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MEASUREMENT OF TAX PROGRESSIVITY IN PAKISTAN BASED ON MACRO DATA

Ayesha NAZ* and Eatzaz AHMAD**

Abstract

This study generalises the tax progressivity index given in Kakinaka and Pereira (2006), which is unlike the traditional measures of tax progressivity that rely on the idea of the Lorenz curve, Gini coefficient, tax burdens and income distributions, can be computed on the basis of time series aggregate data on taxes and GDP. The extended version proposed here is decomposable into the tax progressivity indices for various components of tax and satisfies a number of desirable properties, including additivity, inclusiveness, unit independence, monotonicity, homogeneity, transfer principle and the principle of addition. The proposed index is applied to Pakistan's data over the 60 years period of 1960-2020 to investigate the nature of progressivity in the tax system. The results show overall tax structure has remained progressive during the entire period of analysis, but the degree of progressivity has declined over the years. The relatively more progressive taxes are sales and direct taxes other than income tax, while the regressive or less progressive taxes are federal excise and customs duty.

Keywords: Tax Structure, Lorenz Curve, Gini Coefficient.
JEL Classification: H2, D31.

I. Introduction

The concept of fairness in taxation is one of the oldest issues and applies to developing and developed countries. It is not easy to measure the characteristics of the sophisticated tax structure of an economy. Tax progressivity became a part of economic literature in 1929. Taxation is considered an important toolkit of economic policy as it is a powerful policy instrument for resource mobilisation, financing government expenditures, and redistribution of resource allocation in an economy. The structure of taxation affects the pattern of growth and economic development in developing countries, where taxation structure is used as a principal policy instrument to provide incentives for industrial development [Padovano and Galli (2001), Engen and Skinner

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(1992)]. Its implications are also subject to the redistribution of resources and welfare of economic agents (the value of the Gini coefficient, used to measure inequality, is sensitive to the tax progressivity index). For this purpose, economists are concerned with the optimal degree of tax progressivity/regressivity. On one side, tax policy should be able to raise enough revenues to meet the ever-increasing government expenditures; on the other side, taxes should be fair enough for all taxpayers.

There are various methodologies available in the literature to investigate the overall tax structure of an economy. The earliest work on the measurement of tax progressivity began in the writing of Pigou (1929), and modern treatment of the progressivity index is found in the writing of Musgrave and Thin (1948). Suits (1977) and Kakwani (1977) introduced a little variant version of the tax progressivity index. Several studies have introduced comparisons and refinements in the existing literature since Musgrave and Thin (1948). Among the important contribution towards the measurement of tax, progressivity is the works of Slitor (1948), Musgrave and Thin (1948) and Kakwani (1977). The measures of tax progressivity proposed in these studies rely on the idea of the Lorenz curve, Gini coefficient, tax burdens and income distributions. It is important to note that all the traditional measures of tax progressivity rely on microdata, but Kakinaka and Pereira (2006) have proposed a measure of tax progressivity that can be applied directly to the time series data on tax and income.

Towards the measurement of tax progressivity, the study of Kakinaka and Pereira (2006) is of great importance because their suggested index is based on macro data. It is the ratio of the proportional standard deviation of tax revenue to the proportional standard deviation of income. This index does not require detailed information on income distribution, hence, overcoming the data limitations problems, especially in developing countries.

The study further extends this work by decomposing the proposed index into subindices for the components of tax and establishes a number of properties of the tax progressivity index and its components. The measurement of tax structure, particularly in the case of Pakistan, has been missing for the last few years. Azad (1978), Allaudin and Raza (1981), Malik and Saqib (1985) and (1989), Refaqat (2005), and Ameer and Mohammad (2012) have applied traditional methods in order to determine the progressivity of one or few components with limited sample size. Therefore, this study computes the progressivity of the entire tax structure and its subcomponents in different regimes using the proposed index based on macro data. The trend of progressivity is also analysed over the entire period of analysis.

Furthermore, the share of all direct and indirect taxes components is also calculated. It provides insight into the contraction and expansion of different components of tax shares, which consequently reveals the major sources of tax revenue in different regimes of Pakistan. Therefore, the study intends to provide a comprehensive analysis of the taxation structure by applying the proposed methodology of time series macro data.

The study also constitutes important theoretical and empirical contributions to the existing literature on tax progressivity. First, it extends the Kakinaka and Pereira (2006) index by decomposing it into the components of taxes which satisfies a number of desirable properties. Second, it provides the empirical analysis for a longer period of time as it covers a total of 60 years. Previously, microdata requirements restricted the analysis for one or a few years in the case of Pakistan. Therefore, this study provides a detailed analysis of tax progressivity for direct and indirect taxes and also its components. The weighted share of tax progressivity towards the aggregate tax progressivity is also calculated. These statistics are important in influencing the structure of taxation through tax reforms.

The rest of the paper is organised as follows: Section II reveals a literature review; Section III explains the decomposable tax progressivity index. Data description is discussed in Section IV. Results are presented in Section V. The trend of progressivity/regressivity in Pakistan is presented in Section VI. Finally, Section VII concludes the paper.

II. Literature Review

The earliest work of Pigou (1929) measured tax progressivity with the help of average rate and marginal rate progression. The application of this methodology is found in various studies by Sobel and Lawson (2003), Ameer and Mohammad (2012) and Gerber, et al., (2018).

Musgrave and Thin (1948) compared the inequality of before and after-tax income distributions in order to arrive at a single measure of progression. It was the first time the methodologies of income inequality (Gini coefficient and Lorenz curve) were used to measure tax progressivity. The Gini index of before and after-tax income provides a single measure of tax progressivity. This measure opened new dimensions for researchers to investigate the tax structure of an economy and has been widely used [Lui (1985) and Morekwa and Schoeman (2005)].

