A Study in the Distribution of Gains from International Trade

Suhas C. Chakrabartty

Utah State University

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A STUDY IN THE DISTRIBUTION OF GAINS FROM INTERNATIONAL TRADE

by

Suhas C. Chakrabartty

A dissertation submitted in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

in

Economics

UTAH STATE UNIVERSITY
Logan, Utah
1988
... dedicated to my parents.
ACKNOWLEDGEMENTS

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To my son, Biltu, I offer a father's thanks. Finally, to my wife, Manju, I will remain eternally indebted for her immeasurable sacrifice and constant encouragement.

Suhas C. Chakrabarty
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ABSTRACT

A Study in the Distributions of Gains From International Trade

by

Suhas C. Chakrabartty, Doctor of Philosophy
Utah State University, 1988

Major Professor: Dr. Basudeb Biswas
Department: Economics

In order to investigate the phenomenon of the distribution of gains from international trade, Arghiri Emmanuel's ideas are first critically discussed, particularly in relation to the traditional Ricardian framework as applied to labor-surplus economics.

It is found that Emmanuel's concept of unequal exchange, which has been termed non-equivalent exchange by Jan Otto Anderson, has certain theoretical drawbacks. In particular, it has been pointed out that the question involved is not one to prove that the poor countries are actually worse off through trade as suggested by Emmanuel. The question involved is rather one of redistribution of gains from trade as has been voiced in the search for a new international economic order by the members of some developing countries in the U.N.

Such an approach leads to the adoption of the concept of a generalized asymmetric exchange as the measure of unequal exchange.
This generalization has been achieved in terms of Leontief's input-output analysis. Such a measure coincides with the disjunctive exchange approach when the input-output coefficients are modified over time.

The Leontief input-output analysis leads to an aggregation problem which has been solved by taking labor as the only primary factor of production - an approach standardized by Leontief himself.

According to this measure, the extent of unequal exchange can be quite different from those obtained by the measures suggested by Emmanuel, Shanin and others. It has been pointed out that there is no a-priori reason to believe that a poor country necessarily gains less than its rich counterpart. Indeed, the test that has been made of the measure in the case of trade between Ecuador and the USA shows that it is Ecuador rather the U.S. which gains more from trade between them.

The study also suggests some policy recommendations for reducing unequal exchange with special reference to labor-surplus economics.
CHAPTER I

STATEMENT OF THE PROBLEM

A farmer in Nigeria might tend his peanuts with as much diligence and skill as a farmer in Australia tended his sheep, but the return would be very different... But the market price gave the Nigerian for his peanuts a 700 lbs. of grain per acre level of living, and the Australian for his wool a 1600 lbs. per acre level of living, not because of differences in competence, nor because of marginal utilities or productivities in peanuts or wool, but because these were the respective amounts of food which their cousins could produce on the family farms.... (Lewis, 1978, p. 10)

A. Introduction

The human predicament in the present-day world has many facets. One of them is the awesome diversity in the living conditions of peoples in different countries of the world. While the highest per capita income was $16,330 in Switzerland in 1984 ($15,390 in U.S.A.) the lowest one was $110 in Ethiopia during the same year. According to a recently released study by the International Labor Organization based on data collected in 1986, a worker in India toils 12 times more than his counterpart in Denmark to win his daily bread. The worker in the USA has to work twice as hard as the Dane, but a Filipino must spend thrice the time put in by an Indian worker for the same loaf (Weekly Statesman, 1988). This immense diversity of incomes and living conditions is not a phenomenon which has existed there forever. Indeed, what is interesting to note is that the present significant difference in per capita incomes between the countries of the so-
called North and those of the so-called South seems to have started with the Industrial Revolution which, according to Paul Kennedy (1987, p. 149), began to bring about "a fundamentally important transformation in man's economic circumstances" sometime around 1780. "The elemental truth" about the characteristic of any country before its industrial revolution and modernization was poverty with low productivity in traditional agriculture. Since agriculture was the basis of all European and non-European societies, and in countries like India and China there existed many traders, textile producers, and craftsmen, the differences in per capita income were not enormous. Tables 1.1 and 1.2, prepared by Bairoch (see Kennedy, 1987), show how dramatically the picture changed over the years in consequence of European industrialization and expansion.

The root cause of these transformations, it is clear, lay in the staggering increases in productivity resulting from the Industrial Revolution. On the basis of the Tables 1.1 and 1.2, Bairoch (see Kennedy, 1987, p. 149) makes the "remarkable" and "horrifying" suggestion that "whereas the per capita levels of industrialization in Europe and the Third World may have been not too far apart from each other in 1800, the latter's was only one-eighteenth of the former's (2 percent to 35 percent) by 1900, and only one-fiftieth of the United Kingdom's (2 percent to 100 percent)." According to the World Development Report, 1986, the ratio of the average per capita income of the poor nations to that of the rich nations is now around 1:44, and it was estimated to be around 1:40 in the late 1950s.
### Table 1.1 - Changing Pattern of the Distribution of World Manufacturing Output, 1800-1900

*Adapted from Kennedy, 1987, p. 149*

<table>
<thead>
<tr>
<th>Region</th>
<th>1800</th>
<th>1830</th>
<th>1860</th>
<th>1880</th>
<th>1900</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe</td>
<td>28.1</td>
<td>34.2</td>
<td>53.2</td>
<td>61.3</td>
<td>62.0</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>4.3</td>
<td>9.5</td>
<td>19.9</td>
<td>22.9</td>
<td>18.5</td>
</tr>
<tr>
<td>Habsburg Empire</td>
<td>3.2</td>
<td>3.2</td>
<td>4.2</td>
<td>4.4</td>
<td>4.7</td>
</tr>
<tr>
<td>France</td>
<td>4.2</td>
<td>5.2</td>
<td>7.9</td>
<td>7.8</td>
<td>6.8</td>
</tr>
<tr>
<td>German States/Germany</td>
<td>3.5</td>
<td>3.5</td>
<td>4.9</td>
<td>8.5</td>
<td>13.2</td>
</tr>
<tr>
<td>Italian States/Italy</td>
<td>2.5</td>
<td>2.3</td>
<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
</tr>
<tr>
<td>Russia</td>
<td>5.6</td>
<td>5.6</td>
<td>7.0</td>
<td>7.6</td>
<td>8.8</td>
</tr>
<tr>
<td>United States</td>
<td>0.8</td>
<td>2.4</td>
<td>7.2</td>
<td>14.7</td>
<td>23.6</td>
</tr>
<tr>
<td>Japan</td>
<td>3.5</td>
<td>2.8</td>
<td>2.6</td>
<td>2.4</td>
<td>2.4</td>
</tr>
<tr>
<td>Third World</td>
<td>67.7</td>
<td>60.5</td>
<td>36.6</td>
<td>20.9</td>
<td>11.0</td>
</tr>
<tr>
<td>China</td>
<td>33.3</td>
<td>29.8</td>
<td>19.7</td>
<td>12.5</td>
<td>6.2</td>
</tr>
<tr>
<td>India/Pakistan</td>
<td>19.7</td>
<td>17.6</td>
<td>8.6</td>
<td>2.8</td>
<td>1.7</td>
</tr>
</tbody>
</table>
TABLE 1.2 - RELATIVE PER CAPITA LEVELS OF AVAILABILITY OF CAPITAL, 1800-1900 (U.K. IN 1900 = 100) 
(ADAPTED FROM KENNEDY, 1987, p. 149)

<table>
<thead>
<tr>
<th></th>
<th>1800</th>
<th>1830</th>
<th>1860</th>
<th>1880</th>
<th>1900</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe</td>
<td>8</td>
<td>11</td>
<td>16</td>
<td>24</td>
<td>35</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>16</td>
<td>25</td>
<td>64</td>
<td>87</td>
<td>[100]</td>
</tr>
<tr>
<td>Habsburg Empire</td>
<td>7</td>
<td>8</td>
<td>11</td>
<td>15</td>
<td>23</td>
</tr>
<tr>
<td>France</td>
<td>9</td>
<td>12</td>
<td>20</td>
<td>28</td>
<td>39</td>
</tr>
<tr>
<td>German States/Germany</td>
<td>8</td>
<td>9</td>
<td>15</td>
<td>25</td>
<td>52</td>
</tr>
<tr>
<td>Italian States/Italy</td>
<td>8</td>
<td>8</td>
<td>10</td>
<td>12</td>
<td>17</td>
</tr>
<tr>
<td>Russia</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>United States</td>
<td>9</td>
<td>14</td>
<td>21</td>
<td>38</td>
<td>69</td>
</tr>
<tr>
<td>Japan</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>9</td>
<td>12</td>
</tr>
<tr>
<td>Third World</td>
<td>6</td>
<td>6</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>China</td>
<td>6</td>
<td>6</td>
<td>4</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>India</td>
<td>6</td>
<td>6</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>
It is true that there were interregional and intercontinental movements of goods and services before the Industrial Revolution, but the years since the Industrial Revolution have seen continuous increase of trade between the emerging nation-states, and, as a result, different regions of the world have come closer and closer together. As international trade has increased, both in absolute and relative magnitudes, most of the countries of the world have become more and more open to international trade.

Thus, if \( O \) stands for the openness of an economy, it can be defined as

\[
O = \frac{E}{Y}
\]

(1.1)

where \( E \) stands for exports and \( Y \) stands for national income. By taking logarithms of both sides of (1.1) and then differentiating them with respect to time we have

\[
G_O = G_E - G_Y
\]

(1.2)

where \( G_O \) stands for growth of "openness," \( G_E \) represents growth of exports and \( G_Y \) refers to growth of income. The World Development Report, 1986, suggests that both the "Low Income Economies" and the "Industrial Market Economies" with high incomes have positive values for \( G_O \) during the years from 1965 to 1984 indicating increasing openness. Since countries engage in trade voluntarily, this increasing openness suggests that trade has been found to be beneficial in some sense. Theoretical economics of international trade since the days of the classical economists have tried to provide rigorous justification
for free trade on the ground that it leads to maximization of global benefits involving gains to all countries involved in trade through equalization of prices in different countries.

The neoclassical extension of this free trade principle by Heckscher, Ohlin and Samuelson (see Jones and Kenen, 1984) also predicts that, since movement of goods is a substitute for movement of factors of production, there will be a tendency for factor prices to be equalized in the trading countries. What is needed is free trade or free movement of goods. Thus, trade should lead us to expect a tendency towards equalization of per capita incomes across international borders. Indeed, this seems to have been the case so far as the trade in manufactured goods between the developed countries is concerned. As Table 1.3 clearly indicates, the rapid expansion of trade in manufactured goods between the developed countries since the Second World War corresponds to a "dramatic" convergence of the wage rates in those countries between 1959 and 1979 (Ethier, 1983). But, as pointed out above, the experience of the developing countries vis-à-vis the developed ones has been quite a different one. This difference in experience poses an important question which no student of theoretical international trade can afford to ignore.

B. Objective of the Study

Arghiri Emmanuel (1972, p. 263) has tried to explain this apparent contradiction in experience in terms of a theory of "exploitation at a distance" where "the enrichment of a minority would be impossible without impoverishing most of the rest of
mankind." He maintained that, instead of promoting growth in the developing countries, international trade has led to a new kind of "imperialism" through unequal exchange.

Since Emmanuel (1972) advanced the concept of unequal exchange it has been developed in a number of directions. The following study will concentrate on investigating its role in the field of development economics. Specifically the objectives are to:

(1) critically examine the alternative approaches to unequal exchange;

(2) develop a suitable measure of unequal exchange;

(3) develop testable propositions from the adopted approach to unequal exchange;

(4) empirically test for unequal exchange on the basis of the measure developed; and

(5) develop policy prescriptions to reduce unequal exchange.

