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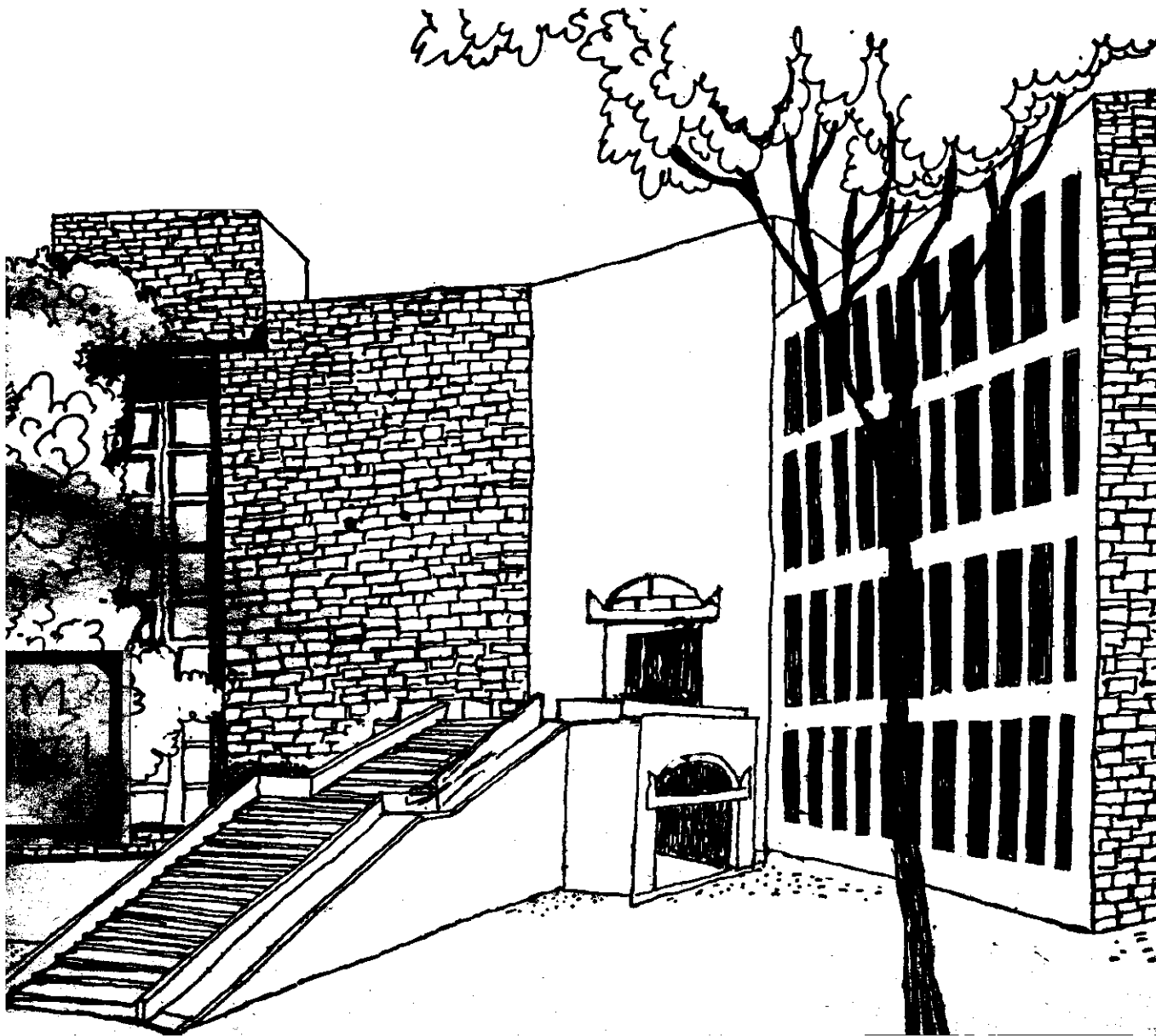
A NOTE ON THE EFFECTS OF TAX-SUBSIDY POLICIES
ON THE PERSONAL DISTRIBUTION OF INCOME
IN DUAL ECONOMIES

By

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Abstract

In this paper the effect of tax-subsidy policies on the personal income distribution is studied using the mobile capital Harris-Todaro model of Corden-Findlay-McCool. It is shown that tax-subsidy packages with efficiency promoting properties also have attractive effects on the personal distribution of income.

