Progressivity and redistributive power of income tax on wage earners in El Salvador: a microsimulation analysis[1]

Catalina Galdámez and Rodrigo Alfonso Morales López

Received: 18/09/2018
Accepted: 18/07/2023

Abstract

This work analyses the effects of wage earners' income tax on vertical equity and income distribution in El Salvador, by assessing the two most recent changes in income tax —the 2011 reform and the 2015 amendment— in light of a comparative methodology based on indices of tax progressivity and redistributive power. The impact of these measures is estimated using microsimulation techniques. The results show that the tax structure in 2017 is weakly progressive and has no impact on income distribution in El Salvador. On the contrary, the differential treatment that the tax system affords to high incomes undermines any possible effect of the income tax on vertical equity and income distribution.

Keywords

Taxation, income tax, fiscal policy, income distribution, equality, measurement, mathematical models, El Salvador

JEL classification

H22, H23, H24, D31

Authors

Catalina Galdámez is a Salvadoran economist and doctoral candidate in economics at the Economic Research Institute of the National Autonomous University of Mexico (UNAM). Email: caldamez@gmail.com.

Rodrigo Alfonso Morales López is a Salvadoran economist and full-time C research associate at the Regional Multidisciplinary Research Centre of UNAM. Email: r.morales@crim.unam.mx.

[1] The authors are grateful for the valuable comments and suggestions of the referee.

I. Introduction

The analysis of the implications of tax policy and its effects on income distribution has been a recurring theme in economic literature (Cetrángolo and Gómez Sabaini, 2007; Mahon, 2012). Contrary to the neoclassical theory on the distorting effects of taxes (Bird and Zolt, 2005; Bird, 2003), authors such as Cornia, Gómez Sabaini and Martorano (2011), Alesina and Rodrik (1994) and Aghion, Caroli and García-Peñalosa (1999) have shown that equitable income distribution has positive impacts on economic growth, especially in developing countries.

Countries like El Salvador, whose prevailing economic conditions are fiscal instability, high rates of public debt and sustained fiscal deficit, combined with low rates of economic growth, need tax reforms to promote equality and drive development objectives (Agosin and others, 2005; Moreno, 2004).

This research analyses and evaluates the ways in which wage earners' income tax affects tax equity and income distribution, considering the tax reform of 2011 and the amendment of 2015. Although income tax on natural persons in El Salvador is levied on both wage earners and non-wage-earners, this research is focused exclusively on the income tax of wage employees, because its association with families' formal disposable income means that its payment can be tracked through gross monthly wage in the Multipurpose Household Survey (EHPM), which is not the case for the non-waged.

The study is organized into five sections after this introduction. Section II reviews the theoretical potential of income tax to improve progressivity and income distribution, and section III explains the configuration of the tax according to the normative framework adopted in 1991, its main reforms and the efforts to modify its progressive brackets. This is followed by the methodology set forth in section IV, and section V, which presents a comparative empirical analysis evaluating the amendments to income tax and its effects on progressivity and income distribution in El Salvador. This is the main contribution of this research, given the prior absence of specific studies of this type on tax matters in the country. Lastly, section VI concludes.

II. Background

Analysis of tax progressivity stems from the concept of tax equity. Although equity is a term that can be interpreted in a multidimensional manner (Jiménez, Gómez Sabaini and Podestá, 2010), in taxation theory it concerns the actions taken by the public sector to ensure equal and fair treatment for citizens.

The principle of tax equity is rooted in two basic criteria that determine the application and distribution of taxes: the benefit criterion, which refers to the need to set taxes based on the benefits that individuals obtain from public powers, and the ability-to-pay criterion, which concerns the economic capacity of individuals to distribute tax burdens (Musgrave and Musgrave, 1989).

As Yáñez (1992) and Sevilla (2004) show, benefit-based taxation is ineffective and limited, given the complexity of defining the benefits that each induvial citizen in particular receives from public spending. This principle also excludes the possibility of the public sector pursuing redistributive and stabilizing policies, since it disregards distributive criteria and the power of segmentation by the conditions of the individual.[2] These are captured by ability-to-pay taxation, which sets tax according to the taxpayer's income level. The tax system will be vertically equitable —and therefore progressive— if it levies more on higher incomes; otherwise, it will be regressive (Jorratt, 2011; Musgrave and Thin, 1948).

[2] This criterion proposes a solution analogous to that offered by the market as an instrument for resource allocation, which implies setting a market price based on the marginal utility of public goods to determine the distribution of the tax burden.

For Martín Seco (2010) and Arenas de Mesa (2016), vertical equity is increasingly important in terms of potential distributional effects. In this sense, ability-to-pay taxation can influence income distribution in the following ways: through the primary distribution of income (determined by market forces) via the capture of tax revenues that finance public policies aimed, for example, at increasing and strengthening human capital and improving health, education and infrastructure services; and through secondary distribution (determined by the application of fiscal policy) through a progressive tax system (Cetrángolo and Gómez Sabaini, 2007; Jiménez, Gómez Sabaini and Podestá, 2010). The evidence presented by Jorratt (2011), Gómez Sabaini and Morán (2016), Musgrave and Musgrave (1989) and Bittker (1979) shows that the redistributive characteristic of taxation is satisfied by a scheme that uses progressive taxation of income higher-income families, i.e. fulfilment of vertical equity.

Jiménez, Gómez Sabaini and Podesta (2010) and Morley (2000) argue that taxation should improve the income structure in countries that have considerable income concentration. Kaldor (1963), Lambert (2004), Gómez Sabaini (2005), Ahmed and O'Donoghue (2009) and the Economic Commission for Latin America and the Caribbean (ECLAC, 2018) concur that direct taxation —specifically, tax on personal income— has the greatest power to improve income inequality, since the application of progressive marginal rates by income levels will impact secondary income distribution. Accordingly, progressive income tax with sufficient redistributive power is needed to attack these disparities.

However, the theoretical potential of income tax depends on the use of differential treatment in its payment. Newbery and Stern (1987), Sicat and Virmani (1988), Alm, Bahl and Murray (1991), Arellano and Corbo (2013) and Bastagli, Coady and Gupta (2012) note that special regimes, exemptions, deductions, reduced brackets and differential treatment of income by source (wages, salaries, dividends, interest, capital gains, profits or others) all undermine the progressivity of the tax and its power to redistribute income.

