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ECONOMIC GROWTH THROUGH

AGRICULTURAL DEVELOPMENT AND TECHNOLOGY CHANGE *

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Table of Contents

I. Introduction

II. Background

III. Methodology

IV. Empirical Findings

A. The Relative Importance of Agriculture in the LDCs

B. Surplus Generation in Agriculture

C. Trends in Agricultural Demand

D. Resource Use in Agriculture

E. The Role of Research and Technological Innovation

F. Agricultural Development and Trade

V. Conclusions

List of Tables

Table No.	Following Page No.	Table Title
1	5	Comparison of Developing Countries Growth Rates for the Fast Growth (Group I) and the Slow Growth (Group II) Countries During 3 Time Periods
2	5	Comparison of Selected Indicators of the Importance of Agriculture in the LDCs among Group I and Group II Countries
3	7	Growth Rate in Agricultural Labor Force Compared to Growth Rates in Total Agricultural Production with Economic Surplus Estimates
4	9	Comparison of LDCs' Caloric Intake, Group I and Group II Countries, 1961-1985, 4 Time Periods
5	9	Selected Agricultural Performance Indicators According to Growth Categories, 1982-1984 Average
6	11	LDCs National Agricultural Research Expenditures Group I and Group II, 1970, 1975, 1980, Latest Year
7	11	Summary of Numbers and Expenditures for National Scientists and Technicians, Group I and Group II, 1975, 1980, and Latest Available Year
8	12	Comparative Analysis of Average Research Expenditures per Capita to Gross National Product per Capita in the Fast Growing and Slow Growing Countries, 1970-1980
9	13	Comparison of Total Trade over Time, Total Exports and Imports, Group I and Group II, 3-year averages for 1968-70, 1977-79, and 1983-85
10	14	Comparison of Agricultural Trade over Time, Agricultural Exports and Imports, World Total, Developed and Developing Market Economies, LDC Group I and Group II, 3-year averages for 1968-70, 1977-79, and 1983-85

List of Tables Continue -

11	16	Trends in Per Capita Agricultural Exports and Imports, Group I and Group II, 1970-84, Dollars
12	16	Trends in Per Capita Agricultural Exports and Imports, Group I and Group II, 1970-84, Index (1970=100)

List of Figures

Figure No.	Following Page No.	Figure Title
1	4	Supply and Demand Shifts Associated with Agricultural Transformations
2	5	Growth Rates in Developing Countries, Fast and Slow Growth Groups, 3 time periods, 1950-72, 1972-79, and 1979-87
3	7	Agricultural Labor and Production, Fast and Slow Growth Groups, 1970-80 and 1980-85
4	8	Food Production Per Capita Indices, Group I and Group II, 3-year moving average, 1963-86
5	8	Total Agricultural Demand Growth Rate, Group I and Group II, 1961-70, 1970-80, and 1980-86
6	9	Cereal Demand and Production Comparisons, Fast and Slow Growth Groups, 1969-71 and 1983-85
7	10	World Grain Production, Area Harvested, and Yield, 1960-88
8	11	World Population and Grain Production, 1960-88
9	11	Total Agricultural Research Expenditures, Fast and Slow Growth Groups, 1970, 1975, and 1980
10	16	Agricultural Exports Per Capita, Fast and Slow Growth Groups, 1970-1984
11	16	Agricultural Imports Per Capita, Fast and Slow Growth Groups, 1970-1984

Economic Growth Through

Agricultural Development and Technology Change*

I. INTRODUCTION

In addition to the traditional political and humanitarian reasons for economic assistance to the Less Developed Countries (LDCs) of the world, we now include U.S. economic self interests and export market promotion. Some have argued that technical and financial assistance to the agricultural economies of LDCs works against the economic interests of the U.S. The concern of several U.S. agricultural commodity groups is that by providing economic assistance to increase agricultural production in these countries, this significantly increases their self sufficiency and consequently reduces the need for future U.S. agricultural exports. If this is the case, then why continue to support agricultural development in the LDCs? The answer is straightforward. History has shown that healthier LDC economies and agricultural sectors, in part due to our assistance, have led to increased U.S. trade and investment that far outstrips our past investments into agricultural development in these LDCs. Development assistance is in the best interest of the U.S. as well as the developing countries. Our future ability to export will depend on our ongoing and future efforts to promote economic growth in the LDCs. As this paper will show, agricultural development in the developing countries is paramount to accomplishing this goal.

The purpose of this paper is to shed some light on the empirical evidence of the last 40 years among the less developed countries. Special emphasis is placed on analyzing the importance of investments in technology development in the process of economic growth The following question formed the basis of the research objective:

> What does the empirical evidence show about the trends and magnitudes in agricultural surplus generation, agricultural demand, consumption, trade, resource use, and investments in agricultural research among developing countries categorized according to their economic growth rates?

II. BACKGROUND

The critical role of agriculture in the economic growth process was not always understood or appreciated. In the post World War II era, some LDCs looked to industrialization to form the cornerstone of economic development policies. Some, on the other hand, adopted rural based economic growth strategies. For them increasing agricultural productivity was their principal development policy.

For those that looked toward industrialization, emphasis was simple: Since developed economies generated an increasing share of their economic activity in the industrial sector, an expanding industrial base was seen as the best route to rapid economic growth by the LDCs. The apparent surplus labor in

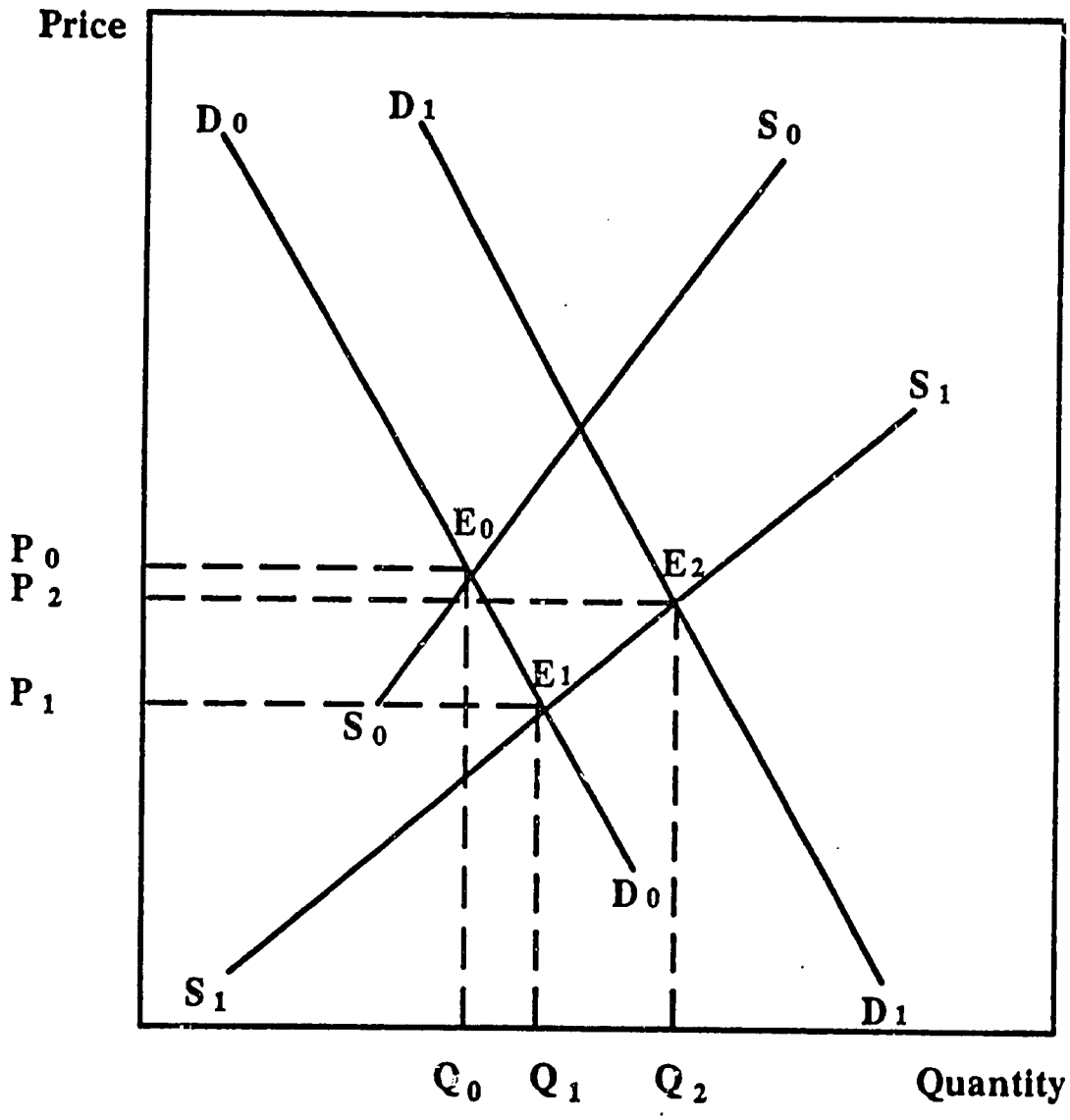
industrial sector. To achieve this objective, development plans and policies were established which favored industrial development, often at the expense of a weakened agricultural sector and their country's agricultural comparative advantage. Skewed financial and investment policies led to heavy infusions of capital which were made in an effort to expand industrialization. The source of this capital formation came from several sources including international donor assistance. Most of it, however, came from internal sources. Since agriculture was the predominant sector of the LDC economy, it became obligatory to look to agriculture for the needed resources for industrial expansion. Taxes on agricultural exports, land taxes, food policies favoring the urban consumers at the expense of the rural sector, multiple exchange rates, and protective industrial tariffs favoring inefficient industries were some of the policy instruments used to transfer resources from agriculture to the industrial sector.

