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LAND DISTRIBUTION, INCOME DISTRIBUTION AND THE PRODUCTIVE EFFICIENCY OF COLOMBIAN AGRICULTURE

Albert Berry

March 20, 1971

Land Distribution, Income Distribution and the Productive Efficiency of Colombian Agriculture

Albert Berry

The most cursory observation indicated that income distribution is a most severe problem in Colombia; it would require strange suppositions about the relative utility of a peso to the rich and to the poor to alter the conclusion that total social welfare would be higher if that distribution were more equal. This paper presents the results of an attempt to quantify income distribution in the agricultural sector (with close to half of the active population) at the beginning of the 60s and to bring out its relationship with the distribution of land and other forms of wealth; it also presents some evidence on the relative static efficiency of farms of different sizes, relevant to the question of whether the goals of rapid growth of agricultural output and improved distribution are conflicting or complementary; finally it tries to draw some tentative policy conclusions and to point out those aspects of the agricultural sector about which our ignorance is particularly great, and the need for empirical work correspondingly high.[1] Since many relevant relationships will not be touched on no conclusive answers can be given for questions raised. Although the analysis is done in the Colombian context, evidence from some Latin American and other underdeveloped countries suggests that the questions raised here are of general interest and the Colombian data not atypical.

[1] As in so many parts of the world, income distribution was essentially neglected in most government policymaking in Colombia until quite recently. The nature of information available on the economy and research carried out reflect this, with the result that the bases for statements about distribution and about the complementarity or competitiveness of the output and distribution goals remain shaky.

As background, some relevant characteristics of Colombia's agricultural sector should be borne in mind. First, land is quite unevenly distributed, both with respect to ownership and with respect to operation. Second, income is unequally distributed. Third, there is evidence of some form of labor surplus, especially in the older highly populated Andean regions of the country where minifundia are very common. And fourth, there are relationships between size of farm and typf of farming which are so significant as to make it plausible that different sized farms differ markedly in productivity; depending on the factor(s) in question, they might be expected to differ in different ways. It is clear (see below) that small farms produce more per hectare and large farms more per worker. Which has a higher total factor productivity depends on the relative factor prices; the socially relevant factor costs depend very much on whether there is labor surplus or not.

The Distribution of Income Generated in Agriculture

The data presented below refer basically to the year 1960, and give a distribution to the individual's role in the current production process[1] i.e., the income defined by what we may call the "national accounts concept.

Although one is usually more interested in the distribution of potential consumption by individuals, data limitations usually restrict him

[1] Unpaid family workers are excluded; they form about 15 percent of the agricultural labor force.

to consideration of distribution by families,[1] by individuals,[2] or both. In the present case the nature of the data precludes a good estimate of both distributions, and makes it easiest to calculate a distribution by individuals. Unfortunately, our data also permits only an estimate of income according to the national accounts concept;[3] we do however present data on the distribution of wealth in land, probably the major source of capital appreciation income,

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[1] If the income of all members of every family (however that unit were composed, e.g., by blood ties or otherwise) pooled all of their income and spent it communally and equally on each member then the family distribution, along with data on the number of members in each family, would give all the information desired to arrive at the directly relevant distribution--that of consumption potential among individuals. (This is a slight exaggeration since one would also have to assume equal distribution in the future of the returns from current savings to be able to assume equal present value of consumption (present and future) based on current income, or that each member's current consumption potential was really total family income divided by the number of family members, i.e., the savings decision was one on which all family members agreed.) In the absence either of near equality of size of all families (or knowledge of the size of each, not usually available) or equal expenditure (or proportional to needs, whichever is more relevant) on each member, this distribution ceases to be a fully satisfactory one.

[2] If family units were basically made up of individual income earners who simply derived some advantages from living together, the personal distribution would be fully satisfactory. It is close to being so as long as each income earner has the same number of dependents, and decreasingly so the more this condition is violated. Assuming that in fact expenditures are spread fairly evenly over the members of a family, the greatest differences would occur when there was a positive or negative relationship between the size of personal income and the percent of the people in the family who work.

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[3] Most calculations of income distribution use the national accounts definition, i.e., they define income as factor payments generated in the course of the production of goods and services during a given period, normally a year. The concept excludes increases in wealth which result from appreciation (in real terms) of various assets, physical of financial. Since this latter income is as real and usable for the individualas that generated in the production of goods, it clearly should be included for such purposes as analyses of the distribution of income with a view to questions of equity, predicted changes in the distribution of wealth, etc. Most of the income not captured in the national accounts concept is related to the ownership of capital and its exclusion tends to bias downward the concentration of income in upper income groups.

Table 1

Personal Distribution of Income (National Accounts Concept) from Agriculture,1960, by Income Categories (Basic Estimate)

Income in Thousands of 1960 Pesos	Percent of People in Category	Percent of Income Accruing to People in Category	Cumulated Percent of People	Cumulated Percent of Income
0 - 1	8.87	1.93	8.87	1.93
1 - 1.5	29.76	9.73	38.72	11.67
1.5 - 2.0	21.77	9.71	60.50	21.38
2.0 - 3.0	14.00	8.69	74.50	30.07
3.0 - 5.0	10.56	10.36	85.05	40.43
5.0 - 10.0	9.82	17.78	94.87	58.20
10.0 - 20.0	3.44	12.06	99.31	70.27
20.0 - 110.0	1.41	14.47	99.72	84.73
100.0 - 200.0	21	8.19	99.93	92.92
> 200.0	.07	7.08	100.00	100.00

Sources and Methodology: The data are adjusted slightly from those presented in Albert Berry The Distribution of Agriculturally Based Income in Colombia, 1960, mimeo. The appendix with the figures underlying these estimates and the details of the methodology is available from the author. Broadly speaking the methodology involved calculations of average income accruing to the producers on each different size of farm and putting this together with an independent estimate of the distribution of labor income to get an overall distribution. Few of the figures are very solid; as a result we frequently present upper and lower limit estimates. The major pieces of information include the distribution of land use by farm size for 1960 from the agricultural census (a relatively accurate piece of information), yield per hectare by farm size for the different crops, based on adjusted 1966 figures coming from DANE's agricultural sample (less accurate but still probably reasonably close to the 1966 reality--perhaps less close to the 1960 reality). It was necessary to estimate the number of workers hired by producers on each farm size,(based on the number of people living on farms of different sizes according to the 1960 agricultural census and on other estimates(only fairly accurate), and the rental payments by producers on various farm sizes (reasonably accurate since the 1960 agricultural census indicated what share of land was rented by farm size) and rental receipts by farm size (a guess since there was no solid information available.)

and speculate as to how the inclusion of capital gains would affect the distribution.

Tables 1 and 2 present in slightly different form, a best estimate of the personal distribution of income (national accounts concept) of the agricultural sector in 1960; family helpers are excluded. Any such calculation of income distribution is naturally fraught with many statistical problems. A study of the methodology used here reveals, however, that

(a) the conclusion that the great majority of the agricultural labor force had an income from agriculture of below 5,000 pesos (about 700 U.S. dollars) is not open to serious question, and there is little doubt that the bottom half had less than 3,000 pesos (400 U.S. dollars).[1]

(b) there is little doubt that the top 15 percent had close to 60 percent of the income (say 55-65) and the bottom 85 percent therefore had 35-45 percent.[2]

It should be emphasized that Tables 1 and 2 present the estimated distribution of income generated in agriculture, not the distribution of all income (from agriculture or other sources) of people involved in agriculture. For the people corresponding to the top and the bottom of the distribution, both share and absolute level of total income [illegible] could be considerably different from share and absolute level of agricultural income alone.

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[1]Since the data refers to income per economically active person, its translation into income per capita (including dependents) involves, roughly, dividing each figure by 3. Thus income per capita in the families in the bottom half was probably about $125, (assuming family size was the same for this group as for the average).

[2]The major areas of doubt involve the distribution of income within these top and bottom groups respectively. For the bottom group the uncertainty results from our not knowing in detail which small producers worked on other farms, how much they worked and what their wages were. The distributions are also in some doubt because of lack of information on the distribution of value added and certain costs by farm size.

Table 2

Personal Distribution of Income from Colombian Agriculture, 1960, by Deciles (Basic Estimate and Alternatives)

Decile	Basic Estimate		Low Estimate of Bottom Deciles Income		Low Estimate of Upper Decile Income		
	Percent of Income	Cumulative Percent of Income	Percent of Income	Cumulative Percent of Income	(a)	(b)	(c)
	(1)	(2)	(3)	(4)			
1	2.24	2.24	1.18	1.18			
2	2.87	5.11	2.38	3.56			
3	3.34	8.45					
4	3.73	12.18					
5	4.21	16.39					
6	4.68	21.07					
7	5.78	26.85					
8	7.90	34.75					
9	12.77	47.52					
10	52.48	100.00			49.48	46.32	43.08

Sources and Methodology: The basic estimate (i.e., best guess) is an adjusted version of that presented in op. cit., Appendix Table A-I. The lower estimate for the bottom two deciles (Cols. (3) and (4) is designed to be downward biased with respect to each doubtful assumption which was made. It assumed, in particular, that the workers with the lowest wages work the smallest part of the year and do not own or operate any land (which would add to their income).

The three estimates designed to give various types of lower limits for the upper decile share involve the following assumptions:

(a) There was no dispersion of incomes for farmers in given size categories. As can be seen in op. cit. appendix, our estimation technique involved calculating the average income accruing to farmers in a given size group, then assuming a certain dispersion around this mean. The share of the upper decile is an increasing function of the amount of dispersion assumed. To assume no dispersion is clearly unrealistic, so, with respect to this aspect of the methodology, estimate (a) is clearly downward biased.

(b) This estimate, further to (a), assumes twice as many laborers working on large farms (or more precisely twice as much salary payments to blue collar workers) as the basic estimate. It seems almost sure that with such an assumption a downward bias is created in this respect as well.

(c) Here it is further assumed that the basic estimate overstated value added in the large farms by 10 percent. Since we use 1966 data on relative yields by farm size, and these showed higher yields of many crops for larger than for small farms, if the former had risen relative to the latter in the period 1960-66, which is possible, there might have been an upward bias. Note that this could well mean that the 1966 distribution would be more like the one presented here.

Impressionistic evidence suggests that the incomes earned in other sectors may be a particularly high share of total income for some of the people towards the top of the agricultural distribution,(i.e., the absentee farmers and the partially absentee "commercial" farmers). Also, capital gains (not included in the tables)are hard to guess at.[1] While not many people towards the bottom of the "income from agriculture" distribution are absentee, the pressure of their very low agricultural incomes pushes them to earn incomes from other sources.[2]

As indicated in Table 2, the bottom decile could have anywhere between 1.2 percent (an estimate designed to be a real minimum) and say 3 percent, and the bottom two deciles could have between 3.6 and around 6 percent, (always disregarding income from non-agricultural sources). For the top decile, 50-55 percent seems the likely range; it seems very unlikely that less than 45 percent accrues to this group.[3] Anf if capital gains income is included it is

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[1]The group of people constituting the upper decile of income earners probably has about 75 percent of all land (by value) and this is the only asset likely to produce secular capital gains; unfortunately there is no information available which casts mugh light on the rate of appreciation of land values for the country as a whole. We estimated the value of land owned by people defined as being within the agricultural sector in 1960 at about 23 billion pesos; if land were to appreciate by say 5 percent in real terms each year, it would add another 20.7 percent to the incomes of the top decile and imply a share for them in income including capital gains of 55.6 percent, assuming our basic estimate of 52.5 was correct for their share of "national accounts" income. If the real appreciation rate were 3 percent their income would be raised by 12.5 percent and their share would be 54.1. The striking feature of these calculations is that when distribution is as unequal as in the present case, the inclusion of capital gains does not affect it much; 5 percent per year is almost certainly an upper bound for the appreciation of land values in Colombia over any extended period.

[2]The findings of a study in the Rio Suarez Valley were consistent with this. See Marco Reyes, Rafael Prieto and Bill Hanneson, Estudio Agroeconomico de la Hoya del Rio Suarez; CEDE, Universidad de Los Andes and CAR; Bogota 1965.

[3]The odds against all the downward adjustments made in estimate (c) being warranted are very high.

very unlikely that less than 50 percent goes to this group. The basic estimate of distribution is represented by the Lorenz curve of Figure 1. The (Gini) coefficient of concentration is .58.

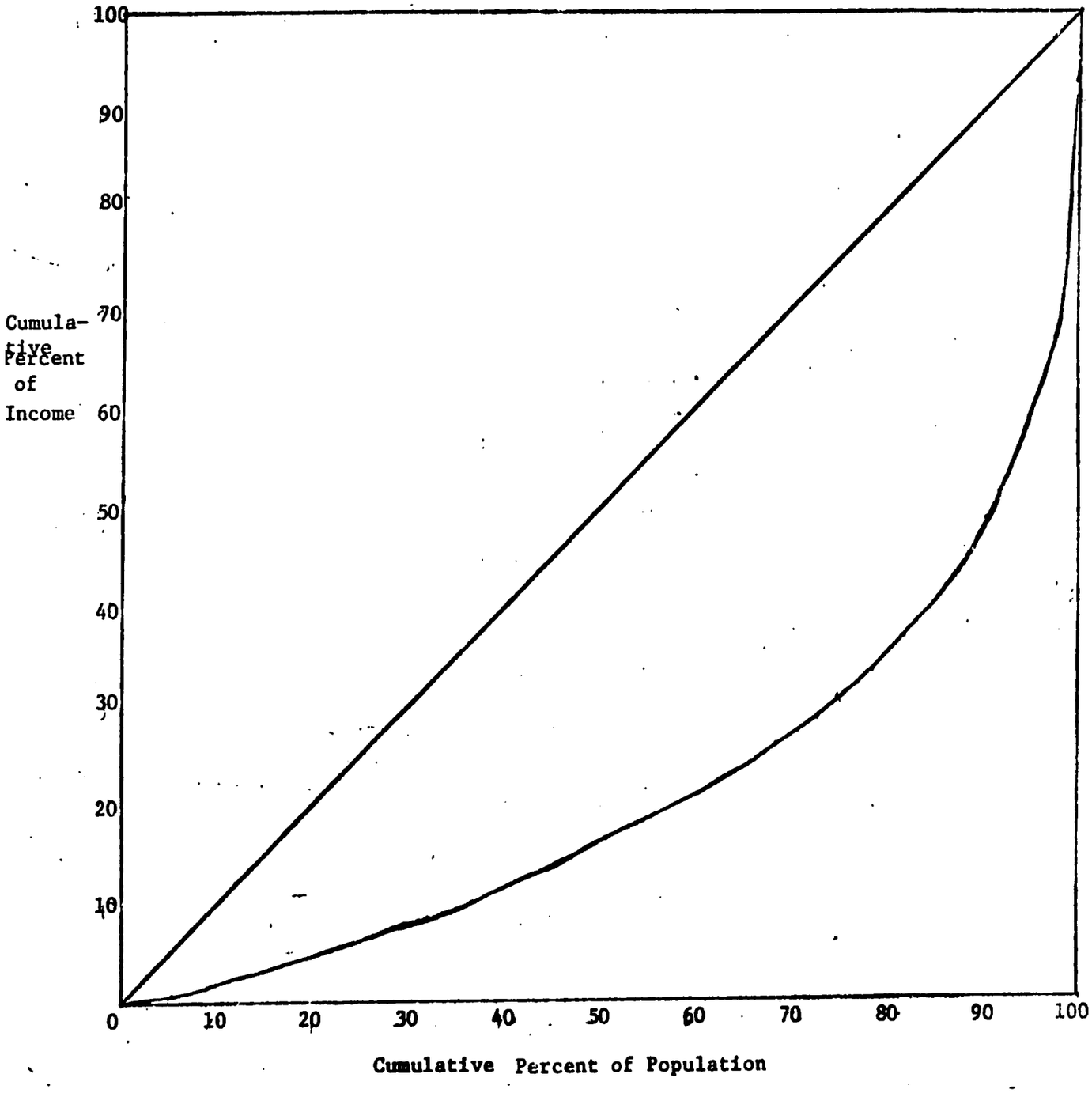
Determinants of the Skewness of the Distribution of Agricultural Income

At a first level of analysis the explanation of the inequality of incomes in agriculture is the unequal distribution of land. The high incomes correspond to people with large farms, as indicated by the figures of Table 3. (The smallest farms, of less than one hectare, are excluded in Table 3 since most of the 300,000 people with such plots earned most of their income working for someone else.) Most of the incomes of the larger producers accrue to them in their role as owners of land and capital, not in their role as suppliers of labor, as we see below.

The distribution of income among salaried laborers, while showing substantial range (much of it due to wage differentials among different regions of the country), does not contribute much to the skewness of the overall distribution, since all these incomes come toward the bottom of it. Table 4 breaks down the roughly one million farm hands[1] by estimated annual earnings in 1960.

The average incomes of different groups are revealing. Laborers earned an average of about 1,400 pesos per year; the earnings of operators of very small farms (less than two hectares) were in this same range and even up to 5 hectares they were very low. Colombia's "small farmers" may be thought of

[1] Most families have at least a small plot for their own use. The figure here corresponds roughly to the number of man years worked for remuneration.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100
Cumulative Percent of Population

Table 3

Average Income of Producers by Farm Size
(1960 pesos)

Farm Size (hectares)	Average Income	Number of Producers
1-2	1,300	191,350
2-3	1,900	117,000
3-4	2,320	92,000
4-5	2,640	58,200
5-10	3,670	169,150
10-20	5,580	114,200
20-30	6,750	44,050
30-40	8,340	26,500
40-50	10,203	16,240
50-100	12,800	40,000
100-200	23,800	22,300
200-500	41,140	13,700
500-1000	102,500	4,140
1000-2000	189,800	1,975
> 2000	527,700	790
Total	6,145	911,595

Source: Berry, op. cit., Appendix Table A-2, revised to take account of new information.

