TECHNOLOGICAL DUALISM AND UNEMPLOYMENT

IN COLOMBIA

By

Alvaro Silva

A RESEARCH PAPER

Submitted in partial fulfillment of
the requirements for the degree of

MASTER OF SCIENCE

Department of Agricultural Economics
Michigan State University

1972

ACKNOWLEDGMENT

TABLE OF CONTENTS

LIST OF TABLES

ABSTRACT

The problem of unemployment in Colombia is very important for a variety of reasons. A large portion of it can be identified as technological unemployment (defined in section I F). This kind of unemployment is related to the technological dualism, which exists in the economy; i.e. the economy has become divided into a traditional sector and a modern sector, and each of these sectors has a different production function. Technological unemployment arises from technological and resource restraints in both sectors, and due to the current composition of effective demand.

The traditional sector uses a technology which is relatively labor-intensive, and depends heavily on simple tools produced domestically. In contrast, the modern sector uses imported production processes which are relatively capital-intensive and with a limited degree of flexibility in the substitution of labor for capital. But, labor is abundant, and capital scarce, in Colombia. Yet, Colombia's consumers seem to prefer a product-mix with a high proportion of goods produced by the modern sector (sophisticated goods) and a relatively low proportion of goods produced by the traditional sector (simple goods). In providing this product-mix the economy can not reach full employment of labor. The result is technological unemployment.

Technological restraints within the modern sector are not necessarily a result of the inavailability of efficient less capital-intensive techniques. Rather, at least part of the limitations seem to result from the belief that the production

processes of highly developed countries are the best, and partly because of entrepeneurs' previous commitments (patents, parent firm policies, tied loans, etc.).

On the other hand, a lack of search for labor-intensive technologies may be a result of high wage-interest rate ratios, because of strongly unionized labor and artificially low interest rates to the modern sector. This ratio may not differ significantly from factor price ratio existing in developed countries for which the technology was originally designed and, thus, to invest in more information may not be profitable. Furthermore, the adaptation of equipment once it is bought, is discouraged by the artificially high wage-interest rate ratio.

The trend is towards increasing technological unemployment. The rate of mechanization of the traditional sector is near zero. In contrast, the rate of mechanization (percentage increase in horsepower per person employed) of the modern sector is high. Therefore, the two production functions are diverging further in terms of capital-labor ratios. The production functions are also facing changing factor endowments with the high rate of growth of the labor force. And, "sophisticated" goods are becoming more important in the structure of demand while "simple" goods are becoming less important in percentage terms. Therefore, the chances of higher and higher levels of unemployment are increasing due to the changing product mix. Empirically, too, unemployment has been increasing rapidly in recent years.

The ILO Mission of 1970 proposed a program of full employment which, if implemented, would alter these trends. However, dualism

would still continue to remain even by the end of the program in 1985 and the number of people in the traditional sector is likely to increase.

Dualism is viewed in this paper from a narrow point of view; from the point of view of its association with technological unemployment. A broader analysis of dualism in the Colombian economy should, however, take into consideration the welfare implications of dualism.

TECHNOLOGICAL DUALISM AND UNEMPLOYMENT IN COLOMBIA

I. INTRODUCTION

A. THE PROBLEM.

Colombia's gross domestic product (GDP) grew at a rate of about 5% per year during the last decade and at 5.2% per year during the period 1964-70. However, this growth in GDP has not resulted in the full absorption of additions to the active labor force. Rather, total unemployment and underemployment have been increasing. The total shortage of work opportunities was very high in 1970.

In 1970, a task force organized by the International Labor Office (ILO) studied this problem of unemployment comprehensively. Some of its recommendations (41) became government policy in the new development plan for 1970-73 (16).

The problem of unemployment is multidimensional and its nature, complex: There are different kinds of open and disguised unemployment and underemployment and there are different interrelated causes and consequences. This paper only attempts to examine the problem of technological unemployment[1] in Colombia within the framework of a dualistic economy with the objective of shedding some more light on the nature of the general problem of unemployment.

_____

[1]See definition in section I F

1

B. A FRAMEWORK FOR DIAGNOSING THE UNEMPLOYMENT PROBLEM.

The concept of a dual economy was originally developed by Lewis (43). He developed a model consisting of one capitalistic (urban) sector and one subsistence (rural) sector.

Eckaus (23) in his "factor proportions" problem, developed several theoretic models. Some of his models illustrate how real limitations in the technological choices available (or technological restraints) are a major source of labor employment problem in underdeveloped countries. Drawing on these models, this paper uses as framework his two-sector-two-product-model (23; p. 557). He assumes that the production function for good X_1 consists of only two alternative processes. Both processes require relatively high capital-labor ratios. The production function for good X_2 permits the flexible substitution of factors of production. However, this flexibility is limited to an area of relatively low capital-labor ratios.

Given the factor endowments, and the two production functions, it is possible to estimate all the production possibilities. Using geometric techniques Eckaus found that even under the assumptions of perfect competition and profit maximization some extreme maximum output combinations[1] could not reach full employment of one or the other factor of production because of the technological restraints. Clearly, if capital is scarce and labor abundant, the

---

[1]See definition in section I F

production of a combination such as the maximum possible of X_1 and none of X_2 could not result in the full employment of labor, because in the production of X_1 only capital-intensive processes are possible. Thus, if the community demanded any of such combinations with high proportion of X_1 technological unemployment would arise.

It follows that any economic policy which fosters an increase in total demand would not stimulate additional output but rather would create inflationary pressures. Output could only be increased by using additional (perhaps borrowed) units of the factor which is in short supply.

On the other hand, if there are factor price distortions, then the maximum output combinations cannot be reached. Thus, within this model "imperfections in factor markets have several undesirable effects. They reduce the amount of goods available and create a wider range of combinations of goods over which labor may become unemployed, depending on the structure of final demand" (23).

The theory of technological dualism incorporates the above problems of factor proportions. Higgins (38) and Hagen (35), among others, have emphasized the concept of technological dualism in understanding the problem of unemployment. With some small modifications the theory of technological dualism is presented in the following paragraphs.

Dualism is associated with technological unemployment. In this situation "productive employment opportunities are limited, not because of lack of effective demand, but because of resource and technological restraints in the two sectors" (46). The economy is considered to be divided into a modern sector and a traditional sector. The modern sector is made up of large scale firms with a oligopolistic and/or monopolistic structure, facing unionized labor, and using few and relatively capital-intensive production processes. The traditional sector is made up of highly competitive small family firms using traditional labor-intensive processes. The modern sector is mainly urban. The traditional sector is partly urban, but mainly rural.

The adoption of modern technology through imports and/or foreign investment is an important factor in the formation of the modern sector. It has grown fast in terms of the volume and value of investment and output (coupled with a growing effective demand), but has created few additional jobs as a result of the imported capital intensive technology. Labor becomes a surplus factor. The non-dynamic traditional sector becomes the only alternative for the excess labor. The continued absorption of labor by this sector at declining rates of real income and low levels of investment and growth, results in high level of underemployment within the traditional sector. All these factors contribute to a severe problem of unemployment in the economy as a whole.

Assuming a given factor endowment, three factors which contribute to the unemployment problem can be separated. First, the technological restraints of the production functions; second, the composition of demand, and third, factor and product price distortions.

The first and the second can result in technological unemployment. The third, can aggravate the unemployment problem in a dual economy.

C. THE OBJECTIVES OF THIS PAPER.

The main objective of this paper is to examine the problem of technological unemployment in Colombia in the recent past, with special emphasis on technological restraints.

Although the relationships between employment, the product mix and income distribution are not the central topic of this paper, its importance in relation to the specific objectives of this paper will be highlighted.

Moreover, the supply side of the problem in terms of the growth of the labor force, education and training, will not be examined in this paper for reasons of simplicity despite their importance in issues connected with unemployment. Furthermore, factor endowments will be taken as given.

The specific objectives are:

(1) To examine the existence of technological dualism in the economy and its technological restraints.

(2) To analyze the factors taken into account by entrepreneurs when choosing between labor intensive and capital intensive techniques.

(3) To examine the rates of labor absorption by sectors (modern and traditional) and the output-mix trend.

D. METHODOLOGY AND INFORMATION SOURCES.

This paper does not have the objective of empirically testing hypotheses related with the objectives. Therefore, no attempt is made to design a field survey, or a mathematical model, or to make an empirical test of the technological dualism theory. Rather, the attempt is to examine available data and previous studies related to unemployment within the framework of the theory of economic dualism using secondary information sources.

The analysis consists of the selection and methodical presentation of the relevant information in relation to the general and specific objectives. The data are given mainly in an aggregate form and are selected from various national and international sources. The data are then compared and contrasted and general conclusions drawn.

E. ORGANIZATION OF THE REPORT.

Chapter II is a very brief review of the main characteristics of the Colombian economy. It also attempts to define the modern and traditional sectors of the economy.

Chapter III discusses the implications of selecting labor intensive, in contrast to capital intensive, techniques on growth and unemployment. Data available on the techniques used in the modern and in the traditional sectors will also be examined

critically. It tries to identify the existence of two different production functions.and analyze the factors taken into account by entrepeneurs in the selection of techniques, both theoretical and applied, in Colombia. Finally, it examines the trends on the product mix and the rates of mechanization. From the existence of two production functions and the trends in the composition of output, it will be argued that "technological unemployment" does, in fact, exist.

Chapter IV examines the available figures on unemployment and underemployment, labor absorption rates, the rates of labor productivity, and the rates of output growth by sectors. Finally, labor migration between sectors and the ILO full employment program will be discussed.

Chapter V contains general conclusions and economic implications for purposes of policy formulation.

F. DEFINITION OF SOME OF THE CONCEPTS USED.

Technological Dualism: When two different production functions exist in the economy, one for the advanced sector and the other for the traditional sector, there is said to be technological dualism.

Sociological Dualism: "Is the clashing of an imported social system with an indigenous social system of another style ... is a form of disintegration, which came into existence with the appearance of capitalism in pre-capitalistic countries" (46).

Economically Active Population: It comprises people 12 years or older who work in a job, a family-aid receiving no payment but

working at least 15 hours a week and the unemployed who are actively looking for a job. It is synonymous with "labor force".

Economically Inactive Population: This refers to the population 12 years or older who are students, housewives, the retired, the disabled, the elderly and so on.

Open Unemployment: It refers to that percent of the economically active population looking for a job.

Underemployment: Persons working less than 32 hours per week who are seeking additional work, or would do so if opportunities were available.

Disguised Unemployment: Refers to persons without work that would seek work if the level of unemployment were lower. In other words, some person considered to be out of the labor force would become part of the labor force if unemployment were lower.

Technological Unemployment: Is the "redundant labor arising from resource and technological restraints and the structure of demand" (23).

Labor-Intensive Technology: It is a technology of production that permits the combination of relatively large amounts of labor with relatively small amounts of capital, or permits the use of relatively large amounts of labor in relation to output.

Capital-Intensive Technology: "It is a technology of production which permits the combination of relatively large amounts of capital equipment in relation to labor (high capital labor ratio), or in relation to the output produced (high capital

output ratio).[1]

Maximum Output Combinations: It refers to the maximum product that is possible for different combinations of two goods. These are points on the production possibility frontier or transformation curve. The transformation curve represents the limit to the possibilities of producing two goods given their production functions and the factor endowments.

Modern Sector Firm: It is a private or public enterprise which has, on the average, ten or more workers. Furthermore, there are "employer-employee relationships including contractual arrangements in regard to work time and rates of payment" (71).

Traditional Sector Firm: It is usually a private enterprise which employs less than ten persons. It is mainly a family firm which provides self employment, family member employment and employment for friends and neighbors mainly through work sharing.[2] The firm uses traditional labor intensive technology.

"Simple" Goods: Goods produced locally using a high percentage of local raw materials and local equipment and are consumed by the mass of the people.

"Sophisticated" Goods: Those goods involving elaborate production techniques that require special skills and the use of modern equipment in their production. Their use requires comparatively little human effort, i.e., electrical appliances,

---

[1]In this paper the capital labor ratio definition is adopted.

[2]See a similar definition in (71) page 29.

private cars, highly elaborated (precooked, frozen) foods, "luxury" homes, etc.

Atomistic Competition: Conditions prevailing in a market where there are a large number of small firms; there is no product differentiation and no restriction to enter or leave the market.

Oligopoly: A type of market structure in which a small number of firms supply the major portion of an industry's output.

Monopoly: A market structure with only one seller of a particular product.

G. ABBREVIATIONS OF INSTITUTIONS.

INCORA: Colombian Institute of Agrarian Reform.

