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# Historical Trends in the Degree of Federal Income Tax Progressivity in the United States

Timothy Mathews\*

**Abstract:** The present study examines how the degree of progressivity of the U.S. Federal Income Tax has changed over time (from 1929 through 2009). Data from the Internal Revenue Service, U.S. Census Bureau, and Bureau of Economic Analysis is used to construct “tax concentration curves” and “income concentration curves” (of which the well known Lorenz Curve is an example) for each year during this time period. Based upon these curves, numerical values of several previously developed tax progressivity indices are determined for each year for the U.S. Federal Income Tax. The obtained values suggests that: (i) the degree of progressivity has varied greatly over time, (ii) taxation outcomes have become more progressive over the past four decades, (iii) the most progressive taxation outcomes of the last 67 years have been realized within the most recent decade, and (iv) recent taxation outcomes are much less progressive than were taxation outcomes before 1942.

**Keywords:** income taxation; progressivity measures; U.S. economic history.

**JEL Classification Codes:** H20; H24; N42.

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# 1 Introduction

This study provides important insights on how the degree of progressivity of the U.S. Federal Income Tax has changed over time. It builds upon existing theoretical studies which focused on alternative approaches to measuring tax progressivity. Defining Average Tax Rate as the ratio of taxes paid to income, a progressive tax is one for which Average Tax Rate increases as income increases. As noted by Kiefer (2005), while there is general agreement on this definition of progressivity, there is no such consensus regarding how to measure the degree of progressivity. For example, consider the U.S. Federal Income Tax. From an inspection of either Marginal Tax Rates or the resulting Average Tax Rates of different segments of taxpayers, this tax has clearly always been a progressive tax.<sup>1</sup> However, it is not immediately clear when this tax was “most progressive.”

Kiefer (2005) provides a concise and informative summary of the varied approaches used to quantify the degree of progressivity of a tax. The focus of the present study is broadly on indices which Kiefer termed “distributional” indices, the value of which depends upon both the tax structure and the distribution of income over the population being taxed.<sup>2</sup> More specifically, the current focus is on distributional indices defined in terms of “concentration curves” (such as the well known Lorenz Curve). The first widely used progressivity measure of this type was the index of “effective progression” developed by Musgrave and Thin (1948), defined as a function of the pre-tax and post-tax values of the Gini-Coefficient (thus, the dependence of the measure on the pre-tax and post-tax Lorenz Curves is self evident).

Subsequently, several tax progressivity indices defined in terms of the relation between an “income concentration curve” (of which the Lorenz Curve is an example) and a “tax concentration curve” were developed by Kakwani (1977b), Suits (1977), and Stroup (2005). Mathews (2012) fully characterizes the relationships between these different measures and develops a fourth previously undefined, closely related index. In Section 2, a brief overview of the definitions of these “distributional” progressivity indices (defined in terms of “income concentration and tax concentration curves”) is provided and the precise relations between the measures noted by Mathews (2012) are briefly reviewed.

Finally, data from the U.S. Internal Revenue Service, Bureau of Economic Analysis, and U.S. Census Bureau is used to determine numerical values of each progressivity index

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<sup>1</sup>Tax Foundation (2009b) reports relevant Marginal Tax Rates for each year from 1913 to 2009; the final table in Tax Foundation (2009a) summarizes the resulting Average Tax Rates for different income groups for each year from 1980 to 2007.

<sup>2</sup>In contrast, the value of a “structural” index depends upon the tax structure, but not on the distribution of income. Musgrave and Thin (1948) discuss common structural measures such as “average rate progression,” “marginal rate progression,” “liability progression,” and “residual income progression.”

for the U.S. Federal Income Tax in each year from 1929 to 2009 (the entire range of years for which the necessary data is available). The discussion of this analysis is presented within Section 3. No previous study has determined numerical progressivity index values for the U.S. Federal Income Tax over such a long time period – numerical progressivity index values were obtained for the U.S. Federal Income Tax by: Kakwani (1977b) using his measure for 1968, 1969, and 1970; Suits (1977) using his measure for 1966 and 1970; Stroup (2005) using his measure for 1980 through 2000; and Mathews (2012) using all four measures for 1987 through 2007. Thus, the present study makes a contribution by allowing for insights on the historical evolution of the degree of progressivity of the U.S. Federal Income Tax over a much longer time period.

When determining such numerical values, in practice it is necessary to define (either explicitly or implicitly) the population over which the index values are to be computed. Should the “income concentration curves” and “tax concentration curves” be constructed (and therefore the index values computed) over “all adults in society” or over “all taxpayers”? If only a relatively small fraction of the population pays the tax, then dramatically different numerical values could result from focusing on “all adults in society” versus “all taxpayers.” When attempting to gain insights over time, this issue is of particular concern if there is a drastic change in the fraction of the population subject to the tax (which has indeed been the case for the U.S. Federal Income Tax since 1929). In previous studies, index values were obtained focusing on the population of “all taxpayers,” whereas in the present study index values are computed for both the population of “all taxpayers” and “all adults in society.” Our primary aim is to determine how the degree of progressivity of the U.S. Federal Income Tax (over the entire adult population) has changed over the past century. By first obtaining values computed over only “taxpayers,” we illustrate how such an approach understates the actual degree of progressivity for society as a whole.

Both Stroup (2005) and Mathews (2012) present evidence to support a claim that U.S. Federal Income Taxation has become consistently and systematically more progressive in recent decades (Stroup focuses on the period from 1980 to 2000; Mathews focuses on the period from 1987 through 2007). The numerical index values obtained in the present study verify this observation. However, observing values since 1929, the changes over time in the degree of progressivity are much more complex. This increase in the degree of progressivity appears to have begun around 1969. Taxation outcomes became gradually less progressive between the early 1940’s and late 1960’s. In the early 1940’s there was a dramatic and sudden decrease in the degree of progressivity, resulting from a dramatic and sudden increase in the fraction of the total population having to pay the income tax.

Further, before this shift in the early 1940’s, the U.S. Federal Income Tax was significantly more progressive than it is today. These changes are discussed in much greater detail within Section 3. Section 4 briefly concludes.