---

**TABLE 1.3 - DAILY WAGES IN MANUFACTURING IN SELECTED COUNTRIES AS A PERCENTAGE OF THE U.S. WAGE**

*(ADAPTED FROM ETHIER, 1983, p. 114)*

<table>
<thead>
<tr>
<th>Country</th>
<th>1959</th>
<th>1979</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>.82</td>
<td>.95</td>
</tr>
<tr>
<td>Japan</td>
<td>.11</td>
<td>.82</td>
</tr>
<tr>
<td>Sweden</td>
<td>.39</td>
<td>1.09</td>
</tr>
<tr>
<td>France</td>
<td>.27</td>
<td>.60</td>
</tr>
<tr>
<td>Italy</td>
<td>.23</td>
<td>.72</td>
</tr>
<tr>
<td>West Germany</td>
<td>.29</td>
<td>1.07</td>
</tr>
<tr>
<td>U.K.</td>
<td>.29</td>
<td>.76</td>
</tr>
<tr>
<td>U.S.</td>
<td>1.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

*Consider 8 man-hour/day.
C. Procedure to be Followed

The following discussion is divided into six chapters. Chapter 1 is introductory and discusses the objectives and the procedure to be followed in the study. The three different approaches to unequal exchange have been discussed in Chapters 2, 4, and 5. Since the concept was originally proposed by the Greek economist Emmanuel, his concept of unequal exchange has been discussed in Chapter 2. It is contrasted with the Ricardian concept of unequal exchange, and then the role of that concept in development economics is investigated. Emmanuel's concept of unequal exchange leads to certain problems which have been discussed in Chapter 3. The two other approaches to unequal exchange are discussed in Chapters 4 and 5 with criticisms of them. The main criticism that has been leveled is against the fact that these concepts have been developed by considering labor as the only factor of production and other factors of production have been ignored. In order to look for a suitable measure of unequal exchange these concepts have been generalized to take account of all the factors of production. Such a generalization has been made in terms of the Leontief (1968) input-output analysis. In terms of this generalized approach the measure that has been adopted here is discussed in Chapter 5.

The Leontief (1968) input-output approach leads to a problem of aggregation which has been solved by assuming labor as the only primary factor of production - a procedure standardized by Leontief himself. This helps to arrive at testable measures for unequal
exchange. Chapter 5 also discusses the results of the application of the measures to the case of trade between Ecuador and the USA. This particular application is essentially illustrative (Lewis, 1972). Ecuador has been chosen because it is a developing country whose input-output tables are readily available. Nothing conclusive can be arrived at from one such test alone. But, groundwork has been laid in this study so that similar tests can be done in the future when sufficient input-output and ancillary data are available. Chapter 6 makes an overview of the study and discusses certain policy recommendations to reduce unequal exchange.
CHAPTER II

UNEQUAL EXCHANGE IN THE NON-EQUIVALENT SENSE

The term "unequal exchange" was first proposed by the Greek economist Arghiri Emmanuel (1972) to indicate the phenomenon that when goods are exchanged between the "rich" and the "poor" nations, the poor nations pay more in terms of labor than the amount of labor embodied in the good they receive in return. Jan Otto Anderson (1976) has categorized this type of unequal exchange as unequal exchange in non-equivalent sense. He has distinguished two other types of unequal exchange, namely "disjunctive exchange" and "asymmetric exchange." By asymmetric exchange he implies that kind of unequal exchange where the gains in labor-time through trade are unequal. Thus, if Country 1 saves 10 labor units by trading with Country 2, which saves 15 labor units, then exchange is asymmetric and favors Country 2. Disjunctive exchange, on the other hand, implies that the effects of trade on developments in different countries are different. Thus, even if the exporters and importers are gaining, Country 2 as a whole may be worse off from trade with Country 1, which may be able to transform trade into a profitable concern from the whole country's point of view. These concepts will be discussed in greater detail in their proper places.

Emmanuel's book, Unequal Exchange: A Study of the Imperialism of Trade (1972, p. 274), is a critique of the "dogma of the theory of comparative costs and the benefits of the capitalist international division of labor." Emmanuel thinks that the assumptions of immobility
of labor and capital in the Ricardian model are no longer appropriate. According to him, the realistic assumptions for the present-day world would be those of immobile labor and mobile capital. Immobility of labor between countries leads to different wage rates in different countries depending on the prevailing "institutional" and "socio-historical" conditions, like surplus population, predominance of family farming, lack of proper development of markets, and so on. Mobility of capital, on the other hand, leads to "international equalization of profits," so that, according to Emmanuel, the Marxian propositions regarding prices of production remain valid on an international scale.

As will be explained below, according to Marx the value of a commodity depends on the total labor embodied in that commodity which includes not only the direct labor needed to produce it, but also the indirect labor needed to produce other factors of production. Equilibrium relative prices of commodities (values-in-exchange), however, are not determined simply by taking the ratios of the total amounts of labor embodied in them. This is done in the simple Ricardian model where production is a function of labor alone. Since in the Marxian model producers use capital in production, the return to capital must be the same in the production of all commodities. Only then intersectoral flow of capital will stop and equilibrium will prevail. In equilibrium the market prices of production (same as the prices of commodities) in a competitive economy are determined by a mark-up over the cost of labor necessary to produce them. This mark-up implies an exploitation of labor in the sense that, though the
products are produced by labor, the laborers get only a fraction of the market price. Since the prices of production under capitalism are, according to Marx, based on exploitation, Emmanuel thinks that pricing of commodities on an international scale lays bare the "mechanism" of international exploitation where "one nation exploits another" - the so-called "exploitation at a distance."

This exploitation takes place through the mechanism of unequal exchange, whereby the poor nations pay more in terms of their national labor than they receive in exchange from the rich nations. Emmanuel's explanation proceeds in terms of the Marxian theory of value and prices. According to the law of value, the value of a commodity may be written as

\[ c + v + m = V = \text{total value} \]

where \( c \) stands for Constant Capital representing the cost of raw materials (or other capital goods) used, \( v \) for Variable Capital representing expenditures on direct labor, and \( m \) for Surplus Value created by necessary labor and appropriated by the capitalist. This surplus originates out of the fact that the laborers need only a fraction of their total working time to produce the goods that their wages can buy. Whatever they produce with the rest of their working time goes to build up the profit of the employer.

With reference to this concept of value, certain rates are defined as follows. The rate of surplus value is given by

\[ m' = \frac{m}{v} = \text{rate of surplus value}. \]
The organic composition of capital measures per capital availability of capital and materials, and is defined as

\[ q = \frac{c}{c + v} = \text{organic composition of capital}. \]

It is analogous to the concept of \( \frac{\text{Fixed Cost}}{\text{Fixed Cost} + \text{Variable Cost}} \) ratio in the neoclassical terminology. Finally, the rate of profit is defined as

\[ \frac{m}{c + v} = t \text{ or } \frac{m}{c + v} = T \]

Emmanuel (1972) utilizes these concepts to show how the opening of trade leads to unequal exchange in the non-equivalent sense. He envisages countries A and B with unequal profit rates in autarky; that is, in equilibrium before trade (e.g., 20% and 33 1/3% respectively). After trade with mobile capital, they emerge with a common intermediate profit rate (e.g., 25%). Both the countries are assumed to have the same three industries (e.g., I wine, II cloth and III food). His point of view can be illustrated by means of Table 2.1 and Table 2.2 as follows. He assumes that the profit rate would be lower in the country where the wage-rate is higher. The reason for his assuming this is that the organic composition of capital, \( q \), is different in the two countries, and, as the organic composition of capital increases relatively more rapidly in the course of capitalist development, the rate of profit, according to Marx, tends to fall. Moreover, according to Samuelson (1979), if the same Leontief-Sraffa technologies would exist everywhere, Emmanuel would be right, in supposing that a lower real wage would imply a higher profit rate.
### Table 2.1 - Prices of Production in Autarky in Country A and in Country B
(Adapted from Emmanuel, 1972, pp. 53-54)

<table>
<thead>
<tr>
<th>Branches</th>
<th>Constant Capital</th>
<th>Variable Capital</th>
<th>Surplus Variable</th>
<th>Value c+v</th>
<th>Rate of Profit</th>
<th>Profit T (c+v)</th>
<th>Price of Production = c+v+p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Country A</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>I</td>
<td>80</td>
<td>20</td>
<td>20</td>
<td>120</td>
<td>20%</td>
<td>20</td>
<td>120</td>
</tr>
<tr>
<td>II</td>
<td>90</td>
<td>10</td>
<td>10</td>
<td>110</td>
<td>20%</td>
<td>20</td>
<td>120</td>
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<tr>
<td>III</td>
<td>70</td>
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<td>30</td>
<td>130</td>
<td>20%</td>
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<td>240</td>
<td>60</td>
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<td>360</td>
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<tr>
<td><strong>Country B</strong></td>
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<tr>
<td>I</td>
<td>40</td>
<td>20</td>
<td>20</td>
<td>80</td>
<td>33 1/3%</td>
<td>20</td>
<td>80</td>
</tr>
<tr>
<td>II</td>
<td>50</td>
<td>10</td>
<td>10</td>
<td>70</td>
<td>33 1/3%</td>
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<td>III</td>
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<td>Country</td>
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<td>IA</td>
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<td>20</td>
<td>120</td>
<td>25%</td>
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<td>125</td>
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<tr>
<td>IIA</td>
<td>90</td>
<td>10</td>
<td>10</td>
<td>110</td>
<td>25%</td>
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<tr>
<td>IIIA</td>
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<td>30</td>
<td>130</td>
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<td></td>
<td>240</td>
<td>60</td>
<td>60</td>
<td>360</td>
<td>25%</td>
<td>75</td>
<td>375</td>
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<tr>
<td>IB</td>
<td>40</td>
<td>20</td>
<td>20</td>
<td>80</td>
<td>25%</td>
<td>15</td>
<td>75</td>
</tr>
<tr>
<td>IIB</td>
<td>50</td>
<td>10</td>
<td>10</td>
<td>70</td>
<td>25%</td>
<td>15</td>
<td>75</td>
</tr>
<tr>
<td>IIIB</td>
<td>30</td>
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<td>120</td>
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<td>60</td>
<td>240</td>
<td>25%</td>
<td>45</td>
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<td>120</td>
<td>120</td>
<td>600</td>
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<td>600</td>
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</tbody>
</table>
"in supposing that the poor country must have the higher profit rate, for a lower real wage can occur only with a higher profit rate." Thus, in his tables, Country A has a lower rate of profit and Country B has a higher rate of profit under autarky. He also assumes the same rate of surplus value in all the industries in both the countries, namely 100%, which continues to prevail even after trade.

It can be pointed out that, according to Marx, in a capitalist world, if every branch of production has the same organic composition of capital, the law of value would be "directly controlling for the prices." But, since the organic composition of capital differs from one branch of production to another, and since the profit rates should be the same in all branches of production under equilibrium, the prices of commodities (what Marx calls "prices of production") will be made up of the capital expended in production (c+v), plus a mark-up for profit calculated as a certain percentage of the capital outlay. This percentage is nothing but the average rate of profit and is found by dividing the total surplus value by total social capital (Sweezy, 1942).

Thus, with reference to Table 2.1, the average rate of profit before trade in Country A is

\[
\frac{60}{(240 + 60)} = \frac{60}{300} = 20\%.
\]

Similarly, the average rate of profit in Country B is

\[
\frac{60}{(120 + 60)} = \frac{60}{180} = 33\frac{1}{3}\%.
\]

Since the total capital invested in Country A in all the branches of production is 100, total profit is 20 in all the branches. Thus, the
prices of production in Country A are given by

<table>
<thead>
<tr>
<th></th>
<th>c</th>
<th>v</th>
<th>p</th>
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<tbody>
<tr>
<td>I</td>
<td>80</td>
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<td>20</td>
<td>120</td>
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<tr>
<td>II</td>
<td>90</td>
<td>10</td>
<td>20</td>
<td>120</td>
</tr>
<tr>
<td>III</td>
<td>70</td>
<td>30</td>
<td>20</td>
<td>120</td>
</tr>
</tbody>
</table>

In a similar way the figures for the prices of production in Country B have been calculated.

Emmanuel (1972) then considers two situations. In Situation I he assumes that the two countries enter into exchange with one another under the condition that there is no international mobility of capital so that the different profit rates are maintained in the two countries. Now "if all the three articles produced participated in exchange in the proportions supposed," then, "the three articles of Country B, taken together" would exchange "at the rate of 360 for 240, against the three articles of Country A, taken together."

When this happens, there is, according to Emmanuel (1972), equal exchange, since 120 units (60+60) of B's direct labor, which he terms "national living labor", exchange for 120 units (60+60) of A's direct labor. Emmanuel does not discuss how the ratio at which the goods are exchanged, namely 3/2 which is same as 360/240, is determined. It can be presumed that it is exogenously determined. At this price ratio there is, according to Emmanuel, equal exchange, since to produce 3 units of the commodities in A one unit of direct (living) labor is needed, and also one unit of direct (living) labor is needed to produce 2 units of the commodities in B. Emmanuel does not consider
past labor on the grounds that it has already been "valorized"; that is, it has already been taken into account in the determination of its past value. What he seems to imply can be explained as follows. The amount of surplus value depends on the rate of exploitation which, in the Marxian sense, is a ratio of unpaid total labor to paid total labor (Morishima, 1973). Thus, the past labor has already been taken into account when value has been estimated. There will be double counting if past labor is again included.