The experience of the industrial led strategies suggests that economic development through industrialization at the expense of its principal sector - agriculture failed overwhelmingly. Instead, what emerged was a small, highly capital intensive industrial sector which depended on continued subsidies for its existence. The promised employment that was to be created through industrial development never materialized. The additional income streams were largely captured by a small segment of urban elite whose expenditure patterns and interests only accentuated the differences between economic classes and did little to stimulate demand induced linkages to the remainder of the economy.

On the other hand, over 40 years of development understanding now suggests that long term economic growth was accomplished in those developing countries where agriculture development was being promoted through productivity enhancing strategies. In those countries where agricultural was the principal productive sector their ability to grow and modernize was directly linked to the capacity of agriculture to generate a surplus above its own sectoral needs. Agricultural growth induces growth in the rest of the economy through a series of linkages which impact on the non-farm sectors and eventually back to agriculture. The production surplus is transformed into lower food prices, higher real wages, and increased demand and consumption. In those countries where income is growing at a rate faster than its own capacity to produce, the increase in real wages (income) is translated into higher imports. The efficiency by which this process is observed is dependent on its relative importance and interdependence with the rest of the economy.

In Figure 1, this understanding of the development process is depicted. During the initial stages of development demonstrated by point E_o, prices are high and consumption low. However, through technology and other cost-reducing and productivity increasing innovations, the overall supply of agricultural commodities increases. This is shown by a shift from S_o to S_1. Lower prices and higher consumption are its immediate consequences. Lower prices, however, simply a higher real wage for consumers who often spend as much as 70-80 percent of their income on food. This reduction in food prices, or conversely an increase in income, results in an expanded demand for food and other commodities. Overall demand shifts to point E_2. This increased demand results in rising prices, and increased farm incomes. Food

Figure 1. Supply and Demand Shifts Associated with Agricultural Transformations



imports are usually necessary in order to keep up with the increased demand and to reduce inflationary pressures.

III. METHODOLOGY

To answer the research question mentioned above, 88 developing countries were first categorized according to their respective growth rates during the 1950 to 1987 time period. Four groups were initially identified which ranged from the fastest to the slowest growing countries of the developing world. In a special analysis for A.I.D., a University of Pennsylvania team developed a comprehensive classification scheme for developing countries. In addition to the fastest and slowest growing categories, two intermediate growth categories were also specified for LDCs.

In this paper, the results of analysis of the two extreme groups are presented (Table 1). Group I consists of fifteen countries. Their average annual growth rate of 3.45 percent places them in the fast growth group. Group II is made up of 20 countries whose annual growth rate for the period 1950-87 was only 0.16 percent, i.e., the slow growth countries. The fast growth countries include Barbados, Botswana, Burma, Cyprus, Egypt, Indonesia, Jordan, Lesotho, Pakistan, Panama, South Korea, Thailand, Turkey, and Zimbabwe. On the other hand, the slow growth countries include Benin, Boliva, Burkina Faso, Burundi, Central African Republic, Ethiopia, Gambia, Ghana, Guyana, Haiti, Honduras, Madagascar, Mali, Mauritius, Nepal, Paraguay, Rwanda, Senegal, Sudan, and Uruguay. Figure 2 presents the results of this analysis.

Table 1: Comparison of Developing Countries

Growth Rates for the Fast Growth (Group I)

and the Slow Growth (Group II)

Countries During Three Time Periods

Country Category	Growth Rates			
	1950-72	1972-79	1979-87	1950-87
	percent per annum			
Group I (1)	3.46	3.77	3.20	3.48
Group II (2)	0.35	1.46	-1.32	0.16
Differences in Growth Rates	3.11	2.31	4.52	3.32

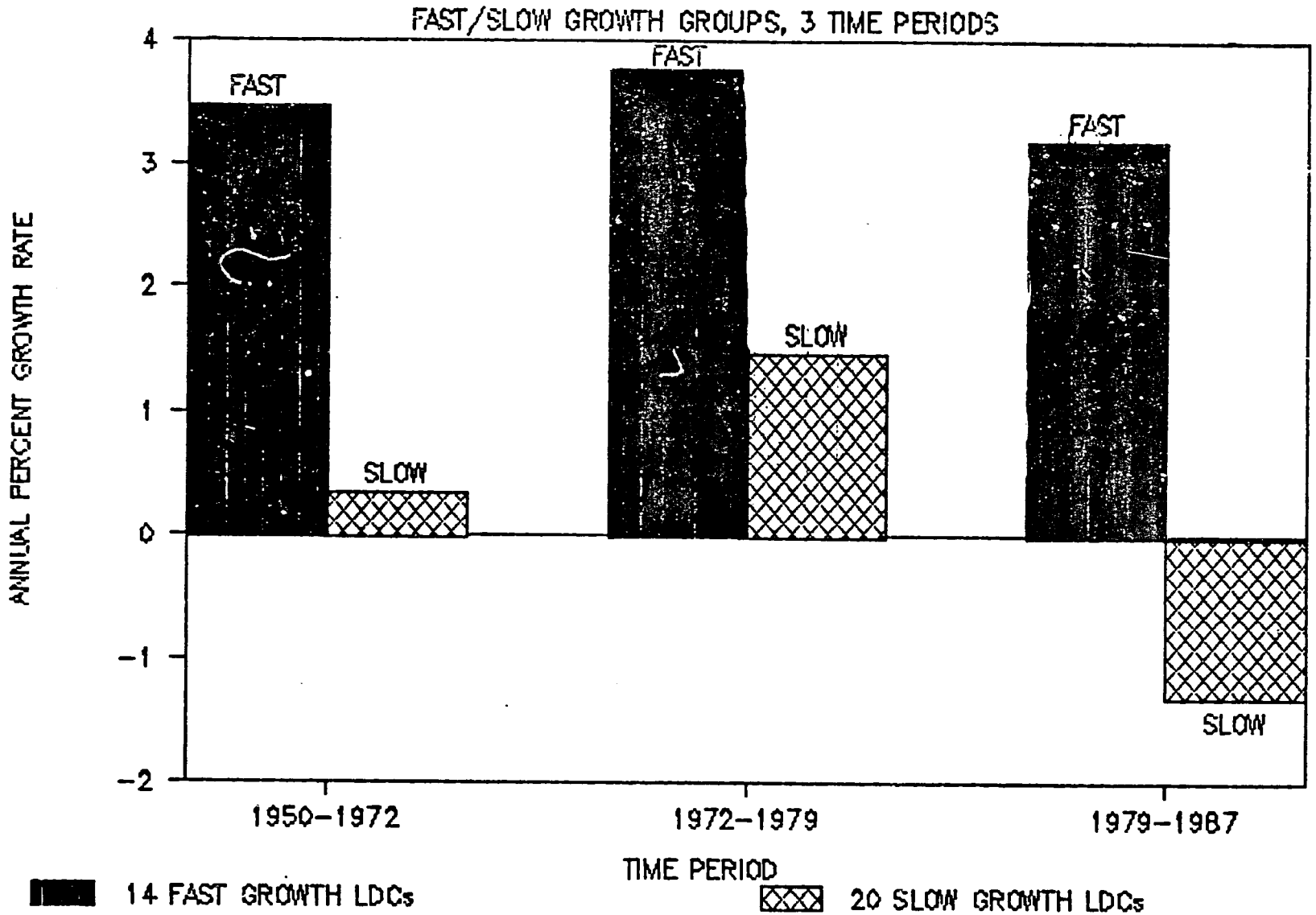
(1) Includes the following countries: Barbados, Botswana, Burma, Cyprus, Egypt, Indonesia, Jordan, Lesotho, Pakistan, Panama, South Korea, Thailand, Turkey, and Zimbabwe.

(2) Includes the following countries: Benin, Bolivia, Burkina Faso, Burundi, Central African Republic, Ethiopia, Gambia, Ghana, Guyana, Haiti, Honduras, Madagascar, Mali, Mauritius, Nepal, Paraguay, Rwanda, Senegal, Sudan and Uruguay.

Source: University of Pennsylvania under contract to A.I.D.

FIGURE 2

GROWTH RATES IN DEVELOPING COUNTRIES



During the 38 year time period from 1950 to 1987, the fast growing countries (Category I) experienced an average growth rate of 3.45 percent while the slower growing countries were lagging behind at an average growth rate of only 0.16 percent.

It is interesting to note that the greatest difference in overall economic performance was experienced during the 1979-87 time period when the fast growing countries continued their strong growth rates averaging 3.20 percent while the slower growing countries were experiencing negative growth rates (-1.32%).

Information on the relative importance of agriculture, production, consumption, trade, resource use, and investments in agricultural research was also collected and analyzed from the FAO, World Bank, IFPRI and USDA data banks. In the following sections these data and the results of the analysis are presented.

IV. THE EMPIRICAL FINDINGS

A. The Relative Importance of Agriculture in the LDCs

Agriculture in the LDCs of the world is important because it must supply food and primary products for industry, generation of foreign exchange, and savings from export and employment for a majority of its inhabitants and labor to newly created and emerging non-farm sectors. As shown in Table 2, agriculture

Table 2. Comparison of Selected Indicators of the Importance of Agriculture in the LDCs among Group I & II Countries

Indicators	Group I			Group II		
	1970	1980	1985	1970	1980	1985
	percent					
Share of Agriculture GDP in total GDP	33.9	25.4	23.6	39.8	34.2	25.8
Share of Agricultural Exports of total Exports[a]	47.9	26.5	17.0	77.8	63.6	56.6
Share of Labor Force of total labor force	54.9	48.1	44.8	78.4	74.8	72.3

[a] Three-year averages were used: 1968-70, 1977-79, 1983-85.

Source: (1)FAO (2) World Bank

occupies as much as two-thirds of the labor force, provides a livelihood to as much as half to two-thirds of the labor force, produces as much as half of the total gross domestic product and provides two thirds of all export earnings. Yet, as growth is fueled through agricultural development, the traditional economies of the LDCs are transformed and its relative importance begins to decline. For example, in 1985 the percentage of total exports accounted by agriculture was estimated at 30.7 percent for the fast growth countries and at 68.5 percent for the slow growth countries. Compared to the 1970 shares, agriculture's relative share of total exports declined by about 23 percent for the fast growth countries and by 13 percent in the slow growth countries.