## 2 Income/Tax Concentration Based Indices

This section provides a brief overview of the four “distributional” progressivity indices based upon “income concentration” and “tax concentration” curves, previously developed by Kakwani (1977b), Suits (1977), Stroup (2005), and Mathews (2012).<sup>3</sup> Consider a population of taxpayers ordered from lowest income to highest income.<sup>4</sup> Denoting an arbitrary cumulative fraction of this population by  $p$ , let  $g = x(p)$  represent their corresponding cumulative fraction of income and let  $t = w(p)$  represent their corresponding cumulative fraction of taxes paid. Alternatively, continuing to let  $g$  denote the cumulative fraction of income earned by those individuals with the lowest incomes, let  $t = y(g)$  represent the corresponding cumulative fraction of taxes paid by these individuals and let  $p = z(g)$  denote the fraction of the population consisting of these individuals.

By slightly adapting terminology developed by Kakwani (1977a), these functions can be easily described. When plotted with  $p$  on the horizontal axis,  $x(p)$  is the “income concentration curve with respect to population” (i.e., the Lorenz Curve) and  $w(p)$  is the “tax concentration curve with respect to population.” Likewise, with  $g$  on the horizontal axis,  $y(g)$  is the “tax concentration curve with respect to income” and  $z(g)$  is the “population concentration curve with respect to income.”<sup>5</sup> Conceptually, the “population concentration curve with respect to population” and the “income concentration curve with respect to income” are each a 45°-line.

For a progressive tax:  $w(p) < x(p)$  for all  $p \in (0, 1)$ ; and  $y(g) < g$  for all  $g \in (0, 1)$ . Figures 1 and 2 illustrate these four curves. Within Figure 1:  $A$  is the area between the

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<sup>3</sup>Two such measures of this type were also developed by Khetan and Poddar (1976), but as noted in Mathews (2012), the two measures of Khetan and Poddar can be expressed as monotonic transformations of the measures developed by Suits (1977) and Stroup (2005)

<sup>4</sup>The overall presentation in this section draws heavily upon the discussion in Mathews (2012).

<sup>5</sup>If Kakwani’s original terminology were used,  $x(p)$  would be the “concentration curve of income,”  $w(p)$  would be the “concentration curve of taxes,”  $y(g)$  would be the “relative concentration curve of taxes with respect to income,” and  $z(g)$  would be the “relative concentration curve of population with respect to income.” When defining each progressivity index, the variable with respect to which a concentration curve is drawn is of critical importance. To avoid confusion the terminology adopted here explicitly states both variables underlying the construction of each curve. Note, when constructing each curve, successively larger fractions of the population are always included based upon levels of income.

“population concentration curve with respect to population” and the “income concentration curve with respect to population”;  $B$  is the area between the “income concentration curve with respect to population” and the “tax concentration curve with respect to population”; and  $C$  is the area below the “tax concentration curve with respect to population.” In Figure 2:  $D$  is the area between the “income concentration curve with respect to income” and the “tax concentration curve with respect to income”;  $E$  is the area below the “tax concentration curve with respect to income”; and  $F$  is the area below the “population concentration curve with respect to income” and the “income concentration curve with respect to income.”

The measures of Kakwani (1977b), Suits (1977), Stroup (2005), and Mathews (2012) are defined in terms of these areas: Kakwani’s measure is  $K = \frac{B}{A+B+C}$  (the ratio of the “area between the income concentration curve with respect to population and the tax concentration curve with respect to population” to the “entire area below the population concentration curve with respect to population”); Suits’ measure is  $S = \frac{D}{D+E}$  (the ratio of the “area between the income concentration curve with respect to income and the tax concentration curve with respect to income” to the “entire area below the income concentration curve with respect to income”); Stroup’s measure is  $St = \frac{B}{B+C}$  (the ratio of the “area between the income concentration curve with respect to population and the tax concentration curve with respect to population” to the “entire area below the income concentration curve with respect to population”); and Mathews’ measure is  $M = \frac{D}{D+E+F}$  (the ratio of the “area between the income concentration curve with respect to income and the tax concentration curve with respect to income” to the “entire area below the population concentration curve with respect to income”).

As fully described in Mathews (2012), these four indices are closely related to one another. Table 1 summarizes the relationships between these measures. Each index is fundamentally a ratio in which the antecedent (or first term in the ratio) is the weighted difference between cumulative fraction of income and cumulative fraction of taxes paid ( $x(p) - w(p)$ ) to a similarly weighted consequent (or second term in the ratio). Two different approaches are taken regarding the choice of the consequent:  $S$  and  $St$  each focus on the ratio of the weighted value of this difference (i.e.,  $x(p) - w(p)$ ) to a similarly weighted value of cumulative fraction of income over the population (i.e.,  $x(p)$ ), while  $K$  and  $M$  focus on the ratio of the weighted value of this difference (i.e.,  $x(p) - w(p)$ ) to a similarly weighted value of population (i.e.,  $p$ ). Further, two different approaches are taken regarding how to weight each term in this ratio:  $K$  and  $St$  are constructed by placing equal weight on each segment of the population, while  $M$  and  $S$  are constructed by weighting each segment of

the population according to that segment’s marginal contribution to cumulative fraction of income (i.e.,  $x'(p)$ ).

All four indices exhibit several common properties, allowing for similar interpretations. For example, under a proportional tax  $w(p) = x(p)$  and  $y(g) = g$ , so that  $B = D = 0$ . As a result, the value of each index is zero. In contrast, for a progressive tax  $w(p) < x(p)$  and  $y(g) < g$ , so that  $B > 0$  and  $D > 0$ . This makes the value of each index strictly positive.

Further, for each index, a larger value indicates more progressive taxation. Fixing the distribution of income,  $K$  and  $St$  increase if and only if  $B$  increases, while  $S$  and  $M$  increase if and only if  $D$  increases.<sup>6</sup> An increase in  $B$  or  $D$  is consistent with the gap between cumulative fraction of income earned and cumulative fraction of taxes paid becoming larger, which intuitively accords with taxation that is more progressive. For example (with the distribution of income fixed), consider a change in tax structure which does not alter the total amount of tax revenue generated, but results in a reduction of total tax dollars paid by some arbitrarily chosen group of taxpayers and an increase in total tax dollars paid by taxpayers with higher incomes (relative to the initial group of taxpayers). Intuitively, this change clearly makes the tax structure more progressive. Since the distribution of income is unaltered, this change does not have any impact on  $x(p)$  or  $z(g)$ , but does lead to a decrease in both  $w(p)$  and  $y(g)$  (weakly over the entire range of  $p$  or  $g$ ; strictly over the upper range of  $p$  or  $g$ ). Further, both  $B$  and  $D$  increase, while  $A$ ,  $B + C$ ,  $D + E$ , and  $F$  each remain constant. This leads to an increase in the value of each index.

