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COMPARATIVE ANALYSIS OF THE STRUCTURE
AND BEHAVIOR OF AGRICULTURE IN DEVELOPED
AND LESS DEVELOPED COUNTRIES**

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** Paper presented at a Seminar on Economic Development Held in Michigan State University, Winter 1975.

I. Introduction

The present state of World Agriculture especially world food supply reflects the influence of both the public policies of each country and the structure of the agriculture prevailing in each country. Historically public policies have varied over time both within a particular country and between any two countries in the world. The public policies have often been directed at modifying the structures and institutions of the agricultural sector in order to enhance desirable performances. Of equal importance are certain historical, institutional and geographic factors that, while varying from one country to another, determines, to a great extent the structural patterns that are characteristic of the agriculture of many countries today. In comparing the structure and the behavior of the agricultural sectors in countries with varying per capita income we hope to identify those variables that can be subsumed in the production process or regarded as factors which enhance or inhibit agricultural productivity. In essence we abstain from consideration of land tenure relations, climatic conditions and the various historical and political factors that are likely to take us too far afield from agricultural production process in each country.

It is extremely difficult to choose a representative less developed country as it is difficult to draw the line between a developing and a developed country. In choosing our representative countries we are guided by differences in the land/man ratio among countries. Japan and India are both regarded as countries with low land/man ratio while U.S. and Greece are regarded as countries with favorable land/man ratio.

II. Trends in Agricultural Output

Before proceeding to analysing the trends over time in the agricultural output of our selected countries we feel it is appropriate to

warn about the reliability of the statistics they are available. For many countries, especially the third world countries, the statistics often compiled by various organizations are more of extrapolations and derivations rather than actual measurements. Where there is no well equipped institution of agricultural or rural surveys data are often haphazard and incomplete.

Table I contains the index of agricultural output for U.S., Japan and India for the period 1890 to 1960. The rate of growth of total output in the U.S. followed an upward trend throughout this period while in Japan the rate of change increased in the early period, that is between 1890 and 1930, followed by a more or less constant rate between 1934 and 1960. Total output was lower in India than in U.S. or Japan for the entire period. Moreover the rate of change was about constant until 1950 when a spurt in output emerged. The rapid change from 1950 has been explained by increase in public investment in agriculture following Indian independence in 1947.

Sources of Change in Agricultural Output

This section is concerned with some of the factors which often account for changes in agricultural output under different situations. The data in Table 2 do not indicate the extent to which changes have been made in land area, yields and crop pattern. Changes in crop area, in India accounted for 59.1 percent of the sources of change in output as compared with 2.8 in Japan and 29.6 in Greece, (Table 3). Changes in yield accounted for 77 percent in Japan, 33 percent in India and about 64 percent in Greece. A clear inference which can be made from this table is the implication of technological innovations of improved varieties as it affects yield. This will be discussed further in the section under agricultural investment. Crop pattern refer to changes from shifting for low to high value crops in determining value of total output.

III. The Agricultural Population

Our emphasis in this section is the agricultural population as it determines the supply of labor in agriculture. The importance of a country's population as a source of labor supply depends on (a) its size relative to the supply of other complimentary resources and (b) qualitative characteristics which influence labor capacity and work participation.

