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THE EMPLOYMENT EFFECTS OF AN INCOME REDISTRIBUTION

A Test for Aggregation Bias in the Indian Sugar Processing Industry*

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This paper analyzes the effect of possible income redistributions on demand for gur (unrefined sugar) in India, and thereafter on derived demand for labor. At this level of microeconomic analysis, it is shown that the employment-generation effect is substantial.

1. Introduction

The ILO Mission Report on Colombia epoused the idea that since the poor tend to consume relatively more labour-intensive commodities than the rich, a redistribution in their favour will tend to increase employment.[1] This proposal led subsequently to a host of attempts to demonstrate its empirical validity at the economy-wide level in a number of less-developed countries.[2] The results however gave only qualified support to the hypothesis. As Morawetz, put it, 'The almost unanimous conclusion is that even quite significant redistributions of income seem likely to have only marginal effects on growth and employment, usually increasing the latter by less than 5%'.[3]

This paper is concerned to examine one possible reason for these disappointing results, namely, the aggregation of products into broad, usually two-digit categories. Aggregation in this sense involves an estimation bias if there are shifts *within* these categories to goods produced by different factor combinations. In this study we attempt to examine the nature and extent of aggregation bias within a particular industry – that of sugar processing in India.

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[1]ILO (1970).

[2]These are surveyed in Cline (1975).

[3]Morawetz (1974, p. 506).

2. Products and technologies in the industry

Sugar processing in India is a good example of an industry in which two similar but distinct products serve the different ends of the market. A traditional product, gur, which is basically sugarcane in concentrated form is still the dominant sweetener for the vast majority of those with low incomes, particularly in rural areas. Some 60 percent of the annual sugarcane crop is used for gur manufacture and 28 percent of the remainder goes to the refined sugar industry. Annual per capita consumption of gur is roughly 12 kilos as opposed to 5 kilos in the case of sugar.[4] Gur represents on average 1.5 percent of total consumption expenditure in rural areas and 0.6 percent in urban. The consumption patterns in the industry can be represented as in table 1 which shows the data presented by monthly per capita expenditure classes for rural and urban areas in terms of index numbers where average expenditure for all classes on gur and sugar is set equal to 100 and the expenditure in each class expressed as a percentage thereof.[5]

The manufacture of gur can be divided into the three stages of extraction, clarification and evaporation of the cane juice.[6] The earliest method of crushing consisted in grinding the cane with a pestle and mortar with the pestle moved by bullocks. This method was followed by crushing the cane between two wooden or iron rollers fitted close to one another vertically or horizontally. Such crushers driven by bullocks are still typically employed by small-scale producers. Power-crushers of varying designs and sizes are used by the small number of large-scale manufacturers.[7] Following the process of extraction the juice is clarified and then concentrated by boiling and evaporation. The resultant semi-liquid mass, when cooled, solidifies into gur.

The production of white sugar differs in that it involves the centrifugal separation of sugar crystals from molasses.[8] Crystal sugar is produced by both vacuum pan and open pan sulfitation techniques, the latter being associated with smaller-scale units than the sugar mills proper. The proportion of total output accounted for by open-pan producers is very small (roughly 5 percent).[9]

Data on labour and capital per unit of output for the two products are taken from Prasad as shown in table 2. Gur thus uses more labour but less

[4]Indian Sugar Yearbook (1969–1970, p. 119).

[5]A method of presentation developed by Mahalanobis (1958). In all cases here and in what follows estimates used are those of the combined sample in the Indian National Sample Survey (1961-1962).

[6]Gur manufacture is described in Government of India (1965) and Roy (1951).

[7]Of the total number of sugar cane crushers in use 96 percent are worked by bullocks. Calculated from Government of India (1959–1960).

[8]The techniques of production of white sugar are described in detail in Baron (1975).

[9]Baron (1975).

Table 1[a]

	Monthly per capita expenditure classes (rupees)													
	0–8	8–11	11–13	13–15	15–18	18–21	21–24	24–28	28–34	34–43	43–55	55–75	75+	Average
Rural (all India)														
Numbers in each class as percent	4.39	11.36	9.51	10.77	14.6	12.57	9.2	8.19	7.31	5.82	3.23	1.72	1.33	
Gur	15.6	40.6	49.9	62.5	87.5	90.6	103.1	121.9	153.1	206.3	221.9	340.6	350.0	100
Sugar	3.8	15.4	30.8	38.5	57.7	69.2	96.2	138.5	169.2	238.5	269.2	403.8	980.8	100
Urban (All India)														
Numbers in each class as percent	2.28	4.92	5.14	7.28	10.34	11 39	10.31	9.44	11.63	9.41	7.75	5.18	4.93	
Gur	22.2	61.1	66.7	88.9	77.8	111.1	88.9	105.6	105.6	111.1	172.2	122.2	100	100
Sugar	10.1	17.4	30.4	40.6	53.6	71.0	79.7	94.2	114.5	146.4	168.1	202.9	249.3	100

[a]*Source:* Indian National Sample Survey (1961–1962).