### 3 Numerical Values of Indices

Focusing on the U.S. Federal Income Tax, numerical values for  $K$ ,  $S$ ,  $St$ , and  $M$  have been determined for every year between 1929 and 2009. To obtain these index values, it was necessary to construct a “tax concentration curve with respect to population” ( $w(p)$ ), an “income concentration curve with respect to population” ( $x(p)$ ), a “tax concentration curve with respect to income” ( $y(g)$ ), and a “population concentration curve with respect to income” ( $z(g)$ ) for each year.

The bulk of the data used to construct these curves was obtained from the Internal

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<sup>6</sup>In practice, the distribution of income also changes over time, so that two measures may possibly move in opposite directions from one time period to the next. For example, when focusing on  $K$  and  $S$ , Formby, Seaks, and Smith (1981) noted how “inconsistent rankings can emerge when the distribution of pre-tax income is not fixed,” an observation illustrated by their empirical finding that “in three instances  $K$  and  $S$  move in opposite directions,” prompting them to state “the Suits and Kakwani indices, although identical in intent, are fundamentally different measures of tax progression” (pp. 1018-1019).

Revenue Service’s “Statistics of Income” report for each relevant year.<sup>7</sup> Each such report contains data summarizing the number of tax returns filed, the amount of income represented on the filed tax returns, and the amount of taxes paid (broken down by income levels of taxpayers). For example, the data summarized in Table 3 on Pages 70-71 of the “Statistics of Income for 1933” show that in this year a total of 3,723,558 returns were filed, and that the people filing these returns had a combined net income of \$11,008,637,754 and had to pay a total of \$374,120,469 in Federal Income Taxes.<sup>8</sup> As an example of how this data is further broken down by taxpayer income levels, Table 3 of the “Statistics of Income for 1933” reveals that in this year people with net incomes of \$2,000 or less collectively filed a total of 1,878,393 returns, had a combined net income of \$2,358,075,653, and had a combined tax obligation of \$10,441,862.

When constructing concentration curves, it is necessary to define (explicitly or implicitly) the population over which the index values are to be determined. If the population of interest is simply those people filing tax returns, then the curves and index values can be determined from solely the data available in the “Statistics of Income” reports. This is the approach taken previously by Kakwani (1977b), Suits (1977), Stroup (2005), and Mathews (2012). However, if the true desire is a measure of the degree of progressivity over the entire adult population, then focusing on only those individuals filing returns has some shortcomings. First, if individuals with incomes below a certain level are not even required to file a return (as has always been the case for the U.S. Federal Income Tax), then this approach ultimately understates (at each point in time) the degree of progressivity in any single year. Further, if the fraction of adults required to file returns changes dramatically over time, then focusing only on this restricted population could give misleading results when attempting to gain insight on how the degree of progressivity has changed over time.

To determine the extent to which such concerns are potentially an issue and to ultimately be able to construct index values which measure progressivity over the entire adult population, additional data was acquired. Data on Personal Income was obtained for each year from the Bureau of Economic Analysis.<sup>9</sup> Estimated values of the adult population of the U.S. in each year were obtained from the U.S. Census Bureau.<sup>10</sup> Returning attention to the “Statistics of Income Reports,” the total number of adults represented on all filed

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<sup>7</sup>All reports can be accessed through <http://www.irs.gov/taxstats/article/0,,id=223808,00.html>. For example, “Statistics of Income for 1933” is available at <http://www.irs.gov/pub/irs-soi/33soirepar.pdf>.

<sup>8</sup>Table 2 in the present study provides a summary of these values (as well as the values of several other variables of interest) for the time period under consideration. In the interest of brevity, these values are reported for only every other year between 1929 and 2009.

<sup>9</sup>See Table 2.1 of the reports at <http://www.bea.gov/national/nipaweb/SelectTable.asp?Selected=N>.

<sup>10</sup>These figures were compiled from reports available at <http://www.census.gov/popest/data/historical/index.html>.



tax returns was determined in each year, and the percentage of all adults represented on a filed tax return was determined in each year. From Table 2, we see that, over time, the value of this figure has changed dramatically (see the column labeled “Percentage of Adults on Returns” in Table 2): before 1937, less than 10% of all adults were represented on a filed tax return, whereas the corresponding figure has been over 75% since 1945.<sup>11</sup> If our aim is to accurately determine how the degree of tax progressivity has changed over this entire time period, we cannot focus solely on individuals filing tax returns (since such a comparison between years in which there was a significant difference in the fraction of adults represented on tax returns could potentially be misleading).

Following an approach first used by Suits (1977), each of the four concentration curves for each year is constructed as a piecewise linear function passing through each relevant pair of values (along with the implicit endpoints of  $(0, 0)$  and  $(1, 1)$ ). For the resulting piecewise linear concentration curves, the relevant Areas  $A$ ,  $B$ ,  $C$ ,  $D$ ,  $E$ , and  $F$  each consist of a collection of triangles and trapezoids. It is subsequently straightforward to determine numerical values of  $St$ ,  $S$ ,  $K$ , and  $M$  in each year.

Even though the ultimate goal is to gain insight on the degree of progressivity over the entire adult population, we start by constructing each relevant curve and determining each index value focusing only on individuals filing tax returns (i.e., without using the data from the Bureau of Economic Analysis and U.S. Census Bureau to include those individuals not represented on filed tax returns). By first obtaining these results, we can ultimately gain insight into how the degree of progressivity over the entire adult population would be understated if we did not account for the fact that the population of adults filing tax returns is not the same as the entire adult population. The numerical index values from this analysis are reported in Table 3 and plotted over time in Figure 3.

From the values in Table 3, we see that  $St$ ,  $K$ , and  $M$  identify 1969 and  $S$  identifies 1970 as the year in which the U.S. Federal Income Tax was least progressive. Further, all four measures identify 1969 and 1970 as the two years in which outcomes were least progressive. There is somewhat less agreement over the four measures in regards to precisely when taxation outcomes were most progressive.  $St$  identifies 1929,  $S$  identifies 1931, and  $K$  and  $M$  each identify 1940 as the year in which the U.S. Federal Income Tax was most progressive. However, each of the four measures reveals a striking difference in the degree of progressivity before and after 1942. For each index, the lowest realized value between 1929 and 1941 is greater than the highest realized value between 1942 and 2009.

