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INCOME DISTRIBUTION AND MIGRATION:
THE CASE OF PUERTO RICO
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Research in progress; comments welcome.

Introduction

A rich and controversial debate arose in the mid 1960's concerning the effects of economic growth on the income distribution in Puerto Rico. Andic (1964) found a positive effect, Castañeda and Herrero (1965) found a worsening of the income distribution and Miller (1964) did not discern any change. These contradictory results, primarily caused by data incomparabilities, prompted Maldonado (1976) to avail herself of the comparable censuses of 1959 and 1969 which she used to conclusively prove that the family income distribution in Puerto Rico had indeed become more equal in the 1960-1970 period.

The aforementioned studies, following the lead of Kuznets (1955), tried to establish a causation link between economic growth and changes in the income distribution. Since economic growth in Puerto Rico was accompanied by a massive migration of its people to the United States, the crucial question arises whether these migrants should be included in a study of the effects of economic growth on the income distribution of the Puerto Rican people. This quandary also besets the analysts of the Mexicans, West Indians, Algerians and other migrants who cross international borders while their countries undergo profound economic changes.

This paper argues that, at least in the Puerto Rican case, the migrants should be included with the people in the origin and, accordingly, that we should sum the Puerto Rican families in the United States to the families in the island to analyze the secular changes in the Gini index from 1960 to 1970.

Section 1 Puerto Rican Migration and Population Distribution

Data collection costs usually dictate that income distribution studies use geographically-based data rather than the data based on the human group whose welfare is being analyzed. In those cases in which the majority of the target population live in the surveyed location this is a safe procedure. In the Puerto Rican case it is not. Table 1 shows that the proportion of the total Puerto Rican population living in the United States tripled in 20 years from 12 percent in 1950 to 35 percent in 1970. Migrants account for most of this increase. Table 2 shows how the migratory flow erupted after the II World War, decreased slightly from 1954 to 1964, increased in the latter part of the 1960's and completely reversed itself in the 1970 decade.

As with all migrations, net figures are much smaller than gross flows. More importantly, the breakdown by age of migrants to the United States and of return migrants to Puerto Rico reveals a distinct life-cycle phenomenon.

TABLE 1
 PUERTO RICAN POPULATION

Year	Total	Residence	
		Puerto Rico	United States
1950	2,512,078	2,210,703 (.88)	301,375 (.12)
1960	3,205,078	2,349,544 (.73)	855,724 (.27)
1970	4,176,710	2,747,046 (.65)	1,429,664 (.35)

Source: U.S. Census of Population, 1950, 1960, 1970.

Table 2
 PUERTO RICO NET BALANCE OF PASSENGER TRAFFIC

Year	Balance	Year	Balance
1945	-11000	1961	-13800
1946	-24621	1962	-11363
1947	-35144	1963	- 4798
1948	-28031	1964	- 4366
1949	-33086	1965	-10758
1950	-34155	1966	-30089
1951	-41920	1967	-34174
1952	-61658	1968	-18681
1953	-74603	1969	+ 7047
1954	-44209	1970	-44082
1955	-31182	1971	- 1811
1956	-61647	1972	+41664
1957	-48284	1973	+28421
1958	-25956	1974	+36117
1959	-37212	1975	+39574
1960	-23742	1976	+38758

Source: Puerto Rico Planning Board, Bureau of Social Planning, Balance of Payments Section.

In one hand, almost 50 percent of the Puerto Rican migrants to the United States had less than 24 years of age while less than 29 percent of return migrants were that young. In the other hand, almost 40 percent of return migrants to Puerto Rico had more than 35 years of age while only 24 percent of Puerto Rican migrants to United States were that old.

TABLE 3
AGE OF PUERTO RICAN MIGRANTS,
1955-1960 AND 1965-1970 *

Destination	Migration Period	Distribution by Age (%)					
		14-19	20-24	25-34	35-44	45-64	65-over
United States	55-60	21.5	26.4	28.3	12.3	9.4	2.1
United States	65-70	21.5	28.8	25.9	11.8	9.9	2.1
Puerto Rico	55-60	10.0	18.5	33.7	20.2	13.5	4.1
Puerto Rico	65-70	11.0	15.0	30.1	21.2	17.2	4.9

Source: U.S. Census of Population, 1960 and 1970.