The same general trend is observed in agriculture's labor force as a percent of the total labor force. As development takes place, agriculture's relative share of the total labor force begins to decline. In 1985, for example, the high growth countries (Group I) had only 47 percent of its total labor force in agriculture compared to 65 percent for the LDCs growing at a much slower rate. During the 1970-85 time period it was agriculture that provided the labor force required for growth to take place in the non-farm sector for both groups. This transfer of labor to non-farm activities took place at a faster rate in the group I countries than group II or the slow growth countries.

B. Surplus Generation in Agriculture

Three variables were used to measure the productive efficiency of the sector to produce a surplus: the difference between the growth rate in agricultural production and the growth rate in the agricultural labor force, the index of

food production expressed in per capita terms, and average yields in cereal grains production. As can be observed in the data reported in Table 3 and Figure 3. Annual growth rates in agricultural production for Group I countries exceeded 3.5 percent or twice the Group II countries growth rates. By contrast, the growth rates in the agricultural labor force was less than one percent per annum for the category I countries while exceeding 1.5 percent for Group II. As a result, the rate of surplus creation in the fast growing countries surpassed the slower growing countries by more than 2.6% per year from 1970 to 1980 and by nearly 2.4% per year from 1980 to 1985.

A similar trend is noted in the index of per capita food production (Figure 4). The three year moving average expands to 130 in 1984-87 from the 1961-63 base year for the fast growing countries. The same index however, declines to the 90 range for the same time period for the slow growing countries. Over the last 25 years the differences between the fast growing countries and the slow growing countries in per capita food production have increased by more the 40 basis points.

Land productivity, measured by tons of cereal grain produced per hectare, was also analyzed as a proxy for the sectors ability to produce a surplus. Again, the results are dramatic. The average yields in cereal grains among the Group I countries (fast growing) was 2.2 tons per hectare in the 1982/84 time period. By contrast, the slow growing countries only averaged 0.9 tons per hectares -- over a twofold difference.

16

Table 3: Growth Rate in Agricultural Labor Force Compared to Growth Rates in Total Agricultural Production with Economic Surplus Estimates

Group	Annual Growth Rate in Agricultural Labor Force		Annual Growth Rate in Agricultural Production		Annual Net Surplus Available for Economic Growth	
	Time period					
	1970-1980	1980-1985	1970-1980	1980-1985	1970-1980	1980-1985
	percent per annum					
I	0.80	1.02	3.57	3.62	2.77	2.60
II	1.55	1.46	1.65	1.67	0.10	0.21

Source: FAO. Agriculture: Toward 2000. July 1987.

FIGURE 3

AGRICULTURAL LABOR AND PRODUCTION

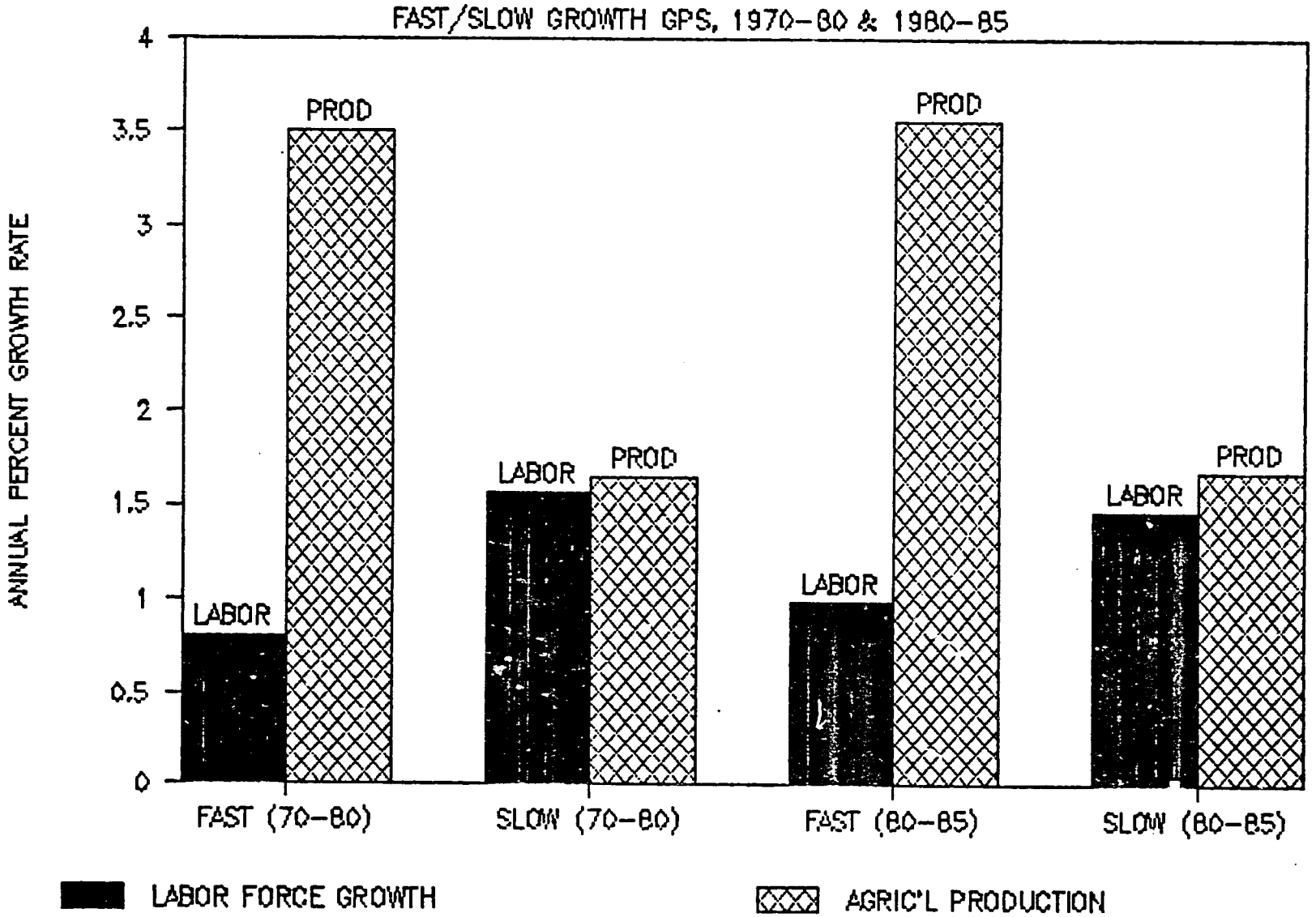
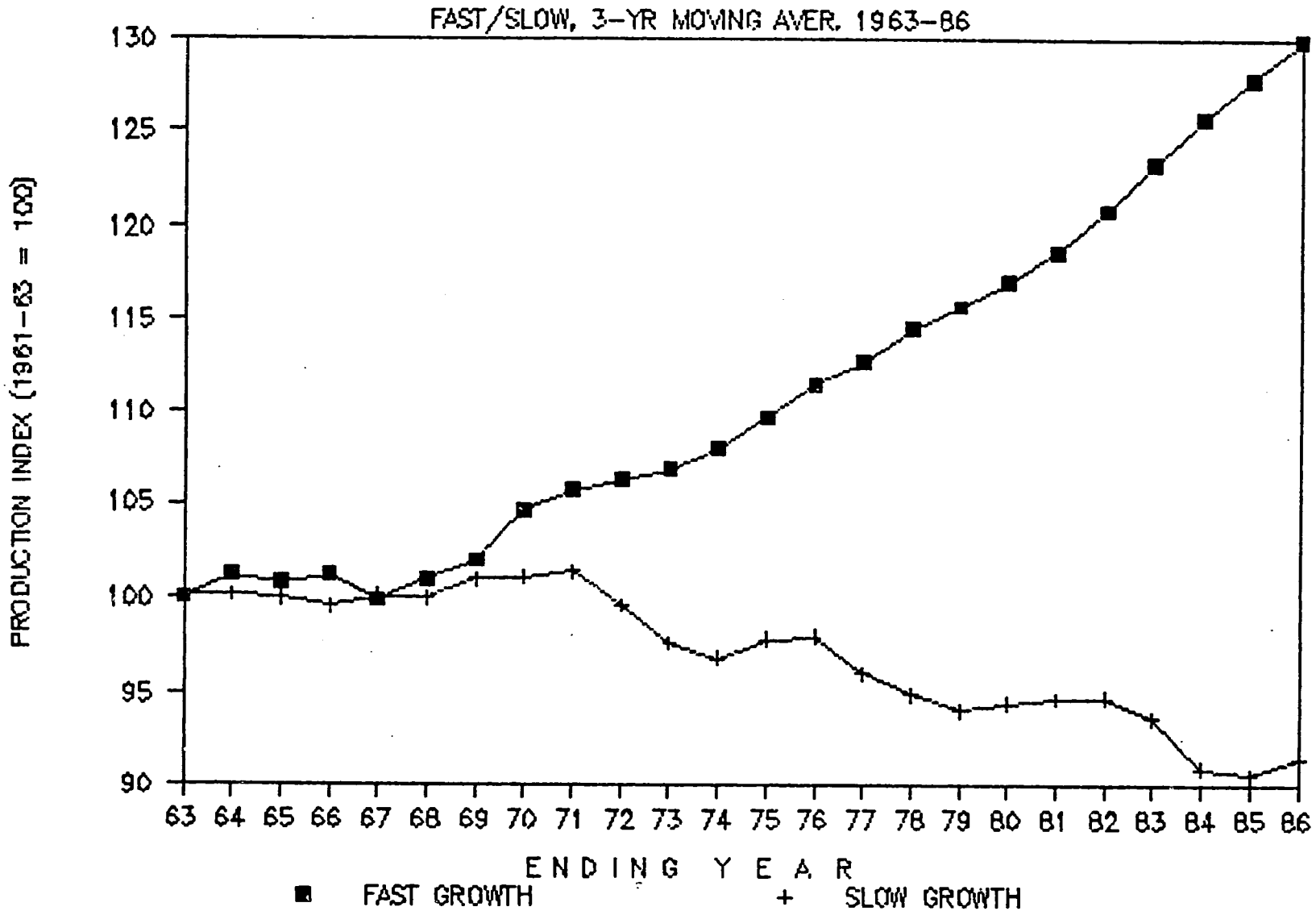


FIGURE 4

FOOD PRODUCTION PER CAPITA INDICES



C. Trends in Agricultural Demand

As indicated above, economic growth takes place only if this surplus is translated into increased demand and consumption. Three variables were analyzed in order to identify differences in the behavior of aggregate demand. The three variables were growth rates in total agricultural demand, total demand compared to total agricultural production and average caloric intake by the population.

