.50	0.50	0.50	0.48
25-99	0.56	0.64	0.53	0.55	0.51
100-199	0.58	0.56	0.61	0.70	0.55
200 y más	0.77	0.70	0.89	1.03	0.58
39 Miscellaneous					
5-24	0.41	0.45	42	0.40	0.38
25-99	0.40	0.34	0.34	0.31	0.34
100-199	0.32	0.33	0.28	0.32	0.36
200 y más	0.38	0.33	0.31	0.41	0.49

Source: DANE, Boletin Mensual de Estadistica, 224, Marzo, 1970, pp. 153-55

Table A-11

Illustration Estimates of Income Earned Per Low Income Person, by Plant Size, 1964

Size (# of Workers)	Wages/ Person (1)	Average Net Non-Labor Income/ Unpaid Person (2)	Gross Value Added/ Person (Thousands) (3)	Net Value Added/ Gross Value Added (4)	Net Value Added/ Person (5)	Probable % of People with Annual Income ≤10,000 pesos (6)	Probable % of People with Annual Income ≤15,000 pesos (7)	% of Capital Income Going to People with Income less than 10,000 pesos (8)	% of Capital Income Going to People with Income less than 15,000 pesos (9)	% of Net Income Generated Going to People with Income less than 10,000 pesos (10)	% of Net Income Generated Going to People with Income less than 15,000 pesos (11)
Independent Workers	—		6.34	95	6,020	95	95+	------	------	≈85	≈90
2-4 (All)	3.53-3.91	7,896	6.35-7.18	93	5,900-6,680	90	90+	50	75	≈60	≈80
<5 Reported by DANE	4.70	22,283	12.50	92	11,500	80	85-90				
5-9	5.98	37,039	14.50	91.4	13,250	75	85	20	30	≈43	≈55
10-14	6.51	100,414	16.30	90.3	14,720	65	78	10	15	25	35
15-19	7.43		20.00	89.3	17,860			5	10		
20-24	8.30		23.70	88.3	20,930						
25-49	9.32		25.84	87.3	22,560						
50-74	11.21		33.67	86.3	29,060						
75-99	11.18		31.79	85.3	27,200						
100-199	14.01		51.20	84.2	43,110	45					
≥200	16.10		46.93	83.2	39,050		55				
Total				84.6							

(a) Theoretically these firms have less than 5 workers but more than 24,000 pesos value of output. In fact many firms fitting that category are undoubtedly missed.

Sources and Methodology: Except for the figures on gross value added per person and wages per person, i.e., columns 1 and 3--and the residual presented in column 2, which themselves have substantial margin of error (see Table 1)--this table involves highly speculative and essentially illustrative calculations, in the sense that for no firm do we have precise information on the information presented in columns 6-11. It is generally true, however, that the relationship between those figures and firm size is much less uncertain than their absolute values, and the relative values shown here are [illegible]

Table A-12

Average Firm Size (# of workers) in the Manufacturing Plants of Different Sized Cities

City	Average Plant Size		City Size (thousands of inhabitants)
	Actual	Weighted[1]	
Bogota, D.E.-Soacha	29	56	1.935
Medellin-Itagui-Bello-Envigado	47	87	1.034
Cali-Yumbo	35	61	730
Barranquilla	39	58	536
Bucaramanga	19	19	243
Pereira-Santa Rosa	28	72	199
Manizales	26	61	214
Cartagena	27	42	242
Palmira	23	24	118
Barrancabermeja	22	41	68
Sogamoso-Nobsa	43	17	40
Cucuta	11	14	165
Ibague	12	14	142
Armenia	14	18	141
Buga	12	12	73
Santa Marta	22	22	102
Girardot	13	13	73
San Gil	13	15	20
Pasto	11	19	89
Neiva	8	12	86
Tunja	12	14	44
Popayan	11	14	64
Buenaventura	17	16	78
Cartago	7	5	61
Tulua	11	7	63
Duitama	11	29	40
Villavicencio	8	8	53
Monteria	9	7	83
Valledupar	16	14	56
Pamplona	6	4	27
Sincelejo	6	3	49
Socorro	5	2	14
Riohacha	5	9	13
Quibdo	2	6	23

[1]Weighted average of the average firm size by industry, where weights are the relative share of each industry in national output.