According to Valle (2001), modern literature has reinforced tax equity within the principle of generality[3] and, although moderate income tax progressivity is currently accepted, it tends to be based on exemption threshold setting rather than significant variations in marginal tax rates. This is due to the abiding concern over the supposed distorting effects of progressivity on basic economic decisions.

Accordingly, Stiglitz (2003) and Caballero and López (2012) see the concentrated income distribution pattern typical of developing countries as being associated with the supremacy of consumption taxes, and they advocate progressive tax reform based on income tax.

III. Income tax on wage earners in El Salvador

The income tax law that underpins the Salvadoran tax system was adopted on 21 December 1991 by virtue of Decree No. 134. It considers taxpayers to be natural persons (i.e. individuals) who obtain from their work income that includes wages, salaries, fees, commissions and all types of remuneration or compensation for personal services, counted from 1 January to 31 December each year.

The tax structure has an exempt bracket and marginal rates from 10% to 30%, plus a fixed payment. The payment is calculated using only income from work activity[4] after deductions for expenditures on medical and hospital services, educational expenses, and donations, among others. Those whose income is below a certain threshold are also exempt (see table 1).[5] Income from abroad is also exempt, as the principle of territoriality is taken as a fundamental criterion for income tax liability.

[3] With equity focused on eliminating evasion and avoidance.

[4] The Central American Institute for Fiscal Studies (ICEFI, 2012 and 2016) classifies this as a granular tax since it taxes the different types or categories of a single taxpayer's income separately (from wage work, interest on deposits, dividends on shares, etc.), which implies forgoing a part of the tax base that is of particular importance for higher-income individuals.

[5] For 2016, only income over US$ 9,100 stemming exclusively from work is taxed. This is equivalent to 2.4 times per capita GDP in El Salvador; a figure that is 2.5 in Honduras and 0.8 in Panama.

Table 1
El Salvador: income tax exemptions and deductions for wage earners

Income taxed
Salaries, wages, fees, commissions and all types of remuneration for personal services From this is deducted: payment into the Pension Fund Administrator (AFP) + payment to the Salvadoran Social Security Institute (ISSS), the Salvadoran Institute for Teacher Welfare or the Social Security Institute of the Armed Forces (IPSFA)
Funds not constituting income
Amounts received as expenses for transportation, food and accommodation
Legacies or inheritances
Donations
Income not taxed
Remuneration, compensation and representation expenses of the diplomatic corps, consular agents and foreign officials residing in the country
Compensation for death, disability, accident or illness
Retirement pension, other pensions, widows' or orphans' benefit
Remuneration, compensation and representation expenses of Salvadorans in the foreign service
Interest, premiums and other returns flowing directly from deposits in financial institutions (up to US$ 25,000)
Insurance contracts
Interest on loans extended abroad
Lottery winnings
Awards granted by the Legislative Assembly of El Salvador or extended to public servants for important services to the country
Deductions
Hospital services
Tuition or schooling payments
Employer contribution paid to ISSS for domestic work
Dues or contributions paid to unions, associations and professional groupings
Maximum legally allowed donation

Source: C. Galdámez, "Efectos de las reformas al impuesto sobre la renta de asalariados de 2011 y 2015 sobre la equidad tributaria, capacidad recaudatoria y distribución del ingreso en El Salvador", master's thesis in economics, National Autonomous University of Mexico (UNAM), 2017.

This structure has undergone few changes since its implementation in 1991, although the law establishes a periodic review of withholding tables by the executive body of the Treasury. The reform of 2011 made changes to marginal tax rates: by virtue of Decree No. 216 of the Ministry of Finance, the reform modified the taxable income brackets, setting a top rate of 30% and eliminating the progressive cut-off for effective tax burdens over 25%. It also expanded the exempt bracket to US$ 487.60 per month and raised the fixed payment for each bracket,[6] and increased the deductions allowed for expenses on hospital services and education by up to US$ 1,600 annually.

In 2015, Decree No. 95 brought new changes to the income tax withholding tables for wage earners, with the introduction of a new deduction from taxable wage income: payment to the Salvadoran Social Security Institute (ISSS), whose upper limit was also changed.[7]

The empirical evidence presented by Barreix, Bès and Roca (2009) shows that wage earners' income tax in El Salvador has limited power to improve progressivity and income redistribution. These authors find that, in 2006, the tax did not substantially alter the income distribution of the richest 10%, whose share of total income went from 30.7% to 30.1%. Likewise, the work of Beneke, Lustig and Oliva (2015) confirms that, although the battery of direct taxes is afforded progressivity by personal income tax, together with direct transfers it reduces inequality by barely 1 percentage point, as measured by the Gini index for 2011.

[6] Since 1990, additional fixed payments had gone from US$ 4.76 to US$ 288.57, but in 2012 the range was changed to US$ 17.48 to US$ 288.57.

[7] The upper limit of payment to ISSS rose from US$ 685.71 to US$ 1,000, with no change to the percentage paid by wage earners, or 3% of wage income. Thus, maximum amount payable to social security is US$ 30 and not US$ 20.57 per month.

The authors, like Jorratt (2011) in the analysis of other countries in Central America, associate this result with the high non-taxable threshold of labour income and the exemption of capital income —interest, dividends and capital gains—, as well as the difficulties encountered by tax administrations in enforcing the tax.

These findings are corroborated by ECLAC/Oxfam, Jiménez (2015), Hanni, Martner and Podestá (2015) and Peréz Trejo (2014) for different years. They conclude that, in relative terms, the effective tax rate of the tenth decile was no higher than 5% in 2011 and 2012, which is low compared to the rates in Argentina and Mexico, which exceeded 8% in both years. Likewise, income tax was considered a weak instrument of redistribution, since in 2011–2012 it improved total income concentration by only around 2.5%. Meanwhile, countries such as Mexico or Uruguay report post-income-tax improvements in the Gini index of close to 6% and 4%, respectively.

Menkos (2013) analysed the effects of the 2011 income tax reform on tax equity and income distribution using the household income deciles in El Salvador's Multipurpose Household Survey. He argues that the reform of wage earners' income tax was progressive, insofar as the amount collected from the tenth decile represents 80% of all revenues from income tax. However, the changes in marginal rates compared to 2010 did not produce any drastic shift in income redistribution. On the contrary, income distribution became more unequal owing to the effects of the predominant tax, the value added tax (VAT), which is highly regressive.