In Situation II capital can circulate freely across international borders equalizing the profit rates as shown in Country A and B together. Now, the exchange rate between the commodities of Country B and those of Country A would no longer be 120 for 80, but would be 125 for 75. Apparently this happens because the profit rate in Country A rises and that in Country B falls. As the price in Country A rises and that in Country B falls, the terms of trade move against B. Since under Situation I there is equal exchange, Situation II implies unequal exchange whereby value is being "transferred" from Country B to Country A, impoverishing the former.

Emmanuel's concept of unequal exchange is based on the Marxian labor theory of value. Marx himself borrowed heavily from the labor theory of value of Ricardo, who for the first time, provided a systematic explanation of the phenomenon of international trade. Before a critique of Emmanuel is developed in the next chapter, it would be worthwhile to look into some of the implications of the Ricardian theory which are relevant in this context.

Indeed, it is quite intriguing to note that unequal exchange in
the non-equivalent sense can also be illustrated within the framework of Ricardo's comparative cost principles of trade, based on a labor theory of value. He pointed out that the basis of trade is a difference in comparative costs prevailing in the countries in their autarkic positions of equilibrium.

Ricardo's theory of comparative costs can be illustrated with reference to a simplified world of two countries called the North and the South producing two goods in which the real labor costs of producing one unit of X would be 5 man-hours in the North and 10 man-hours in the South, while those of producing one unit of Y would be 2 man-hours in the North and 20 man-hours in the South. In this situation, according to Ricardo, the North has a comparative advantage in the production of Y and the South has a comparative advantage in the production of X. The North would specialize in the production of Y to export it in exchange for X for which the South would enjoy a comparative advantage. If the terms of trade were anywhere between 5/2 and 1/2, trade would be beneficial for both the North and the South. If, for example the terms of trade were 1:1, by trading one Y for one X, the North would save 3 man-hours per unit, compared to production of X at home. Using this extra labor time, 1.5 more units of Y would be produced over and above one unit of X obtained through exchange. Similarly, the South could save 10 man-hours by trading one unit of X for one unit of Y. With this extra 10 man-hours, it could produce 1 unit more of X over and above 1 unit of Y obtained through trade.

Even though trade is beneficial for both countries, the amounts of labor exchanged are not the same. In order to produce one unit of Y, the North needs only 2 units of labor, whereas the South needs 10
units of its labor to produce one unit of X. Thus, one unit of Northern labor would exchange for 5 units of Southern labor. This would imply unequal exchange in the sense of non-equivalent trade, showing that the factorial terms of trade would be in favor of the North and against the South. In contrast, equal exchange would prevail in the equivalent sense if equal amounts of labor were exchanged, given the commodity terms of trade. This would imply that the factorial terms of trade would be equal to one.

It can be pointed out that unequal exchange in the Ricardian model, as in Emmanuel's presentation, arises out of trade. In the Ricardian system under autarky, that is, in equilibrium before trade, there is no unequal exchange because the commodities in each country exchange in the ratio of their labor costs. Since the equilibrium terms of trade are stated at a point different from the autarkic price ratios, the commodities are no longer exchanged in the ratio of their labor costs. This gives rise to unequal exchange in the sense of non-equivalent trade.

A. Basis of Unequal Exchange in the Non-Equivalent Sense

According to Emmanuel (1972), inequality of wages is alone the cause of inequality of exchange. In his opinion present-day reality is one in which capital is mobile, but labor is immobile, and that "sufficient" immobility of labor ensures that the prevailing local differences in wages, due to the socio-cultural elements, cannot be eliminated (Emmanuel, 1972). The wage rates are independent of prices since they are determined "institutionally" by the overall supply and
demand for labor in the economics, but they, in turn determine various prices. The relation between the wage ratio and the factorial terms of trade, showing unequal exchange, can be established with reference to equilibrium in the foreign sector in each country as follows

Value of export = Value of import

measured in the prices of the country under consideration. Assuming constant returns to scale and labor as the only factor of production, the value of exports can be given by

Value of export = MPL\(x\) \(L_x\) \(P_x\)

where MPL\(x\) stands for the marginal productivity of labor in export (\(X\)) and is equal to the average productivity of labor in \(X\), (APL\(x\)), \(L_x\) for the amount of labor employed in the production of \(X\) and \(P_x\) is the price of \(X\). Similarly,

Value of import = MPL\(y\) \(L_y\) \(P_y\)

assuming that MPL\(y\) = APL\(y\). Thus,

MPL\(x\) \(L_x\) \(P_x\) = MPL\(y\) \(L_y\) \(P_y\)

or, \(W_x \cdot L_x = W_y \cdot L_y\)

or, \(L_x / L_y = W_y / W_x\).

Thus, the ratio of the amounts of labor exchanged is equivalent to the ratio of wages. In this sense, the factorial terms of trade showing the ratio of the amounts of labor exchanged can also be regarded as equivalent to the ratio of wages.
In order to discuss the basis of unequal exchange in the non-equivalent sense in the Ricardian framework, suppose that $a_{LX}$ and $a_{LY}$ are the real labor costs of producing 1 unit of $X$ and 1 unit of $Y$ in the North, and $a^{*}_{LX}$ and $a^{*}_{LY}$ are the real labor costs of producing 1 unit of $X$ and 1 unit of $Y$ in the South. If, for example, $a_{LX} = 1$, $a_{LY} = 1$, $a^{*}_{LX} = 3$, and $a^{*}_{LY} = 4$, the North will export $Y$ and the South will export $X$. Under these conditions, the world production-possibility or transformation curve, ABC, is shown in Figure 2.1, where the straight line AB is given by

$$a_{LX} \cdot X + a_{LY} \cdot Y = L$$

(2.1) or, $Y = L / a_{LY} - (a_{LX} / a_{LY}) \cdot X$

Similarly, the equation for the line BC is given by

$$a^{*}_{LX} \cdot X + a^{*}_{LY} \cdot Y = L^{*}$$

(2.2) or, $Y = L^{*} / a^{*}_{LY} - (a^{*}_{LX} / a^{*}_{LY}) \cdot X$

Under the special conditions assumed, the slope of AB is -1. Similarly, the slope of the BC portion is -3/4, and the intercept on the Y-axis is determined by $L^{*}$ and the value of $a^{*}_{LY}$.

From the given conditions it is clear that the pattern of trade, by which we mean the commodities that different countries will export and import, is determined entirely by technological conditions. The exact terms of trade can be anywhere between $(a_{LY}/a_{LX})$ and $(a^{*}_{LY}/a^{*}_{LX})$. They are determined by the prevailing demand conditions.
FIGURE 2.1. WORLD PRODUCTION POSSIBILITY CURVE IN A TWO-COUNTRY TWO-COMMODITY CASE
as shown in Figure 2.2 which is drawn from Figure 2.1. In equilibrium we have

\[(2.3) \quad W = MPL_Y P_Y = (1/a_{LY}).P_Y\]

and

\[(2.4) \quad W^* = MPL^*_X P^*_X = (1/a^*_{LX}).P^*_X\]

where \(W\) and \(W^*\) are the real wage rates in the North and the South respectively, and \(MPL_Y\) and \(MPL^*_X\) are the marginal productivities of labor in \(Y\) in the North and in \(X\) in the South respectively. Assuming that in equilibrium the same prices would prevail in both the countries, the "Fundamental Theorem Of Unequal Exchange" (Gibson, 1980), showing the relationship between the factorial terms of trade, \(f\), and the commodity terms of trade, \(t\), would be given by

\[(2.5) \quad f = W^*/W = (1/a^*_{LX})/(1/a_{LY}).(P_X/P_Y) = (a_{LY}/a^*_{LX}).t\]

or,

\[(2.6) \quad f = W^*/W = (MPL^*_X/MPL_Y).(P_X/P_Y) = (MPL^*/MPL_Y).t\]

These equations show that the factorial terms of trade depend on labor productivities in the traded goods sectors in the two countries. According to Emmanuel there would be equal exchange if \(f = 1\). But, since the same price ratio \((P_X/P_Y)\) would prevail in the two countries in equilibrium after trade, the basis for trade in the Ricardian model lies in the differences in labor productivities in the two countries, which, from (2.5) or (2.6), implies that there would always be unequal exchange in trade in the Ricardian model. Labor productivity depends on the technology used. Thus, in the Ricardian model the basis of
FIGURE 2.2. DETERMINATION OF THE COMMODITY TERMS OF TRADE BY RELATIVE DEMAND AND RELATIVE SUPPLY
unequal exchange lies in the differences in technology in the traded goods sectors in the two countries, the extent of unequal exchange being a function of the productivity difference and the commodity terms of trade between the two countries.

It would be worthwhile to investigate the effects of technological changes on unequal exchange in a Ricardian framework. Equations (2.5) and (2.6) imply

\[
\frac{\partial f}{\partial t} = \left( \frac{a_{LY}}{a_{LX}^*} \right) > 0
\]

\[
\frac{\partial f}{\partial a_{LX}^*} = - \left( \frac{a_{LY}}{a_{LX}^*} \right) \frac{t}{(a_{LX}^*)^2} < 0
\]

\[
\frac{\partial f}{\partial a_{LY}} = \frac{t}{a_{LX}^*} > 0
\]

Equation (2.7) shows that the movement of the factoral terms of trade depends directly on the movement of the commodity terms of trade. Equation (2.8) and (2.9) show the effects of technical changes on the factoral terms of trade, on the assumption that the commodity terms of trade are not affected by technical changes. Since technical changes are likely to affect the commodity terms of trade, a more thorough approach would need an analysis involving changes in all the variables. This can be done by taking the total derivatives. If (2.5) and (2.6) are written as

\[ f = a \cdot b \]

productivities of labor and \( b \) for the commodity terms of trade, the total derivative of \( f \) is given by

\[
\frac{df}{dt} = a \cdot \frac{db}{da} + b \cdot \frac{da}{da}
\]

\[
\text{or, } \frac{df}{da} = a \cdot \frac{db}{da} + b
\]
Equations (2.10) and (2.11) show that the effects of technical changes on factoral terms of trade can be captured properly by taking note of the possible effects on the terms of trade. The problem can be pursued in still greater detail if, instead of the factoral terms of trade, attention is focused on the equilibrium wage equations (2.3) or (2.4). Logarithmic differentiation of (2.3) gives

\[ \frac{d \ln W}{d \ln MPL_y} + \frac{d \ln P_y}{d \ln P_y} \]

or,

\[ \frac{dW}{W} = \frac{dMPL_y}{MPL_y} + \frac{dP_y}{P_y} \]

The first term on the right-hand side of (2.12) can be assumed to be equivalent to the productivity growth rate, \( dQ/Q \). The second term involving the rate of change of the price of \( Y \) is related to the growth rate of output as follows. If \( E \) stands for price elasticity of demand, it is defined as

\[ E = \frac{(dQ/Q)}{(dP_y/P_y)} \]

so that

\[ \frac{dP_y}{P_y} = \frac{(dQ/Q)}{E}. \]

Thus, from (2.12)

\[ \frac{dW}{W} = (1 + 1/E) \cdot (dQ/Q) \]

Since \( E \) is negative, if the absolute value of \( E \) is greater than one, then \( dW/W \) is positive, showing that technical progress in \( Y \) would improve the wage rate, resulting in a tendency for the factoral terms of trade to improve. If, on the other hand, the absolute value of \( E \) is
less than one, then $\frac{dW}{W}$ is negative. This indicates that the effect of technical progress in $Y$ will decrease the wage rate, resulting in a tendency for the factorial terms of trade to deteriorate.

The above analysis shows that the effect of technical progress on factorial terms of trade is indeterminate in the Ricardian framework. It can be pointed out, however, that the effect of technical progress on the commodity terms of trade is always negative in the Ricardian framework, but the possibility of improvement in the factorial terms of trade vanishes in Lewis's model of a labor surplus economy if the technical improvement in its export sector is not accompanied by any technical improvement in the food sector (Lewis, 1969). This highlights the special problem faced by many developing poor countries of the present-day world. In developing his ideas, Lewis has used an ingenious way to determine the commodity terms of trade, which, in the Ricardian framework, remain indeterminate between the autarkic price ratios. He assumes a situation in which the North produces steel and food, while the South produces food and coffee. One unit of Northern labor can produce 3 units of steel or 3 units of food, whereas one unit of Southern labor can produce 1 unit of food or 1 unit of coffee. The North and the South exchange steel and coffee, but food is not traded.