A lot of influences have usually been derived from the population of a country's population engaged in the agricultural sector. These include statements out level of industrialization, the level of agricultural productivity, and so on. We however dissociate ourselves from these inferences because current evidence in many countries have shown that there is no unique relationship between the level of industrialization and the rate of industrial non-agricultural employment. Countries such as Australia and New Zealand are industrialized and at the same time have the bulk of their population in agriculture. Moreover labor productivity comparison is meaningless where there are differences in the level of complimentary factors. For example that labor productivity in U.S. agriculture is greater than that of India tells us nothing about the levels of capital/labor ratio in the two countries nor how different levels of capital usage affect labor productivity. What determines the absolute size of agricultural labor force in a given country? Explanations about the determinants of agricultural labor size encompasses both economic and institutional factors that differ from one country to another. A common hypothesis in the development is accompanied by a decline in the size of the agricultural labor force. This hypothesis assumes that the rate of labor absorption in non-agricultural sector is greater than the rate of natural increase in population and the absence of immigration and emigration. Evidence from Japan however did show that economic development can proceed without any appreciable decline in the size of agricultural labor force. Data in Table 2 do indicate on the other hand absolute decline in the agricultural labor force in U.S. and Greece-countries with different degrees of industrialization. An alternative hypothesis which can be advanced is that the absolute size of agricultural labor force in any country is related to the relative earning between agricultural employment and non-agricultural employment rather than a country's level of per capita income. In other words the greater the differential between non-farm and farm income the greater will be the reduction in the size of the farm labor force. However, urban earning may be greater than agricultural earnings yet rate of off-farm movement may be low. In most cases this is often due to inability of agricultural workers to acquire the necessary skills for urban employment or the narrowness of the sense of the urban-industrial sector with regards to employment generation.

Awareness of what is now commonly perceived as the population

explosion is of the rather recent origin. As recently as 15 or 20 years ago, in most underdeveloped countries the question whether, and in what sense, they were faced with a problem of excessive population growth was still a subject of controversy. Only in the census around 1960 was the fact firmly established that the populations of practically all underdeveloped countries were growing at a real rate very much higher than recently assumed. No that rate is approaching 3 percent in most countries, and in some an even higher percentage.

For example, Indian's First Five Year Plan (1951-56) assumed a rate of population growth of 12.5 percent per decade, that is, less than 1.25 percent a year. This assumption was retained in the Second Five Year Plan (1956-61). The 1961 Census showed a rate of 21.5 percent for the decade 1951-61, or some 70 percent higher than the estimate relied upon only five years earlier.

The Draft Third Five Years Plan (1961-66) assumed then a population growth of 2.2 percent per year, but by 1961 the Planning Commission was forecasting a growth rate by 1976 of no less than 2.4 percent compound annually. Later forecasts give still higher future growth rates.

It is important to stress that the fall in mortality (about population control) is largely «autonomous», in the specific sense that it is not connected with any preceding or concomitant rise in incomes and levels of living or any other conditions of life, except the new medical technology and its application.

The high rate of fertility is also «autonomous» in the same sense.

IV. Agricultural Land Resources

One of the sources of change in agricultural output which was discussed in Part I of this study is the total area of land under cultivation in a given country. This is particularly important in poor countries where increasing output often comes from extensive cultivation. Between 1950 and 1960 total land area under crop production has remained more or less constant in Greece, increasing between 1957/58 and declining to original level after 1960. A similar picture is evident from the Japanese figure with total area constant between 1950 to 1960 and then increased between 1961 and 1963. On the other hand total cropland in the U.S. has generally been characterized by a reduction in size throughout the period. In India the agricultural land

area showed an upward trend between this period. Bringing more land into production resulted both from land reclamation and increasing irrigation in both India and Japan. A striking observation from the Table is the relative similarity between the size of agricultural land in India and in the U.S. This is an indication that when considered in terms of the overall performance of the agricultural sector, the contribution of land becomes rather negligible.

Table 5 contains data on land productivity for a number of important crops. For the grains (wheat and maize) average productivity was greater on Japan than at the other countries, almost doubling the yield levels in Greece and about 3 times of India. While all the countries recorded increasing yield for all the crops between the two periods, the greatest increase took place in Japan with grain yield in 1961/63 about twice that of 1949/53 period. This is because the Japanese agriculture is heavily intensified.

V. Capital Use in Agriculture

Comparative analysis of the situation of capital investment in agriculture among countries are often difficult to make. In the first instance data may be available only for different time periods. What is included in the agricultural sector capital may be different from one country to another. For example while crop inventories are included in the U.S. data on Greece did not contain the crop inventories. Moreover because of differences in the price levels and in the currencies used inferences can only be limited to changes over time within each country.

