What happened to the distribution of income in Puerto Rico during the last three decades of the XX Century? A statistical point of view.

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Most of the studies regarding the distribution of income in Puerto Rico and its changes through time have limited themselves to the calculation of inequality indexes without testing the statistical significant of the observed changes.[1] This limitation is not exclusive to the literature regarding Puerto Rico. Mills and Zandvakili (1997) cited this as a major shortcoming of the literature regarding income distribution in general. The purpose of this study is to evaluate whether or not the distribution of income in Puerto Rico has experienced significant changes in inequality between 1970 and 2000, and to analyze the nature of such changes.

Nowadays, methodological and technological innovations allow us to easily perform statistical tests on the significance of changes between inequality indices across places or time. The use of the bootstrapping techniques allows us to define sampling distributions for the inequality indices for which asymptotic distributions are difficult to derive due to their nonlinear nature. This technique presents a statistically sound way to test the significance of the differences in inequality indices.

This paper contributes to the existing literature by combining three key elements that allow a comprehensive view of inequality changes overtime in Puerto Rico. First, It compares changes in household income with changes in household earnings between 1970 and 2000. Second, it uses different inequality measures selected according their sensitivity to changes in different parts of the income distribution. This analysis is important as a starting point to the study of why inequality changes overtime. Third, the statistical significance of changes in inequality overtime is tested using the bootstrapping technique to derive an empirical distribution for each of the inequality measures.

This thirty years period between 1970 and 2000 has been selected given the availability of the data, since it corresponds to the period for which micro data from the Census Bureau is available for Puerto Rico. The degree of inequality is measured by the Gini Coefficient and by three alternative specifications of the Atkinson Index. Total household income and total household earnings are adjusted for family size.

In the case of household income, it is clear that inequality decreased during the 70's and increased during the 90's. Nevertheless, during the 1980's the changes were much smaller and the direction of the changes depends on the index used. The degree of inequality in the distribution of household earnings demonstrates significant increases through the 1970's and 1990's. In the 1970's the increase in earnings inequality significantly affected the entire distribution, specially the lower part. To the contrary, in

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[1] For a review of the literature regarding income inequality in Puerto Rico, refer to Rodríguez (1996) and González (2003). Also refer to Sotomayor (1998) and (2004).

the 1990's the increased was more concentrated in the upper part of the income distribution. The results show that the main forces promoting decreases in household income inequality through the 70's and 80's where Social Security and Public Assistance payments, nevertheless the variations on both sources of income contributed to the increase in inequality during the last decade.

The inequality measures used are introduced in section 2. Section 3 describes the data and presents an overview of changes in income inequality in Puerto Rico through time. The methodology to be used to test the statistical significance of changes overtime is discussed in section 4, followed by the results presented in section 5. Section 6 presents the concluding remarks.

Inequality measures

One of the most common measures of inequality is the Gini Coefficient. It measures the relative distance between the Lorenz Curve and the 45 degrees line. It can be calculated as:

$$G = \frac{-(n+1)}{n} + \frac{2}{n^2 \mu_y} \sum_{i=1}^{n} i y_i$$

where:

$n =$ number of observations

$y_i =$ income of the ith household

$\mu_x =$ mean income

Since the area between the Lorenz Curve and the 45degrees line is measured relative to the total area below the line, the coefficient is bounded between 0 and 1. Most of the studies about income inequality in Puerto Rico have used the Gini coefficient; it is therefore used as the staring point in the present study.

A measure of inequality particularly suitable for the purpose of evaluating the degree of variation in different parts of the income distribution is the Atkinson Index. It includes an inequality aversion parameter (ε). As the aversion parameter increases the index become more sensitive to changes in the lower part of the income distribution, and the smaller the ε the more sensitive the index is to changes in the upper part of the income distribution. The formula to calculate the Atkinson index is as follows:

$$A = 1 - \left[\frac{1}{n} \sum_{i=1}^{n} \left(\frac{y_i}{\mu} \right)^{1-\varepsilon} \right]^{\frac{1}{1-\varepsilon}}$$

Blackorby et. al. (1981) demonstrate that, when the income domain includes zeros, ε must be greater or equal to zero and less than 1, $0 \leq \varepsilon < 1$. This condition is

necessarily for the index to retain its separability, homotheticity and S-concavity condition.[2]

In order to examine how the different parts of the income distribution have been affected over time, the estimation includes the Atkinson Indexes corresponding to three values of ε: 0.1, 0.5 and 0.9. These emphasize the upper, middle and lower parts of the income distribution, respectively.

Income Inequality Trends

It is appropriate to begin our analysis looking at the general trends that have been observed through time in income inequality for Puerto Rico. As mentioned before, the data for the analysis comes from the Census' Public Use Micro Data Sets (PUMS) for Puerto Rico for the years: 1970, 1980, 1990 and 2000. The last three corresponds to a five percent sample of Puerto Rican Households, while the 1970s corresponds to a 1 percent sample. Nevertheless, the 1970 data pools together observations from the state, municipality and neighborhood characteristics files. The data includes 18,974 households for 1970, 43,567 for 1980, 53,385 for 1990 and 63,066 for the year 2000. Group quarters and institutions have been excluded from the sample. It is important to point out that the income reported in each Census corresponds to the previous year. For example, the household income reported in 1980 corresponds to the income received by the household in 1979.

