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**Working Paper**

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Center Discussion Paper, No. 93

**Provided in Cooperation with:**
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*Suggested Citation:* Weisskoff, Richard (1970) : Income Distribution and Economic Growth in Puerto Rico, Argentina and Mexico, Center Discussion Paper, No. 93, Yale University, Economic Growth Center, New Haven, CT

This Version is available at:
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ECONOMIC GROWTH CENTER

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New Haven, Connecticut

Center Discussion Paper No. 93

# INCOME DISTRIBUTION AND ECONOMIC GROWTH IN PUERTO RICO, ARGENTINA, AND MEXICO*

Richard Weisskoff

August, 1970

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## ABSTRACT

Has economic growth in developing countries led to increasing inequality in the size distribution of income? Following a brief review of several measures of distribution, the author examines the evidence from Puerto Rico, Argentina, and Mexico in recent years. The findings suggest that the income shares received by the lower half and by the top 5% of families in Puerto Rico and Mexico have declined from 1950 to 1963, while the bottom nine deciles of families in Argentina have also experienced falling shares during the same period. The trend toward greater inequality indicated by the rising Gini ratio and the standard deviation of the logs of income contrast with the opposite indication in the coefficient of variation for all three countries.

More detailed sectoral distributions for each year reveal greater equality within agriculture than within non-agriculture for Puerto Rico and Mexico, while Argentina and the United States demonstrate less equality within agriculture. The trends in the country-wide distributions are consistent with the observation of increases in the differential between sectors, the weight of the more unequal sector, and the level of inequality within both sectors. These trends, however, are qualified according to the particular set of measures which are applied to the data. Finally, the author speculates on possible explanations of these trends in terms of changes in the crop and industry mix.

# INCOME DISTRIBUTION AND ECONOMIC GROWTH IN PUERTO RICO, ARGENTINA, AND MEXICO*

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## I. Introduction

How is the distribution of income affected by economic growth? In this study we are concerned with measuring the changes in the size distribution of income to families during the postwar period of growth in Puerto Rico, Argentina, and Mexico

In examining the income distributions of these countries, it may be useful to keep in mind a general model of a developing economy which is characterized by differential scarcities of labor in various sectors. The type of economy which is being considered has already acquired a moderate industrial base and has been experiencing real growth of per capita incomes. For a complex set of reasons, among which demographic movements, technological change, and relative land scarcity are probably the most important, individuals leave agricultural activity and seek employment in non-farm pursuits.[1] Nevertheless, the output of the agricultural sector continues to increase in absolute terms, but this growth is confined to the modern plantations on improved or irrigated lands. The expansion of the "modern" sector of the rural economy is thus juxtaposed to and contrasts with the remnants of the traditional methods of farming.

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*This research was supported by the Harvard Project for Quantative Research in Economic Development and by the Yale Economic Growth Center. The author wishes to thank Francine Blau Weisskoff, Sam Bowles, Hollis Chenery, Jose Antonio Herrero, and Thomas E. Weisskopf for their suggestions.

In the meantime, the exodus from the agrarian sector swells the ranks of the urban settlers. The unskilled enter the construction or service sectors; others find their way into peddling, haulage, transport, or domestic services, and a large proportion are reduced to scavengers of the industrial urban economy.[2]

The entry of surplus labor into industry is sharply blocked by the inflexibility of technique and the organization of the current labor force. The newer, dynamic industrial activities require a higher order of training and skills to work the imported equipment. The labor force of the older established industries has, in many cases, gained legal protection under benevolent social legislation, considerable organizational power through unions, and control over worker training programs.[3] Under the current social framework of property rights which characterizes capitalist enterprise in the developing countries, the rewards of the industrial expansion are distributed first to the emerging middle classes, including the blue collar workers whose positions are secure against the competitive fringe in the labor market, and then belatedly, to the urban marginals and recent migrants who fill the service sector and the less-skilled industrial jobs.

During these phases of industrialization, we expect the distribution of income in the non-agricultural sector to grow more unequal and the disparity between average urban and rural incomes to increase with the more rapid introduction of modern machinery. Country-wide inequality may be further aggravated by increasing inequality within the rural sector as the capital-intensive plantation sector displaces subsistence farming and as the rural handicraft industries are destroyed by manufactured

'imports' from the city.

It may be some consolation to hypothesize that in later phases of economic growth, income inequality may narrow as average productivity in agriculture catches up with the industrial sector and the share of the former stabilizes. More important, the urban distribution itself may become more equal with the enforcement of welfare legislation and progressive taxation and with the eventual absorption of urban marginal.[4]

The hypothesis that income becomes more unequally distributed with early industrialization and more equally distributed only in the later stages of development as surplus labor vanishes has been tested in international comparisons and time series of specific countries. The results of cross section studies of countries have led generally to empirical support, and the controversy has focussed on the concept and measurement of "equality" of income.[5]

The analysis of time series data for various countries has led to more contested conclusions. Kuznets [33] demonstrates the narrowing of the distribution of income for industrial countries in the recent century, Ohja and Blatt [47] conclude that income inequality had decreased in India during the first two planning periods. But Swamy [63], using the same sample survey data and a different set of assumptions about expenditures and savings of the low income groups, finds a marked increase in inequality. For Puerto Rico, Andie [2] draws on several sources of national data to support the hypothesis of increasing equality during the period 1946 to 1955. However, the population coverage for each year is not comparable and the sources of income differ from year to year. Castañeda and

Herrero [9], using comparable family surveys for 1953 and 1963, demonstrate the lessening equality of income during the ten years of remarkable economic growth.

Recent studies of income distribution in Norway and England by Soltow [57], [58], suggest that greater equality has been the result of industrialization. Yet the bodies of data which are used for these long term comparisons are so varied that it is only their most recent observations which merit confidence. Nevertheless, the original hypothesis that we should expect greater inequality with industrialization still emerges as a suggestive and useful framework for analyzing trends in the overall distribution of income and growth.[6]

## II. Traditional Measures of Inequality

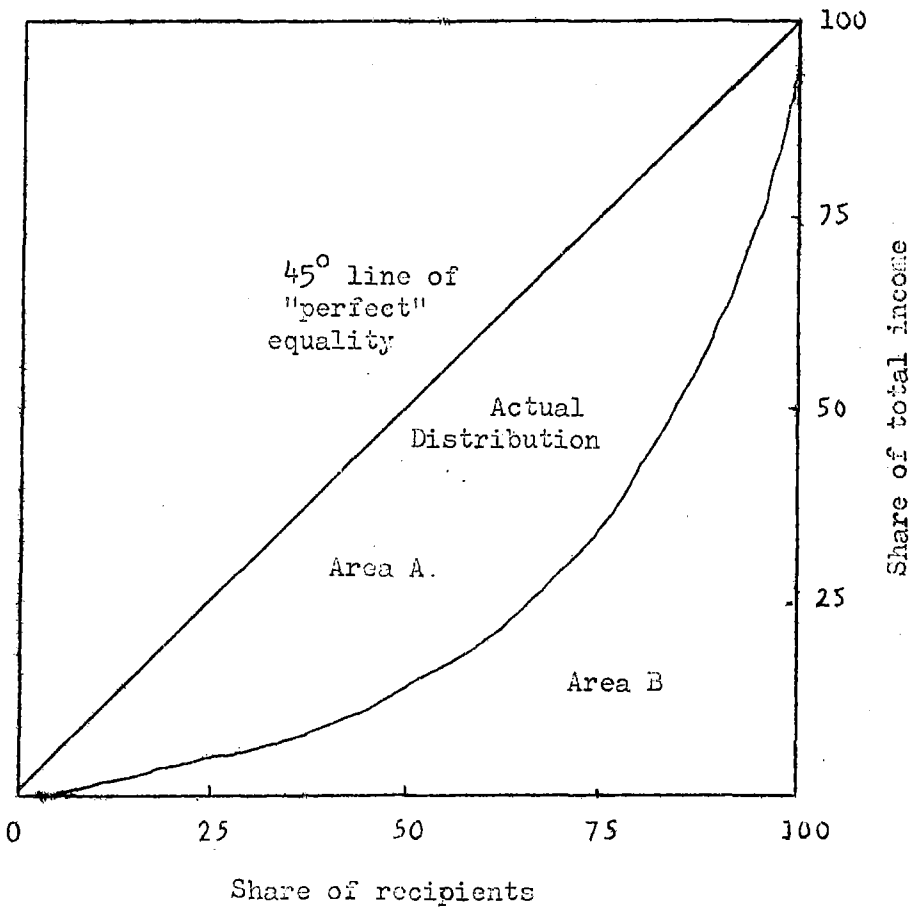
Several measures of inequality have traditionally been utilized in the study of income distribution: the Gini and Kuznets' ratios, the coefficient of variation, the variance of the logs of income, and ordinal shares of income. We shall review the advantages and deficiencies of these measures and the reasons for their selection, and then we shall apply them to test various characteristics of the income distributions of the developing countries.

The most commonly used measure of income distribution is the Gini ratio (more properly known as Gini'a "concetration ratio"), which summarizes the familiar Lorenz curve. The ratio compares the cumulated shares of income as ordered from poor to rich to the income shares that would be held by recipients under the conditions of "perfect" equality. Graphically, the coefficient is formed by the ratio of that area which

lies between the Lorenz curve and the diagonal (Area A of Figure 1) to the total area under the diagonal line of perfect equality (Area A+B of Figure 1).

The Gini ratio approaches zero as the actual income distribution approaches "perfect equality" and 1.00 as the Lorenz distribution becomes more concentrated. Any correction for these "unrealistic" boundaries would require first, the reduction of area under the Lorenz curve in accordance with some notion of "maximum tolerable" inequality, and second, the reduction of the diagonal of

Fig. 1 LORENZ CURVE AND GINI RATIO



perfect equality to a more concave line of "warranted" equality.[7]

A second measure, the Kuznets' ratio, is similar to the Gini ratio but has the convenience that the initial shares need not be ordered or cumulated. The ratio is calculated simply as the sum of absolute differences between shares of income and percentage shares of recipients. Values for the K-ratio vary from zero to perfect equality to 2.00 at maximum inequality.[8]

The application of Gini and Kuznets ratios to summarize the distribution presents several well-known difficulties. First, since, two different Lorenz curves may intersect, it follows that significantly different distributions may yield identical Gini ratios.