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I: INTRODUCTION

The redistributive effects of policy measures have increasingly begun to occupy the attention of policy makers and development researchers, in addition to concern with aggregate efficiency and growth. Analytic studies on the effects of policies on the personal distribution of income have however been few in number. This paper contains an attempt to partially fill this gap. Below, I study the effects of policies on the personal distribution of income using a somewhat extended version of the Corden-Findlay-McCool model of a dual economy with mobile capital and intersectoral migration. It is made apparent from this exercise that general equilibrium models which are deemed useful for the study of policy effects on efficiency and growth can, with only slight extensions, also serve to study policy effects on the personal distribution of income.

The plan of this paper is as follows. In Section II, I present the mobile capital Harris-Todaro model following McCool (1982) and briefly summarise the efficiency effects of various profit tax cum wage subsidy policies as reported by him.

In Section III, the model is extended to incorporate the personal distribution of income. It will be clear that these extensions are inspired by the work of Fields (1980). Section IV contains an analysis of policy effects on the personal distribution. In section V findings are summarised and some tentative conclusions offered.

II: THE MOBILE CAPITAL HARRIS-TODARO MODEL

In the notation of McCool (1982) the model is given by the following nine equations:

$$y_i = f_i(k_i) \qquad i = M,A. \quad f_i' > 0; \quad f_i'' < 0$$

$$l_A + l_M + l_N = 1$$

$$k_M l_M + k_A l_A = k \text{ (k fixed)}$$

$$w_M(1-s_M) = p(f_M - k_M f_M')$$

$$r(1+t_M) = pf_M'$$

$$w_A(1-s_A) = f_A - k_A f_A'$$

$$r(1+t_A) = f_A'$$

$$w_A = \frac{l_M}{l_M + l_N} w_M \quad (w_M \text{ given})$$

$$\underset{i}{\Sigma} M,A \quad s_i w_i l_i = \underset{i}{\Sigma} M,A \quad rt_i k_i l_i$$

where, for i = M,A, M being the modern (or manufacturing) sector and A being the traditional (or agricultural) sector:

y_i is the output of sector i per worker per period.

l_i is the number of labour units per period in sector i, labour units being identical.

l_N is the number of unemployed labour units per period.

k_i is the capital labour ratio in section i.

k is the aggregate capital stock, assumed to be fixed.

w_i, r_i are respectively wages per labour unit per period and rental per capital unit per period in sector i.

s_i, t_i are respectively per unit wage subsidies and profit taxes per period in sector i.

p is the relative price of the M-good in terms of the A-good, assumed exogenously given.

Equation (5.4) is the Harris-Todaro migration equilibrium condition and equation (5.5) is the government budget constraint. While I retain the assumption of a fixed relative price (p), I do away with tariffs as a possible source of government revenue, an additional instrument looked at by McCool (1982).

In line with McCool (1982) I consider nine policy packages (i.e. all policies considered by him except tariff based policies). Subsidies are given either t' agricultural sector wages, manufacturing sector wages or both (at an equal rate). These subsidies are financed by one of three methods: modern sector profit taxes, agricultural sector profit taxes or equal taxes on both sectors. Taxes and subsidies are assumed to be newly levied in each case so that they are initially at a zero level. Relevant comparative static results are in

Table 1.[1] Discussion of most of these results is to be found
in Corden and Findlay (1975) and McCool (1982) and is not
reproduced here. The main findings are as follows.

Full employment is attainable by one of four policy
packages, namely, across the board taxes with either an
agricultural wage subsidy or an across the board subsidy and
also the same subsidies financed by a manufacturing profits
tax. However the manufacturing tax financed across the
board subsidy does not permit the attainment of the
feasibility frontier. Of the other three policies, only the
across the board tax-cum-subsidy permits the attainment of
the first best optimum. With revenue constraints, across
the board subsidies financed by a manufacturing tax may be
the best available package "since the impact effect on the
value of output is larger than that associated with across
the board taxation." (McCool, p.76)

The employment effects of two policies, across the board
subsidies financed by either manufacturing taxes or across
the board taxes, are ambiguous. This is due to the opposing
pulls of subsidies to the agricultural sector and the
manufacturing sector. The exact conditions (see McCool (1982)
for details) for particular employment effects depend, in
part, on labor demand elasticities in the two sectors.
Since decreasing unemployment is necessary (though not
sufficient) for the attainment of the first best optimum,

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1 Some of the formulae in Table 1 are due to McCool (1982).
  See his Table 1.