IV. Methodology

According to Arenas de Mesa (2016), the changes made to income tax in 2011 and 2015 may be classified as tax reform and amendment, respectively. The changes made to the taxable income brackets, marginal rates and fixed rates in 2011 amounted to a tax reform, because they changed its structure. Meanwhile, the changes of 2015 amount to a tax amendment, with a parametric adjustment that did not affect the tax structure or create a new tax system.

Thus, in order to determine the impact of the 2011 income tax reform and the amendment adopted in 2015 on tax equity and income distribution in El Salvador, a comparative analysis was carried out to estimate the economic impact of the tax, before and after its application. The measure of well-being used is family or household income ordered by deciles, similarly to the analysis by Lustig and others (2013) and Barreix, Roca and Villela (2006).

Owing to the limited availability of disaggregated tax data, the analysis uses the wage and family income reported for 2017 in the Multipurpose Household Survey published by the Directorate General of Statistics and Censuses (DIGESTYC) of the Ministry of Economic Affairs of El Salvador. Salvia and Donza (1999), Villatoro (2015), Amarante (2013) and Jorratt (2011) argue that income and expenditure surveys suffer from limitations in this regard and that their scope is not equivalent to the real income tax base, owing to non-response bias (partial or total), underreporting of income and undercapturing of earners, especially among higher-income individuals. These surveys may also include measurement errors, bias or cognitive failures, on the part of both interviewees and interviewers. As Jiménez (2015) mentions, the sample design of the Multipurpose Household Survey produces a difference between the real income tax base and the estimated information from the survey, given the aforementioned limitations. For this reason, this research uses the percentage structure —of wage, family income or tax payments— reported by the survey, and does not involve nominal data.[8]

[8] Total data presented in monetary terms corresponds to information published by the Ministry of Finance of El Salvador.

To calculate the income tax paid by individuals, the Multipurpose Household Survey variable used was monthly income from dependent work, which captures the monthly amounts that people receive as salaries or wages. This variable is used as a proxy for individuals' gross income, so that the net income on which income tax withholding rates will be applied can be calculated directly.[9]

With a view to assessing the situation before and after the 2011 reform, a pension fund contribution of 6.25% is deducted from gross income. To assess the 2015 amendment, meanwhile, the deduction is the percentage of the payment into the pension system, which in 2017 rose to 7.25%, added to the 3% deduction for the ISSS contribution. Next, the marginal rates and fixed payments per net income bracket are applied. The well-being indicator is the monthly family income variable in the Multipurpose Household Survey, which is used only to sort the results by decile, as a proxy for the purchasing power of the Salvadoran population.[10]

The Multipurpose Household Survey uses a cross-sectional sample; accordingly, its socioeconomic and demographic characteristics are constant. The estimates made to evaluate the income tax changes of 2011 and 2015 are based on the data from the 2017 survey, first because individual response behaviours are not taken into account and, mainly, to avoid any methodological disparity that may arise when using two surveys from different years (Barreix, Bès and Roca, 2009).

As Jorratt (2011) argues, this methodology is theoretical in nature, since it is not necessarily related to the tax that each person actually pays. In the absence of official data, however, it is a viable methodology aside from tax evasion or avoidance. Klevmarken (2008) and Absalón and Urzúa (2012) classify the model as a static microsimulation with specific coverage. On the one hand, it isolates the independent impact of variations in a single type of tax, and, on the other, it identifies the immediate impact of tax reforms, without touching on changes in individual behaviour; this may be termed "first-order change outcomes".

In relation to the indicators, the concentration approach —the analysis of which is based on Lorenz curves and Gini indices— is used to measure the income tax vertical equity and redistributive capacity in El Salvador. According to Kakwani (1977), the Lorenz curve relates the cumulative proportion of income units to the cumulative proportion of income received once the units have been sorted in descending or ascending order (percentiles, quartiles, quintiles or deciles). From this may be obtained the measure created by Corrado Gini in 1912 (the Gini index), which shows the population's income distribution through the average differences between population groups. For discrete analysis, the Gini index may be defined as:

$$C_x = \left[\frac{\sum_{i=1}^{n} \sum_{j=1}^{n} |x_i - x_j|}{2N^2 \mu} \right] \quad (1)$$

Where x_i is the income of unit i, x_j is the income of unit j, N is the number of units and μ is the average income distribution. The index takes values of between 0 and 1, which represent, respectively, maximum equality and maximum inequality (Sen, 1997).

Analogously to the Gini index, and with a view to calculating the degree of concentration of the tax burden in the population, the concentration index (IC_t) also known as the quasi-Gini coefficient, may be calculated from the curve of tax concentration, given by:

$$C_t = \left[\frac{\sum_{i=1}^{n} \sum_{j=1}^{n} |t(x_i) - t(x_j)|}{2N^2 \mu t} \right]; \quad 0 \leq t \leq 1 \quad (2)$$

[9] See annex A1 for details of the income tax withholding tables.

[10] The monthly family income variable includes all personal income from dependent or independent work, secondary employment, agricultural activities or other work activities, as well as other income, such as remittances, pensions and retirements, rents, interest and profits.

Where $t(x_{i,j})$ represents the tax burden on taxpayers i, j, while t is the average effective rate of the tax burden, which is given by:

$$t = \frac{\sum_{i=1}^{n}\sum_{j=1}^{n} t(x_{i,j})}{\sum_{i=1}^{n}\sum_{j=1}^{n} x_{i,j}} \tag{3}$$

As Medina (2001) mentions, this index weights the distances between the tax burdens of taxpayers, such that positive values indicate that the tax structure is progressive. That is, as the income scale rises, the absolute amount of tax payment increases and, as the income scale falls, the opposite occurs. The greater the IC_t index, the more concentrated the tax burden on higher-income individuals.

On this basis, the after-tax income concentration index $(C_{x\text{-}t})$ may be inferred as a measure to determine the effect of the tax burden on income distribution after tax, the aim being to draw comparisons with the pre-tax Gini index, which is given by:

$$C_{x-t} = \left[\frac{\sum_{i=1}^{n}\sum_{j=1}^{n}\left|\left(x_i - t(x_i)\right) - \left(x_j - t(x_j)\right)\right|}{2N^2\mu(1-t)}\right] \tag{4}$$

This index weights the distances between income and the tax burden for each taxpayer (i,j). Thus, again, the larger the $C_{x\text{-}t}$ index, the more concentrated the after-tax income, showing the distributional effects of tax application.