Greece: It appears from Table 6 that the volume of total investment in agriculture (excluding stocks) increased more than threefold from 1954-66 to 1959-61. This was chiefly due to large-scale investments in construction. In the following 5-years period annual investment in agriculture increased by only 25%. Investment in construction (other than buildings) showed a marked decrease from 47% to 36% of the total. Expenditures on machinery and equipment, on the other hand rose appreciably. Investment in land also, showed a marked increase while the value of live stock started to decline in the 1960's.

Japan: Land constitutes a main part of the Japanese capital stock. Investment in farm land increased substantially from 1958

(Table 7) upwards. While the total area of farm land has changed little over the period, the new investment took the form of various types of land and irrigation improvement, new reclamation, etc.

Annual investment in farm building has been rising especially since 1962 as a result of the livestock industry. Outflow of agricultural labor and the consequent shortage of labor has forced farmers to introduce machines especially small tractors and cultivations. The rising investment in machinery was also due to the use of new motor driven sprayers and threshers to replace old manual ones. The steady increase in capital both fixed and working capital, has not taken place equally amongst farms as showed by an OECD study. It was found that the fixed and working capital increased with increasing size of farms. Vegetable farms, first growing farms, poultry and hog farms used a greater amount of fixed and working capital than rise and agriculture farms.

U.S.: Farm production (assets associated directly with farm production) is defined to include farm land, service buildings, livestock, machinery and equipment, one-half of feed grain inventories and all capital needed to meet annual production expenses. Table 8 contains the assets for the period 1960-1969. In 1969, the market value of all farm production assets was 237.5 billion, rising from 95% billion in 1950. This represented a 152% increase in current prices, but only a 16% increase in 1947-49 constant prices. Much of the increase is attributed to real estate which rose 186% in value (only 10% in constant prices) and increase from 68% of total production assets to 77%. Asset values of machinery and motor vehicles increased considerably in both current and constant prices, 146% and 58% respectively.

VI. Government in Agriculture

The role which the public plays in influencing the course of agriculture in any country is multi-dimensional. Important public roles include (1) direct investments in agricultural production, (2) investment in agricultural infrastructures, (3) investment in research and agricultural education (4) provision of agricultural credit, and (5) incomes and price support programs.

The role of the public in the provision of agricultural credit is shown in Table 8 for Japan, U.S., and India. In 1962 official source

of agricultural credit accounted for 18 percent of the total credit. The bulk of loans from institutional sources came from cooperatives which accounted for 50 percent of total loans. In the U.S. official sources accounted for 17 percent while commercial banks provided nearly a quarter of the total credit. Institutional powers accounted for roughly a quarter credit in India, while in the U.S. however the role of the commercial banks was insignificant. Non-institutional powers accounted for 28 percent in Japan, 52 percent in the U.S. and 76 percent in India.

Tables 10, 11, and 12 contain expenditures on agricultural research and extension. Total expenditure on extension services increased by 87 percent in Japan from 1948 to 1957. Expenditure on research increased by 51 percent in the U.S. between 1957 and 1965 while appropriations on extension increase by 37 percent for the same period. In Greece, however, change in expenditure on extension services remained steady from 1955 to 1957 and then increased for the entire period by a modest 42 percent. Expenditure figures on research in Japan and Greece were not available.