Subsidy and Method of Finance	dy	dr	du_A	dk_M	dk_A	$d(w_A/y)$	dl_A	dl_M
Across the Board Profit Taxes $(t = t_A = t_M)$								
ds_M	$\dfrac{w_M k_A (1_A - 1)^*}{k_M}$	$\dfrac{k_A 1_A w_M}{k k_M}$	$\dfrac{-w_M k_A^*}{k_M}$	$-k_M N_M^*$	$\dfrac{-k_A^2 N_A^*}{k_M}$	$-$	$-$	$+$	$+$
ds_A	$w_A (1 - 1_A)$	$-w_A 1_A^*$	w_A	0	0	$+$	$+$	$-$	$-$
ds	$w_A (k - k_A)(1 - 1_A)$	$\dfrac{w_A 1_A (k_A - k)}{k k_M 1_M}$	$\dfrac{w_M (k_u - k_A)}{k_M}$	$-k_M N_M^*$	$\dfrac{-k_A^2 N_A^*}{k_M}$	$+$	$?$	$?$	$?$
Taxes on Manufacturing Profits (t_M)								
ds_M	0	0	0	$-k_M N_M^*$	0	0	$-$	$+$	$+$
ds_A	$\dfrac{w_A k (1 - 1_A)}{k_M 1_M}$	$\dfrac{-w_A 1_A^*}{k_M 1_M}$	$\dfrac{w_A k}{k_M 1_M}$	0	$\dfrac{k_A^2 1_A N_A}{k_M 1_M}$	$+$	$+$	$-$	$-$
ds	$\dfrac{w_A k (1 - 1_A)}{k_M 1_M}$	$\dfrac{-w_A 1_A^*}{k_M 1_M}$	$\dfrac{w_A k}{k_M 1_M}$	$-k_M N_M^*$	$\dfrac{k_A^2 1_A N_A}{k_M 1_M}$	$?$	$?$	$?$	$?$
Taxes on Agricultural Profits (t_A)								
ds_M	$\dfrac{-k w_M (1 - 1_A)^*}{k_M 1_A}$	$\dfrac{w_M}{k_M}$	$\dfrac{-w_M k^*}{k_M 1_A}$	$-k_M N_M^*$	$\dfrac{-k k_A N_A^*}{k_u 1_A}$	$-$	$-$	$+$	$+$
ds_A	0	0	0	0	$-k N^*$	0	$-$	$+$	$+$
ds	$\dfrac{-k w_M (1 - 1_A)^*}{k_M 1_A}$	$\dfrac{w_M}{k_M}$	$\dfrac{-w_M k^*}{k_M 1_M}$	$-k_M N_M^*$	$\dfrac{-k_A (k_A 1_A + k_u) N_A^*}{k_u 1_A}$	$-$	$-$	$+$	$+$

NOTES:

$$-N_i = \frac{w_i \, \partial 1_i}{1_i \, \partial w_i} \ , \quad i = M, A$$

$$k_u = \frac{k_M 1_M}{1_M + 1_N}$$

$$d(w_A/y) = \left(\frac{dw_A}{w_A} - \frac{dy}{y} \right) \frac{w_A}{y}$$

$$dl_A = (w_A Z + k_M (1_M + 1_N) dw_A)/b$$

$$dl_M = -(w_A Z + k_A (1_M + 1_N) dw_A)/b$$

$$dl_N = -((w_M - w_A) Z + (k_M - k_A)(1_M + 1_N) dw_A)/b$$

where $Z = 1_A dk_A + 1_M dk_M$; $b = w_M (k_u - k_A)$.

An asterisk signifies a negative multiplier. Some of these results are due to McCool (1982).

I will restrict attention below to unemployment decreases when analysing these two policies.