The PUMS data reports household income and individual earnings. Household earnings are obtained summing the earnings of all members of the household. In addition, measures of equivalent household income and earnings have been created dividing the household measure by the ratio of the household's poverty threshold to the threshold corresponding to an individual living alone. This equivalent income takes into consideration the needs of family of different sizes, and therefore is comparable across different households.

Figure 1 depicts the changes that occurred on both ends of the distribution of household income. The share of income accruing to the bottom decile increased substantially between 1970 and 1990, but decrease more than 50 percent during the 1990's. The ratio between the 10^{th} percentile and the median (P10/P50) follows a similar pattern, although the changes were not as large. Overall between 1970 and 2000, both of these measures increased, showing an improvement in the relative position of the lowest decile.

In contrast, net changes in the share of income accruing to the top decile and in the ratio between the 90^{th} percentile and the median (P90/P50), have an opposite sign. Between 1970 and 1990, the share of income accruing to the top decile went from 39 to 36 percent, but by 2000 it increased to 43 percent. Nevertheless the P90/P50 ratio decreased substantially in the 1970s and only increased slightly during the 1990s. As a

[2] S-concavity implies that such function would order a distribution with a equally or superior Lorenz Curves as better or equal to a distribution with a inferior or equal Lorenz Curve.

result, between 1970 and 2000 this ratio decreased from 3.8 to 3.4, which correspond to a 10 percent reduction on the position of the 90^{th} percentile relative to the median household. This raises a question. Why the households at the 90^{th} percentile did not improve their position relative to the median household, even though the income share of the top decile increased.

There are two possible explanations to this question. The first is that the gains to the top decile may have gone to the "richest of the rich", the top 5 or 1 percent. The second explanation is that the median and the richest households improved relative to the lowest decile, therefore the gains to the richest came to the expenses of the poorest. Both explanations seem to be true in the case of Puerto Rico.

