TAX REFORM AND THE PROGRESSIVITY OF THE PERSONAL

INCOME TAX IN COSTA RICA,

1987-1989

By

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

In 1988, the Costa Rican government passd a major tax reform bill. This legislation was prompted by a desire to increase work effort, savings and investment via changes in the tax code. It was also prompted by a desire to achieve greater income equality and improve the fiscal situation.

Purpose of the Study

The purpose of this study is to determine whether the 1988 Tax Reform Act has achieved its goal of greater income equality. This is done by determining, through appropiate measures, if the new personal income tax rates are more or less progressive than the old rates. Several progressivity measures will be used to compare the progressiveness of the income tax for both the pre-reform and post-reform periods. Progression will be measured by applying some classical measures, such as, the average tax rate, the marginal tax rate, marginal rate progression, liability progression, and residual income progression. Moreover, a newer and more advantageous measure will be used: the rate of share adjustment.

Basically, this study has two main objectives: (a) to describe and to evaluate the different progressivity measures, based on the literature, and (b) to determine the progressivity of the personal income tax in Costa Rica before and after the reform took place.

Significance of the Study

This study is relevant for Costa Rican society in general because it provides insight into the effects of the reform in terms of income redistribution, i.e., it determines who gains and who loses as a result of the new tax policy. This study is an example of policy evaluation in terms of equity considerations. It gives policymakers a perspective about how to analyze the impact that a new tax structure could have on the economic position of those who are taxed. The results are very important in terms of distributive justice and taxation.

By introducing the rate of share adjustment measure, this study goes further than previous studies based on the classical coefficients because it takes into account both the redistribution and the differential impact of the tax on the different income groups that takes place as a result of the imposition of the tax. In addition, the rate of share adjustment measure shows how each income group fares relative to the rest of the population. The previous measures differ from this measure in that they relate taxes to income but do not contemplate distributional effects.

Outline of Work

This work is structured in six chapters. The present chapter has been a brief introduction to what will be studied and the motivation behind the study. The second chapter deals with a review of the progressivity concept and the literature on progressivity measures. The third chapter provides information about some aspects of the Costa Rican institutional framework. This section is intended to give a closer idea of the Costa Rican economy in the tax reform context, the composition of its taxes and some background on the 1988 Tax Reform. The fourth chapter explains the data and methodology used in the study. As will be explained, it was necessary to apply a special procedure to derive representative results for the post-reform period. The fifth chapter is an analysis of the empirical work and it outlines the most important findings. Finally, the sixth and last chapter presents some final conclusions.

CHAPTER II

REVIEW OF THE PROGRESSIVITY CONCEPT

Previous researchers who studied the effect of taxes on income distribution have used different measures to determine tax progressivity. In 1928, A.C. Pigou defined the average rate progression and the marginal rate progression. Later, Musgrave and Thin (1948) used those indexes and defined some more progressivity measures such as the liability progression, the residual income progression and the effective progression. Rosen (1992) mentioned what he calls a "natural way to define" progressiveness and regressiveness by doing it in terms of the average tax rate- i.e., the ratio of taxes paid to income. Each index constitutes an effort to determine how progressive or regressive a particular tax is in terms of its impact on either the distribution of the tax burden or the distribution of income.

In 1938, Simons defined "a progressive income tax as a means of reducing economic inequalities" (Kopelman, 1988, p. 289); whereas, Jakobsson stated: "[t]oday it seems natural to choose income redistribution instead of traditional equity theory as a framework for a discussion of the degree of progression" (1976, p.162). Finally, as Kiefer

(1984) points out what is important is to be able to understand what each measure tries to explain, given its characteristics and implications. Moreover, it is necessary to recognize that no measure of progressivity is perfect (Atkinson and Stiglitz, 1980, p. 268) and that "measuring how progressive a tax system is presents an even harder task than defining progressiveness" (Rosen, 1992).

Classification of the Progressivity Measures

After Wart and Ruggeri (1991) the measures of progressivity may be classified as:

a) aggregated or disaggregated and

b) structural and distributional.

The aggregated or global indexes use one measure for the income distribution and the disaggregated ones give more details about the impacts that the tax has on the income structure. The structural measures refer to the relationship between tax and income and compare the impact of the tax in the different population subgroups (Baum p.171). Those measures were first studied by Musgrave and Thin (1948), as mentioned above. The distributional measures determine progressivity based on the income redistribution that takes place because of the tax. Thus, distributional indexes are a function of the tax structure, but also of the distribution of income.

Usually, distributional measures are based on the concept of the concentration index[1]. For instance, Kiefer (1984) states six distributional progressivity indexes that

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[1]The coefficient of concentration defined is a measure of income inequality, usually related to the Lorenz curve and the Gini index. Moreover, Lorenz curves are a special case of concentration curves. The Lorenz curve is the concentration curve for income. Following Kakwani (1977a pp. 719-720) let X be the income and F(x) be its income distribution which represents the population income units having income less than or equal to X. If the mean u of the distribution exists then the first moment distribution function F1(x) is defined and it represents the proportion of total

5

make use of the Gini coefficient for after-tax and before-tax income, and the concentration index of taxes (p. 498). Those indexes are the Effective Progression Index, the Pechman-Okner Index, the Reynolds-Smolensky Index, the Khetan-Poddar Index, the Kakwani Index and the Khetan-Poddar-Suits Index. The problem with these measures is that the relevance of their information in terms of policy is not clear, given that they do not "relate directly to the relationship of tax liability to ability-to-pay or the effect of the tax system on the distribution of income" (Kiefer, 1984, p. 507).

Although there are many measures, the economic literature related to inequality measures has been mostly based on the Lorenz curve approach and the Gini coefficient as instruments to determine the distribution of income in the economic analysis[2](See for example Gastwirth (1972), Kakwani (1977) and Kakwani and Podder (1976)). These indexes are the subject of the next section.

Classical Progressivity Measures

The Lorenz Curve

Kakwani defines the Lorenz curve as the one that "relates the cumulative proportion of income units to the cumulative proportion of income received when units are arranged in ascending order of their income." Moreover, he recognizes that the Lorenz curve is "widely used as a convenient graphical device to represent the size distribution of income and wealth" (1977a, p. 719). Similarly, Pechman and Okner (1974) refer to the

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income earned by income units having income less than or equal to X. That is, the Lorenz curve is the relationship between $F(x)$ and $F1(x)$. The Gini index is one minus twice the area under the Lorenz curves.

[2]Furthermore, Atkinson (1970) relates the social welfare function and the Lorenz curve.

Lorenz curve as the one that " shows the cumulative percentage of the aggregate income received by any given cumulative percentage of recipients arrayed by the size of their income". Graphically, the Lorenz curve curve relates the accumulated percent of total family income in the y-axis to the accumulated percent of families in the x-axis. The closer the Lorenz curve is to the 45-degree line (the line of equal distribution) the more equal (the less unequal) the distribution of income is. (See Figure 1). Thus, the Lorenz curve corresponds to an aggregated type of measure and may be classified as a distributional index.

One of the problems with the Lorenz curve is that the density function of the income distribution to derive it is not known so that it has to be approached with either a Pareto or a lognormal function. The shortcoming with this estimation procedure is that a good fit to the actual data is very difficult to achieve. Kakwani and Podder advocate that Lorenz curves have some properties that could serve the purpose of finding an equation of the Lorenz curve that fits actual data closely (1976, p.137).

As defined by Kakwani, the distance between the Lorenz curve of pre-tax and post-tax income depends on both the tax elasticity and the average tax rate. However, he argues that because the average tax rate can change without changes in tax elasticity or progressivity, "by simply comparing the Lorenz curves of pre-tax an post-tax income one cannot arrive at a suitable measure of progression" (1977, p. 723).

Figure 1. Lorenz Curve.
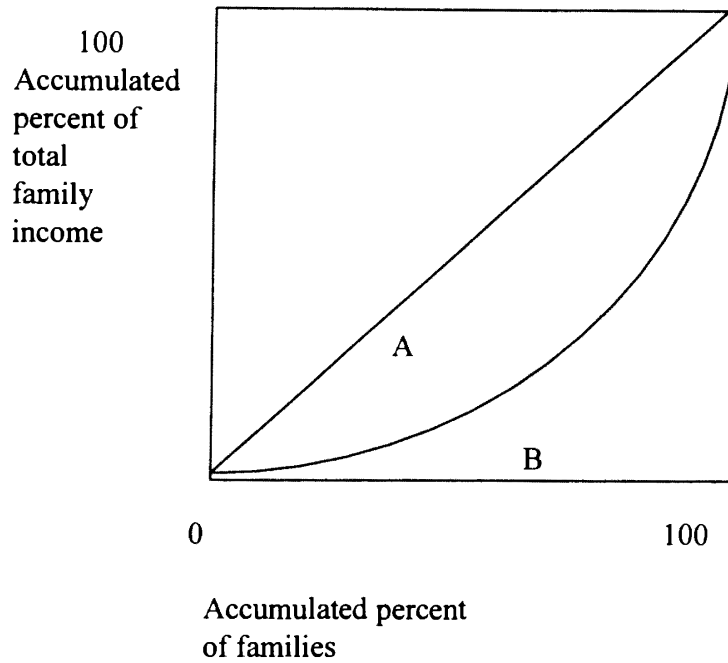
The Gini Coefficient

This index is "the most widely used measure of income inequality" (Kakwani, 1977a) and its definition depends on the Lorenz curve specification[3]; that is why the literature almost always relates the Gini coefficient and the Lorenz curve. Indeed, the Gini index can be classified as a global distributional progressivity measure. Pechman and Okner define the Gini coefficient as "a measure of the equality or inequality in a

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[3]The Gini index is equal to one minus twice the area under the Lorenz curve, as mentioned in footnote 1.

distribution"[4]given by "the ratio of the area between the Lorenz curve and the 45-degree line to the entire area below the 45-degree line", i.e. A/A+B from Figure 1. This ratio may take values from zero (when there is a perfectly equal distribution) to one (which corresponds to the case of perfect inequality).