III: THE PERSONAL DISTRIBUTION OF INCOME IN THE HARRIS-TODARO MODEL

Both absolute and relative aspects of income distribution are focused on in what follows. Thus absolute income levels of different persons in the economy are looked at as well as inequality of incomes. Inequality of incomes is looked at with the help of the Lorenz Criterion whereby inequality is said to have worsened (improved) after policy changes if the post-policy Lorenz curve of the income distribution lies below (above) the pre-policy Lorenz curve. In case Lorenz curves cross, no statement is made about inequality.

Making statements about absolute poverty levels is more difficult since an exogenously specified poverty line is needed for this purpose. Following Fields (1980) we assume that traditional sector workers are poor. Consequently, in our framework, unemployed persons are also poor. We study income differences due to two sources below. Income differences due to institutional rigidities and differences due to differential ownership of productive factors.

Income differences due to institutional rigidities

In the Harris-Todaro model differences in current realized income occur due to differential earnings opportunities caused by the sticky modern sector wage rate. There is no mechanism

leading to differences in earnings from capital. I therefore look at (1) the labour earnings distribution and (2) the distribution of total incomes under the assumption of equally distributed capital stock ownership. Discussion of differential ownership of productive factors is postponed to the next section. I now proceed to a specification of the additional structure.

There are Q individuals each of whom owns and supplies 1/Q labour units per period. Individuals may work in only one sector or are unemployed.[2]

Labour incomes are therefore, 0 if an individual is unemployed, w_A/Q if employed in the agricultural sector and w_M/Q if employed in the manufacturing sector.

Income shares are given by 0, 1/Q and $\dfrac{l_M + l_N}{l_M Q} = w_M/(w_A Q)$ per person. The Lorenz curve connects the points $(0,0)$, $(l_N,0)$, $(l_N + l_A, l_A)$ and $(1,1)$ where the first element of the ordered pair gives the proportion of the work force and the second element gives the income proportion. Thus the three segments of the Lorenz curve have slopes 0, 1 and w_M respectively.

It may be recognized that the Lorenz curve segments have slopes equal to Q times income shares per person.

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2 Indivisibility of labour supply units may lead to market clearing conditions being only approximately satisfied. I ignore this problem here.
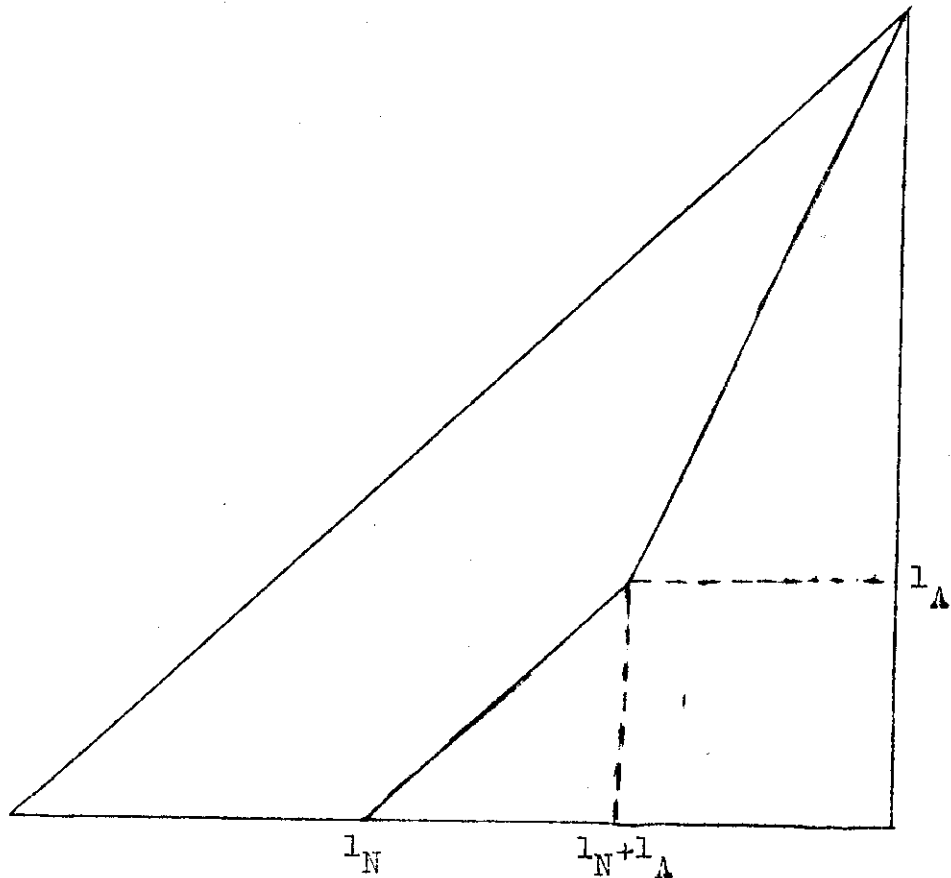
Figure 5.1: The Lorenz Curve for Labor Incomes in the HT Model.