1. Measuring the vertical equity of tax reforms and amendments

The indicator most commonly used to measure taxation vertical equity is the Kakwani index (1977), which measures the progressivity (regressivity) of taxes based on the differences between the tax concentration index and the Gini index, or by the area between the after-tax income concentration curve and the Lorenz curve. The Kakwani index for discrete analysis is given by:

$$K = C_t - C_x = \left[\frac{\sum_{i=1}^{n}\sum_{j=1}^{n}\left|t(x_i) - t(x_j)\right|}{2N^2\mu t}\right] - \left[\frac{\sum_{i=1}^{n}\sum_{j=1}^{n}\left|x_i - x_j\right|}{2N^2\mu}\right] \tag{5}$$

A tax burden proportional to income would yield an index equal to 0; a positive Kakwani index indicates a progressive tax burden, while an index below 0 indicates a regressive tax.

As discussed in Díaz de Sarralde, Garcimartín and Ruiz-Huerta (2010), the concentration approach is commonly used to identify and evaluate the effects of tax reforms or amendments on vertical equity. However, this approach considers only the pre-tax situation and the distribution of the reform's tax brackets across the population, not the changes in actual collection. Therefore, the indicators speak to the design of the reform (variations in proportions) and not its actual impact (changes in the level of revenue and effect of the tax rate).

Following Kakwani (1977), the possible effects of tax reform on vertical equity will be reflected as follows:

$$K = \frac{(1-t)}{t}\left(C_x - C_{x-t}\right) \tag{6}$$

Substituting from formula (4) into formula (6) gives:

$$K = \frac{(1-t)}{t} C_x - \left[\frac{\sum_{i=1}^{n} \sum_{j=1}^{n} \left| \left(x_i - t(x_i)\right) - \left(x_j - t(x_j)\right) \right|}{2N^2 \mu (1-t)} \right] \tag{7}$$

Thus, vertical equity will be affected by the tax level or rate (which implies changes in total collection and revenue), by distributional shifts due to changes in after-tax income level and by the pre-reform income distribution structure. The methodology must therefore show these effects and capture them comprehensively. The aim is to avoid errors of interpretation, or even contradictions, if the source of the tax system's progressivity or regressivity is not accurately identified.

To demonstrate the inseparability of these factors, the methodology of Díaz de Sarralde, Garcimartín and Ruiz-Huerta (2010) was used. This considers changes in collection produced by a tax reform, explicitly identifying the effects of "tax level" and "distances between tax rates" on vertical equity. The aim is to show the absolute change in the Kakwani index, differentiating its magnitude before (K) and after (K^*) the reform. The reform is expected to add progressivity to the tax structure if $K^* > K$; otherwise, ($K > K^*$), the reform's effect is regressive, or if $K = K^*$ is true, the change is neutral. Thus:

$$K^* - K = \left(C_t^* - C_x^*\right) - \left(C_t - C_x\right) \tag{8}$$

Assuming that the Gini index (pre-tax) is the same before and after both reforms (which is true in this simulation study, since the same 2017 income structure is used to evaluate different reforms):

$$C_x^* = C_x \tag{9}$$

Therefore, formula (8) may be defined as:

$$K^* - K = C_t^* - C_t \tag{10}$$

Which may also be expressed as:

$$K^* - K = \left[\frac{\sum_{i=1}^{n} \sum_{j=1}^{n} \left| t^*(x_i) - t^*(x_j) \right|}{2N^2 \mu t^*} \right] - \left[\frac{\sum_{i=1}^{n} \sum_{j=1}^{n} \left| t(x_i) - t(x_j) \right|}{2N^2 \mu t} \right] \tag{11}$$

Applying the additive inverse of factor $\left[\frac{\sum_{i=1}^{n} \sum_{j=1}^{n} \left| t(x_i) - t(x_j) \right|}{2N^2 \mu t^*} \right]$:

$$K^* - K = \left[\frac{\sum_{i=1}^{n} \sum_{j=1}^{n} \left| t^*(x_i) - t^*(x_j) \right|}{2N^2 \mu t^*} \right] - \left[\frac{\sum_{i=1}^{n} \sum_{j=1}^{n} \left| t(x_i) - t(x_j) \right|}{2N^2 \mu t} \right] + \left[\frac{\sum_{i=1}^{n} \sum_{j=1}^{n} \left| t(x_i) - t(x_j) \right|}{2N^2 \mu t^*} \right] - \left[\frac{\sum_{i=1}^{n} \sum_{j=1}^{n} \left| t(x_i) - t(x_j) \right|}{2N^2 \mu t^*} \right] \tag{12}$$

Simplifying formula (12) gives:

$$K^* - K = \left[\frac{\sum_{i=1}^{n} \sum_{j=1}^{n} \left| t(x_i) - t(x_j) \right|}{2N^2 \mu t} \right] \left(\frac{t}{t^*} - 1 \right) + \frac{\left[\sum_{i=1}^{n} \sum_{j=1}^{n} \left| t^*(x_i) - t^*(x_j) \right| \right] - \left[\sum_{i=1}^{n} \sum_{j=1}^{n} \left| t(x_i) - t(x_j) \right| \right]}{2N^2 \mu t^*} \tag{13}$$

If θ is defined as the rate of growth of the average tax rate:

$$\theta = \frac{t^*}{t} - 1 \tag{14}$$

and D and D^* are defined as the sum of the distances between the tax rate before and after the reform, respectively:

$$D = \sum_{i=1}^{n}\sum_{j=1}^{n}\left| t(x_i) - t(x_j)\right| \tag{15}$$

$$D^* = \sum_{i=1}^{n}\sum_{j=1}^{n}\left| t^*(x_i) - t^*(x_j)\right| \tag{16}$$

Therefore, formula (10) may be expressed as:

$$K^* - K = C_t\left(\frac{1}{1+\theta} - 1\right) + \frac{D^* - D}{2N^2\mu t^*} \tag{17}$$

The variation of the Kakwani index will be the sum of two effects. On the one hand, the "level" effect represented by:

$$EN = C_t\left(\frac{1}{1+\theta} - 1\right) \qquad \begin{array}{l} \text{If } \Delta t \text{ " } \theta > 0 \text{ " EN} < 0 \\ \text{If } -\Delta t \text{ " } -1 < \theta < 0 \text{ " EN} > 0 \\ \text{If } \theta = 0 \text{ " EN} = 0 \end{array} \tag{18}$$

Where Δt represents an increase in the tax rate, while $-\Delta t$ represents a fall in the rate.