Suits measures the progressivity of a tax with a "figure similar to a Lorenz curve but one in which the accumulated percent of the tax burden is plotted vertically against the accumulated percent of income on the horizontal axis" (1977, p.748). Hence, this Gini ratio is calculated analogously to the one obtained from a usual Lorenz curve but it measures something slightly different. In fact, Suits states that his index is "inspired by and related to the Gini ratio" (p. 747). However, he is able to measure and compare the degrees of progression for different taxes such as the personal property tax, payroll tax, sales and excise taxes, individual income tax, property tax and corporate income tax.

Simultaneously to Suits' study, Kakwani (1977b) developed some measures of progressivity. In both cases the measures are related to the Gini ratio of income inequality, according to Formby, Seaks and Smith (1981). Kakwani determines the effect of taxation on the income distribution and the effects of the income distribution on taxes (p.77) by using a "Lorenzian income inequality" and a "Lorenzian tax inequality." Earlier, Gastwirth (1975) used the Gini index to estimate a family of measures of relative inequality to determine income distribution and industrial concentration.

Although the Gini coefficient has been widely utilized, there has been some controversy about its efficacy. For instance, Morgan (1962) affirmed that "the Gini index is the best single measure of inequality" whereas Atkinson[5] (1970,p. 62) argues that such an index is misleading for two reasons:

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[4]Gastwirth refers to the Gini index as the formula that measures relative inequality as "it is the ratio of a measure of dispersion, the mean difference, to the average value (μ)." (1972, p. 307)

[5]Not only Atkinson but also Dasgupta, Sen and Starrett (1973), Sen (1973) and Blackorby and Donaldson (1978) criticize the Gini index.

"Firstly, the use of ...[the Gini ratio] often serves to obscure the fact that a complete ranking of distributions cannot be reached without fully specifying the form of the social welfare function. Secondly, examination of the social welfare functions implicit in [such a ratio] shows that in a number of cases [it has] properties which are unlikely to be acceptable, and in general there are no grounds for believing that [it] would accord with social values."

Blackorby and Donaldson (1978) agree with Atkinson (1970) in the sense that the Gini coefficient has "ethically perverse properties" (p. 79). They state that the Gini index is defined over the entire space so that it ranks "as indifferent some distributions of income which have negative components with others which have all positive components".[6] Gastwirth (1972, p.306) focuses on three shortcomings of the Gini coefficient: relative insensitivity, difficulty in computation, and the problems related to the inclusion of negative incomes. In order to minimize those shortcomings, Gastwirth obtains an upper and lower bounds to the Gini index from data that are grouped in intervals where the mean income in each interval is known. Based on the assumption that most income distribution comes from a frequency function that decreases in the large income range, he developed improved bounds for the Gini ratio. Finally, Gastwirth shows that "the Gini index can be accurately estimated without fitting curves to data whenever the data are grouped properly." He aknowledges, however, that "some future problems remain" (1972, p.314).

Élteto and Frigyes(1968) argue that the Gini coefficient is advantageous because of its simple geometric interpretation. Nevertheless, they recognize some disadvantages related to it like its relative insensitivity, the difficulties connected with its computation from empirical data and its lack of direct economic meaning" (pp. 383-384).

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[6] Furthermore, those authors point out that "the only distributionally homothetic function which does not behave in this ethically perverse way is the Rawls maximim rule" (p. 74).

One of the main disadvantages of the Lorenz curve and the Gini coefficient is "their inability to distinguish differences in progressivity at different levels of income" and their "deceptive results under some circumstances" (Baum, p.169-170). As Baum argues, these "indices fail to deal adequately with 'crossover' cases where Lorenz curves intersect and with situations in which the redistribution involves gains (or losses) for the middle relative to the extremes, causing a crossover."

Finally, even though the Lorenz curve and the Gini ratio are the most widely recognized classic measures, there are some other indexes that have been popular as well.

Other Classical Progressivity Measures

In 1928 A. C. Pigou[7]mentioned some progressivity measures that were later referred to by Musgrave and Thin (1948) as the average rate progression and the marginal rate progression. The calculation of these measures is based on the average tax rate and the marginal tax rate, respectively. They both could be classified as structural and disaggregated progressivity indexes, given that each index relates tax to income and that it is possible to obtain these measures for each income group .

Average Tax Rate (ATR)

The average tax rate index is Ti/Y_i, where Ti is the tax liability for the ith income group, and Yi is the income level for the ith income level. This index expresses tax liability as a percentage of income. A tax structure is said to be progressive when the average tax rate increases as income rises, in which case "after-tax income would be more equally distributed than before-tax income" (Kakwani, 1977, p. 723). The tax is

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[7]A. C. Pigou, *Public Finance,* London, 1928.

proportional if this index is constant for all income levels, and regressive if the index decreases as income goes up.

As mentioned above, for Rosen the average tax rate is the "natural way" to define progressiveness or regressiveness.

Marginal Tax Rate (MTR)

The marginal tax rate index is $\partial T_i / \partial Y_i$. A tax is progressive when the marginal tax rate is greater than the average tax rate; proportional when the marginal rate is equal to the average rate; and regressive when the average tax rate exceeds the marginal tax rate. However, after Kakwani (1977), if the marginal tax rate does not increase as income increases but the average tax rate does, income will be still more equally distributed by imposition of the tax. Then, the increasing marginal tax rate is a stronger condition than the increasing average tax rate" (p.723).

Average Rate Progression (ARP)

ARP is equal to: $\dfrac{\dfrac{T_1}{Y_1} - \dfrac{T_0}{Y_0}}{Y_1 - Y_0} = \dfrac{\partial ATR}{\partial Y}$,

where:

T_1: tax liability for income Y_1,

T_0: tax liability for income $Y_{0, \text{ and}}$

$Y_1 > Y_0$.

ARP measures the degree of progression since it is defined as the rate of change in the average tax rate. If a tax is progressive, the ATR increases as income increases and

the ARP is positive. As a result, when the ARP is greater than zero the tax is progressive, when less than zero it is regressive, and when equal to zero it is proportional.

If the average tax rate changed by the same number of percentage points, the ARP would remain unchanged. That would be the case if the ATR increased from 15 to 17 percent for one income level, from 20 to 22 percent for the next income group and so on. In plotting the ATR against the income level, such a 2 percent increase would imply a parallel shift in the average rate curve (Musgrave and Thin pp. 500-501). However, if there was an increasing increment in the percentage points of the ATR (yield increase) throughout the different income classes, the degree of progression would increase. In the case of a yield decline, progression would increase with a decreasing decrement in percentage points when moving up the income scale.

A special property of the ARP is that it can be used for political purposes. Musgrave and Thin point out that if there is a yield increase, the "interest of the high-income group will be served best by adopting the concept of the average rate progression"; whereas the interest of the low-income group will be threatened. This occurs because the "larger the ratio of required yield to taxable income the greater will tend to be the share contributed by the lower incomes" (Musgrave and Thin p. 502). On the other hand, the ARP is more informative for comparisons of tax burdens.

Marginal Rate Progression (MRP)

The MRP is equal to,
$$\frac{\dfrac{T_2 - T_1}{Y_2 - Y_1} - \dfrac{T_1 - T_0}{Y_1 - Y_0}}{Y_2 - Y_1} = \frac{\partial MTR}{\partial Y}.$$

13

Musgrave and Thin(1948) argue that the marginal rate progression is an alternative to the average rate progression. MRP is defined as the rate of change in the marginal tax rate of a tax. In this case, Y_2 is defined to be slightly larger than Y_1. Given that the MRP is the derivative of the marginal tax rate with respect to income (Pigou, 1949, p. 49), if the marginal rate progression is zero then the tax structure is proportional; if the MRP is positive the structure is progressive, and if the MRP is negative the tax structure is regressive. Progression remains the same if the MTR increases by an equal number of percentage points across the income groups. (Musgrave and Thin, 1948, p. 504).

"The basic definition of progression as an increasing average rate is compatible with the definition of progression as an increasing marginal rate only under the condition that the marginal rate is continuously rising(at a decreasing rate) when moving up the income scale." (Musgrave and Thin, 1948, p. 503). On the other hand, "from the perspective of the equity theory of the tax structure, MRP is a more informative and more restrictive measure than ARP, since positive MRP always implies positive ARP" (Van Wart and Ruggeri, 1991, p. 135).

Similarly to the ARP, the MRP could be used to serve different social interests. For instance, after the ARP, the MRP is the measure that would be chosen by the rich. Conversely, poor peoples' interests will be best served by the MRP and then by the ARP. In other words, "what is the rich man's order of preferences for rate increase is the poor man's order of preference for rate reduction" (Musgrave and Thin, p. 512). The average-

marginal relationship serves as an explanation for this: when ATR is rising, the MTR is above the ATR but the MTR does not necessarily rise,it could be falling. Thus, what would be progressive under the ATR could be regressive after the MTR. That is why the MRP becomes a more informative and more restrictive measure than the ARP, as mentioned above.

Liability Progression (LP)

This coefficient is based on changes in the amount of tax liability. It is defined as the ratio of the percentage change in tax liability to the percentage change in income: that is, the elasticity of tax liability with respect to income before taxes.

$$\text{Thus, LP equals, } \frac{T_1 - T_0}{T_0} \cdot \frac{Y_0}{Y_1 - Y_0} = \frac{\dfrac{T_1 - T_0}{T_0}}{\dfrac{Y_1 - Y_0}{Y_0}} = \frac{\Delta\%T}{\Delta\%Y}.$$

After rearranging this expression, Atkinson and Stiglitz define the LP as the ratio of the marginal to average tax rate, or MTR/ATR.

