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Impacts on Growth of the Structure of Demand and Income Distribution in Less Developed Countries:

An Application to Bangladesh*

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This paper explores interactions between economic growth and income distribution in the context of a multi-period linear programming planning model for Bangladesh. In this model the distribution of income varies with the sectoral structure of production. The distribution of income in turn affects both the savings rate and the commodity composition of demand. When economic growth, defined in terms of consumption, is maximized the model chooses the income distribution which leads to the most rapid growth. The results indicate that a shift toward agricultural production, a more equitable income distribution, and more demand for agricultural commodities leads to more rapid growth.

I. Introduction

In the early 1970's there was a revival of interest among development economists in income redistributional policies (see, for example, Ferguson and Nell). This interest arose as it became

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the composition of consumption demand, the structure of factor use and the distribution of income among factor owners, Cline (1972) has argued that if the poor spend proportionately more on relatively labour intensive goods than the rich, then the second round (feedback) effects of policies that exogenously redistribute income toward the poor will reinforce the initial income equalization. The strength of these second round effects on income equalization will depend on the degree of variation in the consumption patterns of different income classes and the differences in the pattern of factor use in the production of different goods and services. Some attempts have been made in recent years to examine the empirical significance of these second round effects of income redistribution. There have been a large number of studies of the impact of consumption — earnings patterns on the less developed countries. Most of these studies are concerned with the growth effects of some initial exogenous change in income distribution. An excellent survey of these studies can be found in Cline (1975). Using a detailed input-output table for Colombia, Ballentine and Soligo have been able to trace the second round effects on the factor earnings of different income classes following a simulated transfer of initial income from rich to poor households. The results of this simulation showed that the second round effects of income transfers would actually hurt the Colombian poor, because redistribution would reduce the direct demand for the services of unskilled labour.

The purpose of this paper is to examine the significance of the variation in consumption patterns across different income classes and sectors of Bangladesh for economic growth, employment creation and income redistribution. The present study differs from the Ballentine and Soligo study in two important ways. First, while the above authors are concerned with the feedback effects on factor incomes of redistributing the existing income, the present study examines the same effects within a framework that allows for interaction between growth and income distribution. Second, methodologically this study does not follow the standard practice of simulating the effects of an initial exogenous income redistribution. Rather, income redistribution is endogenous and is chosen in order to maximize economic growth. In this structure the type of income redistribution which increases economic growth emerges as a result of the analysis. Examination of this result provides an understanding of the links between these two

redistribution will be made taking into account its effects of the mean consumption pattern. In comparing the two solutions, the impact of this composition of demand effect on the direction of income redistribution which promotes growth can be determined.

In this model, redistribution of income is achieved by changing the sectoral composition of gross output. The economy is divided into nine production sectors. The high-wage modern industrial activities are classified into five manufacturing sectors, low-wage farming activities are grouped into two primary production sectors and the medium wage services activities are represented by two services production sectors. Table 1 displays the nine-sector division of the economy and indicates the major commodity type for each sector, its rank in terms of labour intensity, and the relative wage rate.

Table 1

SECTORAL TYPE, LABOR INTENSITY AND WAGE RATE

Sector Designation	Type of Commodity	Rank by Labour Intensity	Wage Rate
S_1	Food Agriculture	4	low
S_2	Non-Food Agriculture	3	low
S_3	Energy	9	high
S_4	Textiles	8	high
S_5	Miscellaneous Manufacturing	2	high
S_6	Machinery	7	high
S_7	Construction	6	medium
S_8	Transportation	5	medium
S_9	Other Services	1	medium

In addition to the standard assumptions (fixed coefficients technology, etc.) which characterize a linear programming, the two versions of the model described in this paper also rely on a number of other assumptions. First, it is assumed that the sectoral wage and price structures are fixed and the analysis focuses on the changes in the intersectoral distribution of income which arise from the income effects associated with investment redistribution

The objective function is maximized subject to the following technological and economic constraints that operate within each five-year sub-period in the model.

B. Intersectoral Consistency Constraints

These ensure that total increments to demands made on each sector during any period do not exceed the total incremental availability of output in the respective sectors. There are five sources of demand.