As can be observed in Figure 5 the total agricultural demand growth rate for the fast growing countries remained stable around the 3 percent range for the period 1961 to 1985. For the slower growing countries the growth rate in total demand has declined from 2.5 point in the 1960s to about 2 percent in the 1980s.

In Figure 6 total cereal demand was compared to total cereal production. It is interesting to note, as expected, that total demand in the fast growing countries exceeded total production by about 10 million tons while in the slower growing countries the difference was only approximately 3 million tons.

When measured in terms of calories per capita per day, the differences among the two groups of countries are again significant (Table 4). In 1983/85 the calories per day in the fast growing countries totaled 2659, while in the slower growth countries the calories per day was only 2177 - a 482 caloric per day difference. Comparing growth in caloric intake from 1961/65 to 1983/85, an increase of over 500 calories per day is observed for the fast growing

FIGURE 5

TOTAL AGRICULTURAL DEMAND GROWTH RATES

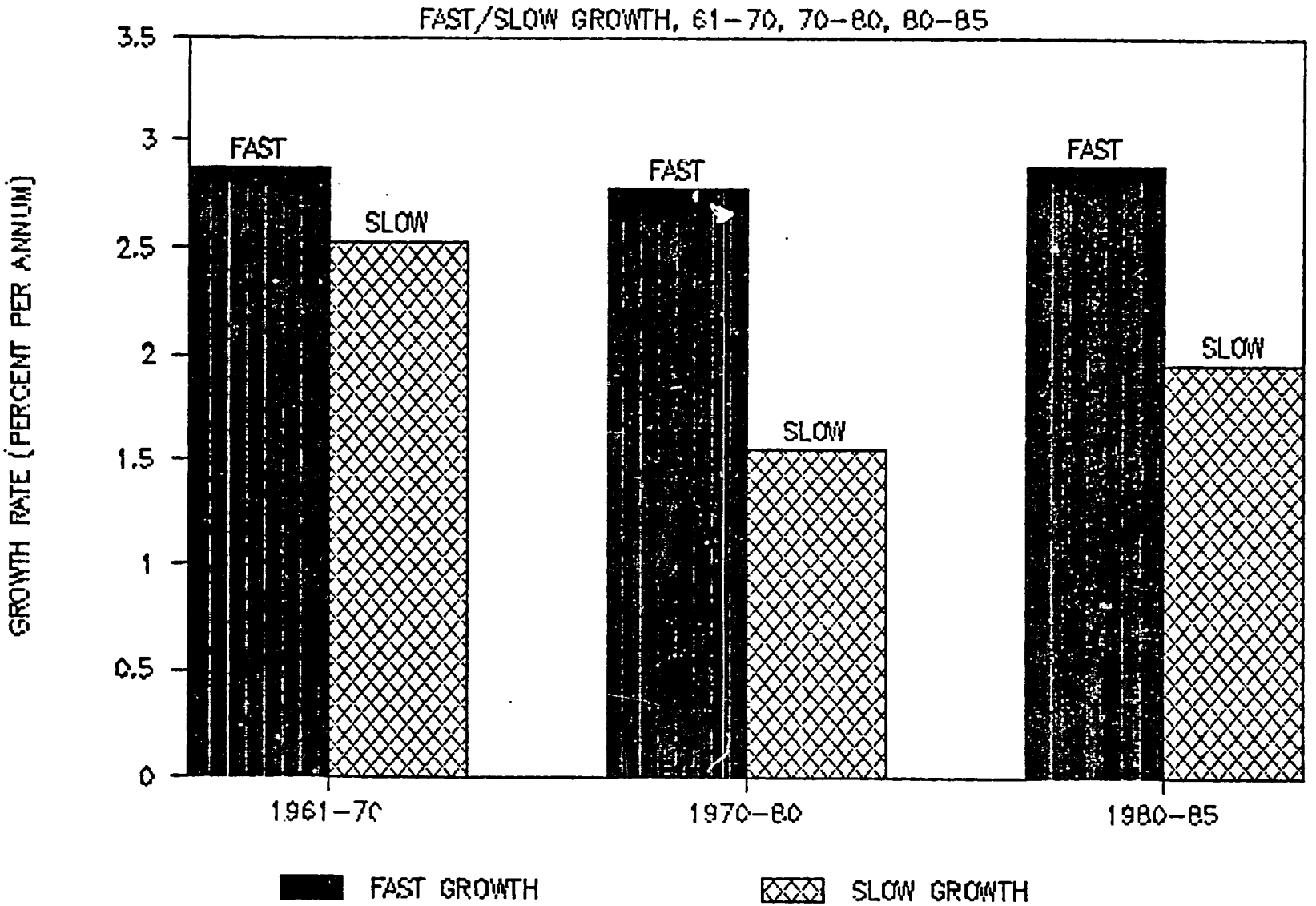


FIGURE 6

CEREAL DEMAND & PRODUCTION COMPARISONS

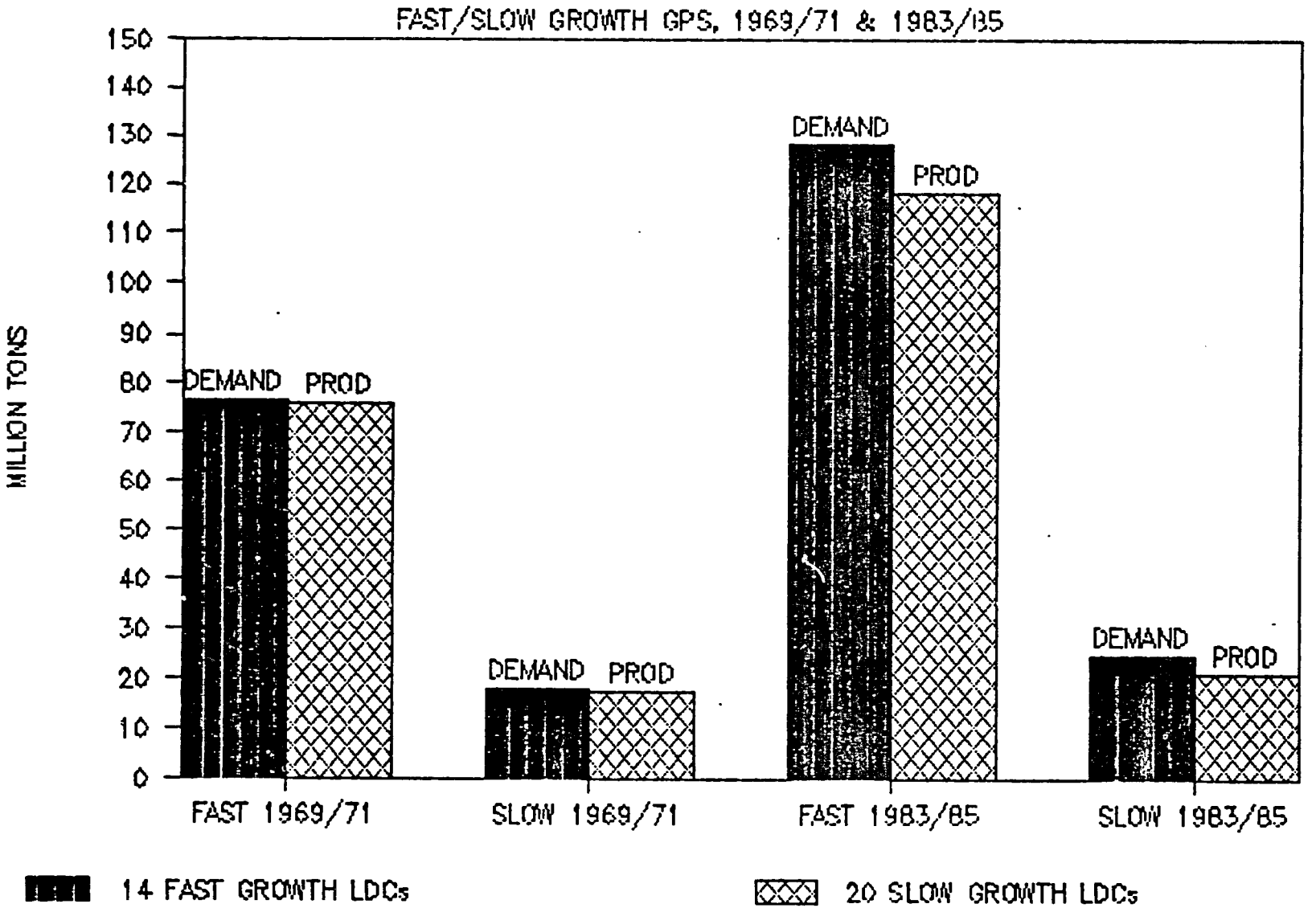


Table 4. Comparison of LDCs Caloric Intake
Group I and II Countries
1961-1985, 4 Time Periods

Group	Time Period			
	1961/63	1969/71	1979/81	1983/85
	Calories per capita per day			
I	2101	2342	2581	2659
II	2082	2195	2217	2177
	Comparison (1961/63 = 100)			
I	100	111	123	126
II	100	105	106	105

Source: FAO. Agriculture: Toward 2000. July 1987

group. The slow growth countries, on the other hand, increased their caloric intake by only 95 calories per day.