Source: Rodrigo Manrique,"Localizacion Industrial y Proceso de Urbanizacion en Colombia," in DANE, Boletin Mensual de Estadistica, #224, March, 1970, p. xvi.

Table A-13

Growth of 315 Sociedades Anonimas

1963-67

	315 Sociedades Anonimas			All Factory Sector			
	Average Gross Value Added Per Firm (Current pesos)	Net Value Added (Current Market Prices)	Net Value Added (1958 prices)	Gross Value Added (Current pesos)	Gross Value Added (1958 pesos)	Gross Value Added Per Firm - Sociedades Not in the Sample	Gross Value Added - All Sociedades Anonimas
1963	13.74	4105.5	2222.8	9050.0	4898.6	4.85	5115.1
1964		4617.9	2321.7	10,320.3	5188.2		
1965		5330.2	2419.5	11,966.4	5431.5		
1966		6184.3	2520.0	14,212.8	5792.5		
1967	20.52	6551.7	2510.3	15,661.7	6000.3	9.90	9294.2

Sources and Methodology: Data for net value added of 315 sociedades anonimas comes from Superintendencia de Sociedades Anonimas, La Industria Manufacturera, 1969. In 1967, unlike the other years, indirect taxes were not included in the published value added figures in beverages; they were calculated and included here to give over time comparability. Factory sector data are from DANE, Anuario General de Estadistica.

TABLE A-14

A. Composition of Manufacturing Output Allocation among Different Sectors by Large and Small Enterprises

	Agr., Forestry, Fishery	Mining	Manufacturing			Service industry	Total of endogenous sectors	Final demand		Total
			Small	Big	Total			Domestic	Exports, etc.	
Small	3.1	0.2	21.3	9.2	30.5	21.4	55.1	33.5	11.4	100.0
Big	2.2	0.2	26.7	30.5	57.2	14.8	74.5	20.9	4.6	100.0
Total	2.6	0.2	23.9	19.5	43.4	18.3	64.5	27.3	8.2	100.0

B. Composition of Manufacturing Input Allocation among Different Sectors by Large and Small Enterprises

	Agr., Forestry, Fishery	Mining	Manufacturing			Service industry	Total of endogenous sectors	Discrepancies	Value-added	Total
			Small	Big	Total					
Small	12.3	0.6	21.8	26.2	48.0	12.0	72.9	0.6	26.5	100.0
Big	9.5	1.6	10.0	31.9	41.9	15.1	68.1	7.9	24.0	100.0
Total	10.8	1.1	16.0	28.9	44.9	13.5	70.3	4.4	25.3	100.0

Note: The percentages are computed by including the amount of imports in the total.

Source: Hoselitz, op. cit., p. 73. Note that the figures refer to 1951.

Table A-15

Share of Small Factories in Total Factory Employment by Major Industry Group (Percent)

ISIC code	Major industry group	Small population			Countries of medium population							Large population				Median %
		El Salvador	Lebanon	New Zealand	South Korea	Philippines[a]	Colombia	Chile	Argentina	Sweden	Australia	Brazil	Japan	West Germany	United States	
	All manufactures	40.6	49.0	46.2	50.6	47.0	37.8	37.9	34.3	33.1	35.3	31.5	43.7	22.1	23 4.	
20	Food products	29	53	25	52	46	48	52	23	48	36	32	57	43	34	32
21	Beverages	37	41	5	54	27	21	29		62		36			39	36
22	Tobacco products	14	....	2	....	17	42	2	11	0	46	14	....	20	9	14
23	Textiles	20	28	31	44	13	13	25	22	24	27	15	44	19	15	22
24	Clothing, footwear, made-up textiles	48	68	70	49	86	49	45	42	53	55	53	67	42	44[b]	52
25	Wood and cork products, except furniture	71	60	57	56	42	45	53	37	54	58	62	73	53	47	56
26	Furniture and fixtures	70	65	64	53	83	50	44		63	61	54	65	46	37	55
27	Paper and paper products	100	81	39	72	41	48	34	47	11	35	32	44	25	18	37
28	Printing and publishing	68	67	45	51	44	42	34	34	50	46	45	55	41	34	45
29	Leather and leather products, except footwear	85	77	70	70	75	41	59	49	46	57	48	66	32	19[b]	51
30	Rubber and rubber products	100	72	20	16	17	13	22	10	11	20	24	10	8	19	17
31	Chemicals and chemical products	75	84	54	66	43	40	38	38	33	29	30	19	15	20	38
32	Petroleum and coal products	.....	....	70	45	....	10	9	12	0	12	n.a.	43	9	12	10
33	Nonmetallic mineral products	54	35	39	51	46	38	22	28	47	45	39	45	41	32	39
34	Basic metals	100	81	49	60	32	16	13	38	3	17	25	25	8	9	25
35	Fabricated metal products	29	52	53	70	52	57	39		31	32		62	32	39	37
36	Machinery, except electrical	61	68	47	60	36	60	48	33[c]		41	40	46	17[d]	21	46
37	Electrical machinery, apparatus and supplies	100	48	49	69	43	48	33	27	15	22	21	26	12	10	33
38	Transport equipment	83	91	45	64	47	40	49	....[c]	27	22	20	23	7[d]	5	40
39	Miscellaneous manufactures, including instruments	72	81	58	59	64	60	65	51	50[e]	43	49	52[e]	28[e]	21[e]	