1. Intersectoral Current Demand

$$(2)\quad a_i(t) = \sum_j a_{ij} X_j(t)$$

where a_i is the current incremental flow of the output of sector i to intermediate demand, a_{ij} is the incremental output of sector i required for intermediate use per unit of incremental output in sector j and X_j is the incremental output in sector j.

2. Inventory Requirements

We assume that a certain fixed ratio has to be maintained between the stock of inventories and the level of sectoral gross output. The demand for new inventories should therefore bear a fixed ratio to changes in gross output. But, as our model is defined in incremental variables, the current period's incremental requirement for inventories is obtained by substracting last period's new inventory requirement from the current period's new inventory requirement, thus,

$$(3)\quad w_i(t) = \sum_j w_{ij} (X_j(t) - X_j(t-1))$$

where w_i is the current period incremental inventory requirement for the output of sector i and w_{ij} is the inventory requirement for the output of sector i per unit of gross output of sector j.

3. Demands for Capital Formation

These represent the incremental demands made on sectoral outputs for new capacity formation in different sectors. Treating

constant. Since sectorial consumption forecasts resulting from (6) usually will not add up to F_{xy}, the function is linearized around the base year (1976-77) consumption pattern (Taylor) to obtain.

$$(6)\quad F_{ixy}(t) = (1 - e_{ixy})\, F_{xy}(0) + e_{ixy} \frac{F_{ixy}(0)}{F_{xy}(0)} \quad F_{xy}(t)$$

To guarantee adding up, the Engel elasticities are required to satisfy the condition

$$\sum_i e_{ixy} \frac{F_{ixy}(0)}{F_{xy}(0)} = \sum_i b_{ixy} = 1$$

The incremental demand for commodity i for income group xy, C_{ixy}, is obtained by lagging by one period and subtracting the resulting equation from

$$(7)\quad C_{ixy}(t) = F_{ixy}(t) - F_{ixy}(t-1)$$
$$= b_{ixy}\,(F_{xy}(t) - F_{xy}(t-1))$$

Aggregating over x and y gives the total increment to consumption demand for commodity i during period t.

$$(8)\quad C_i(t) = \sum_x \sum_y C_{ixy}(t) = \sum_x \sum_y b_{ixy}\, C_{xy}(t)$$

where $C_{xy}(t) = F_{xy}(t) - F_{xy}(t-1)$

5. Government Demand

Government demand for the output of sector i is assumed to grow exogenously at the rate r_g per period. Thus the increment to government demand is

$$(9)\quad \bar{G}_i(t) = r_g(1 + r_g)^{t-1}\, \bar{G}_i(0)$$

where $\bar{G}_i$ is the incremental government demand for good i in period t, and $G_i(0)$ is the level of government demand for good i in the base period.

6. Intersectoral Consistency

Intersectoral consistency requires that the total incremental demand be less than or equal to the incremental supply. Aggregating equations 2, 3, 4, 8, and 9, we obtain the increment to

and C is a scalar, representing incremental consumption in period t.

The consumption constraints for the disaggregated version are obtained by distributing agricultural wage value-added among the rural income classes and non-agricultural wage value-added among the urban income classes in accordance to their respective base year shares.

Thus

$$(12) \quad C_{xy}(t) = S_{xy}\ w^x(t) \ ; \quad x = r, u$$

where C_{xy} is the consumption of income class y in area x, S_{xy} is the historical income share of income class y in area x and w^x is the total wage value-added in area x. In turn, wage value-added in the two ares is based on sectoral gross outputs

$$(13) \quad w^r(t) = \sum_{j=1}^{2} d_j\, x_j(t)$$

and $$w^u(t) = \sum_{j=3}^{9} d_j\, x_j\,(t)$$

where w^r and w^u are agricultural and non-agricultural wage value-added, respectively. It is important to note that the method of disaggregating income described above not alter either sectoral value-added or the implicit sectoral (non-wage value-added) savings coefficients from the values in the aggregate version of the model.