Table 4

Distribution of Income Among Wage Earners

Category Number	Average Annual Income of Category (1960 pesos)	Percent of Workers	Cumulative Percent of Workers
1	600	1.3	1.3
2	715	2.0	3.3
3	835	4.6	7.9
4	950	3.0	10.9
5	1070	10.5	21.4
6	1190	8.3	29.7
7	1310	25.7	55.4
8	1430	5.5	60.9
9	1550	15.8	76.7
10	1670	3.9	80.6
11	1787	8.5	89.1
12	1900	1.8	90.9
13	2025	5.7	96.6
14	2290	3.4	100.0

Source: Based on wage statistics collected in each municipio by DANE, and published in its Boletin Mensual de Estidistica. The details of the calculation are presented in Berry, op. cit., Appendix Table A-5. It was assumed that each worker was occupied 250 days per year.

roughly as the group with 5-20 hectares, and with average income of around 4,500 pesos. While hardly living in luxury, these nearby 200,000 farmers are relatively well off. The upper 10 percent of agricultural families are those with 20 hectares and up; there is still a wide range of incomes in this category, which probably includes almost all of the few white collar workers in agriculture as well as the producers.

If the market for factors were perfect (so that all units of a given factor earned the same), differences in personal or family incomes would depend only on differences in factors owned, so with information on the distribution of physical capital (land and other forms) and human capital (entrepreneurial ability, physical power or whatever makes one man's labor more productive than another's) along with estimates of the income shares of physical capital, human capital, and what we may call pure or basic labor, one could predict the income distribution. Its skewness or dispersion would be a simple function of the skewness of the ownership of each factor, the share of total income going to each factor, and the relationship (if any) between the amount of one factor owned and the amount of other factors owned. Although the assumption of perfect factor markets is untenable, and no information exists on the distribution of human capital, it is still of some interest, as a first [illegible] (crude) step in explaining income differences, to assume that human capital is proportional to physical capital and factor markets are perfect, this may give some feel for the sources of income skewness as well as the likelihood that the assumptions are very wide of the mark. Lumping land into the factor "capital," we may express overall skewness in terms of the skewness of income from capital and labor, the covariance of the income from the two, and the share of total

income going to each factor. It is thus possible to ascertain whether unequal distribution of capital[1] is primarily responsible for the skewness of the distribution of income or whether it depends more on such unmeasured things as the innate ability of the farmer, the amount of work done, or other factors.

There is insufficient data to enable precise calculations of the labor and capital income; we can, however, get some rough clues. A reasonable approximation of returns to pure labor--where we try to exclude the payment to human capital--is the average wage per agricultural worker; in 1960 this appeared to be about 1,400 pesos; applied to all of the active population in agriculture, it implies a pure labor share of about 36 percent.[2] A problem arises in that the calculation is valid only if workers have the same return to their labor whether the income is paid or imputed; the existence of market imperfections or other obstacles to this condition's being met would therefore make it difficult to interpret such a figure; more specifically, a correct estimate of income accruing because of labor inputs calls for a correct imputation in cases where no financial transaction occurs.[3] We turn below to some more plausible estimates of the labor

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[1] Or some other factor distributed in a similar way.

[2] If the average figure of 1,400 includes some people with a reasonable amount of human capital, one should perhaps define the pure labor share as something less than this. The concept of a pure labor share is in one sense a contradiction of terms since if all learning is included as human capital the share could be zero or negative; it is useful, however, if there is a level of learning and ability which almost everyone can achieve fairly quickly on the job, without outside instruction. For the present case the concept meets the generally reasonable criterion of corresponding to people with almost no formal education, and to a large group of the agricultural population.

[3] The fact that 1,400 is not the wage received by all paid workers does not create a problem at this point; the estimate of 36 percent would be incorrect if the average imputed labor income were not equal to the average paid income.

share but since range of possibilities is not particularly wide, it is instructive at this point to draw out somewhat further the implications which could be drawn if indeed the average wage rate were the appropriate measure of labor returns for agricultural labor as a whole. Figure 2 presents estimates of the size distirbution of labor income and that of capital income under this assumption; the latter is much more skewed than the former. The variance of labor income is much less than that of all income. The data of Table 4 suggests that only about 20 percent of hired workers (excluding white collar workers--administratives, etc) earned less than 1,000 pesos or more than 1,850, when the average was 1,400.[1] The standard deviation divided by the mean was 0.26. Average income from all factors was about 3,800 and the ratio standard/mean was 35.3 . Another interesting piece of information is the functional distribution of income within each decile of the income distribution for which estimates are presented in Table 5. These figures reinforce the conclusion evident from Figure 2 that it is income from capital which gives the overall distribution its skewness.

Although the figures presented in Table 5 are "best estimates" rather than firm figures, consideration of other assumptions than the ones used suggest that the general character of the functional distribution by deciles is not very sensitive to plausible alternatives (exceptions will be noted specifically).[2] The conclusions which emerge clearly are the following:

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[1]It should be noted that the variance is underestimated in one respect by these figures, since they are based primarily on average wages of different municipalities, not wages of individuals. In fact, however, since geography is the main cause of the variation, it is probably overestimated in another respect due to the probable positive correlation between wages and the cost of living. Note also that these figures refer to males over 18. But this group includes about 80 percent of the total agricultural population and probably almost as high a proportion of the workers.

[2]See discussion with the Appendix tables where various assumptions about the distribution of labor over land, relationship between wage rate and size of farm, etc., are considered.

Figure 2

Size Distribution of Blue Collar Labor Income and of Capital Income: 1960

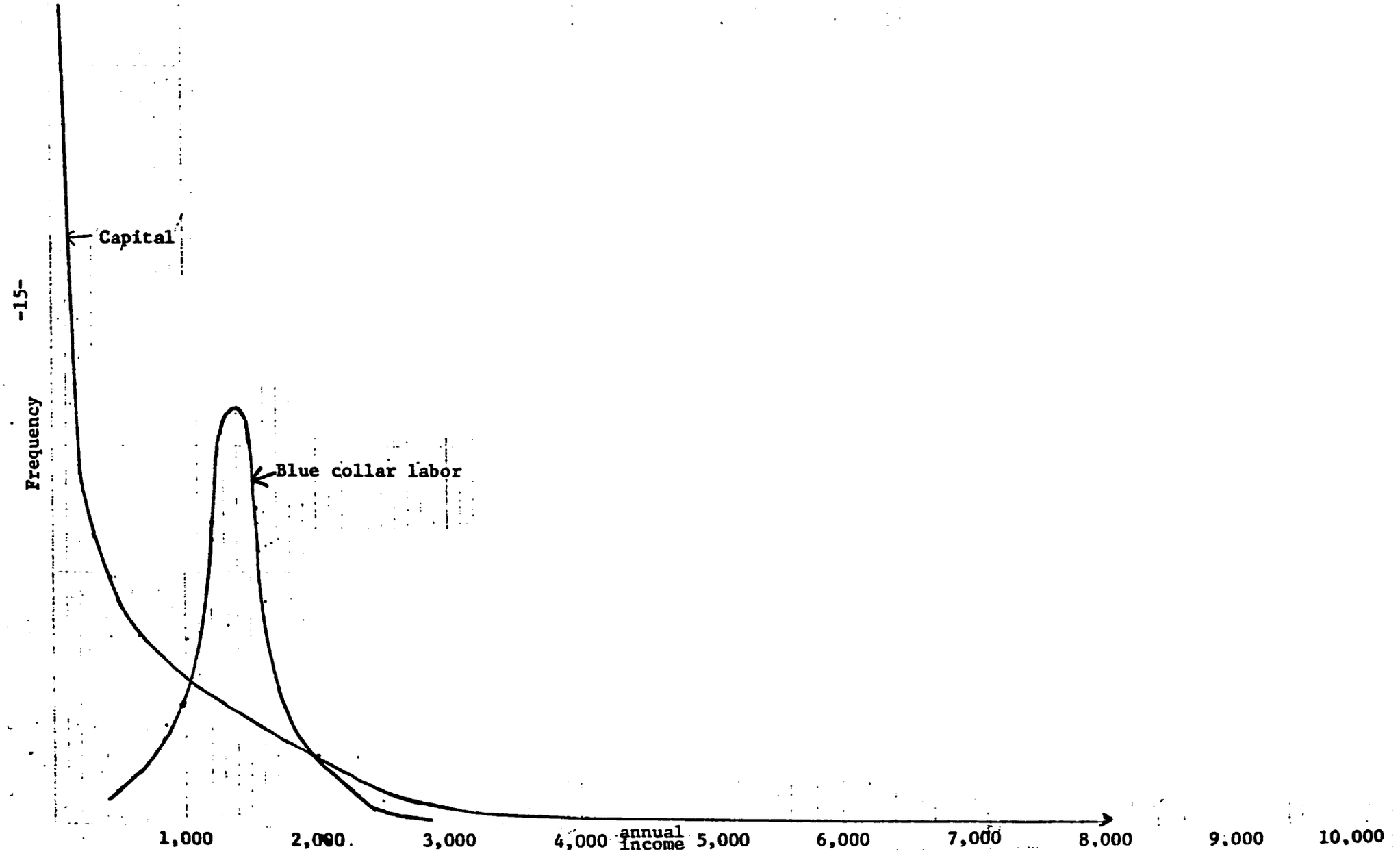

Table 5

Labor and Capital Shares, by Deciles of The Personal Income Distribution[1]

Decile	Average Income (National Accounts Concept)	Hired Labor Share	Imputed Pure Labor Share	Total Labor Share	Capital Share
1	865	72.3	13.9	86.2	13.8
2	1108	70.2	14.9	85.1	14.9
3	1290	80.8	9.6	90.4	9.6
4	1441	80.6	9.7	90.3	9.7
5	1626	81.9	9.0	90.9	9.1
6	1807	57.7	21.1	78.8	21.2
7	2232	30.3	34.8	65.1	34.9
8	3060	7.5	40.4	47.9	52.1
9	4940	1.8	25.3	27.1	72.9
10	20270	1.2	5.7	6.9	93.1
Total	3830	18.9	14.4	33.3	66.7

Source: Calculations by the author.

[1]We discuss elsewhere the issue of whether the income of the producer can meaningfully be distributed among the factors he supplies--since our conclusion there is that no plausible definition of the labor share could make its general relation with farm size dramatically different from that shown in these figures, the problem is set aside for the moment. The assumption used for these calculations is that the income of small scale producers with income less than 2,800 pesos was attributable equally to labor and to capital.

1. Approximately the bottom half of income earners receive by far the largest part of their income as paid blue collar workers on other farms. It seems unlikely that any of the first five deciles earn much less than 75 percent of their income in this way; the rest comes from production on land the farmer operates. Paid blue collar income remains important in the sixth and seventh deciles but essentially does not enter the top three.

2. While uncertainty as to the number of hired laborers on small farms makes the estimated producer share for them subject to error, for the bottom five deciles it is probably in the range of 15 to 30 percent; it rises rapidly to a level of probably over 90 percent for the upper three deciles.

3. White collar workers and administrators are found in the top two deciles.

4. The pure labor share varies dramatically by decile, from something probably below 10 percent in the upper decile to something in the range of 80 to 100 percent in the lower ones. It is impossible to be more precise since no definition of the pure labor share for lower deciles is conceptually convincing in any case.[1]

5. The capital share is very high on the largest farms, possibly around 90 percent but almost certainly above 75 percent. Note that the upper decile corresponds essentially to operators of farms of 20 hectares and up.

While the above figures are not directed at analyzing what factor of

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[1]An argument can be made that the producer income on small plots is almost exclusively capital income in one sense, since the opportunity cost of the labor is zero or close to it; these questions are taken up elsewhere. Our only point here is that regardless of how the imputation as between labor and capital income is made for small producers, the pure labor share of low decile income is much higher than that of high decile income.

production it is which makes the income of large scale farmers much higher than that of small scale farmers or laborers, the answer must lie with one or more of (a) the greater amount of capital (land and physical) (b) a greater amount of human capital, or (c) market imperfections which work in favor of the larger farms. For purposes of analysis of the relative efficiency of different size farms and [illegible]

policy prescriptions it is important to distinguish among these possible explanations, but our objective here is of a more descriptive nature, simply to note that the skewed distribution of the income appears to be inextricably related to distributions of land and capital. It is worth considering how the interpretation may differ under the assumption of market imperfections, however, since this can alter the calculated shares themselves.

The Assumption of Market Imperfections

When groups of farms have such different output-input and output/input ratios as the different size categories do in Colombia (details are presented below) it seems highly probable that some factor markets are imperfect.[1]

The most obvious imperfections are in the labor market--both impressionistic evidence and the data discussed below indicate that the marginal productivity of labor is unequal for farms of different sizes--and in the markets for some types of capital. Some are more difficult to purchase, or more

[1]The data are inconsistent with the same rate of return to labor and capital on all farm sizes unless (a) the return to labor is below the reported wage rate, (b) an unmeasured factor (e.g., entrepreneurship) is highly complementary with land and capital and competitive with labor, or (c) some factor treated as homogeneous (e.g., labor) is in fact quite heterogeneous.

expensive, for one group of farmers than for others; credit is very unequally available.

Measuring imputed labor and capital incomes has serious practical and conceptual problems when factor markets are not perfect.[1] On a farm which hires all of its labor the labor share is conceptually simple to arrive at--it is the total wage bill. The fact that the wage rate may be different in different regions or for different farm sizes may reflect the fact that markets are separated; in that case the labor share is not the income of one homogeneous factor, but it is still the factor's total income, a meaningful figure. But a conceptual problem arises in the case of separated factor markets when not all labor is hired.[2] Consider the case of a small operator who applies his own labor and capital to earn an income corresponding to below the average market rate of return to one or both factors, but which gives him more income than if he sold the services of his labor and capital on the market, i.e., the return from the best alternative use of his factors is below their return on the farm which in turn is below their average market remunerations. In this situation if the rate of return to capital is defined as total income minus the individual's income from the best alternative use of labor, and the return to labor is correspondingly defined as total income minus income attainable from the best alternative use of capital, the sum of these two figures exceeds total income. Since neither the income from the best alternative use nor the marginal productivity calculated in the above way is a valid measure of a

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[1] The case resembles (though is presumably less extreme than) that of a good in whose production the factors are perfect complements; the marginal productivity of each factor is the total output up to a certain level of input of the factor, then zero.

[2] If factor markets were perfect, the failure of some factors to enter the market would still not matter, since the appropriate imputation for any factor would be its market remuneration.

factor's income, the meaning of a factor's share loses precision; it could at best be given upper and lower limits corresponding to these two definitions of marginal productivity. Incomplete knowledge of the nature of factor market imperfections suggests that several alternative functional distributions of the producer income on different farm sizes be considered to see if the total labor and capital shares and their relationship to farm size are sensitive to different assumptions; we have used here each of the following bases:

1) All producers earn the average hired labor wage of 1,400 from their own labor and the rest of their income is from capital: this assumption is internally inconsistent unless the rate of return to capital is very low and possibly even negative for the smallest farms or we have overestimated the number of man hours spent on small farms--with our "best estimate" figures the implied labor income would more than exhaust the total income generated on these farms. This assumption thus presumably leads to an overestimate of the labor share for some range of smaller farms.

2) Labor income of producers is distributed in the same way as is the wage rate of hired laborers, with the smallest producers assumed to earn the smallest imputed labor incomes. Assuming that both producer labor income and paid labor income is smallest on the small farms gives the lowest plausible estimates of the difference in labor shares across different farm sizes (under the general assumption of a fairly perfect labor market, i.e., where it is implicitly assumed that any producer could earn something as a worker).

3) The rate of return to capital is equal at some specific rate on all farms, then after deducing labor payments an imputed rate of return to labor may be calculated for producers.

4) the rate of return to capital varies proportionately to average labor productivity.[1]

Functional distribution, especially for certain farm sizes, is relatively sensitive to which of these assumptions are used, as seen in Table A-12. Two of the more plausible sets of estimates are presented in Table 6. Functional distribution by deciles is less sensitive, since most of the individuals in the bottom half of the distribution are hired laborers. But which assumption is made has considerable interest, both in terms of its implications for relative efficiency by farm size (see below) and for optimal government policy. A lower limit estimate of a pure labor share (since total factor productivity appears to be lower on the smallest farms, the above estimate of 36 percent can be assumed to give an upper limit) suggests 30 percent or a little below. The paid labor share seems to be a little above 20 percent and imputed labor income is likely in the neighborhood of 10-16 percent (see Table A-12). Where the labor share and changes in it are viewed as indicators of the income of the lower income groups, it is worth noting that under the circumstances of Colombian agriculture, where much labor is applied on small farms with low returns, the pure labor share is particularly vulnerable to changes in the potential of these small farms and to rapidly diminishing marginal productivity on them.

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[1]The alternatives included here do not include the possibility that the capital share is quite high on small farms, since the opportunity cost of labor is zero and there is an opportunity cost to capital. In the extreme case of a small farm with surplus labor for which the market offers no alternatives at all, the labor share is zero, and all of the farm's income should be imputed to capital. Such a situation would imply that, if there were constant returns to scale the rate of return to capital would be higher on the small farms, even though total factor productivity could not be if the farms used the same factor proportions.