IDEMA: Governmental Marketing Institute.

ICA: Colombian Institute for Agricultural Research Education and Extension.

DANE: Colombian Statistical Institute (sampling and census).

CAJA AGRARIA: Government bank oriented to serve small and middle-sized farmers.

PIMUR: Rural Urban Marketing Program. It is a food marketing research project by Michigan State University in co-operation with Colombian agencies in the Cauca Valley.

ILO: International Labor Office.

LAFTA: Latin-American Free Trade Association.

CIE: Center for Research in Economics. University of Antioquia.

CEDE: Center for Studies in Economic Development, University of Los Andes.

PREALC: Regional Employment Program for Latin America.

II. THE STRUCTURE OF THE COLOMBIAN ECONOMY

A. GENERAL ECONOMIC CHARACTERISTICS.

Colombia is located in the northwest corner of South America, close to the Panama Canal. Its population was approximately 21 million in 1970 and its crude population growth rate remained steady at about 3.2% annually during the period 1960-1970. The average population density during 1964 was 39 inhabitants per square mile. However, large areas are almost uninhabited; the far southeast,[1] with less than one inhabitant per square mile, and the near-east[2] and Choco in the northwest with 1 to 11 inhabitants per square mile. It was estimated in 1969 that 69% of the land was in forest, non-agricultural and unused. Colombia is four hundred and forty thousand square miles in extent.[3] There has been a significant rural to urban migration during past years such that Colombia now has a predominantly urban population (58% in 1970); there are eighteen cities with more than one hundred thousand inhabitants four of which[4] are referred to as major cities. The population of Bogota, Colombia's capital, was about 2.4 million in 1970.

Agriculture (including live-stock) is the major contributor to the Gross Domestic Product (GDP) (see Table II-1). However, it is declining in importance. But, it continues to provide the largest number of jobs. It also continues to hold a large share of exports.

---

[1] Amazonas, Vichada and Vaupes

[2] Putumayo, Caqueta, Meta and Arauca

[3] About the same size as California and Texas combined

[4] Bogota, Medellin, Cali and Barranquilla

Manufacturing is the second most important sector in terms of contribution to GDP (see Table II-1) and this proportion is rising; it is relatively less important in terms of employment.

TABLE II-1. Gross Domestic Product (GDP) and the Economically Active Population by Economic Sectors - 1970

	Gross Output %		Employment %	
Agriculture	28.3		50.4	
Handicraft	2.8		6.4	
Personal services	6.6		7.3	
Commerce	12.3		7.9	
Construction	3.9		5.4	
		53.9		77.4
Mining	3.6		1.4	
Modern manufacturing	20.0		6.1	
Public utilities	1.4		.2	
Transport	7.7		3.8	
Banking	3.2		1.8	
Other services	10.2		9.3	
		46.1		22.6
TOTAL	100.0		100.0	

Source: Estimated from the National Accounts of the Departamento de Planeacion Nacional.

The average annual per capita income during 1969 was US$ 296. Per capita GDP has increased at an average annual rate of 1.1 percent from 1961 to 1967.

"The economic role of the country's public sector had grown significantly ... This sector was important as developer, owner, and operator of all major public services: telecommunications, irrigation, power, water and sewers, railways, highways, ports

and airports" (75). However, the government continues its clear
preference for an economy dominated by private capital of any
origin.

B. DUALISM IN THE ECONOMY.

1. The modern and the traditional sectors.

Although, the data available is of an aggregate nature it
is possible to differentiate the economy into two sectors the
modern and the traditional. The criterion used in such a division
is the level of productivity per economically active person. The
modern sector has relatively high levels of labor productivity;
the traditional sector has relatively low levels of labor
productivity. It is assumed that sectors using modern technology
also maintain high labor productivity levels. Likewise, sectors
using traditional technology would have low levels of labor
productivity.

A measure of labor productivity is the average value added
per economically active person for each sector. Following this
criterion, mining, transportation and communications, manufacturing,
government services, utilities, and finance, have a higher value
added per economically active person than the average for the whole
economy. Therefore, these areas of economic activity are identified
as the modern sector. Agriculture, commerce, personal services,
craft industry and construction are sub-sectors mostly made up of
traditional firms with low labor productivity.

A similar classification can be made using Thorbeck's
distribution-of-income-per-sector-per-person criterion (69).

Sub-sectors with lower than average per capita incomes form
the traditional sector; those with higher than average incomes
per person constitute the modern sector. Accordingly, the
traditional sector accounted for 35% of disposable income and
79% of the population, while for the modern sector it was 65%
of disposable income and 21% of the population, all during 1966.
Disposable income per economically active person in the modern
sector was seven times more than in the traditional sector (see
Table II-2).

TABLE II-2. Disposable Income per Economically Active Person

by Economic Sectors in 1966

Sector	Pesos per person ,000 $s	Percent of population
A. TRADITIONAL	1.43	79.0
1. Agriculture	1.29	45.8
2. Personal services	1.05	14.1
3. Craft industry	1.27	7.2
4. Commerce	2.19	8.2
5. Construction	3.05	4.3
B. MODERN SECTOR	10.1	21.0
6. Mining	3.17	1.4
7. Transportation and communications	4.31	3.7
8. Modern manufacturing	4.46	5.5
9. Government services	5.35	4.1
10. Finance	8.58	1.1
11. Utilities	9.86	.2
12. Top 5% of all sectors	26.70	5.0
C. TOTAL	3.25	100.0

Source: Adapted from Thorbecke (69).

In the traditional sector there are some "modern" firms. Thorbeck's (69) data permits an arbitrary separation of these "modern" firms from the traditional sector. These "modern" firms are classified as the "top 5% of all sectors" in Table II-2. Thus, this classification gives a better approximation of the "pure traditional" and modern sectors. The actual separation of "modern" firms from certain traditional sub-sectors is very difficult and has not, therefore, been attempted. So that, the traditional sector would include some modern firms and is only an approximation of a "pure traditional sector".

The traditional and the modern sectors described herein have their counterparts in the four sectors considered in the ILO report (41). These are: "Agriculture: agriculture, fishing, and forestry. Alpha: Capital-intensive and skill intensive - mining, modern manufacturing, public utilities and transport. Beta: neither capital-intensive nor skill-intensive - construction, hnadicraft, manufacturing, commerce, catering and personal services. Gamma: skill-intensive - banking, insurance, public administration, other services" (41). Thus, the traditional sector would include agriculture and the Beta sector (less the top 5% of each sector). This permits us to qualify the sector as neither capital, nor skill intensive (or in general labor-intensive) following the ILO criterion.

The modern sector would include the Alpha and Gamma sectors (plus the top 5% of agriculture and the Beta sector), and is skill-intensive and/or capital-intensive. If skills are considered as human capital, then the modern sector may be only referred to as being capital-intensive.

2. Market structure within each sector.

In this paper market strcuture is used as an indicator of competitive performance. Market structure is defined as "those characteristics of the organization of a market which seems to influence strategically the nature of competition and pricing within the market (8). The market structure variables used in the following paragraphs are the number, relative and absolute size of the firms within each industry, and the conditions of entry and exit.

The modern sector of the economy has an oligopolistic or monopolistic structure. The data available in this respect is mainly on manufacturing. "One company dominates the tobacco industry. Directly and through stock ownership one company dominates the beer industry, three financial groups control the cement industry. Three companies consume 84% of all raw cotton produced and are entering the synthetic fiber field. One company dominates aviation, and one has favored position in maritime transport. Two companies supply all the domestically produced steel..." (14). Three retail distributors served the market of refined oil (motor gasoline, fuel oil, diesel oil, kerosene and others). Esso (Standard Oil of New Jersey) 60%, Codi-Mobil 23%, and Texaco 17%. Despite the existence of some 3,000 food processing establishments, a few large companies produce the bulk of canned and packaged foods found in the large supermarkets servicing the higher income areas. Entry and exit are limited due to monopolistic practices and government rules and policies.

In contrast, the industries in the traditional sector are made up of many small firms, most of them family firms. In agriculture INCORA estimated a total of 1.8 million farms[1] .81% of these farms were less than 10 hectares in extent (40). Thus, the structure of traditional agriculture is atomistic competition.

A similar situation is found in commerce other than in the modern commerce sub-sector. For many products, especially fruits and vegetables, and especially at the retail level, there are many competitors. "In looking at the urban food distribution system which services Cali, one is struck by the resemblance to a pure competition model. The structure is one of atomistic competition with generally easy entry and exit for the large number of small-scale retail and wholesale units" (53).

The relatively high percent of people in craft industry and personal services (see Table II-2), and their individual, family, or artisanal basis of organization, permits us to believe that a form of "atomistic competition", with easy entry and exit, prevails.

In sum, the traditional sector may be considered to be an atomistically competitive market structure. This market structure may not be applicable for the construction sub-sector.

C. THE FOREIGN SECTOR.

This section gives one explanation of how a modern sector has developed in the Colombian economy.

---

[1]Excluding Choco, Guajira, Arauca, Vichada, Guainia, Amazonas and Putumayo.

Colombia's exports were about 9% of its GDP during 1970.
Coffee continued to be the most important export, but its
importance is decreasing.[1] Except petroleum and fuel-oil (10%
of exports) exports have relatively high labor-content (coffee,
cotton, banana, sugar and textiles). According to the projections
of the development plan for 1970-73 (16), coffee exports are
expected to increase at a rate of about 2.5%. Petroleum exports
would fall at a rate of about 7.5%. Minor exports are expected
to increase at a rate of 2% after 1971. It is anticipated that
services would increase significantly. These growth rates are
based on reaching a target of a 7.5% rate of growth of the GDP
and this is expected to reduce (a) open unemployment by 2% (from
8.4% in 1970 to 6.4% by 1973) and (b) open unemployment in the
urban sector from 11 to 8.5% by 1973. Export production is likely
to provide more jobs not only because of its anticipated growth
rate but also because its composition seems to tend towards products
with high labor content.

The major clients for these exports are the US and West
Germany. The share of the US has been decreasing slightly. (See
Table II-3).

Foreign exchange receipts from exports, foreign aid and
foreign investment have been used mainly to import capital and
intermediate goods for the "industrialization" of the modern

---

[1]Coffee exports contributed 71% of total exports during
1960 but 62% by 1970.

sector. The major suppliers of imported goods are highly
developed countries; the US, West Germany and the United
Kingdom. These three countries were the source of about 55%
of all imports during 1970. Colombia has a deficit trade
balance with these countries. The highest trade deficit is
with the US (around $ 140 million in 1970).

TABLE II-3. Major Buyers of Colombia's Exports: (Percent)

Country		Year	
	1964	1966	1970
The US	54.1	43.6	38.0
West Germany	13.7	13.6	15.0
LAFTA	4.8	7.8	7.8
Netherlands	5.5	4.3	5.5
Spain	3.2	5.0	5.5
Other	18.7	25.7	28.2
TOTAL	100.0	100.0	100.0

Source: Revistas del Banco de la Republica, Bogota, Colombia.

This deficit indicates a major preference for imports from
highly developed countries, especially the US (see Table II-4).
Imports of consumers goods are relatively low as a result of
restrictions rather than a lack of effective demand. The control
of imports is an important part of the implementation of the
government's policy of import substitution. Consumer goods accounted
for about 10% of all registered imports. If tourism and unrecorded
imports are reckoned, imports of consumers goods would be about
20% of total imports. This leaves about 80% for the import of
capital and intermediate goods.

TABLE II-4. Origin of Imports: (Percent)

==

Country	Year 1964	1966	1970
The US	48.4	48.0	47.8
West Germany	9.6	11.1	8.5
Japan	3.7	3.5	6.3
Spain	2.7	1.9	5.2
United Kingdom	5.9	5.5	4.0
Others	29.7	31.4	28.2
TOTAL	100.0	100.0	100.0

Source: Calculated from data in Revistas del Banco de la
Republica.

D. IMPORTS AND THEIR IMPACT ON THE TRADITIONAL AND MODERN SECTORS.

Imported technology is largely used in the production
processes of the modern sector. From Colombia's input-output (69)
it is possible to glean out the distribution of imports of capital
and intermediate goods between the two sectors. (See Table II-5).
Approximately 94% of all imports of capital and intermediate goods
serve the development of the modern sector, especially manufacturing.

Since manufacturing is the biggest absorber of imported
producers goods, it would be well to review how important imports
are in the total value added. For manufacturing as a whole, the
value added by imports as a percent of total output is about 13.5%.[1]
If the out-flow of profits and royalties from some of the inputs
produced domestically were also included as imports, this

---

[1] Estimated from the input-output table - 1966 (69).

co-efficient would be higher. And, if capital goods are also included, it would be around 25%. In sum, imports of capital and intermediate goods are important in the development of the modern sector, particularly of manufacturing.