D. Capacity Constraints

For any sector j, the capacity constraint in our model states that the increase in output in any period t cannot exceed the level indicated by the new capacity installed in the previous period. Assuming that the new capacity created during period t is given by the product of the net fixed investment in that period and the incremental output-capital ratio, the relevant constraint on the jth sector is given by

the corresponding $M_i(t)$ variables negative, while trading sectors whose products are more costly to produce domestically will emerge as net importers with the sign of the corresponding $M_i(t)$ variables positive in the optimal solution. In addition these constraints effectively place exogenous upper bounds on exports (see below).

F. Post-terminal Growth Constraints

These are formulated on the assumption that the incremental capacity created in the terminal period ($t=4$) must be sufficient to provide for increments in sectoral outputs during the post-terminal period at least as large as those during the terminal period. Thus,

$$(17)\quad I_j(4) - \delta_j K_j(4) \geqslant I_j(3) - \delta_j K_j(3)$$

G. Initial Period Constraints

Incremental sectoral outputs in the first period ($t=1$) are not allowed to exceed the incremental capacities installed in the base period ($t=0$)

$$(18)\quad X_j(1) \leqslant \frac{1}{R_j}[I_j(0) - \delta_j K_j(0)]$$

This completes the description of the structures of the two versions of the model.

H. Disentagling the Pure Savings Effect from the Composition of Demand Effect.

The same implicit savings constraint underlies the structure of either version of the model described above. For the aggregate version the savings constraint may be derived by adding equations (10), (11) and while it is given by the sum of equations (10), (12), (13) and (15) for the disaggregated version of the model. In either case, the savings constraint states that the incremental availability of domestic savings (private plus government) and foreign savings in any period must be at least as large as the incremental financ-

where V is total value-added. Inequalities (19) or (20) represent the economy's ex-ante savings constraint for both variants of the model. But it follows from (22) that the change in the composition of output which is expected to occur due to the influence of the differences in the expenditure patterns of different income classes (in moving from the aggregate to the disaggregated variant of the model) will also be accompanied by a change in the economy's realized (incremental) savings rate since $\bar{G}(t)$ is the same in both variants. In general, this savings effect may be positive or negative and will be determined endogenously.

Thus changes in the composition of output have two different effects in the model, changing both the composition of consumption demand and the savings rate. It is desirable to be able to examine each of these effects separately, in order to evaluate their individual effects on growth. The technique described below allows us to adjust the savins rate in the disaggregated version of the model to that in the aggregated version of the model without constraining the composition of output. We are, therefore, able to isolate the composition of demand effect from the effect due to the change in the economy's incremental savings rate.

Let $(s/v)^*$ be the aggregate incremental savings rate (defined gross of government spending) realized in the solution to the aggregate version. We introduce the following constraint in the disaggregated model

$$(23)\quad (s/v)^* = \frac{\sum_t \sum_j (v_j - d_j)X_j(t)}{\sum_t \sum_j v_j X_j(t)}$$

We may rewrite (24) as

$$(24)\quad 1 = (1 - (s/v)^*) \frac{\sum v_j X_j}{\sum d_j X_j} = \frac{1-(s/v)^*}{1-(s/v)}$$

This constraint is achieved by allowing the wage value-added coefficients, d_j, to vary while maintaining the relationship among them. Thus a new variable, α_c, is defined which applies a common scale factor to the original values of the d_j coefficients, $d_j^{(0)}$.

III. Results

Tables 2 and 3 present the optimal solutions to the thre variants of the model. Each entry in Table 2 represents the incremental level (in hundreds of millions of 1976/77 Takas) at which the corresponding activity is to be operated in the period indicated at the top of respective column. The results are organized in a manner so that it is easily seen how much expansion should take place in production, import or export, and investment in each sector during each period for all three variants of the model. Table 3 presents the increments to consumption, broken down by urban and rural income classes; increments to saving broken down into rural and urban components, the overall savings rate, increments to gross output and the values of the objective function. The shadow prices associated with the various constraints in the model are shown in Table 4.

Examination of Tables 2 and 3 shows that the growth of output and consumption is greatest in the disaggregated version of the model (variant 2). Overall incremental output is 5.68 per cent higher in the disaggreted model relative to the aggregated model (variant 1). Thus, when the model takes into account the impact of the sectoral composition of output on income distribution, the commodity composition of consumption demand and the savings rate, more growth in output and consumption can be obtained. Our main interest in these results is to quantify the relative importance of the composition of demand and the saving effects. In addition we wish to examine the nature of the changes in income distribution, commodity composition of demand and the savings rate which accompany the higher growth in the disaggregated model.