Table 6

Functional Distribution by Farm Size

	Distribution A					Distribution B	
	Paid Blue (1)	Paid White Collar and Technical (2)	Total Paid (3)	Total Labor (4)	Capital (5)	Total Labor (6)	Capital (7)
< 1/2	9.4		9.4	54.7	45.4	67.7	32.3
1/2 - 1	14.4		14.4	57.2	42.8	71.6	28.4
1 - 2	20.7		20.7	60.2	39.8	71.8	28.2
2 - 3	21.3		21.3	60.6	39.4	68.6	31.4
3 - 4	21.9		21.9	60.9	39.1	66.7	33.3
4 - 5	22.2		22.2	61.2	38.8	65.0	35.0
5 - 10	22.6		22.6	51.7	48.3	57.4	42.6
10 - 20	23.0	2.5	25.5	43.9	56.1	49.2	50.8
20 - 30	25.7	2.6	28.3	42.8	57.2	42.7	57.3
30 - 40	26.1	7.6	33.7	45.3	56.7	39.3	60.7
40 - 50	25.8	8.0	33.8	43.7	56.3	36.5	63.5
50 - 100	22.0	8.1	30.1	37.3	62.7	30.1	69.9
100 - 200	17.3	6.9	24.2	28.2	71.8	21.9	78.1
200 - 500	13.0	10.0	23.0	26.3	73.7	15.7	84.3
500 - 1000	9.8	10.0	19.8	20.5	79.5	12.4	87.6
1000 - 2,500	8.3	9.3	17.6	18.0	82.0	9.2	90.8
> 2.500	3.9	6.0	9.9	10.0	90.0	5.1	94.9
Total	18.2	5.0	23.2	33.3	66.7	37.9	62.1

Source: Table A-12 (Columns 1-5) are based on the paid labor distribution of the "best" estimate (estimate A) of Table 11, and the assumption that for farm sizes where producer income is less than 2,800 (twice the average salary), one half is labor income and one half capital income. Distribution B is based on the assumption that the imputed wage level for a given farm size equals 1400 times the efficiency coefficient corresponding to that farm size.

Evidence on Changes in Income Distribution Over Time

The income distribution figures presented above refer, as nearly as possible, to 1960 (although some data from other years were used in their estimation). The fact that distribution was so unequal in 1960 does not imply that it has always been so nor always will be; it is of interest to pursue the more limited evidence bearing on the way distribution has changed over time and to speculate on the causes of the apparent changes.

Pertinent information is much scantier for the years before 1960 and it is also difficult to quantify developments since then, since though there have been sample surveys in agriculture following up the 1960 census, they have not been sufficiently parallel in concept to permit good over time comparisons. Our discussion of the 1960 distribution does suggest that knowledge of the labor share over time would give some feel for changes in overall skewness.[1] One piece of data which has been collected on a municipal level for over 30 years (albeit with weaknesses and biases) is the wage rate; one can compare an estimate of the wage bill based on these figures with value added to estimate a labor share.[2] The evidence is stark; daily wage rates in real terms appear to be about the same in the latter part of the 1960s as they were when the figures were first collected in the mid 1930's;they underwent a decline in the late depression years and the early 40s, then rebounded and continued to increase till the early 60s, and have since levelled off. Over the same period average income per person engaged in agriculture appears to have risen at an average rate of 2-3 percent per year. If it is legitimate to assume

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[1] It would be better, of course, to know also the size distribution of farms.

[2] Some of the dangers involved in such calculations will be referred to below.

that daily wages are a reasonable indicator of "pure labor income" then since it is also true that both land and capital have risen faster than labor over this period, the labor share must have fallen substantially. A best guess estimate is presented in Table 7. Changes in land and capital inputs are hard to estimate, and direct information on their prices is scarce; what data we have does suggest that the rental price of one or both has risen over this period.[1] In any case, whether because of greater relative amounts of these factors or increases in their price, the share of income generated in agriculture going to capital and land together has almost certainly risen substantially.[2]

As discussed elsewhere,[3] it is not possible to make a neat delineation between agricultural laborers and farm operators in Colombia, since many farmers have a little land but not enough to provide a full time job or a

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[1] If we assume, to take round figures, that between 1935 and 1965 the labor share fell from 60 percent to 40 percent then, given that the real wage rate did not change, for the real rental of land and capital to have also remained unchanged, the ratio of each to labor would have had to increase by 100 percent. In fact, the evidence suggests that the ratios rose about 50 percent over this period (capital/man a little more and land/man a little less). This would suggest that on average their prices must have risen by about a third. Direct evidence, while scanty, would not contradict this. Land prices appear to have risen considerably (though this does not necessarily imply that land rent has).

[2] Perhaps the biggest weakness in the linking of a constant real daily wage (as reflected in the figures) to the above conclusion is the possibility that average number of paid work days per year may change over time. There is considerable evidence of such a phenomenon in the Colombian data (also interestingly in the Japanese historical data). For the wage share to have remained constant, however, assuming the figures on daily wages are accurate, the number of days worked per year would have to have increased by almost 70 percent over this 35 year period; this appears implausible so, with some caution, it seems safe to conclude that a decrease in the wage share along with a decrease in the price of labor relative to those of land and capital taken together has occurred. This would suggest that the distribution of income has been getting worse over time.

[3] See A. Berry, The Development of the Agricultural Sector in Colombia, Chapter 6, forthcoming.

Table 7

"Pure" Labor Share[1] in Agricultural Value Added, Selected Groups of Years

1935-39	(66 - 84%)[2]
1940-44	(56 - 79%)[2]
1945-49	48 - 57%
1950-54	40 - 47%
1955-59	34 - 42%
1960-64	35 - 43%

[1]The labor share figure used here has been calculated by multiplying the average male agricultural wage (figures from DANE) by the estimated labor force in agriculture. It would tend to overestimate the labor share since there are some (but not many) women and children (with lower average wages) in the labor force, and would perhaps underestimate it (though this is uncertain) in that is assumes the average quality of labor input is that of the paid worker. To the extent that the quality of the labor force has probably risen a little over time it would not quite refer to the implicit income of the same type of labor over time.

[2]It must be remembered that figures on agricultural output and wages probably get worse and worse the farther back the period to which they refer. The much higher labor share which emerges from our calculations for early years almost certainly reflects errors in these figures. But for labor's share not to have fallen at all the errors would have to be bigger than suggested by consistency checks.

subsistence income without working on someone else's land; frequently a small plot of land is made available to the worker by the owner of the farm partly to tie down the labor supply desired. Since all combinations of operator-laborer (in terms of the share of income from each) exist, it is not clear for how many people the absence of a positive trend in the real wage rate over this period implies a failure of total income to rise.[1] As of 1960 about 80 percent of the labor force earned the majority of its income from labor (paid or imputed), and probably half to two-thirds earned more than three-quarters of their income from labor on other people's land. Thus the failure of the wage rate to increase probably implies directly a failure of real income to increase significantly for a majority of the labor force; further there is the possibility that some substitutability exists between working on another farm and acquiring or expanding one's own, in which case the low wage rate might imply also a low capital return on the very small farm (for if such substitution were possible and small farms were profitable, presumably a number of people would take this option instead of becoming full time laborers);[2] in such a case the failure of the real wage rate to rise would signal a failure of the overall income of small producers to rise. There is clearly insufficient information to guess with any precision what percentage of the population has seen little or no improvement over the period in question.

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[1] It is possible that real annual incomes have risen despite the failure of the daily wage to do so, as noted above. The text should be read with this qualification in mind.

[2] The conditions for this substitutability are not likely to hold very generally, though, due to capital market imperfections, etc.

But it must be substantial.[1]

For a fuller picture of distribution changes over time, it would be necessary to know how the distribution of land changed ; unfortunately we are in the dark in this regard; increasing concentration and decreasing concentration seem about equally likely. Continuing breakup of minifundia has been a well known phenomenon in some parts of the country, but breakup of large farms has occurred elsewhere, and the colonization of new lands tends to provide a partial safety valve against concentration. All in all, no easy balance can be drawn.

Some Tentative Explanations of Changes in Distribution Over Time

Both to better understanding the determinants of the apparent worsening over time of the income distribution, and to predict whether it is likely to continue (barring changes in exogenous determinants or in policy) into the 70s, it is worthwhile considering some possible explanations for the historical worsening. A perhaps useful way of classifying determinants would be the following:

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[1]It is true that the typical rural dweller probably has, in some respects, better complementary options than he had 30 years ago, i.e., working in small towns, etc. Given the fact that communications and transportation have improved, and in general the economy has become more integrated, one might hypothesize a general improvement in off-farm possibilities, and correspondingly conclude that although the bottom half of the people in agriculture today are no better off than was the bottom half 30 years ago, today's group is less dynamic, the people with more skill and motivation having emigrated. There is probably some truth to this. On the other hand population census evidence indicates that between 1951 and 1964 rural industry stagnated, and various municipio studies suggest that income earned outside of agriculture is not an important component of total income for many people. (Of course there is always the possibility that the studies done to date have not been representative.)

(1) Changes in Factor Proportions.

To what extent have increases in output been due to increases in land under cultivation--and to increases in produced capital? On general considerations one can expect increases in land to be complementary with increases in the labor force, i.e., increases in land would shift the demand curve for labor to the right, other things being equal. Capital by itself might in principle be either complementary to or a substitute for labor, but it is more likely to be competitive with labor than is land (of course even land could be competitive) and given the low price elasticity of demand for agricultural products which is usually assumed, its increase could lower the equilibrium wage.

(3) The nature ot technological change, in particular bias towards labor or capital saving.

(3) Changes in the Relative Importance of Different Types and Sizes of Farms.

If farms were homogeneous in terms of their factor proportions (given geographic and climatic conditions) one could consider without further complications, the effects of capital formation and technological change on the demand for labor. But we have already seen that different farm sizes (and perhaps different tenure types) are anything but homogeneous; hence the labor/land ratio, for example, could change simply as a result of a change in the relative importance of different farm sizes (a redistribution of land), all else remaining equal. This heterogeneity also implies that for effective prediction of the effects of a given technological change on labor demand, one would have to know its adaptation on the different farm sizes and its implications on each farm size. A particular technological change could be complementary with labor on one group of farms and a substitute on another group.

(4) Since different crops may use rather different factor proportions, (or different factor proportions when produced in one farm size range but not in another) changes in product composition of demand might be hypothesized to play a role in changes in the relative demand for the different factors. It is of particular interest to consider the implications of the increase and subsequent decrease in the importance of coffee; the phase of very rapid growth of output ended around 1930 with the downturn in the world market, and since then there has not been an extended period of growth (the increase in the current price share of coffee in Colombia's agricultural output in the early 1950s was due to the price rise). Since coffee is in some respects a labor intensive crop,[1] its decline might contribute to labor share. The other major change in crop composition has been associated with the "commercialization" of agriculture beginning in the late 40s and early 50s with the shift to cotton, rice, sesame, etc.; the general impression is that these are capital intensive crops.

Clearly the changes in composition of crop output (as opposed to composition of demand) are at least in part a response to the nature of the new technologies becoming available and to capital formation; so they could not be construed as a separate factor in the determination of labor demand;[2] the changing importance of coffee, however, is primarily a world demand phenomenon and can thus be treated as an exogenous factor separate to the others.

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[1] It has a high labor/land ratio.

[2] Nonetheless looking at the problem from this angle may provide useful insights, even when only output composition can actually be observed.

It is instructive to consider jointly the implications of the combination of land increase, capital increase, and technological change for income distribution. In another study[1] we have hypothesized that the growth of agricultural output up to around 1950 was largely explained by the growth of the traditional inputs--increasing total factor productivity was not very important. Thus it appears that from the late 30s till around 1950 only 10-25 percent of output growth was due to increased factor productivity; it thus accounted for growth of around 0.3 - 0.8 percent per year. Since 1950 it appears that technological change has become more important (especially over the years 1956-1962) accounting for 30-50 percent of output growth.

If one could assume that the above calculations were reasonably accurate, i.e., that there was little technological change before 1945 or 1950 and that land and labor tend to be complimentary in use, then, unless other important factors were affecting the wage rate, the behavior of wages up till about 1950 would suggest that capital was competitive with labor. During this period the agricultural price index was rising; in the absence of any technological change the increase in land would have been expected to increase the demand for labor yet wages did not rise, taking the period of the mid-30s to the late 40s, but rather fell. If technological change was not important, the decrease in wages cannot have been due to labor saving technological change--in any case impressionistic evidence on the use of new techniques suggests relatively little change was occurring during the period. The main forms of capital formation were cattle, plantations, construction and soil improvement.

In fact, however, exogeneous factors like the violent civil disturbances in 1963 could have been important in determing the wage movements. It has been

[1] A. Berry, The Development... op. cit.,

frequently argued that the land law of 1936 (which required landlords to pay tenants for investments they effected while renting land) led the former group to dispossess the latter; this might be expected to increase the supply of labor and help decrease the wage rate in the late 30s and early 40s. The depression may also have had something to do with the decline. A not implausible interpretation of the over time movement of wages has the decline explained in this way, and the subsequent increase (1943-1950) the result of the general expansion of the agricultural sector in the absence of important labor saving technological change--this interpretation would suggest that capital was not sufficiently competitive with labor to imply a decreasing wage rate in the face of output growth. Changes in land distribution could also have been important in changing the demand for labor, but, apart from possibly substantial movements between the categories "tenants" and "landless workers," there is little evidence of large scale changes in distribution. Certainly many people lost their lands during the violencia, but most large farms remained large.

The explanation of changes in factor prices over the post-1950 period has more current interest; unfortunately no clear picture emerges from the information available. The rapid burst of mechanization of the late 40s to about 1956 did not lead (at that time) to a lowering of the average wage rate,[1] though its association with the advance of such low labor share crops as rice, barley, sesame, sugar for refining (and corn and wheat when produced

[1]Much more detailed analysis is necessary to test the overall effect of mechanization and technification. The failure of the wage rate to rise since about 1963 would be a reaction to the continued growth of commercial agriculture, or the main determinant of wage changes over short periods may have been the ability to get a job outside agriculture, which was relatively good in the late 40s and early 50s.

with machinery) suggest that it might have been expected to do so.

Output Composition, Changing Factor Shares, and Changing Comparative Advantage of Small and Large Farms

We noted earlier than an independent determinant of changes in factor shares over time would be changes in composition of demand for crops (a) using different factor proportions and/or (b) having different adaptability to small vs. large farms.[1] In this section we present some empirical evidence on factor proportions and factor shares[2] corresponding to various agricultural commodities; it is necessary to note carefully, however, that factor proportions used on different types of farms for the same product may vary tremendously, so the specification of interest would really be "crop *i* grown on type of farm *j*." We also summarize the evidence on the relationship between farm size and product composition of output.

Although information on factor shares for various crops and animal products is spotty and almost impressionistic in some cases, the shares differ so much for different products that there is little doubt that certain crops may be categorized as labor intensive relative to certain others. Table 8 summarizes my estimates of labor shares and labor income per hectare, along with other available ones. It seems clear that the labor-intensive category (as defined by high labor share of income generated) consists of tobacco,

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[1] Changes in output composition which simply reflect changing factor proportions and factor prices would of course not be an independent determinant.

[2] Shares of the value added gross of depreciation (value of product minus value of purchased inputs). Theoretically, of course, it would be better to use net income but depreciation estimates are not available. For this reason our figures imply an overestimate of the capital share.

Labor Income and Labor Share,[1] by Products

Crops: Perennials	Value Added per Hectare 1958 (1)	Value Added per Hectare 1966 (2)	Labor Income per Hectare 1958 (3)	Labor Income per Hectare 1966 (4)	Labor Share 1958 (5)	Labor Share 1966 (6)	"Future" (7)	Other Estimates
Coffee	1950	3340	475	1380	24.5	40.0		
Cacao	n.a.	n.a.	270	790	n.a.	n.a.		
Bananas (Export)	3700-5500	7300-10900	290	840	≤8.0	≤11.5		
Plantanos	n.a.	n.a.	250	730	n.a.	n.a.		
Sugar Refining	3100	10000	500	1100	16.1	11.0		
Panela	1100	2650	530-810	1540	45-65	55		
Annuals--Relatively Commercialized								
Barley	870	1900	80	240	10	12		
Cotton	1340	2300	380	1100	28	48	15-30	
Rice	960	2425	215	625	28	48	12	
Sesame	550	1980	150	440	27	24	15-18	
Annuals--Less Commercialized								
Beans	600	1700	380	1100	60	60	12	
Corn	425	1030	200	580	47	50	13	
Potatoes	3200	7325	630	1830	20	25		45;54
Tobacco	2890	7630	1960	5700	63	68		
Wheat	510	1350	135	390	26	29		33;44
Yucca	950	3670	385	1120	40	30		
Animal Products								
Cattle					25 (1960 estimate)			

[1]Labor share is likely to be unstable, at least for commercial operations and crops whose yields and/or prices fluctuate considerably. (It is equally likely to be unstable if calculated for non-commercial operations on the assumption of a fixed payment per unit of labor with returns to capital calculated as a residual.) The most appropriate measure is a long run average labor share (the implicit assumption being that in the long run the capital share involves a typical rate of return to the particular type of capital and entrepreneurship involved . Although we did not here take the desirable step of estimating the shares for say 5 or 6 years, the use of both 1958 and 1966 is a step in this direction. The shares differ between the two primarily because of changes in the relative prices of labor and the products.

Sources and Methodology:

Figures on value added per hectare were based on value of output per hectare figures from U.S.D.A. Foreign Agricultural Report #52, Changes in Agricultural Production and Technology in Colombia, Washington, June 1969, and a variety of sources from which estimates of the share of value of output corresponding to purchased inputs could be drawn.