In the case of equal distribution of capital ownership income for individual i is given by

$$y_i = \frac{rk}{Q} + w_j \frac{1}{Q} \quad \text{where} \quad j = A, M, N, \quad w_N = 0; \quad i = 1 \ldots \ldots, Q$$

Since the total wage bill is w_A[4] the ith individual's income share is given by

$$\frac{y_i}{y} = \frac{rk}{rk + w_A} \quad \frac{1}{Q} \quad \text{if unemployed,} \qquad 4$$

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4 The wage bill is $w_A 1_A + w_M 1_M = \dfrac{w_M 1_M 1_A}{1_M + 1_N} + w_M 1_M = \dfrac{w_M 1_M}{1_N + 1_M} = w_A$

Here, equation (1) and (2) have been made use of.

$$\frac{y_i}{y} = \frac{1}{Q} \text{ if employed in the agricultural sector} \qquad 5$$

$$\frac{y_i}{y} = \frac{rk}{rk+w_A} + \frac{w_M}{rk+w_A}\frac{1}{Q} \text{ if employed in the M-sector } 6$$

The Lorenz curve is given by the points (see diagram)

$$(0,0); \quad \left(l_N, l_N(1-\frac{w_A}{y})\right); \quad \left(l_N+l_A, \ l_A+l_N(1-\frac{w_A}{y})\right); \quad (1,1)$$

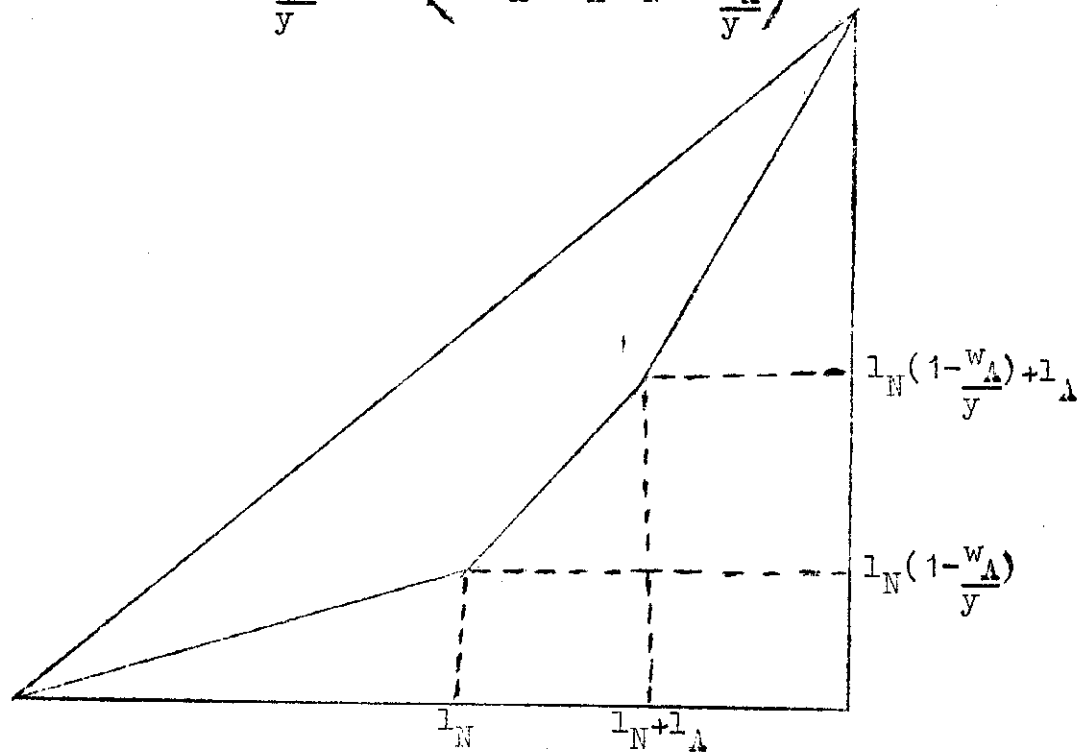
Figure 5.2: The Lorenz Curve in the HT Model With Equal Capital Shares and Occupationally Varying Labor Returns.