Second, the Gini ratio is insensitive to small percentage changes which may represent large income shifts to the lower income classes. Several percentage points difference in the Gini ratio may represent considerable change in relative income to certain groups.[9] Third, the boundaries of perfect inequality and equality are so extreme that changes in the Gini ratio over time would tend to understate any actual gains toward equality.[10]

The coefficient of variation serves as a commonly used, unit-free measure of income distribution, formed as the ratio of the square root of the second moment of the first moment of the arithmetic income distribution. However, it is the "least pure" measure of inequality, since the denominator is also frequently employed as an index of economic growth. Thus if the coefficient of variation is relied on as the sole measure of inequality, then it should be noted that a rapid increase in the average

income may obscure the observation of increasing dispersion of income.[11]

The classification of household frequencies according to intervals on a logarithmic scale also has been used to estimate the parameters of the log-normal density function. Since the variance of the logarithms of incomes is itself a ratio and independent of the original monetary units, it has been employed in international comparison of distributions. Unfortunately, further testing of the assumption that incomes are, in fact, log-normally distributed, is rarely undertaken.[12]

Of the several measures we shall use, only the standard deviation of the logs of income is sensitive to changes in relative income and is little influenced by high absolute incomes. A given distribution, for example, may demonstrate a relatively low standard deviation of the logs of income due to a narrow percentage differential between income groups and at the same time, yield a relatively high Gini ratio due to the large shares belonging to the upper income groups.[13]

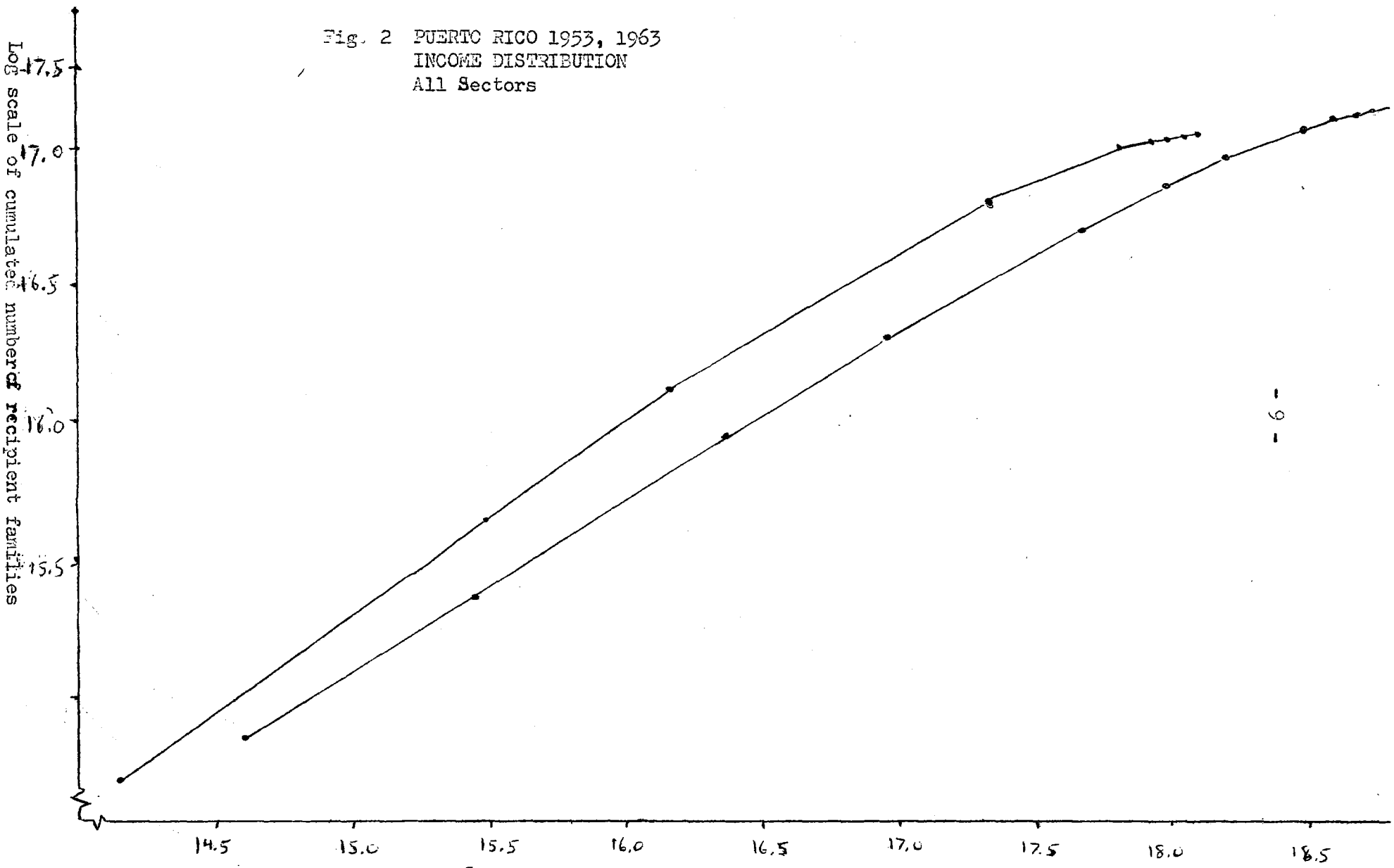
We might also expect the indicators to differ in the direction of the change in the distribution. If average incomes, for example, are rising rapidly at the same time that the distribution is widening, then the coefficient of variation may suggest a movement toward greater equality while, at the same time, the standard deviation of the logs and the Gini coefficient may indicate a movement toward less equality.

Finally, the income shares received by standard ordinal shares will be presented for each distribution and will assist us in studying the changes throughout the array of incomes. The linearity in segments of the plots of cumulated incomes against cumulated number of families suggests

that this cumulative distribution may be used for interpolating between successive observed points. These interpolated points will then be converted to income shares of the standard ordinal groups (Figures 2-4).[14]

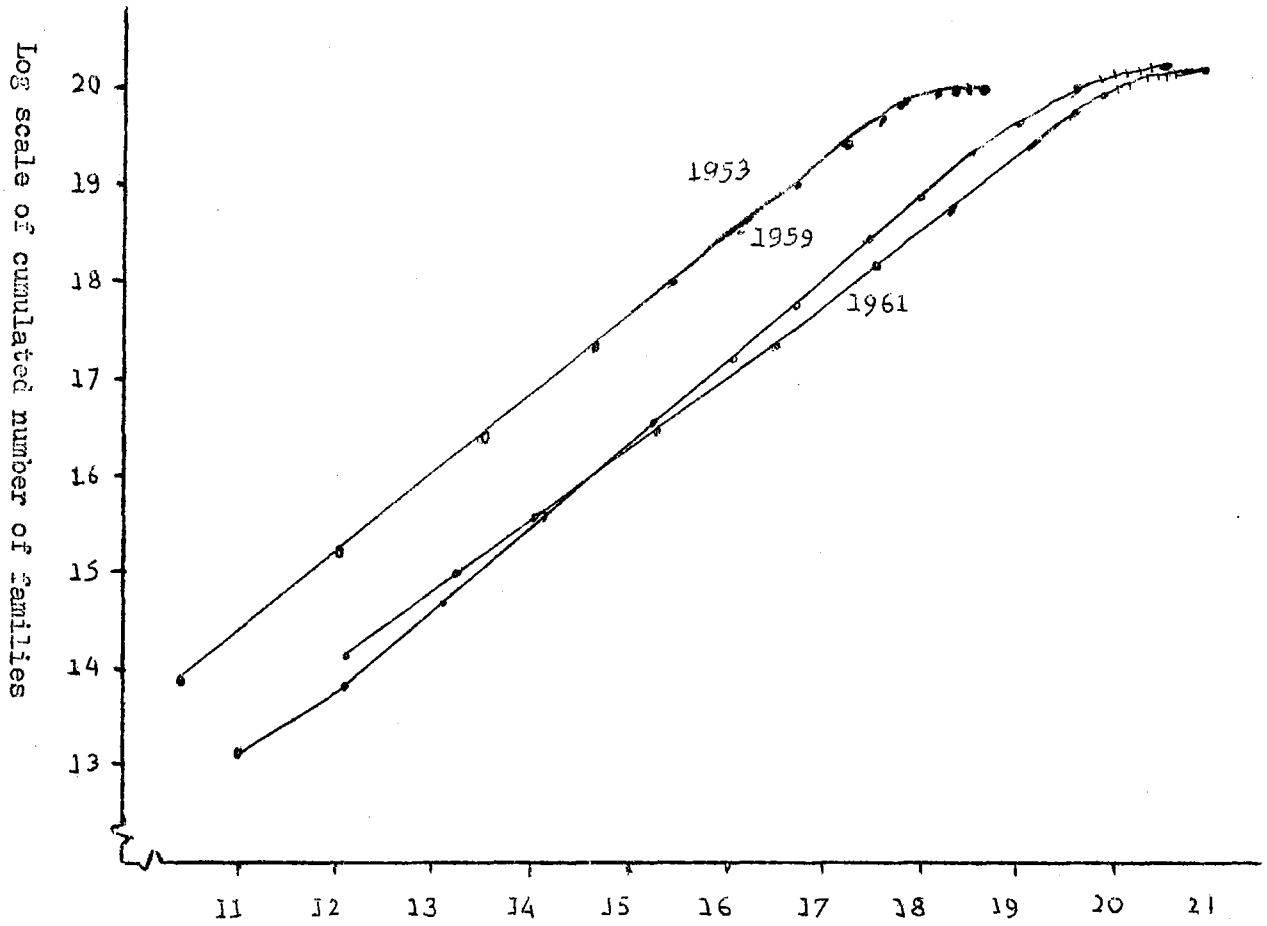
It must be emphasized that these measures of inequality and the income shares cannot be relied on to indicate whether the "poor are getting poorer" or the "rich are getting richer" in real terms. At best, the detailed income shares do indicate whether segments of the distribution have gained or lost relative to other segments. For example, the share of income received by the bottom 10% of families in a given country may fall from 6% to 4%, but the absolute level of income of those families may be doubling at the same time.[15]