TABLE II-5. Distribution of imports among the different sectors of the economy. 1966. Colombia

Sector	Intermediate goods %	Final[1] goods %	Intermediate plus final[1]
TRADITIONAL	2.6	9.1	5.9
Agriculture	1.4	-	0.7
Services and Commerce	0.0	9.1	4.6
Construction	1.2	-	.6
MODERN SECTOR	97.4	90.9	94.1
Mining	1.2		.6
Transportation and Communication	2.8	9.7	6.3
Manufacturing	93.2	81.2	87.1
Finance	-	-	-
Utilities	0.2	-	.1
TOTAL	100.0	100.0	100.0

[1]This also includes consumers goods. However, these are only a small proportion (approx. 10%) of all imports.

Source: Calculated from the Colombian input-output table (69).

Imports are important in the development of manufacturing. Manufacturing provides simple tools for agriculture. Therefore, imports seem to have an indirect impact on the development of agriculture and the whole traditional sector. However, the data indicate that manufacturing only contributes 5% of the gross

output in agriculture through intermediate goods.[1] But, manufacturing provides in intermediate goods about 35% of the gross output from construction.

Manufacturing mainly provides consumer goods. About 53% of the gross output of manufacturing is sold as consumer goods. Therefore, the effect of manufacturing on the traditional sector is rather in terms of the demand for intermediate goods and services. Almost 20% of the gross output of manufacturing consisted of intermediate goods and services provided by the traditional sector (14% from agriculture).[2]

In summary, Colombia has two sectors of production. The modern sector, with high levels of labor productivity, depends mainly on imports of intermediate and capital goods. This sector essentially produces consumers goods. And the traditional sector, with low levels of labor productivity has an important export share. This sector does not depend on imports, but rather on some intermediate and capital goods produced by manufacturing. Most of the population belongs to the traditional sector.

---

[1]Input-output, table - 1966.
[2]Ibid.

III. TECHNOLOGY, GROWTH AND UNEMPLOYMENT

This chapter is a theoretic discussion of the problem of technological unemployment, the different technological alternatives, the factors taken into consideration when choosing techniques, and the complications which appear when problems such as price distortions also exist. Later, it is applied to the Colombian case.

A. TECHNOLOGY AND DEVELOPMENT.

1. Technology - modern and traditional.

Technological progress is defined as shifts in "the production function that either permits the same level of output to be produced with less input, or enables the former level of inputs to produce a greater output" (26). There are many different ways for shifting the production function upwards: by increasing the efficiency of the labor force through formal education; practical training or learning on the job; by changing and improving institutions; better management, organization of work procedures and motivations; or by improving the tools used in the production processes.

From a static point of view "technology refers not only to tools, a stockpile of utensils, but also to a kind of tool using behavior, a set of methods for making specific goods" (67). This paper refers only to the technology embodied in capital and intermediate goods and to the product-mix selected. Technology involves choice of the product-mix (i.e. cotton vs. synthetic fibers).

23

2. Modern technology and the under-developed countries.

Underdeveloped countries have great difficulties in developing technologies more relevant to available factor proportions. Almost all research and development in new technology in the world is carried out by the developed countries, and directed towards satisfying their requirements. "The dominant fact of international life is that, it is the richer countries, with one third or less of the world's population, which account for 99% of the world's scientific and technological innovation" (63). Underdeveloped countries do not seem to realize the need to create their own technology. Instead, they import or copy those of the developed countries. This issue is highly related to the problem of unemployment and underemployment. An appropriate technology is an important variable in development strategy for the Less Developed Countries (LDCs).

Marsden (44) and others argue that technology transferred directly from the highly industrialized countries is not always appropriate for the poor countries. In the advanced countries labor is scarce and dear, and capital relatively plentiful and cheap. Large scale capital intensive production is not efficient if markets are small and scattered and if there are problems of management and technical skills. These conditions exist in underdeveloped countries resulting in the waste of at least part of its scarce capital resources: The social opportunity cost of capital can be very high in the LDCs.

Furthermore, advanced technology tends to reduce both employment and real income. Even when run below capacity, advanced machinery can often make products cheaper than it is possible by traditional methods in such a way that the new product, replaces the traditional ones. Displaced workers may not be absorbed into the new factory because machinery is being employed instead. Consumers may receive benefits through lower prices, but this may be offset by a decline in the average real income of the whole community. This occurs because the new substitute has a higher proportion of imported materials and components than the old commodities, and because the surplus capital is tied up in specialized equipment and cannot be transferred to meet other demands. Also, the unemployed labor has not the mobility, nor the know-how, to meet these other demands.

In other words, the main benefits of adopting capital intensive advanced technology may go abroad to the rich countries which export machinery and components. In these cases, "there is little to compensate the unemployed by transfer payments from those with higher real incomes elsewhere, or to wait until a long-term growth in employment opportunities absorbs them" (49).

This line of reasoning suggests the improvement of traditional technology: "This strategy which raises the level and productivity of employment through progressive technical and organizational change, which fosters the development and implementation of

indigenous technology and material, and which stresses the improvement of the living standards of the poor, may also accelerate the long term economic growth of the society as a whole" (48).

Galenson (31) argues that "Under conditions of modern technology, it is not likely that the major role of manufacturing will be that of generating employment in underdeveloped countries". Perhaps, the effect on employment can be indirect, generating demand which leads to employment in other sectors. Manufacturing may generate indirect employment in services. Bhalla (10) correlated employment in services with manufacturing employment. At high rates of growth, the potential surplus labor in traditional services can be absorbed into manufacturing and largely into complementary services generated by industrial growth.

A labor intensive technology can generate say X_1 jobs in manufacturing, but the output would be relatively low. This output would generate say N_1 "modern" jobs in complementary services. In contrast, a capital intensive technology may generate X_2 jobs in manufacturing and N_2 "modern" jobs in services. X_2 is very likely to be smaller than X_1, but N_2 may be larger than N_1. It is very likely that $X_1 + N_1$ is going to be smaller than $X_2 + N_2$. In conclusion, capital intensive technology may end up generating more jobs than the labor intensive technology if the indirect effects on employment are considered.

Some economists argue that the best way for underdeveloped countries to speed up the development process is to use modern

capital intensive technology. Maurice Dobb (19) for example, argues that the "choice between more or less capital intensive forms of investment has nothing to do with existing factor proportions". He argues that the choice is "precisely the same consideration as that which determines the choice between a high and a low rate of investment". Or it is equal to the choice of raising consumption in the immediate future compared with the potential increase in consumption in the distant future.

Likewise, Baran (9) argues that the abundance of labor may be only a temporary condition and during the lifespan of the equipment to be installed, labor may turn to be a realtively scarce factor. Baron concludes, "The economist's injuction to give preference to labor-intensive techniques in formulatin programs of economic development is far from being an 'innocent' theoretic fallacy, as might appear at first blush. It represents an important link in the new fashionable campaign to prove 'Scientifically' that the backward countries should 'go slow' (or, better still, not go at all) in the direction of industrialization and economic development".

Hirschman (39), too, advocates a capital intensive technology for LDCs. However, his arguments are different. He finds skilled labor and managerial personnel as the factors in real shortage in underdeveloped countries. Modern technology would economize in those factors. Machines and mechanical processes by predetermining to a considerable extent what is to be done, when and where, reduce the very important difficulties of co-ordination and the convergence of many human wills and actions implying the managerial task.

Because capital is a scarce factor, the use of capital intensive technology in some sectors of the economy leaves less capital for other sectors. This situation, of course, may result in technological dualism. Hence, to advocate the use of capital-intensive techniques may be equivalent to advocating a dualistic development process. Hirschman (39) says that the most efficient use of capital in underdeveloped countries is in industries which open new product horizons for the economy and these industries are likely to be capital-intensive. The traditional products can continue being produced by handicraft and cottage industries. "Thus, while dualism no doubt brings with it many social and psychological problems, it has some compensating advantages and represents, in a way, an attempt by the economy of an underdeveloped country to make the best of its resources during a transitional phase" (39).

On the other hand, other economists explicitly advocate a low rate of economic growth. They argue that future generations are going to be better off anyway, then why should the present generation be sacrifized.

In summary, economists have different opinions and conclusions with respect to the kind of technology more appropriate for the development of backward countries. All argue with different development goals in mind. For some, the development of technology is a goal in itself. Those who advocate the use of modern technology see the problem of technological unemployment as temporary, and as a trade-off for achieving fast economic growth.

B. FACTORS AFFECTING THE CHOICE OF TECHNOLOGY.

1. Optimal combination of resources.

This is a brief review of classical economic theory relating to the allocation of resources. Let us assume: (1) a private enterprise in which a desired level of output can be procuded by any of a number of different combinations of inputs (i.e., the isoquants are continuous), (2) perfect competition in the input market, (3) perfect knowledge, (4) a given technology, and (5) a profit maximizing motive.

If there is a budget constraint, the enterprise maximizes its output when the marginal technical rate of substitution of labor for capital (the slope of the isoquant) is equal to the ratio of wages to the price of capital (the slope of iso-cost line). This can also be expresses as

$$\frac{MP_L}{MP_K} = \frac{w}{r} \ \ldots\ldots\ldots\ (1)$$

where MP is marginal physical product, L is labor, K capital, w is wages and r is the price of capital. It is the same as

$$\frac{MP_L}{w} = \frac{MP_K}{r} \ \ldots\ldots\ (2)$$

In other words, the last dollar invested in labor should produce the same as the last dollar invested in capital. If there were no budget constraint the point of maximum profits would be at the level of output

$$\frac{MVP_L}{w} = \frac{MVP_K}{r} = 1 \ \ldots\ldots\ (3)$$

where MVP is marginal value product. This condition expresses
that the last dollar invested in labor or capital would add to
the value of the product one dollar.

Figure III-1. Effect of a chanfe in the price of capital on
the capital-labor ratio.
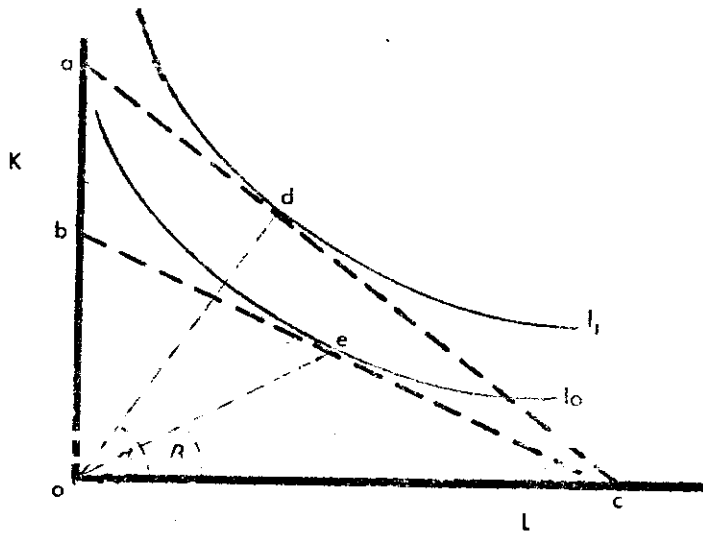
A change in the price of one factor can result in changes
in the factor proportions used in the production of a particular
good. Assume that the entrepeneur is maximizing output at a given
budget constraint at point d (see Figure III-1). The capital-labor
ratio is the tangent of α . Now, let us assume an increase in
the price of capital. This means a smaller w/r ratio which can be
represented by a flatter new price line cb. This line determines
a new output maximization point e. The capital labor ratio, then,
becomes the tangent of β . Tangent of β is smaller than tangent
of α . Thus, a smaller $\frac{w}{r}$ has resulted in a smaller capital-labor
ratio for the production function represented by Io and I_1.

2. Choosing between different technological processes.

a. Expected relative resource prices:

Assuming full employment and no labor force growth, more
output can be produced for the economy as a whole only by making
productive methods more capital intensive. It is assumed that in
general "... more capital intensive methods produce more at the
same cost (exclusive of interest) than less capital intensive
methods" (1). Thus, more capital intensive methods represent in
themselves a technological progress. This principle may hold
whether the more capital-intensive method represents a process in
which capital instruments are more durable or in which capital is
substituted for labor.