The Liability Progression index will be equal to one when the tax is proportional, greater than one when the tax is progressive and less than the unity when it is regressive. This is because when LP is greater than one, the tax liability increases relatively more than income increases so that the MTR is greater than the ATR. Moreover, when LP is equal to one the percentage tax increase is equal to the percentage increase in the income level; thus the MTR and the ATR are equal so that the preferences of both the rich man and the poor man are equally satisfied and everybody in the economy is taxed at the same rate. In the case where LP is less than one the percentage increase in tax liability is

smaller than the percentage increase in income, so that higher income people are favored. Poor people, then, are paying relatively more.

LP will remain unchanged for all income classes when there is an equal *proportionate* change in average rates. "For an increase in yield the rate structure becomes more (less) progressive if the proportionate increase in the average rate rises (falls) with rising incomes. [T]he reverse relationship holds for a decline in rates." (Musgrave and Thin, pp. 505-506).

Wart and Ruggeri state that a positive LP is sufficient for positive MRP given how the LP coefficient is defined. On the other hand, they recognize that Jakobsson (1976) "directly relates LP to the distribution of the tax burden" (pp. 151-152).

One of the advantages of the LP index is that, like the ARP, it is more informative for comparisons of tax burdens.

Residual Income Progression (RIP)

This index measures the degree of progression as the ratio of the percentage change in income after tax to the percentage change in income before tax. It is the same as the elasticity of income after tax with respect to income before tax.

$$\text{RIP} = \frac{(Y_1 - T_1) - (Y_0 - T_0)}{Y_0 - T_0} \cdot \frac{Y_0}{Y_1 - Y_0} = \frac{\Delta\%(Y - T)}{\Delta\% Y}$$

After Atkinson and Stiglitz, it may also be defined as follows:

$$\text{RIP} = \frac{1 - MTR}{1 - ATR}$$

16

The smaller the RIP the more progressive the tax. When the RIP is one the tax is proportional, when it is less than one it is progressive and when it exceeds one it is regressive. More explicitly, if RIP is one, the change in income before tax is equal to the change in income after tax when moving up the income scale. For example, if there were only two income groups in the economy the following would happen:

Income before tax	Tax	Income after tax
100	10%	90
200	10%	180

There is a 100 percent increase in both the before-tax and after-tax incomes. In the case where RIP is less than one income after tax is inelastic with respect to income before tax. That is, as before-tax income increases along the income scale, income after tax increases by a smaller proportion. (1-MTR) is smaller than (1-ATR), i.e. MTR is greater than ATR. MTR is increasing more rapidly than ATR is increasing. The opposite happens when RIP is greater than one.

A strong point of this progressivity measure is that it is "the measure of tax progression most closely connected with the redistributive effect of the tax system, judged by the criterion of Lorenz domination" (Jakobsson, 1976, p. 161).

After Musgrave and Thin, all the above classical measures of "structural progression" are merely technical devices which have no economic significance as such. For them, the effective progression[8] measure is the one that tells most about the

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[8]This index measures the extent to which a given tax structure results in a shift in the distribution of income toward equality (Musgrave and Thin, p. 510).

equalizing effects of a tax. This, as they point out should be the "essence of any progression policy"(p. 514), given that it is the ratio of the coefficient of equality of the distribution of income after tax to the corresponding coefficient before tax.

Finally, even though the above measures have been very popular, the intention in this study is to measure progressivity by using a relatively new index, the Relative Share Adjustment (RSA) measure, which, as it will be shown, proves to be strongly advantageous.

Relative Share of Adjustment Measure

The Relative Share of Adjustment (RSA) measure was developed by Sandra Baum (1987) and can be classified as a distributional and a disaggregated index measure because it determines the impact of a tax on the income share of each income group. RSA is calculated as the ratio of the after tax income share of the ith group to its pre tax share:

$$(RSAi)_a = \frac{\dfrac{Yi - Ti}{Y - T}}{\dfrac{Yi}{Y}}$$

where:

Y : total income before tax

T : total tax liability

Y_i: income before tax for the ith income group

T_i: tax liability for the ith income group

RSA can also be expressed as the ratio of one minus the average tax rate of group i to one minus the average tax rate for the population as a whole:

$$(RSAi)_h = \frac{1-ti}{1-t}$$

where : $t_i = T_i / Y_{i \text{ and }} t = T / Y$.

As Wart and Ruggeri (1991) point out, RSA "corresponds uniquely" to the average rate progression (ARP) developed by Musgrave and Thin (1948), defined as the rate of change in effective tax rates as income rises; that is:

$$ARPi = \frac{\partial ti}{\partial Yi} = \frac{Yi \frac{\partial Ti}{\partial Yi} - Ti}{Yi^2}.$$

On the other hand, the rate of change of RSA with respect to income is:

$$\frac{\partial RSAi}{\partial Yi} = \frac{\partial i \left(\frac{Yi - Ti}{Yi}\right)\left(\frac{Y - T}{Y}\right)^{-1}}{\partial Yi} = -\frac{\frac{Yi \frac{\partial Ti}{\partial Yi} - Ti}{Yi^2}}{\frac{Y - T}{Y}},$$

which is equal to the ARP for group *i* divided by the ratio of aggregate after-tax to before-tax income.

If the after-tax income share of the *i*th income group is greater than the pre-tax share, that *i*th income group is said to be better off with the tax. In such a case the RSA will be grater than one. In contrast, when the RSA is less than one the ith group is worse off. Greater increases in the shares of lower-income groups relative to higher income

groups indicate a more progressive tax; thus, the RSA will be greater than one for low-income people and less than one for high-income people.

One of the advantages of the RSA is that it allows one to measure the redistribution that takes place as a result of the imposition of a tax. Thus, the set of RSAs indicate the overall progressivity related to the tax. Moreover, "it highlights changes in inequality without obscuring the differential impact of taxes on different income groups" (Baum, p.170). As a result, RSA "views income redistribution as a policy objective of the tax system" (Wart and Ruggeri, p.135).

Traditionally, the use of utility functions has been the way to measure inequality and progressivity. RSA results are very convenient because they do not require interpersonal utility comparisons, making that measure a relatively simple one. In addition, RSA shows how each income group fares relative to all the population. After Baum, "one of the advantages of RSA over other measures is that its computation shows the pretax distributional changes so that progressivity changes attributable to modifications in the pretax distribution may be identifiable" (1987,p.175). In addition, this measure is useful "both because of its simplicity and because of the amount of information it provides about the impact of a tax" (Baum, p. 166). However, as with any other progressivity measure, the RSA has some weak points. For instance, "[a]s a disaggregated index of progressivity, RSA does not involve any weighting scheme of redistribution and, therefore, does not provide a measure of social welfare change" (Wart and Ruggeri, 1991)[9]. Moreover, the RSA does not allow one to obtain the progressivity of

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[9]Pfhäler (1987) suggests the assignment of nonlinear monotonically increasing weights to local RSA to make it an aggregate measure using some welfare criteria.

a group of taxes by taking a weighted average of the progressivity of the individual taxes.[10] The RSA was used by D. Van Wart and G. C. Ruggeri (1991) to estimate the effects that the Canadian personal income tax reform had on the progressivity of the tax based on Baum's measure. Even though the RSA measure does have some problems, overall it has convenient characteristics that make it suitable and advantageous for this study. Before measuring the effects of the reform on the income tax for Costa Rica, however, the institutional framework is presented in the following section.

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[10]In contrast, for the Khetan-Poddar-Suits and the Kakwani indexes this property does hold (Kakwani, 1984).

CHAPTER III

INSTITUTIONAL FRAMEWORK

Background

One of the major problems of the Costa Rican economy has been the size of the fiscal deficit which in the last ten years has averaged 3 percent of the GDP. This deficit has been financed primarily in three ways: taxes, fiscal bonds, and open market transactions. Some authors believe that this deficit has been the result of a lack of adequate budgetary planning and excessive Government expenditure. They relate the problem to the deficits of state-owned enterprises, the excess of public workers that make it difficult to obtain the desired efficiency, and duplication in some functions of public agencies. For the last several years, Government expenditure has averaged 18.6 percent of GDP (See TABLE I). Out of the total Government revenue, income taxes account for more than 88 percent during 1978-1993 (See TABLE II). Tax administration has been inefficient, with tax avoidance a major problem. As a matter of fact, the income tax-to-GDP ratio decreases from 16.1 percent in 1983 to 13.6 percent in 1986 (See TABLE III).

Table I. Government Expenditure to GDP ratio, Costa Rica, 1978-1993

	1978	1979	1980	1981	1982	1983	1984	1985
GOVT. EXPEND.	5,039	6,504	8,210	9,755	14,609	26,044	31,978	35,945
GDP	30,194	34,584	41,406	57,103	97,505	129,314	163,011	197,920
Gov Exp.-to-GDP ratio	16.7%	18.8%	19.8%	17.1%	15.0%	20.1%	19.6%	18.2%

Figures in nominal Costa Rican Colones

Source: Ministry of Finance, Costa Rica

Table I. Government Expenditure to GDP ratio, Costa Rica, 1978-1993, continued

	1986	1987	1988	1989	1990	1991	1992	1993
GOVT. EXPEND.	46,275	50,356	63,035	82,430	99,143	123,388	158,336	197,910
GDP	246,579	284,484	349,743	425,911	522,925	689,848	878,284	1,070,587
Gov Exp.-to-GDP ratio	18.8%	17.7%	18.0%	19.4%	19.0%	17.9%	18.0%	18.5%

Figures in nominal Costa Rican Colones

Source: Ministry of Finance, Costa Rica

Table II. Percent structure of the Central Government Current Income,
Costa Rica, 1978-1993.