Table 2[a]

	Gur	Sugar
Output per person in 100 days	2.1 tons	8 tons
Total productive capital per ton	236.79[b]	982.00[b]
Total productive capital per person	503.25[b]	7,859.00[b]

[a]*Source:* Prasad (1963, pp. 99–100).
[b]Rupees.

Table 3[a]

	Rural	Urban
Gur[b]	0.48	0.55
Sugar[b]	1.13	1.06

[a]*Source:* Calculated from Indian National Sample Survey 1961–1962.
[b]*Note:* Rupees per seer. A seer is approximately equal to one kilogram.

capital in relation to output than sugar. The latter is roughly double the price of the former as table 3 shows for rural and urban areas. When the figures for labour productivity in table 2 in terms of tons are adjusted to reflect relative prices, the higher sugar price raises labour productivity in sugar as opposed to gur manufacture. Since the ratio of value-added to gross output is also higher for sugar (25.2 percent) than gur manufacture (13.4 percent),[10] labour productivity measured in terms of labour per unit of value added would further increase the differential productivities. With capital productivity the adjustments of course work in the opposite direction though capital per unit value added in gur production (17.7) remains below that for sugar (19.5).[11]

3. The simulation methodology

In the subsequent sections an attempt is made to estimate the employment effects of alternative simulated income redistributions using both aggregative

[10]Ratios of value-added to gross output were calculated from data given in Prasad (1963).
[11]Assuming a price differential of 2 : 1 between sugar and gur.

and disaggregative approaches. Before beginning the estimation procedure, however, it is useful to set out the broad simulation methodology which underlies this study. This can be expressed as follows;[12] given a number of total per capita expenditure classes n, average per capita expenditure in each class $\bar{Y}_i (i=1,\ldots,n)$ and the percentage of population in each class $\bar{N}_i (i=1,\ldots,n)$ and $\sum \bar{N}_i = 100$) total expenditure can be expressed as[13]

$$Y = \sum_{i=1}^{n} \bar{Y}_i \bar{N}_i, \tag{1}$$

average per capita expenditure as

$$Y_w = \sum_{i=1}^{n} \frac{\bar{Y}_i N_i}{N} \tag{2}$$

where $N=100$. In the case of equal numbers in each group,

$$Y_w = \sum_{i=1}^{n} \bar{Y}_i \Big/ n,$$

otherwise as here,

$$Y_w \neq \sum_{i=1}^{n} \bar{Y}_i \Big/ n. \tag{3}$$

The share of each group in total expenditure

$$K_i = \frac{\bar{Y}_i \bar{N}_i}{Y}, \qquad i=1,\ldots,n. \tag{4}$$

The simulation takes the form of changing the elements of the vector comprising the shares K_i with Y and $\bar{N}_i$ given.[14] As can be seen from (4) the

[12]A similar formulation for equal numbers in each class is to be found in Paukert, Skolka and Maton (1976).

[13]Instead of as here regarding the total population as 100, actual numbers can be used so that actual total expenditure is $\sum_{i=1}^{n} \bar{Y}_i \bar{N}_i K$, where K is a scalar.

[14]An alternative is to regard $\bar{N}_i$ as variable so that an increase in income for a group is reflected in fewer numbers in the group. Meade characterises this as 'contraction of the poor' as opposed to 'enrichment'. [See Meade (1976).] Where, however, the distribution of individuals/households about the mean income is unknown for each group this procedure is difficult.

result is a new $\bar{Y}$ for each class, i.e., a new level of average per capita expenditure in each class. An estimated consumption function for each commodity concerned is applied to these new average per capita expenditure levels for each class. The summation across the classes yields a new estimated total consumption expenditure on the commodity which may be compared with the pre-redistribution total to arrive at the percentage change.

