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Anjana Bhattacharyya  
*Utah State University*

Basudeb Biswas  
*Utah State University*

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SPECIFIC FACTORS, UNEMPLOYMENT, AND IMMISERIZING GROWTH IN A SMALL OPEN ECONOMY

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Anjana Bhattacharyya
Basudeb Biswas
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Anjana Bhattacharyya

and

Basudeb Biswas

Department of Economics
Utah State University
Logan, UT 84322

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The economic rationale of import-substituting strategy of development pursued by the majority of the developing countries has long been questioned. Apart from the familiar argument that tariff tends to discourage exports and hence, can be viewed as an export tax, there is the immiserization argument proposed by Professor Johnson. Within the framework of a two-factor two-commodity model, Johnson has shown that a small tariff-imposing country may suffer a welfare loss from an increase in the stock of resources or technological change if the growth is biased in favor of the importable sector so that it tends to magnify the distortion in production caused by the tariff. The purpose of this paper is to examine the possibility of Johnson-type immiserizing growth for the developing countries characterized by massive unemployment.

Section I of this paper describes the structure of the model. In section II, we establish the proposition that growth cannot be immiserizing for the small developing countries with widespread unemployment which are net importers of manufactured goods in the world market. In section III, we discuss the conditions under which immiserizing growth can occur from the growth of land or natural resources for a small country importing agricultural goods. The welfare implications of endogenous, i.e., tariff-induced growth of capital stock, are discussed in section IV. Section V is devoted to some concluding remarks.

I.

To analyze the impact of growth on welfare, we use the specific-factor model of international trade developed by Batra and Beladi (Economica, 1987) which highlights the importance of the specific factor, land, and
also takes into account the widespread unemployment prevalent in most developing countries. In this model, the economy is broadly divided into two sectors--manufacturing (X) and agriculture (Y), the latter using the specific factor, land. Also, there is generalized unemployment in the economy because of the downward rigidity of wages in both sectors of the economy. The non-specific factors, capital and labor, are fully mobile within the economy. The effects of exogenous accumulation of factors in such an economy on the output levels of various commodities have been studied by Batra and Beladi. In this paper, we extend their model to consider the effect of growth on welfare.

The equations of the model are the following:

\[
X = X(K_X, L_X) \quad (1)
\]

\[
Y = Y(K_Y, L_Y, V) \quad (2)
\]

\[
p^D \cdot X_K(K_X, L_X) = Y_K(K_Y, L_Y, V) \quad (3)
\]

\[
W = p^D \cdot X_L(K_X, L_X) = Y_L(K_Y, L_Y, V) \quad (4)
\]

\[
\rho = Y_V(K_Y, L_Y, V) \quad (5)
\]

\[
r = p^D \cdot X_K(K_X, L_X) = Y_K(K_Y, L_Y, V) \quad (6)
\]

\[
K_X + K_Y = K \quad (7)
\]

\[
V = V \quad (8)
\]

where \(K_i\) and \(L_i\) are capital and labor used in the \(i\)th sector, \(V\) is land (or natural resources), \(X_j\) and \(Y_j\) are the marginal products of the \(j\)th factor in the production of \(X\) and \(Y\), respectively. \(K\) and \(V\) represent the given supply of capital and land. \(Y\) is the numeraire good whose price is assumed to be unity and \(p^D\) represents the relative price of \(X\) in the domestic market, \(W\) denotes the exogenously specified real wage rate, \(r\) and \(\rho\) represent the real rates of return on capital and land, respectively.
Assuming linearly homogeneous production functions, equations (1) - (6) can be written as:

\[ X = L_x f(k_x) \]  \hspace{1cm} (1)'

\[ Y = L_y g(k_y, v) \]  \hspace{1cm} (2)'

\[ p^D \cdot X_K(k_x) = Y_K(k_y, v) \]  \hspace{1cm} (3)'

\[ W = p^D \cdot X_L(k_x) = Y_L(k_y, v) \]  \hspace{1cm} (4)'

\[ \rho = Y_V(k_y, v) \]  \hspace{1cm} (5)'

\[ r = p^D \cdot X_K(k_x) = Y_K(k_y, v) \]  \hspace{1cm} (6)'

where \( k_i = K_i/L_i \) is the capital-labor ratio in the ith sector and \( v = V/L_y \) is the land-labor ratio in Y.