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<sup>11</sup>Although not reported in Table 2, the “Percentage of Adults on Returns” was 8.99% in 1936 and 73.36% in 1944.

Consistent with previous studies, over the course of the last several decades there does appear to be a trend toward taxation outcomes becoming more progressive. The numerical values reported in Table 3 (along with a visual inspection of Figure 3) suggest that the previous observation of taxation becoming more progressive in recent decades is a trend that began in the late 1960's and that the most progressive taxation outcomes of the past half century have been realized in recent years. Focusing on the period from 1951 onward, each progressivity index achieved its largest value in 2009.

Again, in order to compute index values over the entire adult population, additional data was needed (on Total Adult Population and Total Societal Income). Once these additional data were obtained, the necessary concentration curves could be constructed over the entire adult population. When constructing the concentration curves that depend upon income (i.e.,  $x(p)$ ,  $y(g)$ , and  $z(g)$ ), the “residual income of society” or “income not represented on filed tax returns” was allocated equally across the entire adult population of society. As an example, consider 1943. In this year there were a total of 43,506,553 tax returns filed, covering 65,738,182 adults. Based upon U.S. Census Bureau estimates, the total adult population in this year was 95,837,053. Thus, roughly 31.41% of the adult population was *not* represented on a filed tax return (and therefore did not pay any income taxes). As a result, the “starting point” for  $w(p)$  (i.e., the tax concentration curve with respect to population) is the point  $(.3141, 0)$ . Further, the individuals filing tax returns had a combined net income of \$99,209,862,000, while total societal income (i.e., the value of Personal Income as reported by the Bureau of Economic Analysis) was approximately \$152,100,000,000. Thus, the residual income of society in this year was \$52,890,138,000 (roughly 34.77% of total societal income). When this residual income is allocated equally over all adults in society it follows that the 31.41% of the population not filing tax returns collectively accounted for  $(.3141)(.3477) \approx .1092$  of total societal income. As a result, the first segment of the approximated piecewise linear function  $x(p)$  (i.e., the income concentration curve with respect to population) extends from the origin through the point  $(.3141, .1092)$ . Following this approach, each of the four concentration curves was constructed in each year, from which a numerical value of each progressivity index was calculated in each year. The numerical index values from this approach are reported in Table 4 and plotted in Figure 4.

Note that each value in Table 4 is indeed greater than the corresponding value in Table 3. This illustrates how the degree of progressivity over the entire population is understated if attention is restricted to individuals filing tax returns. However, even though the results in Table 3 understate the true degree of progressivity, many insights similar to those acquired from the results in Table 3 emerge from an inspection of the results in Table 4. For

example, from the results in Table 4 each progressivity index identifies 1969 as the year in which taxation was least progressive. Further, it appears as if the general tendency of taxation outcomes becoming increasingly more progressive since the late 1960's is even more pronounced when focusing on the index values computed over the entire population (the time series illustrated in Figure 4) than when focusing on index values computed over only individuals filing tax returns (the time series illustrated in Figure 3).

Additionally, the most progressive taxation outcomes of the last 67 years have been realized within the most recent decade. More precisely, each of the four indices took on a larger value in 2009 than in any other year since 1943. Comparing the recent realized value of each index to its corresponding median value (from 1929 to 2009) reveals that the most recently realized taxation outcomes are more progressive than the average. From the results reported in Table 4, we see that  $S$ ,  $K$ , and  $M$  have each realized a value greater than their respective median in every single year from 2001 onward, while  $St$  has realized a value above its median in every single year from 1991 onward.

However, taxation outcomes in recent years are clearly not the most progressive outcomes over the entire history of the U.S. Federal Income Tax. As revealed by the results in both Table 3 and Table 4 (and dramatically illustrated in both Figure 3 and Figure 4), taxation was much more progressive in every year before 1942 than at any time since.<sup>12</sup> Perhaps most illuminating from Table 4 is the extreme degree of progressivity realized in the 1930's. Three of the four indices ( $S$ ,  $K$ , and  $M$ ) identify 1931 as the year in which taxation was most progressive (while  $St$  again identifies 1929 as the year of most progressive taxation). For  $M$ , the maximum value (of .79023 in 1931) is more than twice as large as its maximum value from 1943 onward (of .37617 in 2009). For  $S$  and  $K$ , the maximum values (of .95006 and .79509 respectively, both realized in 1931) are 1.79 times and 1.85 times greater than their respective maximum values from 1943 onward (of .53129 and .42878 respectively, both realized in 2009). Finally, for  $St$ , the maximum value (of .99796 in 1929) is 1.37 times greater than its maximum value from 1943 onward (of .72968 in 2009).

The extreme degree of progressivity prior to the 1940's is further illustrated by noting that the maximum possible value of each index (by construction) is a value of one.<sup>13</sup> Between 1929 and 1939, both  $St$  and  $S$  realized values relatively close to this maximum

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<sup>12</sup>On some level this result is to be expected, since the percentage of adults represented on filed tax returns was drastically lower before this year than after this year (as summarized in Table 2).

<sup>13</sup>As fully described in Mathews (2012), when altering the tax burden over different segments of society, both  $St$  and  $S$  can each achieve this maximum value of one for any fixed distribution of income. In contrast, "variation in the distribution of societal income...places upper limits on both  $M$  and  $K$  that are strictly less than 1" (pp. 8).

possible value of one in each year – over this time period the value of  $St$  was greater than or equal to .98480 and the value of  $S$  was greater than or equal to .90970 in each year.

Finally, the values in Table 4 reveal the great extent to which the degree of progressivity of this tax has varied over time. The largest reported value: of  $St$  is roughly 2.2953 times greater than its smallest reported value; of  $S$  is roughly 2.9521 times greater than its smallest reported value; of  $K$  is roughly 3.0798 times greater than its smallest reported value; and of  $M$  is roughly 3.4530 times greater than its smallest reported value.