Fig. 2 PUERTO RICO 1953, 1963
INCOME DISTRIBUTION
All Sectors



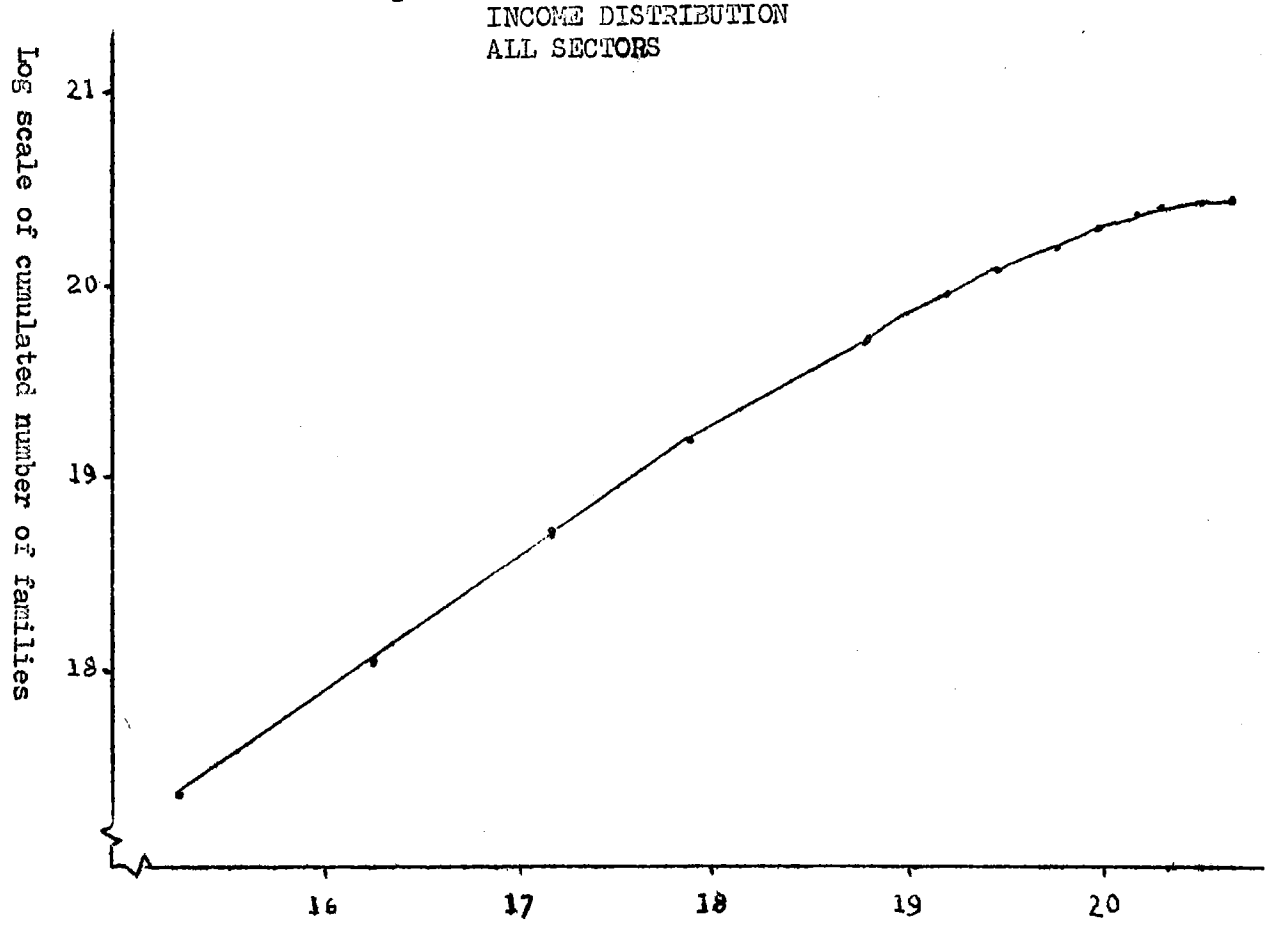

Source: Puerto Rico Department of Labor, Income & Expenditure of the Families, 1963. Report 1 A, Tables 3 & 20.

Fig. 3 ARGENTINA 1953, 1959, 1961
INCOME DISTRIBUTION
All Sectors




Source: Argentina, Consejo Nacional de Desarrollo, Distribción del Ingreso y Cuentas Nacionales en la Argentina, Tomo IV "Distribución del Ingreso por Niveles, "1965, Tables IV-1, 112 &223.

Fig. 4 MEXICO 1963
INCOME DISTRIBUTION
ALL SECTORS




Source: Banco de Mexico, Oficina de Estudios sobre Proyecciones Agrícolas, Encuesta sobre Ingresos y Gastos Familiares en México, 1963, 1966, Table Series 38, p. 432.

## III. Country-wide Distribution of Income

### A. Puerto Rico

During the period 1953-63, Puerto Rico experienced an impressive growth of real incomes. Gross domestic product per capita increased 68% from $502 to $842 in real terms during the decade. (See lines 1 & 2 of Table 1).[16]

This growth of real incomes has been accomplished by a marked structural change in the economy. The share of families with heads employed in agriculture, for example, declined from 31% in 1953 to 17% in 1963. The industrialization program, Operation Bootstrap, has led to the expansion of the industrial and construction sectors, and the major drive for higher earnings.[17] Yet Puerto Rico has also paid in terms of the immense social dislocation resulting from migration to the mainland and the virtual demise of the home needlework industry which had been an important source of income for the "traditional" sector.[18]

In columns 2-5 of Table 1, we note the trends in the distribution of income which have accompanied the real growth of income. The rise in the Gini ratio from .415 to .449 points to a general movement toward greater inequality in the distribution of income shares to families. The increase in the standard deviation of the logs of income (column 4) indicates greater spread in relative incomes, although the degree of skewness has fallen (column 5).[19] The coefficient of variation suggests greater equality of the distribution by its decline from 1.15 to 1.04.

Which particular groups have gained during the ten year period in terms of income shares? In lines 1 and 2 of Table 2, we note that the

Table 1

Measures of Income Growth and Inequality

in Puerto Rico, Argentina, and Mexico

| | | | G.D.P. Per capita (1960 $ equivalents) | Gini Ratio | Coefficient of Variation | St. deviation of logs | Skewness of logs |
|---|---|---|---|---|---|---|---|
| | | | (1) | (2) | (3) | (4) | (5) |
| 1. | Puerto Rico | 1953 | 502 | .415 | 1.152 | .736 | .168 |
| 2. | Puerto Rico | 1963 | 842 | .449 | 1.035 | .843 | .027 |
| 3. | Argentina | 1953 | 786 | .412 | 1.612 | .626 | .328 |
| 4. | Argentina | 1959 | 832 | .463 | 1.887 | .675 | .477 |
| 5. | Argentina | 1961 | 927 | .434 | 1.605 | .653 | .342 |
| 6. | Mexico | 1950 | 397 | .526 | 2.500 | .718 | .773 |
| 7. | Mexico | 1957 | 488 | .551 | 1.652 | .879 | .702 |
| 8. | Mexico | 1963 | 542 | .543 | 1.380 | .976 | .366 |
| 9. | U.S.A. | 1960-62 | 2,837* | .359 | .729 | .715 | .124 |

Notes: *Indicates gross national product per capita.

Sources: See end of Table 2

income share received by each of the lowest six deciles of families has fallen, while the share received by each ordinal group between the middle 61% to 95% of families has increased. Thus the relative loss of the top 5% and the bottom 60% have led to the growth in the middle strata.

B. Argentina

The three Argentina observations for 1953 to 1961 reflect a dramatic period of political revolution, abrupt changes in economic policy, recession, and slight real growth of incomes. The gross domestic product per capita (lines 3-5 and column 1 of Table 2) reflects an 18% increase from $786 in 1953 to $927 in 1961, both expressed in 1960 U.S. dollar equivalents.

It is important to remember that the data for 1959 record the effects of a severe recession. Family income, investment, and national product all fell in real terms from the 1958 levels.[20] The 65% devaluation of the Argentine peso effective on January 1, 1959, also led to an extreme shift in relative prices of agricultural commodities.[21]

The unanimity of the country-wide measures of inequality, calculated from detailed frequency distributions, support the contention that the 1959 recession accentuated the degree of income inequality (lines 3 and 4 and columns 2-5 of Table 1). The Gini ratio, for example, rose from .412 to .463 and the coefficient of variation increased from 1.612 to 1.887.

By 1961, the distribution of incomes returned to a more equal and less skewed positon from the recession extremes of 1959. Nevertheless, comparison of the initial distributions in 1953 to the distribution in

Table 2

Size Distribution of Personal Income for Puerto Rico, Argentina, and Mexico
Income Shares Received by Deciles of Families

| | Country | Year | Bottom 10% | 11-20% | 21-30% | 31-40% | 41-50% | 51-60% | 61-70% | 71-80% | 81-90% | 91-95% | Top 5% | Gini Ratio* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | Puerto Rico | 1953 | 2.1 | 3.5 | 4.5 | 5.4 | 7.0 | 8.0 | 8.9 | 10.9 | 16.9 | 9.5 | 23.4 | .415 |
| | Puerto Rico | 1963Δ | 1.6 | 2.9 | 4.0 | 5.2 | 6.5 | 7.7 | 9.4 | 12.1 | 17.0 | 11.6 | 22.0 | .449 |
| 3. | Argentina | 1953 | 3.2 | 4.3 | 5.0 | 5.6 | 65. | 7.4 | 8.3 | 9.8 | 13.2 | 9.6 | 27.2 | .412 |
| 4. | Argentina | 1959 | 3.0 | 3.9 | 4.4 | 5.1 | 5.7 | 6.5 | 7.8 | 9.0 | 12.8 | 10.1 | 31.8 | .463 |
| 5. | Argentina | 1961 | 2.9 | 4.1 | 4.9 | 5.5 | 6.1 | 7.1 | 8.1 | 9.8 | 12.6 | 9.6 | 29.4 | .434 |
| 6. | Mexico | 1950 | 2.7 | 3.4 | 3.8 | 4.4 | 4.8 | 5.5 | 7.0 | 8.6 | 10.8 | 9.0 | 40.0 | .526 |
| 7. | Mexico | 1957 | 1.7 | 2.7 | 3.1 | 3.8 | 4.3 | 5.6 | 7.4 | 10.0 | 14.7 | 9.7 | 37.0 | .551 |
| 8a. | Mexico | 1963 | 1.3 | 2.2 | 2.8 | 3.8 | 4.9 | 6.2 | 8.0 | 11.3 | 17.4 | 13.4 | 28.8 | .543 |
| 8b. | Mexico (individuals only) | 1963 | 1.7 | 2.6 | 3.3 | 4.2 | 5.2 | 6.5 | 8.9 | 11.7 | 17.5 | 12.1 | 26.4 | .504 |
| 9. | United States | 1960-62 | 1.9 | 4.0 | 5.4 | 6.6 | 7.7 | 8.8 | 10.5 | 12.0 | 15.1 | 12.0 | 16.1 | .359 |

*Note: All Gini ratios are calculated from original income intervals.