However, a more capital-intensive method must not always be
preferred. The interest rate is also a cost. When the interest
rate is high, the more capital-intensive methods are penalized
heavily. Thus, if at given interest rate and expected prices a
particular method is selected as the most profitable, after an
increase in the interest rate (ceteris paribus) the most profitable
would be a less capital-intensive method than the one initially
selected.

Notice that the above analysis always holds when we refer
to capital intensity in terms of the capital-output ratio. However,
it does not hold always when we define capital intensity in terms
of the capital-labor ratio. On the contrary, a technology using
high capital-labor ratios may be much more efficient (in terms of

production per unit of input) than a technology with low capital-labor ratios. Thus, the result may be that the high capital-labor ratio method may produce a given quantity of a particular good with less amounts of both labor and capital. Hence, the labor-intensive method (low capital-labor ratios) ends up using more capital and, therefore, is going to be penalized heavily by the increase in the rate of interest. In this case, the labor intensive method defined by the capital-labor ratio criterion becomes the capital intensive method defined by the capital-output criterion.[1] We assume that this is true for exceptional cases and that, in general, for sectors as well as for the economy as a whole, a less capital-intensive process defined by the capital-labor ratio is also a less capital intensive method defined in terms of the capital-output ratio.

Finally, an indirect effect of the interest rate can be added. When the interest rate is reduced, the cost of the capital-intensive industries also falls. If there is perfect competition, then the prices of the products of these industries also drop. Thereby, in the competition for the consumers' dollar, there would be an increase in the demand for goods produced by capital intensive techniques, and a reduction in the demand for goods produced by labor intensive techniques.

A similar line of reasoning can be followed for analyzing changes in the price of labor. Let us assume that a method is

---

[1] See the example of furnaces in China in Eckaus (22).

selected at a given wage level. After a decline in the real
wage rate, the most profitable method is a more labor-intensive
method than the one initially selected. This is so because the
more labor-intensive methods are penalized heavily by a wage rate
increase, or heavily benefited by a reduction in the wage rate.

Therefore, from neoclassical economics we can conclude that
the selection of technology depends upon the expected future wages
and interest rates at the time that the investment decision was
made.

If the assumption of perfect knowledge is dropped, then the
analysis becomes more complicated. The entrepeneur may have to
forecast the present value of the future revenue produced by the
alternative technologies. He may have to forecast the variable
cost associated with the production of this output. He may have
to attach probabilities to the different alternatives, etc.

But, in the real world firms may be using other more simple
decision rules. "The opinions of well-informed observers, plus
some scarcity evidence from surveys, indicate that, in fact,
investment decisions are often based on hunch or whim or prejudice,
on non-economic factors, or where calculation are made, on rules
of thumb ..." (1).

However, the neoclassical theory may be useful in predictions
for the economy as a whole. It is expected that the errors may
cancel each other out. If this happens in choosing techniques, then
some firms would adopt a technology a little more capital-intensive
than the economic variables dictate to them and some firms would

adopt a technology a little less capital-intensive. Nevertheless, at the end (assuming price and wage flexibility) the errors cancel out and the economy would be producing at a level close to the full employment of its resources.

b. Biased factors affecting the choice of technologies:

A high level of unemployment exists in underdeveloped countries. One of the first arguments explaining this phenomenon was that in fact there is a limited choice from among relatively capital-intensive production methods. "However, the mounting evidence accumulated in the 1950's and early 1960's suggests that even where a choice was possible, many developing countries were not adopting the most labor-intensive techniques possible or promoting only those industries which absorbed the highest amount of labor" (7).

Secondly, there are rigidities and distortions in wages and interest rates which result in using more of the scarce factor leaving the other in surplus. These distortions and rigidities result from an attitude that labor is a "trouble maker". Strassman found for Mexico and Puerto Rico, imperfect signals to producers. He holds that "The error is in the direction of using capital and labor too little with one another. The sectors with too much of one factor cannot get, or do not seek, enough of the other" (67).

Some of the common factor price distortions which lead towards the use of capital-intensive technology by large scale organizations are; (1) The need to pay higher wages due to trade unions and labor

legislation. (2) Ability to borrow at artificially low interest
rates. (3) Ability to get easy import licenses for machinery and
(4) Low exchange rates. (5) "Unscrupulous salesmanship, tied-aid and
loan programmes and the lack of practical technological know-how
on the part of these responsible for investment decisions" (44)
are important reasons. (6) Laws permiting higher depreciation
and investment allowances and the protection of domestic consumers
goods enterprises by tariffs, quotas, or prohibitions, may result
in less pressure to economize on capital.

C. POTENTIAL FOR LABOR INTENSIVE INDUSTRIES.

Tinbergen (70) argues that it would be erroneous to think
that labor intensive industries should be rejected for development
on the grounds that their profits are modest; what matter is not
the profits, but the total income earned through them. Ranking
industries and countries according to their physical capital
intensity, their human capital intensity and a combination of the
two, he found that industries like textiles, shoes, leather, glass,
wooden furnitures and a few metal industries, would be suitable
for the factor endowments of the developing countries.

During the early 1950's, "special attention was given to
construction because this sector seemed able to produce capital
almost without using capital" (65). However, there was an eclipse
later on because many projects proved costly and cumbersome, and
some failed althogether. But, Lauchlin Currie (14) puts construction
back in the centre of employment strategy in the mid-1960s.

D. THE COLOMBIAN CASE.

1. Technology and capital/labor ratios.

a. Traditional sector:

In the traditional sector, the stock of capital and modern inputs seems to be very low, especially in handicrafts, traditional commerce and personal services. In general, the traditional sector uses labor-intensive techniques.

Agriculture is the most important subsector within the traditional sector. However, not all agriculture belongs to the 'pure' traditional sector, "Colombia's agriculture is better characterized as a dual, rather than a transitional economy" (5). A low percentage of the farmers engage in modern agricultural enterprises. The production of sugar canne, irrigated rice, cotton, bananas and a good deal of the poultry industry belongs to the modern sector. All (except poultry) are relatively large farms. Furthermore, Atkinson reports that "One of the striking things over the past several years has been the expansion in acreage of the mechanized crops (cotton, rice and sugar canne) as a group of farms larger than 50 hectares" (6). Furthermore, machinery and imported implements[1] are suitable for use primarily on large farms and are labor-saving equipment.

Traditional agriculture, is comprised mostly of small farmers. The following major crops: yuca, beans, plantain, brown sugar,

---

[1]Tractors are more than 50% of all agricultural machinery imported.

sesame, barley, soy beans, milo, corn, potatoes, wheat, tobacco and coffee and most of the minor crops are in the traditional sector. Livestock is also traditional. A survey conducted by FEDEGAN (Livestok producers' organization) indicates that the "level of technology is quite low, even in areas which have the better ranches" (5). Livestock farms are, however, relatively large.

"In Colombia, preparation of the soil, planting, and cultivation of crops are done either with primitive hand tools, sometimes supplemented by plowing with oxen and crude plows, or with tractors" (6). Hand cultivation is limited to farms of two or three hectares; cultivation by oxen is limited to farms of four or six hectares.

About 7% of the tractors were used in farms smaller than five hectares in 1960. This is relatively unimportant because 71% of the farms were each smaller than 5 hectares. In contrast 42% of the tractors were used in farms larger than 200 hectares. (40).

All this has been stated to show that traditional agriculture continues using a good deal of traditional tools (hand tools, crude plow, etc. in the exploitation of mainly small farms.

The techniques used suggests a growing increase in the "productivity gap" between modern and traditional agriculture. Atkinson argues that "... the flexibility and the adaptability of the tractor over the years without comparable advance in plowing and cultivation with oxen has widened the advantage of mechanical agriculture" (6). Some alternative solutions for small farmers may

exist, such as the organization of cooperatives for using tractors, the custom work system, or the use of small sized tractors. ICA is developing a small two-wheeled tractor for use in small farms and on steep slopes.

The ratio between the number of hectares of agricultural land adaptable for cultivation by tractor in relation to the number of tractors (hectares/tractor) was 280 in 1963. This ratio was 197 for all Latin America. This index indicates the relatively low level of mechanization of agriculture in Colombia as compared to the rest of the Latin American countries.

Traditional agriculture uses hand tools such as hoes, spades, picks, crow bars, machetes and sickles, and repair parts, produced domestically. These national products are usually made from softer materials and are heavier than imported ones. And prices have usually been higher by 33%. (See 17).

Traditional agriculture also uses non-traditional inputs which are in part domestically produced such as pesticides[1], fertilizers and improved seeds. These are more labor using inputs. Pesticides and fertilizers are widely used in traditional crops such as tobacco, tomatoes and potatoes by small farmers or sharecroppers. (See 5 and 62). Fertilizer consumption remains low in comparison to other countries. One estimate is 20 to 25 kilograms per hectare cultivated, an amount moderately higher than the average for Latin America, but about half the average for the developed countries.

---

[1]Insecticides, fungicides and herbicides.

The yield per hectare for the traditional crops have remained almost unchanged in the period 1948 to '67.

In the commerce sector the distribution of food is basically labor intensive[1] and the level of fixed investment is very low[2].

Construction is mainly an unskilled labor intensive sector.[3]

In summary, the "pure traditional" sector uses techniques with low capital-labor ratios. There is some flexibility in the production coefficients, but this flexibility is limited to those techniques with low capital-labor ratios. The substitution of capital for labor cannot continue because of lack of other factors of production (i.e. land available to the traditional farmer and management) and the unavailability to the farmer of intermediate technology. The tiny farms and the small scale-family organization of most of the traditional firms, would limit the use of capital. Ceteris paribus, beyond certain points the addition of capital would not add anything to output.

On the other hand, on the average for the "pure" traditional sector, beyond a certain low capital level additions of labor would not add anything to the output (other factors held constant). If more labor is added, then disguised unemployment and underemployment arises. Because of the family organization of the firms, the entire family shares the scarce work opportunities. Thus, open unemployment would be less important.

----

[1]Except for a few modern self-service retailers.

[2]It is especially low for personal service and public market retailers. Ambulante retailers practically do not have any investment at all. (See 53).

[3]In housing in Cali, for example, about 70% of the workers were essentially unskilled. (53).

b. Modern sector:

The modern sector comprises mining, manufacturing, transportation, government services, financing and utilities. The modern sector also includes the modern agricultural firms[1], modern commerce[2] and the modern construction industry[3]. For simplicity and availability of data, we select only manufacturing for the purpose of analyzing the technology used.

There are some indications that the level of mechanization is relatively high in the manufacturing sector. Colombia ranks relatively high in terms of horsepower per economically active person in comparison to other countries.

Countries were classified by PRELAC[4] (see Table III-1) as (1) highly developed, (2) developed, (3) underdeveloped with high relative development, or advanced underdeveloped countries, and (4) underdeveloped countries. The horsepower per economically active person was estimated for different industries and for some countries as a measure of the degree of mechanization.

Vide Table III-1, the level of mechanization of Colombia's manufacturing sector is about 50% higher than it is for other underdeveloped countries and 10% more than it is for advanced underdeveloped countries. Relative to other countries, the most mechanized subsectors are leather, textiles, the food industry,

---

[1]Sugar cane, irrigated rice, banana and cotton.

[2]Import and export firms; urban department stores of durable consumer goods and self-service food stores.

[3]Especially sky-scraper building.

[4]Comparison of the relative level of mechanization could be made with Colombia.

TABLE III-1. Mechanization by countries in horsepower per economically active person. 1963.

Manufacturing	(1) Highly developed countries	(2) Developed	(3) Underdeveloped with high relative development	(4) Underdeveloped	Colombia
TOTAL MANUFACTURING	9.?	5.7	3.0	2.2	3.3
A. Consumption:					
Food industry	6.0	6.1	3.6	3.1	3.6
Textile	4.6	3.1	2.1	-	3.0
Clothing and footing	?.?	0.6	0.4	0.2	0.3
Furnitures	3.8	2.9	1.5	0.8	1.3
B. Intermediate goods:					
Leather	4.6	3.8	2.4	1.8	3.8
C. Consumer durables and capital goods:					
Metalic products	5.?	3.6	2.2	1.6	2.6
Non-electrical machinery	5.?	3.6	2.4	1.8	2.?
Electrical products	3.1	2.2	1.3	1.0	1.?

(1): USA, Canada, Sweden, Finland
(2): Norway, Australia, Italy, New Zealand, South Africa
(3): Spain, Greece, Israel, Mexico, Brazil, Argentina, Chile, Hungary
(4): Taiwan, Korea, India, Paraguay, Panama

Source: PRELAC, "The Growth of the World Industry. 1953-1965". United Nations.

consumer durables and capital goods. The less mechanized sub-sector relative to other countries (but, more mechanized in Colombia than in other underdeveloped countries) are the furniture, clothing and foot wear industries. However, this less mechanized group represented just 6.4% of total manufacturing value added in 1968.