One of the key behavioral variables in agriculture is the price level of agricultural commodities. Not only is it important in determining the welfare of the farm population but it is the most important single factor in determining the real value of non-farm incomes. Within a market economy characterized by competition in both production and consumption a general increase in the level of agriculture output will result in lower prices and hence low income for producers. When however, total output declines a rise in the price level takes place to the detriment of consumers. For the reasons variations in the price level of agricultural products are often dampened by government policies or through international trade or assistance. The data in Table 13 show a more or less similar trend among the countries under investigation. Indeed it seems likely that the trade in one country is not completely independent of the trend on the other. For example a bumper harvest in Japan will have the effect of lowering the demand for imports and hence a general decline in world food prices. Similarly good harvest in the U.S.A. is likely to affect the domestic price level in India because of increased in grain shipment for food aid. Although it is almost impossible to get data on income in agriculture for all the countries under consideration, evidence from many writers do indicate that the absence of public intervention income per farm operation is

negatively related to increase in productivity. This results from the competitive nature of agriculture and the low income elasticity of demand for farm products.

Conclusion: In this study our approach has been to look at each country's agricultural sector from an aggregative view point. A micro-analysis would require over a year to complete and the total work could have covered volumes of paper. The aggregate nature of the analysis however enabled us to focus on number of issues such as the level of capital formation in agriculture and the role of the state in providing essential agricultural infrastructure.

The question which we had to answer was. How far is the economic theory of the industrially advanced countries applicable to the underdeveloped countries? This question has been raised, at one time or the other, by a variety of people. Some of the sociological writers have questioned the applicability of the concept of the «economic man» (or homo economicus) to the under developed countries where traditional values and attitudes prevail. The historical and institutional economists have argued that the generalizations of economic theory are based on the particular circumstances of the advanced countries and are, therefore, not «universally valid». With the emergence of the underdeveloped countries of Asia and Africa, the questioning of the usefulness of the «western» economic theory to these countries has become widespread. Now, many western economists, not normally regarded as historical or institutional economists, have joined the ranks of the critics.

There are two main lines of criticism currently adopted against economic theory. The first is to elaborate the older line of the criticism, stressing the differences in the social and institutional settings and stages of development between the advanced and the underdeveloped countries. This may be described as attacking the realism of economic theory. The second and newer line of attack is to question the «relevance» of economic theory to the underdeveloped countries (Kumar 1965, pp. 4-5).

The aim of this paper was to clarify and appraise some of the issues that have arisen at the present stage of economic development. We are far from giving support to whatever our view is but we do believe that given the wide differences that exist among the underdeveloped countries with respect, say, to the degree of general level of administrative efficiency, to the degree of population pressure, the overall

size of the economy, the general level of social and political status, and the coherence of the institutional framework, it is high unlikely that any single standard model of development will be appropriate for all of them (Kumar 1965, Myint 1971).

But this does not, by any means, means that these countries cannot be helped by the experience of the developed countries and try to gain from their history of economic development. It is our belief that they can.

TABLE 1
Index of Agricultural Output 1890-1960
(1960=100)

Year	U.S.		J a p a n		I n d i a*	
	Total Output	Output Per Hectare	Total Output	Output Per Hectare	Total Output	Output Per Acre
1890	35	65	35	43	22	114
1895	40	63	37	44	27	141
1900	46	62	42	49	26	141
1905	47	63	46	53	24	124
1910	48	63	53	57	32	162
1915	51	64	60	63	29	148
1920	53	63	65	66	23	121
1925	56	70	65	66	25	128
1930	60	69	69	71	27	134
1935	56	59	73	73	23	114
1940	68	72	73	73	20	103
1945	78	76	63	67	25	114
1950	84	81	71	73	65	75
1955	90	87	83	84	81	83
1960	100	100	100	100	100	110

Source: Yujiro Hayami, Vernon W. Ruttan, *Agricultural Development: An international Perspective*, The John Hopkins Press, Baltimore and London 1971, Appendix, Tables B-1, B-2, pp. 327-328.

* Calculated by the author.

TABLE 2
Agriculture Labor Force

<i>Year</i>	<i>U.S.</i>	<i>Greece</i>	<i>India</i>
1958	10,548	1897	114,000
1959	10,301	1907	116,200
1960	9,795	1917	118,500
1961	9,400	1927	120,800
1962	8,979	1841	n.a
1963	8,664	1759	n.a
1964	8,194	1681	n.a
1965	7,775	1606	n.a
1966	7,381	1534	n.a
1967	7,269	1466	n.a
1968	7,005	1401	n.a
1969	6,695	1339	n.a
1979	6,522	1279	n.a
1971	6,457	1220	n.a

Source: F.A.O.: Production Year Books Several issues.