4. Estimates of consumption functions

In choosing the best-fitting function applied to the thirteen expenditure classes in table 1 one problem is that there are unequal numbers of persons in the different classes. This presents a problem in estimation inasmuch as the sum of the residuals weighted by these numbers is not zero (though the unweighted residuals do sum to zero).

In order to get the sum of the weighted residuals to sum to zero some form of weighting is required. This was achieved by weighting each of the initial thirteen observations by the numbers in each class, i.e., effectively raising the total number of observations in the proportions $\bar{N}_i (i=1,\ldots, n)$. The functions estimated on the basis of the weighted regression analysis are shown below,

Gur (rural) $Y = \underset{(-17.62)}{-0.0001x^2} + \underset{(36.02)}{0.023x} - \underset{(-9.05)}{0.095}, \qquad \bar{R}^2 = 0.976,$

Sugar (rural) $Y = \underset{(11.56)}{0.000056x^2} + \underset{(30.15)}{0.016x} - \underset{(-13.83)}{0.12}, \qquad \bar{R}^2 = 0.994,$

Gur (urban)[15] (1) $\log Y = -1.32 - \underset{(-31.17)}{\frac{9.18}{x}}, \qquad \bar{R}^2 = 0.79,$

(2) $Y = \underset{(-3.08)}{-0.000042x^2} + \underset{(9.24)}{0.0059x} + \underset{(4.91)}{0.063}, \qquad \bar{R}^2 = 0.682,$

Sugar (urban) $Y = \underset{(-34.06)}{-0.00018x^2} + \underset{(58.46)}{0.037x} - \underset{(-14.14)}{0.18}, \qquad R^2 = 0.995$

(t values in parentheses).

[15] In view of the relatively inferior fit in the case of urban gur two alternative functions have been presented (and used in the simulations). Strictly speaking the adjusted coefficients of determination ($\bar{R}^2$) of these two functions cannot be compared since the dependent variables (Y and log Y) are different. Goldberger suggests an adjustment procedure to put the functions on the same footing so that $\bar{R}^2$ can be used as the choice criterion in choosing the best fitting function. See Goldberger (1964, p. 217).

Since the functions are strictly concave (the coefficient of x^2 is negative) an income redistribution towards the average will in each case increase total consumption except for sugar in rural areas where there will be a decrease.[16] In the case of the alternative log-reciprocal function for urban gur nothing *a priori* can be said.

5. The consumption and employment effects of an income redistribution

A series of income redistributions have been simulated by changing the shares of total expenditure accruing to the thirteen expenditure classes.[17] Tables 4 and 5 show the new configurations of income between classes separately for rural and urban areas (with total income given and constant). For each simulation the associated Lorenz ratio is shown at the foot of each table, together with the percentage of total income transferred.

Simulations (1), (2) and (3) are designed to eliminate all those below the absolute poverty line of 15 rupees per month[18] (i.e., the bottom four classes are eliminated), and Simulation (7) represents complete equality in the sense of a Lorenz ratio equal to zero.

The tables show that the elimination of absolute poverty in this period would have required a transfer of income representing 10 percent of the total income in urban areas and 6.2 percent in rural.[19] The implied reduction in the Lorenz ratio is 32 percent (rural) and 39 percent (urban). There is little reason to suppose that these figures would be much altered at the present time if the poverty line were adjusted upwards by an index of prices relevant to the absolute poor.[20]

[16]Strict concavity of a consumption function means that linear interpolation between any two points always gives lower values for consumption than the function itself. An analogues use is made of strict concavity by Sen in the context of utilitarian welfare economics. See Sen (1973).

[17]The simulations are based on the assumption that the income redistributions do not alter the price relative between sugar and gur which is given in estimating the functional forms.

[18]This is defined at 1960–1961 all-India prices as 15 and 20 rupees per month for rural and urban areas respectively. See Bardhan (1974). Dandekar and Rath use a slightly higher figure of 22.5 rupees for urban areas. See Dandekar and Rath (1971). The figure of 21 rupees used here may be regarded as an average of these estimates.

[19]Dandekar and Rath regard this figure in absolute terms as a conceptual measure of unemployment and under-employment inasmuch as it represents the amount of additional employment needed to remove absolute poverty. For 1968–1969 the figure for rural areas is 822.4 rupees crores. See Dandekar and Rath (1974).