A comparison between the sub-sectors presented in Table III-1 suggests that the three industries which require low mechanization are clothing and foot wear, furniture and electrical products, roughly, those in which Colombia is relatively less mechanized. However, all three represent only about 7% of the total manufacturing value added in 1968.

Important industries in terms of value-added are highly mechanized in Colombia, in both absolute and relative terms. These are the food and testile industries. However, this does not mean that Colombia has industries which in general tend to be highly mechanized. Notice that the table shows only a few industries.[1]

But rather it may indicate that once the industry has been installed in Colombia and its market starts growing, then it becomes mechanized, with imported equipment from developed countries.[2]

From Tinbergen's list of industries appropriate for under-developed countries (see chapter III - section C) only clothing, shoes and furniture are the ones which have relatively low mechanization in Colombia.

---

[1]The aircraft industry is missing for example.
[2]See tables II-4-5 and III-1.

In summary, the figures on horsepower per employed person give some indication that Colombia's manufacturing sector has become highly mechanized in comparison with other underdeveloped countries. This may suggest that the sector is using a relatively high capital/labor ratio. If some kind of "standarized" comparison[1] were made with the traditional sector, this capital/labor ratio would be relatively high in manufacturing.

Mining and transportation have small differences with manufacturing. One hint is that their share of the national output is larger than their share of total employment. In addition, both sectors, and especially mining, (and within mining, petroleum) are, in general, capital-intensive industries.

However, some more flexibility and a lower level of mechanization would exist in finance, utilities and government. Thus, the production function for the modern sector has some flexibility of substitution between labor and capital but perhaps within the limits of ridge lines oh and og in figure III-2a and rather in the area of high capital-labor ratios. High capital-labor ratios are expected as result of the technology available and imported from developed countries.

Flexibility of factor substitution may be a result not only of the limited opportunity to choose when selecting technologies but also of the possibility within a certain range to adopt the

---

[1]In which the technical requirements by product could be isolated.

Figure III-2. A theoretical illustration of technological
dualism in the Colombian economy.
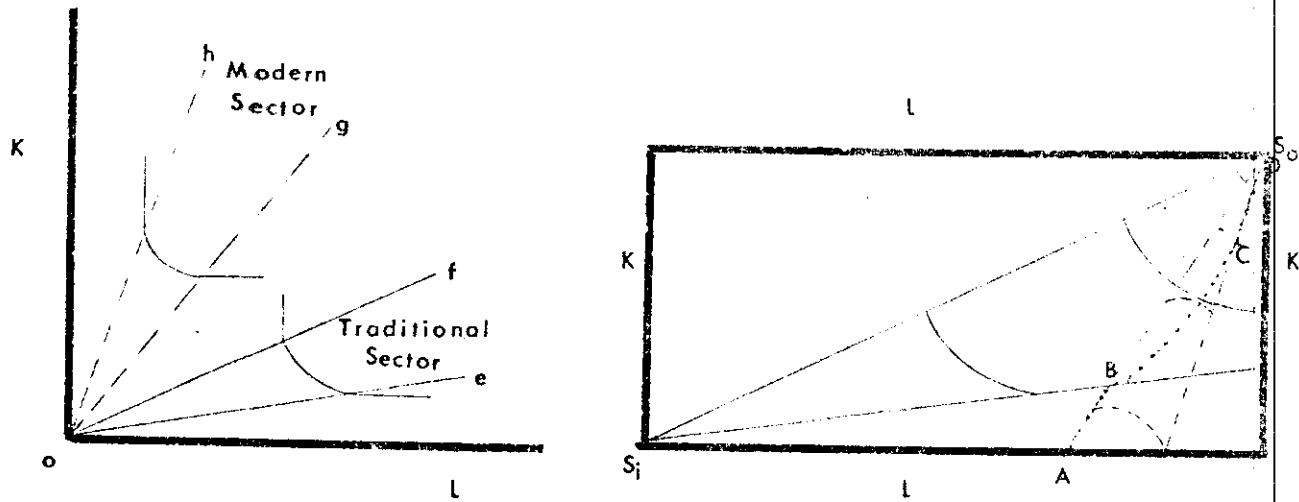
a. Production functions for
the modern and the
traditional sectors.

b. Production function, factor
endowment and efficiency
locus.
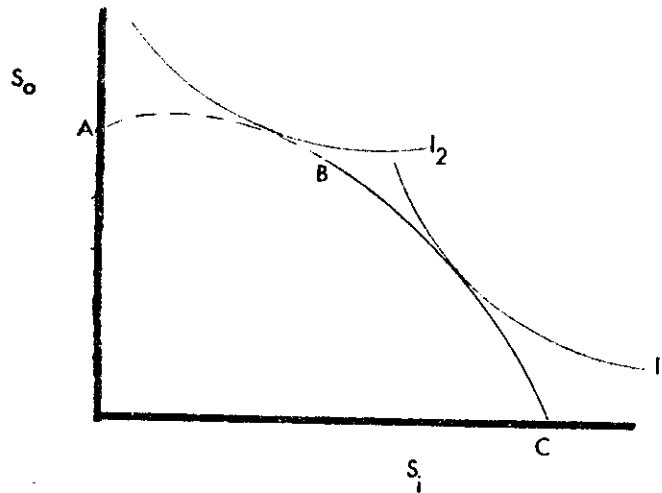
c. Technical transformation curve and
community indifference curve.

Source: A similar theoretical model was developed by Eckaus (23).

imported technology to the prices of the factors of production
at home. Furthermore, in sub-sectors such as government, a
larger flexibility may be expected.

c. Production possibilities for the economy:

With the two production functions described in the previous
section and for a given factor endowment[1] it would be possible
to estimate the maximum output combinations of simple and
sophisticated goods (or the technical transformation curve).

We have assumed that the modern sector with high capital-
labor ratios, produces sophisticated goods with high capital
content and the traditional sector with low capital ratios
produces simple goods with low capital content.

The geometric technique used in figure III-2 is only for
illustration purposes. The two production functions are depicted
in figure III-2a. The Edgeworth-Bowley type box in figure III-2b,
represents the factor endowment, Capital (K) is scarce and Labor
(L) is abundant. The production functions are depicted in the box;
the solid lines refer to simple (Si) goods and the dashed lines
to sophisticated (So) goods. The line ABCD is the efficiency locus.
It represents the maximum output combinations; i.e. for a given
quantity of Si, what is the maximum quantity of So that can be
produced. This line becomes the production possibility frontier
or output transformation curve ABC in the output space of figure
III-2c. The section AB of the transformation and efficiency locus

---

[1]Labor abundant and capital scarce.

curve are areas in which labor is redundant. I_1 and I_2 represent two different community's demand functions.

For certain composition of demand (community indifference curve), unemployment and underemployment can occur in a dual economy even under perfect competition (i.e. when the indifference curve is I_2). If unemployment existed, an increase in total demand would not solve the problem, but rather it would result in inflation because one factor is fully employed and cannot be substituted by other factors any further. Actually, inflation and unemployment have co-existed in Colombia. And the demand for goods produced by the modern sector is relatively high. It can be argued that this is due to the existence of technological dualism which results in unemployment.[1]

2. Market imperfections and the selection of techniques.

a. Factor price distortions:

When there are imperfections of various types in the factor market, the system cannot reach the optimum or technical transformation curve. It falls inside the optimum transformation curve, because there is no flexibility of factors between industries

---

[1] This paper does not attempt to measure the extent of this kind of unemployment.

to reach the maximum output level. Assuming full employment, the marginal product of labor is high in some sectors (i. e. modern sector) while at the same time the marginal product of labor is low, or even zero in the other (i.e. traditional sector). However, distortions in factor prices, structural problems, and behavioral problems, do not permit the shifting of factors from one sector to another. A similar situation may be occurring in both the capital and the labor markets.

One of the economic characteristics of Colombia is the existence of two different wage levels one applicable for the modern sector, and one for the traditional sector. Urban traditional wages were about 41% lower than urban modern sector wages in 1966.[1] The difference may be much higher if the rural sector were considered. The wage differential seems to be more than what is warranted by differential skills. Unionized vs. non-unionized labor and family firms can explain a good deal of these differences. The organization of labor is an important feature of the modern sector. About 15% of the labor force in 1968 belonged to unions. 80% of the large firms (75) work under collective contracts and the only organized agricultural labor is in sugar cane and banana production. The traditional firms constitute of non-organized labor, and most of them are family firms which provide self-employment.

Capital appears to be more expensive for the traditional than for the modern sector. Capital equipment and tools purchased

---

[1] Estimated from Weil (75) for Bogota in June 1966.

by the traditional sector from the local retail store involves high prices due to high marketing margins and the monopoly power of the modern sector resulting from the government policy of protection of local industries from foreign competition.

On the other hand, big firms import directly from foreign manufacturers. In addition, the government system of import quotas, licensing and an overvalued exchange rate benefits the favored modern sector. Certainly, the most favored are manufacturing firms and, in general, the modern sector.[1] This provides another reason for the artificially low price of capital.

Furthermore, "when corrected for inflation, most of the lending r..... ..... also quite low for a country where capital is scarce" (41). However, low interest rates benefit the modern sector firm which has the ability to borrow from banks due their lower riskiness, better organization and management.

In summary, the ratio of the price of labor to the price of capital (w/r) is higher for the modern sector than for the traditional. This artificially high w/r ratio in the modern sector stimulates mechanization.

Ceteris paribus the effect of a change in factor-price ratios on the capital-labor ratio can be measured by the elasticity of substitution.

---

[1]See table II-5

$$\sigma = \frac{\Delta(K/L)}{K/L} \div \frac{\Delta(w/r)}{\frac{w}{r}}$$

w, r: represent the price of labor and capital respectively.

L, K: represent the quantities of labor and capital.

In equilibrium, the "elasticity of substitution is the proportional change in the capital-labor ratio induced by a given proportional change in the factor-price ratio" (26).

If there were just a single process of production, then any change in the factor price ratio would have no effect on the capital-labor ratio and, the elasticity of substitution would be zero.

If the elasticity of substitution is positive, then changes in the factor-price ratio would have some effect on the capital-labor ratio. This would indicate the existence of more than one process of production, at least within the range in which the data on the factor-price ratio varied. If this variation is small even in a case of high elasticity of substituion, it is difficult to predict the shape of the whoel indifference curve.

Therefore, positive values of the elasticity of substitution are no basis to argue that flexible wages and salaries are enough to reach full employment. A dualistic situation as the one depicted in figure III-1 might exist. Then, full employment would depend also on the composition of demand.

Elasticities of substitution have been calculated by National Planning (15)[1] and the CIE of Universidad de Antioquia (32)[2] using the same data for twenty manufacturing sub-sectors for the period 1956-67.

However, the CIE has arrived at much lower elasticities than the National Planning.[3] Thus, the results of National Planning suggest some flexibility of substitution between labor and capital In contrast, the CIE's results suggest more fixed coefficients.

Then, for manufacturing as a whole a unique production process cannot be accepted.[4] Some kind of flexible coefficients can be assumed at least within the range of factor price ratio variations during the period 1957-1964. However, complete flexibility of factors of production cannot be predicted.[5] Because the period considered (1957 to 1964) in the time series was a relatively short one. Therefore, the scope of the variation in price factors and in capital-labor ratios may be reduced to a small area. Furthermore, the movement may be upward for both ratios and they may move for different reasons; the w/r ratio because of union pressures and the K/L ratio because of the

---

[1] Following a method suggested by Arrow et al. (4).
[2] Following a method suggested by Dhrymes (18).
[3] The National Planning worked on the Ho that elasticity of substitution is equal to unity. They accepted this hypothesis for 12 of the 20 subsectors. However, the CIE worked on the hypothesis that elasticity of substitution is equal to zero and it was accepted for 12 of the 20 manufacturing subsectors.
[4] Even using CIE's results.
[5] Even using National Planning results.

production of more capital-intensive techniques in developed
countries which due to non-economic motives may affect the
national manufacturing capital-labor ratio.