Figure 1
Income Shares and Relative Values for the Lowest and Highest Decile

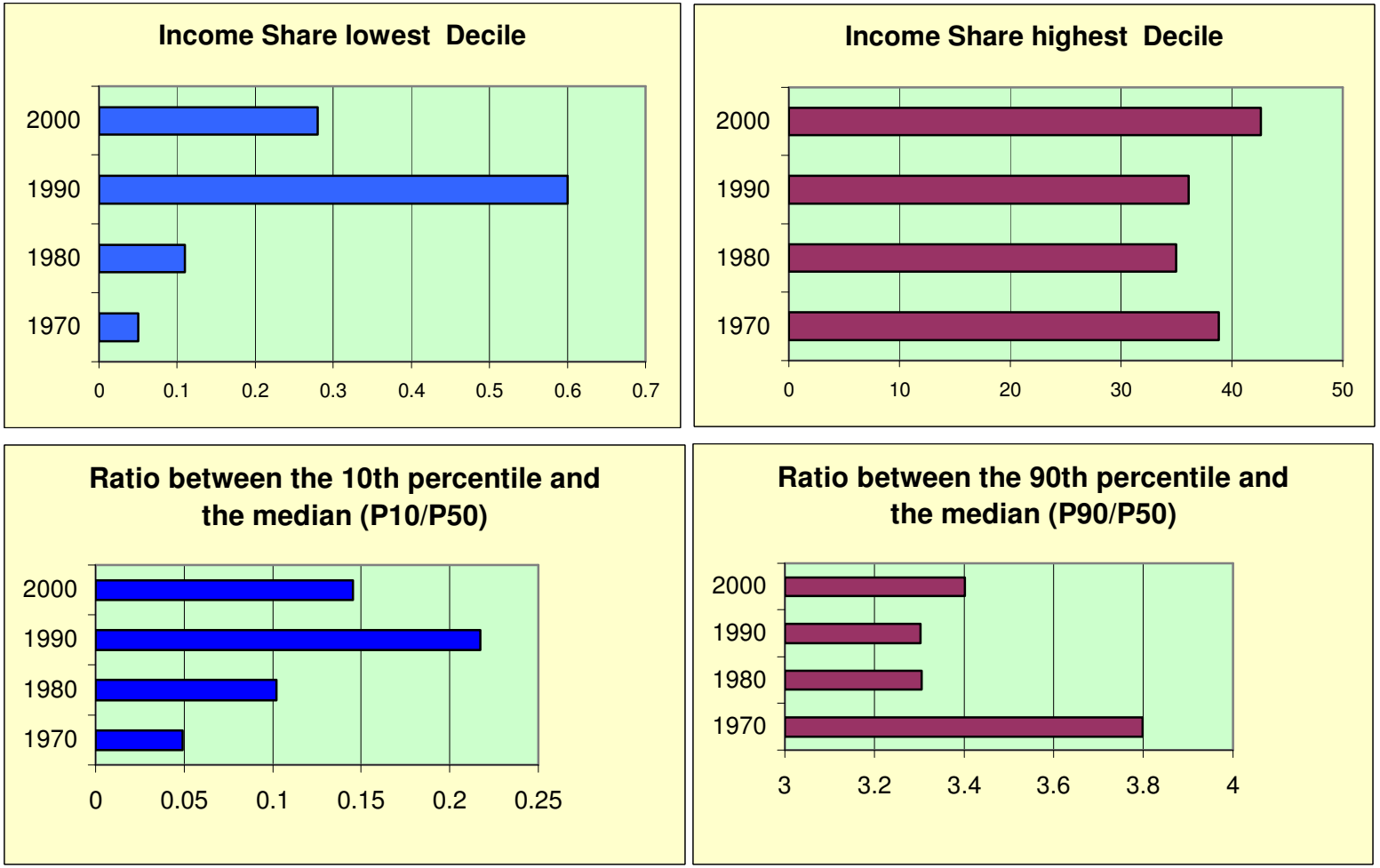


Table 1 shows the ratio between the 95th percentile and the median (P95/P50) and the ratio between the 99th percentile and the median (P99/P50) for each year. The P95/P50 ratio decreased by 15 percent during the 1970s and thereafter only increased slightly. Contrastingly, the changes in the P99/P50 ratio experienced more noticeable changes. During the 1970s, this ratio decreased by 21 percent, but it later increased by 9 and 39 percent during the 1980s and 1990s. Over the entire period, it increased from 9.7 to 11.7, indicating that the richest 1 percent got richer, at least relative to the median.

Table 1

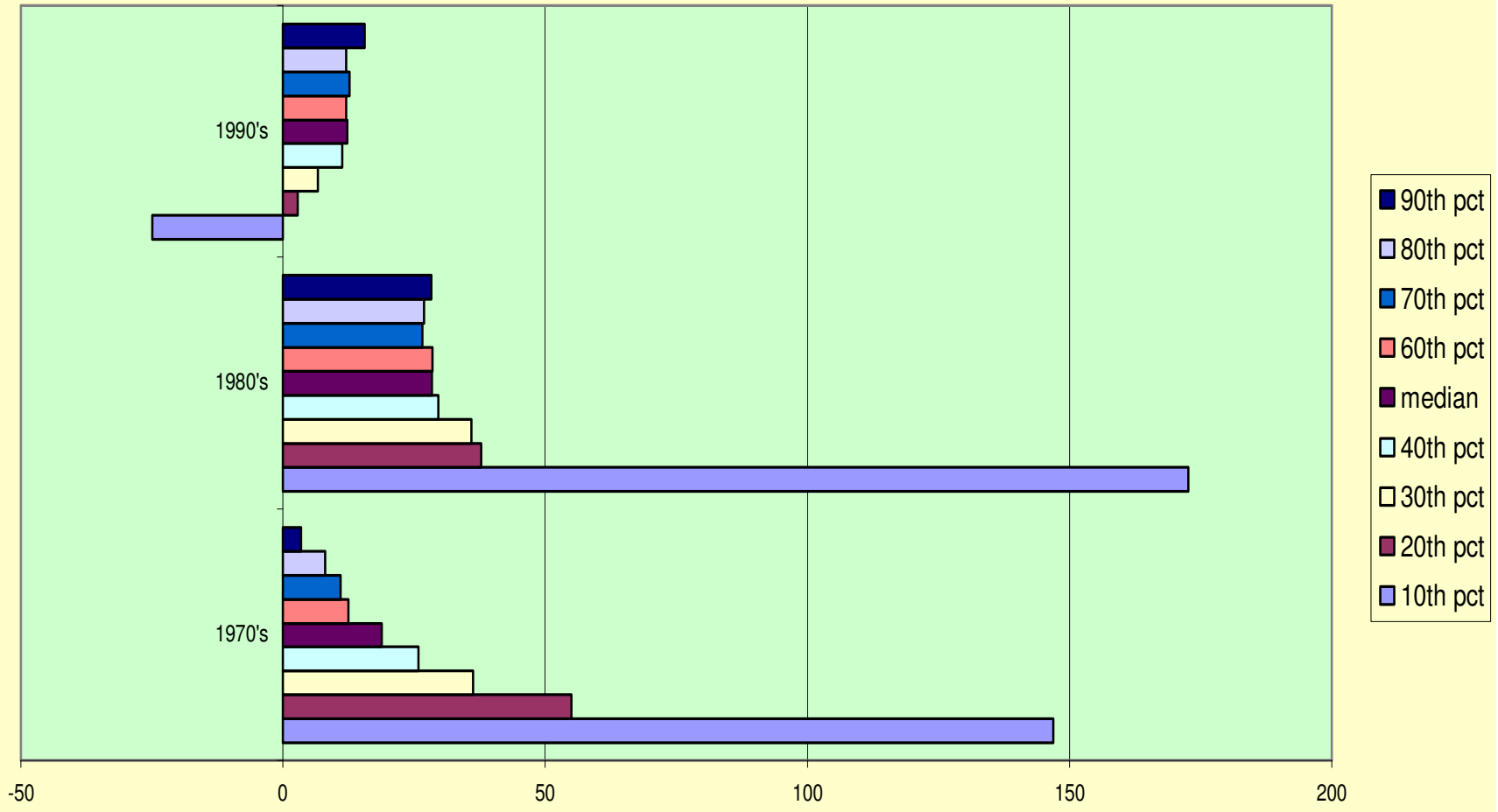
Ratios between the 95th and 99th percentile to the median

	P95/P50		*P99/P50*	
year	*ratio*	*% change*	*ratio*	*% change*
1970	5.3		9.7	
1980	4.5	-15%	7.7	-21%
1990	4.6	2%	8.4	9%
2000	4.8	4%	11.7	39%

The validity of the second explanation is examined in Figure 2**,** which presents the percentage change in the real value of each percentile of the income distribution through the decades.[3] As can be seen in the graph, each decade presents a different profile. During the 1970s the changes in the real value of the percentiles were highly equalizing, since the gains were smaller for higher percentiles. During the 1980s most increases occurred also at the bottom of the distribution, the real value of the 10th percentile increased by 173 percent while the 20th and 30th percentile increased by 38 and 36 percent, respectively. For all other percentiles, the change fluctuated between 27 and 30 percent.