First, we observe that the realized incremental savings rate associated with the disaggregated model is higher than in the aggregated model (see Table 3). Thus the changes in the composition of output and income distribution are chosen by the model in such a way as to increase the savings rate. This increased savings rate may account for all or a part of the increased growth observed in the disaggregated model. A comparison of variant 3 with variant 1 indicates that the size of the composition of demand effect, which amounts to about 33 percent of the difference between variants 1 and 2. The remaining 67 percent of the increas-

Table 2 (continued)

Increments to Domestic Use = Gross Output - Exports or Gross Output + Imports		Aggregate Model (Variant 1)					Disaggregated Model (Variant 2)					Disaggregated Model adjusted for the Saving Rate (Variant 3)				
		t = 1	t = 2	t = 3	t = 4	Total	t = 1	t = 2	t = 3	t = 4	Total	t = 1	t = 2	t = 3	t = 4	Total
Total		14790	22788	22983	24879	85450	13705	23967	24971	27636	90279	13578	23810	24616	25129	87133
Food	S1	4739	7043	6774	7529	26085	4739	8039	7820	10143	30741	4739	8067	7786	8302	28894
Non-Food	S2	1295	1924	2008	2338	7565	1137	2073	2160	2375	7745	1114	2042	2152	2228	7536
Energy	S3	1592	2391	2982	2102	8067	1381	2424	1980	2013	7798	1372	2416	1942	1950	7680
Textiles	S4	846	1226	1366	1624	5062	572	1120	1308	1375	4375	556	1096	1308	1276	4236
Misc. Mfg.	S5	1250	2008	1964	2744	7966	1139	2135	2147	2359	7780	1125	2120	2108	2281	7634
Machinery	S6	699	1050	1141	762	3652	675	874	1493	780	3822	650	821	1401	749	3621
Construction	S7	40	854	1101	498	2493	96	1005	941	1468	3510	82	980	878	1414	3354
Transportation	S8	1399	2006	2160	2597	8162	1293	2126	2442	2618	8479	1280	2109	2407	2528	8324
Other Services	S9	2043	2907	3304	3617	11871	1876	2743	3289	3344	11252	1872	2743	3281	3288	11184
Non-Competitive Imports		897	1379	1183	1068	4527	797	1428	1391	1161	4777	788	1416	1353	1133	4670
New Capacity																
Total		36946	40933	46421	46421	170721	38209	42242	47759	46784	176994	38087	43091	46747	46747	174672
Food	S1	10991	11923	13854	13854	50622	11986	13118	15116	15116	55336	12013	13088	14932	14932	54965
Non-Food	S2	4648	5817	6940	6940	24345	4797	5991	7022	7022	24832	4766	5979	6870	6870	24485
Energy	S3	3491	2651	1597	1597	9336	3524	1680	1465	1465	8134	3516	1599	1453	1453	8021
Textiles	S4	2713	3454	4283	4283	14733	2479	3363	3847	3847	13536	2370	3347	3517	3517	12751
Misc. Mfg.	S5	3825	4318	5657	5657	19457	3952	4519	5315	5315	19101	3937	4478	5229	5229	18873
Machinery	S6	602	511	776	776	2665	602	2405	926	926	4859	602	2312	909	909	4732
Construction	S7	2800	3261	2933	2933	11927	3138	3901	3901	2926	13866	3069	3069	3824	3824	13786
Transportation	S8	3517	3952	4691	4691	16851	3536	4250	4768	4768	17322	3620	4212	4671	4671	17174
Other Services	S9	4359	5046	5690	5690	20785	4195	5015	5399	5399	20008	4194	5007	5342	5342	19885