Major sources of information on labor inputs for various crops were:

(a) The estimates by Lauchlin Currie in Accelerating Development: the Necessity and the Means, pp. 174-178;

(b) Caja Agraria, Manual de Costos, Bogota 1967;

(c) INCORA, Informacion Sobre Costos de Produccion, August 1968;

(d) ILMA (Instituto Latinoamericano de Mercadeo Agricola), Supply Problems of Basic Agricultural Products in Colombia, Bogota, 1964.

None of the above sources could be accepted as definitive since most of them present figures referring clearly to commercial production. Currie's estimates are the most meaningful for our purposes but some were adjusted on the basis of more detailed studies than he had available at time of writing.

The data of Col. (7) are based on figures presented in INCORA, op. cit., and correspond to what the study refers to as "future" technologies and cost structures.

The estimate for cattle is based on the author's estimate of the number of people engaged in cattle raising (about 380,000 in 1960) and Central Bank based estimates of value added. It is perhaps more likely to be biased up than down, as the Central Bank estimate of milk production appears low. On the other hand Currie estimated a higher number of people engaged in the cattle industry (440,000), so there may be a downward bias on this side. A variety of other sources were used for specific crops.

cane for panela,[1] corn, beans, and yucca. Evidence is conflicting on potatoes but they probably belong also in this group for which the labor share appears to have been in the range of 40-70 percent. In contrast are the relatively commercialized annuals (cotton, rice, barley, sesame, etc.) all of which typically have labor shares below 30 percent.[2] All the tree crops appear to have labor shares below 30 or 35 percent, including coffee during the period of high prices; with prices corresponding to the long run average for coffee, the labor share may well be above 35 percent[3] (our estimate for 1966 was 40 percent). The crops with high labor shares are also the ones with high labor income per hectare; coffee joins the ranks of the highest labor income crops and potatoes surpasses some of those with higher labor shares (these two are,

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[1]It is worth noting also in the case of panela that its processing is usually done in rural areas or small towns and as such offers considerable employment. The "trapiches" (presses), of which there were close to 60,000 in 1960-61 are scattered through much of the country. Many are small operations on small farms using family and other low cost labor. Consideration of this stage as well as the production of the cane implies a very high labor income per hectare for panela. (See Asociacion Nacional de Cultivadores de Cana de Azucar, Cana, Trapiches y Panela en Cauca, Valle, Caldas, Colombia, 1964).

The case of coffee is another for which inclusion of labor for on farm processing implies that the figures presented in Table 8 understate somewhat the farm-labor income associated with one hectare of the product. But the share of all coffee-related labor associated with processing seems to be small. ECLA-FAO estimated 15.2 man hours per 100 kilograms of unthreshed coffee (coffee is normally threshed in industrial mills). This is only about 2 percent of the field hours. Almost 90 percent of the coffee farms in the ECLA-FAO sample had their own processing (depulping) plants and 88 percent of these were small and hand operated.

[2]The figure of 48 percent for cotton in 1966 is not typical.

[3]Theory would suggest that the labor share fall, in the short run at least, when coffee prices rise in a context where labor is not in short supply. The much lower labor share for 1958 (the last year for which internal coffee prices were maintained at a high real level) than for 1966 is consistent with this. (The ECLA-FAO study estimated a labor share of value of product of about 24 percent for 1955-6, consistent with our 1958 estimate).

of course, among the highest "value added per hectare" crops).

For cattle, (taking beef and dairy together) the labor share appears to be about one-quarter, making it lower than for all crops taken together (probably about 35-40 percent).[1] The smaller livestock (pigs and poultry) probably have a higher labor share, however, so the share for all of livestock would be a little higher (though not much, since cattle is by far the most important part).

The average labor share for any given crop tends to depend on the percent of it produced on large commercial farms; thus both commercial and traditional technologies for barley and wheat imply about the same shares but the average share is lower for barley since it is a more commercialized crop. For many crops (e.g., wheat, barley, rice, corn, potatoes, sugar) the labor share is likely to vary by four or five times between the commercial and the traditional technologies. The former is likely to produce a higher yield per hectare, often a higher value added per hectare and use much less labor, though sometimes higher cost labor.

Table 9 contrasts crops according to whether they are typically produced on small farms, large farms, or both. The small farm crops are essentially the traditional technology annuals, especially tobacco, potatoes, and wheat,[2] with beans and corn also ranking high in share produced on small units. The crops most characterized by being produced on large farms are cotton and rice.

It is clear from the data of Table 8 that, at least as far as crops are concerned, changing composition of output has been associated with the decreasing labor share over time; most of the high labor share crops have had

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[1]Using Central Bank estimates of value added in crops and other products and a series of alternative estimates of the labor force in crops and in crops plus other.

[2]Note that since these figures refer to 1960.

Table 9

Tendency of Crops to be Grown on Small and Large Farms: 1960

Crop	% Grown (Area) on Farms of ≤ 5 Hectares in 1960	% of Harvested Area on Farms of ≤5 Hectares (1st semester) 1966	% Grown on Farms of ≥50 Hectares in 1960	% Harvested on Farms of ≥50 Hectares (1st semester of 1966	% Grown in Plots of ≤5 ha. 1960	% Grown in Plots of ≥50 ha. 1960
Perennials:						
Coffee	21.6	18.7	20.8	22.0	48.4	8.0
Cacao	16.5	15.0	29.4	29.8	63.5	3.8
Bananas (Export)	13.6	13.8	43.8	40.6	52.8	25.6
Platanos	21.8	19.9	24.2	28.5	78.2	1.6
Sugar	18.4	15.7	40.0	40.7	51.9	25.6
Annuals--Relatively Modern Technology						
Barley	21.2	31.3	39.1	41.8	44.6	23.6
Cotton	8.3*	2.2	50.7*	85.3		
Rice	7.1	6.7	66.7	68.0	29.1	32.3
Sesame	22.2	22.5	36.3	44.0	35.1	16.6
Annuals--Traditional Technology						
Beans	24.2	25.5	29.3	31.7	64.8	9.5
Corn	26.6	24.6	31.2	36.9	61.7	7.6
Potatoes	31.8	39.9	19.9	20.1	67.4	4.2
Tobacco	41.0	37.8	10.2	21.8	84.8	1.6
Wheat	30.6	33.7	16.9	24.7	64.9	5.7
Yuca	24.7	19.8	24.2	35.2	87.7	.8

Source: For all crops but cotton, the 1960 figures are from DANE Censo Agropecuario: Resumen General, Segunda Parte. For cotton, Instituto de Fomento Algodonero, Colombia, Su Desarrollo Agricola: Algodon y Oleaginosas 1961-1962, Bogota, 1963. For 1966 all figures are based on U.S.D.A., Foreign Agricultural Economic Report # 66, op. cit., pp. 24-6.

*The cotton information refers only to the interior of the country; probably large farms are somewhat more important on the coast.

slow output growth over the last two decades or more; thus the average growth of output of panela, beans, tobacco, corn, and yucca over 1950-67 was about 2.4 percent; that of all crops was about 3.6 percent over the same period. Commercial crops (cotton, rice, barley, sorghum, sugar for refining, sesame, soybeans) had output growth of about 7.5 percent and raised their share of total crop output from about 10 percent in 1950 to about 25 percent in 1967. This must have lowered the average labor share. And since these tend to be large farm crops it has also lowered the amount of small producer's capital income associated with a given output.

The case of livestock is less clear. Poultry has shown rapid increase and presumably has a higher labor share than cattle; but no usable information on this is available to my knowledge.

The relative stagnation of coffee output over the last 35 or 40 years (2.4 percent average growth from 1930 to 1965) has probably played some part in the secular decline of the labor share, but since its labor share appears to have been only marginally higher than that of agriculture as a whole (and it has been lower when coffee prices were high) and its rate of growth has been only about 1 percent slower than total output, this cannot be proposed as a major explanatory factor.

Although there is no reliable over time data on factor proportions for given crops, it is plausible to assume that for many the labor share has fallen (holding size of farm on which it is grown constant). This might or might not explain a large part of the secular decline.[1]

A possibility which should be allowed for is an increase in the share of

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[1]This is only a proximate or "mechanical" explanation, of course.

the total hours worked in agriculture by that population defined in the census as "agricultural", i.e., they may be spending less time in the production of non-agricultural products which are not caught in the national accounts as part of agricultural output.[1] There has probably been some drift in this direction and it would imply that the decline in labor share has been overestimated in our figures.

The Social Efficiency of Farms of Different Sizes[1]

The existence of different factor returns on farms which differ in some way (e.g., size) is proof of imperfect factor markets.[2] It also suggests that simple policy conclusions about which group of farms is socially more efficient or which group should be favored by public policy may be impossible. To take the extreme case, if labor and capital are more productive on one group of farms but the obstacles to moving factors from other groups to this group are

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[1]Among the few studies which have given some attention to relative efficiency (in any terms--private or social) of different farm sizes are Comite Interamericano de Desarrollo Agricola (CIDA) Tenencia de la Tierra y Desarrollo Socio-Economico del Sector Agricola en Colombia, Union Panamericana, Washington, 1966; Keith B. Griffin, "Coffee and the Economic Development of Colombia," Oxford Bulletin of Economics and Statistics, Vol. 30 #2, May 1968; James Grunig, "Some Comparisons of Productivity and Efficiency of Large and Small Farms in Colombia," mimeo, 1969. The CIDA study, while presenting much valuable and interesting information introduced one untenable assumption into its methodology for calculating output per hectare, i.e., that yields for a given crop were not dependent on farm size. The use of the output/hectare ratio (instead of output per unit of land measured by productive potential) as a measure of relative efficiency is also highly dubious; both these aspects of the CIDA methodology biased the results in favor of the small farms. Griffin presented a clear exposition of why factor ratios might differ so extremely by farm sizes, but had access only to the CIDA estimates.

Grunig's data has special interest in that it is micro, based on a sample. While not capable of being expanded into national averages it is highly valuable as a check on the conclusions arrived at below.

[2]Unless the difference in measured returns is just offset by unrecorded non-monetary benefits or costs, or the quality of the factor varies in proportion to the returns.

insurmountable, then the differing efficiency has no policy implications at all. Or if total factor productivity is higher in one group but the productivity of the only mobile factor is lower there, output maximization will, paradoxically, dictate shifting that factor to the group of farms whose total factor productivity is lower. This makes it of interest to draw out the policy implications of a given situation under varying assumptions as to which factor (s) allocations can be determined in part by public policy.

Before turning to the policy implications of what can be ascertained about the relative efficiency of different sized farms in Colombia, we present the figures which bear on that issue. Table 10 shows that output (value added) per effective hectare and per peso of capital (including land) decreases with size while output per person increases. (For each variable our best estimate is "A"; other estimates are presented usually to describe limiting cases where it is assumed that all the possible biases in our assumptions work against the conclusion implicit in the A estimate.) The general nature of these results is by now common enough from work in other countries (e.g., India, Brazil) as to warrant little comment.[1] The magnitude of the differences in output per worker and in output per hectare across farm sizes is striking, however. Output per worker is about 10 times as high for the largest size category used here as for the smallest, while output per hectare is only 10 percent as high. Most of the difference in output per hectare seems to be due to the lower average quality of land on the larger farms. According to our best estimate (A)

[1]The decreasing output per hectare with farm size was mentioned in the cases of India, Brazil and Mexico by Peter Dorner and Herman Feltehausen, "Agrarian Reform and Employment: The Colombian Case," International Labor Review, Vol. 102, #3, Sept. 1970. The same result holds also in Egypt, Taiwan, and in every country for which I have seen the calculation made, with the exception of Japan, where the variable output/hectare seems to be independent of farm size.

Table 10

Factor Productivity and Farm Size in Colombia, 1960
(Value figures in thousands of 1960 pesos)

Farm Size (hectares)	Value of Output Per Worker		Value Added Per Worker		Value Added/ Effective Hectare		Value Added/ Hectare	Value Added/ Value of Land and Capital		Value of Crop Output/ Cropped Hectare
	Estimate		Estimate		Estimate		Estimate	Estimate		Estimate
	A	B	A	B	A	C	A	A	C	A
0 - 3	1.83	1.46	1.67	1.33	.75	.75	1.37	.35	.19	1.05
3 - 5	2.37	3.94	2.08	3.46	.79	.79	.86	.36	.20	1.02
5 - 10	3.15	4.17	2.71	3.59	.50	.50	.73	.33	.20	1.04
10 - 50	4.15	4.25	3.47	3.55	.57	.66	.44	.25	.18	0.96
50 - 500	7.66	7.59	6.18	6.12	.38	.58	.23	.16	.18	0.88
> 500	17.16	12.29	15.07	10.79	.35	.65	.13	.14	.25	0.89
Total	4.44	4.44	3.71	3.71	.462	.627	.285	.204	.193	0.953

Sources and Methodology:

Figures are aggregations of the more detailed data presented in Tables A-4, A-5 , and A-7 The methodology of the various calculations is explained there. Estimate A is our "best estimate" in each case.

the ratio of value added to either value of land or value of land and capital is about twice as high on the farms of 0-5 hectares as on those with more than 500 hectares. These results, which are based on national aggregate data and therefore subject to the various weaknesses of such data, are corroborated by micro data collected by James Grunig,[1] and are consistent with other pieces of evidence with which the author is familiar.[2]

The concept of "efficiency" as applied to a producing unit is not likely

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[1] James E. Grunig, "Some Comparisons of Productivity and Efficiency of Large and Small Farms," mimeo, 1969. Grunig's data on latifundios were from samples taken in Meta and Valle, in which he tried to include all types of operators, from the most efficient to ones at or near the other extreme. The minifundia data, from samples taken in Boyaca, Caldas, Meta and Valle, followed the same principle. While his major goal was not representativity of the samples in terms of the variables of interest here (nor would there have been any simple way to achieve that without a random sample covering the whole country), it seems unlikely that the large-small differences would be too far from representative. His latifundia fell within the size range 50-60,000 hectares. (Average size was 573 hectares for the sample in the Cauca Valley and 2,742 in Meta). Average sizes for different categories of minifundia ranged between 2.3 and 37.5 hectares. The big majority of the farms were 10 hectares or less.

The figures presented in Table 11 are either directly from the cited study or derived from it. They indicate a value of output/value of land and capital ratio about twice as high on the minifundia as on the latifundia and about 20 percent higher on the "most entrepreneurial" minifundia than on the "most entrepreneurial" latifundia. Meanwhile labor-productivity (here on an output per man-day basis) is a little under four times as high on the latifundia.

The data as presented here do not permit calculation of the important ratio "value added/value of land and capital" since labor costs are included with other variable costs; but since the minifundia are much more labor intensive, it seems probable that this ratio would favor them by as much as the one presented here does.

[2] In the appendix of the CIDA study (op. cit.) detailed information is presented on a small and not necessarily representative set of farms. Converting the data into the terms we use here as well as possible, it appears that the "value added/commercial value of land" ratio is about one-half as high for the largest farms (in this case over 1,000 hectares) as for the smallest (three hectares and under). Not too much can be deduced from the sample since it was designed to illustrate various ideal types of farms, but it does demonstrate the substantial dispersion of any such ratio, for both large and small farms.

Table 11

Relative Inputs and Outputs of Latifundia and Minifundia
(Data from Grunig Study)

	Latifundios	Minifundios	Most Entrepreneurial Latifundios	Most Entrepreneurial Minifundios
1. Income above variable cost[1] per hectare	US$ 78	$326*	$319	$527
2. Income above total costs per hectare	$-19	$ 57*	$166	$327
3. Variable costs per hectare	$129	$171	$258	$456
4. Fixed costs per hectare[2]	$ 98	$129*	$155	$206
5. Value of output per[3] hectare	$207	$497 or $626	$464	$733
6. Value of output / Value of Land and Capital	$253	.462 or .582	.359	.427
7. Labor productivity (gross income per man-day)	$ 11.75	$ 3.14	$ 11.16	$ 4.79
8. Hired labor per hectare (man-days per year)	41	51	66	159
9. Family labor per hectare (man-days per hear)	--	218	--	151
10. Total labor	41	269	66	310

*These figures are inconsistent indicating a typographical or other error.

[1]Includes inputs, labor, transportation, interest on loans, and marketing costs.

[2]Includes rent or a 12 percent opportunity cost for land; a 12 percent opportunity cost of livestock, buildings, machinery and other fixed capital; taxes, and depreciation (10 percent yearly) on machinery and buildings.

[3]Calculated as variable costs plus fixed costs plus income above total costs, all on a per hectare basis.

to be meaningful--independent of the specification of a policy which would alter the distribution of factors among producing units. The figures of Table 10 suggest that factors used on the different farm sizes receive different returns. But the information that one type of farm gets more per unit of a factor than another has no policy implications unless something can be done about the market imperfection; the existing situation may be efficient given the imperfections in the system.

If one assumes factor homogeneity the most meaningful overall measure of efficiency of a group of farms would be output (i.e., value added) divided by value of factors used, measured at their (social) opportunity costs.[1] The assumption that product prices represent social value is not too far fetched, and the prices can be adjusted if that assumption can be improved on. The comparable assumption for factors is implausible, especially for labor, but it is not clear what figure should be used.[2] The average wage rate is presumably an upward biased measure; zero is probably too low. Nor is it easy to choose a figure to represent the opportunity cost of capital. Thus, in

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[1] All three principle determinants of efficiency are allowed for in such a measure, i.e., economies of scale, production function, and social efficiency of the factor mix. If one assumes a basic "attainable" production function corresponding to the isoquant F_1 of Figure 3, and indicates the two isoquants on which a large farm (point 1) and a small one (point s) actually operate by the dashed curves S_{10} and L_{40}, they choose the points 1 and s respectively in response to the factor price lines P_3 and P_8. If the relative social opportunity cost of the two factors is given by the curve CC', then the relative efficiency of the two farms is given by the ratio of their outputs to their social costs of production, as measured by the distance from the origin of the lines with slope equal to that of CC' passing through the two points. The figure illustrates a case of increasing returns to scale, some un-attained potential technical efficiency for each farm, and the choice of a socially

[2] Further, of course, it is clearly different in different regions, probably is not really valid; it is nevertheless worthwhile proceeding on that basis as a first step.