Formula (18) reflects the effect on vertical equity given by changes in the average effective tax rate after the reform, maintaining constant distribution of the tax burden on the population, where the average effective rate may take values between 0 and 1.

And the "distance" effect is represented by:

$$ED = \frac{D^* - D}{2N^2\mu t^*} \qquad \begin{array}{l} \text{If } D > D^* \text{ " ED} < 0 \\ \text{If } D < D^* \text{ " ED} > 0 \\ \text{If } D = D^* \text{ " ED} = 0 \end{array} \tag{19}$$

This formula shows the effects on tax progressivity (regressivity) from a normative point of view, since it compares two tax structures and the deviation they generate, keeping the level of collection given by the average effective rate constant; this effect may also take positive or negative values. Therefore, the changes in overall vertical equity given by formula (8) can take positive signs, where progressivity is added, or negative signs, where regressivity is added.

As a function of the variation of the Kakwani index, the effect of the reform on tax equity may be identified based on the "distance-level" progressivity index I_K defined by:

$$I_K = \frac{\Delta K}{|\Delta K|}\left(1 + \frac{ED}{|EN| + |ED|}\right) \tag{20}$$

Where:

$$\frac{\Delta K}{|\Delta K|} = \pm 1$$

$$0 \leq \left(1 + \frac{ED}{|EN| + |ED|}\right) \leq 2$$

Thus, the classification of the reform based on indices I_K will be:

- Strongly progressive reform: if there is a positive change in the Kakwani index (ΔK) and the "distance" effect is positive ($ED > 0$), the "distance-level" progressivity index will be in the range $1 < I_K \leq 2$.
- Weakly progressive reform: if there is a positive change in the Kakwani index (ΔK), but the "distance" effect is negative ($ED < 0$), the "distance-level" progressivity index will be in the range $0 < I_K \leq 1$.
- Weakly regressive reform: if there is a negative change in the Kakwani index ($-\Delta K$), but the "distance" effect is positive ($ED > 0$), the "distance-level" progressivity index will be in the range $-2 \leq I_K < -1$.
- Strongly regressive reform: if there is a negative change in the Kakwani index ($-\Delta K$) and the "distance" effect is also negative ($ED < 0$), the "distance-level" progressivity index will be in the range $-1 \leq I_K \leq 0$.

2. Measuring the redistributive capacity of tax reforms and amendments

The redistributive power of taxation on income distribution is measured by the Reynolds and Smolensky index (1977), which measures the change in income inequality (in terms of Gini points) as a result of tax application. The index is given by:

$$RS = C_x - C_{x-t} = \left[\frac{\sum_{i=1}^{n}\sum_{j=1}^{n}|x_i - x_j|}{2N^2\mu}\right] - \left[\frac{\sum_{i=1}^{n}\sum_{j=1}^{n}\left|\left(x_i - t(x_i)\right) - \left(x_j - t(x_j)\right)\right|}{2N^2\mu(1-t)}\right] \quad (21)$$

The Reynolds and Smolensky index will be positive when the Gini index is higher before than after tax, which indicates that the tax has improved income concentration and there is a positive redistributive effect. Conversely, a negative Reynolds and Smolensky index shows a deterioration in income distribution after the application of the tax and, therefore, negative redistribution. If the index is equal to 0, the tax neither improves nor worsens income distribution.

Analogously to the approach to measuring vertical equity, this methodology is also used to break down the redistributive effect of reform. The aim is thus to identify whether a change occurred in the Reynolds and Smolensky index *(RS*)* post-reform, which will be given by:

$$RS^* - RS = \left(C_x^* - C_{x-t}^*\right) - \left(C_x - C_{x-t}\right) \quad (22)$$

Supposing that $C_x^* = C_x$:

$$RS^* - RS = \left(C_{x-t} - C_{x-t}^*\right) \quad (23)$$

This formula may be expressed as:

$$RS^{*}-RS=\left[\frac{\sum_{i=1}^{n}\sum_{j=1}^{n}\left|\left(x_i-t\left(x_i\right)\right)-\left(x_j-t\left(x_j\right)\right)\right|}{2N^{2}\mu\left(1-t\right)}\right]-\left[\frac{\sum_{i=1}^{n}\sum_{j=1}^{n}\left|\left(x_i-t^{*}\left(x_i\right)\right)-\left(x_j-t^{*}\left(x_j\right)\right)\right|}{2N^{2}\mu\left(1-t^{*}\right)}\right] \tag{24}$$

Applying the additive inverse of factor $\left[\frac{\sum_{i=1}^{n}\sum_{j=1}^{n}\left|\left(x_i-t\left(x_i\right)\right)-\left(x_j-t\left(x_j\right)\right)\right|}{2N^{2}\mu\left(1-t^{*}\right)}\right]$ yields:

$$RS^{*}-RS=\left[\frac{\sum_{i=1}^{n}\sum_{j=1}^{n}\left|\left(x_i-t\left(x_i\right)\right)-\left(x_j-t\left(x_j\right)\right)\right|}{2N^{2}\mu\left(1-t\right)}\right]\left(1-\frac{1-t}{1-t^{*}}\right)+\frac{\left[\sum_{i=1}^{n}\sum_{j=1}^{n}\left|\left(x_i-t\left(x_i\right)\right)-\left(x_j-t\left(x_j\right)\right)\right|\right]-\left[\sum_{i=1}^{n}\sum_{j=1}^{n}\left|\left(x_i-t^{*}\left(x_i\right)\right)-\left(x_j-t^{*}\left(x_j\right)\right)\right|\right]}{2N^{2}\mu\left(1-t^{*}\right)} \tag{25}$$

If β is defined as the rate of average net income growth after the application of the tax:

$$\beta=\frac{\left(1-t^{*}\right)-\left(1-t\right)}{\left(1-t\right)} \tag{26}$$

and D and D^{*} as the sum of the distances between net incomes before and after the reform, respectively:

$$D=\sum_{i=1}^{n}\sum_{j=1}^{n}\left|\left(x_i-t\left(x_i\right)\right)-\left(x_j-t\left(x_j\right)\right)\right| \tag{27}$$

$$D^{*}=\sum_{i=1}^{n}\sum_{j=1}^{n}\left|\left(x_i-t^{*}\left(x_i\right)\right)-\left(x_j-t^{*}\left(x_j\right)\right)\right| \tag{28}$$

Therefore, formula (22) may be expressed as:

$$RS^{*}-RS=C_{x-t}\left(1-\frac{1}{1+\beta}\right)+\frac{D-D^{*}}{2N^{2}\mu\left(1-t^{*}\right)} \tag{29}$$

The variation in the Reynolds and Smolensky index will be the sum of two effects. On the one hand, the "level" effect, represented by:

$$EN=C_{x-t}\left(1-\frac{1}{1+\beta}\right) \qquad \begin{array}{l}\text{If } \Delta t \text{ " } -1<\beta<0 \text{ " EN}<0\\ \text{If } -\Delta t \text{ " } \beta>0 \text{ " EN}>0\\ \text{If } \beta=0 \text{ " EN}=0\end{array} \tag{30}$$

where Δt represents an increase in the tax rate, while $-\Delta t$ represents a fall in the rate.