NOTE: Percentages represent share of total factory employment in establishments with 10–99 employees. Total factory employment includes all establishments in New Zealand, Argentina, Australia, West Germany, and United States. In the other countries, total factory employment includes establishments with 5 or more employees.

[a] Data pertain to 5–99 employees.
[b] Footwear included in leather products.
[c] Transport equipment included in machinery, except electrical.
[d] Automobiles and locomotives included in machinery, except electrical.
[e] Includes instruments.

SOURCES: Argentina..... Dirección Nacional del Servicio Estadístico, *Anuario Estadístico de la República Argentina, tomo III, Estadística Industrial*, 1949–1950.
West Germany..... *Statistisches Jahrbuch für die Bundesrepublik Deutschland*, 1954.
Other countries.... As cited in Table 1-2.

Source: From Staley and Morse, Op. Cit., p. 139.

Total Asset/Worker and Horsepower/ Worker Ratios
By

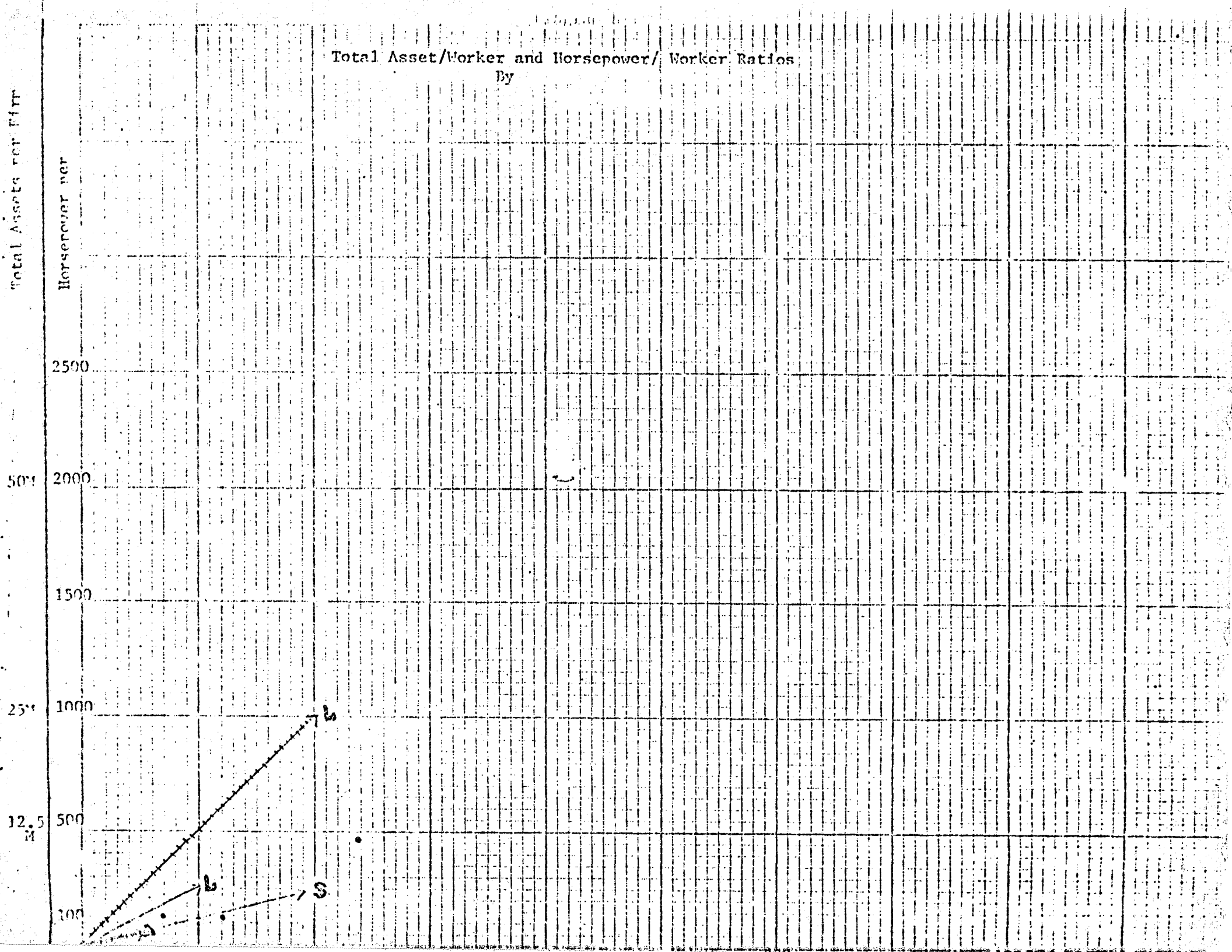
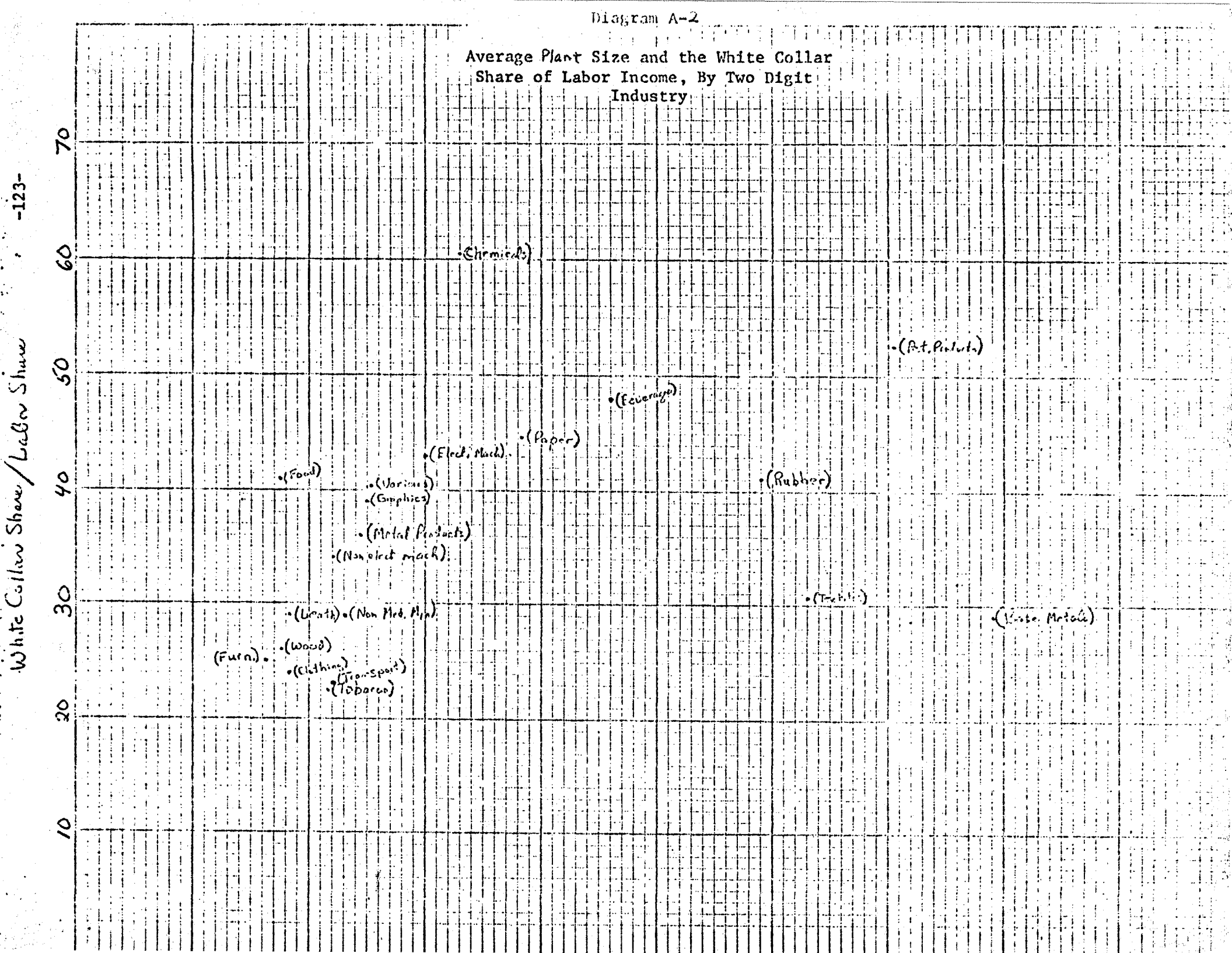