Table 4
RESULTS OF THE MODELS: SHADOW PRICES

	Sector	Aggregate Model (Variant 1)				Disaggregated Model (Variant 2)				Disaggregated Model adjusted for the Saving Rate (Variant 3)			
		t = 1	t = 2	t = 3	t = 4	t = 1	t = 2	t = 3	t = 4	t = 1	t = 2	t = 3	t = 4
Upper Bounds on Exports													
Food	S_1	0.950	1.136	0.549	0.175	0.950	1.167	0.693	0.097	0.967	1.171	0.696	0.097
Non-Food	S_2	1.820	1.177	0.577	0.197	1.845	1.209	0.725	0.110	1.844	1.213	0.727	0.118
Energy	S_3	0.208	0.288	0.000	0.000	0.298	0.280	0.000	0.000	0.306	0.285	0.000	0.000
Textiles	S_4	0.338	0.000	0.000	0.066	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Misc. Mfg.	S_5	0.000	0.409	0.238	0.188	0.316	0.418	0.302	0.121	0.318	0.418	0.301	0.121
Machinery	S_6	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
New Capacity													
Food	S_1		0.145	0.106	0.082		0.155	0.096	0.093		0.154	0.096	0.094
Non-Food	S_2		0.079	0.058	0.045		0.085	0.053	0.052		0.085	0.053	0.052
Energy	S_3		0.375	0.286	0.224		0.399	0.259	0.255		0.398	0.259	0.257
Textile	S_4		0.107	0.078	0.061		0.114	0.071	0.069		0.114	0.071	0.070
Misc. Mfg.	S_5		0.058	0.043	0.033		0.062	0.039	0.038		0.062	0.039	0.038
Machinery	S_6		0.166	0.122	0.093		0.176	0.111	0.105		0.176	0.111	0.106
Construction	S_7		0.070	0.053	0.039		0.073	0.049	0.044		0.073	0.049	0.044
Transportation	S_8		0.816	0.575	0.447		0.876	0.519	0.509		0.872	0.519	0.514
Other Services	S_9		0.276	0.176	0.138		0.301	0.155	0.158		0.299	0.155	0.159

in the first period is lower than in the aggregated model. This feature of the results can be explained by recalling that the pattern of incremental output in the first period is constrained by predetermined capacity expansion, which reflects the historical commodity composition of consumption demand, and, thus, is consistent with the commodity composition pattern in the aggregate model but not with the desired patterns in the disaggregated model. In the disaggregated variants larger increases in gross outputs first appear in the second period, based on the endogeneously chosen pattern of capacity expansion in the first period.

It is also useful to examine differences in the sectoral patterns of output expansion between the aggregated and disaggregated variants of the model. The disaggregated variants show significantly larger increments of gross output in food, machinery, construction and transportation and significantly smaller increments in energy, textiles and miscellaneous manufacturing. In addition, the disaggregated variants show smaller increments of imports of machinery and exports of textiles and larger increments of imports of energy. When the increments to domestic use (gross output less exports or gross output plus imports) are examined, the disaggregated model chooses greater increments to food, non-food, machinery, construction, transportation and non-competitive imports and smaller increments to energy, textiles, miscellaneous manufacturing and other services as compared to the aggregated model. The general picture which emerges indicates a shift (in moving from the aggregated to the disaggregated model) away from relatively capital and import intensive goods. A comparison of variant 3 with variant 1, indicating the composition of demand effect, reveals similar differences in the sectoral patterns of production, trade and domestic use. In particular, domestic use of food, construction, transportation and non-competitive imports is larger and domestic use of energy, textiles, miscellaneous manufacturing and other services is smaller in variant 3.

The result that a higher incremental savings rate is associated with a shift of income to agricultural activities in the disaggregated model occurs because the savings rates for the agricultural sectors are higher than for the non-agricultural sectors in the model. The limited empirical evidence available tends to support this feature of the model. Bergan found higher gross

Available data on income inequality in less developed countries show that the principal sources of inequality in these countries is the variability of labour income across different occupations (see Fields). In Bangladesh, close to 80 per cent of net output is comprised of labour earnings. The distribution of earnings is highly skewed across the agricultural and the non-agricultural occupations and within the urban sector of the economy. Poverty is concentrated in agriculture among the landless peasants who remain either totally unemployed or only marginally employed from year to year. The full time unemployment equivalent in agriculture has been estimated to be about 35 per cent of the country's labour force (Alamigir).