[20]Over the period 1958–1968 it has been suggested that 'disparities in consumption in real terms increased'. See Chatterjee and Bhattacharya (1974). Bardhan finds that 'between 1960–1961 and 1967–1968 there has been a very significant rise in the percentage of people below the minimum level'. See Bardhan (1974, p. 276)

Table 4

Rural Expenditure class	Original share in total expenditure as percentage	Simulation (1)	(2)	(3)	(4)	(5)	(6)	(7)
0–8	1.3	3.0	3.0	3.0	2.0	2.0	3.0	4.4
8–11	5.0	7.8	7.8	7.8	6.0	5.5	5.0	11.4
11–13	5.3	6.6	6.6	6.6	6.0	5.5	5.3	9 5
13–15	6.9	7.4	7.4	7.4	7.0	7.0	6.9	10 3
15–18	11.0	11.0	10.2	11.0	12.0	11.0	11.0	14.6
18–21	11.3	11.3	10.4	11.3	12.0	11.3	11.3	12.6
21–24	9.5	9.5	8.8	9.5	11.0	9.5	9.5	9.2
24–28	9.8	9.0	9.0	9.8	10.0	9.8	9.8	8.2
28–34	10.3	9.5	9.5	9.1	10.0	10.3	10.3	7.3
34–43	10.1	9.1	9.3	8.9	8.0	10.1	10.1	5.8
43–55	7.2	6.2	6.6	5.9	6.0	7.0	7.2	3.2
55–75	5.0	3.7	4.6	3.7	4.0	4.5	5.0	1.7
75+	7.2	5.9	6.8	6.0	6.0	6.5	5.6	1.3
	100	100	100	100	100	100	100	100
Lorenz ratio	0.31	0.21	0.23	0.21	0.25	0.29	0.28	0.0
Percentage of total income transferred		6.2	6.2	6.2	5.9	1.4	1.7	22.4

Table 5

Urban Expenditure class	Original share in total expenditure as percentage	Simulation (1)	(2)	(3)	(4)	(5)	(6)	(7)
0–8	0.4	1.7	1.7	1.7	1.2	2.0	2.0	2.3
8–11	1.6	3.6	3.6	3.6	2.5	2.0	1.6	4.9
11–13	2.0	3.7	3.7	3.7	3.0	2.0	2.0	5.1
13–15	3.3	5.3	5.3	5.3	3.9	3.3	3.3	7.3
15–18	5.5	7.5	7.5	7.5	6.0	5.5	5.5	10.3
18–21	7.2	8.3	8.3	8.3	8.0	7.2	7.2	11.4
21–24	7.5	7.5	7.5	7.5	7.9	7.5	7.5	10.3
24–28	7.9	7.9	6.8	7.9	8.2	7.9	7.9	9.4
28–34	11.6	11.6	10.0	9.6	11.8	11.6	11.6	11.6
34–43	11.5	9.9	9.9	9.5	10.0	11.5	11.5	9.4
43–55	12.2	10.4	10.5	10.2	11.5	12.2	12.2	7.7
55–75	10.7	8.6	9.8	8.7	10.0	10.0	10.7	5.2
75+	18.6	14.0	16.0	16.5	16.0	17.3	17.0	4.9
	100	100	100	100	100	100	100	100
Lorenz ratio	0.36	0.2	0.22	0.22	0.28	0.32	0.33	0.0
Percentage of total income transferred		10	10	10	5.6	2.1	1.6	25.8

5.1. The consumption effect — Disaggregated basis

The percentage changes in consumption for gur and sugar can be estimated as follows: the changed shares in total income of tables 4 and 5 imply new average total per capita incomes in each class and the chosen consumption functions are applied to these for each class. Multiplying the outcome by the given (and constant) numbers in each class and summing over all classes yields the estimated new total demands. These are shown in table 6. The last column in table 6 represents the estimates for gur using the alternative log-reciprocal function. They do not differ much from those based on the quadratic function.

The table shows an increased demand for gur in both cases which is significantly high for urban areas. The predicted decline in consumption of sugar in rural areas as opposed to its increase for the urban sector reflects the much higher initial consumption in the latter case and the marked shift away from gur in the middle and upper income classes in the rural case. The strict convexity of the function in the case of rural areas (i.e., the rising mpc) is dependent upon the extremely high estimate for the last class (see table 1). Since this figure for the combined sample estimate is based on widely divergent sub-samples[21] and in view of the fact that without this observation the linear (convex) function gives a fractionally better fit[22] it is likely that the predicted decline in consumption is an overstatement.