In conclusion, factor price distortions may have significant
effects on the capital-labor ratio, but within certain areas with
relatively high capital-labor ratios. For the period studied
(1957-1964) a relatively high elasticity of substitution could
exist. But, the manufacturing production function can be similar
to the one depicted for the modern sector (see figure III-2a).
Thus, policies directed to correct factor price distortions may
not solve completely the problem of unemployment in the situation
of a dual economy. But, certainly they will have some positive
effect.

b. Other factors considered in the selection of techniques
in manufacturing:

In the real world firms may have decision rules other than
the neoclassical factor price-ratios principle for selecting
techniques. The CIE (32) conducted a research of 106 entrepeneurs
of ten different manufacturing subsectors. About 95% of all
entrepeneurs had maintained that wages were not taken into
account when selecting techniques. A reduction of wages and
a flexible labor policy would not encourage an increase in
employment in manufacturing. Only about 30 percent of the
textile firms are likely to hire more labor, and

the producers of appliances may find some ways of employing more labor. This suggests that the real price of capital is too low and that fixed coefficient of production exist at least in the minds of entrepeneurs. Unfortunately, the information from the survey does not permit the evaluation of entrepeneurs' reactions to changes in the real price of capital[1].

Entrepeneurs are likely to believe that there is little flexibility in combining capital and labor. This flexibility may be somewhat greater in clothing and more so for food and drink industries.[2] Flexibility also exists in some processes as packing and distribution, but not in production.

When asked if they knew other technological alternatives than the ones in use in their enterprises 12% gave negative answers, 73% knew other production processes but which are more capital intensive, 14% knew other processes but equally capital-intensive to the one in use. Only 1% knew other methods less capital intensive. Thus, at least in the minds of entrepeneurs, there is a limit to replacing labor for capital and they are producing at this limit.

In addition, the factors considered by most of the entrepeneurs interviewed in choosing among technologies are the reduction of costs and the improvement of quality.

However, entrepeneurs may be too much preoccupied by quality and may believe that it is only possible to achieve high quality

---

[1]Especially the rates of interest and foreign exchange.
[2]See the CIE's survey results in the appendix of their report (32).

standards only with equipment from highly developed countries.
Their channels of information may reinforce this belief. Presently,
the main channels of information are the producers of equipment,
magazines, technical assistance from producers of capital goods
abroad and their representatives, assistance from the parent firm,
information obtained on foreign trips and international expositions.
It is difficult to judge these sources of information but production
conditions seem to be influenced heavily by the promotional
activities of big corporations.

The choice of production techniques may also be influenced
by previous commitments. Compromises such as "tied" loans, policies
of the parent firm, and patents, affect about 50% of the firms
interviewed in some ways. There is some indication of the direction
towards more capital-intensive methods. But, an exception may be
made of appliance firms, which use second hand equipment from the
parent firms, to some extent.

Since most reductions are also considered in the selection
of techniques by the entrepeneurs, the factor price ratio may have
micro as well as macro effects. They can be: (1) the effect of
looking for information when selecting techniques resulting with
purchase of new or second hand machinery from particular countries;
(2) the effect of giving less importance to "quality"; (3) the
adaptation of techniques after they are bought; (4) the labor
absorption in packing and distribution and (5) the impact on the
product-mix.

All distortions and rigidities discussed in the last two sections can result in a total production less than the maximum possible with the available resources. Because of distortions the economy would have a market transformation curve which falls inside the technical (optimum) transformation curve. The area with redundant factors is then increased. Thus, the possibility that equilibrium in the dual economy is reached with unemployment is also increased.

3. The product mix. Trends.

This section analyzes trends in the composition of demand. Sophisticated goods can become more important over time. Thus, the community indifference curve in figure III-2c can shift to the left. So, technological unemployment is more certain to happen.

Sophisticated goods are believed to have a higher income elasticity. Simple goods have low income elasticities. Hence, a growing demand for sophisticated goods is likely to occur as income grows. In other words, the indifference curve will be shifting towards to left over time.

The community indifference curve would shift to the left also if the distribution of income becomes more uneven. The greater concentration of income may result from the use of modern technology in a sector which employs a low percentage of people. The difference in labor productivity between sectors would be greater over time as further mechanization occurs in the modern sector. Income concentration may result in shifting the indifference curve to

the left. When it becomes tangential to the transformation curve
in the area of redundant labor, then unemployment appears. This
may lead to the further concentration of income and a further
shift of the indifference curve to the left. According to Thorbecke
(69) the trend in Colombia is towards a more uneven distribution
of income.

A third factor which may lead to a shift of the curve to the
left would be from the demonstration effect; the wants of one
sector affecting the wants of society. The use of advertising and
promotion by the modern sector will aggravate this tendency.
Variables such as population growth would tend to shift the curve
to the right mainly if population growth is faster within the low
income groups.

On the average the tendency would be for the community's
indifference curve to shift to the left as the following analysis
of the data indicates.

Table III-2 indicates a clear trend of the modern sector
increasing its share. It means that the demand for sophisticated
goods is increasing very rapidly; increases have been high for
goods and services provided by public utilities, banking services
and manufacturing. Transportation and mining have maintained their
share. The demand for goods produced by the traditional sector has
grown slowly, the share of agriculture and personal services is
dropping: Commerce maintains its share[1] and the share of
construction has increased significantly.

----

[1] 15.6%

TABLE III-2. Composition of gross domestic output.

Sector	1950	1960	1964	1970
Traditional sector	65.9	60.8	58.5	53.9
Modern sector	34.1	39.2	41.5	46.1
TOTAL	100.0	100.0	100.0	100.0

Source: Estimated from Table II-1 and Table IV-2 and from
Boletin Mensual de Estadistica DANE. Dec. 1970.

On the other hand, the composition demand for goods produced
by the manufacturing sector is also changing. Table III-3 shows
that consumption goods are loosing their share[1] while more
sophisticated[2] group C goods are increasing their share rapidly
from 9% in 1953 to 20% in 1968. This indicates further shifts
towards more sophisticated goods.

In conclusion, the composition of demand may be such that
the community indifference curve is shifting to the left
continuously. Even in a perfectly competitive world, unemployment
must sooner or later appear in this dualistic economy.

4. Trends in the rate of mechanization in agriculture and
manufacturing.

a. Agriculture (traditional sector):

The imports of agricultural machinery and implements were
high during the period 1954-56. But, the rate of mechanization

---

[1]From 71% of total manufacturing to 55% for the period 1953-68.

[2]It is assumed that C (consumers durables) are more sophis-
ticated than A (manufactured consumption goods).

of agriculture has been relatively slow during the last fifteen years.[1] Thus, from being considerably more mechanized than all Latin America in 1955, Colombia's agriculture became less mechanized than all Latin America in 1964 (5).

TABLE III-3. Structure of the value added by subsector (Percent).

Sub-Sectors	1950	1958	1968
A. Consumption	73.9	64.8	54.6
Food	18.0	16.0	13.8
Drink	18.9	14.9	12.3
Textiles	17.1	16.5	15.7
Clothing and shoes	5.7	5.4	4.4
Others	14.2	12.0	9.4
B. Intermediate	21.1	25.3	32.0
Chemicals	7.5	9.0	13.5
Minerals non-metallic	6.4	5.6	4.9
Others	7.2	10.7	13.6
C. Consumer durables and capital goods	4.9	9.9	13.4
Metal-mechanics	3.9	8.0	10.1
Others	1.0	1.9	3.3
TOTAL MANUFACTURING	100.0	100.0	100.0

Source: DANE.

[1]The stock of tractors was about 14,600 in 1958. The maximum stock for the period 1958-1967 was 16,500 tractors in 1962. The minimum stock was 14,600 tractors in 1966. For an eleven year period there was no increase in the stock of tractors (according to the estimation of Caja Agraria (see 6) based on a ten year useful life for the average tractor).

However, during the period 1948-68, the yield, per hectare increased with some significance for cotton, rice, sugar and bananas, which are modern agriculture crops. In contrast, the yield per hectare (at constant 1958 prices) has increased very little for most traditional crops (corn, potatoes, wheat, tobacco, yuca, beans, plantains, brown sugar). This contrasting situation may suggest a net mechanization rate of traditional agricultural close to zero.

If the same were happening to other traditional sectors, then the traditional sector production function would be remaining unchanged as is depicted in figure III-2a.

b. Manufacturing (modern sector):

The manufacturing sector is assumed to be more or less synonymous with the modern sector. The process of mechanization with the manufacturing sector means a shift of the production function to the left. This shift could result in an increase in the redundant labor area of the transformation curve.[1]

The process of mechanization by subsector is not smooth; it has discontinuities and peaks. The 'drink' industry, for example, had a 14.3% rate of mechanization per year in terms of horsepower per person employed during the period 1958-1963. But this rate decreased at a 7.8% average rate per year from 1963-1968.[2]

---

[1] Assuming no changes in the proportions of the factor endowment.

[2] See Table III-4

TABLE III-4. Installed capacity by subsector in manufacturing.
Average percent.   Increase per year in the number
of horsepower per person employed.

| Sector | Percentual change per year | | |
	1953-58	1958-63	1963-68
A. Consumption goods	4.4	5.5	.7
Food	6.1	4.0	3.3
Drink	2.6	14.3	-7.8
Textiles	3.4	0.7	2.0
Clothing and shoes	0.0	0.0	6.7
B. Intermediate	13.3	3.2	3.5
Chemicals	0.0	20.0	6.5
Mineral non-metallic	12.6	0.0	3.2
C. Consumer durables and capital	0.0	3.8	7.4
TOTAL MANUFACTURING	8.0	3.6	3.0

Source: Estimated from DANE.

These fluctuations indicate excess capacity and/or adaptation
of the equipment once it is bought to the conditions of the
country.

In sum, the rate of mechanization has been high for all
manufacturing; it was 8% during 1953-58, 3.6% for the next five
years and 3% per year during 1963-68.[1]

----

[1]See Table III-4.

The rate of mechanization in the production of consumption goods (A) and intermediate goods (B) decreased during the period 1953 to 1968. However, the rate of mechanization of consumer durables and capital goods production increased at an increasing rate.[1] Also, consumer durables and capital goods are steadily increasing their share of the total value added in manufacturing.[2]

Thus, the process of mechanization continued to remain high for the most dynamic subsectors. It is mainly the lack of foreign exchange, during the period 1962-67,[3] which slows down the rate of mechanization of the manufacturing sector.

If the rate of mechanization for the whole modern sector were high as indicated for manufacturing the production function for the modern sector would be tending to shift towards the left. The production function for the traditional sector has not been shifting. Therefore, the trend has been to make the economy more and more dualistic.

In conclusion it may be said that there are strong indications of two different production functions within the economy, of factor price distortions, of manufacturing entrepeneurs' prejudices and committments towards capital intensive methods of a high and growing demand for more sophisticated goods, and of a high rate of mechanization of the modern sector. Sooner or later the dual

---

[1]See Table III-4.

[2]See Table III-3.

[3]According to the complaints of the entrepeneur surveyed by CIE (32).

economy is likely to reach equilibrium with the existence of technological unemployment and underemployment. This matter is discussed in the next chapter, which provides data in support.

This chapter presents data on the level and trends of unemployment. No attempt is made to measure the extent of technological unemployment and to separate this from other kinds of unemployment. Some indication of the level of technological unemployment is the low share of employment by the modern sector and the slow rate of employment expansion within this sector[1] though its share of the GDP has grown faster[2].

A. NATIONAL AND REGIONAL UNEMPLOYMENT.

The levels of unemployment and underemployment are very high in Colombia. The government has recognized this problem and solutions are sought. The new development plan for 1970-73, approved by Congress, in fact, incorporates the recommendations of the ILO Mission on employment policy.

Open unemployment is higher in urban areas[3] and higher for women[4]. Open unemployment has grown continously. It reached a peak in 1967.[5] Since then, it has decreased only a little. There has been a reduction in the rate of participation in the labor force, as a percent of the population of working age, since 1951. This suggests that disguised unemployment has been rising (41).

---

[1]22% of the total employment during 1964 to 22.7% in 1970.
[2]41.5% to 46.1% from 1964 to 1970.
[3]See Table IV-1
[4]11.6% and 6.0% for men.
[5]14% in the eight largest cities.

Disguised unemployment for urban areas in 1967 was estimated
at 7% (41). It may have dropped a little by 1970.[1] Thus, total
unemployment (open and disguised) would be about 15% for urban
areas in 1970. Yet, people working less than 32 hours may be
looking for longer hours of work. Or, they may be discouraged
at not finding more work, and have stopped looking for it. Those
under-employed (open and disguised) represent[2] a 5.5% shortage
work in 1970[3].

TABLE IV-1. Rate of open unemployment by regions, 1970.

Region	Urban %	Rural %	Total %
All country	10.0	3.9	7.5
Atlantic	11.0	7.7	9.7
Eastern	4.9	1.6	3.0
Bogota, D. E.	13.1	12.3	13.0
Central	9.6	2.9	6.6
Pacific	8.6	5.0	7.1

Source: DANE Household Survey. 1970.