## Sources for Tables 1 and 2

Lines 1 - 2:

G.D.P. is calculated from product estimates and adjusted price deflator given in Table 1 of Puerto Rico Planning Board, Income and Product 1967, pp. 8-9, lines 1, 16, and 30.

All other columns are based on Puerto Rican Department of Labor, Income and Expenditures of the Families, 1963, Report 1A, Table 20, p. 110, for 1953 data. Measures are calculated from nine original income levels. Data for 1963 are from Table 6, p. 6, and are calculated from thirteen original income levels.

Lines 3 - 5:

G.D.P. estimates are from S. N. Braithwaite, "Real Income Levels in Latin America," Review of Income and Wealth (June 1968), Table 9, p. 147, line 1, for 1959 and 1961. Estimate for 1953 was constructed with an average annual parity rate, obtained by dividing the annual estimates of total GDP in 1960 pesos given in Table 20, p. 168, by thier corresponding 1960 dollar equivalents from Table 9, p. 146. The average parity rate was then applied to the GDP estimate in 1960 pesos for 1953 from Argentina, Consejo Nacional de Desarrollo, Distribución del ingreso y cuentas nacionales en la Argentina, Vol. III, Table III-1, p. 2, line 13, Population estimate is from Volume V, Table V-2, p. 6.

Measures of inequality are based on data in Consejo Nacional de Desarrollo, op. cit., Vol. IV, "Distribución del ingreso por niveles," Tables IV-1, p. 5, for 1953; IV-112, p. 129, for 1959; IV-223, p. 253, for 1961; and are calculated from twenty-two original income levels.

Lines 6 - 8:

G.D.P. estimates are from S. N. Braithwaite, op. cit., Table 9, p. 147, line 17 for 1957 and 1963. Estimate for 1950 was constructed with the average annual parity rate, calculated by dividing the annual estimates of total G.D.P. in 1960 pesos given in Table 20, p. 169, line 17, by their corresponding 1960 dollar equivalents of Table 9, p. 145, line 17. This average parity rate was then applied to G.D.P. estimate for 1950 in 1960 pesos given in Banco de Mexico, Cuentas nacionales y acervos de capital, 1950-1967, Table 87. Population for the 1950 estimate is from United Nations, Demographic Yearbook, 1966, Table 4, p. 123.

Measures of inequality for 1950 and 1957 are based on I. M. de Navarrete, La distribución del ingreso y el desarrollo economico de México, Tables 9 and 10, and are calculated from ten original income levels.

Sources for Tables 1 and 2, continued

Measures for 1963 are based on data from Banco de Mexico, Encuesta sobre ingresos y gastos familiares en México, 1963, Series 38, p. 432, and are calculated from sixteen original income levels.

Line 9:

G.N.P. average was calculated by deflating current dollar estimates given in United States Department of Commerce, National Income & Product Accounts of the United States, 1929 - 1965, "Statistical Tables," Table 1.1, p. 3, line 1, by index given in Table 8.1, p. 159, line 1, adjusted for base 1960 = 100. Annual population is given in Table 7.6, p. 156.

Measures of inequality are based on J. Fitzwilliams, "Size Distribution of Income in 1963," in Survey of Current Business (April 1964). We first averaged the percentage shares of the numbers of consumer units and incomes which appear in Table 4, p. 5, for the three year period, and then calculated the measures from the resulting nine average income groups.

1961 (lines 3 and 5 of Table 1) reveals that all the measures, except the coefficient of variation, indicate greater inequality at the end of the period.

From the interpolated income share presented in lines 3-5 of Table 2, we are able to identify those ordinal groups which lost most heavily during these 8 years and in the recession of 1959 in particular. During the recession, each decile of recipients in the bottom 90% suffered a declining share, while the top 10% gained handsomely. Although each decile in the lower 90% "recovered" slightly by 1961, these same groups had all lost relative to their original 1953 positions. Only the top 5% of families increased its share from 27.2% during the entire 8 year period.

C. Mexico

Economic growth proceeded at a rapid pace in Mexico during the period 1950 to 1963. GDP per capita rose 37% during the 13 years (Table 1, lines 6-8, column 1), although increases in average family income may have been substantially less during the same period.[22]

To the extent that the 1950-1957 and 1963 data may be comparable, the three measures of inequality in Table 1, lines 6-8, indicate three contradictory trends. The Gini coefficient (column 2) suggests greater equality from 1950 to 1957 and then less inequality by 1963. The coefficient of variation (column 3) suggests that the distribution became more equal throughout the period. Finally, the moments of the logs of income (columns 4-5) reveal that despite the decline in skewness, the log distribution demonstrates greater inequality.

The income shares received by particular ordinal groups of families are examined in lines 6-8 of Table 2. We note that despite our reser-

vations about the comparability of the years, the income shares to the bottom 30% of families declined throughout the entire period.[23]

The Mexican distribution clearly demonstrates the rise in the share of income received by the "middle" classes in the 51 to 95% groups. The income share to families in 81%-90% groups in particular rose from 10.8% in 1950 to 17.4% in 1963. The income share of the top 5% fell slightly from 40.0% in 1950 to 37.0% in 1957, and shows a marked decline to 28.8% in 1963.[24] The changes during the period indicate that the middle classes -- families ranked from 51% to 95% -- have captured large increases in incomes at the expense of the bottom two-thrids of the families and the top 5%.

D. Distribution of Income to Families and Individuals in Mexico, 1963

In lines 8a and 8b of Table 2, we compare the distribution of incomes received by families and the distribution of incomes received by individuals. These results suggest that the distribution to individuals is more equal than the distribution to families. For each ordinal group shown in Table 2 with the exception of the seventh and eighth decile, the share of income to individuals is closer to the line of perfect equality than is the corresponding share of income to families.[25]

E. Conclusions: Comparisons to the United States

How do the distributions of income for the three low-income countries compare to each other and to the United States? In terms of the Gini ratio and the coefficient of variation (Table 1, line 9, columns 2 and 3), the U.S. demonstrates the most equal distribution; however, Argentina demonstrates an even narrower dispersion of relative incomes, as indicated by its low standard deviation of the logs (Column 4).[26]

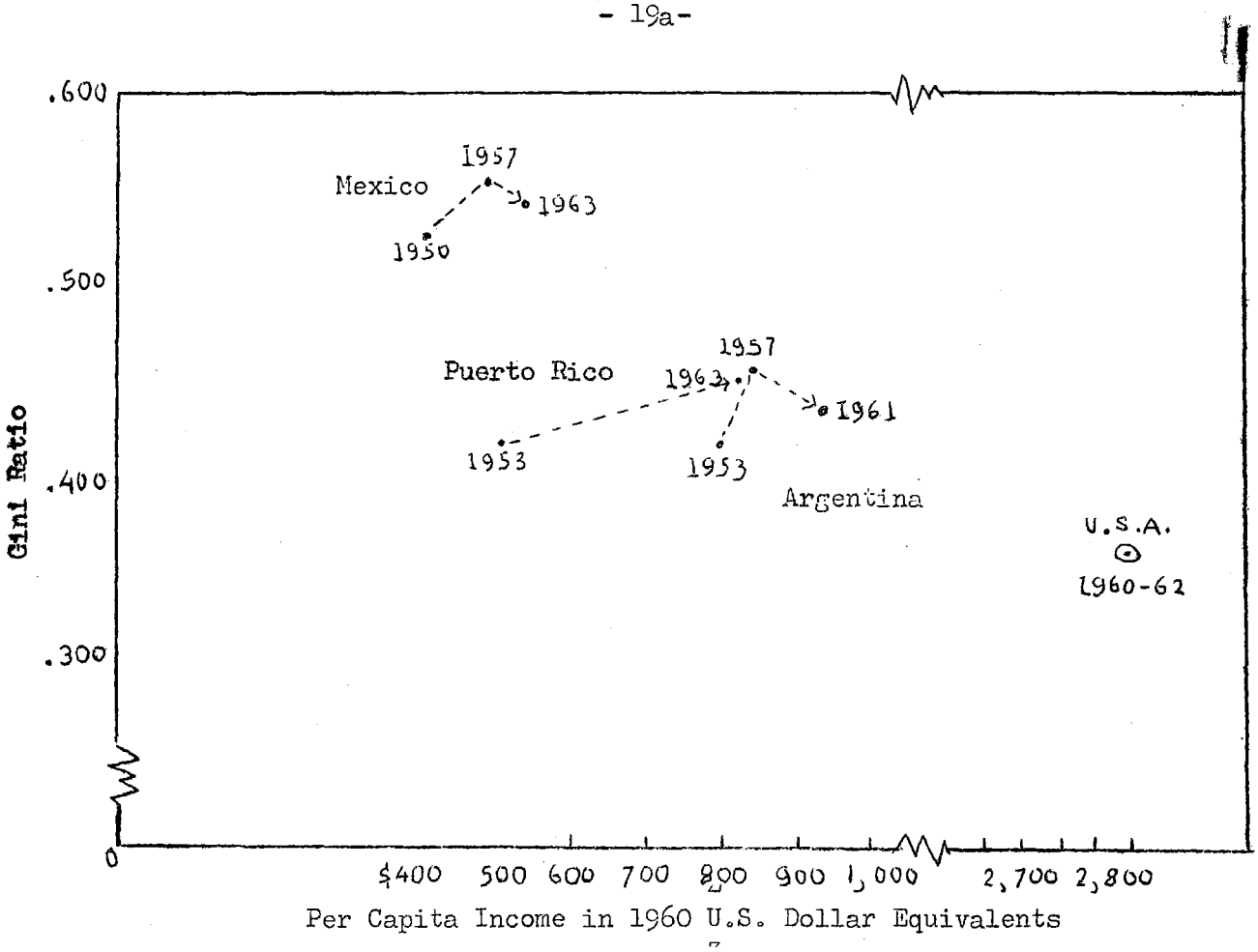



Figure 4

Measures of Income Growth and Income Inequality
in Puerto Rico, Argentina, and Mexico

The sensitivity of the different measures of inequality to different aspects of the income distribution perhaps reflects some of the contradictory conclusions which must be drawn from the international comparisons. First, when the countries are ranked in order of increasing real income, in 1960 dollar equivalents (Mexico, Puerto Rico, Argentina, and the U.S.), we note that the country-wide Gini ratio declines as average income rises, suggesting perhaps a long-run tendency toward greater equality. However, the short-run trend within each country suggests an opposite tendency: that inequality was increasing during the decade of growth in each of the three countries (see Figure 4). A similar effect may be noted if we compare the distribution of relative incomes by means of the standard deviation of the logs (Table 1, column 4). As the average income level rises from Mexico to Argentina, the country standard deviation falls from country to country, although the value of the measure rises from the beginning to the end of each period within each of the individual countries.