	1978	1979	1980	1981	1982	1983	1984	1985
CURRENT REVENUE	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Income Tax Revenue	96.5%	94.6%	95.3%	95.3%	97.5%	97.3%	91.3%	92.7%
Non income tax revenue	3.5%	5.4%	4.7%	4.7%	2.5%	2.7%	8.7%	7.3%

Source: Ministry of Finance, Costa Rica

Table II. Percent structure of the Central Government Current Income,
Costa Rica, 1978-1993, continued.

	1986	1987	1988	1989	1990	1991	1992	1993
CURRENT REVENUE	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Income Tax Revenue	88.5%	92.1%	93.0%	96.5%	98.9%	98.3%	97.4%	96.6%
Non income tax revenue	11.5%	7.9%	7.0%	3.5%	1.1%	1.7%	2.6%	3.4%

Source: Ministry of Finance, Costa Rica

Certainly, the more the Government expends the more sources of income the Government needs. To ease the pressure to find new revenues, the Costa Rican Government is looking for opportunities to cut its expenses. For instance, the Government is considering the possibility of selling some of the state-owned enterprises like the Production National Council and the National Liquor Plant to the private sector. Nevertheless, even if those enterprises were sold and the bureaucracy diminished, it will still be necessary to have an adequate tax policy so that both efficiency and equity principles are satisfied. Thus, focusing on both reducing the Government spending and avoiding, at least, the creation of new taxes by improving the tax collection of the existing ones has been a major concern in Costa Rica. The argument is that, with new taxes, short-run stabilization may take place on the basis of a reduction in the fiscal deficit, but this action would motivate neither investment nor production; thus, there would be a negative effect on the economic growth. (cf. Guardia, 1987, p.20).

In order to alleviate the fiscal deficit and, hence, its related consequences for the Costa Rican economy[11], the Central Government of Costa Rica made very important decisions concerning its tax policy in the period 1986-1989.

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[11]One of the biggest problems caused by the deficit spending is the crowding -out of investment given that the fiscal deficit is financed not only with taxes but also with bonds.

Table III. Income Tax and Tax Revenues-to-GDP Ratios, Costa Rica,1978-1993.

	1978	1979	1980	1981	1982	1983	1984	1985
Tax Revenues	3,801	4,010	4,671	6,932	12,282	20,835	24,659	29,666
Income Tax	897	937	998	1,484	2,908	4,712	4,737	5,023
GDP	30,194	34,584	41,406	57,103	97,505	129,314	163,011	197,920
Income Tax-to-GDP ratio	3.0%	2.7%	2.4%	2.6%	3.0%	3.6%	2.9%	2.5%
Tax Revenues to-GDP rati	12.6%	11.6%	11.3%	12.1%	12.6%	16.1%	15.1%	15.0%

Figures in nominal Costa Rican Colones

Source:Ministery of Finance and CEFSA.

Table III. Income Tax and Tax Revenues-to-GDP Ratios, Costa Rica,1978-1993.
continued

	1986	1987	1988	1989	1990	1991	1992	1993
Tax Revenues	33,639	41,138	50,426	61,444	73,233	99,052	136,694	173,740
Income Tax	5,695	6,290	8,035	9,507	11,821	14,545	19,016	24,338
GDP	246,579	284,484	349,743	425,911	522,925	689,848	878,284	1,070,587
Income Tax-to-GDP ratio	2.3%	2.2%	2.3%	2.2%	2.3%	2.1%	2.2%	2.3%
Tax Revenues to-GDP rati	13.6%	14.5%	14.4%	14.4%	14.0%	14.4%	15.6%	16.2%

Figures in nominal Costa Rican Colones

Source:Ministery of Finance and CEFSA.

Three modifications in tax law were proposed to the Congress:

(1) the update of a law project related to taxes on workers and on firms,

(2) a set of reforms intended to introduce some adjustments to existing taxes and to approve new ones, in order to attain greater tax equity, and

(3) a new code of norms and procedures, in order to modernize the existing tax administration (Naranjo, p. 140). In addition, the Government intended to enforce tax control programs and to prevent tax evasion.

Tax Composition

The income tax is a tax levied on taxable, or net, income. The consumption tax is a tax that consumers are obliged to pay when buying goods or services. The sales tax is the tax levied on those individuals or firms that sell goods or services. The income tax in Costa Rica is imposed on both workers and firms, and the personal income tax accounts for 85 percent of the total income tax revenue.

Among the tax sources in 1978, the income tax and consumption tax together represented approximately 50 percent of total tax income and the sales tax accounted for only 12.5 percent. By 1984, however, the sales tax had become more important than the income tax and even than the exports tax which had been the country's most significant tax in the early 1980s (See TABLE IV). This pattern has prevailed in recent years due to the

Table IV. Percent Structure of the Tax Revenues, Central Government,
Costa Rica 1978-1993

	1978	1979	1980	1981	1982	1983	1984	1985
TAX REVENUES	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Income tax	23.6%	23.4%	21.4%	21.4%	23.7%	22.6%	19.2%	16.9%
Consumption tax	24.1%	21.9%	27.7%	20.6%	15.1%	14.1%	18.1%	18.2%
Sales tax	12.5%	12.8%	13.3%	9.9%	12.3%	21.6%	23.4%	23.2%
Imports tax	17.2%	19.0%	17.5%	13.0%	8.0%	11.6%	17.0%	21.4%
Exports tax	18.7%	18.3%	15.7%	32.1%	38.4%	21.6%	15.6%	14.1%
Others	4.0%	4.7%	4.4%	3.0%	2.6%	8.4%	6.6%	6.2%

Source:Ministery of Finance and CEFSA.

Table IV. Percent Structure of the Tax Revenues, Central Government,
Costa Rica 1978-1993, continued.

	1986	1987	1988	1989	1990	1991	1992	1993
TAX REVENUES	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Income tax	16.9%	15.3%	15.9%	15.5%	16.1%	14.7%	13.9%	14.0%
Consumption tax	16.0%	16.1%	15.0%	15.5%	15.2%	11.2%	16.7%	18.1%
Sales tax	23.9%	25.9%	26.9%	27.4%	29.3%	36.1%	37.6%	35.7%
Imports tax	19.8%	23.0%	19.3%	20.5%	24.5%	24.6%	20.2%	22.7%
Exports tax	17.7%	12.0%	10.2%	5.7%	3.0%	5.5%	4.2%	2.9%
Others	5.7%	7.7%	12.7%	15.4%	11.8%	7.9%	7.4%	6.5%

Source:Ministery of Finance and CEFSA.

fact that tax reform required that the sales tax be levied on many activities that were exempted before. This situation conforms with trends studied by the Fiscal Affairs Department of the International Monetary Fund[12], which points out that "there has been a clear tendency toward lower rates of taxation on the individual" and that Latin American countries "have undertaken reforms that resulted in lower marginal tax rates for the high income brackets".

1988 Tax Reform

In April 21 of 1988 a tax reform on the income tax was officially adopted in Costa Rica. This reform was intended to reduce marginal tax rates, to extend the tax base, and to clearly distinguish between tax obligations for income from work and income from lucrative activities. In addition, the reform intended to reduce fiscal evasion by improving the collection mechanism[13]. On the other hand, one of the purposes was to create a more broad-based tax structure since the tax base had been narrowed because of preferential treatment[14]. The Government was also looking forward to having a tax liability redistribution, in order to comply with the equity principle. For instance, a tax on luxury houses with a value of 5 million colones or more was proposed with rates from 1.0 to 1.5 percent. There was also an increase in the tax on travel abroad.

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[12]IMF. "Trends and Future Directions in Tax Policy Reform: A Latin American Perspective". Fiscal Affairs Department, June 1992, p.4.

[13]Nevertheless, it is worthy to take into account what Tripathy says in this regard:" ...even the best administrative organization cannot satisfactorily collect income taxes from the self-employed when evasion is generally attempted and it incurs little or no moral disapproval from the public as is generally prevalent in the under-developed countries" (1968,p. 182).

[14]To motivate the process of production transformation and the non traditional exports, the Government had been relieving the exports sector from paying both the income tax and the tax on imported raw materials and capital goods if those goods were used to export (Naranjo and Zúñiga, p. 143).

With respect to individuals with lucrative activities, marginal tax rates declined from 50 percent to 25 percent for high income groups (taxable income of 1.000.000 colones[15] yearly), and the number of tax brackets decreased. As a result, the new tax structure seems less equitable because the highest tax rate for individuals with lucrative activities (25 percent) was less than the one imposed on firms (30 percent). In addition, individuals with lucrative activities were exempt up to 200.000 colones of net income a year. Moreover, the highest tax rate that one of these individuals would pay is 25 percent for an income over 1.000.000 colones, whereas a small business would pay only a 10 percent tax for an income up to 3.000.000 colones and a 20 percent tax for an income up to 6.000.000 colones. This difference would be somewhat compensated by giving some credits to those individuals with dependents.

The reform stated that the maximum tax for workers was a twelfth of their total annual income. Then, as mentioned above, the "new tax structure implied a sensitive tax reduction for those workers with higher income" (Naranjo and Zuñiga, p. 142). This situation prevented some tax evasion and had a positive impact on Government revenues[16]. In fact, in the postreform period the income tax-to-GDP ratio remained, at least, stable after having been declining since 1983 (See TABLE III). In the long run, this

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[15]The exchange rates were 145.7, 120.5 and 112 colones per dollar for years 1987, 1988 and 1989 respectively, according to IMF International Financial Statistics.

[16]Skinner and Slemrod (1985) argue that tax simplification and reduced marginal tax rates may be associated with a decline in tax evasion (p. 352).

result would have a positive impact on Costa Rica's economic development given that saving, investment and work effort would be promoted[17].

Taxfilers are all those who file taxes according to what it is required by law. The only exempt organisms are the Government, the municipalities, autonomous and semi-autonomous institutions that are exempt by a special law, religious institutions, cooperatives, non-lucrative associations, and the "asociaciones solidaristas".

Taxpayers are those individuals and corporations that make lucrative businesses in the Costa Rican national territory, independent of their nationality or residence, or, in the case of corporations, independent of their constitution, the place of their board of directors meetings or their contract holdings.