The total work shortage in urban areas was roughly 10% open
unemployment, 5% disguised unemployment and 5.5% underemployment.

---

[1]To 5% assuming a proportional drop.
[2]An equivalent of 48 hours a week.
[3]DANE Household Survey.

Disguised unemployment is difficult to estimate for rural areas because of the lack of statistics. Underemployment has been estimated at about 5% in 1970.[1] In addition, the heavy migration to the cities, low productivity levels especially in the minifundia region and the low rates of growth in productivity suggest that the total rural work shortage is high.

Disguised unemployment seems to exist mainly in the traditional sector (rural and urban). In addition, underemployment may be more important for the traditional (rural and urban) sector. The highest percent of people working less than 32 hours weekly was in the construction and personal services (except domestic service) sectors in 1969 (CEDE). This may indicate, despite the lack of figures for the other traditional sectors, that underemployment may be more important for the traditional sector.

Open unemployment is widespread[2]. In the traditional sector open unemployment was low in agriculture and services but very high in construction during 1967. Unemployment in the modern sector is close to the urban average which indicates that open unemployment is relatively lower in the traditional sector in comparison with the modern sector. Underemployment and "disguised" unemployment is higher than average in the traditional sector. Open unemployment is low in the traditional sector because of the ease of entry and on account of the ease of work sharing within

---

[1] DANE Household Survey.
[2] According to CEDE 1967 and DANE 1969.

the family organization but underemployment and disguised unemployment is then high because of large number of workers relative to the work available.

B. RATE OF LABOR ABSORPTION.

1. Rate of growth of the labor force.

The natural rate of growth of the economically active population was 2.4% between 1951-64 and 3.3% between 1964-1967. However, a reduction in the level of unemployment may result in a net increase in the labor participation rate. The ILO (41) estimates show that the labor force would expand at a rate of about 3.5% a year for the next 15 years.

But, the rate of labor absorption during the period 1964-1970 was only 2.3% per year. It means that total unemployment grew at a rate of about 1%[1].

2. Rate of change in employment by sectors.

The traditional sector provided about 73% of the new full time jobs.[2] Despite low levels of growth it is providing employment for a little less than the growth of its own sectoral labor force. Thus labor productivity within the sector has been growing very slowly and there is redundant labor.

The modern sector has had high rates of output growth: Manufacturing has grown at a rate 7% per annum and public utilities

---

[1] See Table IV-2.
[2] Estimates from Table IV-3.

at 10.5% per annum during the period 1964-70. Yet, their rate
of absorption of increases in the labor force has been low.
While increases in the labor force within the modern sector
have been absorbed into productive employment the modern sector
as a whole has not generated additional employment for redundant
labor from the traditional sector. Despite the growing unemployment
labor productivity has continued to rise significantly in the
capital-intensive industries.

TABLE IV-2. Rates of growth of employment, labor productivity
and value added by sectors; 1964 to 1970, and the
path to full employment by 1985 - ILO.

Sector	Employment		Labor Productivity		Value added	
	Actu-al %	Proj-ected*	Actu-al %	Proj-ected*	Actu-al %	Proj-ected*
A. TRADITIONAL SECTOR						
1. Agriculture	1.4	1.8	2.0	3.5	3.4	5.4
2. Non-capital intensive Non-skill intensive	3.6	6.9	1.4	1.5	5.1	9.1
B. MODERN SECTOR						
3. Capital intensive & skill intens.	2.5/	6.0	4.0	2.9	6.6	8.5
4. Skill-intens.	3.3	8.3	1.8	1.0	5.1	9.3
ALL SECTORS	2.3	4.8	2.9	3.2	5.2	8.1

2. Construction, craft industry, trade and personal services.
3. Mining, modern manufacturing, utilities and transportation.
4. Government services and finance.
* By the ILO Mission with the objective of achieving full
employment by 1985.

Source: ILO (41) with minor modifications.

TABLE IV-3. The distribution of employment[1], 1964 and 1970, and projected full employment structure by 1985.

	Actual		Projected[2]
	1964 %	1970 %	1985 %
A. TRADITIONAL	78.0	77.3	68.3
1. Agriculture	53.5	50.5	32.7
2. Non capital intensive Non skill intensive	24.5	26.8	36.6
B. MODERN SECTOR	22.0	22.7	31.7
3. Capital intensive and skill intensive	11.4	11.6	13.4
4. Skill intensive	10.6	11.1	18.3
TOTAL	100.0	100.0	100.0
Total (Millions of occupied persons)	4.35	5.05	10.25

[1]Employment has been standarized, takes into account under-employment by converting it into equivalent employment.

[2]By the ILO Mission with the objective of full employment by 1985.

Source: Calculated from data in the ILO Report (41).

3. Employment migration between sectors.

Dorner and Felstehausen (20) found that the annual rate of rural population growth was 1.2% and that of the urban population 5.6% in the period 1951-1964. Rural to urban migration has been taking place at a rapid rate. This is reflected in the dramatic growth of the cities. Although the agricultural population as a

percentage of the total has declined[1] population growth adds
over 100.000 people to rural areas each year resulting in the
crowding of minifundia, fragmentation and subdivision of already
small farms. (20). Despite the Agrarian Reform Program the Gini
co-efficient of land distribution has increased (40).

In the larger farms the tendency has been to reduce employment
opportunities due to mechanization (6). Currie's (14) calculations
show that about 40% of the population, can be displaced without
loss in output by resorting all agriculture to modern technical
operations. He believes it to be desirable to shift these excess
workers to non-agricultural activities. He argues that their
presence in agriculture slows up the process of technification
to the detriment of the economy; in this sense they are truly
unemployed. Thus, he suggested a higher rate of migration.

The actual migration is not so much from the traditional
to the modern sector but mainly between traditional sub-sectors.
Migrants from rural areas to the urban town find jobs in the
traditional labor intensive activities, especially in construction
and personal services.

In conclusion, the modern sector has rapid rate of growth
of output but remains as an enclave, practically close to new
entrants. The traditional sector remains almost stagnant with
low labor productivity levels but unable to absorb its full labor
force growth.

---

[1]61.5% in 1961, 47.2% in 1964 and 41.7% in 1970.

C. THE ILO FULL EMPLOYMENT PROGRAM.

The ILO Mission estimated a target of 5.2 million additional jobs to be created within 15 years which is more than double the level of employment in 1970.[1]

1. Employment to be provided by sector.

The traditional sector is to provide 3.1 million jobs and the modern sector 2.1 million.

TABLE IV-4. ILO recommendations for a full employment program 1970-1985.

Sector	Number of new jobs (thousand)	Rate of growth in labor productivity
Traditional sector	3,110	
Agriculture	800	3.5
Construction	680	1.8
Handicraft	420	2.0
Commerce	750	1.0
Personal services	460	1.0
Modern sector	2,150	
Mining	70	2.5
Manufacturing	410	3.2
Public utilities	10	8.5
Transport	370	2.0
Banking	160	1.0
Other services	1,130	1.0
TOTAL	5,210	3.2

Source: Calculated from ILO (41).

---

[1]The employed population was 5.05 million in 1970 and a projection of 10.25 million people to be employed by 1985.

Modern manufacturing, despite its high rate of increase
in output is to provide just as many jobs as the handicraft
industry. The important impact on manufacturing might be
indirectly generating employment in services such as commerce,
as Bhalla (10) suggests.[1] However, the anticipated increase in
employment in the commerce sector would be high; it would have
to provide by 1985, as much as three times more job opportunities
as it was providing in 1970. Nevertheless, the PIMUR study[2] shows
that: "Over the next decade increased percentages of the urban
labor force will need to find employment in activities other than
in food distribution if reduction in real prices of food are to
be achieved" (53).

2. The structure of the economy with full employment.

If implemented, the full employment program would result in
a significant change in the historical trends.[3] The modern sector
is to employ a greater percentage of the labor force by 1985.
Furthermore, the "gap" between the traditional and the modern
sectors would be reduced a little on the average because of
anticipated increases in agricultural productivity and the reduction
of the historical rate of growth of labor productivity in
manufacturing. More important, the trend of widening "gap" between
the two sectors would be reversed.

---

[1] See the previous chapter.
[2] It is a regional study.
[3] See Table IV-3.

The "dualism" in the economy would continue to persist and with it the threat of technological unemployment. However, increasing productivity in the traditional sector would become the new challenge.

A. CONCLUSIONS.

1. There are clear indications that the Colombian economy is "dualistic". A modern sector coexists with a traditional sector.

2. The modern sector comprises of mining, transportation and communications, manufacturing, government services, finance, utilities, modern agriculture[1] and modern commerce.[2] The traditional sector would comprise agriculture, personal services, craft industry, commerce and construction.

3. The modern sector has a production function involving relatively high capital-labor ratios. Production techniques are largely imported from the developed countries. The traditional sector's production function requires relatively low capital-labor ratios.

4. Each sector produces about half of the total output. However, the traditional sector provides more than three-fourths of the total employment.

5. The annual rate of mechanization of the modern sector is relatively high while for the traditional sector it is near zero.

6. The share of employment by the modern sector remains almost constant while its share of output has been increasing.

7. Technological unemployment has been the result of the dualistic structure and its trends.

---

[1]Sugar cane, irrigated rice, cotton, bananas, poultry industry.
[2]Import and export firms, department stores and self service retailers.

8. Further, distortions in the factor prices and also other distortions are encouraging biased choices towards capital intensive techniques in the modern sector, but bias choices towards labor intensive techniques in the traditional sector. Therefore, the maximum possible output cannot be reached and also the area of redundant labor is increased.

9. Unemployment and underemployment are high in the economy. Certainly, technological unemployment is a significant proportion of total unemployment. The trends are towards more unemployment and underemployment.

10. The ILO full employment program for 1985 would reverse the trend of a widening productivity "gap" between modern and traditional sectors. The rate at which the modern sector was increasing its total output share is likely to slow down a little. The modern sector would increase its share of total employment.

11. But, some modern sectors with already high productivity levels and with high growth in labor productivity would continue to have high labor productivity growth (i.e. utilities). Sectors with low labor productivity would continue having low levels of labor productivity (except agriculture). These traditional sub-sectors (construction, handicraft, commerce and personal services) would provide most of the jobs. Dualism would remain in the economy by 1985.

12. The economy would have a very high rate of economic growth (8.1%). This appears over-optimistic. Furthermore, the program of full employment may result in high disguised unemployment and underemployment specially in the traditional commerce sector.

B. IMPLICATIONS FOR POLICY, ECONOMIC THEORY AND RESEARCH.

The level of aggregation used in this paper does not permit specific policy recommendation. Rather, some implications on the direction of the economy and on economic theory and research which may be applied to underdeveloped countries are highlighted.

1. Policy implications.

Technological dualism can be related with part of the unemployment problem in Colombia. Some of the general policy implications are:

(1) Selectivity of technology. In deciding policy on the use of modern technology the following issues should be considered:

- Their direct and indirect effects on employment generation and on efficiency.

- The alternative methods which are available and the substitute commodities that can be produced.

- Its use in the production of commodities or capital goods which meet absolute necessities[1] rather than "luxuries".

- The impact on foreign trade and foreign exchange.

(2) Correction of factor price distortions is required. The system of imports quotas and overvalued exchange rates must be studied. Interest rates should also be studied. A lower cost of capital for traditional sectors and actual availability vs. a higher cost of capital for modern sector firms can be studied. In such a way that the "real interest rate" reflects the real social cost of capital.

---

[1]A minimum of food, clothing, shelter, education and health.

(3)   INCOMEX (International Trade Institute for Colombia) perhaps with the cooperation of another Colombian or LAFTA institutions may organize an information center on technological process available in other countries especially in advanced underdeveloped countries and developed countries. (The most developed countries may have already very efficient information channels).

(4)   It may be important to revise the "infant industry" policy. High wall protection from foreign competition may be important only for some few years while a key industry gets started.

(5)   Monopoly regulation devices must be studied, taking into account their implications on economies of scale, excess capacity and the goods and services which the planning office want to develop. This also implies some control on labor unions.

On the other hand, some kind of association of traditional firms must be studied (INCORA has good examples when it controls and integrates land reform, marketing, credit and technical assistance). These associations can be cooperatives, collective firms, collective bargaining, etc. Besides, agrarian reform and colonization are fundamental for agriculture.

