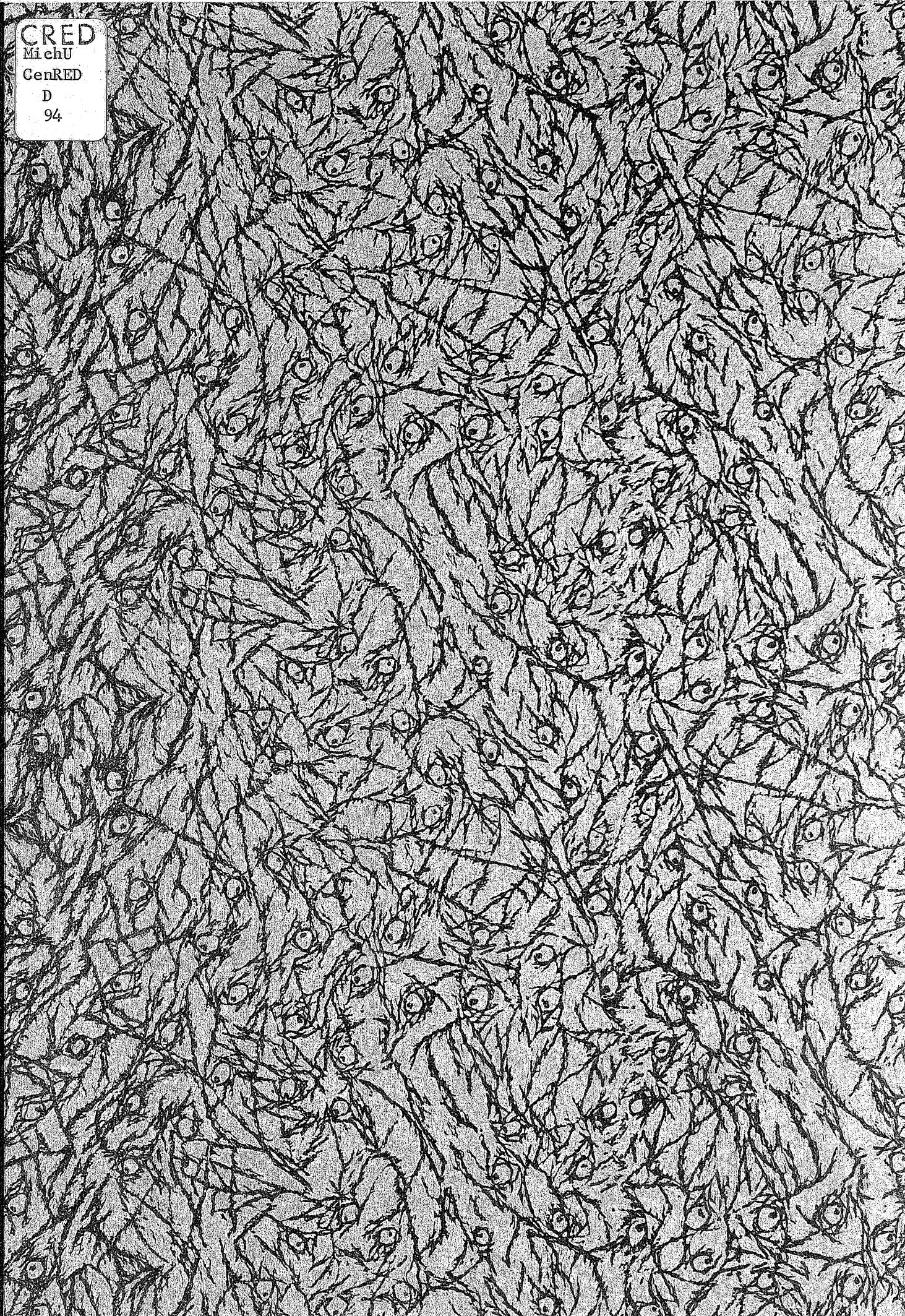

TERMS OF TRADE AND DOMESTIC DISTRIBUTION:

A COMMENT

by

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ABSTRACT

This note comments on a paper by G. Chichilnisky in the Journal of Development Economics (April 1981). Her conclusion that a positive shift in demand from the North for the South's exports may worsen the South's terms of trade, is shown to be incorrect in the context of her model. It is, however, possible that the quantity of exports from the South may decline in the new equilibrium.