Taxpayers must file taxes within the two months following the termination of the corresponding fiscal period, i.e., the latest date possible is the last business day of November each year. This is true even when the gross income is totally or partially exempt from paying taxes. The tax liability can be paid until the last business day of December each year.

Gross income is the total income or total benefits received in the tax period, coming from any Costa Rican source. The tax period corresponds to one year, from the first day of October to the last day of September.

Net income is the income resulting from subtracting both the costs and expenses necessary to earn the benefit or profit, and all the other expenses allowed by the Income

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[17]In this respect, Tripathy affirms that a "highly progressive income tax with high marginal tax rates on upper income ranges ...tends to conflict with the criteria of economic efficiency and progress in a context where the growth of private savings and investment occupies an important place in the process of economic development"(p.188).

Tax Law, supported by the required documentation. Net income corresponds to taxable

income.

CHAPTER IV

DATA AND METHODOLOGY

Data for this study were taken from the official Income Tax Fiscal Statistics published by the Costa Rican Ministry of Finance. More specifically, the 1987 data correspond to chart n. 15 of this document under the following title: "Taxfilers, Taxpayers and Non-taxpayers Workers Income Tax Distribution, by gross income level, Fiscal Period 1987, at May 31 year 1988". These data include the number of taxfilers for each income group and their gross income level, the number of taxpayers and non-taxpayers, taxpayers' gross income per income class, the level of taxable income for taxpayers per income group, and the corresponding amount of family credits.

One important consideration with these data is that for both pre-reform and post-reform periods, the number of taxpayers is less than the number of taxfilers because the tax system is structured in such a way that some individuals are exempt due to family credits and high levels of expenditure. Therefore, it seems more accurate to work with

taxfilers' gross income instead of taxpayers' gross income if one is to account for the progressivity existing in the exemptions system. In fact, Blum and Kalven state that "[u]nder a single rate of tax the granting of an exemption to all taxpayers results in a progression of effective rates" and that "[s]uch progression comes about because the taxpayers have a progressively larger fraction of their incomes subject to tax once they are over the exemption level" (1953, p. 4).

On the other hand, since the causes[18] and the amount[19] of tax avoidance are not considered in this study, it will be assumed that the difference between the number of taxfilers and the number of taxpayers is mostly due to the exemptions system. The main assumption then is that everybody who, according to the law has to pay, in fact does pay[20]. However, as mentioned, the fact that tax evasion in Costa Rica has been a problem, should arouse some thoughts about its effects on the progressivity of the tax. For instance Skinner and Slemrod (1985) state that tax evasion may affect vertical equity "since some sources of income available to higher (or lower) income groups may be more difficult to detect and hence result in widespread tax evasion and greater (or less) tax progressivity." (p. 347)

Since, in 1987, data on personal income (Yi) and tax liability (Ti) are available- i.e. were published by the Ministry of Finance- the effective average tax rate is calculated by income class for the pre-reform period as Ti/Yi. However, for the pre-reform period

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[18]Some of the reasons for a compliance gap are the following: high marginal income tax rates (Clotfelter, 1983, p.363) and inflation that "is pushing people into higher and higher tax brackets and increasing the pressure to cheat." (Thomas Vitez, 1984).

[19]In fact, there exist some ways of measuring tax avoidance. For example, the estimate of noncompliance in the United States of more than $100 billion reported by the Internal Revenue Service (IRS) in 1983.

[20]For studies on tax evasion see Spicer (1987), Graetz and Wilde (1985) and Stiglitz (1985).

(fiscal year 1987) the official tax schedule has a different income aggregation than found in the Ministry of Finance document.

Table V, Official Tax Schedule for Workers. Costa Rica, 1987

Over (colones)	Up to (colones)	Tax Rate
0	138,000	5%
138,000	170,000	10%
170,000	220,000	14%
220,000	292,000	17%
292,000	385,000	19%
385,000	475,000	21%
475,000	578,000	26%
578,000	699,000	29%
699,000	1,100,000	34%
1,100,000	1,650,000	39%
1,650,000	2,200,000	46%
2,200,000	3,300,000	49%
3,300,000	+	50%

Source: Dirección General de la Tributación Directa
Estadísticas Fiscales del Impuesto sobre la Renta
Periodo Fiscal 1987, San José, Costa Rica, 1989. p.100

Since these income ranges do not coincide with those presented by the Ministry of Finance in its Fiscal Statistics for that year[21], a tax schedule was calculated for the latter levels of income by adjusting each level according to the ranges in Table V. For instance, the adjustment for the 100,000 to 150,000 range is the following: $0.76(5\%)+0.24(10\%)=0.062$, i.e. a 6.2% tax rate[22]. The resulting marginal tax schedule and its corresponding yield are the following:

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[21]See Estadística Fiscal del Impuesto sobre la Renta. Período 1987. Direccion General de la Tributación Directa. San José, Costa Rica. Enero 1989, p. 52.

[22]0.76 comes from dividing 38/50 and 0.24 comes from dividing 12/50.

Table VI, Adjusted Tax Schedule for Workers, Costa Rica, 1987

Over (colones)	Up to (colones)	Marginal Tax Rate	Yield (colones)
0	50,000	5.00%	2,500
50,000	100,000	5.00%	2,500
100,000	150,000	6.20%	3,100
150,000	200,000	12.40%	6,200
200,000	250,000	15.80%	7,900
250,000	300,000	17.30%	8,660
300,000	350,000	19.00%	9,500
350,000	400,000	19.60%	9,800
400,000	450,000	21.00%	10,500
450,000	500,000	23.50%	11,750
500,000	600,000	26.60%	26,600
600,000	700,000	29.10%	29,050
700,000	800,000	34.00%	34,000
800,000	900,000	34.00%	34,000
900,000	1,000,000	34.00%	34,000
1,000,000	2,000,000	41.00%	409,500
2,000,000	3,000,000	48.40%	484,000
3,000,000	+	49.70%	

Source: Dirección General de la Tributación Directa
Estadísticas Fiscales del Impuesto sobre la Renta
Período Fiscal 1987, San José, Costa Rica, 1989

Once the MTR and the effective ATR are calculated, the next step is to get the rest

of the measures, i.e., MRP, LP, RIP, and RSA. Hereafter, this procedure will be called

Procedure I (See Table VII).

The MRP is defined as the rate of change of the MTR. However, following the

argument stated by Wart and Ruggeri, since the MTR is discontinuous, the MRP is going

to be measured at the *colón* threshold for the rate of change within each class. Thus, MRP

for each income level will correspond to the percentage point change in MTR from the

adjacent lower income class. Moreover, LP and RIP calculations are based on the

Atkinson and Stiglitz definition in which, LP = MTR/ATR, and RIP = (1-MTR)/(1-ATR)

(See Table VII).

Table VII. Progressivity Measures

Pre-reform (Procedure I)							
Income Group (colones)	Average Tax rate	Marginal Tax rate	MRP	LP	RIP	RSA	RSA II
0.1-50,000	0.0000	0.0500	-	-	0.9500	1.0283	1.0283
50,000.1-100,000	0.0000	0.0500	0.0000	-	0.9500	1.0283	1.0283
100,000.1-150,000	0.0000	0.0620	0.0120	-	0.9380	1.0283	1.0283
150,000.1-200,000	0.0000	0.1240	0.0620	-	0.8760	1.0283	1.0283
200,000.1-250,000	0.0000	0.1580	0.0340	-	0.8420	1.0283	1.0283
250,000.1-300,000	0.0002	0.1732	0.0152	770.1943	0.8270	1.0281	1.0281
300,000.1-350,000	0.0009	0.1900	0.0168	201.6338	0.8108	1.0273	1.0273
350,000.1-400,000	0.0024	0.1960	0.0060	81.9783	0.8059	1.0258	1.0258
400,000.1-450,000	0.0052	0.2100	0.0140	40.0014	0.7942	1.0229	1.0229
450,000.1-500,000	0.0103	0.2350	0.0250	22.8731	0.7729	1.0177	1.0177
500,000.1-600,000	0.0193	0.2660	0.0310	13.8176	0.7484	1.0085	1.0085
600,000.1-700,000	0.0338	0.2905	0.0245	8.5982	0.7343	0.9936	0.9936
700,000.1-800,000	0.0477	0.3400	0.0495	7.1212	0.6931	0.9792	0.9792
800,000.1-900,000	0.0582	0.3400	0.0000	5.8405	0.7008	0.9684	0.9684
900,000.1-1000,000	0.0659	0.3400	0.0000	5.1588	0.7066	0.9605	0.9605
1,000,000.1-2,000,000	0.0960	0.4095	0.0695	4.2661	0.6532	0.9296	0.9296
2,000,000.1-3,000,000	0.1124	0.4840	0.0745	4.3071	0.5813	0.9127	0.9127
3,000,000.1 +	0.0657	0.4970	0.0130	7.5603	0.5384	0.9607	0.9607

Finally, RSA I is obtained by using both the average tax rate per income range and the overall average tax rate, i.e., ti = Ti/Yi, and t = T/Y. In other words, RSA will be equal to (1-ti)/(1-t); where t = T_{87}/Y_{87} or 6,290,000,000 divided by 284,484,000,000, and ti is the average tax rate per income class, where:

T_{87}: total tax liability for year 1987.

Y_{87}: total tax filers income for year 1987.

RSA II results from applying the (RSAi)$_a$ definition referred to before. As expected, RSA I and RSA II have the same numerical values.

For the post-reform period it turns out that there exist some limitations on obtaining the progressivity measures based on an *effective* ATR. These limitations are:

1. There were two different laws in effect in fiscal year 1988. That is, the 1988 Tax Reform Act (Law 7092), started to be in force in June 1, 1988, when there were still four months left in that fiscal year. In other words, the pre-reform tax schedule (Law 837), was effective from Oct. 1, 1987 through May 31, 1988. The problem posed by this timing is that the data are not available in a disaggregated way, so as to be able to analyze the two situations (pre-reform and post-reform) separately.