It must be noted that the trends recorded by the coefficient of variation contradict the above observations; that is, the declining values of the coefficient of variation suggest increasing equality within each of the three countries over time. Comparisons between countries according to this measure, however, are inconclusive since Argentina, which exhibits a higher average income than Puerto Rico, also demonstrates a less equal distribution.

In conclusion, there are several patterns which emerge from the income distributions of Puerto Rico, Argentina, and Mexico. First, the countries all demonstrate real growth during the periods. Two measures -- Gini

ratio and variance of the logs of income -- indicate that we are observing an increase in the variance of absolute and relative incomes for the three countries during the periods under examination. In these same cases, however, the coefficient of variation suggests a declining inequality from 1953 to 1963.

Mexico and Puerto Rico, the fastest growing countries, follow a similar pattern in their changing income distributions. In both countries the income shares to the lower half and to the top 5% of families declined while the shares of the middle groups (61-95% in Puerto Rico and 51-95% in Mexico) increased. Thus the record of inequality is also the growth of the middle classes during the observed period. In Argentina by comparison, a country with a long-established middle class and a reorganizing rather than expanding industrial program, only families of the top 5% increased their share of total income while the income shares of all other groups fell.

It should be remembered that these three cases of development pursued different paths in achieving higher national incomes. Puerto Rico, at one extreme, represents the case of export promotion of industrial goods, extensive outmigration and the shrinking of the agricultural sector. Mexico, at the other extreme, entered a period of import substitution, expansion of basic industry, and heavy investment in modern agriculture. Argentina, starting on a higher plane of industrialization, continued policies of further import substitution while attempting to favor the recovery of agriculture after an era of systematic neglect.

## IV. Income Distribution in the Agricultural and Non-Agricultural Sectors

Two contradictory results have been noted from the comparison of countrywide distributions. First, income appears to be more equally distributed in the United States than in the developing countries which were studied. Second, in each of the three developing countries, we noted that the equality of incomes declined as the level of income rose over time.

How can these two observations be mutually consistent? Surely, if economic growth results in diminishing equality in the developing nations and if the growth process is in some way continuous, then it would appear that the final distribution of income in the industrial society should be extremely unequal rather than more equal, as we have observed.

The set of hypotheses which we are specifically testing in this section suggests that the final income distribution is the weighted average of two basically different distributions which characterize the agricultural and non-agricultural sectors. The distribution in the agricultural sector is more equal around a lower mean than the non-agricultural sector. With growth, the non-agricultural sector expands relative to the agricultural sector, the differential between the two sectors narrows, and finally, the distribution within the non-agricultural sector itself becomes more equal.[27]

To test this set of hypotheses, we shall divide the families in the three countries according to the sector of major employment of the head. It should be noted that in agricultural areas, many families may supplement their incomes with proceeds from non-agricultural pursuits, and in this case, the sectoral divisions fail to represent the industries in which

total family income originates. In tracing the trends in income distribution within sectors for recent periods, we shall also pursue a number of other questions related to the set of hypotheses. How different are the distributions in agriculture from one country to the next? Is there any evidence that the distribution within the non-agricultural sector is becoming more equal over time in any of the countries?

A. Puerto Rico

The measures of inequality and the income shares for the sectoral distributions in Puerto Rico support the hypothesis that income is distributed more equally in agriculture than in the aggregated "other" sector. All the summary measures for 1953 (Table 3, lines 1a and b) are unanimous in this respect, and the display of income shares received by ordinal groups of families (Table 4, lines 1a and b) also indicates greater equality in agriculture throughout most of the range of income with the exception of the fourth quintile (column 6). The lowest 60% of families in agriculture, for example, receive greater shares than the corresponding ordinal groups in the non-agricultural sectors, and the top 5% families in agriculture receive only 18.5% of income compared to the 23.7% of income received by the top 5% in non-agriculture.

By 1963, however, major changes had occurred in both the agricultural and non-agricultural sectors in Puerto Rico. Agricultural families had declined considerably in number and received an average income which had fallen relative to the non-agricultural average (see Table 3, columns 1 and 2). Summary measures indicate that by 1963 the distributions in

Table 3

Measures of Income Inequality in the Agricultural and Non-Agricultural Sectors

| | % Families (1) | Average Income Relative to Agriculture (2) | Gini Coeff. (3) | Kuznets Coeff. (4) | Coefficient of Variation (5) | Standard Deviation of Logs of Income (6) | Skewness (7) |
|---|---|---|---|---|---|---|---|
| 1. Puerto Rico 1953 | | | | | | | |
| a. Agriculture | 31 | 100 | .323* | 47.00* | 1.015* | .568* | .106 |
| b. All other | 69 | 157 | .422 | 64.06 | 1.140 | .771 | .121 |
| 2. Puerto Rico 1963 | | | | | | | |
| a. Agriculture | 17 | 100 | .414* | 61.60* | 1.156 | .678* | .275 |
| b. All other | 83 | 170 | .442 | 63.98 | 1.003* | .855 | -.075 |
| 3. Argentina 1953 | | | | | | | |
| a. Agriculture | 21 | 100 | .499 | 76.82 | 1.805 | .746 | .585 |
| b. All other | 79 | 113 | .383* | 55.70* | 1.591 | .576* | .300 |
| 4. Argentina 1961 | | | | | | | |
| a. Agriculture | 16 | 100 | .489 | 74.40 | 2.086 | .716 | .554 |
| b. All other | 84 | 131 | .418* | 60.20* | 1.551* | .622* | .330 |
| 5. Mexico 1963 | | | | | | | |
| a. Rural | 44 | 100 | .475* | 69.90* | 1.290 | .808* | .310 |
| bb Urban | 56 | 231 | .521 | 77.35 | 1.238* | .976 | 1.144 |
| 6. U.S.A. 1957-59 | | | | | | | |
| a. Farm | 12 | 100 | .415 | 60.60 | 1.088 | .724 | .174 |
| b. Non-farm | 88 | 174 | .346* | 48.20* | .974 | .641* | -.009 |
| 7. U.S.A. 1960-62 | | | | | | | |
| a. Farm | 10 | 100 | .416 | 60.20 | .929 | .749 | .128 |
| b. Non-farm | 90 | 172 | .346* | 49.00* | .702* | .685* | -.118 |

Note: *indicates the more equal sector.

## Appendix Table 1

### Measures of Income Inequality for Four Major Sectors, in Puerto Rico, Argentina, and Mexico

| | Lowest 10% (1) | 0-20% (2) | 21-40% (3) | 41-60% (4) | 0-60% (5) | 61-80% (6) | 81-90% (7) | 91-95% (8) | Top 5% (9) |
|---|---|---|---|---|---|---|---|---|---|
| 1. Puerto Rico 1953 | | | | | | | | | |
| a. Agriculture | 3.1 | 7.8 | 12.3 | 16.3 | 36.4 | 22.6 | 12.9 | 9.6 | 18.5 |
| b. All other | 1.8 | 5.0 | 9.9 | 14.5 | 29.4 | 21.5 | 15.6 | 9.9 | 23.7 |
| 2. Puerto Rico 1963 | | | | | | | | | |
| a. Agriculture | 2.8 | 6.7 | 10.4 | 13.6 | 30.7 | 19.5 | 14.1 | 11.3 | 24.5 |
| b. All other | 1.5 | 4.4 | 9.6 | 14.3 | 28.2 | 21.9 | 16.9 | 11.5 | 21.4 |
| 3. Argentina 1953 | | | | | | | | | |
| a. Agriculture | 2.8 | 6.5 | 8.2 | 10.4 | 25.1 | 16.5 | 15.0 | 11.0 | 32.4 |
| b. All other | 3.7 | 8.4 | 11.4 | 14.2 | 34.0 | 18.1 | 12.7 | 9.2 | 26.0 |
| 4. Argentina 1961 | | | | | | | | | |
| a. Agriculture | 2.8 | 6.4 | 8.8 | 11.7 | 27.0 | 15.8 | 13.6 | 10.2 | 33.4 |
| b. All other | 3.2 | 7.6 | 10.6 | 13.2 | 31.5 | 18.0 | 12.3 | 9.6 | 28.6 |
| 5. Mexico 1963 | | | | | | | | | |
| a. Rural | 2.0 | 5.1 | 8.5 | 12.8 | 26.4 | 19.5 | 15.4 | 12.9 | 25.8 |
| b. Urban | 1.3 | 3.4 | 7.3 | 12.0 | 22.7 | 20.5 | 17.3 | 13.3 | 26.3 |
| 6. U.S.A. 1957-59 | | | | | | | | | |
| a. Farm | 3.0 | 6.2 | 8.8 | 15.1 | 30.0 | 22.5 | 15.9 | 10.7 | 20.9 |
| b. Non-farm | 2.4 | 7.0 | 12.6 | 16.5 | 36.1 | 21.5 | 14.4 | 8.9 | 19.1 |
| 7. U.S.A. 1960-62 | | | | | | | | | |
| a. Farm | 2.6 | 5.4 | 9.5 | 15.3 | 30.1 | 22.6 | 16.1 | 10.8 | 20.5 |
| b. Non-farm | 2.2 | 6.5 | 12.4 | 16.6 | 35.4 | 22.3 | 14.6 | 12.2 | 15.5 |

## Sources for Table 3 and 4

Line 1:

Puerto Rico Department of Labor, 1953 [81], Report A-1, Table 6, p. 15. Agriculture includes forestry and fisheries. Non-agriculture is aggregate of construction, manufacturing, utilities, trade, finance, services, public administration and others. Shares of number of families in each sector is given in Table 6. Average incomes were calculated by dividing the income received by each income interval by the number of families in that interval for the country-wide distributions constructed from Report 1-A, Tables 1 and 3. Income shares were obtained by multiplying the number of families in each interval for each industry by the average income for that interval. Finally, the income shares for the 9 intervals were interpolated.