RESUME

Cette note offre quelques remarques concernant le rapport de G. Chichilnisky publié dans le Journal of Development Economics (avril 1981). L'affirmation avancée en guise de conclusion d'avère erronée dans le contexte du modèle, à savoir qu'un changement positif dans la demande des exportations du Nord vers celles du Sud aggraveraient les termes de l'échange de ce dernier. Quoi qu'il en soit, il est possible que les exportations en provenance du Sud amorcent un déclin dans le cadre du nouvel équilibre.

TERMS OF TRADE AND DOMESTIC DISTRIBUTION: A COMMENT

In a recent issue of the Journal of Development Economics, Chichilnisky (1981) presents an interesting article in which she develops a general-equilibrium macro model to explore the effects of export-led growth policies on the terms of trade and the domestic income distribution of a developing region with abundant labor. Unfortunately her conclusion, that an increase in the exports of the South due to a positive shift in the demand of the North may bring about a sustained worsening of the South's terms of trade, is incorrect. In the framework of her model, it is true that such a positive shift in demand may lead to a lower level of Southern exports (and thus Northern imports) in the new equilibrium, but only because the demand shift improves the terms of trade for the South, causing a positive impact on the real income of the South. Since in the model any increase in income goes into the consumption of the South's export commodity, this implies that, in the new equilibrium, the domestic demand for exportables may increase in the South reducing the volume of exports to the North.

In this comment, as in Chichilnisky's paper, a shift in demand by the North is examined through the use of an export supply curve and an import demand curve. The analysis requires three basic steps. First, we examine how an exogenous increase in the demand for investment/luxury goods (the North's export) by the North shifts the North's import demand curve for basic goods. Next, we calculate how the terms of trade must change in the new equilibrium due to this shift. By examining the world market clearing conditions, it is shown that an exogenous increase in the demand for the South's export goods must improve the South's terms of trade in the new equilibrium. Last, we look at the slopes of the export supply and import demand curves for basic goods. Although the export supply curve may be either upward or downward sloping, under the assumptions of the model the supply curve must always be steeper than the demand curve in the neighborhood of the world equilibrium.

Chichilnisky's model is characterized by two countries (the North and the South), two goods (investment/luxury and basic), and two factors of

production (labor and capital). The following basic assumptions are made:

a) Both countries produce both goods according to fixed coefficients production functions, although the technical coefficients will in general be different in each region.

b) The South exports basic goods, the more labor-intensive commodity in both countries.

c) Factor supplies are an increasing function of factor rewards, and are always fully employed.

d) The demand for investment/luxury goods is exogenous in both countries.

Chichilnisky undertakes the analysis by examining the export supply (by the South) and import demand (by the North) curves. In the model, for a given set of commodity prices we are able to calculate the wage and rate of profit in each country.[1] This allows us to calculate factor supplies,[2] which in turn enables us to determine the levels of output supplies of each commodity in each country which provides full employment.[3] If we, in addition, specify an exogenous level of domestic demand for the investment/luxury good (the North's export), it is possible to calculate the level of demand for the basic good in each country by requiring that international payments balance.[4] We are thus able to construct the export supply curve of the South and the import demand curve of the North as a function of relative commodity prices. Along each curve, the value of exports equals the value of imports for the country in question and all the equilibrium conditions within the country are met. However, world markets may not clear. World equilibrium is attained at the price of basic goods (using investment/luxury goods as the numéraire, which is done throughout the remainder of this comment) which equates export supply from one country with import demand from the other.

Chichilnisky states three propositions in her paper. The first two essentially deal with the slope of the export supply curve of the South,

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[1] See equations (7) and (8) on p. 167 of Chichilnisky's article.

[2] See equations (3) and (4) on pp. 166-167 of Chichilnisky's article.

[3] See equations (11) and (12) on p. 168 of Chichilnisky's article.

[4] See the equation on the bottom of p. 170 of Chichilnisky's article.

showing that it could be either positive or negative. Proposition 3 deals with characteristics of world equilibria:

> Proposition 3. Assume that labour in the North is relatively price inelastic (α small)and that the economy of the South has the characteristics described in Proposition 1. If a new world equilibrium with an increased volume of exports by the South is attained due to a positive shift in demand for basic goods by the North (e.g., higher growth rate of the North), then the terms of trade will worsen for the South and the purchasing power of wages within the South will also decrease. This takes place within a Walrasian stable world economy. (p. 181)

It is this proposition that we examine in detail here.