2. There were no tax filing after the 1988 Tax Reform became effective because tax reform required the collection of the income tax from the employee directly. This regulation was initiated, as mentioned, to improve the collection mechanism. As a result of this, there were no data available following the year 1988, so that is not possible to obtain the ATR's that indeed were paid by workers, as it was done for the 1987 fiscal period.

Given the above, 1988 data are not convenient to use. On the other hand, since there are no data for 1989, it was necessary to use a procedure (hereafter called Procedure II) to obtain the post-reform ATR's. This procedure applies the 1989 marginal tax schedule to the 1987 data, the idea being to determine tax reform effects on the same pre-reform income earners.

The post reform tax schedule[23] is the following:

Table VIII, Official Tax Schedule for Workers, Costa Rica, 1989

Over (colones)	Up to (colones)	Tax Rate
0	540,000	0%
540,000	816,000	10%
816,000	+	15%

Source: Dirección General de la Tributación Directa
Estadísticas Fiscales del Impuesto sobre la Renta
Periodo Fiscal 1989, San José, Costa Rica, 1989. p.95

This schedule is adjusted for the same income levels that were used for the 1987 fiscal period, in the same way as done for the pre-reform case. For example, the second income above (540,000 to 816,000 range), is adjusted as follows:

Table IX, Ajustment of the New Tax Structure to the 1987 Income Brackets

Over (colones)	Up to (colones)	Tax Rate
500,000	600,000	0.4(0%)+0.6(10%)=6%
600,000	700,000	10%
700,000	800,000	10%
800,000	900,000	.16(10%)+0.84(15%)=14.2

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[23]See Estadística Fiscal del Impuesto sobre la Renta. Periodo 1989. Direccion General de la Tributación Directa. San José, Costa Rica.

If this procedure was done for all income levels the adjusted post-reform marginal tax schedule would be:

Table X, Tax Liability per Income Level, Costa Rica , 1989

Over (colones)	Up to (colones)	Excess Tax (colones)	Tax up to the Lower Bound	Tax Liability
0	500,000	Exempt	0	0
500,000	600,000	6.0%	0	2,766
600,000	700,000	10.0%	6,000	10,500
700,000	800,000	10.0%	16,000	20,636
800,000	900,000	14.2%	26,000	32,587
900,000	1,000,000	15.0%	40,200	47,303
1,000,000	2,000,000	15.0%	55,200	95,083
2,000,000	3,000,000	15.0%	205,200	263,355
3,000,000	+	15.0%	355,200	964,130

The goal, then, is to obtain the expected tax liability per income level by applying the above tax schedule in Table X to a representative income bracket. An average income, then, was calculated per income range. That is, 1987 tax filers' total income was divided by the 1987 number of taxfilers for each income class. This taxfiler per capita income gives an idea of the average personal income per income group for the 1987 fiscal year (See Table XI). Furthermore, the excess by which that average income exceeds each income level's lower bound is going to be the taxable portion of the individual's income for that income level. For example, in the 450,000 to 500,000 income range, per capita income is 474,185, so the excess over the lower bound of that income level is 24,185. This amount times the corresponding MTR will result in the tax liability value - hereafter called "the excess tax" -for that specific income level. This excess tax will be zero given that incomes up to 500,000 were exempt in 1989. In the case of the 1,000,000 to 2,000,000 income range, per capita income equals 1,265,884 so that the excess on the lower bound is 265,884 which would be taxed in the margin at a 15%, giving the excess

tax of 39,883 colones. See Table XI. To obtain the level of tax liability the tax up to the

lower bound is added to the excess tax value in Table XI.

Table XI. Tax Liability and ATR Calculation (Procedure II), Costa Rica, Post-reform Period.

Over (colones)	Up to (colones)	Income (Yi)	Income per capita (Yi pc)	Excess on lower bound	MTR	Tax up to lower bound	Excess tax	Tax liab. per cap.	ATR
0	50,000	2,089,260	3,270	3,270	0.0%	0	0	0	0.0%
50,000	100,000	8,723,310	78,588	28,588	0.0%	0	0	0	0.0%
100,000	150,000	26,033,069	129,518	29,518	0.0%	0	0	0	0.0%
150,000	200,000	73,404,558	179,036	29,036	0.0%	0	0	0	0.0%
200,000	250,000	294,242,023	231,141	31,141	0.0%	0	0	0	0.0%
250,000	300,000	939,619,309	279,649	29,649	0.0%	0	0	0	0.0%
300,000	350,000	3,102,847,653	323,956	23,956	0.0%	0	0	0	0.0%
350,000	400,000	2,530,087,294	373,224	23,224	0.0%	0	0	0	0.0%
400,000	450,000	2,005,965,475	423,557	23,557	0.0%	0	0	0	0.0%
450,000	500,000	1,664,862,143	474,185	24,185	0.0%	0	0	0	0.0%
500,000	600,000	2,521,854,590	546,092	46,092	6.0%	6,000	2,766	2,766	0.5%
600,000	700,000	1,658,941,186	645,000	45,000	10.0%	16,000	4,500	10,500	1.6%
700,000	800,000	1,266,569,350	746,358	46,358	10.0%	26,000	4,636	20,636	2.8%
800,000	900,000	965,729,431	846,389	46,389	14.2%	40,200	6,587	32,587	3.9%
900,000	1,000,000	718,093,988	947,354	47,354	15.0%	55,200	7,103	47,303	5.0%
1,000,000	2,000,000	1,963,386,331	1,265,884	265,884	15.0%	205,200	39,883	95,083	7.5%
2,000,000	3,000,000	322,339,076	2,387,697	387,697	15.0%	355,200	58,155	263,355	11.0%
3,000,000	+	578,881,499	7,059,530	4,059,530	15.0%		608,930	964,130	13.7%

Figures in Costa Rican colones

Once the tax liability per income group is obtained it is possible to calculate ATR by dividing that liability by tax filers' per capita income (Yi pc) for each income level. As was done for the pre-reform schedule, the remaining progressivity measures (MRP, LP, RIP, RSA), are calculated for the post-reform period (See Table XII). Ti/Yi for the RSA calculation corresponds to the 1989 tax liability divided by 1987 income per income bracket, whereas T/Y is the 1989 total tax liability divided by 1987 total income.

Given that a special procedure was followed to obtain post-reform progressivity indexes, and in order to have comparative results for both periods under study (pre-reform and post-reform), the methodology used for the 1989 tax schedule was used for the 1987 schedule as well. Results for 1987 under Procedure II are presented next.

Tax liability is calculated by multiplying 1987 tax rates -from Table VI- by the amount by which the per capita income exceeds the lower bound of the corresponding income range (See Table XIII). For a better understanding of this calculation process, the 800,000 to 900,000 case will be explained. This income class has an excess of 46,389 over the lower bound. If this excess is multiplied by its corresponding marginal tax rate it would yield 15,772. Now, it is necessary to account for the tax yield of the previous 800,000 colones that conform to the total income of 846,389. Taxation of the previous 800,000 yields a tax liability of 162,000, which if added to 15,772 results in a 177,832 tax liability for people pertaining to the 800,000 to 900,000 income group. Following this procedure the tax yield is calculated for each income level; this yield is in turn used to calculate the ATR.

Table XII. Progressivity Measures

Post-reform (Procedure II)							
Income Group (colones)	Average Tax rate	Marginal Tax rate	MRP	LP	RIP	RSA	RSA II
0.1-50,000	0.0000	0.0000	-	-	1.0000	1.0204	1.0203
50,000.1-100,000	0.0000	0.0000	0.0000	-	1.0000	1.0204	1.0203
100,000.1-150,000	0.0000	0.0000	0.0000	-	1.0000	1.0204	1.0203
150,000.1-200,000	0.0000	0.0000	0.0000	-	1.0000	1.0204	1.0203
200,000.1-250,000	0.0000	0.0000	0.0000	-	1.0000	1.0204	1.0203
250,000.1-300,000	0.0000	0.0000	0.0000	-	1.0000	1.0204	1.0203
300,000.1-350,000	0.0000	0.0000	0.0000	-	1.0000	1.0204	1.0203
350,000.1-400,000	0.0000	0.0000	0.0000	-	1.0000	1.0204	1.0203
400,000.1-450,000	0.0000	0.0000	0.0000	-	1.0000	1.0204	1.0203
450,000.1-500,000	0.0000	0.0000	0.0000	-	1.0000	1.0204	1.0203
500,000.1-600,000	0.0051	0.0600	0.0600	11.8478	0.9448	1.0152	1.0151
600,000.1-700,000	0.0163	0.1000	0.0400	6.1428	0.9149	1.0038	1.0037
700,000.1-800,000	0.0276	0.1000	0.0000	3.6168	0.9256	0.9922	0.9921
800,000.1-900,000	0.0385	0.1420	0.0420	3.6882	0.8924	0.9811	0.9810
900,000.1-1000,000	0.0499	0.1500	0.0080	3.0041	0.8947	0.9695	0.9693
1,000,000.1-2,000,000	0.0751	0.1500	0.0000	1.9970	0.9190	0.9438	0.9436
2,000,000.1-3,000,000	0.1103	0.1500	0.0000	1.3600	0.9554	0.9079	0.9077
3,000,000.1 +	0.1366	0.1500	0.0000	1.0983	0.9844	0.8810	0.8809

Table XIII. Tax Liability and ATR Calculation (Procedure II), Costa Rica, Pre-reform Period.