## 4 Summary and Conclusions

Building on previous research focused on alternative approaches to measuring the degree of progressivity of a tax, the present study examined how the degree of progressivity of the U.S. Federal Income Tax has changed over time. After briefly reviewing the construction of four previously developed “distributional indices” defined in terms of “income concentration and tax concentration curves,” numerical values of progressivity indices were determined for the U.S. Federal Income Tax for every year from 1929 to 2009.

When measuring tax progressivity, it is necessary to specify the population over which index values are computed. Previous studies computed index values over solely the population of individuals filing tax returns. The primary aim of the present study is to measure (and observe changes in) the degree of tax progressivity over the entire adult population. In addition to using data from the Internal Revenue Service’s “Statistics of Income” reports, data on total adult population and total societal income (from the U.S. Census Bureau and Bureau of Economic Analysis) was used to adjust for the fact that the entire adult population is not the same as the population filing tax returns. If such adjustments are not made, then the obtained numerical values understate the true degree of tax progressivity. Index values were obtained both without making and with making such adjustments, to illustrate that such an understating of the degree of progressivity does in fact occur when using only data associated with people filing tax returns (as was done in previous studies).

Focusing on the period from 1980 to 2000 and the period from 1987 to 2007 respectively, Stroup (2005) and Mathews (2012) showed that taxation outcomes have become more progressive in recent decades. However, no previous study determined progressivity index values for the U.S. Federal Income Tax over the longer time period considered here. The results of the present study suggest that this previously observed trend toward greater progressivity began in the late 1960’s, at a time when taxation outcomes were less progressive than at any other time since 1929. While taxation outcomes have been more

progressive in the past decade than at any other time since the early-1940's, the degree of progressivity is not at an all time high. Income taxation was much more progressive before 1942 than it is today. In fact, during the 1930's two of the four indices realized values relatively close to their upper bound. Finally, the variation in the value of each index since 1929 reveals the great extent to which the degree of progressivity of the U.S. Federal Income Tax has changed over time. Many of these observations could not possibly be made by Stroup (2005) or Mathews (2012), since they only examined taxation outcomes over a much shorter period of time.

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**Table 1: Summary of Relations between the Four Different Indices**

		<i>Each Segment of the Population Weighted...</i>	
		Equally	by Marginal Contribution to Cumulative Income [ $x'(p)$ ]
<i>Ratio of the Difference Between Income and Taxes Paid to...</i>	Income [ $x(p)$ ]	$St = \frac{B}{B + C}$	$S = \frac{D}{D + E}$
	Population [ $p$ ]	$K = \frac{B}{A + B + C}$	$M = \frac{D}{D + E + F}$

**Table 2: Characteristics of Entire Population and Taxpayers**

Year	Number of Returns	Adults Represented on Returns	Total Adult Population	Percentage of Adults on Returns	Income Represented on Returns (millions of \$)	Total Societal Income (millions of \$)	Total Taxes Paid (millions of \$)	Taxes Paid as a percentage of Societal Income
1929	4,044,327	5,901,926	78,619,000	7.507	24,800.74	84,900	1,001.94	1.180
1931	3,225,924	4,635,290	81,209,172	5.708	13,605.00	65,200	246.13	0.377
1933	3,723,558	5,494,891	83,392,142	6.589	11,008.64	46,800	374.12	0.799
1935	4,575,012	6,675,038	85,698,080	7.789	14,909.81	60,300	657.44	1.090
1937	6,350,148	9,132,970	87,876,551	10.393	21,238.57	74,100	1,141.57	1.541
1939	7,570,320	10,894,018	90,311,164	12.063	22,938.92	72,900	890.93	1.222
1941	25,770,089	39,908,842	93,135,825	42.850	58,527.22	96,000	3,815.42	3.974
1943	43,506,553	65,738,182	95,837,053	68.594	99,209.86	152,100	16,974.23	11.160
1945	49,750,991	74,631,339	98,372,755	75.866	120,301.13	171,600	17,050.38	9.936
1947	54,799,936	81,288,966	100,723,315	80.705	150,295.28	190,900	18,076.28	9.469
1949	51,301,910	82,169,845	103,444,722	79.434	161,373.21	207,000	14,538.14	7.023
1951	55,042,597	87,545,182	106,048,368	82.552	203,097.03	257,900	24,438.74	9.476
1953	57,415,885	91,566,023	108,053,025	84.742	229,863.41	291,700	29,656.67	10.167
1955	57,818,164	93,115,608	110,192,874	84.502	249,429.18	316,000	29,613.72	9.371
1957	59,407,673	95,953,192	112,514,204	85.281	281,308.43	358,500	34,393.64	9.594
1959	59,838,162	96,798,855	114,779,195	84.335	306,616.92	392,300	38,645.30	9.851
1961	61,067,589	97,447,864	117,900,175	82.653	330,935.74	428,800	42,225.50	9.847
1963	63,511,244	101,007,468	120,822,242	83.600	370,270.62	479,500	48,203.58	10.053
1965	67,198,928	106,245,102	124,572,108	85.288	430,663.21	555,500	49,529.70	8.916
1967	71,282,524	111,784,150	128,784,895	86.799	506,641.75	648,100	62,919.96	9.708
1969	75,375,731	118,373,426	132,904,639	89.066	605,574.00	778,300	86,570.00	11.123
1971	74,146,785	116,610,979	137,852,263	84.591	676,334.16	903,100	85,397.55	9.465
1973	80,248,984	123,842,306	143,144,603	86.516	830,653.26	1,110,500	108,068.05	9.731
1975	81,585,541	125,342,139	148,805,353	84.232	954,089.43	1,334,900	124,511.77	9.327
1977	86,066,23	129,781,866	154,776,287	83.851	1,165,776.87	1,632,500	159,746.44	9.785
1979	92,152,198	136,745,013	160,950,041	84.961	1,474,781.37	2,059,500	214,424.05	10.411
1981	94,586,878	139,896,873	166,753,445	83.894	1,791,115.52	2,582,300	283,993.05	10.998
1983	95,330,713	141,152,582	171,741,042	82.189	1,969,599.86	2,952,200	274,055.71	9.283
1985	100,625,484	147,819,514	175,842,487	84.064	2,343,988.82	3,496,700	325,524.86	9.309
1987	106,154,761	153,441,887	179,747,130	85.365	2,813,727.90	3,924,400	369,046.18	9.404
1989	111,312,721	159,001,961	183,885,403	86.468	3,298,857.99	4,557,500	432,837.75	9.497
1991	113,804,104	162,091,174	188,184,628	86.134	3,516,141.52	5,031,500	448,348.65	8.911
1993	113,681,387	161,572,504	192,669,718	83.860	3,775,577.61	5,568,100	502,719.91	9.029
1995	117,274,186	165,941,734	197,093,059	84.195	4,244,607.26	6,200,900	588,331.07	9.488
1997	121,503,285	170,332,286	201,995,309	84.325	5,023,457.04	7,000,700	731,210.04	10.445
1999	126,008,974	175,484,446	207,348,336	84.633	5,909,328.56	7,910,800	877,292.22	11.090
2001	128,817,051	179,385,013	212,345,162	84.478	6,241,035.55	8,883,300	887,881.82	9.995
2003	128,609,786	179,567,821	217,068,101	82.724	6,287,586.38	9,378,100	747,938.91	7.975
2005	132,611,637	184,588,398	222,003,984	83.146	7,507,958.69	10,485,900	934,702.40	8.914
2007	141,070,971	194,565,001	227,239,768	85.621	8,798,500.33	11,912,300	1,115,661.33	9.366
2009	137,982,203	190,748,825	232,458,335	82.057	7,825,389.18	12,174,900	865,863.32	9.366