The first step in the analysis is to examine how an exogenous increase in the demand for investment/luxury goods by the North shifts the North's import demand curve or the demand for basic goods by the North. Chichilnisky states on p. 180 that, "As the (exogenous) demand for investment goods $(\bar{I}^D)^N$ is increased within the North, eq. (21a) implies a positive shift in its demand for B, X_B^N, at each price level." (Chichilnisky's variables used here are defined in Table I.) Equation (21a) shows us the slope of an export supply curve, which is not particularly useful in calculating the direction the curve shifts. Instead we write out the equation for X_B^N and examine how it changes with an increase in $(\bar{I}^D)^N$ for any given price level.

$$1) \qquad X_B^N = (B^D)^N - (B^S)^N$$

The North's balance-of-payments constraint states that (when domestic prices are equal to international prices)[5]:

$$2) \qquad p_B [(B^D)^N - (B^S)^N] = (I^S)^N - (\bar{I}^D)^N$$

Substituting into (1) we get,

$$3) \qquad X_B^N = [(I^S)^N - (\bar{I}^D)^N]/p_B$$

Recall that if commodity prices were specified, they in turn would determine commodity supplies. Thus, at a given price level,

$$4) \qquad \partial X_B^N/\partial(\bar{I}^D)^N\big|_{p_B} = -1/p_B < 0$$

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[5]Although Chichilnisky allows for cases where domestic (p_B) and international ($\bar{p}_B$) prices may differ on p. 176, she soon after assumes that $\bar{p}_B = p_B + \Delta$, $\Delta \lesssim 0$ and sufficiently small. Thus I shall focus throughout on the free trade case and assume Δ equal to 0.

Table I

Definition of Symbols

B^D	= South's demand for basic goods
$(B^D)^N$	= North's demand for basic goods
B^S	= South's supply of basic goods
$(B^S)^N$	= North's supply of basic goods
$\bar{I}^D$	= South's exogenous demand for investment/luxury goods
$(\bar{I}^D)^N$	= North's exogenous demand for investment/luxury goods
I^S	= South's supply of investment/luxury goods
$(I^S)^N$	= North's supply of investment/luxury goods
p_B	= relative price of basic goods
X_B^N	= North's demand for imported basic goods
X_B^S	= South's supply of exported basic goods

An exogenous increase in the demand for investment/luxury goods by the North implies a negative shift in its demand for imports of basic goods.

The remainder of the analysis is straightforward. World equilibrium requires that exports of the South equal imports of the North, or eqivalently (referring to eq. (3)), that the world market for investment/luxury goods clears. Thus the world equilibrium value of p_B can be calculated by the following:

$$5) \qquad (I^S)^N + I^S = (\bar{I}^D)^N + \bar{I}^D$$

Totally differentiating,

$$6) \qquad (\partial(I^S)^N/\partial p_B + \partial I^S/\partial p_B)\, dp_B = d(\bar{I}^D)^N + d\bar{I}^D$$

In each country an increase in p_B would increase real wages and decrease the rate of profit. This increases the supply of labor and decreases the supply of capital. Full employment of factors requires a shift away from the production of capital-intensive luxury/investment goods towards the production of labor-intensive basic goods. Thus an increase in p_B results in a decline in the production of I goods in both countries.[6]

So, eq. (6) tells us that an exogenous increase in the demand for investment/luxury goods by either country results in a decrease in p_B. That is, a positive shift in the demand for imports by the North (a decrease in $(\bar{I}^D)^N$) must result in an improvement in the terms of trade for the South, and Proposition 3 cannot be correct.

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[6]Writing out the expression for the output of investment/luxury goods in the South as a function of p_B by substituting equations 3, 4, 7, and 8 into 12 (from Chichilnisky's article):

$$I^S = a_1[\bar{K} + \beta(a_1 - p_B a_2)/D]/D - c_1[\bar{L} + \alpha(c_2 - c_1/p_B)/D]/D$$

so that,

$$\partial I^S/\partial p_B = -(a_1 a_2 \beta\, p_B^2 + \alpha c_1^2)/D^2 p_B^2 \quad < \quad 0$$

Since the structure of the North's economy is identical to the South's except for the magnitude of the parameter values, the North's production of investment/luxury goods also declines as p_B rises.