Here $y = rk+w_A$ and, as before, the first element of each ordered pair is the cumulative population proportion and the second element is the cumulative income proportion. The slopes of the three segments are respectively $1-\frac{w_A}{y}$, 1 and $1+\frac{w_M-w_A}{y}$ which are once again Q times the per person income share.

Income differences due to endowment differentials

Capital ownership is assumed to be unequally distributed in the population. Labor supply by individuals is also unequal when measured in efficiency units though not in time units. Individuals are risk neutral and seek to maximise the expected utility of income. Given the Harris-Todaro migration equilibrium, they are indifferent between an hour of labor supplied to the agricultural sector and an hour of labor supplied to the manufacturing sector. In this section I study the distribution of expected incomes so as to keep endowment linked and institutional effects separate.

Letting E denote the expectation operator, expected incomes are $Ey_i = rk_i + w_A l_i$, where l_i is in efficiency units, $\Sigma l_i = 1$; $i = 1 \ldots \ldots Q$ 7

Dividing through by $Ey = y$ and letting $h_i = k_i/k$ represent the ith person's capital share will give the income share of the ith person which may be seen to be a linear combination of capital and labor shares.

$$Ey_i/y = h_i(rk/y) + l_i(w_A/y) = h_i(1 - w_A/y) + l_i(w_A/y);\qquad 8$$

The Lorenz curve of expected income is thus given by

$$lZ(j) = \sum_{i=1}^{j} h_i (1 - w_A/y) + \sum_{i=1}^{j} l_i(w_A/y)$$

$$= c_i(1 - w_A/y) + b_j(w_A/y)\qquad 9$$

where it is assumed that persons have been ranked in ascending order of expected incomes so that c_i is the

cumulative capital share of the poorest j persons and b_j
is the cumulative labour share of the poorest j persons.

IV: EFFECTS OF POLICIES ON THE PERSONAL DISTRIBUTION OF
INCOME

(a) <u>Policy effects on income differences due to institutional
rigidities.</u>

    (i) <u>Absolute Incomes</u>

Here, we wish to enquire as to what policies, if
any, result in at least as many persons at each
labour income level as in the initial situation. In
other words we wish to enquire as to what policies
result in $dl_N \leq 0$; $dw_A \geq 0$ and $dl_M \geq 0$. Conversely,
if $dl_N \geq 0$, $dw_A \leq 0$ and $dl_M \leq 0$ results from the
enactment of any policy we may conclude that absolute
incomes are adversely affected (or rather not
improved) in the post policy regime. It will be
clear from table I that no policy package
unambiguously raises or lowers absolute labour
incomes of all individuals. Across the board
subsidies financed by either across the board taxes
or M-sector taxes may raise absolute labour incomes
especially if, in the former case, the first best
optimum is obtained.

Turning to total (labour plus capital)income
we see that in the case of the two policies
mentioned above the returns to capital decreases from
Table I. Thus no policy analysed results
unambiguously in income gains to all individuals.

(ii) Absolute Poverty

Following Fields (1980), consider the class of
poverty indices given by

$$p = p(l_A, l_N, w_A) ; p_1 \geq 0; p_2 \geq 0; p_3 \leq 0.$$

Sufficient conditions for poverty to decrease
(increase) are given by $dl_M \geq 0$ and $dw_A \geq 0$ and $dl_N \leq 0$
($dl_M \leq 0$ and $dw_A \leq 0$ and $dl_N \geq 0$). From Table 1
poverty may decrease in the case of the two packages
which raise absolute labour income. Since the
attainment of the first best optimum requires that
$w_M = w_A$, we may conclude that poverty is alleviated
if the first best optimum is indeed achieved. The
impact of other packages on poverty will be measure
specific.