[3] The real values for 2000 and 1990 were calculated deflating each percentile value by the Consumer Price Index (CPI) for all urban families for 1999 and 1989, respectively, given that the census household income variable refers to income earned during the previous year. For years prior to 1980, the CPI available is for all urban working families. To make the series comparable the ratio between both CPI measures available for 1980 to 1991 was projected backwards to 1960 and a new CPI measure for 1979 and 1969 was estimated dividing the CPI for working families by the projected ratio.

Figure 2
Percentage Change in the Real Value of each Quantile
by Decade



The last decade shows the opposite pattern. The real value of the 10th percentile decreased by 25 percent. For all other percentiles, the changes were relatively small and were larger for higher percentiles. Contrary to the previous decades, during the 1990s the lowest decile suffered a lost of well-being. Figure 2 shows that the increase in well being for the richest during the 1990s came at the expense of a worsening of the economic conditions of the poorest 10 percent.

Table 2 presents the Gini coefficients for household income, as well as for household earnings, for each of the four Census years, and the percentage change between periods. There are various facts that should be mentioned. For household income, the Gini shows a tendency to decrease slightly between 1970 and 1990, but increases from 1990 to 2000. Notice that the percentage changes observed during the nineties are bigger than the percentage reductions observed during the eighties. The Gini coefficient for household earnings has been increasing through the entire period, experiencing sharper increases in the 1970s and 1990s.

Table 2
Gini Coefficients for Household Income and Household Earnings, 1970-2000

Year	*Household income*	*% Change*	*Household Earnings*	*% Change*
1970	0.545		0.61504	
1980	0.512	-5.9	0.65678	6.8
1990	0.506	-1.2	0.66313	1.0
2000	0.564	11.4	0.69129	4.2

There are various questions arising from Table 2. The first, which is one of the central focuses of this paper, which is whether or not the changes observed are statistically significant, specially the small changes observed during the 1980s. The second is whether these changes were uniformed across the entire income distribution. The third one, that will be addressed later on, is why total income inequality decreased during the first two decades, even though household earning inequality has been increasing. The last question is perhaps the most complicated and therefore out of the scope of the present paper: Why has household earnings inequality increased steadily?

The use of bootstrapping to perform hypothesis testing.

The technique of bootstrapping consists of K repeated random sample drawing of the data, in each of which a parameter of interest G is estimated. As a result, $\hat{G}_k$ estimates are obtained. These k estimates of G are then used to generate an empirical distribution for G. The empirical estimate of standard error if given by:

$$se_b = \left\{ \frac{1}{K-1} \sum_{k=1}^{K} \left[\hat{G}_k - \bar{\hat{G}} \right]^2 \right\}^{1/2} \qquad (1)$$

The estimated standard error can then be used to define a confidence interval for the parameter G. There are two general methodological approaches to compute the confidence interval: The standard normal method and the percentile method. Under the assumption that the parameter G is normally distributed, the standard normal approach uses the student's t distribution to define a $1-\alpha$ confidence interval such that the lower ($\hat{G}_L$) and upper ($\hat{G}_U$) limits are given by:

$$\hat{G}_L = \hat{G} - t_{\alpha/2,n-1} se_b$$

and (2)

$$\hat{G}_U = \hat{G} + t_{\alpha/2,n-1} se_b$$

The limitations of this approach include the assumption that the parameter is distributed normally and it does not account for possible skewness in the population. An extended version of the normal approach has been developed to accounts for these limitations, but it is computationally cumbersome.

The second approach, and the most widely used, is the percentile method. This method uses the estimated $\hat{G}_k$ to empirically construct a cumulative distribution F_b for G. For any value *x*, the cumulative distribution will be equal to the number of estimated $\hat{G}_k$ that are less than or equal to *x*, divided by the number of drawings K.

$$\hat{F}_b(x) = \frac{\#(\hat{G}_k \le x)}{K} \qquad (3)$$

To construct a $1-\alpha$ confidence interval the $\hat{G}_k$'s are ordered increasingly and the upper and lower limits will be given by:

$$\hat{G}_L = the\left[K \times \alpha^{th}\right] value$$

and (4)

$$\hat{G}_U = the\left[K \times (1-\alpha)^{th}\right] value$$

Moran (2004) argues that according to Trede (2002) even though the percentile methods can be problematic when the distribution of $\hat{G}$ is skewed, it is still adequate in the case of inequality measures given that the distributions of inequality measures are asymptotic. Nevertheless a bias corrected percentile bootstraps methodology has been suggested to overcome the limitations of the percentile methods. The correction takes

into consideration the number of estimates that are less than the mean. If the mean corresponds to the median, then no correction is used.