For a complete description of the model we also need an equation showing the relationship between the domestic and the international price ratios. However, this depends on which good is imported and so the domestic price-setting equation will be different for the sections II and III which treat different goods as importables. Hence, this equation is left out from the present section.

In the model described by the equations (1)' - (6)', (7) and (8) the effects of changes in \( K \) or \( V \) on output of \( X \) and \( Y \) at constant domestic prices are given by:

\[ \frac{dX}{X} = f(k_x) \left\{ v \frac{dK}{K} - k_y \frac{dV}{V} \right\} \left\{ v k_x \right\} \]  \hspace{1cm} (9)

and

\[ \frac{dY}{Y} = g(k_y) \frac{dV}{V} \]  \hspace{1cm} (10)

From these equations and the first two theorems of Batra and Beladi we derive the following propositions given in the next two sections.
II.

First we consider the possibility of immiserization arising from the exogenous growth of factors for a developing country importing manufactured goods (X). For such a country the price equation may be written as:

\[ p^D = P(1+t) \]  

where \( t \) is the rate of tariff and \( P \) represents the relative price of \( X \) in the international market.

In the context of such an economy, we can derive the following proposition:

**Proposition 1:** A small country characterized by unemployment and imposing a tariff on its imported manufactured goods will never experience a loss of welfare with exogenous capital accumulation, that is, Johnson case of immiserizing growth will never arise with exogenous growth of capital.

To prove this proposition we use the well-known result that the effect of growth on the welfare of a small country in the presence of tariff depends on the direction of change in the value of output measured at world prices (Caves and Jones, 1985). Even though the criterion for welfare gain is a rise in the value of consumption at domestic prices it is possible to infer about the welfare change by evaluating the change in production at world prices. In the present model, the effect on welfare is indicated by the sign of \( P \cdot dX + dY \) where \( P \) is the relative price of \( X \) in the world market. From equations (9) and (10) we see that \( dX \) is positive and \( dY \) is zero when \( dK \) is positive and \( dW \) is zero. So the Rybczynski line (with the importable good \( X \) measured on the vertical axis) is vertical in this case which implies that it is steeper than the international price line. Hence, the value of output measured at world prices increases with the rise in the capital stock. This is because the country is characterized by
unemployment and so an expansion of the importable manufacturing sector
does not require a fall in the output of the exportable good. So the
effect of an exogenous rise in capital stock is to raise both employment
and the value of output and therefore to raise the welfare of the country.

It is obvious that the increase in the stock of land (through land
reclamation or land-augmenting technological progress) cannot lower the
welfare of this economy. The rise in the supply of land leads only to an
expansion of the exportable sector and hence, growth, in this case, tends
to correct the initial tariff-induced distortion in production. Thus, we
can derive the following proposition:

Proposition 2: Exogenous growth of factors, either of capital or of land,
cannot be immiserizing for a small tariff-imposing country with widespread
unemployment.

III.

Next, we consider the possibility of immiserizing growth for a small
country importing agricultural goods (Y). In this case, the equation for
the domestic price ratio is given by:

\[ \frac{pD}{p} = \frac{1}{1+t} \]  \hspace{1cm} (11b)

For such an economy, Johnson-type immiserizing growth can only arise
because of a rise in the supply of land. In this case, we can derive the
following proposition:

Proposition 3: For a small country importing agricultural goods
immiserizing growth can occur through an increase in the supply of land if
and only if the ratio of the domestic to the international price of the
importable good, 1 + t, exceeds the ratio of the share of capital in the
exportable manufacturing sector to the share of capital in the importable sector.