This reflects the effect on income distribution given by the changes in the rate of average income after the reform, keeping income distributions before and after the reform constant; values may be between 0 and 1.

And, on the other hand, the net income "distance" effect, represented by:

$$ED = \frac{D - D^*}{2N^2\mu\left(1 - t^*\right)} \qquad \begin{array}{l} \text{If } D > D^* \text{ " ED} > 0 \\ \text{If } D < D^* \text{ " ED} < 0 \\ \text{If } D = D^* \text{ " ED} = 0 \end{array} \tag{31}$$

This formula uses normative valuation to measure variation in the distribution, since it compares the differences in the two income distributions (before and after tax) in terms of proportionality, keeping the average net income constant, an effect that can also take positive or negative values.

Accordingly, changes in the distribution of total income given by equation (29) may take positive signs when income inequality improves after the tax reform, or negative signs when the post-reform effect on income inequality leads to greater income concentration.

As a function of the variation in the Reynolds and Smolensky index, the effect of the reform on income distribution may be defined on the basis of the "distance-level" redistribution index I_{RS}, defined by:

$$I_{RS} = \frac{\Delta RS}{|\Delta RS|}\left(1 + \frac{ED}{|EN| + |ED|}\right) \tag{32}$$

Where:

$$\frac{\Delta RS}{|\Delta RS|} = \pm 1$$

$$0 \leq \left(1 + \frac{ED}{|EN| + |ED|}\right) \leq 2$$

Thus, the classification of the reform based on the index I_{RS} will be:

- Strongly redistributive reform: if there is a positive change in the Reynolds and Smolensky index (ΔRS) and the "distance" effect is positive ($ED > 0$), the "distance-level" redistribution index will be in the range $1 < I_{RS} \leq 2$.
- Weakly redistributive reform: if there is a positive change in the Reynolds and Smolensky index (ΔRS), but the "distance" effect is negative ($ED < 0$), the "distance-level" redistribution index will be in the range $0 < I_{RS} \leq 1$.
- Weakly non-redistributive reform: if there is a negative change in the Reynolds and Smolensky index ($-\Delta RS$), but the "distance" effect is positive ($ED > 0$), the "distance-level" redistribution index will be in the range $-2 \leq I_{RS} < -1$.
- Strongly non-redistributive reform: if there is a negative change in the Reynolds and Smolensky index ($-\Delta RS$) and the "distance" effect is also negative ($ED < 0$), the "distance-level" redistribution index will be in the range $-1 \leq I_{RS} \leq 0$.

V. Findings

Between 2010 and 2017, income tax collection from wage earners in El Salvador did not follow a specific trend, despite being an important source of income for the State. The 2011 income tax reform was the measure that most reduced the number of taxpayers, because it increased the tax-exempt bracket and raised the minimum level for mandatory declaration; however, it also contributed most

to income tax collection in the reference period, which reached 2.92% of GDP in 2015. However, the amendment in 2015 reversed this trend and reduced the amount collected by 7.4% and the number of taxpayers by 1.8%. As a result, in 2017 income tax collection sank to its lowest level ever reported in GDP terms (2.55%) (see table 2).

Table 2
El Salvador: collection of wage earners' income tax, 2010–2017
(Millions of dollars and percentages)

Year	Collection *(Millions of dollars)*	Taxpayers *(Number)*	Collection/GDP *(Percentages)*	Value added tax (VAT)/income tax
2010	524.52	301 289	2.84	2.99
2011	575.71	314 406	2.84	3.13
2012	557.89	141 598	2.61	3.33
2013	606.01	166 590	2.76	3.14
2014	588.96	194 951	2.61	3.24
2015	685.20	216 575	2.92	2.82
2016	634.30	212 736	2.63	2.92
2017	634.89	234 428	2.55	3.06

Source: Prepared by the authors, on the basis of Ministry of Finance, *Informe de la Gestión Financiera del Estado 2012*, San Salvador, 2012; *Informe de la Gestión Financiera del Estado 2015*, San Salvador, 2015; and *Informe de la Gestión Financiera del Estado 2017*, San Salvador, 2017.

This finding is consistent with those of Menkos (2013), who defines the foregoing as evidence of the depletion of the fiscal space's ability to significantly increase revenues. Although the changes reduce the tax's administrative failures, they fail to impact the determinants of loss of income tax collection power.

Comparison with the collection of the main indirect tax, VAT, bears out the observations made by Peréz Trejo (2014). The immense number of measures aimed at boosting indirect taxes helps to undermine income tax collection, which puts the tax's capacities at risk.

Before the 2011 reform, income tax was levied from the fourth decile upward. The reform pushed the threshold to the sixth decile, which generated an increase of 13% in the contribution of the tenth decile. With the 2015 amendment, the sixth to ninth deciles seem to bear a lower tax burden than those applied by the 2011 reform, while the burden of the tenth decile rose by 3% (see table 3).

Table 3
El Salvador: contribution and effective rate of payment of income tax on wage earnings, by household decile, 2010, 2011 and 2015
(Percentages)

Decile	Situation in 2010		Reform of 2011		Modification of 2015	
	Contribution	Effective rate	Contribution	Effective rate	Contribution	Effective rate
I	0.00	0.00	0.00	0.00	0.00	0.00
II	0.00	0.00	0.00	0.00	0.00	0.00
III	0.01	0.01	0.00	0.00	0.00	0.00
IV	2.33	0.81	0.00	0.00	0.00	0.00
V	3.76	1.22	0.00	0.00	0.00	0.00
VI	3.60	0.98	2.66	0.55	0.96	0.18
VII	5.96	1.26	5.63	0.90	5.18	0.75
VIII	8.42	1.56	7.85	1.10	7.11	0.90
IX	17.74	2.63	18.26	2.04	18.19	1.84
X	58.18	5.44	65.60	4.63	68.57	4.38
Total	100.00	2.46	100.00	1.86	100.00	1.68
Poorest 40% of the population	2.34	0.82	0.00	0.00	0.00	0.00
Richest 20% of the population	75.91	8.07	83.85	6.67	86.76	6.22

Source: Prepared by the authors, on the basis of Ministry of Economic Affairs, *Encuesta de Hogares de Propósitos Múltiples 2017*, Delgado, 2018.