The construction of confidence intervals for the inequality indexes allows a graphical representation of the true differences in inequality between two indexes. If the intervals do not overlap, then we can ascertain that the differences are significant. Nevertheless, if the intervals do overlap then further hypothesis testing is needed to determine whether or not the differences observed are significant.

The bootstrap methodology can be used to construct such a test. Following the analysis presented by Moran (2004), K repeated random drawings are used to obtain K estimates ($\hat{D}_k$) of D, which is defined as the difference between the two inequality measures being compared:

$$D = G^{''} - G^{'} \tag{5}$$

The difference is said to be significantly different from zero if zero is not contained in the confidence interval. Correspondingly, a one-side p-value can be derived as:

$$p - value_b = \frac{\#(\hat{G}_k^{''} > \hat{G}_k^{'})}{K} \tag{6}$$

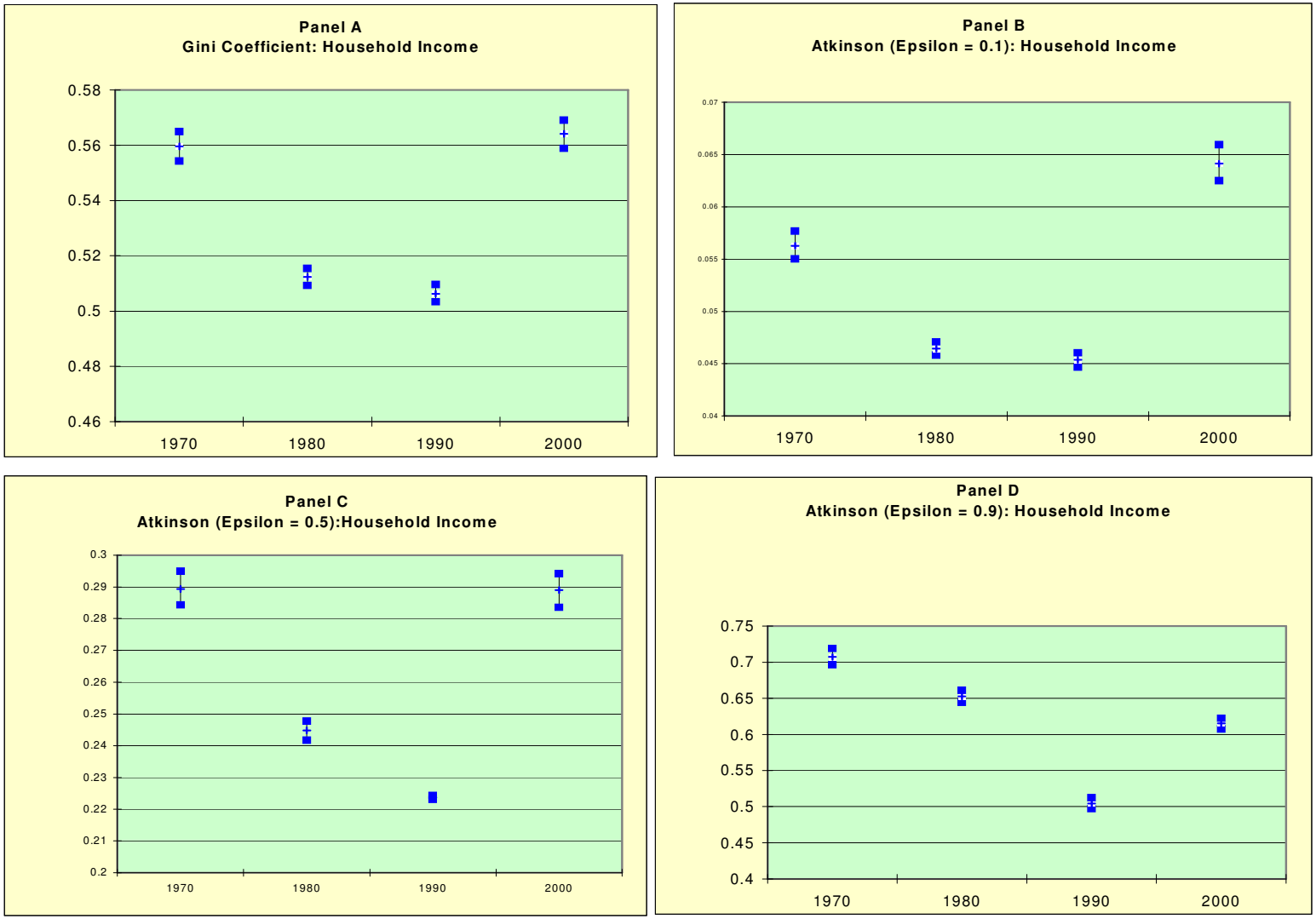
Bootstrap Results:

Household Income Results

The confidence intervals estimated for the Gini Coefficient for household income are presented in Panel A of Figure 3. It can be observed that there was a significant decreased in inequality during the 1970 and a significant increase during the 90's. Nevertheless the intervals for 1980 and 1990 overlap, therefore we cannot ascertain without further tests that the observed decrease in inequality is significant, or whether the coefficient for 2000 is significantly different from the one corresponding to 1970.