To prove this proposition we again consider the direction of change in the value of output, measured at the international prices, brought about by a rise in the supply of land. From equations (9) and (10) it follows that a rise in $V$, $K$ remaining constant, leads to the usual Rybczynski result, i.e., at constant prices agricultural output expands while that of manufacturing falls because capital needs to be reallocated between the two sectors. It can be shown that the overall change in the value of output will be negative if the above condition holds. (The proof is given in Appendix A). The condition is in line with the condition derived by Martin (1977) for the standard two-factor, two-commodity model.

From the condition it follows that immiserization will necessarily result from a rise in the supply of land if the importable agricultural sector has a higher share of capital than the manufacturing sector. As the agricultural output expands it draws capital away from the manufacturing sector which, as a result, faces a contraction. Now the higher the share of capital in agriculture relative to industry the larger is the contraction needed in the latter for a unit expansion of the former and so the greater is the possibility of a fall in the value of total output at world prices.

Hence, we have seen that the tariff-imposing countries importing agricultural goods may suffer a welfare loss from exogenous land-augmenting technological progress only under the restrictive condition given in Proposition 3. However, since most of the developing countries are importers of manufactured goods and exporters of primary products this type of immiserization is of little relevance to us. So in the next section we
will concentrate on the first case outlined in section I where growth of neither factor can be immiserizing even in the presence of tariffs.

IV.

So far we have treated the growth of capital as exogenous. However, it is possible that the growth of capital is endogenous, i.e., dependent on the tariff policy. Unlike the Stolper-Samuelson Theorem for the two-factor, two-commodity case tariff protection given to the manufacturing sector raises the general rate of return to capital in the present model irrespective of the relative magnitudes of the capital-labor ratio in the two sectors (Batra and Beladi, Theorem 4). This rise in the rate of return may either increase the domestic rate of saving and investment or may attract capital from foreign countries. Here we will study the impact of such changes on welfare.

For an analysis of the effect on welfare of a tariff-induced growth in the domestic capital stock the relevant base for comparison is the free trade level of welfare because the welfare change associated with growth has to be attributed to the departure from free trade. In such cases a complication arises because a straightforward comparison of the value of output at world prices under the two situations does not indicate the direction of welfare change. A fall in the value of output at international prices compared to the free trade level necessarily implies a welfare loss but a rise in this value does not necessarily indicate a welfare gain. This is because the production gain brought about by growth can be offset by the consumption loss due to tariff. Hence, the sufficient condition for immiserization in this case is a decline in the value of output at world prices.
In the context of the present model we find that it is possible for the endogenous rise in capital stock to affect the welfare of the country adversely. Tariff imposition alters the domestic commodity and the factor prices thereby causing a reallocation of capital and labor between the sectors and leading to a rise in X output and a decline in the output of Y compared to the free trade level (the proof is given in the Appendix B). The consequent welfare change can be described in terms of Figure 1.

The curve TT represents the domestic transformation curve under the situation of wage rigidity and a given magnitude of unemployment. $P_0$ represents the production point under free trade and the slope of the line $P_0P_0'$ represents the price ratio in the international market. When the tariff is imposed the relative domestic price of X rises and the employment of labor can change in either direction depending on the relative values of capital intensity for the two sectors (Batra and Beladi, Theorem 8). To illustrate our point we can make a simplifying assumption that the degree of utilization of the labor force remains more or less the same under tariff so that $P_t$ represents the production point on the same transformation curve before capital accumulation has taken place with the
The domestic tariff-inclusive price ratio being given by the slope of $P_tP'_t$. The vertical Rybczynski line, $P_tR$, passing through the point $P_t$ represents the locus of production points with different amounts of capital accumulation given the domestic price ratio and the corresponding factor prices. Since this line is vertical it intersects the international price line $P_0P'_0$ at point A. Hence, for small increments to the capital stock caused by the tariff policy the production point will lie below the point A on the Rybczynski line and the country will necessarily experience a welfare loss. Alternatively, if the increase in capital stock is large enough to shift the production point above A then there is a rise in the value of output measured at world prices and consequently the possibility of a welfare gain arises in this case. Thus, given the tariff rate, the factor prices and the factor intensities (in the free trade as well as in the tariff situation) there is a critical value of the rise in capital stock, $dK^*$, which keeps the value of output at world prices unchanged after growth. This corresponds to the production at point A in the diagram. The mathematical expression for this critical rise in capital stock is given by the equation (22)' in Appendix B. So the welfare effect of tariff-induced domestic capital accumulation is ambiguous. A welfare gain can arise only if the actual increase in capital stock is larger than the critical value $dK^*$.