Under such a situation the commodity terms of trade between steel and coffee will be 1:1, showing unequal exchange in the non-equivalent sense, because to produce 1 unit of coffee the South needs 1 unit of labor, but the North needs only 1/3 of a labor unit to produce 1 unit of steel. Lewis's (1969) model is also different from
Ricardo’s in the sense that it can accommodate equal exchange which the Ricardian model cannot. Thus, if the productivity of Southern labor is 3 in food, the equilibrium commodity terms of trade would be 3:1, and 1 unit of Southern labor would exchange for 1 unit of Northern labor.

If the productivity of Southern labor increases in the production of coffee, the commodity terms of trade would move against the South—a result which is also true in the Ricardian model. Thus, for example, if labor productivity per head in the South doubles, the equilibrium terms of trade would be 1:2 between steel and coffee, but this will not affect the factorial terms of trade. If, however, productivity of labor per head in the South increases in the non-traded food sector instead of the traded coffee sector, both the factorial and the commodity terms of trade in the South will improve.

Lewis’s (1969) presentation assumes constant returns to scale and does not consider any demand conditions. It can be shown that even in a general equilibrium model where "demand plays an important role" and "transformation curves are nicely concave to the origin" technical changes in the nonfood sectors in the poor country are "unimportant" in influencing its factorial terms of trade, while technical changes in the food sector are (Bardhan, 1982). These asymmetric effects of technical progress on factorial terms of trade can be explained as follows. In the Lewis model, agricultural production in the less developed countries takes place mostly on family farms, which aim at maximizing total output. This implies that the wage rate is determined by the average productivity of labor rather than by the marginal
productivity of labor. This is shown in Figure 2.3. With unlimited supply of labor, this wage rate becomes a constant (Figure 2.4) and, when there is technical progress in the export sector, the effect is only a reduction in the price of the commodity leading to a deterioration of the terms of trade as is evident from equations (2.3) and (2.4). In the case of a developed country a rise in productivity of labor from $\text{MPL}_E$ to $\text{MPL}'_E$ in the export sector leads to an increase in the general wage rate and an improvement in the factoral terms of trade. This is shown in Figure 2.5. To the extent that the factoral terms of trade are an indicator of well-being, the position of developing countries becomes more and more precarious in the face of technical improvement in non-food sectors.

Possible impacts on the terms of trade in the face of technical progress has long been a topic of discussion in development economics. Edgeworth (see Findlay, 1981), Bhagwati (1958) and others found in technical progress the possibility of a country of being "damnified" or "immiserized". In the present context the hypothesis that is of special importance is the Prebisch-Singer theory based on Prebisch (1950) and Singer (1950) which says that "there is a systematic bias in the distribution of the gains from trade against the developing countries, revealed by a secular adverse tendency in their terms of trade" (Findlay, 1981, p. 428). Findlay (1981) has identified three major strands in the argument behind the Prebisch-Singer hypothesis.
FIGURE 2.3. DETERMINATION OF THE WAGE RATE IN A LABOR-SURPLUS FAMILY FARM

FIGURE 2.4. EFFECT OF TECHNICAL PROGRESS IN THE EXPORT SECTOR IN A LABOR-SURPLUS ECONOMY
FIGURE 2.5. EFFECT OF TECHNICAL PROGRESS IN THE EXPORT SECTOR IN A FULL-EMPLOYMENT ECONOMY
They are:

(1) The income-elasticity of demand for imports from the South is low in the North while it is high in the South for imports from the North. (2) Technological progress in the North tends to reduce the demand for imports from the South, while technological progress in the South tends to occur in the export sector. (3) The structure of product and factor markets tends to be much more monopolistic in the North than in the South, because of the existence of large corporations and well-organised labour unions. This makes technological progress lead to a rise in incomes in the North, whereas it leads to a decline in the relative prices of exportable products in the South.


Following the arguments of Edgeworth (see Findlay, 1981), Bhagwati (1958), Rybczynsky (1955) and others, Sodersten (1964) has developed a model which predicts a completely different trend for the terms of trade between the North and the South. If the North is identified as the capital-abundant country and the South as the labor-abundant one, the North will export the capital-intensive good and the South will export the labor-intensive good. An additional hypothesis could be that the income-elasticity of demand for the capital-intensive good is greater than unity, and of the labor-intensive good less than unity, though both are positive. Capital accumulation in either country would then turn the terms of trade against the North while population growth in either country would turn them in favor of the South. Since capital accumulation tends to proceed faster than population growth in both regions, the model would seem to indicate a presumption for terms of trade to move in favor of the South.

Now some clarification is required. Since in equilibrium after trade, \( P_X \) and \( P_Y \) are the same in both the countries from equations
(2.3) and (2.4), \( W \) will be higher than \( W^* \) if the value of \( MPL_y \) is greater than the value of \( MPL^*_x \). Now, suppose that there is technical progress in the production of \( X \) in the South so that \( MPL^*_x \) rises. Any of the following results can occur. (a) If the South is a small country, \( P_x \) does not fall and \( W^* \) rises, leading to an improvement in the South’s factorial terms of trade, which is the usual Ricardian result. (b) If the South is a large country, \( P_x \) can fall and lead to the Bhagwati case of "immiserizing trade" if technical improvement is due to trade. (c) Depending on the magnitude of the rise of \( MPL^*_x \) and the fall of \( P_x \), the rise or fall of \( W^* \) and, hence, the improvement or deterioration of the South’s factorial terms of trade will be determined. (d) The Lewisian result, mentioned above, follows because the productivity of labor on the household farm is constant, in spite of technical changes in the non-food sector. This leads to the wage rate being institutionally fixed at labor’s average productivity on the household farm. In this case, a rise in \( MPL^*_x \) will be matched by a corresponding fall in \( P_x \), leading to a deterioration of the South’s commodity terms of trade as shown by Lewis. (e) The Sodersten case is analogous to case (b) above, where improvement in \( MPL_y \) in the North can lead to a fall in \( P_y \) and hence its terms of trade, if that is not reflected in a corresponding rise in \( W \).

In reality, the income effects within the economy following from the technical improvement cannot be ignored. They can have significant influence on demand and on prices (Spraos, 1983; McIntosh, 1986). But, in equilibrium, we end up with relations such as (2.3) and (2.4), which show that technical changes can account for changes in
all of W, MPL and P. In terms of (2.3) and (2.4), the Prebisch-Singer hypothesis is a distinct possibility because low income-elasticity of demand for imports from the South can lead to a deterioration of the terms of trade due to technical improvement. Thus, given all these hypotheses, it is apparent that the movement of the factoral and the commodity terms of trade cannot be determined from theory alone. Theory can discuss only the possibilities. What will actually happen depends on the prevailing conditions.
CHAPTER III

A CRITIQUE OF EMMANUEL’S CONCEPT OF UNEQUAL EXCHANGE

Emmanuel’s (1972) presentation of unequal exchange in the non-equivalent sense raises some questions of great importance. In the first place, his theory does not provide any basis for trade. If the total industrial output does not rise because of trade, trade cannot be justified. Indeed, it is "profoundly wrong" to leave the after-trade industry totals the same as they were before trade (Samuelson, 1979). According to Emmanuel, the producers in the South (Country B) procure a higher rate of profit since the wage rate there is lower than that in the North (Region A); they should have no incentive to engage in trade which equalizes profits and, hence, lowers their rates of profit (Sau, 1984). One can argue, however, that once the boundaries are thrown open and capital can freely move across national borders, the capitalists in the poor nations will not be able to stop the inflow of capital. This, of course, contradicts another Marxian theory where the state is controlled by the bourgeoisie.

Secondly, since profit rates are equalized, exploitation of the developing countries must imply a higher rate of surplus value. In Emmanuel’s presentation each country continues to have the same rate of surplus value as it had before trade, namely 100%. What he claims to be "exploitation of one nation by another" seems to be an exploitation of the bourgeoisie in the poor country by those in the rich country. The surplus value which the local bourgeoisie were
exploiting is now flowing out of the country. This foreign surplus is appropriated by the bourgeoisie in the rich country. According to Emmanuel's presentation, the workers there do not benefit from this, but the workers in the poor country are not losers either. Moreover, the inflow of capital will at least help raise the productivity of labor in the non-food sector. If the workers cannot benefit from this, the producers will. Thus, the situation is more complex than imagined by Emmanuel.

Thirdly, Emmanuel's concept of unequal exchange is ambiguous. If the exchange of a larger amount of labor is associated with a larger amount of benefit, it may not be called unequal. He seems to imply that the benefits from trade are equal for the countries involved, so that the payment of different costs would imply unequal exchange. But, Emmanuel has almost nothing to say in the case in which larger expenditure of labor is associated with a larger amount of benefit.

Moreover, it is worthwhile in this connection to mention that with Emmanuel a deterioration in the terms of trade is necessarily harmful. That this need not be so can be illustrated by the following figures (Lindert, 1986). Figure 3.1 and Figure 3.2 show how the terms of trade are determined by the intersection of the demand curve AB and the supply curve CD. In Figure 3.1 they intersect at E to determine the equilibrium terms of trade. In Figure 3.1 the net gain to the society is given by the area AEC. The terms of trade can fall in either of two ways. It can fall either by a reduction in foreign demand for the home export good (Figure 3.1), or, by a rise in the domestic supply of the export good (Figure 3.2). In the case of
FIGURE 3.1. A DETERIORATION OF THE COMMODITY TERMS OF TRADE FOLLOWING A DECREASE IN FOREIGN DEMAND

FIGURE 3.2. A DETERIORATION OF THE COMMODITY TERMS OF TRADE FOLLOWING A TECHNICAL IMPROVEMENT IN THE EXPORT SECTOR
Figure 3.1 the area AEC decreases, where as the corresponding area in Figure 3.2 increases, showing that in the former case the country's position deteriorates and improves in the latter.

This point has been more elaborately put forward by Findlay (1984). Following Bacha (1978), he assumes that the North specializes in steel and the South in coffee. If the superscripts N and S stand for the North and the South respectively, then $q^N$ is the output of steel per unit of labor in the North and $q^S$ is the output of coffee per unit of labor in the South. $w^N$ and $w^S$ are the real wages fixed in terms of steel. The common rate of profit is $r$ while $p$ is the relative price of coffee in terms of steel. Wages are paid at the beginning of each production period which is assumed to be one for both the goods. All these assumptions imply:

$$r = (q^N - w^N) / w^N = (p.q^S - w^S) / w^S$$

so that:

$$p = (w^S/w^N).(q^N/q^S)$$

This equation shows that the commodity or "net barter" terms of trade of the South, $p$, is a function of the wage rates and the productivities. The double factorial terms of trade, $f$, are related to $p$ by:

(3.1)  $f = (p.q^S/q^N) = (w^S/w^N)$

From (3.1) it follows that $f$ is equal to unity if, and only if, $w^S = w^N$. Under such a situation "the amount of foreign labor embodied in imports per unit of domestic labor embodied in exports is equal to
unity" (Findlay, 1984, pp. 192-193). According to Emmanuel (1972), the South suffers from "unequal exchange" since \( w^S < w^N \). It implies that the South gets commodities worth less than a day's labor in the North in exchange for commodities worth a day's labor in the South.

To show how the concept of unequal exchange can be misleading Findlay assumes a situation where initially there is equal exchange with \( w^S = w^N \). If \( q^N \) and \( w^N \) both increase in the same proportion with no change in \( q^S \) and \( w^S \), the double factorial terms of trade will deteriorate from unity, but the rate of profit and the commodity terms of trade will not be affected. There is now unequal exchange even though the well-being of the South is unaffected, since it still gets the same amount of steel per unit of coffee exported.

It can be pointed out that the commodity terms of trade will improve in favor of the South if \( w^N \) does not increase as much as \( q^N \) does. This implies that the double factorial terms of trade must deteriorate since \( w^S \) is constant while \( w^N \) is higher. Thus, "the South's gain from trade could increase even if it becomes a "victim" of unequal exchange!"

This apparent contradiction can be resolved with reference to equations (2.10) and (2.11) which show that the change in factorial terms of trade depends not only on the change in the commodity terms of trade, but also on the change in the ratio of the labor productivities in the two economies. Thus, if \( a_{LX}^* \) falls in equation (2.2), the line AB in Figure 2.1 shifts to AB' and the line EFGH in Figure 2.2 shifts to EF'G'H, resulting in a deterioration of the South's terms of trade. Thus, a technical improvement in the export
sector will either deteriorate or leave unchanged the commodity terms of trade of the country concerned. What will actually happen can only be predicted by making a Prebisch-Singer type of factual analysis. Further, the impact on the factoral terms of trade will be determined by the equation (2.11). Thus, there is nothing misleading about the fact that the commodity and the factoral terms of trade can move in opposite directions. It can be shown that if labor productivity in the North increases steadily at a faster rate than that in the South, the South always benefits from the faster growth rate in the North in spite of the fact that its factoral terms of trade "necessarily" worsen.