TABLE 3
Sources of Changes in Production

<i>Country</i>	<i>Time Period</i>	<i>Annual Rate of increase in % crop output</i>	<i>Average % crop</i>	<i>Sources of change</i>	
				<i>of Yields %</i>	<i>Crop pattern %</i>
Japan	1948-63	2.8	2.8	77.0	20.2
India	1948-62	3.1	59.1	32.9	8.0
Greece	1948-62	3.1	29.6	63.9	6.5
U.S.A.	1950-71	—	—	—	—

Source: U.S.D.A.: Economic Research Service, Foreign Economic Report No. 27, p. 19. Agriculture in 26 Developing countries 1948 to 1963.

TABLE 4

Land — Total Cropland 1950-1962. Million Acres

<i>Year</i>	<i>U.S.</i>	<i>India</i>	<i>Japan</i>	<i>Greece</i>
1950	377.3	291.1	5.992	3.605
1951	381.1	291.5	5.048	3.476
1952	380.0	295.5	5.095	3.482
1953	379.5	305.8	5.095	3.500
1954	379.9	322.9	5.095	3.500
1955	377.7	325.9	5.095	3.515
1956	368.7	334.0	5.095	3.515
1957	358.2	336.9	5.065	3.520
1958	354.8	330.5	5.048	5.530
1959	358.5	342.5	5.048	5.530
1960	355.3	341.7	5.085	5.628
1961	339.9	346.9	6.072	3.701
1962	331.2	349.8	6.072	3.702

Source: F.A.O.: Production Year Books Several issues.

TABLE 5

Land Productivity
Average Annual Yield per Hectare of some Important Crops
(1,000 kilograms)

	<i>Wheat</i>		<i>Maize</i>		<i>Rice</i>		<i>Cotton</i>	
	<i>1949-53</i>	<i>1961-63</i>	<i>1949-63</i>	<i>1961-63</i>	<i>1949-53</i>	<i>1961-63</i>	<i>1949-53</i>	<i>1961-63</i>
U.S.	11.2	16.9	24.9	37.8	25.6	39.5	3.2	5.0
Japan	18.5	26.1	14.2	25.9	40.0	50.5	1.2	—
India	6.7	8.4	6.9	9.5	11.3	14.8	0.9	1.2
Greece	10.2	15.3	9.3	14.1	31.3	39.3	3.0	4.2

Source: U.S.D.A.: Economic Research Service, Foreign Agricultural Economic Report No 27: Changes in Agriculture in 26 Developing Nations, 1948 to 1963, p. 46.

TABLE 6
Capital Use in Agriculture
Growth of fixed Capital formation in Greece

	<i>Agriculture</i> 1954-66	<i>Million dr.</i> 1959-61	<i>1958 Prices</i> 1964-66
Construction	371	1.867	1.960
(Of which buildings)	(23)	(439)	(566)
Machinery and Equipment	370	659	1.104
Land Improvement	217	538	769
Change in Livestock Inventory	+280	+123	-291

TABLE 7
Japan. Capital Investment in Agriculture (Million yen)
(In constant 1965 prices)

	1955	1958	1961	1964	1967
<i>Capital Formation</i>					
Land	110.8	107.8	155.7	187.1	309.9
Building	75.8	80.0	97.5	130.5	179.2
Machinery	60.4	75.8	145.6	194.3	273.5
Livestock	59.4	56.0	53.1	50.8	50.6
Plantation	15.2	21.4	27.1	43.4	53.1
Total	320.9	341.0	479.0	606.1	866.3
<i>Investment in related</i>					
Activities	12.9	19.5	24.4	34.7	46.5
Farmland Purchased	56.4	75.6	81.4	90.4	94.2
Livestock Purchased	46.6	52.2	71.8	74.3	76.4
Total fixed Capital	436.8	488.3	656.6	805.5	1,083.4
Total working Capital	161.8	198.5	266.6	836.5	485.8

Source: O.E.C.D.: Capital Investment in Agriculture, Paris 1973.