**Table 3: Progressivity Indices, Calculated over Adults Filing Returns**

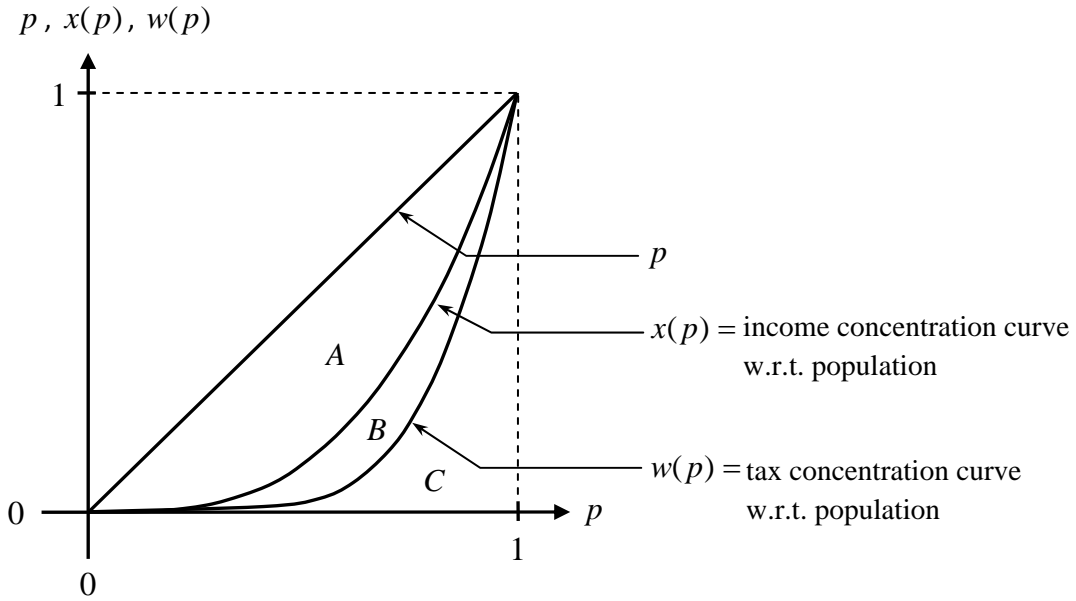
Year	<i>St</i>	<i>S</i>	<i>K</i>	<i>M</i>	Year	<i>St</i>	<i>S</i>	<i>K</i>	<i>M</i>
1929	0.95543	0.69442	0.41779	0.44437	1969	0.29775	0.22411	0.16090	0.15354
1930	0.91844	0.74235	0.46518	0.49705	1970	0.30104	0.22341	0.16621	0.15431
1931	0.91343	0.77075	0.49209	0.52745	1971	0.33078	0.24442	0.18195	0.16857
1932	0.79676	0.67543	0.45150	0.47123	1972	0.34311	0.25316	0.18745	0.17416
1933	0.84604	0.70637	0.46572	0.48731	1973	0.32790	0.24029	0.17784	0.16485
1934	0.88084	0.75126	0.49044	0.52055	1974	0.32111	0.23521	0.17348	0.16113
1935	0.88504	0.74956	0.48806	0.51745	1975	0.36243	0.26347	0.19590	0.18052
1936	0.89002	0.73207	0.46633	0.49597	1976	0.37299	0.27271	0.20140	0.18678
1937	0.87996	0.74160	0.48364	0.51132	1977	0.39031	0.28313	0.21013	0.19371
1938	0.86406	0.74584	0.50372	0.52634	1978	0.37407	0.26958	0.20082	0.18425
1939	0.84992	0.74010	0.50525	0.52656	1979	0.37507	0.27138	0.20076	0.18528
1940	0.84523	0.75721	0.53776	0.55523	1980	0.36287	0.26033	0.19282	0.17726
1941	0.69505	0.60233	0.51204	0.47679	1981	0.34544	0.24513	0.18411	0.16709
1942	0.51896	0.43716	0.37903	0.34432	1982	0.34948	0.24818	0.18555	0.16894
1943	0.44302	0.36347	0.30974	0.27941	1983	0.35977	0.25675	0.18917	0.17417
1944	0.41102	0.32470	0.23818	0.22858	1984	0.36417	0.26141	0.19042	0.17697
1945	0.43724	0.33991	0.24554	0.23631	1985	0.36847	0.26279	0.19110	0.17740
1946	0.48390	0.38180	0.27427	0.26640	1986	0.39329	0.28011	0.19896	0.18747
1947	0.42725	0.34207	0.25061	0.24201	1987	0.38466	0.26353	0.18708	0.17410
1948	0.46997	0.37295	0.27244	0.26259	1988	0.38411	0.24969	0.17902	0.16277
1949	0.46473	0.36708	0.27047	0.25887	1989	0.36920	0.23851	0.17318	0.15579
1950	0.46756	0.36973	0.26889	0.25948	1990	0.36830	0.23839	0.17348	0.15592
1951	0.40621	0.31879	0.23495	0.22425	1991	0.37904	0.25003	0.18015	0.16398
1952	0.37483	0.29217	0.21801	0.20599	1992	0.40056	0.26288	0.18752	0.17161
1953	0.34991	0.27183	0.20460	0.19206	1993	0.42075	0.28378	0.19733	0.18536
1954	0.37441	0.29023	0.21646	0.20412	1994	0.42298	0.28415	0.19796	0.18548
1955	0.36469	0.28257	0.20924	0.19812	1995	0.43059	0.28711	0.19796	0.18640
1956	0.35122	0.27144	0.20180	0.19043	1996	0.44158	0.28901	0.19788	0.18623
1957	0.33959	0.26219	0.19528	0.18400	1997	0.44178	0.28129	0.19439	0.18032
1958	0.34370	0.26281	0.19567	0.18370	1998	0.45519	0.28559	0.19741	0.18233
1959	0.33520	0.25627	0.18936	0.17858	1999	0.46459	0.28753	0.19697	0.18244
1960	0.32182	0.24540	0.18226	0.17118	2000	0.46746	0.28170	0.19438	0.17782
1961	0.32701	0.24885	0.18322	0.17285	2001	0.46429	0.29386	0.20375	0.18823
1962	0.31032	0.23547	0.17364	0.16347	2002	0.49574	0.32343	0.22304	0.20865
1963	0.30683	0.23262	0.17112	0.16128	2003	0.49143	0.31602	0.21865	0.20322
1964	0.33054	0.24977	0.18378	0.17297	2004	0.50343	0.31288	0.21611	0.19919
1965	0.33646	0.25601	0.18490	0.17650	2005	0.51546	0.30876	0.21282	0.19454
1966	0.32325	0.24571	0.17662	0.16903	2006	0.51369	0.30127	0.20832	0.18895
1967	0.32156	0.24414	0.17448	0.16752	2007	0.51361	0.29564	0.20504	0.18468
1968	0.31561	0.23872	0.16974	0.16327	2008	0.52016	0.31476	0.21641	0.19872
					2009	0.55681	0.35906	0.24321	0.22969
<i>Minimum</i>						0.29775	0.22341	0.16090	0.15354
<i>(Year of Min.)</i>						(1969)	(1970)	(1969)	(1969)
<i>Maximum</i>						0.95543	0.77075	0.53776	0.55523
<i>(Year of Max.)</i>						(1929)	(1931)	(1940)	(1940)
<i>Median</i>						0.40056	0.28313	0.20076	0.18623