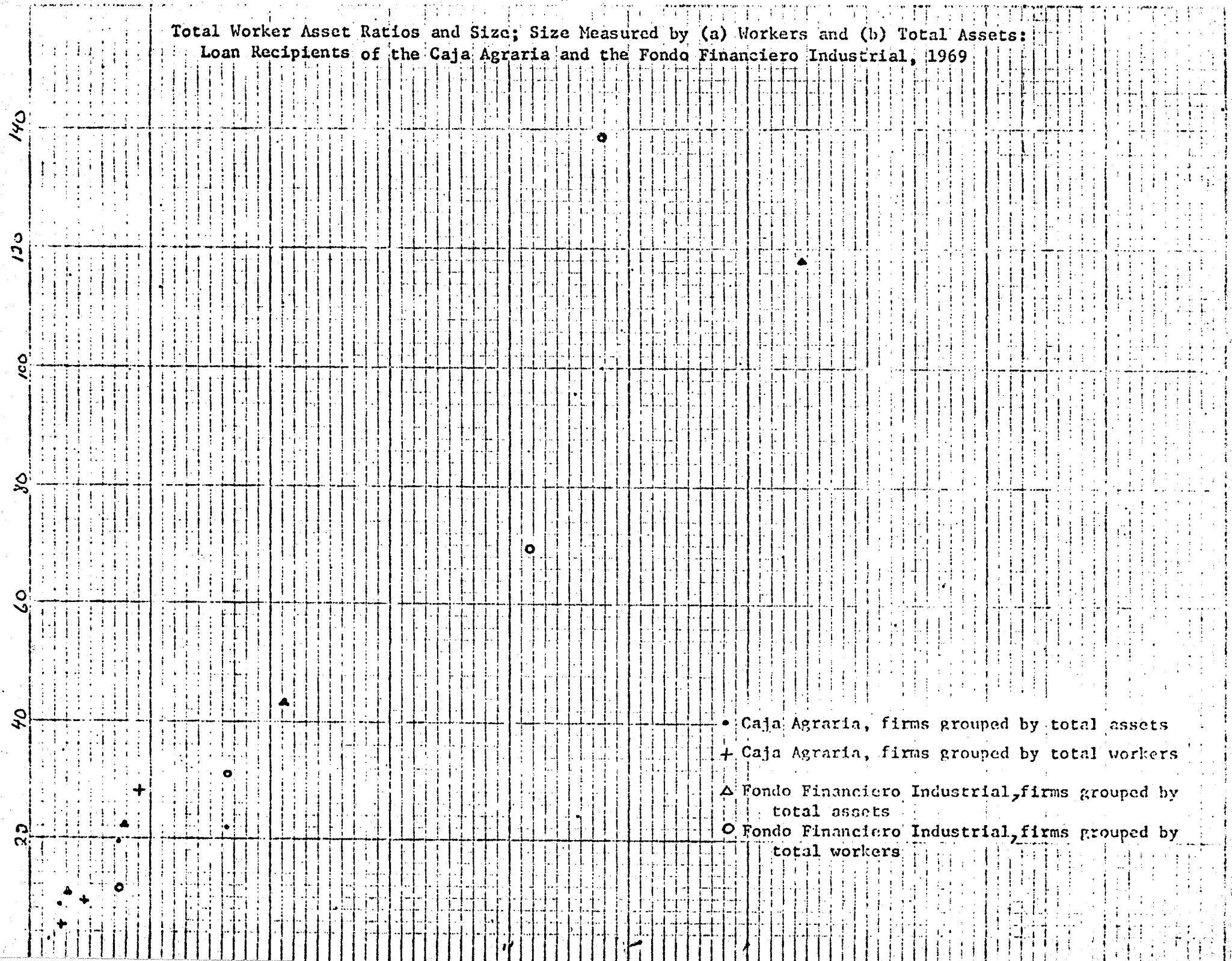
Diagram A-2

Average Plant Size and the White Collar Share of Labor Income, By Two Digit Industry