The migration rate to the United States was sustained at the high level of 90,000 per quinquennium in the periods 1955-1960 and 1965-1970 while the return flow to Puerto Rico doubled from 41,620 to 92,702 in the same periods. These different migration rates were caused in part by the relatively constant stock of migrating age cohorts

* In 1960 and 1970 individuals were asked what was their place of residence five years before. Table 3 describes only these migrants.

in Puerto Rico and the huge increase of potential return migrants, as shown in table 4.

TABLE 4
 PUERTO RICAN POPULATION CHANGE
 IN U.S. AND P.R.
 FROM 1950 to 1960

Age	Puerto Rico	United States
15-24	+1.2 %	+492.3 %
25-34	-9.2	+179.2
35-44	+6.1	+144.2
45-64	+22.8	+161.1
65-over	+35.8	+162.7

Source: U.S. Census of Population, 1960 and 1970.

Section 2 Decomposition of the Gini Coefficient

The most widely used measure of income inequality in a group of N families is the Gini coefficient

$$(1) G = \left(\frac{1}{N^2} \right) \left(\frac{1}{\bar{Y}} \right) \left(\sum_{i=1}^N \sum_{j=1}^N \text{MAX} (0, Y_j - Y_i) \right),$$

where \bar{Y} is the average income, Y_i is the income of the i th family, and $\text{MAX} (0, Y_i - Y_j)$ stands for the higher of the two values within the parenthesis. Following Pyatt (1976) we can interpret G as the average gain, expressed as a percent of the mean family income, of an income-comparison game in which the i th family picks at random a j th family, and either retains its income Y_i or keeps the other income Y_j when it is greater than its own. The expected gain from this game to the i th family is

$$\frac{1}{N} \sum_{j=1}^N \text{MAX} (0, Y_j - Y_i) \geq 0.$$

The off-diagonal elements, G_{12} and G_{21} , can be interpreted as the expected gains of a family in location i from migrating to location j as a proportion of the mean income in the origin.

There must be a credible income redistribution mechanism to give real meaning to the G_{ij} 's. Migration is such a mechanism because individuals can effectively trade their income in the origin for the income of similar individuals at destination. Since Puerto Ricans can move at a low cost between the island and the mainland we can view them as playing the above income-comparison game in both places.

Section 3 Empirical Results

The following values were obtained using the family income data that appear in the published reports of the U.S. Censuses of Population of 1960 and 1970 and are subject to a final revision.

$$(2) \quad G = (V_1 \quad V_2) \begin{pmatrix} G_{11} & G_{12} \\ G_{21} & G_{22} \end{pmatrix} \begin{pmatrix} W_1 \\ W_2 \end{pmatrix}$$

$$1960 \quad .52 = (.52 \quad .48) \begin{pmatrix} .57 & 1.50 \\ .12 & .31 \end{pmatrix} \begin{pmatrix} .69 \\ .31 \end{pmatrix}$$

$$1970 \quad .49 = (.53 \quad .47) \begin{pmatrix} .52 & .99 \\ .19 & .37 \end{pmatrix} \begin{pmatrix} .63 \\ .37 \end{pmatrix}$$

We notice first that the proportion of Puerto Rican families in United States increased from 31 to 37 percent while the income shares in both places remained roughly unchanged. This can be interpreted as a relative deterioration of the income position of Puerto Rican families in the United States vis-a-vis the Puerto Rican families in Puerto Rico.

Second, the Gini coefficients within each location follow different paths. In Puerto Rico (G_{11}) it decreased from .57 to .52, as was found by Maldonado (1976), but in the United States (G_{22}) it worsened from .31 to .37.

Third, the Gini coefficient in the United States (G_{22}) is absolutely smaller than the Gini index in Puerto Rico (G_{11}). This is probably due to the self selective nature of the migration process which led most of the Puerto Rican population in the mainland to have the same income capabilities while the remaining population in the island was increasingly heterogeneous.