(6)   An aggresive marketing program for exports may be co-ordinated by the government with the help of the Coffee Federation. Studies on the potential products in which we have comparative advantage in (because of "tropicality" and abundant

labor) important potential markets, and the potential markets
that can be created through advertising and promotion should
be carried out. A co-ordinated production and marketing program
needs to be elaborated. Such a program would be important in
reducing unemployment and dualism.

(7) Devices for influencing the output mix must be studied,
i.e., differential excise taxes, income redistribution policies,
etc.

(8) The ILO guidelines must be studied and some criteria
might revised in the light of the dual economy theory. The creation
of large number of new jobs in the traditional sector at a cost
of maintaining very low increases in labor productivity, while the
modern sector continues at a high increases in labor productivity,
should be reconsidered.

2. Implications on economic theory and research.

(1) The theory of dualism seems to be a promising concept
for explaining un and underemployment and helping to find useful
solution in the process of development of backward countries.

(2) The theory of dualism may be broadened to include social
dualism. Further attempts to study dualism at a more disaggregated
level may be important for policy making in Colombia. It is
necessary to construct social indicators of well-being (poverty,
health, education, nutrition, child nutrition, etc.) which can
help in policy making.

(3)   Attempts to separate the forces which lead to dualism as well as the forces which oppose dualism, i.e. modern technology, monopoly, advertising, income distribution, education, etc., and their trade-offs, can be important theoretically and also for policy making.

(4)   The need for and the impact of organizing the "atomistic" traditional sector, the technology it can then employ, its bargaining power (collective bargaining) are other important areas of study with important policy implications.

(5)   What are the impacts of dualism on income concentration, unemployment and social unrest? What is the impact of this on investment and "leaks" abroad? These are important questions related to economic growth and development.

(6)   What are the "goods" and "bads" of having close trade links with highly developed countries and the alternatives open are questions which must be examined.

BIBLIOGRAPHY

1. ACKLEY, G. 1961. Macroeconomic theory. U. of Michigan. Macmillan Company. 597 pp.

2. ADAMS, D. W. 1969. Rural migration and agricultural development in Colombia. Ec. Dev. Cultural Change. Chicago, Ill. 17, 4, 527-39.

3. ADAMS, D. W. 1966. Colombia's Land Tenure System. Antecedents and problems. Land Tenure Center. University of Wisconsin.

4. ARROW J. et al. 1961. Capital labour substitution and economic efficiency. Review of economics and statistics. Vol. XLIII, August.

5. ATKISON, L. J. 1970. Agricultural productivity in Colombia. Foreign Agric. Econ. Rep. Econ. Res. Serv. US Dept. Agrc. Washington, D. C. No. 66.

6. ATKISON, L. J. 1969. Changes in agriculture production and technology in Colombia. Foreign Agric. Econ. Rep. Econ. Res. Serv. US Dept. Agric. Washington, D. C. No. 52.

7. BAER, W. and M. Herve. 1966. Employ,ent and industrialization in developing countries. Quarterly Journal of Economics. Vol. LXXX, No. 1, 88-107.

8. BAIN, J. 1959. Industrial organization. John Wiley & Sons, Inc. University of California. Berkeley, 643 pp.

9. BARAN, P. A. 1957. The political economy of growth. New York, Monthly Review Press. 308 pp.

10. BHALLA, A. S. 1970. The Role of services in employment expansion. International Labor Review. Vol. 101, 5, 519-540.

11. BERRY, A. and A. Padilla. 1971. La distribucion de ingresos provenientes de la agricultura en Colombia - 1960. CID. Universidad Nacional. Boletin mensual de estadistica. DANE. Enero.

12. CEPAL. 1967. El uso de maquinaria agricola en Colombia. Santiago, Chile.

13. CRUZ, R. 1969. Analisis socioeconomico de la construcdion residencial en la ciudad de Cali. Pimur. Informe # 16. Michigan State University.

14. CURRIE, L. 1966. Accelerating development. The necessity and the means. McGraw Hill. New York.

15. DEPARTAMENTO NACIONAL DE PLANEACION. 1970. Breve esquema sobre el problema de desempleo en Colombia. U.P.G. 002, Junio 30.

16. DEPARTAMENTO NACIONAL DE PLANEACION. 1970. Plan de desarrollo economico y social 1970-1973. Resumen. Revista del Banco de la Republica, Diciembre. 1784-1798.

17. DEPARTAMENTO NACIONAL DE PLANEACION. 1969. Informe sobre disponibilidad y uso de maquinaria agricola en Colombia.

18. DHRYMES, J. P. 1965. Some extensions and tests for the C.E.S. class production functions. Review of Economics and Statistics. Vol. XLVII, 4.

19. DOBB, M. 1955. A note on the so called degree of capital-intensity of investment in under-developed countries. On economic theory and socialism. London.

20. DORNER, P. and Felstehausen, H. 1970. Agrarian reform and employment. The Colombian case. Int. Labor Rev. Genova, 102, 3, 221-40.

21. DZIADEK, F. 1967. Unemployment in the less developed countries. AID Paper 16.

22. ECKAUS, R. 1962. Technological change in the less developed areas. Development of the emerging countries. The Brookings Institution. Washington, D. C.

23. ECKAUS, R. 1955. The factor-proportions problems in under-developed countries. American Economic Review. Vol. XLV, 539-65.

24. EICHER, C. et al. 1970. Employment generation in African Agriculture. Institute International Agriculture. Michigan State University.

25. EICHER, C. and L. Witt. 1964. Agriculture in economic development. McGraw Hill. New York.

26. FERGUSON, C. E. 1969. Microeconomic theory. R. Irwin, Inc. Homewood, Ill. 439 pp.

27. FLINN, W. L. 1966. Rural to urban migration. A Colombian case. Madison, Wisconsin. Land Tenure Center. Research paper. July.

28. FRANK, A. G. Capitalism and underdevelopment in Latin America. New York. Monthly Review Press, 1968.

29. FURTADO, C. 1970. Obstacles to development in Latin America. Garden City, N. Y. Anchor Books, 204 pp.

30. FEI, J. C. and G. Ranis. 1964. Development of the labor surplus economy. Theory and Policy. Homewood, Ill.

31. GALENSON, W. Economic development and the sectoral expansion of employment. International labor review. June, 1963. 505-19.

32. GAVIRIA, J. et al. 1971. Contribucion al estudio del desempleo en Colombia. CIE (Centro de Investigaciones Economicas). Universidad de Antioquia. DANE. Bogota, Colombia. 172 pp.

33. GLADE, W. P. 1969. The employment question and development policies in Latin America. Journal of economic issues. Vol. 3, 3, September.

34. GITTINGER, J. P. 1971. Economic analysis of agricultural projects. Economic Development Institute International Bank for Reconstruction and Development. May.

35. HAGEN. The economics of development. Irwin 1968, ch. 18. Capital intensive vs. labor intensive methods.

36. HAVENS, A. E. and Flinn, W. 1. (Eds). 1970. International colonialism and structural change in Colombia. Praeger Publishers, Inc. New York. 252 pp.

37. HAVEMAN, R. and J. V. Krutilla. 1968. Unemployment, idle capacity and the evaluation of public expenditures. National and Regional Analysis. Johns Hopkins press. 159 pp.

38. HIGGINS, B. 1968. Economic development. Revised edition. New York.

39. HIRSCHMAN, O. A. 1958. The strategy of economic development. New Haven. Yale University press.

40. INCORA. 1971. La realidad rural y la reforma agraria como factor de cambio. Ponencia ante el seminario de directivos. Noviembre 1970. Boletin Mensual de Estadistica. DANE, Enero.

41. INTERNATIONAL LABOR OFFICE. 1970. Towards full employment. A programme for Colombia. ILO. Geneva. Imprimerie Vaudoise S. A., Lausanne.

42. INTERNATIONAL LABOR OFFICE. 1961. Employment objectives in economic development. Report of a meeting of experts. Geneva.

43. LEWIS, W. A. 1958. Economic development with unlimited supplies of labor. In Aggawala and Singh. The economics of under-development. New York.

44. MARSDEN, K. 1970. Progressive technologies for developing countries. Int. Lab. Rev. Vol. 101, 5, 475.

45. McCORMICK, B. J. 1969. Wages. Penguin modern economics. Baltimore, Maryland.

46. MEIR, G. M. 1970. Leading issues in economic development; studies in international poverty. New York. Oxford University Press.

47. MEIER, G. M. 1969. Development without employment. Banca Naz. Lavoro Quart Rev. Stanford University. St. Calif. September, 22 (90), 309-19.

48. MARSDEN, K. 1969. Towards a synthesis of economic growth and social justice. International Labor Review. Vol. 100, 5, Nov., 389-418.

49. MYRDAL, G. 1970. An approach to the Asian drama, methodological and theoretical. Vontage Books. New York.

50. NELSON, R. R. and T. P. Schultz and R. L. Slighton. 1971. Structural change in a developing economy. Colombia's problem and prospects. Princeton, N. J. Princeton University Press. 322 pp.

51. NURKSE, R. 1957. Excess population and capital construction. Meier. Leading issues in economic development - 1970.

52. RANIS, G. Balanced growth in a labor surplus economy. AID in manpower and social growth.

53. RILEY, H. et al. 1970. Market coordination in the development of the Cauca Valley Region - Colombia. LAMP. Michigan State University.

54. SACHS, I. 1970. Selection of techniques. Problems and policies for Latin American. Econ. Bull. Latin America. New York. 40,1, 1-34

55. SANDILANDS, R. J. 1971. The modernization of the agricultural sector and rural urban migration in Colombia. Occ. Pap. Inst. Latin-Am. Stud. University of Glasgow, Glasgow, 1, 23 pp

56. SCHULTZ, T. P. 1970. Rural-Urban Migration in Colombia. Rev. Econ. Statist. Rand Corporation. Santa Monica, Calif. May, 53 (2), 157-63.

57. SCHULTZ, T. P. 1969. Population growth and internal migration in Colombia, prepared for the agency for international development. The Rand Corporation. Santa Monica (Calif.).

58. SEERS, D. 1970. The meaning of development. The agricultural and development consul. New York, N. Y.

59. SEERS, D. 1970. New approaches suggested by the Colombian employment programme. Int. Labor. Rev. Oct, 102 (4), 377-89.

60. SEN, A. K. 1962. Choice of techniques; an aspect of the theory of planned economic development. Oxford, B. Blackwell.

61. SEN, A. K. 1966. Pesants and dualism with or without surplus labor. Journal of policitcal economy. Vol. 14. October, 425-450.

62. SILVA, A. et. al. 1970. Produccion y distribucion de frutas y hortalizas en la zona de influencia de Cali. 259 pp.

63. SINGER, H. W. 1970. International Policies and their effect on employment. University of Cambridge. Overseas Studies Committee Conference. Prospects for employment opportunities in the nineteen seventies.

64. STEWART F. and P. Streeten. 1970. Prospects for employment opportunities in the nineteen seventies.

65. STRASMAN, W. P. 1970. Construction productivity and employment in developing countries. Int. Labor Rev. Vol. 101, 5, 505-518.

66. STRASMAN, W. P. 1970. Innovation and employment in building. The experience of Peru. Oxford Econ. Pap. July, 22 (2), 243-59.

67. STRASMAN, W. P. 1968. Technological change and economic development. Cornell University Press. Ithaca, New York, 353 pp.

68. THORBECKE, E. and A. Stoutiesdijk. 1970. Employment and output a methodology applied to Peru and Guatemala. Dev. Center, OECD, Paris.

69. THORBECKE, E. and J. K. Sengupta. 1972. A consistency framework for employment, output and income distribution. Projections applied in Colombia.

70. TINBERGEN, J. 1970. Trade policy and employment growth. International Labor Review. (Genova, ILO) Vol. 101, 5, May.

71. TURNHAM, D. 1971. The employment problem is less developed countries. A review of evidence. Development Center of the Organization for Economic Cooperation and Development. Paris.

72. UPPAL, J. 1966. Disguised unemployment in an underdeveloped economy. A theoretical analysis and review of literature. Michigan State University, East Lansing.

73. U.S. DEPARTMENT OF COMMERCE. 1971. Market profile - Colombia. Overseas Business Reports. Washington, D. C.

74. UNITED NATIONS, ECONOMIC AND SOCIAL COUNCIL. 1968. El desarrollo industrial de Colombia. Santiago, Chile. Economic commission for Latin America. Jan.

75. WEIL T., et al. 1970. Area Handbook for Colombia. U. S. Government Printing Office. Washington, D. C.

76. YUDELMAN, M. et al. 1971. Technological change in agriculture and employment in developing countries. OECD. Development Center. Employment Series: No. 4.