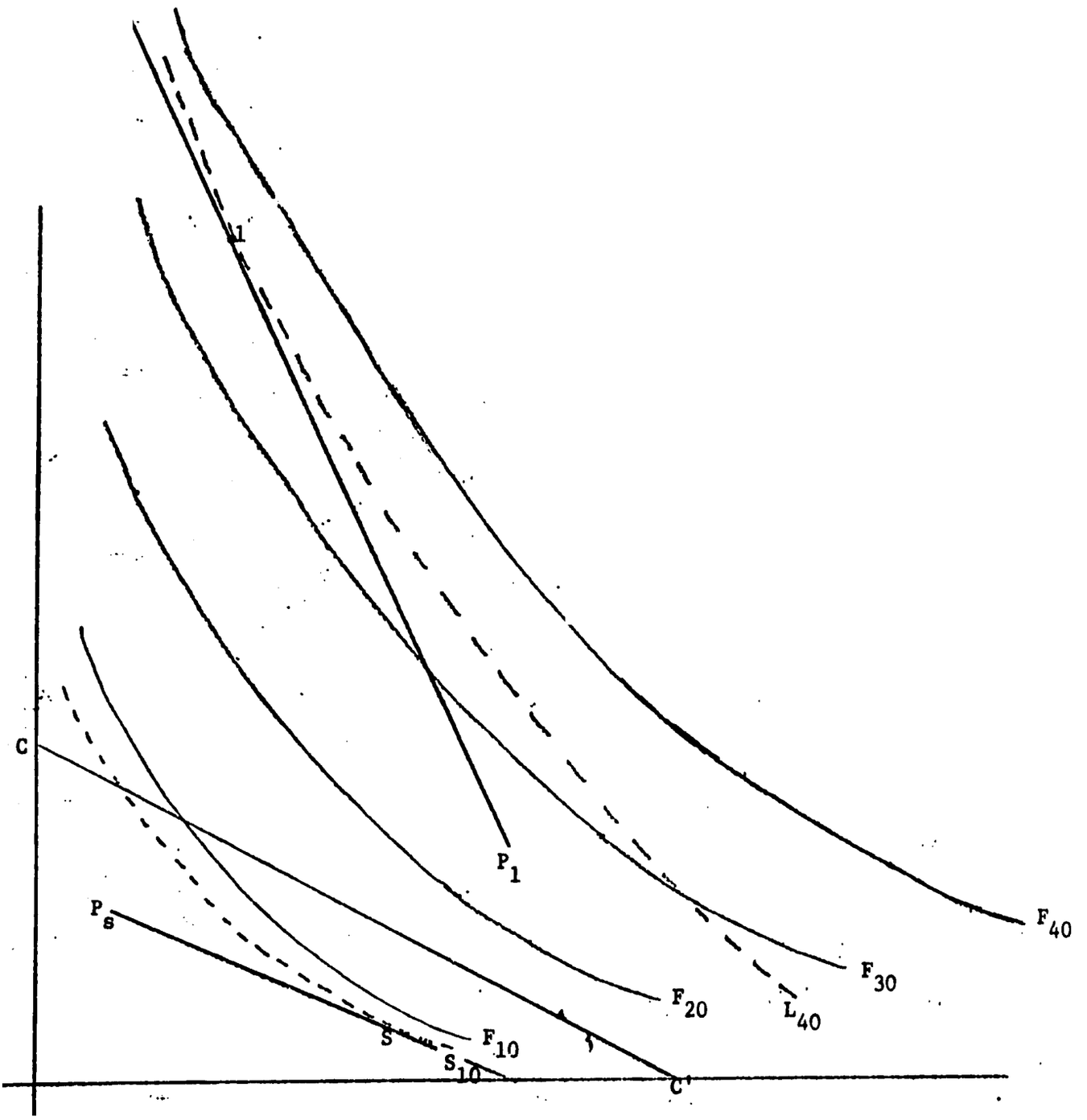

Figure 3

trying to learn something about relative efficiencies it is advisable to consider various opportunity cost levels for capital and labor to see whether the efficiency ranking of farms is sensitive to the values chosen.

Perhaps surprisingly, not even when labor's annual opportunity cost is based on the recorded average wage rate (and assuming 250 days as a typical working year), is there evidence that the large farms are more efficient, i.e., that the implicit rate of return to investment in land and capital is an increasing function of farm size (see Table 12). For our best estimates of labor distribution over the land and of value of land and capital (estimate A), the smallest farms (0-3) hectares) are less efficient but the other groups are all close to average, with some suggestion that those in the 5-50 range and especially those in the 5-10 range are the most efficient. For other

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[1]The use of an alternative distribution of labor based on data in the CIDA study suggests a more clear-cut quadratic relation between size and efficiency, with the 3-10 hectare range the most efficient. But this labor series seems less likely to correspond to the facts than that of Estimate A.

Table 12

Relative Social Efficiency, Implicit Returns to Capital and the Opportunity Cost of Labor
(Labor Assumed to be Homogeneous Except for Employed White Collar Workers:
Product Prices Equal Marginal Social Benefit)

	Case 1						Case 2					
	Opportunity Cost of Non-White Collar Labor: 1400 White Collar Labor: 8000						Non-White Collar Labor: 700 White Collar Labor: 8000					
	Coefficient of Efficiency			Rate of Return to Capital			Coefficient of Efficiency			Rate of Return to Capital		
Farm Size	Est. A	Est. B	Est. C	Est. A	Est. B	Est. C	Est. A	Est. B	Est. C	Est. A	Est. B	Est. C
0-3	.85	.72	.71	5.69	1.96	3.12	1.16	1.03	0.84	20.48	16.67	11.25
3-5	1.00	1.37	.82	11.84	21.69	6.59	1.30	1.58	0.93	24.11	29.04	13.42
5-10	1.14	1.34	.94	15.92	20.12	9.88	1.36	1.49	1.02	24.45	26.55	15.18
10-50	1.10	1.11	.94	14.05	14.29	10.11	1.16	1.17	0.94	19.04	19.16	13.70
50-500	0.98	0.98	1.09	11.46	11.42	12.70	.87	.87	0.99	13.27	13.25	14.71
> 500	1.00	0.97	1.63	11.82	11.30	20.72	0.81	0.80	1.40	12.47	12.21	21.96
Total	1.01	1.01	1.01	11.98	11.98	11.38				15.82	15.82	15.02

Sources: Tables A-8 and A-9.

Table 12 (continued)

Opportunity Cost of All Labor = 0

Farm Size	Coefficient of Efficiency			Rate of Return to Capital		
	Est. A	Est. B	Est. C	Est. A	Est. B	Est. C
0-3	1.73			35.3		19.39
3-5	1.79		1.05	36.4		20.26
5-10	1.62		1.06	33.0		20.47
10-50	1.21		.92	25.0		17.79
50-500	0.78		.92	16.0		17.71
> 500	0.69		1.27	14.0		24.52
Total	1.00		1.00	20.4		19.33

assumptions about the opportunity cost of lab or (Cases 2 and 3 of Table 12), and again using our best estimate (A) of resource distribution by farm size, the smaller farms have a clear cut efficiency advantage, the relation being monotonic from at least the size group 5-10 hectares up. That size group stands out as the most efficient over the full range of plausible assumptions.[1,2]

A more detailed breakdown by size(see Table A- 8 and Figure 4) suggests that the smallest farms (those below two hectares) are dominated. The average labor and capital inputs for the other farm sizes indicate more or less that any size would be socially efficient given a certain factor price ratio. In fact the input combinations corresponding to the production of 1,000 pesos of value added lie almost along a straight line (Fig. 4). This is an interesting outcome since it is what would be predicted if factor prices were the same for different categories.[3] In the present case, it would seem more likely to have

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[1]When the CIDA based labor distribution is used none of these qualitative conclusions are affected; the small and large farms become a little less efficient relative to the middle sized ones.

[2]That extreme set of assumptions about resource distribution most favorable to the large farms implies greater efficiency for them if the social cost of labor is 1400 or 700 per it implies little relation between efficiency and size for a wage of zero. In other words, if a zero opportunity cost assumption for labor were valid, the chance that correctly measured factor inputs would imply that large farms were more efficient than small ones is infinitesimal. If the social cost were one half the wage (700 pesos) it is possible, but quite improbable that the large farms are more efficient than the small ones.

[3]The slope of the line through these observations would suggest roughly that one tenth of a worker and 1,500 pesos worth of land and capital were equally productive. The cost of the former, applying the average annual wage of 1,400 would be 140 pesos; as payment to 1,500 pesos of land and capital this amount would imply a rate of about 9.8 percent. In fact the average rate of return to capital corresponding to an imputation of 1,400 for all workers, was about 12.5 percent. When allowance is made for returns to human capital, the rate on physical capital would perhaps be closer to 10 percent. The correspondence here is indeed close enough to be suggestive of markets working at least moderately well for a substantial range of farm sizes; taken at face value the figure suggests that farms of 5 hectares and under do not face the same factor prices as the larger farms and it is indeed plausible on impressionistic grounds that the dividing line occur at about this size.

been an accidental result.

While the estimates reported above are suggestive, the efficiency coefficients and rates of return to capital could not (even abstracting from the statistical deficiencies) be accepted as accurate since the implicit assumption that the capital and labor on various farm sizes are homogeneous cannot be taken seriously; its use provides only a set of benchmark estimates.[1] Among the ways in which this assumption is probably invalid are (a) failure to take account of the fact that the larger the farm the greater the educational level, and presumably the human capital of the operator (though large farms managed by administrators may not fall into this pattern); (b) the social cost of a peso's worth of capital may differ among farm sizes; the the large farms--especially the medium-large farms involved in commercial crop growing--use the bulk of the machinery, whose purchase price underestimates its social opportunity cost due to the overvaluation of the exchange rate; (c) the market price of capital produced largely with surplus labor may overestimate its social cost--this type of capital is characteristic of some small farms.[2]

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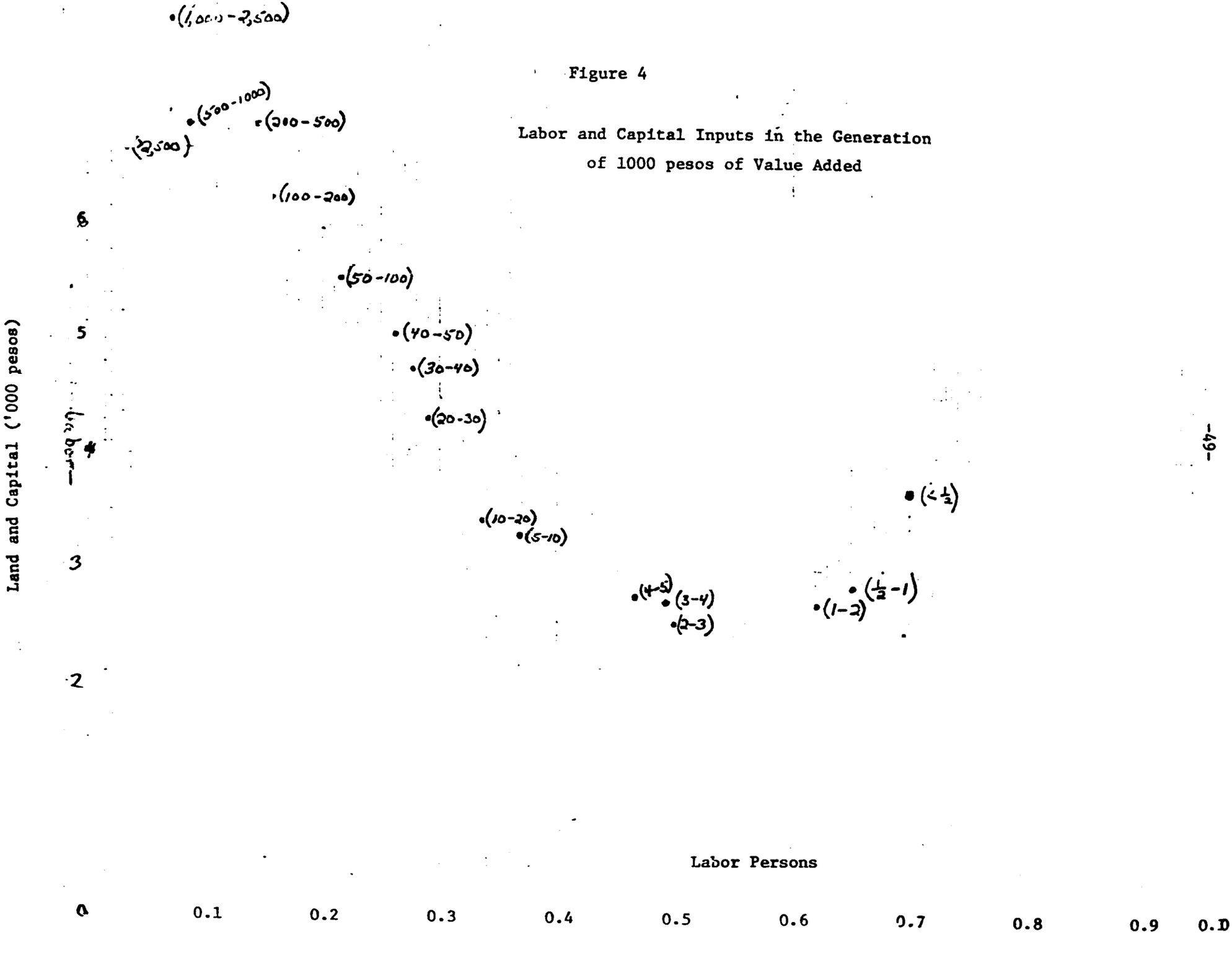
[1]The fact that certain product prices may be poor indicators of their social value was mentioned above, is taken into account in the "price adjusted" results presented in Table 13. We return to it again below.

[2]We have thus far not considered the fact that factor market imperfections may not only imply different factor remunerations in different groups of farms, but also lead to the same factors having a different price in different groups. In the case of labor the issue does not arise since workers are not bought and sold only their services are. But in the case of capital (especially land) it may. Consider two hectares, identical in physical properties, one being located on a small farm and the other on a large one. The market price for a hectare is given by $P = \frac{Y}{r}$ where Y is the annual return to the land (its marginal productivity) to the person with the highest demand price, and r is the rate of discount or interest rate which that buyer uses. Assume for simplicity that Y and r are the same for all small farmers and (at different levels) for all large farmers. Whether P_s (the price of a hectare on a small farm) will be greater or less than P_l (price on a large farm) is an open

Figure 4

Labor and Capital Inputs in the Generation
of 1000 pesos of Value Added



In the calculations presented in Table 10 we estimated the implicit social rate of return to capital if the social cost of labor were the same on each farm size. In Table A-10 implicit returns per worker and implicit income per producer are estimated on the assumption that the rate of return to capital is the same on each farm size. Using the most likely sets of assumptions, the per capita labor income is highest for the smaller-medium sized farms.

Implications of Socially Inaccurate Product Prices

Just as market prices may not correctly measure social opportunity costs,

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question. Y_s is almost certain under Colombian conditions to be greater than Y_l but some considerations would suggest an r_s greater than r_l, given that the small farmers live close to the subsistence level. If this is the case, it cannot be predicted on general rounds which of P_s or P_l will be greater if $r_s \leq r_l$, then $P_s > P_l$. There seems considerable impressionistic evidence . . . for this relation. The much greater average assessed value per hectare on small farms than large ones is consistent with this, but is explained at least in part by higher average land quality on smaller farms and greater underassessment on large farms.

In this connection, it has been found in some countries that the average rate of return on wealth held by rich people is greater than that on wealth held by poorer people. It seems likely that this results from the fact that, although the rich would place less relative value on present as opposed to future consumption for a given distribution of total over life consumption, they also have much better investment opportunities, with the latter tendency outweighing the former and keeping average returns higher for them, and probably the marginal rate of return as well--the relevant one in this case.

The major grounds for doubting that land prices would be higher on small farms are the non-economic reasons for holdings on the part of large owners--prestige, direct pleasure from recreation, hedge against inflation, etc. This suggests that even if large owners of capital generally get higher rates of return than smaller ones, this might not be true in the case of land, because of these special characteristics. Despite the unquestioned presence of this phenomenon in Colombia, it seems unlikely to be so strong as to lead to higher prices on large than on small farms.

If $P_s > P_l$, the correctly measured relative social efficiency of small farms is greater than that indicated by a calculation which assumes the social cost of land is proportional to its value (as we have assumed for the most part, in the calculations carried out above). If the opposite is true, there is an upward bias. The possibility is also present that other factors besides land may have significantly different prices on different sized farms. This seems less likely, though for plantations it is not impossible.

product prices may not correctly measure social benefits of a given product. Probably the main discrepancies between market prices and marginal social benefits occur in the cases of coffee and of export or potential export crops. The price of coffee is usually above that required to induce production of the amount that can be exported under the International Coffee Pact, so the marginal social productivity of another bag is probably close to zero. In the case of other export crops, the overevaluation of the exchange rate means that the domestic prices are likely to be underestimates of social productivity; here the important cases are bananas, rice, sugar and cotton.[1] If one applies shadow prices for these various crops, the social productivity of the large farms rises relative to that of the small ones, since coffee is primarily on small and medium sized farms and the others are large farm crops. In Table 13 estimate R is based on the assumption of a social value/market price ratio of 0.6 for coffee and 1.5 for bananas, rice, sugar, and cotton. This implies an improved relative performance for the farms over 50 hectares, but leaves them with substantially lower efficiency than the smaller farms. A second estimate further assumed that the social value/market price ratio of cattle was 1.2; this assumption decreased the relative efficiency difference further but left the category 5-10 still 15 to 30 percent above the farms of over 50 hectares.[2]

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[1] In recent years more favorable export rates for minor exports have decreased the discrepancy between market prices and social productivity of these crops.