Occupied Persons

Total Worker Asset Ratios and Size; Size Measured by (a) Workers and (b) Total Assets: Loan Recipients of the Caja Agraria and the Fondo Financiero Industrial, 1969



Sources and Methodology

The information comes from Planeacion's study of small and medium industry (op. cit.), Dane's industrial survey information (presented in Industria Manufactuera Nacional 1968), and information from the Revista de la Superintendencia de Sociedades Anonimas. Dane's information were used to plot a series of points (the dots) corresponding to different firm size categories, and showing the average worker/firm and horsepower/firm ratios for selected firm sizes. The largest size category, with an average of almost 500 workers, had average installed capacity of a little over 2,500 horsepower. While the series of points referrring to the smaller size categories was somewhat curvelinear (with horsepower/workers gradually increasing with firm size) the undashed arrow marked "S" reflects the fairly constant horsepower/worker ratio for firms up to 50 or more workers. The slope of the undashed line L refers to the largest size category; thus the difference between the slopes of these two lines reflects the proportionate difference between the largest size category's horsepower/worker ratio and that of a group of the smaller size categories.

The information on assets is probably less trustworth (though perhaps not as frequently misstated as some- the major difficulty is placing an economic interpretation on it) and the comparison between large and small is complicated by the fact of different sources. The scale on the vertical axis for total assets (in 1969 pesos) was chosen so that the fairly typical asset/worker ratio found in the Planeacion study of recipients of credit from the Caja Agraria, Fondo Financiero Industrial and the Corporacion Financiera Popular would be connected with the origin by a slope of the same ray as that for the horsepower/worker ratio of the small firms just discussed. (Total asset/firm and worker/firm coordinates are shown by the triangular points.) Only one observation is shown for

the smaller firms. An estimate was made of the total assets/worker ratio for a subset of all large firms for which information was available in the Sociedades Anonimas. The estimate is approximate since the last year for which we have evidence on total assets of the Sociedades is 1967 and the last year on which an estimate of workers was available was 1968. Past trends were projected to 1969; it is unlikely that this extrapolation would lead to any serious error. A comparison of the slopes of the slashed arrows marked S and L shows how different the asset/worker ratio is for this set of large firms compared to the small ones.

Since the average firm size for the Sociedades Anonomas is much smaller (a little over 200) than the average firm size of the largest size category for which the horsepower and worker figures are presented, and since both relationships are presumably curvilinear, one might argue that the total asset/horsepower ratio rises by a good deal more than 100 percent moving from firms of twenty or less workers to ones of say 400 or 500. A number of complications must be allowed for, however. First of all, Sociedades Anonim as are known to have higher horsepower/worker ratios for a given firm size than do other firms; therefore it is plausible to assume that they also have higher total asset/worker ratios. While about two-thirds of the 250 odd firms appearing in the "large" firm observation on horsepower/worker are Sociedades Anonimas, and therefore the figure could not be dramatically different for Sociedades Anonimas only, it is true that if the ratio total asset/horsepower is the same at each firm size for Sociedades Anonimas and for others, then the "large" observation on "total assets/workers" would have been 16-17 percent less if the Sociedades Anonimas had had the same horsepower/worker ratios as other firms—fairly significant. Conversely, if one were to consider only the Sociedades Anonimas in Dane's largest size category, the horsepower/worker observation would be increased by only 9 percent-not very important. Furthermore, in the upper size category, at least in 1966 where figures are available, average size of Sociedad Anonimas is much larger (574 workers) than for other firms (385) or for all firms (407). There would seem to be little suggestion, therefore,

that the Sociedades Anonimas would have, at a given firm size, a higher horsepower/worker ratio in the upper size group. (The evidence is quite strong that such as difference exists at the lower size groups.) One other difficulty is that since in the Dane statistics the upper category is defined in terms of number of workers, this tends to give it a lower horsepower/labor ratio than it would have if defined in terms of capital, total factors used, or whatever other indicator. It seems unlikely that in an open-ended category with a wide range, that this factor should be too important.