Agricultural demand and consumption were growing and significantly more so in the faster growing countries than in the slower group countries.

D. Resource Use in Agriculture

Explanations for these striking differences could be traced to many factors including macro economic policies and institutional capacities. However, as shown in Table 5 significant differences are also observed when comparing indicators of resource use.

For example, there is a noticeable difference in the percentage of total arable land in use, and in the input intensity for the cultivated land. Group I countries, the fast growing, utilized 67 percent of their arable land base in 1984. The slower growing countries (Group II), on the other hand, only used 27 percent. The same is true for irrigation use. Group I countries are using irrigation much more intensively than Group II countries. The intensity of irrigation use in Group I countries is nearly double that of Group II. That is to say, 77 percent of total arable land is under irrigation in the fast growing countries while only 41 percent is under irrigation for the slower growing countries. Another important factor is the striking differences in fertilizer use. The fast growing economies of Group I are using on the average 63 kg per hectare of fertilizer. By contrast only 4 kg per hectare are being used in the slower growing countries. As indicated

Table 5: Selected Agricultural Performance Indicators According to Growth Categories 1982-1984 Average

Indicators	Group I	Group II
Land Use as Percentage of Total Arable Land	67%	27%
Fertilizer Use by kg/ha	62.5	4.3
Irrigated Land as % of Total Arable Land	77%	41%
Cereal Yields MT /ha	2.2	0.9

Source: FAO. Agriculture: Toward 2000. July 1987.

above, noteworthy differences also are observed in average yield, expressed in tons of cereal grains per hectare.

E. The Role of Research and Technological Innovation

Technological innovations generated through research reduce costs of production including risks and ultimately result in income enhancement. Throughout history, agricultural technology has been the primary motivation for economic growth. From the introduction of irrigated agriculture, the wooden plow, to the high yielding varieties of the Green Revolution, agricultural innovation has been an important mechanism for increased productivity which has resulted in the release of labor and capital for non-agricultural development. As can be observed in Figure 7 the dramatic increases in cereal production during the last quarter century have come about mainly through yield increases. Agricultural production has exceeded population growth largely through improved yields and not through an expansion of the area harvested (Figures 7 and 8).

Improved yields are related to technology development and improved input use. Many of the new techniques of production have been created by agricultural research which provides new knowledge. As shown in Figure 9 and Table 6 total research expenditures in the faster growing countries (Group I) exceeded by more than twofold the research expenditures for Group II countries in 1980.

At the same time, it is important to note that growth in agricultural research expenditures has been greater in the Group I (faster growth) than in the Group