[2] It is true though, that if all of the product price adjustments referred to here are made, and the most favorable (to the large farms) assumption as to the distribution of land and capital is made and the most favorable assumption as to the social cost of unskilled labor (1400 pesos per year) is made, then the efficiency coefficient is higher on the large than the smaller farms. The size category 500 and up is then up to 50 percent more efficient than the 5-10 category, with the advantage over the 0-5 range even greater. As the discussion has indicated, the likelihood that all these assumptions be valid is extremely small.

Table 13

Indicators of Relative Efficiency of Different Sized Farms

(Assuming Factor Homogeneity

Best Estimates of Factor Quantities and Opportunity Cost of Labor = 700 Pesos)

	Product Prices Unadjusted		Product Prices Adjusted			
		Implicit Social Rate				
Farm Size	Coefficient of Efficieny	of Return to Land and Capital	Coefficient of Efficiency		Rate of Return Land and Capital	
			Est. R	Est. S	Est. R	Est. S
0-3	1.16	20.5	1.09	1.07	16.9	16.2
3-5	1.30	24.1	1.17	1.15	17.7	18.2
5-10	1.36	24.5	1.18	1.16	17.3	17.8
10-50	1.16	19.0	1.06	1.05	14.5	15.1
50-500	0.87	13.3	0.92	0.93	12.1	13.0
> 500	0.81	12.5	0.98	1.00	12.9	14.2
Total	1.01	15.8 (15.66)	1.00	1.00	13.3 (13.27)	14.2 (14.14)

Sources: Tables A-7, A-8, A-9.

Explanations of Differing Social Efficiency of Farms by Size

The most plausible reasons for the greater social efficiency of small farms are (a) the lower price for labor and higher price for capital that they face, and (b) the greater incentive associated with low income levels, which shows up according to some observers in a higher average quality of entrepreneurship on smaller Factors most hypothesized to work in the other direction are economies of scale and the greater ease of adoption of improved technology by the better educated and financed large farmers.[1]

Colombian evidence suggests that most of these factors are at work, at least in of the agricultural sector. A technological on the part of the large farm is suggested by the greater average yields for specific crops, a differential apparently reaching 2:1 or more for some crops like wheat, barley, sugar, and potatoes, (using 1966 data).[2] For other crops there is little or no differential, but in no case is there a generally negative relation between farm size and yield. The average differential in "value of product per hectare used in the proportions characterizing the crop sector as a whole" was a little over 50 percent in 1966 between the farms over 500 hectares and those under 2 hectares. (See Table 14). When weighting did not allow differences in value of product per hectare to enter[3] the dif-

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[1]This is not a separate argument suggesting higher total social productivity on large farms unless capital and labor (including entrepreneurship) are treated as homogeneous. Where entrepreneurial talent is better on the larger farms, higher lab or productivity (given the productivity of the other factors) does imply something especially efficient about large farms. If ease of adoption is related to large farm size, it is best treated as a component of economies of scale.

[2]The differential is greater for the variable "value of product" than for the more relevant value added, since purchased inputs are relatively more important on the large farms. These figures thus exaggerate somewhat the advantage of the larger farms.

[3](I.e., the formula $I_i = \sum_j \frac{Y_i}{Y_j}$ was used, where I_i is the yield index of the ith size category.)

Table 14

Differences in Yield by Farm Size
(First Semester of 1966)

Farm Size Hectares	Index #[1] Pesos per Hectare if All Farm Sizes had the Average Land Use Composition (1)	Index #2[2] Weighted Average Yields (2)	Index #1, Using Cultivated Plus Fallow Land as Base (3)	Index #2, Using Cultivated Plus Fallow Land as Base (4)	Value of Crop Output Cropped Hectare (Thousands of Pesos) (5)	Value of Crop Output/Hectare of Cropped and Fallow Land (6)	Percent of Arable and Pasture Land in Crops (7)	Index of Intensity of Use of Crop Land[3] (8)
0-2	94.2	94.1	80.5	80.4	1.23	1.05	.87	.85
2-5	96.8	97.7	81.6	82.4	1.22	1.03	.77	.84
5-10	96.7	98.7	79.4	81.1	1.27	1.04	.66	.82
10-20	100.0	100.0	78.5	78.5	1.34	1.05	.56	.78
20-50	96.8	96.4	68.1	67.8	1.25	.88	.44	.70
50-200	117.8	118.0	68.8	68.9	1.50	.87	.28	.58
200-500	140.3	140.0	70.7	70.5	1.79	.90	.18	.50
< 500	147.4	153.5	67.3	70.1	1.99	.89	.06	.46

[1]Weights are the percent of all cropped land in a given crop. Yields are expressed as pesos per hectare. The index thus reflects the value of output in pesos per hectare which would correspond to the different farm sizes if each had the same composition of land use as that of the sector as a whole.

[2]Weights are as in (1) but yields are expressed as relatives to the average yield for the crop rather than in pesos.

[3]Percent of cropped plus fallow land which is cropped.

Sources and Methodology:

Columns (1) and (2) are based on 1966 yield data and land use data of USDA, Foreign Agricultural Economic Report #66, pp. 24-27 and price data are from the Banco de la Republica.

Columns (3) and (4) make use of the fallow/cultivated land ratios of the 1960 Agricultural Census.

Col (6) is from Table A-6.5. Column (5) is based on the same output data and the same source for land data (Agricultural Census).

ference was more marked.[1] The smaller differential measured by the first index reflects the tendency of the smaller farms to concentrate more on somewhat higher value crops; this tendency was not so strong as to make the actual value of crop output per hectare greater on smaller farms (Col. 5) though value of output per hectare of cropped land plus fallow land was greater on them. Value added per hectare is undoubtedly a more negative function of farm size, since associated with the more modern technologies which produce the higher yields on the larger farms is a higher purchased input/value output ratio; we do not have adequate figures to quantify this difference,however.

The major factor explaining the smaller farms' higher value added per value of scarce resources (land and capital) appears to be the different proportions of the land directed to crop and livestock (more precisely cattle) activities, though it is difficult to demonstrate statistically.[2]

Policy Relevance of the Above Conclusions

Broadly speaking, the above conclusions might be relevant to two sorts of agricultural sector policy questions: (a) decisions affecting the size of farm units,[3] e.g., the size chosen for the colonization of public lands or new settled lands and the nature and extent of redistribution via agrarian reform,

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[1]The data (from DANE surveys) are not very trustworthy but are adequate for our purposes here. It is possible that they exaggerate yield differences by farm size since higher yields on large farms appear to have been expected by the technicians designing the sample and the interviews.

[2]The difficulty is due to the apparently substantial difference in land quality by farm size. One would need detailed production function information to know for what share of all land cattle would be the most productive use with given relative prices of the other factors.

[3]Clearly the same sort of analysis carried out above should be done for any distinguishable characteristic of different farms which might play a role in productivity.

(b) decisions involving the distribution (and possibly the pricing) of factors whose supply the government affects directly or indirectly, e.g., credit.[1] In this latter category, if policies could be applied with great efficiency, one might conceive of attempts to affect the distribution of labor over land by subsidies to large farmers to employ more workers, etc. But in the real world credit is the most obvious area where public policy may help to determine the distribution of a factor. Other ways (besides distribution of credit) by which the distribution of capital can be affected include the pricing of certain capital goods, etc.

What relevance do the figures presented above have for each of these issues? The matter is clearer with respect to question (a). Table 13 indicates that, if it is correct to assume that the annual opportunity cost of labor is 700 pesos and that the rate of return to capital is equal for all farm sizes, then a given amount of land in small farms will lead to a greater national income than the same amount in large ones. (It will also lead to greater agricultural output, since the "value of output/resource used" ratio is higher on the small farms, but this is not the important question.) It is well to bear in mind two senses in which this conclusion must be interpreted cautiously. First, it does not say that taking land currently in large units and splitting it up will increase national income (or even agricultural output), since there are then transitional costs associated with the movement of people who previously farmed smaller plots to the larger units (or landless workers farming land which they did not do before), with the large operators moving to smaller units or out of agriculture entirely, etc. If the

[1]The distribution of credit may be affected both directly, by decrees, and indirectly, by rules affecting interest rate changes, which in turn affect distribution.

entrepreneurial skills of operators are highly "size-specific," when the farmer who now has 5 hectares is given 45 more he may be less efficient than the current 50 hectare farmer whose relatively inadequate performance is reflected in the data. Thus the fact that at present 10 five hectare farms produce more than one 50 hectare farm does not imply that dividing the representative 50 hectare farm into 10 units and placing a group of farmers currently operating 5 hectares on the new units would raise output. This is a different question, and although data like those in Table 13 constitute strong circumstantial evidence that agricultural output and total output would rise, they are not a direct demonstration that whis would occur.

Secondly, the fact that, with the durrent distribution of land, small farms have higher coefficients of efficiency than large ones does not mean that this would remain so if the distribution of land were changed substantially. At present the composition of output on small farms is quite different from that of large ones, with each, in some sense, producing disproportionately those products in which they have a "comparative advantage." If land were increasingly redistributed from large units to small ones, output of the products for which small farms have the comparative advantage would increase and that of products for which large farms have the advantage would decrease, with the corresponding changes in relative prices working to diminish the differences in relative efficiency as observed with the present land distribution. Other factors might, of course, work in the opposite direction; for example, if there were fewer large farms, rural services might be better, the population would probably become more educated, etc. Still, the general expectation would be that the efficiency differential would diminish as redistribution

occurred, especially in the short run.

If the assumptions underlying Table 13 were valid, then the coefficients of efficiency calculated would refer essentially to relative average factor productivities; it is important to note that they do not represent, nor allow one to deduce, the relative marginal productivities of either factor or of both together. But since it is unlikely for political reasons that the government can do much along land redistribution lines, and more likely that the issue will be factor distribution, then the key datum is the relative marginal productivity of the "mobile" factors on different farm sizes. To take a realistic policy question, the distribution of credit, if it may be assumed that the impact of credit is to increase the capital stock (rather than to increase labor employed), then policy should be aimed at directing credit to those farms where the marginal product of capital is highest. And there is no necessary relation between a high marginal productivity of capital and a high average productivity, though a low average productivity would probably more or less guarantee a low marginal one. It is especially important to note that there is no necessary relation between a high total factor productivity and a high marginal productivity of any particular factor. Suppose, for example, that due to imperfections in the factor markets a given farm category has much too much labor for the amount of capital, and as a result has a very low marginal (and average) product of labor and low overall efficiency. This is quite consistent with its having a very high marginal product of capital and unless production functions are substantially different across groups of farms, this is the plausible expectation. Expressed in terms of the data presented above, even if the coefficient of efficiency for farms in

the 5-10 hectare range were above that for smaller farms, it might well be true that the marginal productivity of capital would be higher for the latter group so there would be nothing implausible about the government favoring distribution of credit to them. (All this on grounds of maximizing output, rather than income distribution.)

Without knowing the role played by each of the three factors (referred to above) which determine a farm size's coefficient of efficiency (i.e., economies of scale in the "attainable production function," closeness to the attainable production function, and extent to which the factor proportions chosen are social cost minimizing) one cannot deduce much that is firm about the optimal direction of government credit policy. Intuitively, however, one might well assume, as indicated above, that the marginal productivity of capital would be higher on the small farms, partly because this is suggested by the high "labor/land and capital" ratio, and partly since whereas large farms have some opportunity to increase their capital stock either via credit or via sale of land, both routes are likely to be impossible for the small farm--the operator may not own the land and if he does he may be expected to take a more negative attitude toward selling part of what is likely to be a last buffer against misfortune in the future. But it is necessary here to consider the relation among all of land, labor, and capital. If, as may well be the case, land and capital are complementary (as well as being complementary with labor), then the only solution for the small farm could be more land--more capital might not help him out much. In other words, as soon as account is taken of the presence of three factors, a high labor/capital ratio does not necessarily imply a high marginal productivity of capital. Meanwhile if

capital and land are complementary on large farms for those whose profit incentives are low (or which for some other reason have a serious disproportion between capital and land) capital could have a high marginal productivity.

Only microeconomic analysis can get to the bottom of these questions; production function analysis based on sample surveys would be necessary. The information is not available with which to perform such an exercise in Colombia at present, although some is becoming available through various sample surveys, INCORA data, etc.

Despite the impossibility at this time of any fully satisfactory interpretation of the interrelationship between size of farm and factor productivities, the data presented suggest very strongly that there is no solution for the bad distribution of income in agriculture which does not involve land redistribution as an important and probably the major component.[1] While there is no doubt that small farms can be made more productive by improved technology and additional capital, it seems doubtful that over the short run (say 10 to 20 years) farms of less than 5 hectares can provide what might be reasonably considered a minimum income level in Colombia, given the resources available.[2] In a country like Japan (i.e., with Japanese technology and experience) this would not be the case.

The conclusion that large farms are relatively unproductive is not put forward as the major conclusion of our study; much more important is the highly concentrated distribution of income which they generate with a very

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[1] Unless a solution is found entirely outside the sector.

[2] This figure is, of course, a sort of average one; it would vary greatly according to region, soil, etc. Currie in La Industria Cafetera en la Economia Colombiana, used a figure of 3 hectares as defining a minimum reasonable income on coffee farms--but coffee is more productive than the average crop. In 1960 a farm of 5 hectares in the coffee zone (with say 2-3 hectares of coffee) provided an income of about 6,000-7,000 pesos on average, i.e., around 1,000 dollars).

high land and capital share and a small hired labor share. For farms above 100 hectares, the share of total income generated going to blue collar workers is probably not above 20 percent for any farm size and probably about 10-12 percent on average. To make things worse, occasional labor is apparently more prevalent on large scale farms; it is not clear whether it can be safely generalized that the larger the farm the greater the share of man days which are worked by temporary labor, but there is some evidence to this effect. The dependence of hired labor on an employer who may at any time change his crop composition or his technology in such a way as to lower the demand for labor or make it more seasonal is a severe problem in a system where land ownership is as concentrated as in Colombia.[1] The greater is the capital share, and the more uncertain is the future level and stability of demand for labor, the greater the advantages to having capital widely distributed so that a minimum of individuals depend exclusively on labor income.

Judged against these criteria of social welfare, the structure of Colombia's agricultural sector is abysmal.

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[1]It is not clear just what role seasonality of occupation plays in the determination of the income distribution. Certainly it increases the unevenness of flow of income and probably increases its uncertainty as well, but since we have no data on the relation (if any) between extent of seasonality and average salary per day, little can be said. (Presumably one expects that the employer of seasonal labor will have to pay a higher per day rate than the employer of permanent labor, and the question must be asked as to whether this largely offsets the disadvantages of seasonality.) According to the population census of 1964 (DANE, Censo de Poblacion: Resumen General, p. 140,) agriculture is one of the sectors with the lowest ratio of time worked to economically active population. During the year preceding the 1964 population census, something over one-third of the population economically active in agriculture worked less than 6 months. (Few of the active population are women, so this corresponds roughly to the situation for men). Since there were 370,000 family helpers (mostly young) in agriculture it is probable that many if not most of these worked under 6 months (family helpers were defined as unpaid family members working at least one-third of the normal working period). As a

minimum there must be something like 300,000 men who are not family helpers and who worked less than 6 months in the year, i.e., something like 15 percent of the labor force excluding family helpers. Certainly many individuals affected by seasonality problems do work more than 6 months, by moving from zone to zone as migrant workers, but the disadvantages of this life style hardly need recounting.