The methodology describe above was used to test whether the changes are significant. When testing the hypothesis that the increase observed between 1980 and 1990 is greater that zero, the resulting p-value is 0.005. Therefore the hypothesis is accepted. It can be concluded that there was a small but significant decrease in household income inequality during the 1980s.

Figure 3
Confidence Intervals for Household Income Inequality Measures



As for the difference between the coefficients corresponding to 1970 and 2000, the estimated p-value is 0.12, implying that there is no significant difference between household income inequality in 1970 and 2000. It is therefore concluded that the improvement in the distribution of household income achieved in the 70's and the 80's was reversed by a sharp increase during the 90's, which reverted income inequality to the level that prevailed in 1970, as measured by the Gini Coefficient. All the intervals and the p-values for those that overlap are presented in the appendix. The appendix also includes the p-values to test the statistical significance of the changes when the intervals overlap.

Panel B, C and D in Figure 3, show the corresponding intervals for the three Atkinson measures corresponding to $\varepsilon = 0.1$, $\varepsilon = 0.5$ and $\varepsilon = 0.9$, respectively. As expected the results obtained using an ε of 0.5 are very similar to the ones obtained for the Gini Coefficient, since both measures are more sensitive to changes in middle part of the income distribution. The other two Atkinson measures, also follow a general U-shape, but the net change for the entire period varies. When an ε of 0.1 is used, the increase in inequality during the 1990s more than offset the decreases of the previous two decades causing a net increase in inequality. The opposite is true when ε is set at 0.9. A comparison of Panel B and C illustrate that when the lower part of the income distribution if given more weight, the decreases in inequality during the 1970s and 1980s appears sharper and the increases of the 1990s is not as large, as when the upper part of the income distribution is given more weight. Therefore, it can be concluded that the increase in household income inequality during the last decade was concentrated more in the upper part of the income distribution.

Household Earnings Results

The confidence intervals corresponding to household earnings are reported in Figure 4. All measures show that the inequality in the distribution of household earnings significantly increased between 1970 and 2000. Panel A presents the intervals for the Gini Coefficient. It shows significant increases in inequality between 1970 and 1980 and between 1990 and 2000. Once again, the confidence intervals form 1980 and 1990 overlap, therefore it cannot be ascertained from the graph whether or not the increased in the coefficient is statically significant. Therefore, It was needed to calculate the p-value to test the hypothesis that the difference is significantly different from zero. The resulting estimated p-value is 0.002, implying that the increased in household earning inequality, even though small, was significant.

The results obtained using the Atkinson Index with $\varepsilon = 0.5$ are very similar; with the exception that the change observed between 1980 and 1990 is not statistically significant. [4]

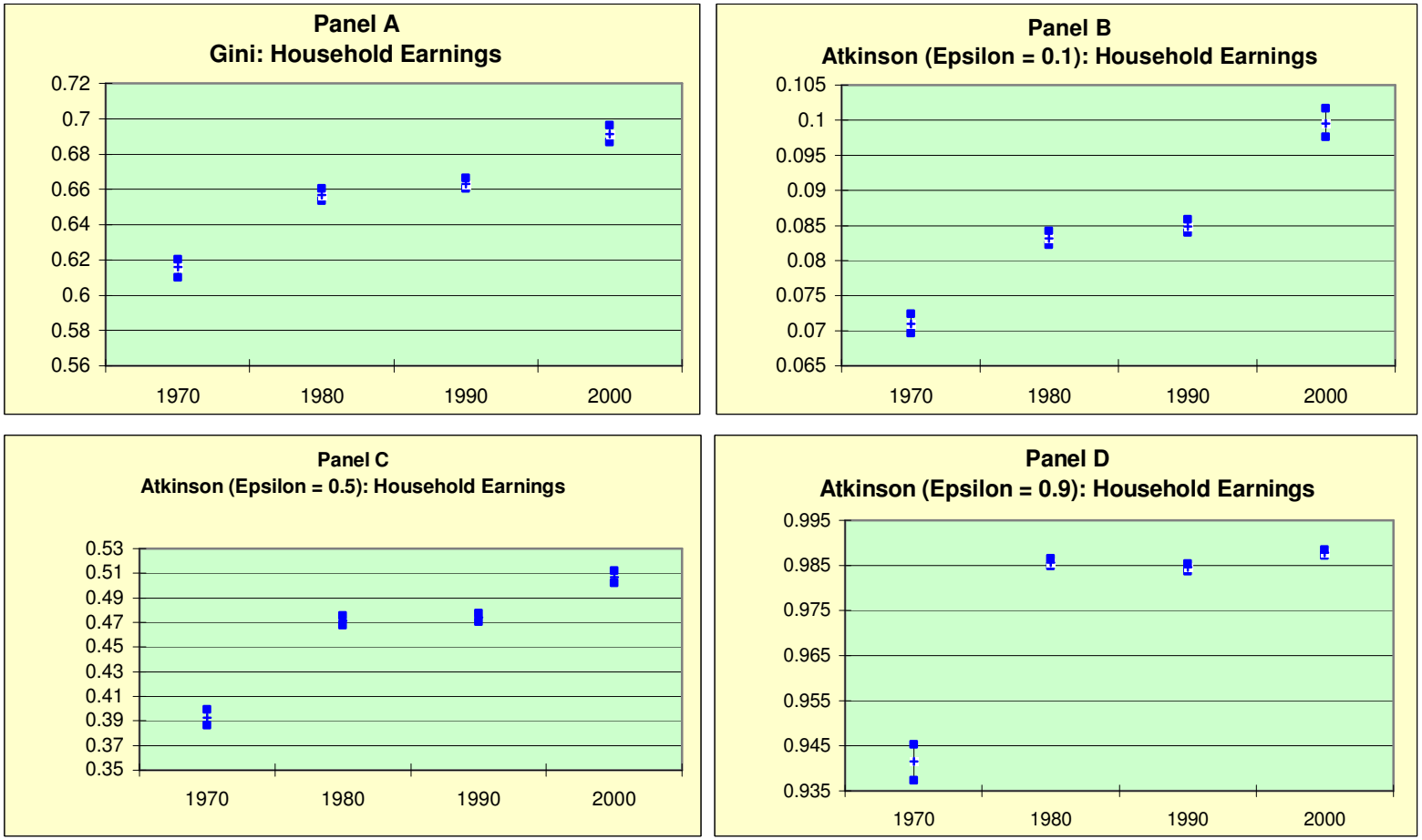
Panels B shows that when the upper part of the distribution is given more weight, earnings inequality continuously increases overtime. Although the 1980 and 1990