Hallmark's contribution on the measurement of tax progressivity is the work of Kakwani (1977) and Suits (1977). They both rely on Lorenz income distribution and the Gini concentration of inequality. Kakwani (1977) suggested that a suitable measure of tax progressivity can be derived by simply using the difference in the Lorenz curve of income and the concentrated curve of taxes. The result shows that income tax structure is highly progressive in the United Kingdom compared to Australia, Canada, and U.S. Suits (1977) computed the Gini coefficient for a Lorenz curve in which the accumulated percentage of the tax burden is plotted against the accumulated per cent of income. The results are obtained for the U.S. economy for the years 1966 and 1970 [Table 1]. These two methodologies are widely used to measure tax structure in various developed and developing economies [Morekwa and Schoeman (2005), Ahmed and O'-donoghue (2009), Ameer and Mohammad (2012), Enami, et al., (2017), Mantovani (2017) and Gerber, et al., (2018)].

Formby, et al., (1981) compared the Suits and Kakwani indexes; both measures are based on the difference between income and taxes. However, Suits integrate this difference concerning income and Kakwani into tax returns. Although their study tries to establish a relationship between Suits and Kakwani indexes, the two measures differ by weighting factor, resulting in a difference in the magnitude of progressivity. The results show that the two measures exhibit progressivity in income tax with different magnitudes (Suits index = 0.272 and Kakwani index = 0.201) for the U.S. in the year 1976.

Hayes, et al., (1995) and Stroup (2005) proposed some improvements and modifications to the measure of tax progressivity. Hayes, et al., (1995) suggested an algorithm to calculate the effective income tax progression. They applied this procedure to the U.S. tax system by using the annual data for the period of 1950-87. The results yield contour plots which show variation in effective tax progression across the income distribution and with time. The study is worth contributing towards the issue of progressivity because it focuses on both quantitative and qualitative aspects.

The modification introduced by Stroup (2005) is an exponential specification to estimate the cumulative income and tax share curves. The index was based on the simple idea of the Lorenz curve and used to compute an index for each year from 1980 to 2000 for the United States. The results show an increasing trend of progressivity of income tax structure for two decades.

The above methodologies are based on the Gini coefficient, Lorenz curve and tax burdens. All these traditional measures require microdata containing specific information regarding the distribution of income and tax burdens.

A recent improvement in the index of tax progressivity has enabled the measurement of tax progressivity on the basis of macro data. The index proposed in the study is equal to the ratio of the coefficient of variation (proportional standard deviation) of tax revenue to the coefficient variation of income. This index is directly linked to average rate progression and has a one-to-one correspondence between the classification of a tax system in the categories of progressive, proportional and regressive regimes. The index is also monotonic, as indicated by the elasticity of the average tax rate for income. The requirement of detailed microdata to access the tax structure of the economies restricts the empirical applications to a few advanced countries with a limited sample size. However, the advantage of this method is that it can be applied to all economies as macro data is readily available for almost all developing countries.

Moreover, this approach can be used to measure the degree of progressivity for international comparisons without acquiring specific information regarding tax burden and income distribution. However, this measure does not incorporate welfare changes caused by differences in the tax structure. The results show that the tax system is progressive in all nine countries, including Japan, the U.S., Canada, France, Italy, Germany, the United Kingdom, Australia and South Korea.

The application of this index is found in various recent studies. The study by Turkmen-Ceylan (2019) shows that the overall tax structure of Turkey has been less pro-

gressive from 1924 to 2016. Similarly, the results of Tahova and Banociova (2020) show that corporate income tax is progressive in the EU-28 during 2007–2018. Some studies also used this index to study the relationship between tax progressivity with some other variables [Shah (2010), Rieth, et al. (2016)]. For instance, Rieth et al. (2016) show that higher VAT progressivity is negatively associated with output volatility in OECD countries. Literature shows that the availability of macro data makes it easy to apply this index in different economic analyses. However, literature has yet to come up with refinement in this index; in the present study, we will extend this index and provide a comprehensive analysis to understand the tax structure for the economy of Pakistan.

In Pakistan, very few studies are available that investigate the tax structure of the economy [Azad (1978), Allaudin and Raza (1981), Malik and Saqib (1985 and 1989), Refaqat (2005), Ahmad and O'donoghue (2009), Ameer and Mohammad (2012)]. Table 2 presents the results of existing literature in Pakistan. It shows that empirical analysis concerning the tax structure of the different components of the taxes is limited, covering one or few years. One of the reasons of missing empirical analysis is the requirement of microdata, as various studies highlight this fact in the case of Pakistan [Malik and Saqib (1985) and (1989)]. Hence, the proposed decomposable extended version of Kakinaka and Pereira (2006) is applied to the sub-categories of taxes over the larger sample size. The trend of tax progressivity is measured for different regimes, highlighting policy reforms and variation in the share of different components, therefore presenting a comprehensive analysis.

Table 1 summarises the results of the tax structure of different developed, emerging and developing economies mentioned in the literature review. In this connection, the tax structure in most economies is found to be progressive, but in some economies, it is highly progressive, while in others, it is marginally or slightly progressive. It can be concluded that broadly the overall tax structure of the developed, emerging and developing economies are progressive under the period of consideration.