Next, we consider the effect on welfare of a rise in the stock of foreign-owned capital which is induced by a high domestic tariff. In this case if the entire increase in total output valued at the domestic price ratio accrues to foreign capital and the entire profit is repatriated then the welfare of the host country necessarily falls with the growth of capital even though the size of the increase is such that it would lead to
a net welfare gain if the increased stock were domestically owned (Brecher and Alejandro, 1977). The policy implication is that the host country should impose tax on foreign investment and/or impose restrictions on the repatriation of profit to avoid the welfare loss inflicted on the country by the additional inflow of foreign capital.

V.

From the above analysis we can conclude that the exogenous growth of capital stock (and also of other resources) is very likely to raise, rather than lower, the welfare of a small developing country with widespread unemployment and imposing tariff protection for its manufacturing sector. This conclusion, however, cannot serve as an argument in favor of the import-substituting industrialization policy but can merely be used to contradict the immiserization argument. To make a case for tariff it is necessary, first of all, to mention that tariffs may, in the presence of generalized sticky wage and unemployment, raise welfare above the free trade level (Bhagwati and Srinivasan, 1983). From our analysis of section IV it may now be added that even if this primary, purely static impact of tariff is not favorable for the country the secondary benefits of tariff-induced increase in the domestic capital stock may be large enough to outweigh the primary loss thereby leading to a net rise in welfare. However, even in this case of welfare gain the first-best policy would be a generalized wage-subsidy to remove the problem of unemployment at its source. The second-best policy is a production subsidy to the manufacturing sector which brings about the same net production benefits from the increased capital stock (assuming that it is positive) caused by tariff without a consumption loss. Tariff can, therefore, be at most a
third-best argument for raising welfare through increased capital accumulation and growth.

Appendix

(A) Effect of increase in V:

For a small country welfare falls with accumulation of factors in the presence of tariff iff \( dY + P \cdot dX < 0 \) where \( P = \left( \frac{P_X}{P_Y} \right)^W \) and \( X \) and \( Y \) represent the output levels of the two goods. Hence, the necessary and sufficient condition for immiserizing growth is:

\[
g(k_y, v) \frac{dV}{v} - P \cdot f(k_x) \frac{k_y}{k_x} \frac{dV}{v} < 0
\]

\[
g(k_y, v) < P \cdot f(k_x) \frac{k_y}{k_x}
\]

\[
\frac{Y}{L_y} < P \cdot \frac{X}{L_X} \frac{k_y}{k_x}
\]

\[
Y < P \cdot X \frac{k_y}{k_x}
\]

With import tariff on \( Y \) we have: \( P = \frac{p_x^W}{p_y} = (1 + t) \frac{p_x^D}{p_y^D} \). Hence, the condition can be written as:

\[
Y < (1 + t) \frac{p_x^D}{p_y} \frac{k_y}{k_x} \cdot X
\]

\[
\frac{r \cdot K_X}{P_x^D} \cdot \frac{p_y^D}{p_x^D} \cdot \frac{Y}{X} \cdot \frac{r \cdot K_y}{K_X} < 1 + t
\]
\[ \frac{\alpha^Y}{\alpha^K} < 1 + t \ldots \ldots \text{condition (A)} \]

where \( \alpha^K \) represents the share of capital in the value of output of the \( i \)th sector.

If \( \alpha^Y > \alpha^K \) then \( \alpha^Y/\alpha^K < 1 \) and so we have immiserization. Hence, a sufficient condition for immiserization is that the share of capital is higher in \( Y \) than in \( X \).