In view of the above facts, we have chosen to define the index of relative inequality for this study in terms of the sectoral distribution of incremental earnings over the entire labour force, including those that are employed in low, medium and high wage sectors of the economy and also those that are unemployed. By defining the earnings distribution over the total labour force, we have implicitly made income inequality sensitive to changes in the rate of unemployment. thus, other things remaining the same, a more rapid rate of productive job creation in our study will reduce inequality at the lower end of the income scale. This assumption seems to be particularly useful for labour surplus economies, where the extent of poverty tends to be concentrated among the unemployed and the marginally employed. The Lorenz curve shown in Figure 1 has also been constructed excluding the unemployed, thus focusing on the distribution of incremental labour earnings among the employed. Although the differences are not as pronounced as in Figure 1, the disaggregated model yields a more equal distribution among the employed.

The Lorenz curves shown in Figure 1 were constructed as follows. The solutions to each variant of the linear program presented in Tables 2, 3 and 4 can be used to compute the structure of incremental employment and labour and non-labour incomes during each period. Aggregating these over the four periods, we have calculated the change in the sectoral distribution of employment and earnings that holds at the end of the plan. These are presented for each variant of the model in Table 5. We have then further consolidated the economy by summing over the agricultural (S_1 and S_2), manufacturing (S_3 through S_7) and ser-

vices (S_8 and S_9) activities. The resulting information is then arranged to define the distribution of (incremental) earnings over low wage agriculture, medium wage services and high wage manufacturing occupations (see Table 6). The index of relative inequality is then defined in terms of Lorenz curves, by plotting cumulative proportions of the total labour force, including the unemployed (with no income), and those employed in lower to higher wage sectors.

Figure 1 shows that the Lorenz curve (distribution) associated with the disaggregated model lies entirely inside that associated with the aggregate model, so that the former represents an unequivocally more equitable distribution of incremental earnings than the latter (the Gini coefficients reported in Table 6 are consistent with the Lorenz curves). Although the relative position of those employed in the low wage sectors improves under the disaggregated version, based on this fact alone it cannot be concluded that the investment strategy under this version of the model is socially more preferable. Such a decision would require additional information on what has happened to aggregate (incremental) output. this study suggests that there need not exist a policy conflict between efficiency and equity in a labour economy with a fixed wage structure.

The major results of the study cannot be fully understood without a more detailed examination of the solutions. In particular, we would like to examine the nature of the change in the commodity composition of demand and its relationship to the increased growth and more equitable income distribution in the disaggregated model. The preceeding discussion indicates that income is redistributed toward the lower wage sectors of the economy, especially the agricultural sector.

It is clear from Table 2 that the optimal pattern of production in the disaggregated version of the model becomes significantly less industrialized as the agricltural sector experiences relative expansion under a higher demand for food in this version of the model. There are two sources of the increased demand for food (farm products) in the disaggregated version. The first is due to the rural-urban differences in consumption patterns and the second is due to the variation across income classes within each region. The net result of variation within and across regions is that the poor on an average spend a much larger proportion of in-

come on food (68%) then the society's mean expenditure on food (56%), the difference being largely explained by the low demand for food by rich households (42%). The expenditure patten of the middle income households, who spent about 59% of their income on food is not very much different from the society's mean expenditure pattern.

The fact that the poor spend a higher than average proportion of their income on food causes the composition of output to shift toward the farm output when the income distribution shifts in favour of the poor. Thus, the relative share of the consolidated agricultural sector (activities S_1 and S_2) in aggregate incremental output rises from 53 per cent in the aggregate version to over 57.5 per cent in the disaggregated version of the model. At the same time, owing to the low demand by the poor for petroleum products, electricity and gas (S_3), mill-made textiles (S_4) and miscellaneous modern manufactured products (S_5), the relative shares of these sectors decline. Thus, in spite of the marginal expansions registered by the construction (S_7) and the machinery production sector (S_6), the overall share of the manufacturing sector in incremental output diminishes by over 2.5 per cent. The relative size of the services sector (activities S_8 and S_9) also experiences a similar decline, mainly because the poor spend less than half of the proportion of income spent by the rich on housing, banking and other services (S_9).