TABLE 1

Empirical Evidence of Progressivity/Regressivity

Study	Country and Year of Analysis	Type of Taxes Considered	Tax Structure
Lovejoy (1963)	Jamaica (1958)	Overall tax structure	Progressive
Salkin (1974)	Thailand (1963)	Overall tax structure	Slightly progressive
Kakwani (1977)	Australia (1968-1972)	Income tax	Progressive
	Canada (1968-1970)	Income tax	Progressive
	U.K. (1964-1967)	Income tax	Progressive
	U.S. (1968-1970)	Income tax	Progressive

(Continue)

TABLE 1 *(Continued)*

Empirical Evidence of Progressivity/Regressivity

Study	Country and Year of Analysis	Type of Taxes Considered	Tax Structure
Suits (1977)	U.S. (1966)	Overall tax structure	Slightly progressive
		Individual income tax	Progressive
		Corporate income tax	Progressive
		Property tax	Progressive
		Sales and excise tax	Regressive
	U.S. (1970)	Overall tax structure	Slightly progressive
		Individual income tax	Progressive
		Corporate income tax	Progressive
		Property tax	Progressive
		Sales and excise tax	Regressive
Formby, et al., (1981)	U.S. (1962-1976)	Income tax	Progressive
Hayes, et al., (1995)	U.S. (1950-1987)	Income tax	Progressive
Lawson & Sobel (2003)	Ohio (1994)	Overall tax structure	Highly progressive
Morekwa & Schoeman (2005)	S. Africa (1980-2003/4)	Income tax	Progressive
Stroup (2005)	U.S. (1980-2000)	Income tax	Progressive
Jenkins, et al., (2006)	Dominican Republic (1998, 2005)	Value Added Tax (VAT)	Progressive
Kakinaka & Pereira (2006)	Canada (1972-1995)	Overall tax structure	Progressive
	Australia (1965-1999)	Overall tax structure	Progressive
	France (1970-1988)	Overall tax structure	Progressive
	Germany (1966-2003)	Overall tax structure	Progressive
	Italy (1980-2005)	Overall tax structure	Progressive
	Japan (1960 – 80)	Overall tax structure	Progressive
	U.K. (1960-1988)	Overall tax structure	Progressive
	U.S. (1980-2005)	Overall tax structure	Progressive
	South Korea (1973-1999)	Overall tax structure	Regressive in 1973 - 89
			Progressive in 1990 – 99
Lim & Hyun (2009)	Korea (1991, 1996, 2000)	Overall tax structure	Highly progressive in 1991
			Progressive in 1996 & 2000
Faridy & Sarker (2011)	Bangladesh (2005)	VAT	Regressive
Arunatilake, et al., (2012)	Sri Lanka (2006, 2011)	Income Tax	Progressive
Chen (2012)	Malaysia (2010)	Income Tax	Progressive
Gerber, et al., (2018)	OECD (1990-2017)	Income Tax	Less progressive/ progressivity declined
Turkmen-Ceylan (2019)	Turkey (1924-2016)	Overall tax structure	Less Progressive
Tahova & Banociova (2020)	EU-28 (2007–2018)	Corporate income tax	Progressive

Source: Authors' estimation.

TABLE 2

Empirical Evidence of Tax Progressivity in Pakistan

Study	Year of Analysis	Type of Taxes Considered	Tax Structure
Azad (1978)	1972-73	Overall tax structure	Progressive
		Direct taxes	Highly progressive
		Indirect taxes	Progressive
Allaudin & Raza (1981)	1966-70	Overall tax structure	Regressive in 1966-69
			Slightly progressive in 1970-72
Malik & Saqib (1985)	1978-79	Overall tax structure	Regressive
		Direct taxes	Progressive
Malik & Saqib (1989)	1978-79	Overall tax structure	Slightly progressive
		Direct taxes	Highly progressive
		Indirect taxes	Slightly progressive
Refaqat (2005)	1990-2001	GST	Proportional
Ahmed & O'donoghue (2009)	2001-02 and 2005	Income tax	Progressive
Ameer & Mohammad (2012)	1991-2011	Income tax	Less Progressive

Source: Authors' estimation.

III. A Decomposable Tax-Progressivity Index

The tax progressivity index proposed by Kakinaka and Pereira (2006) is given in Equation (1):

$$\gamma = \frac{\sigma / \mu}{\sigma_y / \mu_y} \tag{1}$$

where γ, σ, μ_y, and σ_y denote tax-progressivity index, the mean tax revenue, the standard deviation of tax revenue, the mean income and the standard deviation of income, respectively. Using Taylor Series linear approximation, the study shows that the above index can be related directly to the average rate tax-progressivity measure provided in Equation (2):

$$\gamma = \frac{\sigma / \mu}{\sigma_y / \mu_y} = 1 + \eta(\mu_y), \tag{2}$$

where, $\eta(\mu_y)$ is the elasticity of the average tax rate with respect to income evaluated at the mean income. It follows that the index is greater (less) than one if the

tax system is progressive (regressive), i.e., the elasticity of the average tax rate with respect to income is positive (negative). In the borderline case, the index is equal to one when the tax system is proportional. The index is monotonic, increasing in the degree of tax progressivity as measured by the elasticity $\eta(\mu_y)$.

We now generalise this index in order to decompose the progressivity index of the overall tax system into tax progressivity indices of the tax components. The proposed tax progressivity index is aimed to measure the contribution of each tax component to the overall tax progressivity. Thus, consider a tax system consisting of n categories of taxes and the corresponding tax functions in which the average tax rates are assumed to depend on national income. Denoting total tax revenue, the tax revenue from each tax category, the average tax rate for each tax category and the national income by T, T_i, τ_i and y respectively, we have Equations (3) and (4):

$$T_i = \tau_i (y)\, y \tag{3}$$

$$T = \sum_{i=1}^{n} T_i = \sum_{i=1}^{n} \tau_i (y) y \tag{4}$$

Even though certain tax categories may have tax bases other than national income, the specification considered here is proposed for the purpose of measuring tax progressivity with respect to national income.