[4] The intervals and the corresponding p-values for the overlapping intervals are presented in the appendix.

intervals overlap, the hypothesis that earnings inequality significantly increased cannot be rejected. Also, the magnitude of the increase during the 1970s is smaller compared to the increase evidenced during the 1990s. On the contrary, when the bottom part of the distribution is emphasized, most of the increase occurs during the 1970s. In fact, Panel D demonstrates that during the 1980s the index decreases slightly. This changed was found to be small but statistically significant. During the 1990s the index rebounded back.

It can be concluded that the distribution of household earnings became substantially and significantly more unequal between 1970 and 2000. Nevertheless, through the decades these changes did not affected all parts of the income distribution equally. For those at the bottom of the distribution, the 1970s brought a larger increase in inequality than the 1990s. This hints that the 1970s recession was one of the main reasons for the increase in inequality, since recessions tend to place a greater burden on less skilled workers. The sources of increases in earnings inequality during the 1990s were of a different nature since they had a stronger impact on families in the middle and, specially, the upper part of the income distribution.

Figure 4
Confidence Intervals for Household Earnings Inequality Measures



Explaining the differences in trends between household income and earnings

To explain the differences in trends between the inequality of household income and that of household earnings from 1970 to 1990, the components of household income are examined. Table 3 presents the percentage of household income that comes from: earnings, social security income and public assistance, for the average household in each of the four census years.

Table 3
Percentage of Household Income from Earnings, Social Security and Public Assistance
(Household Average)

	1970	*1980*	*1990*	*2000*
% of Household income from earnings	77	61	59	59
% of Household income from Social Security	13	21	19	21
% of Household income from Public Assistance	5	8	16	10
Total	**95**	**90**	**94**	**90**

Together these three sources of income account for between 90 to 95 percent of total income. The drop in the percentage of household income coming from earnings between 1970 and 1980 is noticeable, and the increased in the percentage coming form social security income. It is also important to point out that the percentage of income coming from public assistance is shown to have double between 1980 and 1990. Nevertheless, this is a result of data collection.

In the mid 1970's the Food Stamp program was extended to Puerto Rico. By 1980 approximately 50 percent of the population was receiving benefits from the Program (Segarra, 1999). But since the benefits were given in the form of food coupons and not cash, there value was not included in the census as public assistance income, which only accounts for cash payments. The rapid expansion of the Program in Puerto Rico, prompted federal authorities to substitute the food stamp program for a block grant, with reduced funding. One cost reduction mechanism used by the Puerto Rican government was to cash out the program. As a result, since 1990 the benefits from the Puerto Rico food assistance program, called the Nutritional Assistance Program, are included in the census as public assistance income.

With this in mind, the information in Table 3 implies that in reality during the 70's the relative importance of earnings was reduced, while social security income and public assistance income increase in importance, although the increase in public assistance is understated during the 1970s and overstated during the 1980s.

To measure the extent at which each of these additional sources of income contribute to compensate the increase in household earning inequality during the first two

decade under study, the Gini coefficient is calculated for two additional definitions of household income: household income excluding social security payments and household income excluding public assistance payments. Table 4 presents the Gini coefficients for the three measures of household income and compares the percentage change in each of them for each decade.

Table 4
Gini Coefficients for total household income, with exclusions 1970-2000

Year	*Total Household income*	*% Change*	*Total Household Income (Excluding Social Security Income)*	*% Change*	*Household Income (Excluding Public Assistance Income)*	*% Change*
1970	0.560		0.595		0.565	
1980	0.512	-8.4	0.592	-0.4	0.535	-5.2
1990	0.500	-2.4	0.583	-1.5	0.543	**1.5**
2000	0.564	12.7	0.638	9.4	0.581	6.9

While the income inequality is shown to decrease during the 70's by 8.4 %, when social security income is excluded from the measure of household income, income inequality only decreases by 0.4 %, implying that the decrease in income inequality that is measured by the data during the decade was mainly due to the increased relevance of social security income. As for the reduction that is measured to occur during the 80's, it is shown that when social security is excluded from income, the percentage reduction is cut in half and when the public assistance payments are excluded inequality actually increases. Since the increased in public assistance income measured in the 1990 census actually happened in the 70's, it could be concluded that the improvement in household income inequality actually happened during the 70's and later reverted during the 1990's.