Appendix B: Total Capital vs. Physical Capital

Besides real investment, a plant's (firms's) capital stock consists also of working capital. Large firms particularly tend to have sizeable amounts ot working capital tied up in accounts payable, cash, etc.; for the Sociedades

Anonimas in the manufacturing sector in 1964 the three categories cash + short term credits, inventories, and fixed capital were all about equal (according to the official figures), although the fixed capital would probably be the largest after allowance for inflation.[1] To a considerable extent the "accounts payable" of large firms (like many of the Sociedades Anonimas) constitute credit extended to other presumably smaller firms with less easy access to the institutional credit channels. In general short term credits of the Sociedades are quite close in amount to short term debts (to banks, foreign suppliers, etc.). Whether some or all of this working capital should be treated as part of a firm's capital stock for purposes of evaluating its total factor productivity raises some theoretical questions. If, as seems probable, working capital/total capital is higher for large than for small ones, its exclusion in factor productivity calculations leads to a certain bias against the small units.[2]

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[1] Which is not taken into account in the official figures in such a way as to provide a measure of current value.

[2] In a world of perfect factor and product markets, the issues raised are not particularly complicated, and the way they should be handled is fairly clear. (Of course with all markets perfect the object of the exercise of comparing total productivity for different sets of firms loses meaning.) Two types of comparisons across producing units are possible. One focuses on the productivity of "factors used" by the producing unit; in this case a firm which receives credit from another one has that amount included in its "capital"--this capital not being a factor input to the firm advancing the credit. Outputs are measured by the usual "value added." The alternative approach, focusing on "factors owned" involves deducting from the debtor firm's value added the interest it must pay on this capital, and not including that capital in the denominator; the reverse would be done for the creditor. Since it is not normally possible to sort out interest payments (if any), the latter procedure would not be practical in any case, so the "factors used" approach would seem the only possible one; in it cash but not accounts receivable would be treated as part of a firm's capital.

This approach involves a bias, however, since the lending firm is normally repaid in the form of a lower purchase price (or higher sales price) than would otherwise be the case. Thus the fact that the debtor firm does not own an amount of capital equal to real capital used (fixed + inventories plus cash) does affect the estimate of its value added, by leading to a lower sales price than would otherwise be the case; the opposite is true for the larger firm. In other words, it is clear that the availability of capital to use in the form of accounts receivable does have an impact on a firm's recorded "output/other forms of capital" ratio.

The little empirical evidence available here suggests that the total assets/physical capital ratio rises with firm size (measured by number of workers).[1] If physical capital/horsepower increases with size, and total assets/physical capital increases, clearly total assets/horsepower increases.[2] There is some more direct support for this proposition, adduced by comparisons of the horsepower/worker and the total assets/worker ratios to size; the latter ratio rises more rapidly than the former. Though the information used to arrive at this conclusion comes from a variety of sources, the incomparabilities and/or errors would have to be substantial for it to be negated; as they stand, the data suggest that the total assets/horsepower ratio may be twice as high or more for large firms (of 200 workers or more) than for small ones, of say less than 20 or perhaps less than 50 workers. (See Diagram A-1.)

Although there is substantial evidence of positive relation between the total asset/horsepower ratio and firm size, the fact that large firms appear to have a higher share of their assets in the form of accounts receivable.

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[1] Only for the Sociedadaes Anonimas (whose special characteristics make them a rather unrepresentative sample) is evidence available on this ratio. Table A-9 indicates, in general, a positive relationship between the ratio "fixed capital plus inventories/total assets" and the level of assets per firm. Since the observations are, once again, averages for all the Sociedades Anonimas in a given 2 or 3 digit sector, the usual "failure to normalize" problems are present, i.e., it may be that different industries imply different optimal ratios of the variable in question as well as different average size firms. Abstracting from this problem, the ratios would suggest that over the range of perhaps 50-600 workers, the ratio might decrease by 20-40 percent.

Note that such economic variables as labor productivity, the capital/labor ratio, and others tend to vary less by plant size for Sociedades Anonimas than they do for other plants. This might suggest that the calculation just cited underestimates the variation of the ratio in question over firm sizes in the universe of firms.