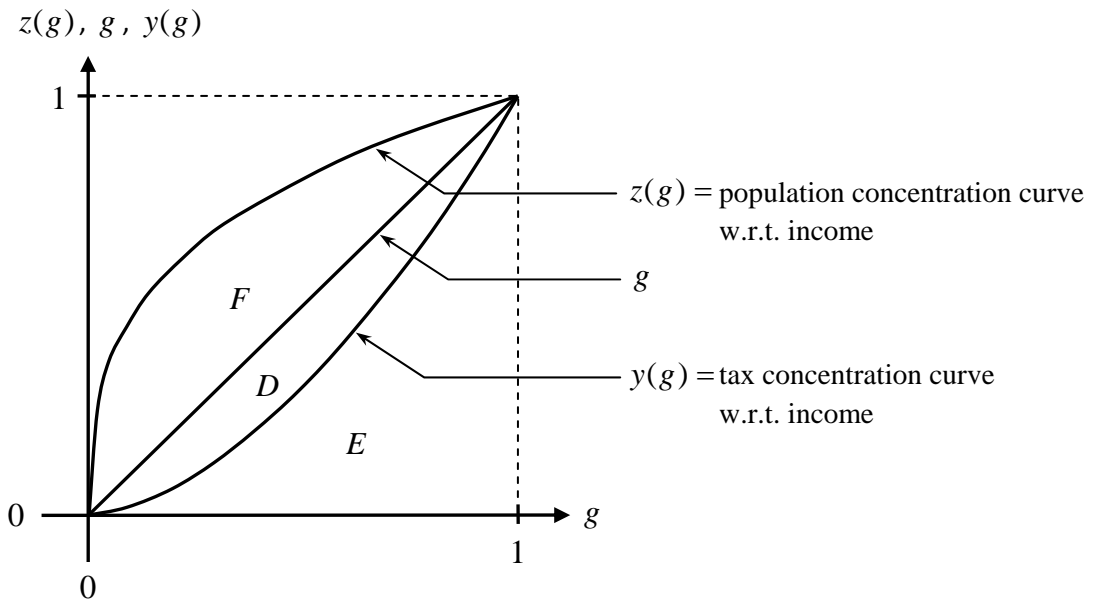
**Table 4: Progressivity Indices, Calculated over Entire Adult Population**