Emmanuel (1972) seems to maintain that trade between the "poor" and the "rich" countries leads to actual loss to the poor countries. He has criticized other approaches to unequal exchange on the ground that they imply unequal sharing of advantages. Thus, in connection with his discussion on the famous controversy on German reparations for war he says, "From this point of view, if unequal exchange did take place, the inequality could relate only to the sharing of the advantages of international trade. Not only quantitatively but also qualitatively, what was involved was unequal exchange of a different kind from that which I am going to discuss in this book, since in no case could it mean more than a failure to gain, never an actual loss" (Emmanuel, 1972, p. xxii- xxiii). In this respect he seems to have transgressed the position maintained by Marx himself. Emmanuel quotes Marx as saying, "And even if we consider Ricardo's theory... three days of one country's labor may be exchanged for a single day of
another country's.... In this case the rich country exploits the poor one, even if the latter gains through the exchange..." (see Emmanuel, 1972, p. 92). The Marxist theory of exploitation does not imply that laborers are worse off through exchange of labor with the employer compared to a situation of unemployment. In the Ricardian model unequal exchange in the non-equivalent sense is not incompatible with both the countries being better-off through trade. The contradiction in Emmanuel's approach has become apparent in connection with his recommendations for improvements. If trade implies "actual loss," the immediate policy prescription would be a dissociation from trade. Indeed, there have been suggestions for "delinking" or "dissociation" from trade (see Senghas, 1985). For Emmanuel, however, the choice before the poor countries is not one of autarky, but one of diversification of industries between the two extremes of complete specialization and autarky. Appropriate measures in this direction would, he believes, lead to gains to the poor country.

Finally, it can be pointed out that in determining whether there is equal or unequal exchange, Emmanuel takes only national living labor or direct labor into account and leaves indirect and past labor totally out of consideration on the ground that it has already been "valorized". Thus, in Situation I he has equal exchange, since, as he maintains, 120 units of B's national living labor exchange for 120 units of A's national living labor when the exchange rate is 360 for 240. This is a departure from the Marxian approach to value where constant capital is regarded as congealed labor. This distorted labor theory of value leads him to keep the value of constant capital
unchanged when the total value of living labor in A goes up from 120 to 135 and that in B goes down from 120 to 105 after value has been transformed into prices. A proper analysis, it will be argued below, should not only take direct labor, but also indirect labor into account if it is to stick to a labor theory of value. A labor theory of value which does not take the contributions of other factors of production into account cannot be justified. In Emmanuel’s scheme, the transformation of values into prices seems to have no bearing on determining the exchange rates. The theory of the determination of relative prices cannot be different from the theory of prices. Ricardo did not have to face the problem of transformation of value into prices, for, in his model there are no other factors of production. As soon as any other factors of production are taken into account, they have to be converted into categories of labor if labor theory of value is to be abided by.
CHAPTER IV

UNEQUAL EXCHANGE IN THE ASYMMETRIC SENSE

It was mentioned above that payment of a higher amount of labor may not imply unequal exchange, for it might be associated with a higher amount of benefit. On the other hand, unequal exchange or exploitation at a distance in the Marxian sense need not imply actual loss from trade. In conformity with the idea that laborers stand to gain by being employed even though they are being exploited, it can be argued that exploitation implies that the distribution of gains from the exchange involved is unequal - a position which Emmanuel tried to refute. Laborers are not exploited if they are not employed. But that does not mean that a situation of unemployment is preferable to a situation of employment. What is true is that employers reap most of the gains which accrue through employment of labor and production in the Marxian sense.

Though the exchange analogy is not so appropriate in the case of employers employing laborers, it is very appropriate in the case of trade between countries. Thus, the question of unequal exchange is not one of "actual loss" on the part of the poor nations as suggested by Emmanuel (1972). It is rather a question of unequal distribution of gains between the countries involved in international trade, namely the "poor" countries on one hand, and the "rich" countries on the other. It has been pointed out by Metcalfe and Steedman (1974) and Ocampo (1976) that compared to autarky, trade always leads to an outward shift of the wage-profit frontier, leading to a rise in
economic well-being. It will, however, be pointed out below that trade might lead to actual losses in some special cases in a sense which is very different from that indicated by Emmanuel (1972).

Anderson (1976) has categorized unequal exchange arising out of unequal distribution of gains as "asymmetric trade." L.B. Shanin (see Anderson, 1976) has discussed this concept in terms of distribution of gains in labor-time. He discusses his point of view with reference to two economies, I and II, each producing two goods X and Y. He assumed that the productivities of daily labor in economy I were $x_1$ and $y_1$ and the productivities of daily labor in economy II were $x_2$ and $y_2$ in X and in Y respectively.

If economy I exports X to import Y at the price of "a" quantities of X for "b" quantities of Y, then the gain in labor time from trade for economy I is given by

\[(4.1) \quad \frac{b}{y_1} - \frac{a}{x_1}\]

This is so because to produce "b" units of Y and "a" units of X, economy I needs $b/y_1$ and $a/x_1$ labor days respectively. Similarly, for economy II, the gain in labor time is:

\[(4.2) \quad \frac{a}{x_2} - \frac{b}{y_2}\]

According to Shanin (see Anderson, 1976), the condition for equal exchange is:

\[(4.3) \quad \frac{b}{y_1} - \frac{a}{x_1} = \frac{a}{x_2} - \frac{b}{y_2}\]

and equivalent exchange would require
Now (4.3) and (4.4) will be the same if, and only if, we have $b/y_1 = a/x_2$, or, $b/a = y_1/x_2$, that is, if the ratio of the price of the imported good to the price of the exported good is equal to the ratio of domestic labor productivity in the imported good sector to the foreign labor productivity in the foreign country's import sector. Thus, the two concepts of equivalence will coincide only in very special instances. And, as is obvious from (4.3) and (4.4), it is most likely that both asymmetric exchange and non-equivalent exchange would be present at the same time.

Shanin's (see Anderson, 1976) concept of unequal exchange is very similar to Ricardo's theory of international trade, for there also the gains consist of saving in labor time. Thus, in the Ricardian example discussed above in Chapter 2, by trading one $Y$ for one $X$, the North saves 3 man-hours per unit, compared to producing $X$ at home. Using this extra labor time the North can produce 1.5 more units of $Y$. Similarly, the South can save 10 man-hours with which it can produce 1 unit more of $X$. Thus, in trade, both parties are benefiting, so that the basis of trade is maintained. It can also be pointed out that, since gains consist of reducing costs, the cost aspect of the problem has not been neglected.

Now the question of savings or gains in labor-time arises because only labor productivities or labor costs are considered. In reality there are other resource costs, so it is legitimate to take into account not only savings in labor-time, but savings in all other resources as well. It can be pointed out that the same considerations
should be applied to the case of non-equivalent exchange which was also framed solely in terms of the amounts of labor exchanged. Though Emmanuel (1972) speaks of past labor, apparently in constant capital, an explicit consideration of the total amounts of all factors of production exchanged would obviously be more preferable. In the following a reformulation of the concepts involved has been sought to take account of all factors of production.

To the extent that all resources or all factors of production are taken into account, the idea of asymmetric exchange involving unequal distribution of gains can be tackled in terms of opportunity costs. The concept of opportunity costs takes all resources into account which can be saved to produce another commodity if one unit less of a specific good is produced. Thus, if \((x_1, y_1)\) and \((x_2, y_2)\) stand for the productivities of all resources in the production of \(X\) and \(Y\) in economy I and economy II considered above respectively, then, given the same prices, equation (4.1) would show the saving in opportunity cost for economy I, and equation (4.2) that for economy II. The relation (4.3) would stand for equal exchange as before. The saving in opportunity costs can also be regarded as net opportunity costs. If net opportunity costs are unequal, we have unequal exchange in the asymmetric sense.
CHAPTER V

A REFORMULATION OF THE CONCEPT OF UNEQUAL EXCHANGE

The important question is how to measure the productivities of all resources in the production of different commodities and, hence, their opportunity costs. This question can be tackled if the concept of opportunity cost of producing a commodity is developed carefully. This can be done as follows. The opportunity cost of producing a commodity is not measured in terms of resource costs or money. It is measured in terms of other commodities whose production has to be reduced. Thus, in a 2-commodity economy, the opportunity cost of producing a commodity is measured by the extra amount of the other commodity that could have been produced if one unit less of the commodity under consideration were produced. In a multi-commodity economy it should accordingly be measured in terms of the remaining composite commodities that could have been produced if one unit less of the commodity under consideration were produced. The idea is that production of commodities needs resources, and when one commodity is produced in a smaller quantity, resources are released which can be utilised for the production of other commodities.

But production is a continuous process, and every commodity plays a role in producing the economy's total production. Thus, the resources that are used up in the production of one more unit of a commodity will reduce the production of not only other goods, but will reduce the production of the good under consideration in the next rounds of production. In the continuous process of production the
output of every commodity depends on the output of every other commodity. Thus, the production of all other commodities will affect the production of this particular commodity in the next round of the production process and so on.

The idea under consideration is best captured by an input-output model where every output is also an input for all outputs including itself within the economy. Thus in an input-output framework the export of a commodity implies loss of inputs for the production of every good including the commodity exported. This loss has cumulative chain effects over time on the total production of the economy. Similarly, the import of a good leads to cumulative favorable chain effects on the whole economy, since the imported good is used in the production of all goods including the imported good itself. These chain effects are often termed as "linkage effects" which vary from one industry to another. Depending on the magnitudes of these linkage effects, the impacts of different industries on the whole development of the economy is determined. Thus, to the extent opportunity costs are calculated in terms of production of all commodities over time, they take into consideration the whole development of the economy which is consequent on them - a concept which is emphasized by the idea of disjunctive exchange.

The concept of unequal exchange in the disjunctive sense points to the fact that the effects of trade may not be equally favorable for the countries involved. According to Anderson (1976), trade is disjunctive in an absolute sense if it has positive impact on development in the more developed country, and hinders development in the less developed. Trade is disjunctive in a relative sense if it
leads to a faster development in the more developed country than in the less developed.

The reason for this kind of phenomenon, according to Anderson (1976), may be due to a number of reasons. In the first place, it can be due to forcefully manipulated trade which was a feature of colonialism. Secondly, it can arise out of a very sizeable decline in the terms of trade following initial growth through trade, the case of the so-called "immiserizing trade." Anderson has also included under this category of trade the case called "Graham's Paradox" in which two products are exchanged, one being produced under diminishing returns, the other enjoying increasing returns to scale. This case is rather suspect, since increasing and diminishing costs will have their impacts on the terms of trade which have been ignored. The point, however, is that exports and imports have linkage effects throughout the whole economy which influence the development of the economies concerned and, therefore, must be taken into consideration in determining the net opportunity costs of trade in different countries. Thus, the cost of export to a country is the whole development that could have been achieved if the commodity were not exported at all so that it could have been utilized to help produce the chain of goods in general. Similarly, the gain from import is the total amount of economic development that can be made from the imports. The net opportunity cost is the net development effect.

It can be pointed out that this is an approach which is just the opposite of the Keynesian approach, where export is regarded as an exogenous demand giving rise to a positive multiplier or development
effect on the economy, and import has a negative multiplier or 
development effect. Keynesian economics looks at export and import 
from a demand point of view, where it is assumed that the economy will 
catch up with changes in demand. In contrast, the present point of 
view is a supply-side one, where export and import are regarded as 
inputs for production in general.