FIGURE 7

GRAIN PRODUCTION, AREA, & YIELD

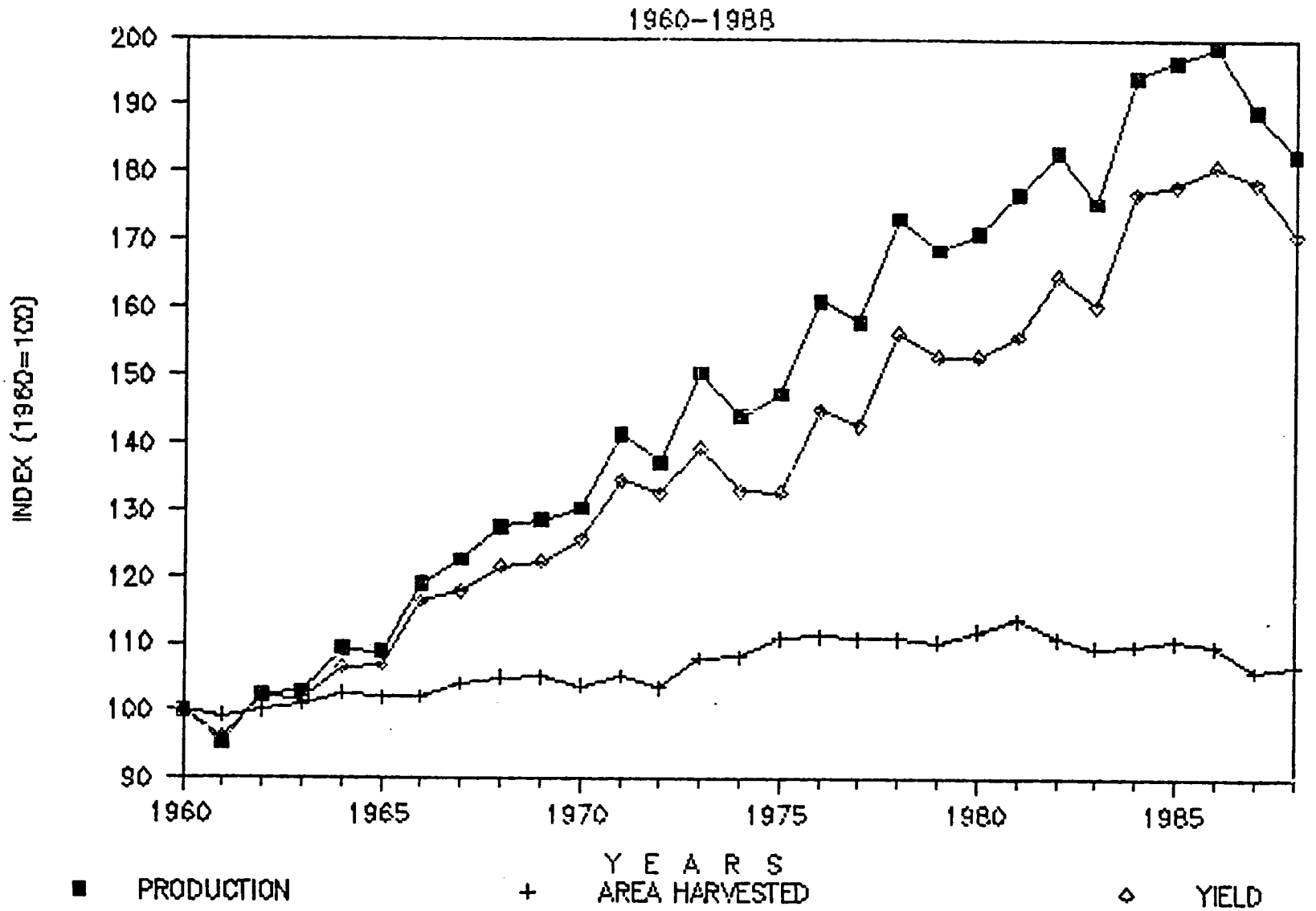


FIGURE 8

WORLD POPULATION AND GRAIN PRODUCTION

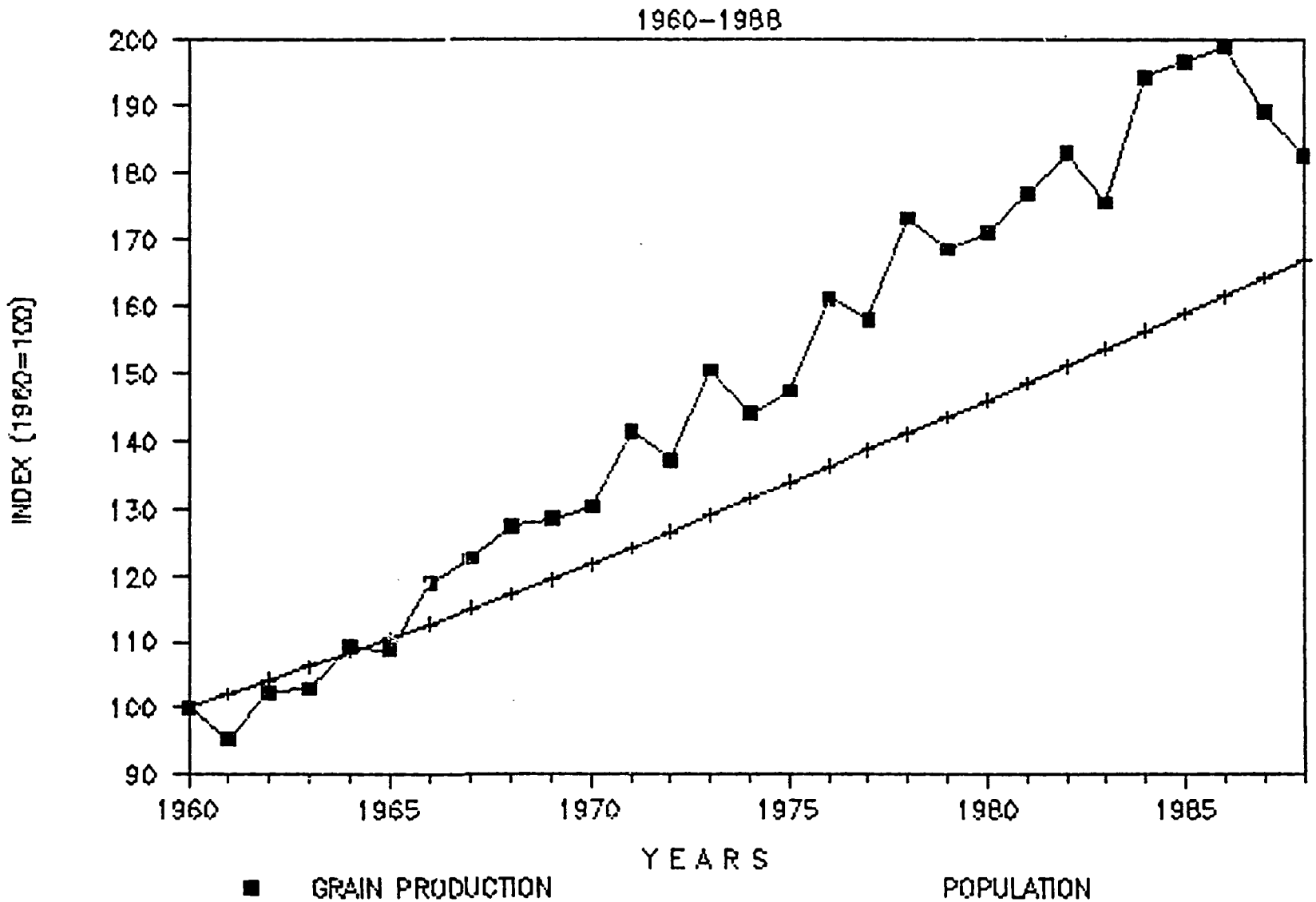


FIGURE 9

TOTAL AGRIC. RESEARCH EXPENDITURES

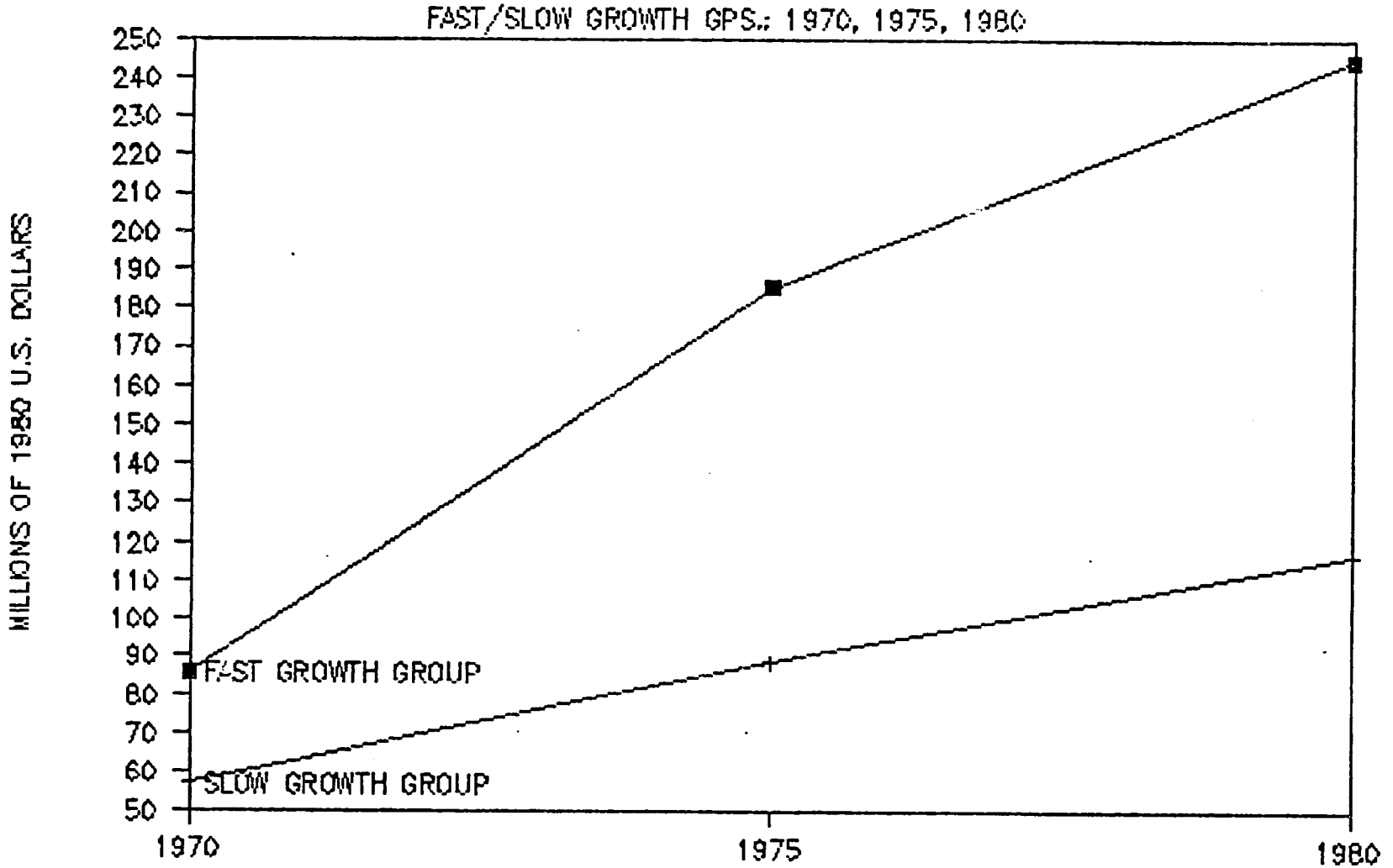


Table 6: LDCs National Agricultural research Expenditures
Groups I and II, 1970, 1975, 1980, Latest Year

Group	Agricultural Research Expenditures			
	1970	1975	1980	Latest
	-- Millions of 1980 U.S. $ --			
I	86	185	245	246
II	58	89	117	104

	Change from the Previous Year		
	1970 to 75	1975 to 80	1980 to Latest
I	+ 116 %	+ 32 %	+ 0.6
II	+ 55 %	+ 32 %	- 10.8 %

Source: IFPRI. P. Oram. Unpublished survey data.

II countries (slower group) (Figure 9). The change in total research expenditures, for example, during the 1970-75 time period was over 116 percent for the Group I countries and only 54.9 percent for the group II countries (Table 6).

In terms of the total number of agricultural scientists, the fast growth group is substantially ahead of the slow growth group (Table 7). In 1975, for example, the fast growth countries had about 7,100 scientists compared with 1,500 scientists for the slow growth group. In 1980, the numbers were 10,300 scientists versus 2,400. In the latest year, the numbers were 12,800 versus 3,300. Although the slow growth countries are making significant progress the absolute difference is still quite significant.

In order to analyze the relative importance of agricultural research within the context of the countries GNP, a ratio of research expenditures per capita to GNP per capita was calculated. Again the trend supports the basic notion that research expenditures have played an important role in the economic growth of the individual country. As shown in Table 8, from 1970 to 1975 the ratio declined by 31 percent in the slow growth countries while increasing 3 percent in the fast growth countries. The change from 1975 to 1980 in the same ratio was even more dramatic. A 27 percent increase in Group I countries compares to a 6 percent increase in the slow growth countries.

The analysis of the number of scientists per million dollars of agricultural Gross Domestic Product (GDP) reveals the same general trend discussed above (Table 7). The fast growing group is clearly superior to the slow growing

Table 7: Summary of Numbers and Expenditures for National Scientists and Technicians
Group I and Group II, 1975, 1980, Latest Year

Comparison	Year	Group I	Group II	Comparison by Group (Group I=100) I	Comparison by Group (Group I=100) II
Total No. of Agricultural Scientists	1975	7,109	1,524	100	21
	1980	10,384	2,435	100	23
	Latest	12,834	3,347	100	26
Expenditures/Scientists (1980 U.S. $)	1980	23.41	40.28	100	172
	Latest	19.66	29.05	100	148
No. of Scientists/Millions $ Agr. CDP	1980	0.30	0.14	100	49
	Latest	0.30	0.19	100	63
No. of Agr'l Scientists/Millio.. Total Population	1980	32.41	16.31	100	50
	Latest	34.21	20.55	100	60
No. of Agr'l Scientists/Million	1980	0.29	0.05	100	18
	Latest	0.32	0.07	100	21
No. of Technicians per Scientists	Latest	1.00	1.39	100	139

Source: IFPRI: P. Oram, unpublished survey data. Sept. 1988

Table 8: Comparative Analysis of Average Research Expenditures per capita to Gross National Product per capita in the Fast Growing Countries (Group I) and the Slow Growing Countries (Group II) 1970-1980

	AREPC/GNPC			Change	
	1970	1975	1980	1970-75	1975-80
I (Fast Growth)	0.0013	0.00134	0.0017	+3.0	+26.8
II (Slow Growth)	0.0034	0.0026	0.0027	-31.0	+6.0

Source: Calculated based on data from IFPRI and FAO

group. There are about 0.3 scientists in the Group I category compared to between 0.14 to 0.19 in the slow growth countries.

The difference between the two groups is also significant when the number of scientists per million of total population is compared (Table 7). For Group I, there are 32.4 and 34.2 scientists per million compared to 16.3 to 20.5 respectively for the slow growth group.

In the measure of the number of scientists per million hectares of arable land, the fast growth group again comes out ahead (Table 7). There were 0.29 and 0.32 scientists per million hectares in category I for 1980 and the latest year compared with 0.05 and 0.07 scientists/million hectares in category II group. In other words, there were about 5 times as many scientists in the fast growing countries per million hectares than in the slow growth group.

In a final measure, the number of technicians per scientist, the slow growth countries are clearly ahead (table 7). In the only year for which data were available, the ratio was 1.39 to 1. Although this would indicate more support staff per unit of research scientists in the slow growth countries, it also supports the notion that was mentioned above that there is a paucity of highly trained research scientists in the slower growth countries.

F. Agricultural Development and Trade

At the outset of this document the question was asked -- why should the U.S. spend money for agricultural development abroad when budgets are tight and farmers at home are struggling? The discussion thus far has centered on agricultural development in the LDCs, its linkages to economic development and the importance of agricultural research to this process. In this section the results of the comparative analysis on the trade variable is discussed.

Total trade in both Group I and Group II countries increased during the period 1968-1985. The category I countries increased much more than Group II countries in both the export and import categories.

In the export comparisons between the two categories, Group I countries increased at a rate more than four times as fast when compared to Group II (Table 9). In the fourteen fast growth countries, total exports rose from $4.9 billion per year in the 1968-1970 era to $38.5 billion in 1977-1979 and on to $91.4 billion in 1983-1985 -- this is a fifteen-fold increase. By contrast, in the twenty slow growth countries, exports increased from about $2.0 billion in the 1968-70 era to $7.2 billion in 1983-85, up about 3 1/2 times.