(B) Effect of endogenous growth of capital stock:

Here we will analyze the condition for a fall in welfare, below the free trade level, caused by capital accumulation induced by a tariff policy.

Let us consider the equation (3)' and (4)'

\[ pD \cdot X_K (k_X) = Y_K (k_Y, v) \]

\[ \bar{w} = pD \cdot X_L (k_X) \]

\[ \bar{w} = Y_L (k_Y, v) \]

Totally differentiating these equations and assuming that \( pD = 1 \) in the initial situation we get:

\[
\begin{bmatrix}
-X_{Kk} & Y_{Kk} & Y_{Kv} \\
X_{Lk} & 0 & 0 \\
0 & Y_{Lk} & Y_{Lv}
\end{bmatrix}
\begin{bmatrix}
dk_x \\
dk_y \\
dv
\end{bmatrix}
= 
\begin{bmatrix}
rdP \\
-wdP \\
0
\end{bmatrix}
\]

The determinant is: \( D = -X_{Lk} (Y_{Kk} Y_{LV} - Y_{Lk} Y_{KV}) > 0 \) since we assume \( Y_{Kk} < 0, Y_{LV} > 0, Y_{Lk} > 0, Y_{KV} > 0, \) and \( X_{Lk} > 0 \).
So we have:
\[
\frac{dk_X}{dp^D} = \frac{-W}{X_{LK}} < 0
\]
\[\text{(13)'\quad} \]
\[
\frac{dk_y}{dp^D} = \frac{Y_{Lv} (WX_{Kk} - rX_{Lk})}{D} < 0
\]
\[\text{(14)'\quad} \]
and
\[
\frac{dv}{dp^D} = \frac{Y_{Lk} (rX_{Lk} - WX_{Kk})}{D} > 0
\]
\[\text{(15)'\quad} \]

Now from \( r = Y^k (k_Y, v) \) we get:
\[
\frac{dr}{dp^D} = \frac{rX_{Lk} - WX_{Kk}}{X_{Lk}} > 0
\]
\[\text{(16)'\quad} \]

Totally differentiating equation (5)' \( \rho = Y^V (k_Y, v) \) we get:
\[
\frac{d\rho}{dp^D} = Y_{V_k} \frac{dk_y}{dp^D} + Y_{V_v} \frac{dv}{dp^D}
\]
\[\text{(17)'\quad} \]

Using (14)' and (15)' we get: \( \frac{d\rho}{dp^D} < 0 \).

Hence, we find that a rise in the domestic relative price of the importable good \( X \) raises the rate of return on capital and lowers the real return on land. The change in factor prices causes \( k_X \) and \( k_Y \) to fall and \( v \) to rise. Also, the rise in \( r \) causes the capital stock to increase (through investment). This implies \( \frac{dK}{dp^D} > 0 \) since \( \frac{dr}{dp^D} > 0 \) and \( dp^D > 0 \).

Next we consider the effect of the increased stock of capital and changed factor prices on the output of \( X \) and \( Y \). Let us first consider:
\[
V = v L_Y
\]
Differentiating we get:

\[
\frac{dV}{dP^D} = v \cdot \frac{dL_y}{dP^D} + L_y \cdot \frac{dv}{dP^D}
\]

From this we get:

\[
\frac{dL_y}{dP^D} = -\frac{1}{v} [L_y \frac{dv}{dP^D}] < 0
\]

Since

\[
\frac{dV}{dP^D} = 0 \text{ (by assumption)}
\]

and

\[
\frac{dv}{dP^D} > 0 \text{ form (15)' .}
\]

Now the full employment condition for the increased stock of capital can be written as:

\[
\frac{dK}{dP^D} = k_x \frac{dL_x}{dP^D} + k_y \frac{dL_y}{dP^D} + L_x \frac{dk_x}{dP^D} + L_y \frac{dk_y}{dP^D}
\]