(iii) Inequality due to Institutional rigidities

It is repeated that the Lorenz curve for labour
incomes in this case connects the points $(0,0)$,
$(l_N,0)$, (l_N+l_A,l_A) and $(1,1)$ and that the three
segments have slopes $0,1$ and w_M/w_A. To examine the
impact of policies on inequality of labour incomes
there is need to examine the impact on l_A, l_N, l_M and w_A.

This will then enable an examination of the behaviour of the points $(l_N,0)$ (l_N+l_A,l_A) and the slope w_M/w_A. Doing this, we conclude that five packages, those with (only) manufacturing subsidies and those with agricultural profit taxes result in greater labour income inequality by the Lorenz criterion. The other four packages result in lowering inequality of labour incomes (if they succeed in lowering unemployment in two cases).

'   If we examine total incomes under the assumption of an equal distribution of profit income, we now have a Lorenz curve which connects the points $(0,0)$, $(l_N,l_N(1-w_A/y))$, $(l_N+l_A, (l_A+l_N(1-w_A/y))$ and $(1,1)$ so that the three segments have slopes given by $1-w_A/y$, 1 and $1+(w_M-w_A)/y$. The expression $1-w_A/y$, the profit share of income clearly changes in a direction opposite to labour's share of income, while the expression $1+(w_M-w_A)/y = 1+w_M/y - w_A/y$ may be seen to increase (decrease) if both y and w_A/y decrease (increase). By examining the movement in just w_A/y and y (See Table I) we may conclude that Lorenz curves cross except in the case of the two policy packages (t_M,s_M) and (t_A,s_A) which operate on one sector alone. For these two packages, the slopes of all segments of the Lorenz curve are unchanged.

However both coordinates of the point $(l_N, l_N(1-w_A/y))$ increase with these policies so that inequality is worsened in these cases.

(iv) <u>Inequality due to Endowment differentials</u>

From (a) we see that $d(lZ(j)) = (b_j-c_j)d(w_A/y)$ for $j < Q$. It may be realistically assumed that the cumulative share of the poorest j individuals in total labour income (b_j) exceeds their cumulative capital share (c_j). If this assumption is valid, then the importance of labour's share of income in determining inequality of incomes is clearly revealed in an intuitive way. Examining table I, we may conclude that inequality due to endowment differentials decreases when manufacturing wage subsidies or across the board wage subsidies are instituted with finance being obtained from manufacturing or across the board profit taxes. Inequality is unaffected if tax -subsidy policies are restricted to one sector only. In the other three cases inequality is worsened.

<u>Concluding Comments</u>

In this note I have looked at the impact of policies on six aspects of the personal distribution of income:

(i)   Absolute labour earnings

(ii)   Absolute total incomes

(iii) Absolute poverty

(iv)   Relative labour income inequality due to
       institutional rigidities

(v)   Relative total income inequality due to
       institutional rigidities and

(vi)   Relative total income inequality due to
       endowment differentials.

Looking at these aspects in turn it has been
shown that two policy packages, across the board wage
subsidies financed by either across the board taxes
or manufacturing profit taxes are the only ones which
can have desirable effects on absolute labour earnings,
absolute poverty, relative labour income inequality
and total income inequality due to endowment
differentials. No policy package studied
unambiguously increases absolute total incomes of all
persons or unambiguously decreases total income
inequality due to institutional rigidities (under the
extreme assumption of equal capital ownership). What
is remarkable is that the two packages named are
precisely the packages found by McCool to be the most
effective in improving efficiency - one when revenue
is not a constraint and the other when revenue is
a constraint. Therefore, such policies may be seen
to be desirable both on equity and efficiency grounds.

Two other packages, it was seen, may lower inequality of labour incomes and total income inequality due to endowment differentials. These packages both involve subsidies to agricultural wages and either across the board profit taxes or manufacturing profit taxes.

The analysis here, when combined with the analysis of McCool may be seen to call into question the existence of the equity-efficiency trade offs induced by development policies that have been made so much of the development literature.

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