Over (colones)	Up to (colones)	Income(Yi)	Income per capita (Yi pc)	Excess on lower bound	MTR	Tax up to lower bound	Excess tax	Tax liab. per cap.	ATR
0	50,000	2089260	3,270	3,270	5.0%	2,500	163	163	5.0%
50,000	100,000	8723310	78,588	28,588	5.0%	5,000	1,429	3,929	5.0%
100,000	150,000	26033069	129,518	29,518	6.2%	8,100	1,830	6,830	5.3%
150,000	200,000	73404558	179,036	29,036	12.4%	14,300	3,600	11,700	6.5%
200,000	250,000	294242023	231,141	31,141	15.8%	22,200	4,920	19,220	8.3%
250,000	300,000	939619309	279,649	29,649	17.3%	30,860	5,135	27,335	9.8%
300,000	350,000	3102847653	323,956	23,956	19.0%	40,360	4,552	35,412	10.9%
350,000	400,000	2530087294	373,224	23,224	19.6%	50,160	4,552	44,912	12.0%
400,000	450,000	2005965475	423,557	23,557	21.0%	60,660	4,947	55,107	13.0%
450,000	500,000	1664862143	474,185	24,185	23.5%	72,410	5,683	66,343	14.0%
500,000	600,000	2521854590	546,092	46,092	26.6%	99,010	12,261	84,671	15.5%
600,000	700,000	1658941186	645,000	45,000	29.1%	128,060	13,073	112,083	17.4%
700,000	800,000	1266569350	746,358	46,358	34.0%	162,060	15,762	143,822	19.3%
800,000	900,000	965729431	846,389	46,389	34.0%	196,060	15,772	177,832	21.0%
900,000	1,000,000	718093988	947,354	47,354	34.0%	230,060	16,100	212,160	22.4%
1,000,000	2,000,000	1963386331	1,265,884	265,884	41.0%	639,560	108,880	338,940	26.8%
2,000,000	3,000,000	322339076	2,387,697	387,697	48.4%	1,123,560	187,645	827,205	34.6%
3,000,000	+	578881499	7,059,530	4,059,530	49.7%		2,017,587	3,141,147	44.5%

Figures in Costa Rican colones

45

The numerical values for the remaining different measures were computed for the income ranges corresponding to the different income groups for 1987 under Procedure II (See Table XIV). Ti/Yi for RSA calculation is equal to pre-reform tax liability divided by pre-reform income. T/Y is pre-reform total tax liability under Procedure II divided by total pre-reform income. The results will be shown in the next chapter.

Table XIV. Progressivity Measures

Pre-reform (Procedure II)							
Income Group (colones)	Average Tax rate	Marginal Tax rate	MRP	LP	RIP	RSA I	RSA II
0.1-50,000	0.0500	0.0500	-	-	1.0000	1.1446	1.1401
50,000.1-100,000	0.0500	0.0500	0.0000	-	1.0000	1.1446	1.1401
100,000.1-150,000	0.0527	0.0620	0.0120	-	0.9902	1.1413	1.1368
150,000.1-200,000	0.0654	0.1240	0.0620	-	0.9373	1.1261	1.1217
200,000.1-250,000	0.0832	0.1580	0.0340	-	0.9184	1.1046	1.1003
250,000.1-300,000	0.0977	0.1732	0.0152	1.7719	0.9164	1.0871	1.0828
300,000.1-350,000	0.1093	0.1900	0.0168	1.7382	0.9094	1.0731	1.0690
350,000.1-400,000	0.1203	0.1960	0.0060	1.6288	0.9140	1.0598	1.0557
400,000.1-450,000	0.1301	0.2100	0.0140	1.6141	0.9082	1.0481	1.0440
450,000.1-500,000	0.1399	0.2350	0.0250	1.6796	0.8894	1.0363	1.0322
500,000.1-600,000	0.1550	0.2660	0.0310	1.7156	0.8687	1.0180	1.0141
600,000.1-700,000	0.1738	0.2905	0.0245	1.6717	0.8587	0.9955	0.9916
700,000.1-800,000	0.1927	0.3400	0.0495	1.7644	0.8175	0.9727	0.9689
800,000.1-900,000	0.2101	0.3400	0.0000	1.6182	0.8356	0.9517	0.9480
900,000.1-1000,000	0.2240	0.3400	0.0000	1.5182	0.8505	0.9350	0.9314
1,000,000.1-2,000,000	0.2677	0.4095	0.0695	1.5294	0.8064	0.8822	0.8788
2,000,000.1-3,000,000	0.3464	0.4840	0.0745	1.3970	0.7895	0.7874	0.7844
3,000,000.1 +	0.4450	0.4970	0.0130	1.1170	0.9062	0.6687	0.6661

CHAPTER V

EMPIRICAL RESULTS

Pre-reform Period (Procedure I)

In the pre-reform period, the average tax rate increases as income rises in the 250,000 to 3,000,000 colones range. That is, the tax as a percentage of income is higher for each level when moving up in the income scale. The lowest income groups have a zero average tax rate whereas the average tax rate decreases for the highest income level. In other words, the tax is proportional for the lowest income groups and regressive for the highest, being progressive for most of the income scale. On the other hand, the marginal tax rate increases all along the income scale, from 0.05 for the lowest income group to a 0.497 for the highest income level, which implies that after the MTR the tax schedule is progressive as income rises.

In conclusion, the income tax appears to be progressive for most people after both measures (ATR and MTR) even though ATR does not coincide with the MTR for the lowest income levels and the highest income groups.

MRP is zero for the lowest income group and the 800,000 to 1,000,000 income range, and positive for the remaining income groups. Consequently, the MRP shows a proportional income tax for the lowest income group and the two middle-income classes. However, it does not show any regressivity. Overall, the MRP seems to report a situation in which progressivity reigns.

The pre-reform period shows an LP that is always greater than one, i.e., the percentage change in tax liability is always greater than the percentage change in income, so that $(T_1-T_0)/T_0 > (Y_1-Y_0)/Y_0$. Consequently, the MTR is always greater than the ATR, which is the case of a progressive tax structure. This result supports what was concluded, in theory, about the ATR, MTR, and MRP measures. Moreover, the RIP measure is less than one throughout the income scale, i.e., the percentage change in income after tax is less than the percentage change in income before tax. Thus, the tax is progressive for all income levels by the RIP measure. Furthermore, given that the RIP gets smaller while moving up the income scale, the tax gets more and more progressive as income increases.

RSA is greater than one for the 0 to 600,000 range. For those income levels the after-tax income share is greater than the pre-tax share. On the other hand, RSA is less than one for the 600,000.1 to 3,000,000 income groups, i.e., for those individuals their after tax income share is less than their pre-tax share. Lower-income groups are better off and higher-income groups are worse off, given that there has been a greater increase in the share of the poorer people relative to the richer people. Therefore, RSA shows some income redistribution resulting from the tax schedule change that took place with the 1988 Tax Reform.

Pre-reform Period (Procedure II).

ATR and MTR always increase throughout the different income levels. Although ATR and MTR are equal for the two lowest income groups, MTR is always greater than the ATR for the remaining levels. Even when the average tax rate keeps rising for all the income levels the MTR is constant for the two lowest income groups and three of the upper income levels. Nonetheless the tax system may still be progressive (Wart and Ruggeri, p.135). Furthermore, the MRP measure is equal to zero for both the lowest income groups and the 800,000.1 to 1,000,000 income range, and positive for the remaining income levels. It is possible to conclude from the MRP that the lowest income group (0-50,000 income range) has a proportional income tax. The same seems to be the case for the two middle income groups (800,000 to 900,000 and 900,000.1 to 1,000,000), for which the MRP is zero. However, most of the income levels still portray a progressive situation. LP is always greater than one. By this measure, therefore, the pre-reform regime is progressive, implying that the percentage change in tax liability is greater than the change in income, or that the MTR is greater than the ATR for all income groups. On the other hand, RIP is less than one for 15 out of the 17 groups, and equal to one for the two lowest income groups. Consequently, after the RIP measure the tax is proportional for the 0 to 100,000 income class and progressive for the rest of the income categories. In other words, the percentage change in income with the tax is less than the percentage change in income without the tax. Finally, by both MRP and RIP measures, the income tax for the 1987 fiscal year was proportional for the lowest income class, under Procedure II.

The RSA measure is greater than one for the lower-income groups (0 to 600,000 income range). That situation indicates that high income groups' relative economic position worsened as a result of the tax and, that of low and high income groups improved, which makes it evident that some income redistribution takes place with regard to the 1987 taxation schedule.

Pre-reform results for the different progressivity measures under procedures I and II are very similar. For both procedures, the personal income tax turns out to be progressive overall, even though the ATR with procedure II is greater for all income levels than the ATR with procedure I.

Moreover, by the RSA measure, income redistribution from the higher-income groups to the lower-income groups seems to be the case under both Procedures I and II. Specifically, RSA is greater than one for the same income levels under both methodologies. The same is true with those RSA's less than one.

Finally, given that procedure II produces the same results as procedure I (which uses effective ATR), it can be concluded that the procedure used to derive the ATR for both 1987 and 1989 fiscal years (procedure II) is not misleading. This is consistent with what would have been the results had actual data been used to obtain the different measures.

Post-reform Period (Procedure II).

The average tax rate increases as income rises, which is an argument in favor of the progressivity of the income tax. Compared to the pre-reform period, tax reform results in reduced ATR all along the income scale, with rates decreasing from 5 to 30 percentage

points. See Table XV. MRP reports a proportional tax for most income brackets, i.e., 14 out of the 17 income brackets are zero. This is because people were exempted until the 500,000 income level and because the MTR was the same for both the 600,000 to 800,000 and the 900,000 to 3,000,000 income ranges.