At first glance, the 2011 reform and the 2015 amendment made the income tax substantially more progressive. The contribution made by the richest 20% came to 87% of total income tax collection. However, when progressivity is evaluated from the progressive effective rates approach (shown in table 3), the average effective rate is seen to go from 2.46% in 2010 to 1.68% after the changes that were made to the tax.

Although the effective rate is progressive, since it increases with income level, the tenth decile —in real terms— pays only 5% of wage income in tax, on average. Furthermore, the changes made to the tax decreased the effective tax rate. Although the exempt bracket was expanded, which to some extent contributes to tax progressivity, the effective rates are lower than in 2010 for all deciles and, with the introduction of the social security payment in the deductions, the total effective rate decreased by 20% for 2017.

As shown in ECLAC/Oxfam (2016), these differences between the contribution by deciles and the effective rates mean that the personal income tax in ineffective in taxing high incomes, since the effective rate paid by El Salvador's tenth decile is significantly lower than in countries such as Argentina and Mexico, where it exceeds 8%.

The foregoing is reaffirmed by analysis of the Kakwani index, showing that both the 2011 reform and the 2015 amendment are progressive in that they present an index greater than 0 (see table 4). These results coincide with the arguments of Gómez Sabaini (2005), Ahmed and O'Donoghue (2009) and ECLAC (2018) on the vertical equity effects generated by income tax.

Table 4
El Salvador: evaluation of progressivity of the 2011 reform and the 2015 amendment of income tax
(Indicator points)

Indicator	Situation in 2010	Reform of 2011	Amendment of 2015
Gini index before income tax		0.379	
Income concentration index	0.701	0.777	0.796
Kakwani index	0.321	0.398	0.417
Difference		0.076	0.020
"Level" effect		0.227	0.083
"Distance" effect		-0.151	-0.063
I_k		0.046	0.011

Source: Prepared by the authors, on the basis of Ministry of Economic Affairs, *Encuesta de Hogares de Propósitos Múltiples 2017*, Delgado, 2018.
Note: I_k is defined as the "distance-level" index, which shows the effect (strong or weak) of the reform on tax equity.

On the one hand, the 2011 reform increased the progressivity index by 0.08 points. The reform's 54% increase in the exempt bracket lowered the average effective rate, so that the "level" effect contributed positively to tax progressivity. On the other hand, the "distance" effect reduces progressivity because, after the reform, the differences between the contributions paid by low-income and high-income taxpayers shrink. Taking into account both the reflections above and the findings for the "distance-level" progressivity index, the 2011 reform constitutes a weakly progressive reform.

The same occurs with the amendments of 2015. They were progressive, but the progressivity index increased by only 0.02 points compared to the 2011 reform (0.08 points). Likewise, the decline in the effective rate due to the introduction of a new deduction contributed to progressivity, but the reduction in the gaps between the payments of all taxpayers detracted from vertical equity and reduced the progressive effect of the reform. Therefore, the 2015 amendments are also classified as progressively weak, based on the "distance-level" progressivity index.

This reaffirms the findings of Jorratt (2011) for Ecuador, Guatemala and Paraguay, where, although the income tax is confirmed to have a progressive effect in both structures, the absolute contribution to vertical equity is small. Jorratt associates this with low tax collection, the differential treatment of income sources and the large income tax exemptions and deductions allowed. These results are also consistent with those of Valle (2001) from a historical perspective, insofar as tax progressivity has focused on the establishment of the minimum exempt bracket rather than on strong variations in marginal tax rates. Similarly, the study by Barreix, Bès and Roca (2009) found that income tax has limited power to improve progressivity in El Salvador owing to the high non-taxable threshold for labour income, as the present research has also demonstrated. Thus, the misguided simplification of tax treatment will prevent substantive changes in progressivity if lawmakers are reluctant to make changes to effective and marginal rates, especially for the upper income deciles.

Analysis of the redistributive capacity of income tax based on the reforms and amendments carried out shows that the tax improves income distribution compared to the distribution of gross income. This supports the arguments of Yáñez's (1992) and Sevilla (2004) regarding the importance of introducing tax reforms —from the ability-to-pay criterion— that improve market-determined income.

The resulting structure once the income tax is applied reduces the income concentration of the richest 20% by 1 percentage point (see table 5). This is reflected in the improvement of the Gini index —close to 2%— after tax. However, as indicated in ECLAC/IEF (2014), this is a relatively low redistributive rate compared to the levels attained in 2011 in Mexico and Uruguay, where income tax is able to improve the Gini index by 6% and 4%, respectively.

Table 5
El Salvador: distribution of wage income by household decile, 2010, 2011 and 2015
(Percentages)

Decile	Gross income	Income by structure in 2010	Income after 2011 reform	Income after 2015 amendment
I	1.53	1.58	1.57	1.57
II	3.18	3.27	3.25	3.25
III	5.11	5.26	5.22	5.22
IV	5.77	5.93	5.90	5.89
V	6.94	7.08	7.09	7.09
VI	9.33	9.51	9.54	9.53
VII	10.07	10.25	10.23	10.23
VIII	12.51	12.68	12.65	12.65
IX	16.68	16.68	16.72	16.72
X	28.88	27.75	27.84	27.85
Poorest 40% of the population	15.59	16.04	15.94	15.93
Richest 20% of the population	45.56	44.43	44.56	44.57

Source: Prepared by the authors, on the basis of Ministry of Economic Affairs, *Encuesta de Hogares de Propósitos Múltiples 2017*, Delgado, 2018.

Evaluating the redistributive capacity of each tax structure, table 6 shows that both the 2011 reform and the 2015 amendments worsened income distribution compared to the 2010 structure. This means that the progressivity achieved was unable to improve income distribution as such and, although both initiatives had redistributive power in general —reflecting the ability of income tax to improve income distribution—, they were not enough to accomplish this.