Year	<i>St</i>	<i>S</i>	<i>K</i>	<i>M</i>	Year	<i>St</i>	<i>S</i>	<i>K</i>	<i>M</i>
1929	0.99796	0.90970	0.71601	0.70930	1969	0.43479	0.32182	0.25816	0.22885
1930	0.99634	0.93651	0.76732	0.76148	1970	0.45013	0.33203	0.27083	0.23745
1931	0.99666	0.95006	0.79509	0.79023	1971	0.48063	0.35595	0.28817	0.25417
1932	0.98969	0.91806	0.76761	0.74981	1972	0.48706	0.36126	0.29104	0.25759
1933	0.99278	0.92666	0.76772	0.75541	1973	0.47700	0.35227	0.28762	0.25215
1934	0.99385	0.93711	0.76644	0.76261	1974	0.47315	0.34905	0.28606	0.25014
1935	0.99353	0.93436	0.75842	0.75556	1975	0.52467	0.39078	0.32040	0.28127
1936	0.99293	0.92112	0.72757	0.72687	1976	0.53022	0.39657	0.32277	0.28505
1937	0.99060	0.92105	0.72289	0.72509	1977	0.54751	0.40939	0.33303	0.29416
1938	0.98921	0.92483	0.73526	0.73590	1978	0.53456	0.39755	0.32643	0.28614
1939	0.98480	0.91084	0.69714	0.70493	1979	0.53376	0.39756	0.32537	0.28593
1940	0.96106	0.87485	0.58402	0.62834	1980	0.53222	0.39363	0.32442	0.28309
1941	0.83483	0.71998	0.48653	0.50803	1981	0.52529	0.38674	0.32385	0.27954
1942	0.67177	0.56500	0.43141	0.41611	1982	0.53915	0.39832	0.33407	0.28856
1943	0.59562	0.49193	0.39343	0.36726	1983	0.55456	0.41204	0.34447	0.29883
1944	0.57975	0.45086	0.34541	0.32108	1984	0.55600	0.41587	0.34784	0.30258
1945	0.59882	0.46557	0.35786	0.33198	1985	0.55727	0.41505	0.34658	0.30118
1946	0.60329	0.47726	0.35447	0.33790	1986	0.57532	0.42657	0.34947	0.30632
1947	0.53684	0.42434	0.31427	0.29997	1987	0.56006	0.39966	0.32522	0.28159
1948	0.57610	0.45564	0.33454	0.32103	1988	0.55693	0.38130	0.31081	0.26444
1949	0.57396	0.45205	0.33336	0.31853	1989	0.55095	0.37815	0.31390	0.26439
1950	0.57329	0.45185	0.33166	0.31787	1990	0.55479	0.38358	0.32067	0.26975
1951	0.51824	0.40329	0.30499	0.28572	1991	0.56713	0.39934	0.33305	0.28267
1952	0.49093	0.37908	0.29242	0.26993	1992	0.59477	0.41901	0.34672	0.29569
1953	0.46532	0.35791	0.28033	0.25609	1993	0.61295	0.44101	0.36079	0.31247
1954	0.49386	0.37940	0.29288	0.26966	1994	0.61691	0.44374	0.36381	0.31465
1955	0.48088	0.36881	0.28534	0.26220	1995	0.62028	0.44248	0.36004	0.31170
1956	0.46743	0.35735	0.27850	0.25448	1996	0.62801	0.44090	0.35564	0.30752
1957	0.46034	0.35132	0.27626	0.25097	1997	0.62250	0.42578	0.34156	0.29337
1958	0.47801	0.36246	0.28696	0.25896	1998	0.62991	0.42622	0.33994	0.29186
1959	0.46389	0.34953	0.27405	0.24803	1999	0.63129	0.41918	0.32892	0.28343
1960	0.45835	0.34463	0.27402	0.24579	2000	0.63459	0.41401	0.32642	0.27868
1961	0.46782	0.34915	0.27397	0.24686	2001	0.64402	0.44482	0.35930	0.30845
1962	0.45658	0.33916	0.26914	0.24045	2002	0.67291	0.48193	0.38917	0.33899
1963	0.45020	0.33380	0.26465	0.23638	2003	0.67521	0.47974	0.38913	0.33697
1964	0.46619	0.34802	0.27503	0.24682	2004	0.68143	0.47022	0.37756	0.32520
1965	0.47117	0.35331	0.27710	0.25024	2005	0.68603	0.45783	0.36345	0.31141
1966	0.45734	0.34184	0.26937	0.24226	2006	0.68468	0.45021	0.35890	0.30506
1967	0.45514	0.33938	0.26691	0.24009	2007	0.67645	0.43630	0.34760	0.29358
1968	0.45056	0.33462	0.26412	0.23668	2008	0.69952	0.48043	0.38981	0.33300
					2009	0.72968	0.53129	0.42878	0.37617
<i>Minimum</i>						0.43479	0.32182	0.25816	0.22885
<i>(Year of Min.)</i>						(1969)	(1969)	(1969)	(1969)
<i>Maximum</i>						0.99796	0.95006	0.79509	0.79023
<i>(Year of Max.)</i>						(1929)	(1931)	(1931)	(1931)
<i>Median</i>						0.56713	0.41587	0.33336	0.29358

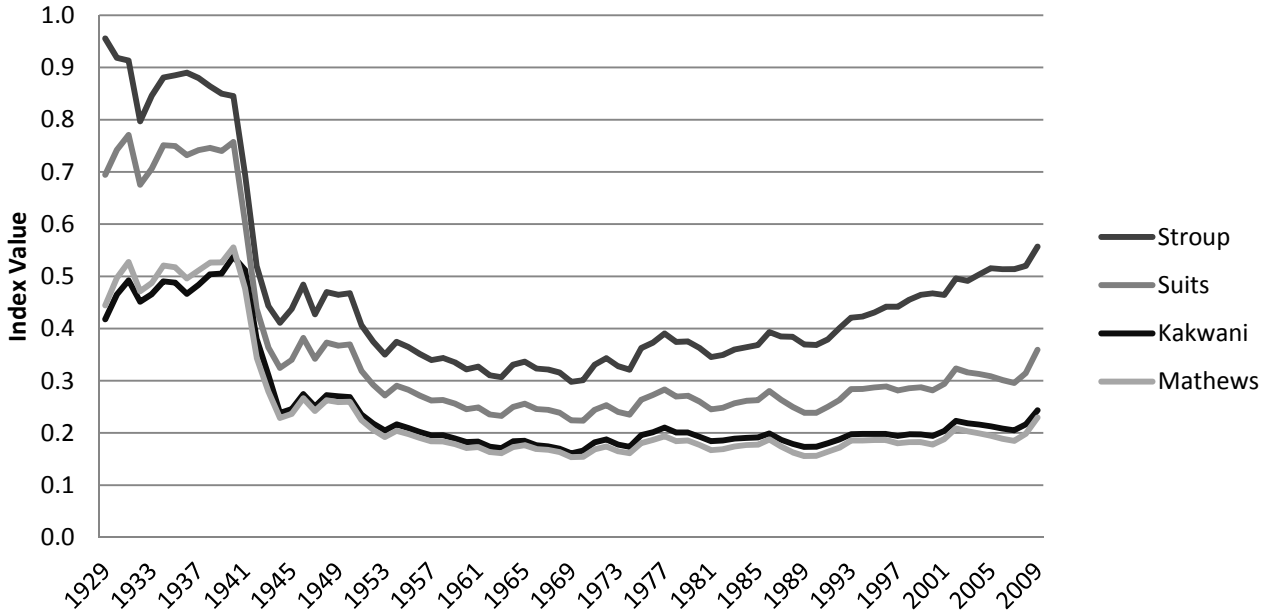
**Figure 1: Concentration Curves with Respect to Population**



**Figure 2: Concentration Curves with Respect to Income**



**Figure 3: Progressivity Indices, Calculated over Adults Filing Returns**



**Figure 4: Progressivity Indices, Calculated over Entire Adult Population**