Line 2:

Puerto Rico Department of Labor, 1963 [82], Report 1-A. Sectors are composed of the same industries as in the 1953 data. Shares of the number of families in each income interval for each sector are given in Table 15-A1, p. 78. Average incomes were calculated first for each of the 13 intervals for the urban and rural zones from the information in column 1 of Tables 15-D1 and 15-E1. Then, these average incomes for each interval were applied to the number of families within each sector residing in the rural or urban zone to yield the actual income of rural and urban families for each interval within each industry. The rural and urban distributions were then aggregated and income shares formed for each income interval within each industry. These income shares were then interpolated to obtain the shares for standard ordinal groups. The ordinal non-interpolated shares were used to calculate all measures of inequality.

Lines 3 - 4:

Argentina [77], Volume IV. Each sector was formed by adding the number of families and their incomes for each of the 22 income intervals of the following tables: Agriculture for 1953: Tables on pp. 7 and 15: Non-Agriculture for 1953: Tables on pp. 8-13, 16-22; Agriculture for 1959: Tables on pp. 131 and 139; Non-Agriculture for 1959: Tables on pp. 132-7, 140-46; Agriculture for 1961: Tables on pp. 225 and 263; Non-Agriculture for 1961: Tables on pp. 256-61, 264-70. Shares in numbers of families and incomes were then calculated for each of the aggregated sectors and the shares interpolated to obtain shares for standard ordinal groups of families. All measures were calculated from the original, non-interpolated shares from the 22 income intervals.

Line 5:

Banco de México [79]. Rural shares in numbers and income from Table 38, p. 429. Urban shares in numbers and income from table on p. 430-1. All measures are calculated from shares to families in 16 income intervals.

Sources for Tables 3 and 4, continued

Lines 6 - 7:

Based on Fitzwilliams [17], Tables 7 and 8, p. 7. We averaged the percentage shares in numbers of families and incomes for each three year period and then interpolated the twelve original income intervals. This is the same porcedure followed by Kuznets above for the earlier periods. Data for 1960-62 include Hawaii and Alaska.

both sectors had become more unequal, although the agricultural sector was still relatively less unequal than the non-agricultural sector. The coefficient of variation (Table 3, column 5) stands alone in suggesting that the non-agricultural distribution had become considerably mor equal during the decade.

The most striking features of the detailed income shares in Table 4 are first, the magnitude of the changes in agriculture during the period and second, the stability in non-agriculture. In agriculture (lines 1a and 2a), the income share received by the bottom 60% of families fell from 36.4% to 30.7% during the ten year period, while the income share to the top 5% rose from 18.5% to 24.5% by 1963.

What factors account for this dramatic change within the agricultural sector? Since we expect the nature of the income distribution to be related to the changes within Puerto Rican agriculture, we turn briefly to some evidence on the crop composition and labor force. The major decline in employment (Table 5, lines 3 and 5) occurred in the share of laborers in sugar cane from 47% to 32% of the agricultural labor force and the rise of those in coffee from 12% to 21% of the agricultural labor force. At the same time, the value of sugar cane (Table 6, line 1a) fell from 49% to 39% of total value of farm production, while the share of the value of coffee rose from 4% to 8% (line 1a) and the share of the value of livestock products increased from 28% to 34% (line 2).

This rough association of increasing inequality in the agricultural sector with the decline of sugar cane and the rise of coffee is contrary

Table 5

Agricultural Labor Force in Puerto Rico by Crop,

1953-1963

| | Employed Persons: | | Employed Persons: | |
|---|---|---|---|---|
| | 1953 (thousands) | 1963 (thousands) | 1953 (percent) | 1963 (Percent) |
| 1. Total Labor Force (All Puerto Rico) | 550 | 606 | - | - |
| 2. All Agriculture | 170 | 140 | 100% | 100% |
| 3. Sugar cane | 80 | 45 | 47% | 32% |
| 4. Tobacco | 15 | 13 | 9% | 9% |
| 5. Coffee | 20 | 29 | 12% | 21% |
| 6. Other | 55 | 54 | 32% | 39% |

Sources:

(a) Puerto Rico Planning Board, 1956 Economic Report of the Governor, Table 19, p. A-18.

(b) Puerto Rico Planning Board, 1964 Economic Report to the Governor, Table 17, p. A-22.

Table 6

Value of Farm Produce in Puerto Rico,

1953-1963

| | 1953 (millions of current dollars) (1) | 1963 (millions of current dollars) (2) | 1953 (percent) (3) | 1963 (percent) (4) |
|---|---|---|---|---|
| Total Value: | 211.8 | 298.0 | 100 | 100 |
| 1. Principal Crops | 124.5 | 153.0 | 59 | 51 |
| a) Sugar cane | 104.6 | 117.0 | 49 | 39 |
| b) Tobacco | 11.2 | 13.0 | 5 | 4 |
| c) Coffee | 8.7 | 23.0 | 4 | 8 |
| 2. Livestock Products | 59.8 | 100.0 | 28 | 34 |
| a) Milk | 31.4 | 53.0 | 15 | 18 |
| b) Eggs | 5.4 | 10.0 | 3 | 3 |
| c) Beef | 7.4 | 14.0 | 3 | 5 |
| d) Other* | 15.7 | 24.0 | 7 | 8 |
| 3. Legumes | 1.8 | 3.0 | 1 | 1 |
| 4. Fruits | 4.1 | 6.0 | 2 | 2 |
| 5. Starchy Vegetables | 12.9 | 16.0 | 6 | 5 |
| 6. Other | 8.7 | 20.0 | 4 | 7 |

Notes:
*Pork, poultry, goats

Sources:

1953: Puerto Rico Planning Board, 1956 Economic Report to the Governor, Table 9, p. A-9.

1963: Puerto Rico Planning Board, 1964 Economic Report to the Governor, Table 8, p. A-10.

to the experience of other countries.[28] Since cane is grown on large plantations and coffee is grown on small family farms, we would expect a more equal distribution to result from the change in crop importance.

I suspect, however, that the observed "decline" in sugar cane has resulted in the contraction of the marginal cane farmer and the modernization of the larger, efficient plantations. Since cane workers tend to be organized into labor unions and employed by corporations which are more closely regulated, the labor force in cane receives a negotiated, enforced wage related to the industrial wage rate. Coffee workers, in contrast, tend to be poorly organized. Work arrangements are more informal and land holdings small. The average hourly wage of cane workers is nearly twice the minimum wage of coffee workers, and has increased faster during the period 1953-1969.[29] In short, coffee is playing the role of a "traditional" cash staple which absorbs rural surplus labor and supports a relatively independent worker in the interior mountainous regions of the island. Cane, on the other hand, is increasingly closed to low-wage labor and has in the past decade limited its work force while expanding output. This further increase in the "separation" between the modern cane plantations and the traditional coffee farms has resulted in declining equality in the agricultural sector.

B. Argentina

The income distributions for the agricultural and non-agricultural sectors of Argentina provide evidence which is contrary to the general hypothesis that income is more equally distributed in agriculture. All the summary measures of Table 3 (lines 3 and 4) indicate that incomes are

more unequally distributed in agriculture. The log distribution of income in the agricultural sector is also more skewed (column 7) than the non-agricultural distribution.

From 1953 to 1961, the share of agricultural families fell from 21% to 16% (Table 3, column 1), and the average agricultural income relative to the non-agricultural average declined as well. Contrary to the Puerto Rican experience, equality within the agricultural sector increased in terms of all summary measures except the coefficient of variation (columns 3 - 6). The slight changes in the income shares received by ordinal groups (Table 4, lines 3a and 4a) within agriculture indicate a weakening of the middle groups and the slight increases to the lower and upper groups.

It is difficult to relate these changes in income distribution to the structural changes in the agricultural sector, although the decline of wheat and the increase in the output of cattle, wool, milk, and fruit are consistent with the observed distributional changes.[30] The decline of wheat planting, it may be speculated, contributed to the declining share to the middle income or more highly-skilled farm workers. The increase in cattle and sheep contributed to the increased share to the land owners and, in the case of dairy products, to the owners of capital.

The trends within the non-agricultural sector indicate an increasing inequality during the period, as summarized by the measures of Table 3, lines 3b and 4b, columns 3-6. The migration of workers from the agricultural sectors may have contributed to the decline of the income share to the lowest 60% of non-agricultural families from 34.0% to 31.5%. The increase in the share to the top 5% of families (Table 4, lines 3b and 4b,

column 9) may reflect a shift in the composition of industry from the "vegetative" industries, such as textiles, food processing, and wood products, toward the "dynamic" industries, such as metal products, machinery, vehicles, and chemicals.[31] Thus the release of manpower from the agricultural sector, the change within industry toward a more capital-intensive mix of outputs, and the post-Peronist social policy challenging the power and position of organized labor, may have all contributed to declining equality within the non-agricultural sector from 1953 to 1961.

C. Mexico

In examining the data from the Mexican distributions, we are limited to a comparison of the rural and urban secotrs for one year. The measures of inequality in Table 3, lines 5a and 5b, indicate that the differential in incomes between the sectors is enormous; the average family in the urban sector enjoys an income premium of more than twice the average rural income. The rural distribution, however, is somewhat more equal, as indicated by the lower Gini and Kuznets ratios and lower $\sigma$ of logs of income. Again, the higher coefficient of variation (column 5) in the rural zone dissents from the other measures and indicates slightly higher inequality than in the urban regions.

From the income shares held by ordinal groups described in Table 4, lines 5a and 5b, we conclude that the greater equality of the rural area is due to the larger share received by the lowest 60% of families compared to the urban sector. These large shares to a relatively poor sector probably reflect the subsistence levels of the wage-earning and ejido farmer. The substantial shae of the top 5% in the rural sector, which is almost

equal to the share of the corresponding urban families, indicates the dual character of Mexican agriculture. The communal lands persist in their improverished condition, while the increases in agricultural output in recent periods have occurred on the newly-opened irrigated land and on larger plantations growing cotton, beans, and wheat.