Table 6
El Salvador: evaluation of redistributive capacity of the 2011 reform and the 2015 amendment to income tax
(Indicator points)

Indicator	Situation in 2010	Reform of 2011	Amendment of 2015
Gini index before income tax		0.3790	
Gini index after income tax	0.3714	0.3719	0.3723
Reynolds and Smolensky index	0.0081	0.0075	0.0071
Difference		-0.0006	-0.0004
"Level" effect		0.0020	0.0010
"Distance" effect		-0.0020	-0.0010
I_{RS}		0.0000	0.0000

Source: Prepared by the authors, on the basis of Ministry of Economic Affairs, *Encuesta de Hogares de Propósitos Múltiples 2017*, Delgado, 2018.
Note: I_{RS} is defined as the "distance-level" index, which shows the effect (strong or weak) of the reform on tax equity.

According to the differences in the Reynolds and Smolensky index before and after the 2011 and 2015 changes, income concentration rose in the richest 20% and fell in the poorest 40%.

The decrease in the average effective rate resulting from the broadening of the exempt bracket, as shown in table 3, produced an increase in the average income rate after tax $(1-t)$, which is reflected in a positive "level" effect and indicates that the reform improved redistributive power by increasing taxpayers' average income after the measure was introduced. However, this effect is undermined by the "distance" effect, which shows that the gaps between average incomes increase after the reform, heightening the concentration of wage income in the upper deciles. Therefore, the "distance-level" redistribution index is very close to 0, which means that the 2011 reform is classified as strongly non redistributive.

For their part, the 2015 amendments to the income tax do not improve income redistribution either. The introduction of the social security payment as a tax deduction benefited the higher-income deciles, since the amount deducted is fixed (because of the upper limit) and not progressive, which is reflected in the negative "distance" effect. Therefore, the amendment to the income tax in 2015 may also be classified as strongly non-redistributive.

These results corroborate those presented by Barreix, Bès and Roca (2009) for Costa Rica and El Salvador, which testifies to the limited effect of the income tax structure in developing countries. The study by Menkos (2013) reaches the same conclusions for El Salvador and associates the weak redistributive power with the minimal or absent changes in marginal rates, which undermines tax progressivity and redistributive ability.

The results also confirm the arguments of Arenas de Mesa (2016) and Jiménez, Gómez Sabaini and Podestá (2010), who point out that tax adjustments will be unable to generate positive redistributive changes unless they tackle the structural weaknesses of the tax. Merely expanding the tax burden is not enough, its composition must also be addressed in order to influence income distribution levels.

VI. Conclusions

The findings obtained in this research reaffirm the power of direct taxes, such as income tax, to improve vertical tax equity and the redistribution of market-determined income, which makes it a desirable measure, especially in countries, such as El Salvador, where income is highly unequal. However, income tax has played a limited role in the country, mainly because the reforms and adjustments needed to develop this potential have not been made.

The methodology used to evaluate the reform of the wage earner income tax carried out in 2011 and its subsequent amendment in 2015 isolated the real and normative effects on the tax's progressivity and redistributive power in El Salvador, drawing on the differences in traditional indices (Kakwani index and Reynolds and Smolensky index) to analyse the resulting structures. The main source of data for the research was the 2017 Multipurpose Household Survey, which suffers from methodological limitations related to lack of response, underreporting of income and undercapturing of earners, especially in the higher income brackets. Accordingly, the population's income and effective payment of the tax are underestimated, as a result of avoidance at the levels where income is concentrated owing to the survey sample design.

On this basis, it is concluded that the measures introduced by both the 2011 reform and the 2015 amendment to the income tax turned out to be weakly progressive and strongly non-redistributive. This means that these changes did not enhance the tax's power, since the position on the income distribution scale of the upper deciles, especially the richest 20%, saw no deterioration after the reforms. Furthermore, capital income continues to be afforded preferential and differential treatment, which erodes personal taxation.

The income tax policies implemented in El Salvador are measures focused on the short term, based on apparent progressivity based on an exempt bracket. This has generated a feedback loop of low taxation and income concentration. The challenge in this regard is for the administration to engage actively and autonomously in tax policy formulation. Expansion and diversification into other direct taxes, such as wealth tax, may be options to improve both tax revenues and income inequities.

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Annex A1

Calculation of monthly income tax withholding

The following taxable brackets are used to calculate the monthly income tax withholding.

1. For the situation before the 2011 reform:

Table A1.1
El Salvador: monthly income tax withholding tables, 2010
(Dollars and percentages)

Bracket	From	To	Percentage applicable	On the excess	Fixed payment
Bracket I	0.01	316.67		Exempt	
Bracket II	316.68	469.05	10	316.67	4.77
Bracket III	469.06	761.91	10	469.05	4.77
Bracket IV	761.92	1 904.69	20	761.91	60.00
Bracket V	1 904.70	Upwards	30	1 904.69	288.57

Source: Legislative Assembly of the Republic, Decree No. 134 "Ley de Impuesto sobre la Renta", *Diario Oficial*, No. 242, 21 December 1991.

2. For the 2011 reform:

Table A1.2
El Salvador: monthly income tax withholding tables, 2011
(Dollars and percentages)

Bracket	From	To	Percentage applicable	On the excess	Fixed payment
Bracket I	0.01	487.60		Exempt	
Bracket II	487.61	642.85	10	487.60	17.48
Bracket III	642.86	915.81	10	642.85	32.70
Bracket IV	915.82	2 058.67	20	915.81	60.00
Bracket V	2 058.68	Upwards	30	2 058.67	288.57

Source: Office of the President of the Republic, Decree No. 216 "Tablas de retención del impuesto sobre la renta", *Diario Oficial*, No. 240, 22 December 2011.

3. For the 2015 amendment:

Table A1.3
El Salvador: monthly income tax withholding tables, 2015
(Dollars and percentages)

Bracket	From	To	Percentage applicable	On the excess	Fixed payment
Bracket I	0.01	472.00		Exempt	
Bracket II	472.01	895.24	10	472.00	17.67
Bracket III	895.25	2 038.10	20	895.24	60.00
Bracket IV	2 038.11	Upwards	30	2 038.10	288.57

Source: Executive Organ of the Republic, Decree No. 95 "Tablas de retención del impuesto sobre la renta", *Diario Oficial*, No. 236, 22 December 2015; and J. Guzmán, personal communication, 2016.
Note: The addition of the deduction of the payment to the Salvadoran Social Security Institute (ISSS) led to the fusion of brackets II and III into a single bracket, because the additional bracket in the old structure was due to the previous upper limit of the payment.