Setting the benchmark of the tax progressivity index at zero, we define the tax progressivity index by subtracting one from the index proposed in Kakinaka and Pereira (2006). Thus, we write the tax progressivity indices of the aggregate tax and the tax component i, denoted by λ and λ_i respectively, as presented in Equations (5) and (6):

$$\lambda = \frac{\sigma / \mu}{\sigma_y / \mu_y} - 1 = \eta(\mu_y), \tag{5}$$

$$\lambda_i = \frac{\sigma_i / \mu_i}{\sigma_y / \mu_y} - 1 = \eta_i(\mu_y), \tag{6}$$

It follows that the proposed tax-progressivity index is positive (negative) if the tax system is progressive (regressive), i.e., the elasticity of the average tax rate to income is positive (negative). In the borderline case, the index is equal to zero when the tax system is proportional, i.e., the elasticity of the average tax rate to income is equal to zero.

The above indices satisfy a number of properties, as presented below.[1] All these properties are based on Equations (5) and (6), which relate the progressivity index with the average rate progressivity as summarised in elasticities of average tax rates to income.

[1] Some of these properties are based on the properties of income inequality described in Litchfield (1999).

1. Additivity

The overall tax-progressivity index is a weighted average of the tax-progressivity indexes of the individual tax categories, the weight being equal to the shares of tax categories in the total tax revenue.

Proof

Applying Taylor Series linear approximation to the tax functions Equation (3) and (4) around the mean income yields Equation (7) and (8), respectively:

$$T_i \approx \tau_i(\mu_y)\,\mu_y + \tau_i(\mu_y)\,[1 + \eta_i(\mu_y)]\,[y - \mu_y] \tag{7}$$

$$T \approx \sum_{i=1}^{n} \tau_i(\mu_y)\,\mu_y + \sum_{i=1}^{n} \tau_i(\mu_y)\,[1 + \eta_i(\mu_y)]\,[y - \mu_y] \tag{8}$$

Where η_i is the elasticity of average tax rate of category *i* with respect to income. Now it is easy to confirm that the mean and standard deviation of tax revenues can be expressed as given in Equations (9), (10), (11), and (12):

$$\mu_i = E(T_i) = \tau_i(\mu_y)\,\mu_y \tag{9}$$

$$\sigma_i = SD(T_i) = \tau_i(\mu_y)\,[1 + \eta_i(\mu_y)]\sigma_y \tag{10}$$

$$\mu = E(T) = \sum_{i=1}^{n} \tau_i(\mu_y)\,\mu_y \tag{11}$$

$$\sigma = SD(T) = \sum_{i=1}^{n} \tau_i(\mu_y)\,[1 + \eta_i(\mu_y)]\sigma_y \tag{12}$$

Using the above mean and variance equations, we obtain Equations (13) and (14) after a few manipulations:

$$\lambda_i = \frac{\sigma_i / \mu_i}{\sigma_y / \mu_y} - 1 = \eta_i(\mu_y), \tag{13}$$

$$\lambda = \frac{\sigma / \mu}{\sigma_y / \mu_y} - 1 = \sum_{i=1}^{n} \alpha_i(\mu_y)\,\eta_i(\mu_y) = \sum_{i=1}^{n} \alpha_i(\mu_y)\,\lambda_i \tag{14}$$

Where α_i denotes the share of tax category i in total tax revenue as provided in Equation (15):

$$\alpha_i = T_i / \sum T_j = \tau_i / \sum \tau_j \tag{15}$$

Except for the change of origin, Equation (13) is similar to the one derived in Kakinaka and Pereira (2006), while Equation (14) is new, which relates the overall tax-progressivity index with the tax-progressivity indices of the individual components of tax.

2. Inclusiveness

If all tax categories are progressive (regressive) according to their respective tax-progressivity indices, the overall tax-progressivity index will indicate the tax system to be progressive (regressive). If all the taxes are proportional, the overall tax-progressivity index will also indicate that the tax system is proportional.

Proof

The proof follows from Equation (14) which expresses the aggregate tax-progressivity index as a weighted average of tax-progressive indices of the individual tax categories.

3. Independence of Unit of Measurement

The tax-progressivity index is independent of the unit of measurement of income and taxes.

Proof

The proof follows from the observation that by construction, the shares of all tax components and all the coefficients of variation are independent of units of measurement.

4. Monotonicity 1

The aggregate tax-progressivity index is monotonic, increasing in tax-progressivity indices of the individual tax components.

Proof

From Equation (14) $\partial\lambda / \partial\lambda_i = \alpha_i (\mu_y) > 0$

5. Monotonicity 2

An increase in the rate of a tax component will result in an increase (decrease) in the aggregate tax-progressivity index if the progressivity index of the tax component

is greater (less) than the aggregate tax-progressivity index. The increase in a component of tax will keep the aggregate tax-progressivity index unaffected in case the progressivity index of the tax component is equal to the aggregate tax-progressivity index.