In the import comparisons between the two categories, Group I also increased at a more rapid rate than Group II (Table 9). Group I imports rose from nearly $8.0 billion in 1968-70 to $91.4 billion in 1983-85, an eleven-fold increase. By contrast, Group II imports rose from $2.4 billion in 1968-70 to

Table 9: Comparison of Total Trade over Time
Total Exports and Imports, Groups I and II
3-Year Averages for 1968-70, 1977-79, and 1983-85

INDICATOR-GROUP	1968-1970 Exports	1977-1979 Exports	1983-1985 Exports	1968-1970 Imports	1977-1979 Imports	1983-1985 Imports
Total Trade	Millions of Current Dollars			Millions of Current Dollars		
I(Fast Growth)	4,949	38,518	74,892	7,989	50,644	91,442
II(Slow Growth)	2,046	6,798	7,174	2,394	9,440	10,558

	1968-1970 Exports	1977-1979 Exports	1983-1985 Exports	1968-1970 Imports	1977-1979 Imports	1983-1985 Imports
Index Comparison	(1968-1970=100)			(1968-1970=100)		
I(Fast Growth)	100	778	1513	100	634	1145
II(Slow Growth)	100	332	351	100	394	441

Trade Ratio	1968-1970	1977-1979	1983-1985
	(Exports/Imports)		
I(Fast Growth)	0.62	0.76	0.82
II(Slow Growth)	0.85	0.72	0.68

Source: World Bank. 1987 World Tables.

about $10.6 billion fifteen years later, an increase of over four times the base year level.

When the comparisons are made between the categories regarding the trade ratio, the ratios in Group I are increasing -- from 0.62 in 1968-70 to 0.82 in 1983-85 (Table 9). By contrast, the ratios in the Group II are declining -- from 0.85 in 1968-70 to 0.68 in 1983-85. The increasing ratio in Group I indicates the improved economic strength of the countries because they are better able to afford imports. By contrast, the strength of the Group II economies apparently has declined.

In comparing the trends in agricultural trade, a five-way comparison was made among total world agricultural trade, developed Market Economies, Group I, and Group II (Table 10). During the latest 15-year period, world agricultural trade has increased over four times. The increase in exports was greatest for the Developed Market Economies which were 4.8 times as much in the 1983-85 era compared to the 1968-70 base period. Even though the total value for all Developing Market Economies was 3.92 times as much in the latest 3-year period, the fourteen countries in Group I fared even better, rising to 5.37 times its base period figure. By contrast, Group II exports increased only 2.55 times during the past 15 years.

The increase in imports was greatest for the Developing Market Economies, which indicates that this group is now the best market for agricultural imports. The Group I imports increase at 8.10 times the base period level was over 25 percent higher than the 621 index for the developing market economies

37

Table 10: Comparison of Agricultural Trade over Time
Agricultural Exports and Imports
World Total, Developed & Developing Market Economies,
LDC Groups I and II
3-Year Averages for 1968-70, 1977-79, 1983-85

GROUP	1968-1970 Exports	1977-1979 Exports	1983-1985 Exports	1968-1970 Imports	1977-1979 Imports	1983-1985 Imports
Total Agr'l Trade	Millions of Current Dollars			Millions of Current Dollars		
World Total	54,470	203,857	237,810	59,427	222,706	261,761
Developed Market Econ.	33,574	135,223	161,322	42,197	147,026	158,336
Developing Market Econ.	16,314	57,013	63,906	10,568	46,665	65,576
Group I	2,369	4,321	12,721	1,733	9,362	14,033
Group II	1,592	4,321	4,057	463	1,547	2,023

Index Comparison	(1968-1970=100)			(1968-1970=100)		
GROUP	1968-1970 Exports	1977-1979 Exports	1983-1985 Exports	1968-1970 Imports	1977-1979 Imports	1983-1985 Imports
World Total	100	374	437	100	375	440
Developed Market Econ.	100	403	480	100	348	375
Developing Market Econ.	100	349	392	100	442	621
Group I	100	431	537	100	540	810
Group II	100	271	255	100	334	437

	1968-1970 Exports	1977-1979 Exports	1983-1985 Exports	1968-1970 Imports	1977-1979 Imports	1983-1985 Imports
Share of World Total						
Developed Market Econ.	61.64%	66.33%	67.84%	71.01%	66.02%	60.49%
Developing Market Econ.	29.95%	27.97%	26.87%	17.78%	66.02%	25.05%
Group I	4.35%	5.01%	5.35%	2.92%	4.20%	5.36%
Group II	2.92%	2.12%	1.71%	0.78%	0.69%	0.77%

Trade Ratio	1968-1970	1977-1979	1983-1985
	(Exports/Imports)		
World Total	0.92	0.92	0.91
Developed Market Econ.	0.80	0.92	1.02
Developing Market Econ.	1.54	1.22	0.97
Group I	1.37	1.09	0.91
Group II	3.44	2.79	2.01

Source: USDA/ERS. Statistical Bulletin 760. November 1987.

total. The Category II group at an index value of 437 was nearly 200 points below the 621 index for the Developing Market Economies total.

The share of the World Trade Total also provides insight into the distribution of the trade during the past 15 years. The Developed Market Economies continue to dominate the export picture in terms of the share -- the share has risen from 61.6 percent in 1968-70 to 67.8 percent in 1983-85. Group I countries have been able to increase their share of exports by one full percentage point (going from 4.35% to 5.35%). By contrast, the export share for Group II has fallen over one-half of a point from 2.9 percent to 1.7 percent.

The Developing Market Economies countries have been more successful in gaining shares in the importation of agricultural commodities -- the share has risen over 7 percentage points in going from 17.8 percent in 1968-70 to 25.0 percent in 1983-85. Group I countries were even more successful than this and able to increase their import share by nearly 80% in going from 2.9 percent to 5.4 percent. By contrast, Group II group stayed virtually the same as in the base period.

The trade ratio provides an indication of the relationship between agricultural exports and imports. For the world as a whole, the ratio for Developing Market Economies has increased to from about 0.80 in the base period to over unity in 1983-85, an indication that exports for the nations in this group have grown more rapidly than imports. By contrast, the ratios for the Developing Market Economies, and Group I and II have all declined over this period.

When agricultural trade trends are expressed in per capita terms using constant dollars, there are some important findings (Table 11). First, Group I countries have improved their position for exports -- up from $31 per capita in 1968-70 to $34 in 1983-85 (Figure 10). It is interesting to note that the peak period was in the 1977-81 era at about $48 per capita, but a steady decline was experienced during the past three years. By contrast, Group II countries have declined in the per capita value of agricultural exports -- falling from $30 to $22 in the past 15 years. The peak exports period for the Group II countries was realized in the 1976-1979 era, coming several years earlier than for Group I countries and with a more severe drop (down over $20 compared to a $14 drop in Group I countries).

A comparison of the trends in per capita agricultural imports indicates that Category I countries have improved their position during the past 15 years (Table 11 and Figure 10). The peak was realized in 1981 with $39 per capita. The past three years have been a slow decline from the peak. By contrast, Group II countries did better until 1980 with a subsequent decline to about the 1970 level of $11.

Comparison of the trends in index terms are also displayed in Table 12. In summary, the fast growth countries have done quite well in both total and agricultural trade during the past 15 years. These fast growth countries(Group I) countries have done well relative to both Developed Market Economies and the average for Developing Market Economies. By contrast, the trade performance for Group II countries has been disappointing in all aspects.

Table 11: Trends in Per Capita Agricultural Exports and Imports
Groups I and II, 1970 - 1984
in U.S. Dollars

Year	Value of Agricultural Exports Per Capita	Value of Agricultural Exports Per Capita	Value of Agricultural Imports Per Capita	Value of Agricultural Imports Per Capita
	Group I*	Group II**	Group I*	Group II**
1970	31	30	15	10
1971	31	30	17	11
1972	36	34	16	11
1973	43	35	20	14
1974	45	39	30	18
1975	41	36	30	16
1976	45	39	28	14
1977	48	43	30	14
1978	48	36	33	16
1979	47	38	34	16
1980	47	33	35	17
1981	47	26	39	15
1982	40	25	31	13
1983	36	24	31	12
1984	34	22	28	11

Notes: *Group I countries: Barbados, Botswana, Burma, Cyprus, Jordan, Korea (Rep.), Pakistan, Panama, Thailand, Turkey and Zimbabwe.
**Group II countries: Benin, Burkina Faso, Burundi, Central African Republic, Ethiopia,, Gambia, Guyana, Honduras, Madagascar, Mali, Mauritius, Paraguay, Rwanda, Senegal and Sudan.