The result here is also inconsistent with Fig. 2(b) in Chichilnisky's paper.[7] In the figure, as she explains on p. 180, X_B^N crosses X_S^N (I assume it should be X_B^S) from above. This is in fact inconsistent with the assumptions of her model. To see this, we must first examine the slopes of the import demand and export supply curves. Differentiating eq. (3) with respect to p_B,

$$7) \qquad \partial X_B^N/\partial p_B = [\partial (I^S)^N/\partial p_B]/p_B - [(I^S)^N - (\bar{I}^D)^N]/p_B^2 < 0$$

We have seen that the supply of investment/luxury goods declines in both countries as p_B rises. By assumption the North is an exporter of investment/luxury goods, so $(I^S)^N - (\bar{I}^D)^N$ is greater than zero. Thus the import demand curve for the North is always downward-sloping.

Using the balance-of-payments constraint for the South, we can derive a similar expression for the export supply of basic goods.

$$8) \qquad X_B^S = B^S - B^D = (\bar{I}^D - I^S)/p_B$$

Differentiating with respect to p_B,

$$9) \qquad \partial X_B^S/\partial p_B = \underbrace{-(\partial I^S/\partial p_B)/p_B}_{+} - \underbrace{(\bar{I}^D - I^S)/p_B^2}_{-} \lesseqgtr 0$$

As Chichilnisky points out in Propositions 1 and 2, the export supply curve may be upward or downward sloping.[8]

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[7] Although the horizontal axis is labelled "Quantity of Exportable" in Fig. 2b, the note below it states that E_B represents the quantity of exports (and is derived as such). Thus I have interpreted the curves in the diagram as an import demand curve by the North (labelled WD, and X_B^N elsewhere in the text) and an export supply curve from the South (unlabelled, but X_B^S elsewhere in the text). The Marshallian adjustment process described here is unlikely to converge towards equilibrium in this Walrasian stable economy.

[8] The footnote to Proposition 1, however, is misleading:

> "Our case reflects, instead, shifts in the demand of the North, that increase the demand for the exportable at each price. This would under traditional assumptions increase the price of the exportable. In our case, just the opposite effect takes place." (p. 178)

This simply describes Proposition 3, which has already been shown to be incorrect.

It should also be noted that the export supply curve is unambiguously downward sloping if the labor supply in the South is abundant but factor supplies are totally unresponsive to changes in their returns. If factor supplies are fixed, full employment requires that the supply of investment/luxury goods remain unchanged for any change in p_B. Thus, the first term in eq. (9) becomes zero, and the slope of the export supply curve is negative with the magnitude depending on the initial level of trade.[9] If we increase, for example, the labor supply response to the real wage holding the initial labor supply fixed (and thus the initial levels of production and exports) the slope of the export supply curve becomes more positive. An increase in p_B now decreases the production of investment/luxury goods, which increases import demand (equal to the value of export supply).[10]

Returning to Fig. 2(b), can X_B^N ever cross X_B^S from above? That is, as the price of basic goods rises above its world equilibrium level, could it ever result in an excess <u>demand</u> for basic goods exports as indicated in Fig. 2(b)? Algebraically, we ask if $\partial(X_B^S - X_B^N)/\partial p_B$ can ever be negative when evaluated at a world equilibrium.

$$10) \qquad \partial X_B^S/\partial p_B - \partial X_B^N/\partial p_B = -[\partial (I^S)^N/\partial p_B + \partial I^S/\partial p_B]/p_B + [I^S + (I^S)^N - \bar{I}^D - (\bar{I}^D)^N]/p_B^2$$

At a world equilibrium, world markets must clear, so that the last term becomes zero. Thus, <u>X_B^N must always cross X_B^S from below</u> in the context of this model.

This can be more easily understood by considering the two components of (10) separately: the effect of the price change on factor supplies and the effect on the terms of trade. As discussed earlier, an increase in

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[9] In this extreme case a world equilibrium probably doesn't exist, since neither the supply of nor the demand for investment/luxury goods responds to price changes.