On the other hand, by the LP measure, tax reform turns out to be progressive given that the elasticity of tax liability with respect to income before tax is always greater than one. In other words, percentage increases in income are overwhelmed by the percentage increases in the tax liability for each income group. The RIP measure supports the results obtained with MRP and the ATR, i.e., that the income tax in the post-reform is proportional for the lower income groups (0 to 500,000 income brackets). Furthermore, the RIP turned out to be less than one for the higher income levels, i.e., the percentage change in income before tax is greater than the percentage change in income after tax. Thus, the elasticity of income after tax with respect to income before tax reveals progressivity for those brackets. Moreover, the RIP across the income scale are greater in the post-reform period than they were in the pre-reform period. This situation shows a less progressive tax after reform.

Table XV. Comparison of the Progressivity Measures. Pre and Post Reform Tax Structure
Applied to 1987 Income. Costa Rica 1987,1989

Income Group (colones)	PRE Average Tax rate	POST Average Tax rate	PRE Marginal Tax rate	POST Marginal Tax rate	PRE MRP	POST MRP
0.1-50,000	0.05	0	0.05	0	-	-
50,000.1-100,000	0.05	0	0.05	0	0	0
100,000.1-150,000	0.05273486	0	0.062	0	0.012	0
150,000.1-200,000	0.06535242	0	0.124	0	0.062	0
200,000.1-250,000	0.08315379	0	0.158	0	0.034	0
250,000.1-300,000	0.09774817	0	0.1732	0	0.0152	0
300,000.1-350,000	0.10930995	0	0.19	0	0.0168	0
350,000.1-400,000	0.12033504	0	0.196	0	0.006	0
400,000.1-450,000	0.13010519	0	0.21	0	0.014	0
450,000.1-500,000	0.13991045	0	0.235	0	0.025	0
500,000.1-600,000	0.15504808	0.00506424	0.266	0.06	0.031	0.06
600,000.1-700,000	0.1737714	0.01627913	0.2905	0.1	0.0245	0.04
700,000.1-800,000	0.19269801	0.02764865	0.34	0.1	0.0495	0
800,000.1-900,000	0.21010695	0.03850145	0.34	0.142	0	0.042
900,000.1-1000,000	0.2239504	0.04993176	0.34	0.15	0	0.008
1,000,000.1-2,000,000	0.26774927	0.07511163	0.4095	0.15	0.0695	0
2,000,000.1-3,000,000	0.34644485	0.11029647	0.484	0.15	0.0745	0
3,000,000.1 +	0.44495121	0.13657134	0.497	0.15	0.013	0

Table XV. Comparison of the Progressivity Measures. Pre and Post Reform Tax Structure
Applied to 1987 Income. Costa Rica 1987,1989. Continued

| Income Group (colones)	PRE LP	POST LP	PRE RIP	POST RIP	PRE RSA	POST RSA
0.1-50,000	-	-	1	1	1.14457831	1.02040816
50,000.1-100,000	-	-	1	1	1.14457831	1.02040816
100,000.1-150,000	-	-	0.99021906	1	1.1412833	1.02040816
150,000.1-200,000	-	-	0.93725166	1	1.12608143	1.02040816
200,000.1-250,000	-	-	0.91836558	1	1.10463399	1.02040816
250,000.1-300,000	1.77190025	-	0.91637386	1	1.0870504	1.02040816
300,000.1-350,000	1.73817656	-	0.90940727	1	1.07312054	1.02040816
350,000.1-400,000	1.6287858	-	0.91398434	1	1.0598373	1.02040816
400,000.1-450,000	1.61407864	-	0.90815578	1	1.04806604	1.02040816
450,000.1-500,000	1.67964579	-	0.88944227	1	1.03625247	1.02040816
500,000.1-600,000	1.71559691	11.8477811	0.86868848	0.94478462	1.01801437	1.01524057
600,000.1-700,000	1.67173653	6.14283456	0.85872118	0.91489367	0.99545614	1.00379681
700,000.1-800,000	1.7644188	3.61681288	0.81753794	0.92559135	0.97265299	0.99219525
800,000.1-900,000	1.61822347	3.6881732	0.83555616	0.89235704	0.95167837	0.98112097
900,000.1-1000,000	1.51819331	3.00409987	0.8504611	0.89467258	0.93499952	0.96945739
1,000,000.1-2,000,000	1.52941592	1.9970276	0.80641777	0.91902983	0.88222979	0.94376364
2,000,000.1-3,000,000	1.39704776	1.35997103	0.78952786	0.95537442	0.78741584	0.90786075
3,000,000.1 +	1.11697639	1.09832703	0.90622664	0.98444729	0.66873348	0.88104965

Tax reform reduced the marginal tax rates for all income groups, with a large reduction for the higher income classes. Consequently, with this measure it seems that the post-reform tax structure tends to reduce overall progressivity. Furthermore, the post-reform MRP is greater than the pre-reform MRP only for people whose income is in the 450.000 to 600.000 and 700.000 to 900.000 income brackets . In other words, for twelve income groups the pre-reform MRP exceeds the 1989 MRP. Accordingly, the post-reform tax structure is less progressive (smaller degree of progression) than the pre-reform structure for most income classes.

The pattern of RSA shows how progressivity declined for the lower income classes and increased for the upper income levels, based on the fact that the RSA decreased for the 0 to 600.000 income range and increased above 600.000 income. Therefore, tax reform reduced the relative income share of individuals below 600.000 and increased the relative income share of those with higher income, i.e. over 600.000 colones a year. For the former group, the lowest income earners (from 0 to 250.000 colones) had a larger decrease (12 to 8 percentage points) in their RSA than those with higher income (6 to 0.2 percentage points reduction) (See Figure 2). Moreover, the RSA declines faster in the pre-reform than it does in the post-reform period. This situation is an argument in favor of less overall progressivity after reform. Thus, from the standpoint of income redistribution, tax reform impaired the lower income groups' economic position and improved that of higher income classes.

Clearly, the results indicate a 1988 tax reform strategy of reducing the income tax for higher income earners to prevent tax evasion and to have a positive effect on

Government revenues. Finally, a tradeoff between efficiency and equity appears to be the

case.

Figure 2. Pre and Post Reform RSA, Costa Rica, 1987,1989
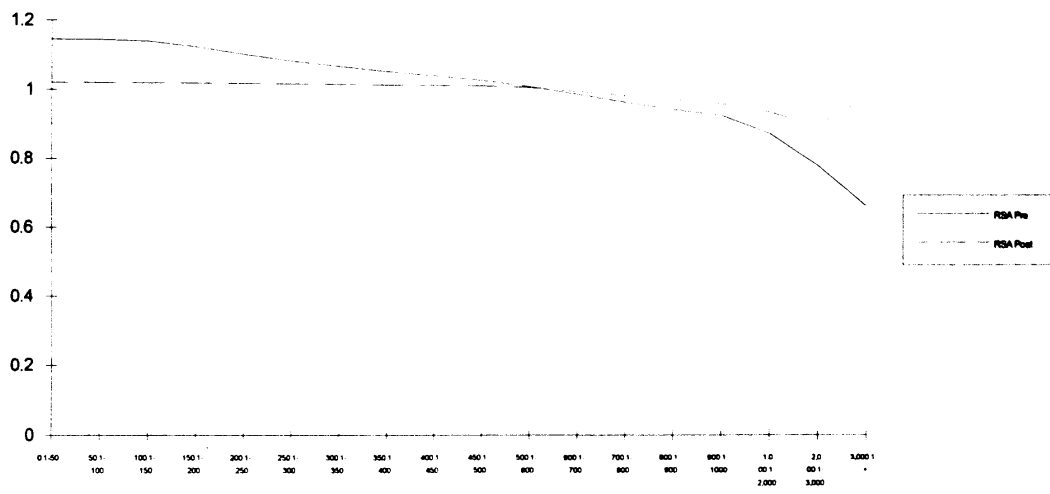
CHAPTER VI

CONCLUSIONS

In the Economic Literature much work has been done on progressivity measures and on the progressivity concept since early in this century. Studies like those from Musgrave and Thin (1948), and Pechman and Okner (1974), have dealt with empirical work. Other studies have been more theoretical. In any event, "the optimal progressivity measure" has not been designed yet. Scholars are still attempting to develop new measures for analyzing the impact that taxation has on income distribution. That is the case, for example, of the Relative Share of Adjustment (RSA) measure (Baum, 1991) used for the purposes of this study. Classical progressivity measures such as the Lorenz Curve and Gini Index have been traditionally widely used. However, they have some relative disadvantages compared to other measures that give an idea of the impact of the tax per income bracket; for example, Musgrave and Thin's structural measures or Baum's RSA. Moreover, the latter measures do not use utility function comparisons so that they are easier to calculate and still yield valuable information.

With respect to data and methodology, there were some limitations that needed to be solved, given the unavailability of reliable data for post-reform. However, it was possible to use Procedure II, which proved to be consistent with what the results would have been if the real data had been used. This method gives confidence to the findings obtained.

Furthermore, the 1988 Costa Rican Tax Reform Act was proposed as a partial remedy to Costa Rica's fiscal situation in the latter 1980's. The Tax Reform intended to increase government revenue by decreasing tax avoidance from high income groups and to improve income distribution. The new tax schedule implied more exempt income levels and lower marginal tax rates, especially for higher income groups. Averages tax rates were also smaller. When obtaining the value for the different progressivity measures for both pre- and post-reform periods, it is evident that tax schedules are progressive in both cases, but that overall progressivity is reduced in the post-reform period. That is, the degree of progression is smaller in the post-reform period. This result is explained by the increase in the exemption level that benefits higher incomes and by the relatively greater reduction of marginal tax rates for high income brackets. Moreover, in the post-reform period there was some income redistribution, as was the case in pre-reform. Nonetheless, this redistribution lessened in post-reform. Tax reform reduced the relative income shares of lower income groups and increased those of higher income groups. On the other hand, the income tax-to-GDP ratio that had been consistently declining since 1982, stabilized in post-reform years. This indicates to some extent, that the government goal of improving

its revenues was attained. Thus, as pointed out, a trade off between efficiency and equity

appears to be have resulted from 1988 tax reform in Costa Rica.

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