D. United States

The patterns in the distribution of income for farm and non-farm families in the United States are similar to the Argentine distributions rather than to the Puerto Rican and Mexican sectors. In the two sets of years studies, 1957-59 and 1960-62, income distribution is more unequal in the farm than the non-farm sector, as indicated by all the measures in Table 3, lines 6 and 7. However, both distributions appear to have been basically stable during this short time period, although the logs of income for each sector suggest a widening of relative incomes and the coefficients of variation suggest a narrowing of the arithmetic variance relative to the rising mean.

The income shares in Table 4, lines 6 and 7, illustrate these trends more precisely. The share to the bottom 20% of farm families fell from 6.2% to 5.4% during the period, while the middle ordinal groups gained (columns 3 - 8). A similar tendency can be observed within the non-farm distribution (lines 6b and 7b), with the additional note that the income share to uppermost 10% fell as well (columns 8 and 9). Comparing the farm to the non-farm for each of the years, it is evident that the poorest 60% of the urban families receive larger shares and that the top 10% receive smaller shares than the corresponding rural groups.

E. Conclusions on Sectoral Distributions

The empirical findings generally lend support and demand more careful qualifications to the hypotheses presented at the beginning of Section IV.

We note, first, that in Puerto Rico, Argentina, and the United States, the three countries for which the time series are available, the share of families employed in the farm sector fell with economic growth (Table 3, column 1). Second, with the exception of the United States in the most recent years, the differential between average incomes in the two sectors increased in both Puerto Rico and Argentina (Table 3, column 2). Third, in Puerto Rico and Mexico, the distribution of income within the agricultural sectors is more equal than within the non-agricultural sector. While this same ranking has been maintained during the decade of growth, structural changes have resulted in decreasing equality within both sectors, especially in agriculture. Fourth, in Argentina and the United States, the distribution within the agricultural sector is more unequal than in the non-agricultural sector. The distribution within the non-agricultural sectors has grown less equal while the agricultural distribution has grown more equal during recent years in Argentina.

In Section III, we noted that the Gini coefficient and the standard deviation of the logs indicate a trend toward greater inequally of the country-wide distribution in both Puerto Rico and Argentina, while the coefficient of variation suggest a trend in the opposite direction. The examination in this section of the sectoral changes does assist us in explaining these overall trends, if we focus on sectoral equality in the same terms as the country-wide measures. For example, the observation

that the country-wide equality declined in Puerto Rico is consistent with the three major factors revealed by the sectoral study: first, divergence between average incomes in both sectors; second, increasing weight to the less equal sector (non-agriculture); third, increasing inequality in both sectors.

In Argentina, only two of these factors were observed. The inter-sectoral differential between the two sectors increased, as in the Puerto Rican case. However, contribution toward greater equality made by the increasing weight of the more equal sector (non-agriculture, in the Argentine case) apparently was offset by the increasing inequality within the non-agricultural sector itself during this period.

It must be recalled that the trends measured by the coefficient of variation indicated gains towards greater equality in the country-wide distributions. In Puerto Rico from 1953 to 1963, this appears to be explained by the movement toward greater equality within the non-agricultural sector, which apparently swamps the negative contribution made by the increasing inter-sectoral divergence and by the increasing inequality within the agrarian sector. Similarly in Argentina, the increasing equality measured by the coefficient of variations within the non-agricultural sector and the increasing weight of that sector apparently offset the tendency toward inequality due to the growing inequality within agriculture and to the growing inter-sectoral differential.

In short, any attempt to account for country-wide changes in equality must be based first, on the selection of a particular summary measure

consistent with the measure applied to the sectoral distributions. Second, one hopes that the sectoral measurements are useful in revealing more specific details about the underlying changes and can ultimately be translated into statements about the welfare of the families during the course of economic growth.

## V. Concluding Remarks

In this study, we have attempted to trace changes in the country-wide distributions of income from detailed examinations of the trends and characteristics of the agricultural and non-agricultural sectors. We have noted the increasing inequality within the urban sector and the rising differential between the average urban and rural incomes. We have also speculated on the relationship of these observed changes to the expansion of the plantation sector and the release of manpower from agrarian activities.

It appears that the particular mechanism of the growth process in these countries has led to increasing inequality, despite the efforts by the respective governments to modify and lessen the stresses generally associated with Western industrialization.

Can a country which has chosen to promote economic growth avoid the deteriorating equality which we have observed in these countries? Several further speculations may be offered at this point. A mix of activities which will have "desirable" effects on the overall distribution may be selected and emphasized as part of a development program. In agriculture, such a policy may be translated into more restrained expansion of the plantation sector and a more complete agrarian reform in the traditional sector of the rural economy. In the urban zone, the development strategy may emphasize those industrial and service activities which might have the effect of narrowing the distribution of income.[33] This is, the goal of achieving greater overall equality can serve along with efficiency as criteria in the choice of activities in the import-substituting or export-promoting industrialization.

Thus far we have focused on the income-generating implications of our findings. We might also inquire into the relationship of income distribution and consumer demand as the spread of incomes and the rising inequality is translated into the direct final demand for goods and services.

It may be speculated that the increasing inequality of incomes implies a consumption pattern with time which cannot be satisfied by the production which generates those demands. While such "inconsistencies" are usually resolved through international trade, the alteration of relative prices, and the mobility of capital and labor between sectors, the extent of this flexibility and the nature of the adjustments may not be realized without severe reactions within such a society. Indeed, we have suggested that the more "successful" the industrialization, the more intense the political and social antagonisms which are generated for reform or revolution.

## Appendix Table 1

### Measures of Income Inequality for Four Major Sectors, in Puerto Rico, Argentina, and Mexico

| | Puerto Rico 1953 (1) | Puerto Rico 1963 (2) | Argentina 1953 (3) | Argentina 1961 (4) | Mexico 1963 (5) | Average* (6) | Average** (7) |
|---|---|---|---|---|---|---|---|
| A. Kuznets Ratio: | | | | | | | |
| I. Agriculture | 47.00 (1) | 61.60 (2) | 76.82 (4) | 74.40 (3) | 79.21 (3) | 67.81 (3) | 71.74 (4) |
| II. Industry | 51.86 (2) | 50.86 (1) | 53.64 (1) | 61.96 (2) | 71.79 (1) | 58.02 (1) | 61.54 (1) |
| III. Commerce | 65.76 (4) | 63.22 (4) | 58.34 (3) | 76.04 (4) | 81.56 (4) | 68.99 (4) | 73.61 (3) |
| IV. Services | 62.96 (3) | 60.38 (3) | 55.35 (2) | 55.46 (1) | 75.81 (2) | 61.99 (2) | 63.88 (2) |
| V. Total | 62.00 | 65.70 | 60.01 | 62.40 | 81.93 | 66.41 | 70.01 |
| B. Coefficient of Variation | | | | | | | |
| I. Agriculture | 1.015 (2) | 1.156 (4) | 1.805 (4) | 2.086 (3) | 1.445 (4) | 1.501 (3) | 1.562 (3) |
| II. Industry | 1.050 (3) | 0.839 (1) | 1.792 (3) | 2.824 (4) | 1.300 (2) | 1.551 (4) | 1.654 (4) |
| III. Commerce | 1.269 (4) | 0.921 (3) | 1.328 (1) | 1.769 (2) | 1.354 (3) | 1.328 (2) | 1.348 (2) |
| IV. Service | 0.967 (1) | 0.896 (2) | 1.591 (2) | 1.437 (1) | 1.175 (1) | 1.213 (1) | 1.169 (1) |
| V. Total | 1.152 | 1.035 | 1.612 | 1.605 | 1.380 | 1.357 | 1.340 |
| C. Standard Deviation of Logs of Income | | | | | | | |
| I. Agriculture | 0.568 (1) | 0.678 (2) | 0.746 (4) | 0.716 (3) | 0.880 (2) | 0.718 (2) | 0.758 (2) |
| II. Industry | 0.623 (2) | 0.636 (1) | 0.541 (1) | 0.602 (1) | 0.842 (1) | 0.649 (1) | 0.693 (1) |
| III. Commerce | 0.757 (3) | 0.801 (4) | 0.605 (3) | 0.721 (4) | 1.036 (4) | 0.784 (4) | 0.853 (4) |
| IV. Services | 0.776 (4) | 0.796 (3) | 0.577 (2) | 0.588 (1) | 0.969 (3) | 0.741 (3) | 0.784 (3) |
| V. Total | 0.736 | 0.843 | 0.626 | 0.653 | 0.776 | 0.767 | 0.824 |

Notes: *Column 6 is an unweighted average of columns 1 - 5.
**Column 7 is an unweighted average of columns 2, 4, and 5.

Footnotes

[1]See W. Arthur Lewis [38] and [39].

[2]See W. Mangin [42], pp. 65-98, and the inroduction of Oscar Lewis [37] for a statement of the relationship of urbanization and slum culture. See O. Lewis [36] for a narrative of Mexican urban life, and C. M. DeJesus [14] for a diary of a favelado in São Paulo.

[3]The extension of the branches from heavily unionized American firms has carried the union shop to Puerto Rico's industrial and service sector. The political support of urban labor had resulted in the strengthening of the Argentine and Mexican industrial unions relatively early in the industrialization. See H. Landsberger [34] for a brief review of labor organization in Mexico and Argentina.

[4]See Kuznets [32] for the initial hypothesis that changes in the country-wide distribution can be traced to the size and shape of the sectoral distributions and to their relative incomes.

See S. Hymer and S. Resnick [28] who emphasize the importance of rural household income from non-agricultural pursuits.

[5]See the work of Morgan [45] and [46], Reid [53], Kravis [30], Oshima [50], and Kuznets [33] and [32].

[6]Independent of the literature on the relationship of the distribution of income and economic growth, numerous theoretical attempts have been made to explain the particular shape of the mathematical distribution of income. These writings are largely partial analyses, restricted to a particular sector or segment of the distribution. See Roy [55], Champernowne [11], Lydall [40], Houthakker [27], and Mandebrot [41].