Fourth, the off-diagonal elements of the middle matrix show a relative increase in the expected gain of returning to Puerto Rico (G_{21}) from .12 to .19 of the average Puerto Rican family income in the United States. The opposite is true for the migrants to the United States; the gains decrease from 1.50 to .99 of the average income received in Puerto Rico.

Fifth, the aggregate Gini index of the whole Puerto Rican population (G) decreased from .52 to .49, not as much as the Gini index in the island but still in an equalizing direction.

Section 4 Conclusion and Future Agenda

Past studies of the Puerto Rican income distribution left out the sizable portion of the Puerto Rican population that lived in the United States. When the latter are properly included the aggregate Gini index still decreases in the 1960-1970 period, albeit by a smaller amount than the decrease of the Gini index of the families who resided in Puerto Rico. The Gini index of the Puerto Rican families in the United States increased along with the share of the Puerto Rican families that live in the United States. The probable gains from migration increased for families in the United States and decreased for families in Puerto Rico.

The interpretation of the off-diagonal elements of the middle matrix in equation (2) in terms of the probable gains from migration requires that each family or individual compare itself with a similar family or person in destination. Thus, holding the proper variables constant is crucial to obtain a meaningful index. Age, sex, education level and job experience are part of the set of relevant variables that determine the income possibilities in the origin and in destination. Indeed, the information network of potential migrants based on close contacts with relatives and friends at destination is designed to provide this matching information economically. Our estimates were based on published census reports that do not cross tabulate migrants according to the aforementioned characteristics (except age) and a more refined analysis should be carried out using the Public Use Sample tapes of the censuses.

The main diagonal elements in the matrix in equation (2), which are the Gini coefficients in each location, must also be computed by holding constant the appropriate individuals' characteristics. It is not valid, as Paglin (1975) emphasizes, to compare the income of a young unskilled worker with the income of a middle-aged skilled worker, since their present income differences are related solely to their different position in the life cycle.

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APPENDIX

Equation (2) states

$$G = \left(\frac{1}{\bar{Y}} \right) \left(\frac{1}{N^2} \right) \left(\sum_{i=1}^N \sum_{j=1}^N \text{MAX} (0, Y_j - Y_i) \right).$$

The total population (N) is divided into those living in location 1 (N_1) and those living in location 2 (N_2), $N = N_1 + N_2$.

Each summation can be decomposed likewise:

$$G = \left(\frac{1}{\bar{Y} N^2} \right) \left(\sum_{i=1}^{N_1} \sum_{j=1}^{N_1} \text{MAX} (0, Y_j - Y_i) + \sum_{i=1}^{N_1} \sum_{j=1}^{N_2} \text{MAX} (0, Y_j - Y_i) + \sum_{i=1}^{N_2} \sum_{j=1}^{N_1} \text{MAX} (0, Y_j - Y_i) + \sum_{i=1}^{N_2} \sum_{j=1}^{N_2} \text{MAX} (0, Y_j - Y_i) \right).$$

Divide each term within the parenthesis by the appropriate mean income and population in each location to obtain

$$G = \left(\frac{1}{\bar{Y} N^2} \right) \left(G_{11} \frac{\bar{Y}_1}{N_1 N_1} + G_{12} \frac{\bar{Y}_1}{N_1 N_2} + G_{21} \frac{\bar{Y}_2}{N_1 N_2} + G_{22} \frac{\bar{Y}_2}{N_2 N_2} \right).$$

Rearrange terms as follows:

$$G = \left(\frac{\bar{Y}_1}{\bar{Y}} \frac{N_1}{N} \quad \frac{\bar{Y}_2}{\bar{Y}} \frac{N_2}{N} \right) \begin{pmatrix} G_{11} & G_{12} \\ G_{21} & G_{22} \end{pmatrix} \begin{pmatrix} N_1 / N \\ N_2 / N \end{pmatrix}.$$

Upon cancellation of the population shares in the first row vector we obtain equation (2). QED

7. 1. 00

1. 1. 00

9. 1. 00