TABLE 8
U.S. Capital Investment in Agriculture 1950-69
(Current prices, Million dollars)

	1950	1955	1960	1965	1969
Farm real estate	63.6	84.1	114.1	143.5	182.0
Livestock	12.4	11.0	15.2	14.5	20.1
Machinery and					
Motor Vehicles	11.2	15.8	19.1	21.2	27.6
Others	6.7	7.4	7.1	7.2	7.7
Total	93.9	118.3	155.5	184.4	237.4

Source: O.E.C.D.: Capital investment in Agriculture, Paris 1973.

TABLE 9

Agricultural Credit. Percentage distribution of Institutional and non Institutional Credit Sources

	<i>Japan %</i>	<i>India %</i>	<i>U.S. %</i>
	1961	1961	1960
Year			
Institutional	71.7	32.1	47.7
Non-institutional	28.3	76.9	52.3
Sources of institutional Credit			
Official and semi official agencies	18.1	—	24.7
Commercial banks	2.3	—	24.7
Cooperatives	51.3	23.1	15.7
Non institutional Professional money lenders			
	20.0	76.9	—
Traders	16.7	76.9	26.7
Relatives and friends	16.7	76.9	26.7
Land lords	16.7	76.9	25.7
Others	11.6	76.9	26.7

S o u r c e: The same as Table 5, p. 82

TABLE 10

*Agricultural Research and Extension
Japan. Annual Appropriations for Extension Services*

<i>Year</i>	<i>By Natural Cost</i>	<i>By Prefectural Cost</i>	<i>Total</i>
1948	—	—	496.2
1949	579.3	440.5	1,016.8
1950	730.4	794.5	1,524.9
1951	1,137.0	975.6	2,112.6
1952	1,238.4	1,208.7	2,447.1
1953	1,300.4	1,533.2	2,833.6
1954	1,466.6	1,801.7	3,268.3
1955	1,631.3	1,629.5	3,260.8
1956	1,617.1	1,406.4	3,023.5
1957	1,942.7	1,789.7	3,732.4

TABLE 11
U.S. Appropriations for Agricultural Research and Education
1957-65
(Million dollars)

<i>Year</i>	<i>Research</i>	<i>Extension Education</i>	<i>Total</i>
1957	114.7	53.2	167.9
1958	112.5	60.2	172.7
1959	129.0	63.7	192.7
1960	135.1	64.1	199.2
1961	159.7	67.4	227.1
1962	160.5	70.7	231.1
1963	172.8	75.3	248.1
1964	172.8	80.1	272.9
1965	234.8	85.1	319.9

Sources: U.S.D.A.: Reports No 27, 29, Foreign. Agric. Economic Reports and O.E.C.D.

TABLE 12
Greece: Budget Appropriations for Extension Service

<i>Year</i>	<i>Amount</i>
1955	10.9
1956	10.4
1957	11.1
1958	13.9
1959	15.5
1960	19.7
1961	21.7
1962	29.4
1963	18.9

Source: Statistical Year Book of Greece, Athens, Greece 1967.

TABLE 13

Prices and Income in Agriculture
Wholesale Price Indices for Agriculture 1948-58
(1953=100)

<i>Year</i>	<i>U.S.</i>	<i>Japan</i>	<i>India</i>
1948	95	36	92
1949	90	59	97
1950	94	70	102
1951	104	79	110
1952	101	100	97
1953	100	100	100
1954	101	98	96
1955	101	98	88
1956	104	102	99
1957	107	105	104
1958	108	98	107

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