As can be observed in the Table 4, the relative importance of public assistance income decreased during the 1990's. Two logical explanations for this are: the extended economic recovery period that lasted for most of the decade and the reductions in benefits and program enrollment that came as a result of strict eligibility requirements instituted by the 1996 Welfare Reform.

Concluding Remarks

Based on the examination of the PUMS census data for Puerto Rico, it is concluded that household income inequality measures followed a U pattern between 1970 and 2000. It was reduced during the 1970's due to increases in social security and public assistance payments but it later increased during the 1990's influenced by the continuous increase in household earnings inequality and a reduction in the relative importance of

public assistance income during the 1990's. If measured by the Gini Coefficient or the Atkinson Index with $\varepsilon = 0.5$, in 2000 household income inequality was back to its 1970 level.

However, this conclusion regarding the net change in inequality may change if we alter the emphasis in different parts of the distribution. An $\varepsilon = 0.1$, will weight more the upper part of the distribution and results in a net increased in inequality between for the entire period, while an $\varepsilon = 0.9$, weights more the lower part of the distribution and results in a net decrease in inequality.

The analysis presented indicates a small but significant decrease in inequality during the 1980s. Nevertheless, such an increase results from the expansion on transfer payments, which occurred during the 1970s but is not recorded in the data until the 1980s. Overall, the 1980s brought very little change to the distribution of income in Puerto Rico.

Most worrisome is the fact that household earnings inequality maintained a pattern of significant increases through the decades. Although determining the reasons for the sharp increases in household earnings inequality observed during the 1970's and 1990's is beyond the scope of this article, some possible culprits may be mentioned and further study in future research.

The 1970s was a decade marked by worldwide economic recessions, which tend to have a more precarious effect on lower skill workers. In Puerto Rico, it brought about a stagnation of the rapid industrialization process that characterized the 1950's and 1960's. It also coincided with a net return migration of Puerto Ricans from the US that may have altered the distribution of workers skills in an unpredictable way. As a result the increase in earnings inequality had a stronger effect on the lower part of the income distribution.

As for the 1990's, increases in earnings inequality concentrated more among middle and upper earnings households. Segarra (2005), after dividing households by: type, education of head, age of head and working status of head; found most of the increases in household earnings inequality during that decade come from increases in within group inequality. Future research will examine difference in earnings inequality within industries to determine factors that may affect earnings inequality.

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Appendix

Household Income
Confidence Intervals for each index

Gini Coefficient

Year	lower limit		upper limit	
1970	0.5542	-	0.5650	
1980	0.5093	-	0.5155	
1990	0.5033	-	0.5096	pvalue=0.005**
2000	0.5589	-	0.5691	pvalue=0.12

Atkinson (epsilon = 0.5)

Year	lower limit		upper limit	
1970	0.2843	-	0.2949	
1980	0.2417	-	0.2478	
1990	0.2231	-	0.2243	`
2000	0.2836	-	0.2941	pvalue=0.452

Atkinson (epsilon = 0.10)

Year	`		upper limit	
1970	0.0550	-	0.0577	
1980	0.0458	-	0.0471	
1990	0.0447	-	0.0461	pvalue=0.013*
2000	0.0625	-	0.0659	

Atkinson (epsilon = 0.90)

Year	lower limit		upper limit
1970	0.69647	-	0.71895
1980	0.64438	-	0.66080
1990	0.49734	-	0.51222
2000	0.60739	-	0.62206

Household Earnings
Confidence Intervals for each index

Gini Coefficient

Year	lower limit		upper limit	
1970	0.6100	-	0.6202	
1980	0.6536	-	0.6605	
1990	0.6604	-	0.6662	pvalue=0.002**
2000	0.6868	-	0.6962	

atkinson (epsilon=0.50)

Year	lower limit		upper limit	
1970	0.3865	-	0.3989	
1980	0.4676	-	0.4755	
1990	0.4703	-	0.4776	pvalue=0.16
2000	0.5020	-	0.5119	

Atkinson (epsilon = 0.10)

Year	`		upper limit	
1970	0.0696	-	0.0724	
1980	0.0822	-	0.0842	
1990	0.0840	-	0.0858	pvalue=0.005**
2000	0.0976	-	0.1017	

Atkinson (epsilon = 0.90)

Year	lower limit		upper limit	
1970	0.93734	-	0.94535	
1980	0.98479	-	0.98654	
1990	0.98371	-	0.98536	pvalue=0.038**
2000	0.98714	-	0.98839	

The light shadows denote that the intervals for 1980 and 1990 overlap
The dark shadows denote that the intervals for 1970 and 2000 overlap
P-values are presented to test whether the difference is significantly different from zero for intervals that overlap
*significant at a 5 percent level
** significant at a 1 perdent level