Footnote 6 continued:

At the other extreme, a more descriptive literature suggests that the particular technology associated with a commodity or crop is the primary determinant of income distribution. See Baldwin [4] and [5]; Watkins [72] and Caves [10]. The expansion of a plantation sector, the displacement of subsistence farming by an export staple, and its impact on income patterns have been described in general terms for Caribbean, Mexican, and Indonesian sugar cane, and for various Brazilian staples. See Guerra y Sanchez [25]; Womack [74], pp. 42-43; Geertz [20] and [21], and Furtado [18]. Yet a detailed empirical analysis of the impact of different crop cultivations on the size distribution of income has never been carried out.

[7] See Garvey [9], p. 29.

Note also that the original Gini "Index of Concentration," $\delta$, is the slope of the equation:

(1) $\log N = p + \delta \log Ax$

where N = number of income receivers with income of level x or greater. Bowman [6], p. 32, plots the Gini equation and its reverse (that is, where N is the number of receivers with income below x) on a double log scale of shares of income and of receivers. The slope, $\delta$, may then be compared to the slope of the equation of "perfect equality." As Bowman points out, the Gini equation is more accurate for incomes at lower levels than the Pareto equation, but the equation still does not describe the entire distribution.

The Gini concentration ratio used in this paper is calculated on the basis of approximate triangles given in H. P. Miller [43], p. 26, and J. Morgan [44], p. 270.

Footnote 7 continued:

$$(2)\quad G = 1 - \sum_{1}^{k} (f_{i+1} - f_i)(y_i + y_{i+1})$$

where G = Gini ratio

$f_i$ = share of recipients in the $i^{th}$ group

$y_i$ = share of income of $i^{th}$ group ( i = 1, 2, ...k)

This Gini concentration ratio is formally the ratio of the sum of mean difference to twice the arithmetic mean. See Bowman [6], p. 87; Gini [22], p. 125, n. 1; Kendall and Stuart [29], Volume I, p. 47.

[8]Kuznets [33], p. 19; Swamy [63]. See M. Mukherjee and G. S. Chatterjee [47], p. 1268, for comparisons for the Kuznets Index and Gini ratio for Indian data.

[9]S. Goldsmith [23], p. 299.

[10]See comments by Garvey on article by Pechman [51], p. 217.

[11]Also note that the choice of class marks for group data my introduce a bias in the calculation of the moments of the arithmetic distribution. Miller [43] uses the arithmetic midpoints except for the open-ended interval. Theil [65], p. 99, also uses midpoints but notes that "this procedure underestimates the true inequality level" by assuming perfect equality within intervals. He attempts to put limits on the measures of inequality to correct for this understatement, pp. 128-134.

Houthakker [26], p. 24, chooses the values by inspection.

Leibenberg and Kaitz [35], pp. 442-4, apply a parabolic density function to the first interval, straight-line density functions for the middle intervals, and the Pareto curve for the open-ended interval.

Footnote 11 continued:

If the intervals themselves are of equal value and if the tails of the distribution are of high order of contact, then Sheppard's correction may be applied to correct the moments which are derived from the grouped data. These requirements, however, are rarely met by income distributions, since the lower tail does not extend into negative values and the distributions are infrequently grouped into equal intervals. See Kendall and Stuart [29], Vol. I, pp. 75-81.

[12]The "search" for a logarithmic distribution of income is reviewed in Kravis [31], pp. 163-178. See also Aitchison and Brown [1], pp. 116-120. Zipf [76], pp. 445ff., relates logarithmic distributions of income to social structure.

For international comparison, See Oshima [50], p. 439; Kravis [31], p. 184; Kuznets [33], p. 17.

[13]Reid [53], p. 960, notes that Ceylon indicates a higher Gini ratio than the United States but a lower standard deviation of the logs of income; Kuznets [33], p. 17, notes that the average Gini ratio for the developing countries is higher but that the standard deviation of the logs is lower in the developing countries than in the industrialized countries.

Kravis [31], p. 181 suggests that use of only two points to facilitate the calculation of the standard deviation of the log of income, namely the log of income of the 20th and 80th percentiles. In so doing, however, he assumes that the underlying distribution is log-normal. He had explicitly rejected the hypothesis of lognormality previously on the basis of visual inspection of the distributions. See also Aitchison and Brown [1], p. 42.

Footnote 13 continued:

Kravis also suggests that any logarithmic measure of income distribution may be preferred to the Gini ratio if relative incomes are to be compared (p. 179).

[14]Kuznets [33], p. 15.

[15]The average level of absolute income for each ordinal group may be calculated from the interpolated shares, but this is of little use unless the currency value is deflated by a price index which is composed for the basket of goods purchased by that income group. This has been roughly attempted for India. See Mukherjee and Chatterjee [47].

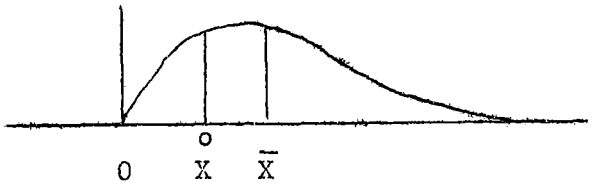
In the absence of price indices for various "income classes" for other countries I have selected a single overall price index of general consumption as a deflator of average family income.

[16]Detailed tests of consistency and bias in the data for Puerto Rico Argentina and Mexico and comparison of "control totals" with other surveys are described in Chapter IV, "Sources of Data," in my unpublished dissertation, "Income Distribution and Economic Growth; and International Comparison" (Harvard University, May 1969).

[17]The general literature on the economic growth and structural change in Puerto Rico is extensive, yet relatively silent on the negative aspects of development programs. See Baer [3] and Stahl [60] for introductory reviews. The record of the hearings of the U.S. Senate [69], Vol. III, documents the aspects of economic growth bearing on the statehood issue.

[18]See Reynolds and Gregory [54], chapter I, "Economic Transformation in Puerto Rico."

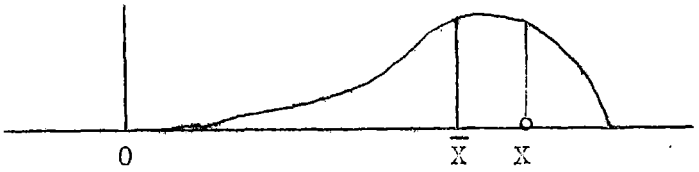
[19]A distribution is said to be skewed in the direction of the longer tail. Hence if the mode is less than the mean the distribution generates a positive third moment.




$\overset{o}{X}$ = mode

$\bar{X}$ = mean

If the mode is greater than the mean, then the distribution carries a negative third moment.




[20]See Argentina [77], Table III-1.

[21]See Braun [8], Table 1, p. 871. The peso was again devaluated in 1962. For the changes in the composition of industry which occurred during this period, see D. Felix [16]. Diaz [15], pp. 148-157, chronicles the economic impact of the 1959 devaluation on domestic prices, real wages, and the sectoral redistribution toward the rural sector away from the urban worker. Much of the extraordinary shift in relative prices seems to have been reversed by 1961.

[22]Navarette [48], p. 77, in deriving the 1950 and1957 income distributions, applied the distributions from smaller sample surveys to "adjusted totals" of income in order to account for the entire personal income estimated in the national accounts. The "difference" between sample personal income and personal income from the national accounts was then distributed to the middle and upper income brackets, although

Footnote 22 continued:

the reasons for these particular allocations are not given. See Navarette [48], Table 10.

The results of the Bank of Mexico sample for 1963 have not been reconciled with the national accounts in a similar manner. Therefore, we expect that the 1963 distribution and the set of distributions for 1950-1957 are not strictly comparable. In view of this fact it is rather surprising that the decile results of the Bank study are so similar to the results of the Navarette study.

[23]We suspect that property incomes to the upper income groups are underreported in the 1963 study. Therefore, we would expect the unadjusted data to understate the decline in the shares of the lowest classes in the presentation in Table 2.

[24]It is difficult to believe that a decline in the share of the top 5% of this magnitude has, in fact, occurred. I suspect, first, that the Navarette shares for the top 5% are overstated, and second, that the 1963 survey under-reports the shares of the top group. See also R. Vernon's note on the Navareete study in [71], n. 10 p. 208.

[25]This apparent equality in the distribution of individual incomes is a consequence of the variation of family size with income level. The income shares received by families was converted to shares by individuals in the 1963 study by distributing the income at each interval to the total number of family members. For example, the 28.8% received by the top 5% of families (Table 2, line 8a) was allocated to a larger share ofindividuals. Similarly, the 1.3% of income received by the poorest 10% of families was distributed to a slightly smaller share of individuals.

Footnote 25 continued:

Average family size for Mexico in 1963 was 5.8. Average family size for the lowest income groups was 4.8, 4.7, and 5.2 individuals, while the average size of the top three levels was 6.5, 6.3, and 6.7 individuals per family. See Mexico [79], Series 38, p. 432.

[26]The negative value of the skewness (-.124) indicates that the shape of the U.S. distribution is considerably different from the other countries. See footnote 19 above. We shall find in later sections that the left-skewed distributions are characteristic of urban incomes and are probably due to the rise of more numerous families in the upper middle classes and to the persistence of low-income families "left behind" by the rising mean income.

[27]Kuznets [33], pp. 53-57.

[28]See Guerra y Sanchez [25], for the impact of cane on the Caribbean agriculture. Coffee cultivation in Puerto Rico is more related to practices in Colombia, Central America, and the highlands of Tanzania, Kenya, and Ethiopia, which produce a mild, shade-grown arabica species. In some area of Puerto Rico, orange trees are used for shade and provide a second cash crop. Coffee grown in Brazil is also arabica but is cultivated on large plantations without the protection of shade. The land and income patterns associated with the latter are similar to the patterns associated with other plantation crops, such as tea, cacao, rubber, and cane.

[29]See Puerto Rico Planning Board, Economic Report to the Governor for 1964, table on p. 56, Part II. The average hourly wage in cane was $.416 and in coffee $.236, for 1952-53. By 1962-63 the average wage in cane had risen to $.698 and $.358 in coffee.

[30]Argentina [77], Table III-17, p. 38.

[31]See D. Felix [16], p. 34.

[32]See Victor Urquidi [70], Table 5, p. 182.

[33]In Appendix Table 1, we have presented more detailed sectoral rankings by degree of inequality. Industry demonstrates the more equal ranking in terms of both the Kuznets coefficient and the standard deviation of the logs; commerce ranks the least equal by both these measures. Measurement of the distribution by the coefficient of variation suggests that the service sector is the most equal and that agriculture is the least.

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