Proof

If the tax component i is multiplied by a constant, $\theta > 1$, the tax progressive indices of the individual tax components Equation (13) will remain unchanged. However, Equation (15) indicates that the overall tax progressivity index given by Equation (14) will change in Equation (16) as follows.

$$\Delta\lambda = \frac{(\theta - 1)\tau_i\lambda_i + \sum_j \tau_j\lambda_j}{(\theta - 1)\tau_i + \sum_j \tau_j} - \frac{\sum_j \tau_j\lambda_j}{\sum_j \tau_j}$$

$$= \frac{(\theta - 1)\tau_i\lambda_i \sum_j \tau_j - (\theta - 1)\tau_i \sum_j \tau_j\lambda_j}{\sum_j \tau_j [(\theta - 1)\tau_i + \sum_j \tau_j]} = \frac{(\theta - 1)\tau_i(\lambda_i - \lambda)}{(\theta - 1)\tau_i + \sum_j \tau_j} \tag{16}$$

The proof follows by noting that the right-hand side of the Equation is positive, zero or negative if λ_i is greater than, equal to or less than λ.

6. Homogeneity 1

The overall tax-progressivity index is homogeneous of degree one in the tax-progressivity indices of all the tax components.

Proof

The proof directly follows from Equation (14), recognising that $\sum_{i=1}^{n} \alpha_i(\mu_y)=1$.

7. Homogeneity 2

The overall tax-progressivity index is homogeneous of degree zero in average rates of all tax components. That is, an equally proportional change in all components of tax leaves the tax-progressivity index unaffected.

Proof

Suppose all the average rates revenues T_i are replaced by kT_i and, hence, the tax rates τ_i are replaced by $k\tau_i$, where k is a constant. Then the coefficients of variation of tax revenues and income, as well as the shares of tax components $k\tau_i \sum k\tau_i$

$= kT_i / \sum kT_i = T_i / \sum T_i$ remain unaffected. Therefore, the aggregate tax progressivity index given in Equation (14) remains unaffected.

8. Transfer Principle

If one component of tax is increased and another component is decreased such that the total amount of tax remains unchanged, then the tax-progressivity index will increase (decrease) if the progressivity of the first component is greater (less) than that of the second component.

Proof

If the share of tax from component '*i*' increases and that from another component '*j*' decreases to leave the total tax revenue unchanged, then the total effect on the tax progressivity index can be obtained from Equation (14) as given in Equation (17):

$$\frac{d\lambda}{d\alpha_i} = \frac{\partial\lambda}{\partial\alpha_i} - \frac{\partial\lambda}{\partial\alpha_j} = \lambda_i - \lambda_j \tag{17}$$

It is obvious from above that the transfer of tax from a less (more) progressive category to a more (less) progressive category will result in increased (decreased) overall tax progressivity.

9. Principle of Addition

If a lump-sum tax is supplemented to all components of tax, the value of the tax-progressivity index will decrease (increase) if the initial tax system is progressive (regressive).

Proof

Suppose all the categories of tax T_i are replaced by $T_i + \Gamma$, where T is a constant. Obviously, the standard deviations of all categories of tax revenues remain unchanged, while the mean tax revenues are affected, as mentioned in Equation (18).

$$\mu'_i = E(T_i + \Gamma) = \mathrm{E}(T_i) + \mathrm{E}(\Gamma) = (\tau_i + \tau)\mu_y \tag{18}$$

Now using Equations (14) and (15), we can write the new value of the tax progressivity index as provided in Equation (19),

$$\lambda' = \sum_{i=1}^{n} \alpha'_i (\mu_y)\lambda'_i = \frac{\sum_i (\tau_i + \tau)\, \lambda'_j}{\sum_i (\tau_i + \tau)} = \frac{\sum_i (\tau_i + \tau)\, [\sigma_i / (\tau_i + \tau)\mu_y] / [\sigma_y / \mu_y]}{\sum_i (\tau_i + \tau)}$$

$$= \frac{\sum_i \tau_i \lambda_i}{\sum_i (\tau_i + \tau)} = \frac{\sum_i \tau_i \lambda_i}{\sum_i \tau_i} \frac{\sum_i \tau_i}{\sum_i (\tau_i + \tau)} = \lambda \frac{\sum_i \tau_i}{\sum_i \tau_i + \eta\tau} \quad (19)$$

IV. Data

The study includes the time series annual data for Pakistan over the 60 years period of time 1960-2020. This data set enables us to examine the trend of progressivity over time. The data sources of the present study are the Statistical Year Book of FBR 2019-20 and the Economic Survey of different years. In order to avoid discrepancies among the data of various sources, data for all types of direct and indirect taxes are acquired from FBR except surcharges. Data for GDP and surcharges are collected from Economic Survey. Although there are different components of direct taxes, our study includes income tax and merges all the other components into 'Other direct taxes' because their shares are quite small. Other direct taxes include corporate assets tax (CAT), capital value tax (CVT), workers' welfare fund (WWF), wealth tax, gift tax and estate duty (gift tax and estate duty have been abolished since 1985 and 1979 respectively). The present study includes the custom duty, federal excise and sales tax in indirect taxes. Sales tax further includes domestic and import sales tax and surcharges. Data collection of all direct and indirect taxes components are in Pak rupees.

V. Computing Tax Progressivity in Pakistan

Equation (6) is used to obtain the estimates of tax progressivity of the components of direct and indirect taxes. Results are presented in Table 3. The aggregate progressivity index is obtained using Equation (14), and the results are presented in Table 4. This index relates the overall tax progressivity index with the tax progressivity indices of the individual components of tax, and results are discussed every five years to observe the variation in the structure of taxation over a decade.Equation (6) is used to obtain the estimates of tax progressivity of the components of direct and indirect taxes. Results are presented in Table 3. The aggregate progressivity index is obtained using Equation (14), and the results are presented in Table 4. This index relates the overall tax progressivity index with the tax progressivity indices of the individual components of tax, and results are discussed every five years to observe the variation in the structure of taxation over a decade.