The assumption of fixed coefficient Leontief type sectoral production functions rules out any direct factor substitution in the production of any given commodity. For the economy as a whole, however, indirect substitution between labour and foreign exchange and labour and domestic capital (savings) occurs through changes in the composition of aggregate output. Thus, the relative contraction of the high cost manufacturing activities as a consequence of investment reallocations toward agriculture releases some of the pressure on scarce foreign exchange and domestic capital. Therefore, for the same availabilities of resources, the economy grows at a faster overall rate under the disaggregated model.

The above claim that the agricultural sectors are less dependent on foreign exchange and domestic capital is supported by an analysis of the shadow prices associated with the solutions (see Table 4). Variants 1 and 2 of the model were initially run with no

highest in all but the last period, when miscellaneous manufacturing (the most labour intensive among the trading sectors) ranks first or second.

The above discussion sheds further light on the improvement in income distribution associated with the disaggregated model. The higher growth rate under the assumption of a fixed wage structure is directly translated into a higher rate of productive job creation. However, as indicated above, the relative expansion of the farming activities in the disaggregated version takes place partly due to a diversion of demand from housing services (S_9) and miscellaneous manufactured products (S_5) on which the poor spend relatively little. Because these two commodities are relatively more labour intensive than the farming activities (S_1 and S_2, the (incremental) level of employment in the disaggregated version is higher by less (5.6%) than is the (incremental) level of output (6.7%). Nonetheless, the higher rate of labour absorption in the disaggregated version results in a reduction of the unemployment rate from the initial level of 30 per cent to the level of 24 per cent at the end of the plan, while for the same labour supply growth assumption, the unemployment rate under the aggregate version is lowered to only 26 per cent at the end of the plan. Since for the large pools of the unemployed and the marginally employed in a poor labour surplus economy, employment provides the only source of income, a faster rate of productive job creation is distributionally equalizing, as it results in a greater reduction in the proportion of the economically active population without an income. The potential reduction of income inequality at the margin, as depicted in Figure 1, reflects this fact, as well as the increased labour income in agriculture.

IV. Conclusion

In this paper we have used three variants of a linear programming model in order to examine the significance of the variation in the consumption patterns across different income classes and regions of Bangladesh for the interaction between economic growth and income redistribution. Our results suggest that in a labour-surplus developing economy like Bangladesh, in which capital and foreign exchange are the scarce resources, income redistribution toward the poor is consistent with more rapid

Cline, W.R., *Potential Effects of Income Redistribution on Economic Growth: Latin American Cases,* Praeger Publishers, New York, 1972.

_____, "Distribution and Development: A Survey of Literature," *Journal of Development Economics,* 1, 1975, 359-400.

Ferguson, C. and E. Nell, "Two Review Articles on Two Books on the Theory of Income Distribution," *Journal of Economic Literature,* 10, 2, 1972, 437-453.

Fields, G.W., *Poverty, Inequality and Development,* Cambridge University Press, New York, 1980.

Land, J. and R. Soligo, "Models of Development Incorporating Distribution Aspects," Program of Development Studies Paper, 22, Rice University, Houston, Texas, 1972.

Mellor, J.W., *The New Economics of Growth: A Strategy for India and the Developing World,* Cornell University Press, London, 1976.

Morawetz, D., "Employment Implications of Industrialization in Developing Countries: A Survey," I.B.R.D. Staff Working Paper, 170, Washington, 1974.

Morley, S. and J.G. Williamson, "Class Pay Differential, Wage Stretching and Early Capitalist Development," *Economic Development and Cultural Change,* 25, 1977, 407-427.

Seers, D., "New Approaches Suggested by the Colombia Employment Programme," *International Labor Review,* 102, 1970, 377-389.

Soligo, R., "Factor Intensity of Consumption Patterns, Income Distribution and Employment Growth in Pakistan," Program of Development Studies Paper, 44 Rice University, Houston, Texas, 1973.

Taylor, L., "Theoretical Foundations and Technical Implications," Charles, R., Blitzer, Peter, B., Clark and L. Taylor, eds., *Economy-wide Models and Development Planning,* Oxford University Press, Oxford, 1975.