Table A-1

Basic Estimate (Estimate "A") and Alternative (Estimate "B") of the Distribution of Labor by Farm Size and Type of Labor (Man-Years)

Farm Size (hectares)	Hired Blue Collar	Hired White Collar	Producer (operator)	Family Helpers	Estimate A Total	Estimate B Total
2 1/2	10,000	0	84,108	9847	103,955	326.4
1/2-1	15,000	0	73,600	6338	94,938	
1-2	50,000	0	149,781	9765	209,546	217.3
2-3	45,000	0	95,976	6620	147,596	155.6
3-4	44,820	0	90,609	5586	141,015	82.9
4-5	31,595	0	57,442	3712	92,749	57.1
5-10	136,061	0	164,204	11,773	312,038	235.2
10-20	147,154	2400	108,769	8767	267,090	258.8
20-30	79,343	1200	41,080	3612	125,235	128.9
30-40	58,433	2400	23,976	2233	87,042	138.1
40-50	41,776	1800	14,596	1397	59,569	
50-100	115,503	6000	34,147	3628	159,278	143.6
100-200	87,397	4800	17,387	2288	111,872	111.2
200-500	76,092	8400	9,210	1720	95,422	115.3
500-1000	37,198	7200	2,193	683	47,274	95.7
1000-2500	26,167	4200	851	411	31,629	34.3
> 2500	11,835	1800	290	225	14,850	
Total	1,013,374	40200	968,219	78605	2,100,398	2100.4

Sources and Methodology:

Since there are no good countrywide data on labor applied by farm size, we use two separate estimates here. One (Estimate A) was developed by the author using agricultural census information (the 1960 census) on distribution of population by the size of farm on which people lived, on comparisons between the number of people in various occupational statuses (from the 1964 population census) and the number of producers reported in the agricultural census, and other available pieces of information. This estimate had the advantage of referring to the country as a whole, but the disadvantage of involving a good deal of guesswork as to how many people lived on one farm and worked on another. The second estimate (B) is based on the CIDA study (op. cit.) which, for those municipios in which depth surveys were done, presented data on the number of permanent and temporary laborers, these were then converted to permanent and temporary workers per hectare. This data was taken with little modification from tables presented in the CIDA study, and no attempt was made to evaluate the representativeness of the municipios and the farms and sizes sampled in those municipios. This information, then, has the advantage of being based on direct study of labor application on farms, and the disadvantage of

(Sources and Methodology for Table A-1)

corresponding to a rather small number of municipios (about 10 in total scattered around the country) whose degree of representativity is unknown. The second problem in the use of CIDA data is the difficulty in converting figures on occasional workers to figures on man-year equivalents. In the more detailed data given for a small number of farms in the statistical appendices to this study, it could be seen that on some farms temporary workers were employed only say 10 days a year and on other farms they worked more than half the year. While the profile of total man days by farm size is not very sensitive to this assumption, as long as the average number of days worked by temporary workers is not itself a function of farm size, it is affected to some extent. The ratio of temporary workers employed at some time or other [illegible] permanent workers appears to rise with farm size--that is, it appears that large farms get a greater share of their total from part-time workers. One would expect this relationship to depend on the nature of the crop, but highly fragmentary CIDA data does not give much information along these lines, but does suggest that the relation varies widely even for farmers specializing in a given crop. There is evidence that for cattle farms the majority of labor is not necessarily permanent, and that such farms as those specializing in cotton, where sometimes almost all the labor is temporary, are not always that way,especially if in rotation with cattle.

If one includes owner-operators as permanent labor, there seems little doubt that the majority of workers are permanent, in the sense of having one job which provides say over 2/3 of all working days. (It would be less clear that the majority of workers were permanent if this group were defined to include only people who worked 80 percent of the year at one job; this would exclude many owner-operators who do part time work elsewhere.) But including the perhaps 1/2 of all man years which seem to correspond to people who either earn most of their income off land they operate or are white collar workers and administrators, with the perhaps up to half of blue collar hired workers who are permanent, one might have 3/4 of all labor classified as permanent. But the ratio might go as low as 60 percent and as high as say 80, depending on how the lines are drawn. In any case, judging from the CIDA figures, if in fact 3/4 of all the man years applied to agriculture corresponded to people whom they categorized as permanent then the average time worked per temporary worker would probably only be on the order of 1/10 of a year. Since this seems a little low given some of the other direct evidence from the CIDA study, we have used as a base estimate the assumption that the average temporary worker works 1/4 of a full year. As noted above, the profile of man years per hectare is not highly sensitive to this assumption. But in another sense the temporary/permanent ratio has an important bearing on the "social" performance of different farm sizes, since the security of occasional workers is notoriously bad, and farms characterized by this sort of operation make smaller contributions to overall welfare than would otherwise be the case.

Table A-2

Estimates of the Man/Land Ratio, by Farm Size

Farm Size (Hectares)	Man Years Applied (thousands) Estimate A	Man Years Applied (thousands) Estimate B	Man Years Per Hectare Estimate A	Man Years Per Hectare Estimate B	Man Years per Effective Hectare Estimate A	Man Years per Effective Hectare Estimate B	Estimate E
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
< 1/2	103,955	326.4	2.71	2.47	.390	.686	
1/2-1	94,938		1.01		.466		
1-2	209,546	217.3	.78	.803	.491	.509	
2-3	147,596	155.6	.54	.564	.428	.451	Same as
3-4	141,015	82.9	.46	.268	.390	.229	Esti-
4-5	92,749	57.1	.37	.226	.368	.227	mate A
5-10	312,038	235.2	.27	.201	.268	.202	
10-20	267,090	258.8	.17	.164	.194	.188	.215
20-30	125,235	128.9	.12	.123	.151	.156	.180
30-40	87,042	138.1	.098	.087	.133	.120	.168
40-50	59,569		.084		.119		.156
50-100	159,278	143.6	.059	.053	.090	.081	.130
100-200	111,872	111.2	.037	.037	.060	.059	.090
200-500	94,422	115.3	.024	.029	.041	.049	.068
500-1000	47,274	95.7	.017		.032	.065	.052
1000-2500	31,629	34.3	.011	.0041	.022	.014	.045
> 2500	14,150		.0025		.013		.026
Total	2,100,398	2,100.4	.077	.077	.128	.128	.169
By Groups							
0-3	556,035	699.3	.820	1.031	.448	.563	
3-5	233,764	140.0	.417	.250	.381	.228	
0-5	789,799	839.3	.637	.677	.426	.452	
5-10	312,038	235.2	.275	.201	.185	.139	
10-50	538,936	525.8	.128	.125	.160	.157	.190
50-500	366,572	370.1	.038	.038	.061	.062	.095
> 500	93,053	130.0	.0084	.012	.023	.035	.043

Sources and Methodology:

Cols. (1) and (2) are from Table A-1, Cols. (3) and (4) are based on (1) and (2) and on the distribution of hectares presented in the Agricultural Census of 1960. Cols. (5) and (6) are based on (1) and (2) along with an estimate of land distribution by value based on adjusted assessment valuations (from the

(Sources and Methodology for Table A-2 continued)

Geographical Institute "Agustin Codazzi) by farm size. (The adjustment was based partly on the conclusions of the CIDA study as to the relative underassessment by farm size--they observed that it was greater for larger farms--and on a known bias in the methodology of the Institute itself, which operates in the same direction. Further details are presented in Berry, The Development of the Agricultural Sector in Colombia, appendix.) Col. (7), estimate "E",uses the unadjusted assessment values by farm size to estimate the value of land by size category;assessment per hectare is more than 20 times as high for farms of 1/2-1 hectare as for those of 2,500 and over; this series clearly leads to a downward bias of the share of all land value in the large farms, both for the above reasons and because assessment figures include some forms of investment (including housing) which bear a higher ratio to the value of land on small farms than on large ones.

Table A-3

Value of Crop and Livestock Production by Size of Farm, 1960

(Millions of 1960 pesos)

Size of Farm	Major Crops	Minor Crops	All Crops	Live-stock (cattle, hogs, sheep, goats)	Other Animal Products (Mostly Eggs & birds)	All Livestock	Draft Animals	All Animal Production	Total Crops & Animals	Total Value Added
< 1/2	24.6	4.7	29.3	44.9	86.8	131.8	0.7	132.4	161.7	148.8
1/2-1	60.2	11.6	71.7	28.3	57.6	85.9	0.8	86.7	158.4	145.8
1-2	191.4	26.3	217.7	54.7	96.2	150.9	2.1	153.0	370.7	337.4
2-3	189.8	21.9	211.7	44.4	70.4	114.8	2.0	116.8	328.5	295.7
3-4	195.1	20.6	215.7	43.2	64.4	107.6	2.1	109.7	325.5	286.4
4-5	146.5	14.2	160.9	32.5	44.8	77.3	1.6	78.9	228.3	198.6
5-10	624.6	54.2	678.9	135.1	161.3	296.4	6.9	303.2	982.0	844.5
10-20	680.8	51.4	732.1	159.0	155.4	314.4	7.2	321.6	1053.7	395.7
20-30	298.9	26.0	324.9	98.4	87.7	186.0	3.7	189.8	514.7	432.3
30-40	211.8	18.4	230.2	82.1	67.6	149.7	2.6	152.3	382.5	313.6
40-50	150.3	13.9	164.2	65.4	51.5	116.9	1.8	118.7	282.9	226.3
50-100	464.8	32.9	497.6	235.3	181.6	417.0	5.2	422.2	919.8	735.8
100-200	381.4	22.1	403.5	264.4	189.0	453.4	4.2	457.6	861.1	706.1
200-500	393.6	17.5	411.1	366.2	245.7	611.9	4.0	616.0	1027.1	821.7
500-1000	202.6	4.9	207.5	256.1	154.3	410.4	2.2	412.6	620.1	533.3
1000-2500	139.2	4.2	143.4	226.4	130.5	356.9	1.6	358.5	501.9	441.6
≥ 2500	109.0	1.2	110.3	231.8	131.0	362.8	1.5	364.4	474.7	427.2
Total	4464.9	345.9	4810.8	2368.2	2047.8	4416.0	50.4	4466.4	9265.6	7790.9

Source: Berry, op. cit., appendix.

Table A-4

Value Added Per Unit of Land by Farm Size

Farm Size	Value Added Per Hectare	Value Added per Effective Hectare		Value of Output of Crops/ Cropped Hectare
		Estimate A	Estimate E	
	(1)	(2)	(3)	(4)
< 1/2	3.8807	.5579		1.225
1/2-1	1.5569	.7150		.979
1-2	1.2482	.7907		1.055
2-3	1.0727	.8566		1.056
3-4	.9264	.7920		1.034
4-5	.7886	.7884		.993
5-10	.7250	.7246		1.043
10-20	.5698	.6501	.7194	1.051
20-30	.4143	.5222	.6215	.879
30-40	.3523	.4798	.6044	.866
40-50	.3210	.4521	.5922	.883
50-100	.2745	.4162	.5991	.888
100-200	.2357	.3764	.5658	.858
200-500	.2057	.3520	.5880	.903
500-1000	.1953	.3605	.5870	.886
1000-2500	.1573	.3140	.6293	.835
>2 500	.0775	.3873	.7762	.990
Total	.2850	.4766	.6272	.953

Sources and Methodology:

Value added figures are from Table A-3. Land figures are from the sources cited in Table A-2, with Estimates A and E here using the same alternative assumptions about the distribution of effective land as do Estimates A and E in Table 2.

Col. (4) uses the same value of output figures with data from the agricultural census on cropped land by farm size.

Table A-5

Alternative Estimates of Output/Value of Land and Capital

Farm Size	Estimate A (1)	Estimate F (2)	Estimate F' (3)	Estimate F'' (4)
< 1/2	.2712	.1748	.3005	.1640
1/2-1	.3493	.2323	.2895	.1829
1-2	.3695	.2737	.2814	.1983
2-3	.3944	.3131	.2856	.2143
3-4	.3669	.3219	.2544	.2059
4-5	.3595	.3207	.2406	.1980
5-10	.3297	.3450	.2266	.2047
10-20	.2928	.3216	.2102	.1948
20-30	.2323	.2549	.1828	.1681
30-40	.2101	.2406	.1744	.1644
40-50	.1971	.2148	.1755	.1588
50-100	.1797	.2217	.1745	.1727
100-200	.1596	.2116	.1712	.1799
200-500	.1452	.1974	.1657	.1788
500-1000	.1447	.2194	.1705	.2043
1000-2500	.1280	.2583	.1540	.2428
> 2500	.1476	.3507	.1791	.3315
Total	.2035	.2547	.1933	.1933
0-3	.3530	.2537	.2869	.1938
3-5	.3639	.3214	.2486	.2026
0-5	.3566	.2735	.2725	.1968
5-10	.3297	.3450	.2266	.2047
10-50	.2471	.2732	.1923	.1779
50-500	.1597	.2092	.1702	.1771
> 500	.1398	.2617	.1673	.2452

Sources and Methodology:

All the series are based on the value added figures of Table A-3; each is based on one of the value of land and capital series of Table A-6 (the one designated by the same symbol)

Table A-6

Estimates of the Value of Land and Capital by Farm Sizes
(Millions of 1960 pesos)

Farm Size	Estimate A	Estimate F	Estimate F'	Estimate F''
< 1/2	548.5	851.2	495.2	907.2
1/2-1	417.3	627.3	503.5	796.8
1-2	912.9	1,232.8	1,198.8	1,700.9
2-3	749.6	944.4	1,035.3	1,380.0
3-4	780.5	889.7	1,126.1	1,391.2
4-5	552.3	619.2	825.3	1,002.8
5-10	2,560.8	2,447.8	3,726.3	4,125.6
10-20	3,058.9	2,785.0	4,260.1	4,597.6
20-30	1,860.8	1,696.0	2,364.5	2,571.4
30-40	1,492.3	1,303.3	1,798.2	1,907.6
40-50	1,147.8	1,053.8	1,289.8	1,425.1
50-100	4,093.1	3,319.3	4,217.1	4,261.7
100-200	4,422.2	3,336.3	4,125.4	3,924.0
200-500	5,658.4	4,162.9	4,957.8	4,594.3
500-1000	3,684.9	2,430.8	3,128.1	2,610.9
1000-2500	3,448.9	1,709.9	2,868.2	1,819.0
> 2500	2,893.3	1,218.0	2,385.3	1,288.9
Total	(38,230.0)	(30,627.8)	(40,304.9)	(40,304.9)

Sources and Methodology:

Since the calculation of the ratio of the "value added"/"value of land and capital" is probably the most important single proxy for efficiency we have, special care must be taken in the performing of sensitivity analysis, especially in view of the fact that perhaps the weakest data we have is that relating to the distribution of effective land by farm size and the distribution of capital.

There is substantial difficulty in getting valid estimates either of the absolute value of land and capital on a given farm size, or of its relative value compared to other farm sizes. Both are important for efficiency calculations, although the closer the appropriate shadow price for labor (or more precisely, for "other factors") is to zero, the less important is the absolute valuation and the more important the relative one.[1]

[1] There is, in any case, the problem of different length of life of various forms of capital, and the natural difference in the life of capital as opposed to land, which suggests that present value will bear different relations to the current service flow according to the form of capital. Our information does not easily permit us to do more than suggest the direction of the bias of this conceptual problem.

(Sources and Methodology for Table A-6 continued)

The first land and capital series used here (Estimate A) uses the author's estimate of value of land by farm size, based on the CIDA data on relative assessment per hectare on different farm sizes, but adjusted according to their observation and other independent information to the effect that underassessment is by a greater percentage on large farms than small. The capital value includes only capital in the form of machinery and cattle, on the grounds that the assessment figures are supposed to include other forms of capital and a summation of the two series would involve double counting if such things as plantations, construction, improvements, etc., were included separately as forms of capital.

Estimate F uses a distribution of effective land which assumes the same degree of underassessment for all farm sizes (specifically about 45 percent), and the same unassessed capital series as the first measure. In both cases working capital is assumed to be 20 percent of the total capital stock, and is assumed to be proportional therefore to the combined value of land and capital. Estimate F implies a better performance for the larger farms than Estimate A, and it appears to give a fairly safe limit (i.e., a definitely upward biased measure of their performance) to the relative efficiency performance of the large farms, since the assumption of a constant working capital/total capital share probably favors the large farm, as does the assumption about distribution of land by value. While it is true that our distribution of cattle by size of farm varies substantially from that of the agricultural census (we assume many more on the large farms) there seems to be no other way to interpret the difference between the census information and other probably more reliable evidence; in any case if we were to assume less capital stock in the form of cattle on the large farms, our estimate of their output would also fall, a partially compensating error.

Even assuming that the distribution of both land and improvements, and other forms of capital used in Estimate A is reasonably accurate, if over or underestimation of their absolute values is substantial, this can affect our calculations. Our estimate of the value of capital stock is well below that of the Planning Commission (17.6 millions of 1958 pesos) for 1960. (See Table II-1.) Since our total estimate for 1960 at 1960 prices was 30.6 billion pesos, probably equivalent to about 25 billion in 1958 prices and a little less allowing for the real growth of both between those two years, if Planeacion's capital stock figure is correct, this would imply a very high capital/land ratio, possibly suggesting we have underestimated capital. According to our estimates in Estimate A the ratio of capital to land plus improvements rises with farm size, so if an underestimate had occurred in these forms of capital, it's correction would increase the share of all capital in the larger farms and make their performance look worse. (Parenthetically it would also decrease the value added to value of land and capital ratio, which according to our estimates of Estimate A was .20.) An underestimate of a type of capital good included in our assessed land value figures (such as plantations) would bias the results in the opposite direction. The third series (Estimate F') uses the same land series as Estimate A, but capital is assumed to be more important relative to land and the additional capital (not included in Estimate A) to have a distribution like that of

(Sources and Methodology for Table A-6 continued)

plantations, i.e., substantially oriented toward the medium size farms, where coffee predominates. (There is in fact no possibility that plantation capital itself could be this important, since our assumption makes it 60 percent more important than cattle and machinery put together; but there is some suggestion that other forms of capital may be heavily concentrated on small farms from the fact that the ratio of the value of buildings, improvements, and so on to land is greater on small farms than on large farms according to the Geographic Institute data.

Estimate F'' uses the land value figures used in Estimate F and the capital values of F'. It shows the highest share of total value of land and capital on the small farms. The object of its use was to give a series almost certainly biasing down (and probably strongly) the share of scarce resources assumed to be found on large farms. Conceptually, as we have seen above, all this should have been included in the land-price figure itself.