By taking a weighted average of rural and urban areas the composite total consumption effect can be obtained. The weights used are the shares of rural and urban sectors in the total output of gur and sugar in 1961–1962.[23] These combined results are presented in table 7 for the absolute poverty Simulations (1), (2) and (3) and the totally egalitarian case as these are directly comparable.

The fall in the demand for sugar in rural areas is thus offset by the high share of urban areas while the large rural share in gur consumption pulls down the higher predicted increase in urban consumption.

An alternative set of calculations was performed on the absolute poverty simulations for gur using the discrete data instead of the continuous function

[21]The combined sample estimate is 2.55 rupees and the three subsample estimates are 1.18, 1.62 and 3.89 rupees.

[22]Though this is also true of gur in rural areas the sub-sample estimates are far more convergent and hence more reliable. The combined estimate is 1.12 rupees, the average of 1.15, 1.05 and 1.16 rupees.

[23]Total production of gur in 1961–1962 was 5,885,827 tons, 67 percent of which was demanded by rural areas. In the same period output of sugar comprised 2,546,000 tons; the urban sector dominating (74 percent) the consumption in this case. Total production estimates are from the *Indian Sugar Yearbook*, 1969–1970. The rural and urban shares are taken from the average consumption of gur and sugar in volume terms presented in the Indian National Sample Survey 1961–1962.

Table 6[a]

Simulation	Percentage change in demand for gur				Percentage change in demand for sugar				Estimates for gur
	Rural		Urban		Rural		Urban		
(1)	+3.6	(0.22)	+7.9	(0.07)	−2.4	(0.35)	+8.6	(0.18)	+7.8
(2)	+2.0	(0.24)	+5.7	(0.06)	−1.3	(0.39)	+6.3	(0.18)	+6.8
(3)	+3.6	(0.22)	+5.5	(0.06)	−2.4	(0.35)	+5.7	(0.18)	+7.0
(4)	+3.1	(0.27)	+4.6	(0.10)	−2.1	(0.40)	+5.0	(0.26)	+4.9
(5)	+1.5	(0.31)	+2.3	(0.11)	−1.0	(0.47)	+2.5	(0.29)	+2.4
(6)	+2.1	(0.30)	+2.2	(0.12)	−1.4	(0.46)	+2.4	(0.30)	+1.9
(7)	+7.7	(0)	+13.2	(0)	−5.2	(0)	+14.6	(0)	+11.8

[a]*Notes:* Pre-redistribution specific concentration ratios are 0.51 for sugar and 0.33 for gur in rural areas. In urban districts the figures are 0.33 and 0.12 for sugar and gur respectively. Figures in brackets denote the specific concentration ratios associated with each simulation. They are simply the Lorenz ratios for particular commodities.

Table 7

Simulation	Percentage change in demand for gur	Percentage change in demand for sugar
(1)	+5.0	+5.7
(2)	+3.2	+4.3
(3)	+4.2	+3.6
(7)	+9.5	+9.5

and making the *ex ante* mpc assumption.[24] In both rural and urban areas the results were very similar to those shown in table 6.[25] The main difference between the methods lies not in the overall estimates but in the fact that with a continuous (and strictly concave) function any redistribution which is an unambiguous movement towards the average increases consumption while in the discrete case this does not always hold because of the discontinuities in the behaviour of the marginal function.

5.2. The employment effect

With the assumption of a constant labour-output ratio, employment increases at the same percentage rate as output. To define the increase in terms of actual numbers, however, requires applying the labour-output ratios for gur and sugar to the estimated incremental output. Taking the output of gur and sugar in 1961–1962, calculating the rural and urban shares and applying the percentage increases in demand of the last section yields the incremental output. Multiplying by the labour-output ratios of 7 : 100 tons for sugar and 47 : 100[26] tons for gur gives the additional numbers demanded for each simulation. Table 8 presents these results for rural and urban areas.

6. The aggregative approach – The direction and extent of aggregation bias

Unlike the disaggregative approach used above which estimates the change

[24]The *ex ante* mpc assumption is that for each individual the change in consumption is equal to the change in income multiplied by the pre-redistribution mpc. The difficulty with this assumption is that it makes ΔC insensitive to the size of ΔY. We have used in the simulations the *ex post* apc assumption, i.e., each individual in moving to a new level assumes the apc of those already at that level. With this assumption the mpc is not insensitive to the size of ΔY. Our approach follows Cline (1972).