1. The Early 1960s (1960-64)

During the early 1960s, in the category of direct taxes, income tax was progressive, with the value of the index equal to 0.485. All the components of indirect taxes were also progressive, but the progressivity of federal excise was extremely high, followed by sales tax and customs.

Direct and indirect taxes are found to be progressive, but the progressivity of indirect taxes is very high. All the components of direct and indirect taxes have contributed to the overall tax progressivity, making the entire tax system highly progressive in this period. Tax structure with a high degree of progressivity may result in higher revenues, more equitable income distribution and faster economic growth [Weller (2007)]. Linking these benefits with the tax structure of Pakistan shows higher growth with improved income distribution [Zaidi (2015)].

2. The Late 1960s (1965-69)

In this period, income tax is found to be regressive. The regressivity is because of 'Tax Holidays' and incentives to the industrial sector by means of tax exemptions. The shares of other direct taxes are negligible, with a slightly progressive index. Although this period also reveals the progressivity in all the components of indirect taxes, the federal excise tax is the most progressive.

TABLE 3

Results of Progressivity in Pakistan for Different Regimes

Years	Income Tax		Other Direct Taxes		Custom Duty		Federal Excise		Sales Tax	
	Progres-sivity index	Tax share	Progres-sivity index	Tax share	Progres-sivity index	Tax share	Progres-sivity index	Tax share	Progres-sivity index	Tax share
1960-64	0.485	0.24	-	-	0.346	0.295	1.886	0.223	0.876	0.244
1965-69	-0.261	0.20	0.017	0.004	0.425	0.267	1.234	0.354	0.302	0.178
1970-74	-0.514	0.18	0.799	0.006	1.153	0.356	-0.354	0.367	-0.365	0.091
1975-79	0.349	0.14	-0.353	0.004	0.479	0.415	0.0823	0.323	1.123	0.109
1980-84	-0.160	0.18	0.071	0.004	-0.027	0.393	-0.176	0.288	0.835	0.135
1985-89	-0.211	0.13	1.186	0.004	0.092	0.413	-0.423	0.202	0.917	0.247
1990-94	0.715	0.18	1.150	0.008	-0.455	0.379	-0.136	0.184	0.348	0.246
1995-99	0.202	0.27	1.256	0.015	-0.321	0.252	-0.223	0.175	0.689	0.291
2000-04	0.018	0.28	-0.347	0.015	0.502	0.141	-0.416	0.102	0.522	0.464
2005-09	0.327	0.32	0.032	0.018	-0.609	0.148	0.31	0.084	0.104	0.427
2010-14	0.087	0.37	0.177	0.009	-0.086	0.118	-0.731	0.072	0.224	0.453
2015-20	0.205	0.38	0.079	0.004	2.076	0.143	0.433	0.061	0.121	0.392

Source: Authors' estimation based on Equation (6).

Direct taxes were slightly regressive, with the value of the index equal to -0.051, while indirect taxes were progressive in nature. All the components of indirect taxes contributed to the overall tax progressivity. On the other hand, income tax decreased the degree of tax progressivity. Overall progressivity decreased from 0.8498 to 0.5525, resulting in low revenue collected. Although the overall tax structure was pro-poor, the system of direct taxes was in favour of rich segments of society.

The decline in progressivity increases income inequality. It was the ruling period of Ayub Khan; the economic policies resulted in higher growth but at the cost of regional income disparities. The capitalist model favoured the rich class through tax exemptions, hence generating a declining trend in progressivity. In this period, the taxation system emphasised growth rates, regardless of its composition and distributional effects.

TABLE 4

Aggregate Progressivity and Share Weighted Tax Progressivity Indices

Years	Share Weighted Tax Progressivity Indices							Aggregate Progressivity Index
	Direct Taxes		Indirect Taxes			Direct Taxes	Indirect Taxes	
	Income Tax	Other Direct Taxes	Customs	Federal Excise	Sales Tax			
1960-64	0.1150	-	0.102	0.420	0.213	0.1150	0.735	0.850
1965-69	-0.0513	0.000	0.114	0.436	0.054	-0.0512	0.604	0.552
1970-74	-0.0920	0.005	0.410	-0.130	-0.033	-0.0880	0.247	0.159
1975-79	0.0519	-0.002	0.199	0.027	0.123	0.0500	0.348	0.398
1980-84	-0.0290	0.000	-0.011	-0.051	0.112	-0.0290	0.051	0.022
1985-89	-0.0280	0.004	0.038	-0.086	0.226	-0.0240	0.179	0.155
1990-94	0.1310	0.009	-0.172	-0.025	0.085	0.1400	-0.112	0.028
1995-99	0.0538	0.019	-0.081	-0.039	0.199	0.0730	0.079	0.152
2000-04	0.0050	-0.005	0.070	-0.042	0.242	0.0000	0.271	0.270
2005-09	0.1070	0.001	-0.090	0.026	-0.044	0.1060	-0.102	0.006
2010-14	0.0220	0.006	-0.007	-0.037	0.067	0.0280	0.023	0.051
2015-20	0.0560	0.000	0.213	0.019	0.035	0.0560	0.267	0.323

Source: Authors' estimation based on Equation (14).