From this we get:

\[
\frac{dL_x}{dP^D} = \frac{1}{k_x} \left[ \frac{dK}{dP^D} - k_y \frac{dL_y}{dP^D} - L_x \cdot \frac{dk_x}{dP^D} - L_y \cdot \frac{dk_y}{dP^D} \right] > 0
\]

since

\[
\frac{dK}{dP^D} > 0, \quad \frac{dL_y}{dP^D} < 0, \quad \frac{dk_x}{dP^D} < 0, \quad \frac{dk_y}{dP^D} < 0
\]

The production function for \( X \) is:

\[
X = L_x f(k_x)
\]

\[
\frac{dX}{dP^D} = L_x \cdot f'(k_x) \frac{dk_x}{dP^D} + f(k_x) \frac{dL_x}{dP^D}
\]
Using (19)' we get:
\[
\frac{dX}{dp} = -L_x \frac{dkx}{dp} \left[ \frac{f(k_x)}{k_x} - f'(k_x) \right] + \frac{f(k_x)}{k_x} \left[ \frac{dK}{dp} - k_y \frac{dLy}{dp} - L_y \frac{dky}{dp} \right]
\]

Hence
\[
\frac{dX}{dp} > 0 \quad \text{if} \quad \frac{f(k_x)}{k_x} > f'(k_x)
\]

i.e., if \( 1 > \frac{f'(k_x)}{f(k_x)} \)

i.e., if \( 1 > \frac{\alpha x}{k} \)

Now from the linear homogeneity of the production function and the assumption of a positive wage rate we get: \( \alpha_x < 1 \). Hence, we can conclude that the output of \( X \) will rise as a result of the capital accumulation induced by a rise in \( r \).

Next we consider:
\[
Y = Ly \; g(k_y, v)
\]

Differentiating we get:
\[
\frac{dY}{dp} = g(.) \frac{dLy}{dp} + L_y \cdot g_k \frac{dky}{dp} + L_y \cdot g_v \frac{dv}{dp}
\]

Using (18)' we can write:
\[
\frac{dY}{dp} = L_y \frac{dv}{dp} \left[ g_v \cdot g(.) \right] + L_y \cdot g_k \cdot \frac{dky}{dp}
\]

Hence
\[
\frac{dY}{dp} < 0 \quad \text{if} \quad \frac{g(.)}{v} > g_v
\]

i.e., if \( 1 > \alpha_v \)
Again from the linear homogeneity of the production function and the assumption of positive factor prices we get: \( \alpha^Y < 1 \). So it follows that \( \frac{dY}{dpD} < 0 \).

Thus, from a comparison of output between the free trade and the tariff-induced growth situations we find that \( \frac{dX}{dpD} > 0 \) and \( \frac{dY}{dpD} < 0 \). So in this case the possibility of immiserization cannot be ruled out. In the present context a sufficient condition for immiserization would be a fall in the value of output evaluated at the international price ratio, i.e., \( PdX + dY < 0 \) when \( dpD > 0 \). From this condition we can derive the expression for the critical rise in capital stock such that an increase below this amount would necessarily imply a welfare loss but a rise beyond this amount may not raise welfare. This can be done by considering the change in capital stock necessary for keeping the value of output at world prices constant. Hence, from the condition \( P \cdot dX + dY = 0 \) we get:

\[
\frac{Pf(.)}{k_x} \left[ dK - k_y dL_y - L_y dk_y - L_x dk_x \left( 1 - \alpha^X \right) \right]
+ \frac{k_x L_y}{Pf(.)} \left( g_k dk_y - dv \cdot g(.) \left( 1 - \alpha^Y \right) \right) = 0
\]

Hence, the critical rise in capital stock is:

\[
dK^* = k_y dL_y + L_y dk_y + L_x dk_x \alpha^X
+ \frac{k_x L_y}{Pf(.)} \left( dv \cdot g(.) \left( 1 - \alpha^Y \right) - dk_y g_k \right)
\]

(22)

If the actual rise in capital stock \( dK \) is such that \( dK < dK^* \) then immiserization necessarily results from a tariff-induced capital accumulation. Conversely, when \( dK > dK^* \) welfare may change in either direction as a result of growth.
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