In order to ascertain the net opportunity costs of import and 
export one can assume an economy where the total outputs of 
\( x_1, x_2, \ldots, x_n \) are produced in an input-output model to meet the final 
bill of goods \( y_1, y_2, \ldots, y_n \) (Leontief, 1968). This can be written as

\[
\begin{align*}
x_{11} + x_{12} + \ldots + x_{1n} + y_1 &= x_1 \\
x_{21} + x_{22} + \ldots + x_{2n} + y_2 &= x_2 \\
\vdots &\quad \vdots &\quad \vdots &\quad \vdots &\quad \vdots \\
x_{n1} + x_{n2} + \ldots + x_{nn} + y_n &= x_n
\end{align*}
\]

(5.1)

and

\[
x_{01} + x_{02} + \ldots + x_{0n} = x_0
\]

where \( x_{ij} \) stands for the amount of the product of sector "i" absorbed 
as an input by sector "j", and \( x_{0j} \) for the amount of labor absorbed as 
input by sector "j." Thus, \( x_0 \) stands for the total wagebill. Since the 
net output is the same as the final demand, subtraction of inter-
industry demands from gross output yields:

\[
\begin{align*}
(x_1 - x_{11}) - x_{12} - \ldots - x_{1n} &= y_1 \\
- x_{21} + (x_2 - x_{22}) - \ldots - x_{2n} &= y_2 \\
\vdots &\quad \vdots &\quad \vdots &\quad \vdots &\quad \vdots \\
- x_{n1} - x_{n2} - \ldots + (x_n - x_{nn}) &= y_n
\end{align*}
\]

(5.2)
and
\[ x_{01} + x_{02} + \ldots + x_{0n} = x_0 \]

The quantity of the output of sector \( i \) absorbed by sector \( j \) per unit of \( j \)'s total output is represented by the symbol \( a_{ij} \) and is called the input coefficient of sector "i" into sector "j." Thus

\[ a_{ij} = \frac{x_{ij}}{x_j} \]  \hspace{1cm} (5.3)

where \( i = 0 \) indicates labor.

A substitution of equations (5.3) into (5.2) yields \( n \) general equilibrium relationships between the total outputs \( x_1, x_2, \ldots, x_n \) and the final bill of goods \( y_1, y_2, \ldots, y_n \):

\[
(1 - a_{11})x_1 - a_{12}x_2 - \ldots - a_{1n}x_n = y_1 \\
- a_{21}x_1 + (1-a_{22})x_2 - \ldots - a_{2n}x_n = y_2 \\
\vdots \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \vdots \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \vdots \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \vdots \\
- a_{n1}x_1 - a_{n2}x_2 - \ldots + (1-a_{nn})x_n = y_n
\]  \hspace{1cm} (5.4)

and
\[ a_{01}x_1 + a_{02}x_2 + \ldots + a_{0n}x_n = x_0 \]

In order to investigate the viability of the system (5.4) where availability of labor is not a constraint, the last equation in (5.4) is omitted. Then (5.4) can be written in the succinct form

\[ (I - a)x = y, \]  \hspace{1cm} (5.5)
where
\[
\begin{bmatrix}
  x_1 \\
  x_2 \\
  \vdots \\
  x_n
\end{bmatrix}, \quad
\begin{bmatrix}
  y_1 \\
  y_2 \\
  \vdots \\
  y_n
\end{bmatrix}, \quad
I = \begin{bmatrix}
  1 & 0 & \ldots & 0 \\
  0 & 1 & \ldots & 0 \\
  \vdots & \vdots & \ddots & \vdots \\
  0 & 0 & \ldots & 1
\end{bmatrix},
\]

and
\[
A = \begin{bmatrix}
  a_{11} & a_{12} & \cdots & a_{1n} \\
  a_{21} & a_{22} & \cdots & a_{2n} \\
  \vdots & \vdots & \ddots & \vdots \\
  a_{n1} & a_{n2} & \cdots & a_{nn}
\end{bmatrix}
\]

The general solution of these equilibrium equations for the unknown \(x\)'s in terms of the given \(y\)'s can be presented in the following form:

\[
x_1 = A_{11}y_1 + A_{12}y_2 + \ldots + A_{1n}y_n \\
x_2 = A_{21}y_1 + A_{22}y_2 + \ldots + A_{2n}y_n \\
\vdots \quad \vdots \quad \vdots \quad \vdots \quad \vdots \\
x_n = A_{n1}y_1 + A_{n2}y_2 + \ldots + A_{nn}y_n
\]

(5.6)

The constants \(A_{ij}\) are the multipliers indicating by how much \(x_i\) would increase if \(y_j\) were increased by one unit. \((5.6)\) can be written alternatively as

\[
x = (I - A)^{-1} y = A y
\]

(5.7)
where the matrix

\[
A = \begin{bmatrix}
A_{11} & A_{12} & \cdots & A_{1n} \\
A_{21} & A_{22} & \cdots & A_{2n} \\
& \cdots & \cdots & \cdots \\
A_{n1} & A_{n2} & \cdots & A_{nn}
\end{bmatrix}
\] (5.8)

is the inverse of the matrix

\[
\begin{bmatrix}
(1 - a_{11}) & -a_{12} & \cdots & -a_{1n} \\
-a_{21} & (1 - a_{22}) & \cdots & -a_{2n} \\
& \cdots & \cdots & \cdots \\
-a_{n1} & -a_{n2} & \cdots & (1 - a_{nn})
\end{bmatrix}
\] (5.9)

Only if all the \( A_{ij} \) are nonnegative will there necessarily exist a set of positive total outputs for any given set of final deliveries. A sufficient condition for the nonnegativity of the \( A_{ij} \) is that in the structural matrix \([a]\) the sum of the coefficients in each column (or in each row) be not larger than one and that at least one of these columns (or row) sums be smaller than one.

This real input-output system has a dual price system where the price that each productive sector receives must equal its total payments per unit of output for inputs purchased from itself and from other industries, plus a "value added" per unit of output, which essentially represents payments made to the exogenous sectors. Defining \( p_i \) as the price received by industry \( i \) and \( V_i \) as the value added by industry \( i \) per unit of output, these equations are
Each equation describes the balance between the price received and payments made by each endogenous sector per unit of its product; \( V_i \) represents the payments made by sector \( i \), per unit of its product, to all exogenous (that is, final demand) sectors. \( V_i \) usually consists of wages, interest, profits, and taxes paid to the government and so on.

The solution of the price equations (5.10) or (5.11) allows the determination of prices of all products from given values added by each sector. The solution can be written as

\[
\begin{align*}
    p_1 &= A_{11} V_1 + A_{12} V_2 + \cdots + A_{1n} V_n \\
    p_2 &= A_{21} V_1 + A_{22} V_2 + \cdots + A_{2n} V_n \\
    \vdots & \quad \vdots \quad \vdots \quad \vdots \\
    p_n &= A_{n1} V_1 + A_{n2} V_2 + \cdots + A_{nn} V_n
\end{align*}
\]

or,

\[
    p = (I - a^{-1}) V = A' V
\]

The constant \( A_{ij} \) measures the dependence of the price of the product of sector \( j \) on the value added by sector \( i \). Only if all the \( A_{ij} \) in the
price solution are nonnegative will there necessarily exist positive prices allowing each sector to balance exactly its input-output accounts in value terms for any given set of positive values added. Since $A_{ij}$ in the price solution equals $A_{ji}$ in the output solution, this condition is the same as that needed to assume positive outputs for any given set of final demands.

Exports can be introduced by considering them as an addition to the final demand vector. Thus, if only commodity $l$ is exported, the final demand column is given by

$$[y_1] + \Delta y_1 = y + \Delta y_1,$$

where $y = [y_1]$

$$\begin{bmatrix}
y_1 \\
y_2 \\
\vdots \\
y_n
\end{bmatrix}
$$

and

$$\Delta y_1 = \begin{bmatrix}
\Delta y_1 \\
0 \\
\vdots \\
0
\end{bmatrix}$$

Thus, the total output needed to meet the final demand of $y + \Delta y_1$ is, by relation (5.7), given by

$$x + \Delta x_1 = A [y + \Delta y_1] = Ay + A \Delta y_1$$

It follows that when $\Delta y_1$ is exported the total resource set used to produce it is given by $\Delta x_1 = A \Delta y_1$. This set constitutes the opportunity cost of exporting $\Delta y_1$. This set of resources could have been used to produce some other domestic goods.
When $\Delta y_2$ is imported, the domestic production of $y_2$ is reduced by an equivalent amount to meet the home demand for $y_2$. This reduction in domestic production releases certain amount of resources, $\Delta x_2 = A\Delta y_2$, which is obtained as follows:

$$x - \Delta x_2 = A[y - \Delta y_2],$$

where

$$\Delta y_2 = \begin{bmatrix} 0 \\ \Delta y_2 \\ \vdots \\ 0 \end{bmatrix}.$$

These released resources can be utilized to produce other commodities. This is the opportunity gained by the society from importing $\Delta y_2$.

The net gain to the society of exporting $\Delta y_1$ in exchange for an import of $\Delta y_2$ can be expressed as

$$A\Delta y_2 - A\Delta y_1.$$

Similarly, for the other country which exports $\Delta y_2$ to import $\Delta y_1$, the net gain to that country will be given by

$$A\Delta y_1 - A\Delta y_2.$$

If the superscripts $S$ and $N$ are used for the South and the North respectively, the condition for the North to gain more than the South from trade between them so that there is unequal exchange according to the criterion adopted, will be given (Appendix I) by

$$(5.14) \quad (A^S \Delta y_2 - A^S \Delta y_1) < (A^N \Delta y_1 - A^N \Delta y_2).$$
Such a formulation in terms of total resources can also be made for Emmanuel's concept of unequal exchange, which has been called non-equivalent exchange here. Since $A^S \Delta y_1$ is the total resource cost of the South to export $\Delta y_1$ and $A^N \Delta y_2$ is the total resource cost of the North to export $\Delta y_2$, the South will suffer from unequal exchange if

\[ (5.15) \quad A^S \Delta y_1 > A^N \Delta y_2 \]

The relations (5.14) and (5.15) give the conditions for asymmetric and non-equivalent exchange when all resources are taken into account. The formulation of unequal exchange that has been adopted here is given by the relation (5.14). In this formulation the concept of disjunctive exchange has no separate measure since the total amounts of resources gained and lost by the society over time is captured by the relation (5.14). This is equivalent to total developments following from trade which the concept of disjunctive exchange tries to evaluate. The only difference is that the concept of disjunctive exchange gives more weight to spinoff effects that might follow from trade. The present formulation of the asymmetric exchange cannot take account of these effects, because the I-O coefficients will usually change over time. Thus, if the I-O coefficients are appropriately changed over time, the present formulation of the asymmetric exchange will tend to coincide with the formulation for the disjunctive exchange.

The relations (5.14) and (5.15) showing the conditions for asymmetric exchange and non-equivalent exchange respectively are
expressed in terms of matrices. To make it more manageable and meaningful, the following analysis assumes labor as the only primary factor of production - a method standardized by Leontief (1968). This leads to an adoption of the labor theory of value. But, here the difference is that total labor costs would be different from direct labor costs, for total labor costs include not only direct labor costs but indirect labor costs as well. Thus, the implicit value theory in the Leontief open system is different from the simple labor theory of value. It contains an implicit labor theory of value in the sense that equilibrium prices for all final demands would be proportional to the total labor requirement coefficients (Lancaster, 1968). The total labor requirement coefficient for industry \( j \) is obtained by operating the whole system so as to produce a net output of one unit of \( j \) and zero net outputs elsewhere. An equilibrium set of prices in this context means a set of prices which is such that, if the wage level just enables labor to purchase the net output of the economy, profits are exactly zero in all industries. If \( x' \) is the vector for unit operation of \( j \) and zero operation elsewhere, then from (5.6) and (5.7), \( x' \) is given by

\[
x' = A_j
\]

since

\[
x' = (1 - a)^{-1} \begin{bmatrix} 0 \\ \vdots \\ 1_j \\ 0^j \\ \vdots \\ 0 \end{bmatrix} = A_j
\]

(5.17)
and the total labor requirement for unit operation of \( j \), which is labeled \( a_{0j} \), is given by

\[
(5.18) \quad a_{0j} = a_0 x^* a_0 A_j = \sum_{i} a_{0i} A_{ij}
\]

where \( a_0 \) is the vector of input coefficients for labor and the element \( a_{0j} \) in this vector is the total labor input coefficient for industry \( j \) (Appendix 2). The relationship between the total labor content and the price can be illustrated by a simplified two-industry economy. The constraint imposed by the total availability of labor determines the consumption-possibility frontier of the economy (Dorfman, Samuelson and Solow, 1958). If \( x_0 \) is the total supply of labor available to the economy, then it is given by

\[
(5.19) \quad a_{01}x_1 + a_{02}x_2 = x_0
\]

But the gross outputs, \( x_1 \) and \( x_2 \), can be expressed as linear functions of the final demands shown in (5.6). Thus,

\[
(5.20) \quad x_1 = A_{11}y_1 + A_{12}y_2
\]

\[
(5.20) \quad x_2 = A_{21}y_1 + A_{22}y_2
\]
Substitution of (5.20) into (5.19) gives

\[ a_{01}(A_{11}y_1 + A_{12}y_2) + a_{02}(A_{21}y_1 + A_{22}y_2) = x_0 \]

or,

\[ (a_{01}A_{11} + a_{02}A_{21})y_1 + (a_{01}A_{12} + a_{02}A_{22})y_2 = A_{01}y_1 + A_{02}y_2 = x_0 \]

(5.21)

where \( A_{01} \) represents the direct and indirect labor content in a unit of final consumption of commodity 1, and \( A_{02} \) the total direct and indirect labor content in a unit of final consumption of commodity 2.