FIGURE 10

AGRICULTURAL EXPORTS PER CAPITA

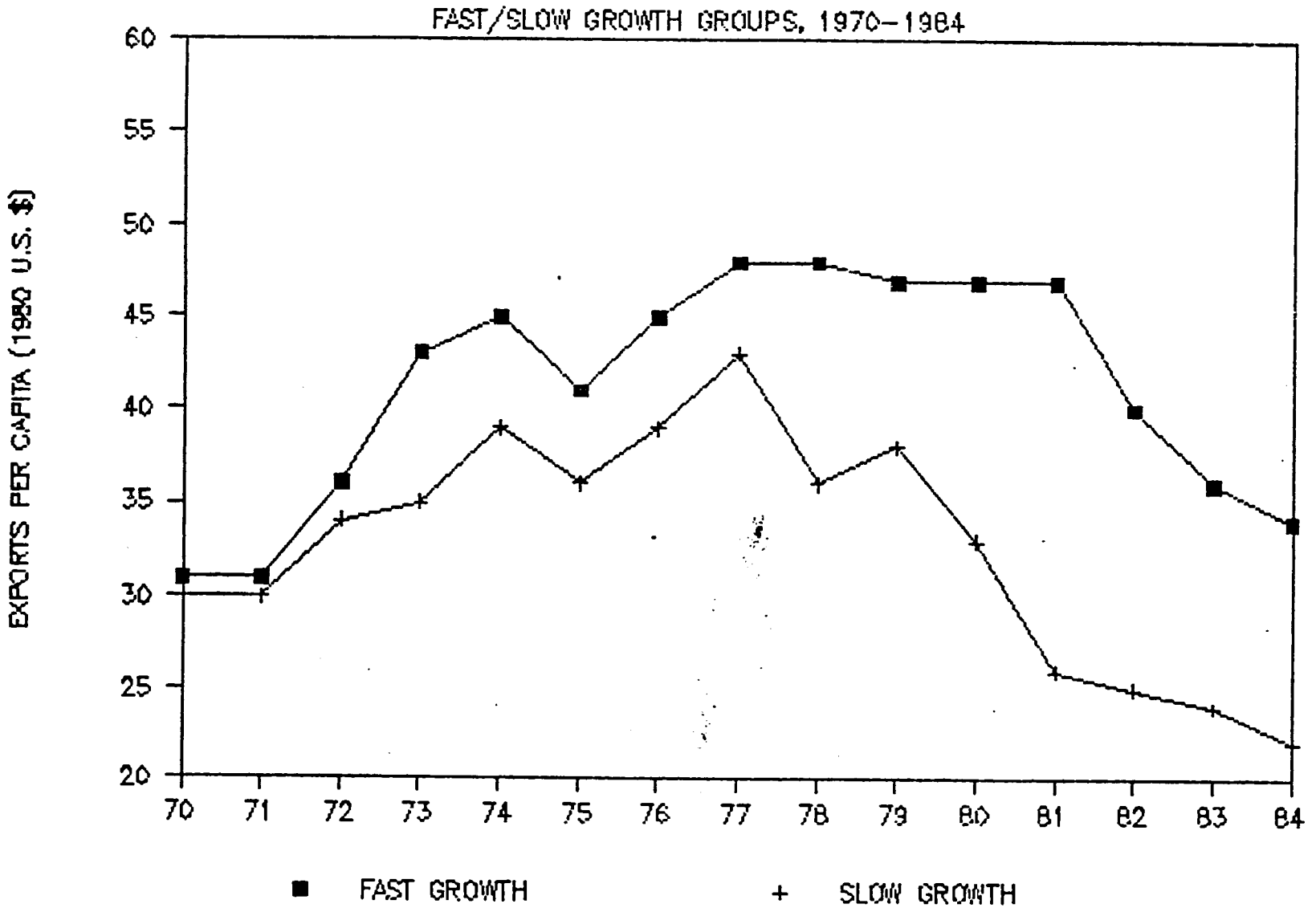


FIGURE 11

AGRICULTURAL IMPORTS PER CAPITA

FAST/SLOW GROWTH GROUPS, 1970–1984

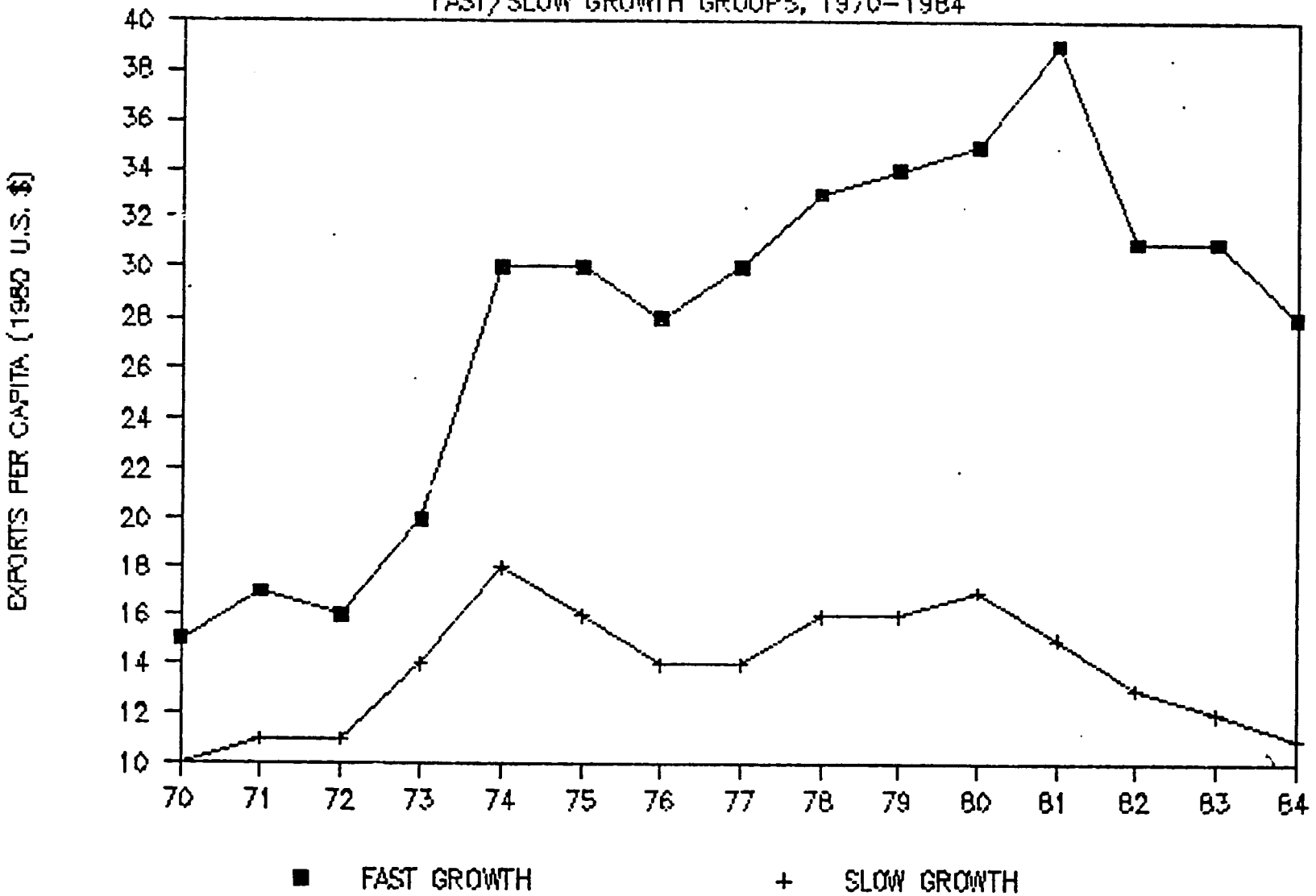


Table 12: Trends in Per Capita Agricultural Exports and Imports
Groups I and II, 1970 - 1984
in U.S. Dollars

Year	Value of Agricultural Exports Per Capita	Value of Agricultural Exports Per Capita	Value of Agricultural Imports Per Capita	Value of Agricultural Imports Per Capita
	Group I*	Group II** Index (1970=100)	Group I*	Group II**
1970	100	100	100	100
1971	99	100	116	109
1972	113	114	107	111
1973	137	118	139	144
1974	144	129	206	183
1975	130	121	206	157
1976	144	131	191	145
1977	154	143	203	139
1978	154	119	224	156
1979	150	127	236	163
1980	150	108	241	169
1981	148	85	271	154
1982	129	83	215	128
1983	116	80	214	118
1984	109	75	192	112

Notes: *Group I countries: Barbados, Botswana, Burma, Cyprus, Jordan, Korea (Rep.), Pakistan, Panama, Thailand, Turkey and Zimbabwe.
**Group II countries: Benin, Burkina Faso, Burundi, Central African Republic, Ethiopia, Gambia, Guyana, Honduras, Madagascar, Mali, Mauritius, Paraguay, Rwanda, Senegal and Sudan.

V. CONCLUSIONS

Although causality is difficult to conclude, the information and analysis presented in the previous sections are indicative of the following conclusions concerning the importance of agricultural sector development in the process of economic growth:

(i) There is a significant difference in the performance of the agricultural sectors of the fast and slow growing countries in the developing world. Labor and land productivity are much higher for the fast growing countries. Differences in growth rates in agricultural production and labor for the fast growth group exceeded 3.75 percent per year. For the slow growth group this difference was less than 0.05 percent per year. The same trend was observed in the analysis of the average land productivity where average yields for the fast growth countries was above 2 tons of cereal grains per land unit.

(ii) Differences in the utilization of resources were also observed. Measures of irrigation and fertilizers use as well as intensity of land use as a percent of total arable land were found to be significant and favoring the fast growth country group.

(iii) Significant difference was also observed in the investments in agricultural research. This was especially true for total research expenditures, number of research scientists, and in general the level of scientific knowledge available in the developing world. The fast growth countries surpassed the slow growth countries in all measures.

(iv) Increased agricultural productivity has resulted in expanded total demand and consumption. The greatest increases were observed in the measure of aggregate demand and caloric intake, with the fast growth countries doing much better than the slower growth group.

(v) Fast growing countries are trading more than the slow growth countries. Significant differences are observed in the levels of exports and imports. Although both groups are importing more than exporting, the fast growing countries imports are growing faster than the slower growth group countries.

(vi). The analysis contained in this paper supports the general notion that agricultural development is paramount in the transformation of traditional societies. The experience of the past 40 years suggests that sustained economic growth was achieved in those countries where agricultural development and rural based growth strategies formed the basis of overall development.

(vii). The analysis also highlights the importance of agriculture's linkages to the rest of the economy. Surplus production and labor must be captured by the non-farm sectors and transfomed into employment opportunities. Urban consumers must be willing to expand their demand for food and agriculture must be ready to change as consumer demand and tastes change.

(viii) Technological innovations are critical to the process of agricultural growth and development. It is through cost reducing and productivity enhancing technology that agriculture can continue to grow and meet the food and fiber needs of future generations.