[2] There is an asymmetry in the information available on these two ratios, that for the first relating to firm size (as the Sociedades are firms, not plants) and the second, as explained earlier, to plant size. It seems unlikely that any conclusions drawn here are the result of this asymmetry, though it would be advantageous, of course, to have the data in common terms.

Appendix C: Value Added/Capital and Firm (Plant) Size with Other Definitions of Firm (Plant) Size

While it is generally recognized that for many purposes the use of "number of workers" to measure a firm's size is not the appropriate one, other measures are difficult to implement for reasons of data availability. Although it is not possible, for Colombia, to go through any real analysis with alternative measures, it is worth clarifying to some extent how results might differ if that were possible. For many policy purposes (e.g., with respect to credit policy toward a firm planning to expand its capital) capital stock is likely to be the more relevant indicator of size; for many other questions some concept like "total factors used" would be optimal.[1] In the absence of actual information on the relationship among total inputs, the capital/labor ratio and total factor productivity, no firm predictions can be made as to how the relationship between, for example, output/capital and size of firm will change when capital replaces labor as a measure of firm size. But it is worthwhile noting that if there were no relation between firm size measured by total inputs and either capital/labor or total factor productivity, then one would expect output/capital to rise less rapidly (fall more rapidly) with firm size where firm size is defined in terms of capital than where it is defined in terms of labor.[2]

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[1] Statistical offices could easily classify firms by amount of output and this would be in some cases more closely related to total factors used, but it would make it impossible to analyze in an unbiased fashion questions like the relationship between total factors used and total productivity.

[2] Where firm size is defined by number of workers, "small" firms include both ones with small amounts of both factors and ones with small amounts of labor but substantial amounts of capital; the inclusion of the latter firms should imply a lower output/capital ratio than would obtain for the firms small in terms of both inputs. Firms with many workers include firms with a large amount of both factors and firms with only a moderate amount of capital but a high labor/capital ratio; the inclusion of the latter group implies a higher output/capital ratio than would obtain for just the firms with high amounts of both factors. How different the output/capital-firm size relation would be

Footnote 2 of Appendix C continued

for these two definitions of firm size would depend on the dispersion of the capital/labor ratio for firms of given "total inputs." If for any given size (defined by total factor inputs with fixed factor prices) firms were normally distributed around a given capital/labor ratio (a plausible expectation if the production function were homogeneous and factor market imperfections faced by firms were not related to their size) the difference would depend only on the standard deviation of that normal distribution (assuming that either (a) all firms are at the same level of technical efficiency [i.e., the output of each one is that predicted by a single isoquant map or production function] or (b) there is no relationship between total factor productivity and capital labor ratio).

A third (and frequently the most relevant) output/capital-firm size relationship would appear if size were defined by "total inputs." We refer to this as the "true" relationship.

We know, in fact, that the capital/labor ratio is an increasing function of total factor inputs. (Whether this is due to a nonhomogeneity in the production function or to problems in factor markets is not relevant here.) This tends to imply that the use of labor as a measure of size will generate a greater upward bias to the output/capital-firm size relation than in the benchmark case just referred to. (Firms of a given total input size normally distributed around a given K/L ratio and having no relation between technical efficiency and K/L.) Consider the relationship between L/K for firms recorded as being in the highest size class (i.e., L above a certain level) to L/K for firms actually in the highest class (defined by total factor inputs), and the corresponding comparison for the lower size class; the percent difference between these two ratios is greater in the present case than in the preceding one. Thus the use of L as a measure of size gives a more biased picture (relative to the true measure) here than in the previous case. Conversely, however, if capital is used as a measure of size, then the top size category will have a K/L ratio above that of the top size category measured by total inputs by a smaller proportion than in the benchmark case, i.e., the bias will be less than in the benchmark case. Whether the total difference between the output/capital-firm size relationship found using the two different size measures would be greater here than in the benchmark case is not clear. If it is assumed that the nonconical (i.e., not forming a sort of cone when each labor and capital coordinate is plotted on a graph) distribution of firms by amounts of labor and capital is due to a nonhomogeneous production function, and (perhaps in other cases as well) one would probably not expect a normal distribution of firms along a given factor price ray. But nothing is very clear in this area.

In a more complete analysis it would be of interest to discuss the expected distribution of capital/labor combinations. It would also be useful to ascertain the typical "growth to equilibrium" paths of firms, since there may be more to learn from firms which are at least in some sort of equilibrium. But this is empirically impossible too.