This linear consumption possibility frontier (Figure 5.1) has the constant marginal rate of substitution given by \( -(\frac{dy_2}{dy_1}) = \frac{A_{01}}{A_{02}} \). In equilibrium the relative prices of the two commodities is the same as the marginal rate of substitution. Thus, we have \( \frac{p_1}{p_2} = \frac{A_{01}}{A_{02}} \). Since \( A_{01} \) is the total content of 1 unit of final output of commodity 1, and since labor is the only cost-generating element in the system, we have in equilibrium in the sense defined above

\[ p_1 = A_{01}w = (a_{01}A_{11} + a_{02}A_{21})w \]

(5.22)

\[ p_2 = A_{02}w = (a_{01}A_{12} + a_{02}A_{22})w \]

where \( w \) is the wage rate.
FIGURE 5.1. CONSUMPTION-POSSIBILITY FRONTIER FOR AN ECONOMY PRODUCING TWO GOODS X AND Y WITH A GIVEN AMOUNT OF LABOR
In general, let $p$ be a price vector proportional to the total labor requirements vector, so that $p = k \cdot a_0$ where $K$ is an arbitrary vector. If the final demand vector is $c$, the value of final demand is $pc$. If $L$ is the total labor used to produce this bill of goods, then $L = a_0c$. But, if the wage rate, $w$, is such that labor can just buy the bill of goods, it follows that $wL = w'a_0c = pc = ka_0c$, so that $w = k$.

It can be shown that, at the labor theory of value prices, the labor intensity of unit values of all commodities is the same. Since direct labor varies from industry to industry, this highlights the point that direct labor coefficients do not properly represent relative labor intensities. Since the labor input coefficients vectors vary from country to country, the labor theory of value prices for the same goods in different countries would differ, providing a scope for gainful trade.

With this new perspective, the concepts of non-equivalent and asymmetric exchanges which were originally framed in terms of direct labor exchanged and direct labor-time saved respectively can be reformulated. A proper view of the labor theory of value needs total, rather than direct, labor to be taken into consideration. If the South exports $\Delta y_1$ at the given commodity terms-of-trade, the total labor requirement for $\Delta y_1$ is, from (5.18), equal to $(\sum_i a_{1i} S_{0i} A_{i1}) \Delta y_1$ in the South. Similarly, the total labor requirement to produce $\Delta y_2$ in the North is $(\sum_i a_{1i} N_{0i} A_{i2}) \Delta y_2$. Thus, equivalent exchange would imply

$$\sum_i a_{1i} S_{0i} A_{i1} \Delta y_1 = \sum_i a_{1i} N_{0i} A_{i2} \Delta y_2$$

(5.23)
If only direct labor is considered, equivalent exchange would imply

\[(5.24) \quad a_{01}^S \Delta y_1 = a_{02}^N \Delta y_2\]

The two expressions on either side of (5.23) give the total amounts of labor needed to produce the exports in the respective countries. Thus, the exports of goods are transformed into exports of labor from the respective countries. In a similar way imports of goods are equivalent to savings of domestic labor. Thus the total amount of labor saved through the import of \(\Delta y_2\) in the South is \((\sum_i a_{0i}^S A_{12}^S)\) \(\Delta y_2\) and the total amount of labor saved through the import of \(\Delta y_1\) in the North is \((\sum_i a_{0i}^N A_{11}^N)\) \(\Delta y_1\). Thus, taking the left-hand expression in (5.23) into account, the net gain to the South will be given by

\[(5.25) \quad \left( \sum_i a_{0i}^S A_{12}^S \right) \Delta y_2 - \left( \sum_i a_{0i}^S A_{11}^S \right) \Delta y_1\]

while the net gain to the North is

\[(5.26) \quad \left( \sum_i a_{0i}^N A_{11}^N \right) \Delta y_1 - \left( \sum_i a_{0i}^N A_{12}^N \right) \Delta y_2\]

Thus, asymmetric exchange would imply that (5.25) and (5.26) are not equal to one another. If \(\Delta y_1\) and \(\Delta y_2\) are in value terms, (5.25) and (5.26) will give the net gains to the respective economies in value terms.

So far as the disjunctive exchange is concerned, it can be pointed out that since the concept of asymmetric exchange has been developed to take account of the total net gains to the societies
involved, the two concepts tend to coincide when the I-O coefficients are properly adjusted over time to consider the spinoff effects of trade.

From the above analysis certain corollaries follow:

(a) There can exist non-equivalent exchange in Emmanuel’s sense, but unequal exchanges in the present sense may not exist. Of course, both can co-exist. It might be possible for the extent of non-equivalence to be greater if measured by the adopted formulation than by Emmanuel’s measure.

(b) Asymmetric exchange in Shanin’s (see Anderson, 1976) sense can exist, but unequal exchange in the present sense may not. Of course, both can co-exist. Again, the asymmetry can well be greater if measured by the present formulation rather than by Shanin’s measure.

(c) All the three aspects of unequal exchange can be present at the same time.

(d) A "poor" country may gain more than her "rich" partner. In that case unequal exchange would favor the poor country against its rich counterpart. As relations (5.25) and (5.26) show, this might happen as a result of either, or both, the following factors being present. In the first place, the commodity terms of trade may be heavily in favor of the poor country. This is quite plausible if the poor country is "small". If her rich partner is "big", then the equilibrium terms of trade will invariably tilt in favor of the small country.
Secondly, in many developing poor countries the export sector is a "leading" sector, giving rise to economic externalities such as backward and forward linkages (Hirschman, 1958), availability of labor with different skills (Rosenstein-Rodan, 1943; Scitovsky, 1954), and the training of labor (Myint, 1971; Katz, 1984, Pack and Westphal, 1986). If these externalities are properly taken into account of, the net drain on the economy due to export would be much less. This, together with the terms of trade tilted in favor of the poor country, may result in a poor country gaining more from unequal exchange through trade with a rich country.

That this is a distinct possibility is shown by the following application of the results (5.25) and (5.26) to the case of trade between Ecuador with a "less developed" economic structure and the USA with a "more developed" economic structure. In order to apply the measures (5.25) and (5.26), several assumptions have been made. In the first place, the 87 sector Input-Output Structure of the U.S. Economy: 1963 (Survey of Current Business, November, 1969) has been condensed into a 7 by 7 matrix to make it conformable with the 9 sector Interindustry Transactions Table for Ecuador, 1963 (Yotopoulos and Nugent, 1976), which has also been converted into a 7 by 7 matrix. Secondly, the U.S. table does not contain any row for wages and salaries which is available in the Ecuadorian Table. Wages and salaries of each sector have been calculated from data for value added for each sector by utilizing the fact that "of the total income generated in the U.S. economy each year, about 80 per cent is in the form of wages" (Petersen and Lewis, 1986). It is also noticed that
imports by the United States from Ecuador consist mainly of fish, food, cocoa, coffee, oil seeds, textile and sawmill products, and petroleum and products. These imports have, therefore, been categorized as agriculture. Similarly, the main export items to Ecuador from the United States consist of grains and preparations, vegetable oils, fats, refined waxes, tobacco manufactures, auto parts and chemicals. These have been categorized into the manufacturing sector. Assuming that the value of import is equal to the value of export, the net gains to the USA and Ecuador have been calculated for one dollar worth of export and for one dollar worth of import. The estimated net gain for the U.S. economy for 1963 per unit dollar worth of trade has been found to be .0846953 and that for Ecuador has been found to be .1194266. To the extent that the procedures followed are correct, it shows that it is not the U.S., but Ecuador, which is gaining more from trade between them. Thus, trade between Ecuador and the U.S. during 1963 involved unequal exchange, favoring Ecuador (Appendix 3).
CHAPTER VI

A RECAPITULATION: SOME IMPLICATIONS FOR POLICY

The above analysis has deviated from Emmanuel's (1972) approach in view of the critique developed in Chapter 3 above. The approach that has been adopted here tries not only to get around those criticisms, but also to probe into the problems that developing countries of the present-day world face. They need international trade for development purposes. But, instead of looking at trade as "an engine of growth", they often feel that their gains are smaller than those reaped by the developed countries. The purpose of the present study was to investigate whether or not there was any basis for such a sentiment. It has been suggested that the problem can be studied following the traditional Ricardian lines using Shanin's (see Anderson, 1976) approach to unequal exchange, called the asymmetric exchange. It has the advantage of being able to explain the basis of trade by the fact that both parties stand to gain through trade in a fashion similar to Ricardo's theory of trade. Shanin's approach has been reformulated to take into account not only the direct labor costs, but also the indirect labor costs involved. According to this approach, Ricardo's model as outlined in Chapter 2 can be presented as follows:

\[
\begin{align*}
\text{North} & \\
X & \geq \left( \sum_{i} a_{0i} A_{iX}^N \right) \\
Y & \geq \left( \sum_{i} a_{0i} A_{iY}^N \right)
\end{align*}
\]

\[
\begin{align*}
\text{South} & \\
X & \geq \left( \sum_{i} a_{0i} A_{iX}^S \right) \\
Y & \geq \left( \sum_{i} a_{0i} A_{iY}^S \right)
\end{align*}
\]
If \( \left( \sum_{i} a_{0i} A_{iY} \right) / \left( \sum_{i} a_{0i} A_{iX} \right) \) is less than \( \left( \sum_{i} a_{Si} A_{siY} \right) / \left( \sum_{i} a_{Si} A_{siX} \right) \) the North has a comparative advantage in the production of \( Y \), and it will produce and export \( Y \) in which the South enjoys a comparative advantage. The equilibrium terms of trade \( (P = P_X / P_Y) \) would be somewhere between \( \left( \sum_{i} a_{0i} A_{iX} \right) / \left( \sum_{i} a_{0i} A_{iY} \right) \) and \( \left( \sum_{i} a_{Si} A_{siX} \right) / \left( \sum_{i} a_{Si} A_{siY} \right) \) and not between 5/2 and 1/2 as in the Ricardian model, because the total labor costs are usually different from the direct labor costs. The gains from trade can be calculated by using the relation (5.25).

Lewis's (1969) presentation can be similarly reformulated as below:

Steel Food Coffee

North \( 3 >= <1/(\sum_{i} a_{0i} A_{iSi}) \) \( 3 >= <1/(\sum_{i} a_{0i} A_{iFi}) \)

South \( 1 >= <1/(\sum_{i} a_{Si} A_{siFi}) \) \( 1 >= <1/(\sum_{i} a_{Si} A_{siCi}) \)

According to this presentation the equilibrium terms of trade may or may not be 1:1. If now there is technical progress in the production of coffee in the South, it will reduce not only the direct labor costs of producing coffee in the South, but it will reduce the indirect labor costs of producing coffee, as well. This implies that the terms of trade would deteriorate further than could be expected in the Lewis's framework. As has been pointed out in Chapter 2, technical progress in the export sector tends to deteriorate the terms of trade not only in the case of a developing country, but in the case of all countries as well. Similarly, technical progress in the non-traded food sector improves the terms of trade of all countries irrespective of whether they are developed or developing ones.
But, it can be pointed out these Lewis-like results need to be examined more carefully since they depend on two critical implicit assumptions, namely that (a) there are only three commodities, of which two are traded, and that (b) the non-traded good is the same in both the countries. The latter assumption implies that the opportunity costs of the traded goods can be measured in terms of the common non-traded good, which is food in the Lewisian model.

If these two assumptions are relaxed to take account of more than three commodities and non-common, non-unique and non-traded goods, then there are no unique opportunity costs of the traded goods. This is more realistic than the case envisaged by Lewis (1969). In this situation the opportunity costs cannot be calculated in terms of other good or goods in general; they have to be calculated in terms of the total resource costs, which are total labor costs in the present case. The total labor costs of producing different commodities in their turn are equivalent to their equilibrium prices in the Leontief labor theory of value. Several results follow. In the first place, technical progress in the exportable sector of any country will tend to reduce the price of the exportable good, deteriorating the terms of trade. To the extent technical progress reduces the amounts of other commodities needed, in addition to reducing the amount of labor needed, the deterioration in the terms of trade would be still higher. In the case of a "big" country, this can lead to Bhagwati's (1958) "immiserizing growth" case.