3. The Early 1970s (1970-74)

In this period, income tax was regressive because of the extension of the policies of the late 1960s, including 'Tax Holidays' and incentives to the industrial sector by means of tax exemptions and concessions in addition to 'Tax Avoidance'. Agricultural income and agricultural industries were also exempted from taxes. 'Other direct taxes' are found to be highly progressive, but their share is trivial. In the category of indirect taxes, customs duty was highly progressive. Alternatively, federal excise and sales tax were found to be regressive in nature. This finding is consistency with the study of Wanjala (2006), as it states that the consumption taxes, i.e. excise and sales, are assumed to be regressive. Similarly, the study of Faridy and Sarker (2011) also shows that VAT is regressive in Bangladesh.

Overall, direct taxes have been regressive, whereas indirect taxes were progressive in nature. Direct taxes other than income tax and customs contributed to the overall tax progressivity. Federal excise and sales tax decreased the extent of tax progressivity, but their intensity was relatively low. Therefore, the entire tax system remained progressive in nature, with the value of the index equal to 0.159. This era reports a further decline in progressivity which results in low revenue collections. The government of Zulfiqar Ali Bhutto followed previous tax policies that further declined the trend of progressivity which can be associated with higher income inequality [Zaidi (2015)].

4. The Late 1970s (1975-79)

In this period, income tax was progressive, with the value of the index equal to 0.349, while other direct taxes were regressive, but their share was negligible. All the components of indirect taxes were progressive, but sales tax was the most progressive, followed by customs and federal excise.

Both the direct and indirect taxes were found to be progressive in this period, but the degree of progressivity of direct taxes was relatively low. Income tax and all the components of indirect taxes contributed to the tax progressivity, which increased the overall tax progressivity in this period from 0.159 to 0.398. An increase in progressivity can be attributed to the withdrawal of 'Tax Holiday'. In June 1979, the Income Tax Act of 1922 was replaced by the Income Tax Ordinance 1979. The main objective was to make the system more effective and to arrange the provision in a more systematic form [FBR Year Book (2010-12)].

5. The Early 1980s (1980-84)

During this second military government of General Zia's regime, tax policy deviated from the previous decades as the income tax threshold was raised and tax

rates were also reduced. Mixed policy approach of tax exemptions in certain areas while withdrawals of other concessions opted. Anti-tax evasion and avoidance provisions were introduced in this period.

All these reforms reported a slightly regressive structure of direct taxes, with the value of the index equal to -0.029, while indirect taxes were slightly progressive. Only sales tax contributed to the overall tax progressivity in this period. The tax structure in this regime was only slightly progressive. The World Bank assessment report of reforms (1981-88) found that the tax reforms were not comprehensive and had limited success.

6. The Late 1980s (1985-89)

Income tax was found to be regressive during the late 1980s, and the extent of regressivity was almost similar to the one in the early 1980s due to the continuation of the policies of the early 80s. Other direct taxes were highly progressive, but their share was almost zero. Customs and sales tax were progressive, but the extent of progressivity of sales tax was very high. Federal excise is found to be regressive in nature with a value of index equal to -0.423.

Direct taxes were slightly regressive, with a value of an index equal to -0.024, and the indirect taxes were progressive in nature, with a value of an index equal to 0.179. All direct and indirect taxes components contributed to the overall tax progressivity except for the income tax and federal excise. Overall, the tax structure is found to be progressive in this period.

7. The Early 1990s (1990-94)

The tax policy of the 1980s did not broaden the tax base; it rather resulted in the reduction of government revenues. Hence, an extensive tax policy reform program was undertaken in Pakistan in 1990. The primary direction of tax reforms was aimed at broadening the tax base. In 1993 Pakistan signed an agreement for a structural adjustment program with the IMF, focusing on expanding the tax base and streamlining the tax rate structure to meet the government's revenues. As a result, income tax and other direct taxes are found to be highly progressive during the early 1990s. Both customs and federal excise were regressive in nature, and the sales tax was found to be progressive in this period.

Direct taxes became progressive in this period because there was a reduction in the wide-ranging exemption and concessions. Simplification and rationalisation were introduced for direct taxation. There was the unification of the corporate profit tax rate in this period. Tax holiday provisions were also reduced. With this reform package, the previously regressive structure of direct taxes turned progressive. In this period, indirect taxes became regressive in nature, with the value of the index equal to

-0.112. All direct and sales taxes components contributed to the overall tax progressivity. Whereas customs and federal excise decreased the extent of progressivity, their intensity was low. Overall, the tax structure was only slightly progressive.

8. The Late 1990s (1995-99)

The results of all policy reforms, which were adopted in the early 1990s, can be seen in the tax progressivity index for the period of the late 1990s. Income tax was found to be progressive, with the value of the index equal to 0.202 due to the elimination of income and wealth tax exemptions. Customs and federal excise were found as regressive, while sales tax was moderately progressive in this period.

Direct and Indirect taxes were found to be slightly progressive, with the value of the index equal to 0.073 and 0.079, respectively. All the components of direct and indirect taxes contributed to the overall tax progressivity except for customs and federal excise, which made the overall tax structure moderately progressive with the value of index equal to 0.1518. This era reports an increase in progressivity because of the significant shift of tax structure from primitive mode to broad-based mode. In this period, the objective of the government was to streamline and rationalise the tax structure. The reform program of the 1990s brought comprehensive changes on the basis and concept of taxation that departs from the old net basis of income taxation.

9. The Early 2000 (2000-04)

The military government of Musharraf brought down the tax rate significantly, which turned the structure of 'other direct taxes' regressive. However, the revenue collection from income tax increased in this period due to the self-assessment scheme and broad-based Income Tax Ordinance of 2001. Customs duty and sales tax were moderately progressive, and federal excise was regressive in nature.

Direct taxes were found proportional in this period, while indirect taxes were progressive with the value of an index equal to 0.271. All direct and indirect taxes components contributed to the overall tax progressivity except for 'other direct taxes' and federal excise. The entire tax system was also progressive in this regime.