Table A-7

Estimates of Output Per Man, by Farm Size

Farm Size	Value Added Per Man		Value of Output Per Man
	Estimate A (1)	Estimate B (2)	Estimate A (3)
< 1/2	1.431	.902	1.555
1/2-1	1.535		1.668
1-2	1.610	1,553	1,769
2-3	2.003	1.900	2.226
3-4	2.031	3.455	2.308
4-5	2.141	3.478	2.461
5-10	2.707	3.591	3.147
10-20	2.982	3.461	3.945
20-30	3.452	3.354	4.110
30-40	3.603	3.910	4.394
40-50	3.800		4.749
50-100	4.620	5.124	5.775
100-200	6.312	6.350	7.697
200-500	8.611	7.126	1.076
500-1000	11.280	5.572	13.117
1000-2500	13.964	25.331	15.868
> 2500	30.191		33.548
Total	3.709	3.709	4.441
Categories Grouped			
0-3	1.668	1.326	1.833
3-5	2.075	3.464	2.369
0-5	1.789	1.683	1.992
5-10	2.707	3.591	3.147
10-50	3.466	3.553	4.145
50-500	6.175	6.116	7.660
> 500	15.068	10.785	17.159

Sources and Methodology:

Cols. (1) and (2) are based on the value added to figures of Table A-3 and the labor input figures (Estimates A and B) from Table A-1.

Col. (3) uses the value of output figures of Table A-3 and the Estimate A labor series.

Table A-8

Coefficients of Efficiency[1]
(Assuming homogeneous capital and labor;[2] varying shadow prices)

Size of Farm	Basic Value of Land and Capital Series: 2=s=1400 Est. A of Labor Dist.	Basic Value of Land and Capital Series: 2=s=1400 Est. B of Labor Dist.	Basic Value of Land and Capital Series: w=s=700 w=s=1400 A	Basic Value of Land and Capital Series: w=s=700 w=s=1400 B	Series F of Value of Land and Capital: w=s=1400 A	Series F of Value of Land and Capital: w=s=1400 B	Basic Value of Land and Capital Series w=s=0 A (same as B)	Basic Value of Land and Capital Series w=1400, s=800 A
< 1/2	.6925	.5087	.9114	.8043	.5314	.4265	1.3331	.7077
1/2-1	.7851		1.0772		.6282		1.7165	.8002
1-2	.8254	.8040	1.1348	1.1144	.6911	.6761	1.8160	.8411
2-3	.9811	.9459	1.3026	1.2712	.8309	.8056	1.9383	1.0020
3-4	.9674	1.3340	1.2591	1.8281	.8475	1.1161	1.8034	.9893
4-5	.9947	1.3262	1.2727	1.8091	.8722	1.1171	1.7671	1.0184
5-10	1.1105	1.2934	1.3176	1.4384	1.0254	1.1795	1.6207	1.1428
10-20	1.1776	1.1959	1.2949	1.3059	1.1004	1.1163	1.4389	1.1931
20-30	1.0531	1.0401	1.0953	1.0883	.9753	.9641	1.1417	1.0732
30-40	1.0101	1.0245	1.0211	1.0145	.9568	.9544	1.0328	.9995
40-50	.9907		.9795		.9057		.9691	.9817
50-100	.9939	1.0243	.9352	.9484	.9845	1.0143	.8834	.9869
100-200	.9868	.9881	.8739	.8744	1.0327	1.0341	.7846	.9944
200-500	.9680	.9373	.8213	.8100	1.0383	1.0031	.7136	1.0038
500-1000	1.0025	.8892	.8318	.7900	1.1844	1.0294	.7116	.9728
1000-2500	.9197	1.0226	.7470	.8117	1.4046	1.7015	.6293	.9221
> 2500	1.1081		.8767		2.0126		.7256	1.1450
Total	1.0015	1.0015	1.0005	1.0005	1.0014	1.0014	1.0000	1.0088
0-3	.8352	.7074	1.1273	1.1289	.6841	.5959	1.7343	.8521
3-5	.9784	1.3308	1.2646	1.8203	.8574	1.1165	1.7884	1.0010
0-5	.8794	.8430	1.1709	1.1382	.7351	.7095	1.7525	.8980
5-10	1.1105	1.2934	1.3176	1.4384	1.0254	1.1795	1.6207	1.1428
10-50	1.0923	1.1042	1.1498	1.1563	1.0130	1.0283	1.2142	1.1001
50-500	.9822	.9801	.8722	.8714	1.0185	1.0162	.7843	1.0452
> 500	1.0032	.9674	.8154	.8033	1.4335	1.3630	.6872	1.0011

Note: w refers to the blue collar wage.
s refers to the white collar wage.

[1]Coefficients of efficiency are calculated as value added divided by w(L) + r(k) where w and r are the wage rate and the capital rate of return; for a given set of assumptions, the same w and r are applied for all farm sizes.

[2]White collar and blue collar labor are assumed here to have the same social cost.

Table A-9

Implicit Social Rates of Return to Capital*

Farm Size	Capital Value A: w = s = 1400 A	Capital Value A: w = s = 1400 B	Capital Value A: w = s = 700 A	Capital Value A: w = s = 700 B	Capital Value A: w = s = 0 A = B	Capital Value w=1400, s=8000	Capital Value w = s = 1400 A	Capital Value w = s = 1400 B
1/2	.596	-16.815	13.862	6.842	27.12)		.384	-10.984
1/2-1	3.078		19.004		36.956		2.047	
1-2	4.821	3.632	20.889	20.294	36.956		3.570	2.689
2-3	11.880	10.365	25.662	24.915	39.444	w = 1400	9.430	8.243
3-4	11.404	21.829	24.052	29.264	36.700		10.005	19.150
4-5	12.448	21.485	24.204	28.723	35.960		11.102	19.162
5-10	15.921	20.122	24.451	26.551	32.980		16.656	21.050
10-20	17.057	17.436	23.169	23.358	29.281	16.539	18.734	19.151
20-30	13.811	13.535	18.522	18.384	23.233	13.385	15.154	14.851
30-40	12.851	13.130	16.934	16.791	21.017	11.789	14.714	14.706
40-50	12.454		16.087		19.720	11.419	13.565	
50-100	12.529	13.066	15.253	15.522	17.977	11.562	15.450	16.112
100-200	12.426	12.447	14.197	14.207	15.968	11.710	16.470	16.498
200-500	12.160	11.668	13.341	13.095	14.521	11.855	16.529	15.860
500-1000	12.676	10.836	13.574	12.654	14.472	11.386	19.216	16.427
1000-2500	11.522	12.943	12.164	13.321	12.806	10.718	23.240	28.035
> 2500	14.081		14.423		14.765	13.670	33.386	
Total	(12.639)	(12.639)	(16.495)	(16.495)	20.351	11.977	(15.798)	(15.798)
	12.670	12.670	16.511	16.511		(11.799)	15.837	15.837
0-3	5.688	-1 96	20.484	16.669	35.293	5.688	4.080	-1.406
3-5	11.837	21.687	24.115	29.040	36.393	11.837	10.455	19.155
0-5	7.749	5.999	21.706	20.831	35.663	7.749	5.943	4.601
5-10	15.921	20.122	24.451	26.551	32.980	15.921	16.656	21.050
10-50	14.729	14.972	19.719	19.841	24.709	14.048	16.283	16.552
50-500	12.350	12.315	14.160	14.143	15.971	12.490	16.180	16.134
> 500	12.684	12.168	13.334	13.076	13.984	11.816	23.734	22.769
	r=12.64		r=16.50		r=20.35			

*The social rate of return to capital is defined as value added minus implicit labor cost all divided by value of capital (including land).

Table A-10

Implicit Labor Earnings for Various Capital Rates of Return

(using Capital Series A; Labor Series A)

Farm Size	Implicit Average Earnings of All Labor		Implicit Average Payment to Producers[1] w = 1400 s = 8000			
	r = .126	r = .165	r = .1180	r = .08	r = .08	r_s = .1180 # farms
	(1)	(2)	(3)	(4)	(5)	(6)
< 1/2	764.50	560.84	-833	1081.05		
1/2-1	979.70	810.04	1026	1241.48		
1-2	1059.35	891.19	1066	1297.50		
2-3	1361.38	1165.33	1503	1799.59		
3-4	1331.62	1117.97	1452	1779.55	1752.62	1430.27
4-5	1388.58	1158.73	1553	1918.13	1893.76	1533.06
5-10	1669.25	1352.48	2143	2735.64	2655.73	2080.43
10-20	1905.83	1463.75	2846	3914.23	3727.07	2709.48
20-30	1574.00	1000.45	2241	3962.59	3695.50	2090.20
30-40	1436.13	774.37	1524	3888.81	3518.42	1378.57
40-50	1364.25	620.49	1235	4222.94	3795.44	1109.73
50-100	1371.58	379.65	1263	5818.34	4968.22	1078.79
100-200	1315.37	-210.44	1354	11018.86	8584.71	1054.94
200-500	1115.51	-1173.40	-2145	21201.19	14252.77	-1442.63
500-1000	1428.02	-2008.93	-5114	58735.98	31105.53	-2708.52
1000-2500	180.88	-4028.11	-41765	112237.37	48361.52	-17995.95
> 2500	4345.80	-3546.93	189062	568182.76	209634.86	69755.73
Total	1405.47	701.94	1518	3086.09	2470.04	1267.52
0-3	1070.80	888.34	1114	1361.59		
3-5	1354.22	1134.15	1491	1833.32	1807.31	1470.09
0-5	1154.68	961.10	1215	1488.23	(1482.50)	(1210.63)
5-10	1669.25	1352.48	2143	2735.64	2655.73	2080.43
10-50	1693.00	1151.55	2421	3945.45	3698.16	2269.09
50-500	1287.77	-204.71	773	9639.26	7704.30	617.50
> 500	1447.80	-2711.58	2420	116705.16	56374.24	1169.08

Note: r is the rate of return to capital.

Sources and Methodology: Cols. (3) and (4) give the average residual (per farm) after hired blue and white collar wages are paid and specified rate of return to capital is deducted from value added.

[1]"Producer" here refers to the number of farms. While this is designed to illustrate the entrepreneurial earnings producers would be receiving if certain rates of return to capital were earned by all, it is impossible to distinguish the output and profit of those farms managed by the producer (on which it might most logically be assumed that these earnings occur). In any case one could argue that earnings might have as much to do with shrewd land purchase as good management, i.e. that r really could not be equal for all farms.

Table A-11

Value Added by Farm Size Adjusted for Exchange Rate Overvaluation and the Artificially High Coffee Price

Size of Farm	Value of Output (thousands of 1960 pesos)	Value Added (thousands of 1960 pesos)	Estimate R* Est. A Efficiency Coefficient	Est. B w=700) (s=700)	Return to Land and Capital	Coefficient of Efficiency
< 1/2	147,611	135,802	.9330		.1149	
1/2-1	139,143	128,012	1.0507		.1475	
1-2	320,356	291,524	1.0885		.1587	
2-3	278,558	250,702	1.2362		.1966	
3-4	267,709	235,584	1.1646		.1754	
4-5	185,478	161,366	1.1675		.1746	
5-10	767,627	660,159	1.1826		.1725	
10-20	812,871	690,940	1.1654		.1648	
20-30	404,297	339,609	1.0150		.1354	
30-40	302,724	248,234	.9586		.1255	
40-50	229,284	183,427	.9455		.1235	
50-100	753,409	602,727	.9207		.1200	
100-200	742,552	608,893	.9154		.1200	
200-500	906,692	761,621	.9315		.1228	
500-1000	584,894	503,009	.9635		.1275	
1000-2500	488,487	429,869	.8959		.1182	
> 2500	475,591	428,032	1.0868		.1445	
Total	7,807,282	6,558,117	1.0012	1.0012	.1329 (.1327)	1.3063
0-3	885,668	805,958	1.0921	.9614	.1586	.8028
3-5	453,187	398,805	1.1713	1.4510	.1765	.9031
0-5	1,338,855	(1,204,970)	1.1173	1.0825	.1646	.8336
5-10	767,627	660,159	1.1826	1.3087	.1725	1.0055
10-50	1,749,176	1,469,308	1.0644	1.0715	.1445	1.0101
50-500	2,432,653	1,970,449	.9219	.9208	.1209	1.2320
> 500	1,548,972	1,363,095	.9766	.9589	.1294	1.2648

*Based on the assumption of social value/market price ratios as follows: coffee 0.6, bananas, rice, sugar and cotton 1.5, all other products, 1.0.

Table A-11 continued

Size of Farm	Value Added	Estimate S+ Efficiency Coefficient w=700 s=700 Est. A	Est. B	Return to Land and Capital	Coefficient of Efficiency w=700 s=8000
< 1/2	136,687	.9093		.1165	
1/2-1	129,404	1.0314		.1509	
1-2	295,355	1.0710		.1629	
2-3	254,174	1.2143		.2012	
3-4	239,409	1.1451		.1803	
4-5	164,340	1.1491		.1800	
5-10	674,450	1.1618		.1781	
10-20	709,916	1.1460		.1710	
20-30	352,182	1.0040		.1421	
30-40	259,011	.9525		.1327	
40-50	192,083	.9416		.1310	
50-100	635,007	.9200		.1279	
100-200	648,131	.9212		.1289	
200-500	819,729	.9456		.1331	
500-1000	545,526	.9345		.1391	
1000-2500	468,774	.9195		.1295	
> 2500	469,129	1.1196		.1587	
Total	6,888,144	1.0007	1.0007	.1415 (.1414)	1.2876
0-3	815,568	1.0719	.9471	.1622	.7945
3-5	405,639	1.1521	1.4161	.1816	.8953
0-5	(1,221,464)	1.0975	1.0644	.1688	.8255
5-10	674,450	1.1618	1.2804	.1781	.9939
10-50	1,520,762	1.0515	1.0583	.1513	1.0007
50-500	2,097,925	.9280	.9270	.1299	1.2188
> 500	1,485,691	1.0018	.9847	.1417	1.2764

+Based on the same assumption as R except that the social value/market price ratio for cattle is 1.2.

Table A-12

Factor Shares by Farm Size

Farm Size	Hired Blue Collar		Total Hired		Total Labor Share w=1400 p=1400[1]		Paid Labor Share w is f(farm size) s=8000	Total Labor Assuming w=aC coefficient of efficiency (where w=s=p)
	Est. A (1)	Est. B (2)	w=1400: Est A. (3)	s=8000 Est. B (4)	Est. A (5)	Est. B (6)	A (7)	(8)
< 1/2	9.408	42.871	same		97.80	155.13	4.032	67.73
1/2-1	14.408				91.19		7.108	71.59
1-2	20.749	23.944			86.96	90.17	12.075	71.77
2-3	21.306	25.094			69.88	73.67	14.649	68.56
3-4	21.907	12.219			68.92	40.52	16.743	66.68
4-5	22.273	14.099			65.38	40.25	17.023	65.04
5-10	22.555	9.814			51.73	38.99	19.329	57.44
10-20	23.001	21.695	25.145	23.839	43.52	42.22	23.666	49.16
20-30	25.693	26.878	27.914	29.098	42.39	43.57	26.262	42.71
30-40	26.084	23.775	32.206	29.998	43.81	40.94	32.682	39.25
40-50	25.839		32.201		42.09		34.970	36.50
50-100	21.976	19.007	28.499	25.530	35.69	32.70	30.854	30.12
100-200	17.328	17.190	22.766	22.628	26.67	26.49	26.815	21.89
200-500	12.965	16.357	21.144	24.536	24.44	27.82	25.471	15.74
500-1000	9.766	22.473	20.567	33.274	21.32	34.04	24.926	12.44
1000-2500	8.295	4.286	15.902	9.811	16.30	10.08	20.963	9.22
> 2500	3.878		7.249		7.41		9.715	5.14
Total	18.210	18.210	22.338	22.238	41.30	41.30	22.401	37.80
0-3	18.111	30.321	18.11	30.32	83.92	105.54	10.825	70.09
3-5	22.057	12.989	22.06	12.99	67.47	40.41	16.858	66.02
0-5	19.467	24.370	19.47	24.37	78.27	83.18	13.108	68.83
5-10	22.555	9.814	22.56	9.81	51.73	38.99	19.329	57.44
10-50	24.486	23.496	27.83	26.84	43.15	42.16	27.150	44.12
50-500	17.255	17.478	24.04	24.26	28.79	29.01	27.640	22.27
> 500	7.509	11.203	15.04	18.73	15.50	19.19	19.043	9.32

[1] p refers to the assumed wage income of producers (and family helpers, or rather their full person equivalents).

Sources and Methodology: Ests. A and B are based on the corresponding estimates of hired labor by farm size presented in Table A-1. In the calculations of Cols. (1) and (2) all blue collar workers were assumed to receive 1400. In Col. (7) the assumption is made that there is a perfect rank correlation between size of farm on which a worker is hired and his salary, i.e., we in effect arranged workers by salary and allocated the ones with highest wages to the largest farms, etc. The same assumption is made for Col. (11).

Table A-12 continued

Factor Shares by Farm Size

Farm Size	Producer's Share Assuming w=1400 s=8000 Est. A	Est. B	Producer's Share Assuming w is a Function of Farm Size A
< 1/2	90.592	57.129	95.968
1/2-1	85.592		92.892
1-2	79.251	76.056	87.075
2-3	78.694	74.906	85.351
3-4	78.093	87.781	83.257
4-5	77.727	85.901	82.977
5-10	77.445	90.186	80.671
10-20	74.855	76.161	76.334
20-30	72.086	70.902	73.738
30-40	67.794	70.002	67.318
40-50	67.799		65.030
50-100	71.501	74.470	69.146
100-200	77.234	77.372	73.185
200-500	78.856	75.464	74.529
500-1000	79.433	66.726	75.074
1000-2500	84.098	90.189	79.037
>2500	92.751		90.285
Total	77.662	77.662	77.599
0-3	81.89	69.68	89.175
3-5	77.94	87.01	83.142
0-5	80.53	75.63	86.892
5-10	77.44	90.19	80.671
10-50	72.17	73.16	72.850
50-500	75.96	75.74	72.360
> 500	84.96	81.27	80.957