[10] Note that differentiating the slope of the export supply curve with respect to α takes into account changes in both the responsiveness of labor and the abundance of labor in the initial equilibrium (at the initial wage). Thus, a higher α implies a larger increase in the labor supply if p_B increases ($\partial I^S/\partial p_B$ larger), but also a larger initial level of imports ($(\bar{I}^D - I^S)/p_B$ larger).

p_B within each country results in an increase in the supply of labor and a decrease in the supply of capital, and thus a shift in production from luxuty/investment goods towards basic goods in both countries. The demand for basic goods is determined by the balance of payments condition. For each country,

$$11) \qquad B^D = B^S + (I^S - \bar{I}^D)/p_B$$

Since the income elasticity of demand for I goods is zero, examination of (11) shows that any tendency towards an increase in B^S (due to an increase in the labor supply) is exactly met by an increase in B^D. A decrease in I^S, however, will result in an excess supply of B goods (holding the terms of trade fixed for the moment). Thus the "factor supply" effect results in an excess supply of B goods in each country, as indicated in the first term of eq. (10).

With the demand for I goods fixed, any change in real income due to a change in the terms of trade is completely absorbed by the demand for B goods, again as indicated in eq. (11). Beginning at world equilibrium, a change in the terms of trade (now holding factor supplies fixed) redistributes income from one country to another (and between workers and capitalists). An upward pressure on p_B begins to increase the demand for B goods in the South, but decreases the demand for B goods in the North by exactly the same amount since trade is initially balanced. The net impact of the "terms of trade" effect on the world market is zero, as indicated by the second terms in eq. (10). Thus on the world level, only the factor supply effects are relevant in the neighborhood of world equilibrium, and any small increase in p_B must result in an excess supply of B goods.

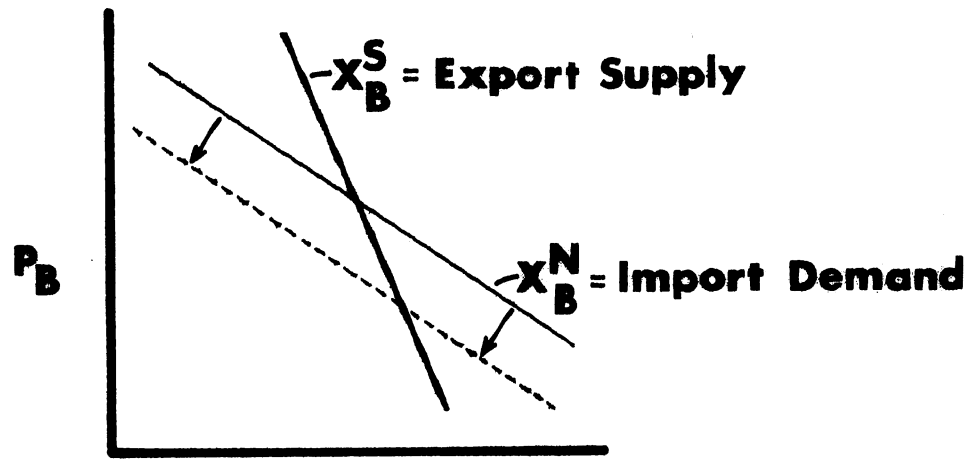
What then is the appropriate diagram and explanation to accompany the simulation reported in the Appendix? The comparative static results are: "the parameter of investment demand is increased in the North from 1.5 to 2. Equilibrium value of exports of basic goods by the South increase and their price p_B decreases," (p. 187).

Figure 1 provides the explanation. The export supply curve may be downward sloping in the experiment, but we know it must be steeper than the import demand curve. We also know that an exogenous increase in

investment demand by the North is equivalent to a negative shift in the import demand curve. As in any simple Walrasian system, an exogenous decrease in demand results in a fall in the price of that commodity. The new equilibrium quantity, however, may either rise or fall. In this case it rises in the new equilibrium, even though the exogenous shift was negative.

The simulation experiment is consistent with the fact that, under the assumptions of the model, a positive shift in demand for basic goods by the North will never result in a worsening of the terms of trade for the South or a decrease in the purchasing power of wages within the South.

FIGURE 1


$-X_B^S$ = Export Supply
P_B
$-X_B^N$ = Import Demand
Quantity of Basic Goods Exported by the South

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