[25]For rural gur the percentage increases in consumption were 3.2, 2.4 and 3.0 percent for simulations (1), (2) and (3) respectively. For urban gur the corresponding estimates were 8.3, 7.6 and 8.3 percent.

[26]The labour-output ratio for sugar shown in table 2 above, which is based on a 100 day season, has here been reduced to reflect the fact that the season varies between 135 and 200 days. [See Baron (1975).] Gur, on the other hand, operates on the basis of a 100 day season. The capital-output ratio for sugar has also been reduced in the same proportion to a figure of 549.92 from 982 rupees.

Table 8[a]

(Actual numbers)

Simulation		Change in demand for labour: Gur		Sugar		Gur	Sugar
		Urban	Rural	Urban	Rural	Urban+rural	Urban+rural
(1)	(+71,205)	+72,118	+66,724	+11,473	−1,112	+138,842	+10,361
(2)	(+62,076)	+52,034	+37,068	+8,308	−602	+89,102	+7,706
(3)	(+63,902)	+50,208	+66,724	+7,517	−1,112	+116,932	+6,405
(4)	(+44,731)	+41,992	+57,456	+6,594	−973	+99,448	+5,621
(5)	(+21,909)	+20,996	+27,801	+3,297	−463	+48,797	+2,834
(6)	(+17,344)	+20,083	+38,922	+3,165	−648	+59,005	+2,517
(7)	(+107,721)	+120,501	+142,715	+19,122	−2,409	+263,216	+16,845

[a]*Note:* Figures in brackets represent estimates based on the log-reciprocal function for urban gur.

in consumption and employment for gur and sugar separately, the aggregative approach groups the two products together into a single category of sweetener and applies a consumption function estimated for the two products combined.[27] We take first the situation in the rural areas. To ease the computational requirements it was decided to apply the consumption function for the composite good to the changed income levels associated with just one simulation – that of perfect equality with a Lorenz ratio equal to zero. On this basis, consumption of the composite good was found to increase by 3.4 percent. Since this is equivalent to growth of both gur and sugar at 3.4 percent the incremental outputs of the two were obtained in the manner described for the disaggregative approach. Labour and capital requirements were then found using the same labour/output and capital/output ratios as in the disaggregated approach. Table 9 shows the differential increases in capital and labour predicted by the two approaches on the basis of Simulation (7).

Table 9

	Disaggregative approach	Aggregative approach	Aggregation bias
Increase in labour (actual numbers)	140,306	64,592	54%
Increase in capital (millions of rupees)	53.0	44.1	17%

The aggregative approach thus understates both capital and labour requirements relative to the approach which considers the shifts between the two products. In the case of labour the understatement is extremely marked.

In the urban sector it is plain from table 6 that there is an almost equiproportionate rise in the two products so that no aggregation bias results. This result can probably be explained by the fact that sugar typically has a satiety level since there is no (or very little) shift to higher qualities as incomes rise.[28] In their extensive study of English family budgets Prais and Houthakker thus found that of all the commodities studied, only in the case of sugar were no such shifts apparent.[29]

[27]The estimated consumption function for the rural areas is

$$y = \underset{(-5.7)}{-0.000046x^2} + \underset{(44\,28)}{0.039x} - \underset{(-14.92)}{0.22}, \qquad \bar{R}^2 = 0.993,$$

(figures in parentheses represent t ratios).

[28]Although there is no actual point of satiety in the case of sugar in urban areas, there is nevertheless a marked decline in the mpc as incomes rise.

[29]Prais and Houthakker (1955).

7. Conclusions

This paper has examined the problem of aggregation bias in the use of existing models which purport to estimate the employment effects of an income redistribution. That is, it has examined for one industry the distortions resulting from the aggregation into a homogeneous group products which in fact are produced by highly disparate methods of production and consumed by different income groups. In the Indian sugar processing industry it was found that while no bias exists for the urban sector, aggregative estimates for the rural areas involve significant distortions. In particular it was found that labour requirements were considerably understated relative to the results reached by the disaggregative approach. Understatement was also found in the case of capital albeit to a lesser extent. Obviously only very limited conclusions can be drawn on the basis of results from a single industry in a single country. However, similar relationships found between different types of products, technologies and incomes in other industries suggest that our results may have wider significance.[30] In any event there is a clear need for further studies on the basis of disaggregated data to test the ubiquity and direction of aggregation bias for various industries and countries.

[30]On the maize-grinding and laundry soap markets in Kenya see respectively Stewart (1977) and Langdon (1975).

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