Secondly, the exportable sector is a "leading" sector that generates favorable economic externalities in many developing
countries. In that case, the technical progress in the exportable sector will "spillover" to other sectors including the non-traded sectors. This will improve the terms of trade, and it might even be imagined that the benefits to the non-traded sector is so very great that the net result can be an improvement in the terms of trade. This externality factor can perhaps explain why over time the terms of trade are not reduced to zero in the face of continued technical progress. Of course, there are other factors restricting this tendency, namely, that there can be technical improvements in the non-traded sectors and that there can be technical improvements in the foreign country's exportable sector as well.

Thirdly, in an I-O framework with more than one non-traded good, technical progress anywhere in the non-traded sector, including the food sector, can even deteriorate the country's terms of trade through a reduction in the price of the exportable commodity. This result goes totally against Lewis's (1969) predictions.

Finally, since the concept of a just price in the sense of a Paretian optimum price cannot capture externalities, the exportable sector may have to be treated as a "leading" sector. In that case the concept of unequal exchange in Emmanuel's (1972) sense cannot be justified for it does not take into consideration the impacts of changes in the export sector on other sectors of the economy. In this respect, the concept of disjunctive effect would be more appropriate. The measure suggested here would then need necessary modifications to take account of changes in the I-O coefficients over time.
A. Policy Considerations

Policy questions can be considered with reference to the fact that unequal exchange implies that

$$W^*/W \neq 1$$

From (2.5) we have

$$f = \frac{W^*}{W} = \frac{MPL_X^*/MPL_Y^*}{P_X^*/P_Y^*} = MPL_X^*/MPL_Y^* \cdot t$$

If as a result of technical progress $MPL_X^*$ rises, but $W^*$ cannot rise because of institutional factors, it will imply a fall in $P_X^*$ leading to a deterioration of the terms of trade. As previously pointed out, there is a tendency for the price to fall everywhere following a technical progress in the sector concerned. But, if the rise in productivity is followed by a proportional rise in the wage rate, the price will not fall. In many labor-surplus countries the wage rate can be considered as something constant, being determined largely in the agricultural sector and not particularly responsive to changes in productivity elsewhere. These countries are most likely to suffer from a greater amount of deterioration in the terms of trade due to technical improvement in its exportable sector. Since the wage rate does not change, the effect of technical progress leads to a greater reduction in the price of the export good leading to a sizeable decline in the terms of trade. The beneficial effects of technical progress would be transmitted to the foreign country to a large extent.
The policy conclusions from the above discussion are that mechanisms must be found to increase the wage rate if the terms of trade are to be improved. The most general and basic of the policy measures would be population control. Without this, all other policy prescriptions can only have temporary effects. It is so basic that its importance cannot be overemphasized. Secondly, unionization would help to improve the employed laborers' position vis-a-vis the employers. As a result, there would be greater chances of wage increase following technical progress. Thirdly, wage rise can be tagged to profit or productivity rise. This also would require strong unions.

The relations (5.25) and (5.26), which use the real aspects of the terms of trade, imply that the gains from trade depend not only on the commodity terms of trade, but also on the I-O coefficients. The I-O coefficients depend on technical knowledge, labor productivities and so on. Improvement in labor productivities, particularly in contrast to the low productivity of labor in agriculture in the "poor" countries, has, as it has been pointed out above, an adverse effect on the commodity terms of trade. In this respect, developing countries seem to be caught in an inextricable trap. Thus, what is apparent from the above discussion is that the concept that trade is "an engine of growth" should be more carefully examined. In the initial stages of economic development, when a lot of externalities can be expected to follow, trade can be regarded as an engine of growth since it is the developing "poor" countries which are likely to benefit more from unequal exchange. After development has been well under way and when
not many externalities can be expected to follow, trade may cease to be an engine of growth, and possibly, the poor country may start to lose most of the benefits from technical programs to its rich partners through trade.

The relations (5.25) and (5.26) also show that the net gains from trade depend not only on the commodity terms of trade, but also on the economic situations prevailing within the economy, as reflected in the input-output coefficients. Thus, for economic development the developing countries will have to change their input-output coefficients, which is tantamount to changing the whole structure of the economy itself. This cannot be expected from trade alone. To the extent export helps to generate demand for the unutilized resources such as unemployed labor and other materials, it is certainly a gain. But export can become a drain on the economy even when private producers may find it profitable to export. Keeping these facts in perspective, we can make the following policy prescriptions to reduce unequal exchange if there is any:

(a) Import and export those commodities whose production involves highest facilities for transfer of technology. The more the non-export sectors gain from such transfer of technology, the better.

(b) Import those commodities which have large total linkage effects. These linkage effects will help development of the entire economy.

(c) Export those commodities that have small total linkage effects. Labor-intensive commodities would be good examples. But, after development has been under way for a considerable time, there will be no special way to distinguish between the two.
(d) Increase labor productivity in all sectors so that the input coefficients can be decreased. Lewis’s (1969) case was a special one, where productivity in food stood for productivities of labor in general in the rest of the economy.

(e) An improvement in the commodity terms of trade will always improve the situation. Thus, it contradicts Bacha’s (1978) contention that a deterioration in the commodity terms of trade is a necessary condition for an improvement in the economic well-being.

(e) Reduce population growth so that W can grow.
REFERENCES


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Appendix 1. Matrix Calculations for Unequal Exchange

Where the North Gains More Than the South

\[ \Delta y_2 = \begin{bmatrix} a_{11} & a_{12} & \ldots & a_{1n} \\ a_{21} & a_{22} & \ldots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \ldots & a_{nn} \end{bmatrix} \begin{bmatrix} 0 \\ \Delta y_2 \\ \vdots \\ 0 \end{bmatrix} = \begin{bmatrix} a_{12} \Delta y_2 \\ a_{22} \Delta y_2 \\ \vdots \\ a_{n2} \Delta y_2 \end{bmatrix} \]

Similarly,

\[ \Delta y_1 = \begin{bmatrix} a_{11} & a_{12} & \ldots & a_{1n} \\ a_{21} & a_{22} & \ldots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \ldots & a_{nn} \end{bmatrix} \begin{bmatrix} \Delta y_1 \\ 0 \\ \vdots \\ 0 \end{bmatrix} = \begin{bmatrix} a_{11} \Delta y_1 \\ a_{21} \Delta y_1 \\ \vdots \\ a_{n1} \Delta y_1 \end{bmatrix} \]

Thus,

\[ [A \Delta y_2 - A \Delta y_1] = \begin{bmatrix} a_{12} \Delta y_2 - a_{11} \Delta y_1 \\ a_{22} \Delta y_2 - a_{21} \Delta y_1 \\ \vdots \\ a_{n2} \Delta y_2 - a_{n1} \Delta y_1 \end{bmatrix} \]

And \( [A^S \Delta y_2 - A^S \Delta y_1] < [A^N \Delta y_1 - A^N \Delta y_2] \) implies

\[ \begin{bmatrix} a_{12}^S \Delta y_2 - a_{11}^S \Delta y_1 \\ a_{22}^S \Delta y_2 - a_{21}^S \Delta y_1 \\ \vdots \\ a_{n2}^S \Delta y_2 - a_{n1}^S \Delta y_1 \end{bmatrix} < \begin{bmatrix} a_{11}^N \Delta y_1 - a_{12}^N \Delta y_2 \\ a_{21}^N \Delta y_1 - a_{22}^N \Delta y_2 \\ \vdots \\ a_{n1}^N \Delta y_1 - a_{n2}^N \Delta y_2 \end{bmatrix} \]
Appendix 2. Matrix Calculations for Unit Operation of the jth Sector

\[ a_0 = \begin{bmatrix} a_{01} & a_{02} & \ldots & a_{0n} \end{bmatrix} \]

and

\[ x^r = (1 - a) \begin{bmatrix} 0 \\ \vdots \\ 1_j \\ 0^j \\ \vdots \\ 0 \end{bmatrix} = A_j = \begin{bmatrix} 0 & 0 & \ldots & A_{1j} & 0 \\ 0 & 0 & \ldots & A_{2j} & 0 \\ \vdots & \vdots & \ddots & \vdots & \vdots \\ 0 & 0 & \ldots & A_{nj} & 0 \end{bmatrix} \]

Therefore,

\[ a_{0j} = \begin{bmatrix} a_{01} & a_{02} & \ldots & a_{0n} \end{bmatrix} \begin{bmatrix} 0 & 0 & \ldots & A_{1j} & 0 & \ldots & 0 \\ 0 & 0 & \ldots & A_{2j} & 0 & \ldots & 0 \\ \vdots & \vdots & \ddots & \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \ldots & A_{nj} & 0 & \ldots & 0 \end{bmatrix} = a_{01}A_{1j} + a_{02}A_{2j} + \ldots + a_{0n}A_{nj} = \sum_{i} a_{0i}A_{ij} \]
Appendix 3. Input-Output Tables and Calculations for the
Distribution of Gains From Trade Between

Ecuador and the USA

Interindustry Coefficient Matrix for Ecuador, 1963,
Reduced To 7 From 9 Producing Sectors

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If this 7 by 7 matrix is called E, then \((1 - E)^{-1}\) is given by

\[
\begin{array}{ccccccc}
1 & 2 & 3 & 4 & 5 & 6 & 7 \\
1 & 1.0435 & .11312 & .047614 & .18548 & .053918 & .032466 & .010029 \\
2 & .002148 & 1.0022 & .00655 & .02665 & .007705 & .004678 & .001645 \\
3 & .005238 & .00539 & 1.0158 & .06438 & .18858 & .01157 & .002728 \\
4 & .12318 & .12737 & .37739 & 1.538 & .44355 & .26802 & .06516 \\
5 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
6 & .29578 & .2295 & .12125 & .3033 & .13871 & 1.2125 & .01352 \\
7 & .033 & .0292 & .04275 & .0873 & .6248 & .08324 & 1.0346 \\
\end{array}
\]

Since manufacturing goods are imported by Ecuador from the USA, which imports agricultural goods from Ecuador, the net gain to Ecuador for one dollar worth of trade is given by

\[
\left( \sum a_{0i}^{E} A_{i4}^{E} \right) - \left( \sum a_{0i}^{E} A_{i1}^{E} \right)
\]

\[
= \left[ (.18548)(.166) + (.026651)(.283) + (.064379)(.343) + (1.538)(.138) + 0 + (.3033)(.3218) + (.0873)(.6764) \right] \\
- \left[ (.10435)(.166) + (.0021475)(.283) + (.0052377)(.343) + (.12318)(.138) + 0 + (.29578)(.3218) + (.033)(.6764) \right]
\]

\[
=.4293283 - .3099017 \\
= .1194266
\]
Input-Output Coefficients For The U.S. Economy, 1963, Reduced To 7 From 87 Sectors

Row & Column 1 = Livestock; Row & Column 2 = Agriculture; Row & Column 3 = Mining; Row & Column 4 = Construction; Row & Column 5 = Manufacturing; Row & Column 6 = Transport; Row & Column 7 = Others; Row 8 = Labor.

<table>
<thead>
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If this 7 by 7 matrix is called A, the \((1 - A)^{-1}\) is given by

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Because of the pattern of trade between Ecuador and the USA mentioned above, the net gain to the U.S. economy per dollar of trade is given by

\[
(\sum a_{0i} A_{i2}) - (\sum a_{0i} A_{i5})
\]

\[
= [(2.1463)(.2006) + (1.8573)(.415) + (.046911)(.4297) + (.064594)(.3472) + (1.0908)(.2856) + (.14512)(.532) + (.79862)(.545)] - [(2.0191)(.2006) + (.75414)(.415) + (.087824)(.4297) + (.053555)(.3472) + (2.4805)(.2856) + (.16244)(.532) + (.75967)(.545)]
\]

\[
= 2.0678959 - 1.9832006
\]

\[
= .0846953.
\]
VITA
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Candidate for the Degree of
Doctor of Philosophy

Dissertation: A Study in the Distribution of Gains From International Trade

Major Field: Economics

Biographical Information:

Personal Data: Born in Calcutta, India, April 16, 1943, son of Panchanan and Gouri Chakrabarty; married Manju Banerjee December 8, 1980; one son, Biltu.

Education: Attended elementary school and high school at Jiaganj, Murshidabad, India; graduated from Maharaja Manindra Memorial High School, Calcutta, in 1958; received the Bachelor of Arts degree from Calcutta University in 1963, with a major in Economics and Political Science; Received the Masters of Arts degree in Economics from Calcutta University in 1966; completed the requirements for the Doctor of Philosophy degree in Economics at Utah State University in 1988.