10. The Late 2000 (2005-09)

Fiscal efforts continued to increase revenue collection by introducing several measures to address the issue of a narrow base, low tax compliance, widespread exemptions, large undocumented informal sector and weak audit and enforcement.

Hence, income tax and 'other direct taxes' turned out progressive in this period. Customs duty was regressive, with a value of an index equal to -0.609, and federal excise was progressive, with a value of an index equal to 0.310. Direct taxes were progressive, while indirect taxes were slightly regressive. All direct and indirect taxes components have contributed to the overall tax progressivity except customs duty.

11. The Early 2010 (2010-14)

In order to broaden the tax base, a broad-based value-added tax was implemented during this period. However, the limited capacity of a tax system with a low rate of tax compliance needed more simplification and rationalisation of tax administration. Taxes on agricultural income, real property and capital gains were essentially negligible, making the structure of direct taxes slightly progressive. The finding is consistent with the study of Arunatilake, et al. (2012) for the case of Sri Lanka.

All direct and indirect taxes categories were found to be progressive in this period except for federal excise duty. The degree of the regressivity of federal excise duty was slightly high with a value of -0.653. Overall tax progressivity decreased in this period. Preferential treatment and exemptions in this period not only reduced the tax collections but also reduced the progressivity.

12. The Late 2010 (2015-20)

Imran khan's government prioritised increasing the tax base and tax reforms. The government proposed a business-friendly tax and administrative reform package in this regard. The primary objective was to remove distortions from the tax system through systematic reforms based on fairness and equity.

In this period, all the components of direct and indirect taxes contributed in overall tax progressivity. The degree of progressivity improved in these years with a value of 0.323.

VI. Trend of Progressivity

A graphical illustration is provided to analyse the trend of tax progressivity of different components of taxes. Figure 1 shows the trend of progressivity of the components of direct taxes. Overall progressivity of income tax has increased by 53 per cent from the early 1960s to late 2000. The tax system is found to be regressive in the late 1960s, early 1970s and 1980s. After the 1980s tax system became progressive in nature, but a declining trend of progressivity has been found in recent years. Other direct taxes also show a progressive trend over time, with two exceptions from 1975-79 and 2000. Other direct taxes are found to be relatively more progressive than income tax.

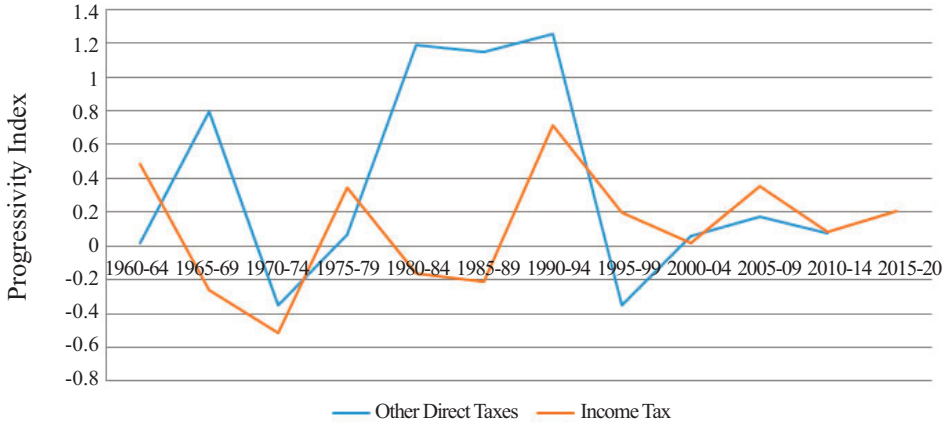

FIGURE 1

Income Tax and Other Direct Taxes

The trend of progressivity of the components of indirect taxes is presented in Figure 2. Custom duty showed a progressive trend in the initial periods, then became regressive; however, the progressivity has substantially increased in the recent period. Federal excise is found to be regressive over the entire period of analysis with few exceptions, and the level of regressivity has remained quite consistent during the past three decades. Sales tax is showing a progressive trend over time, excluding the period of 1970-74. Among the components of indirect taxes, sales tax is relatively more progressive.

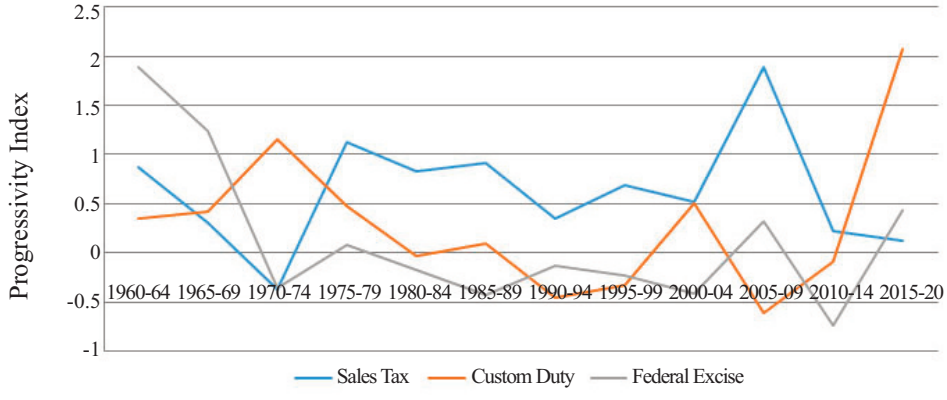

FIGURE 2

Progressivity Trend of Sales Tax, Custom Duty and Federal Excise

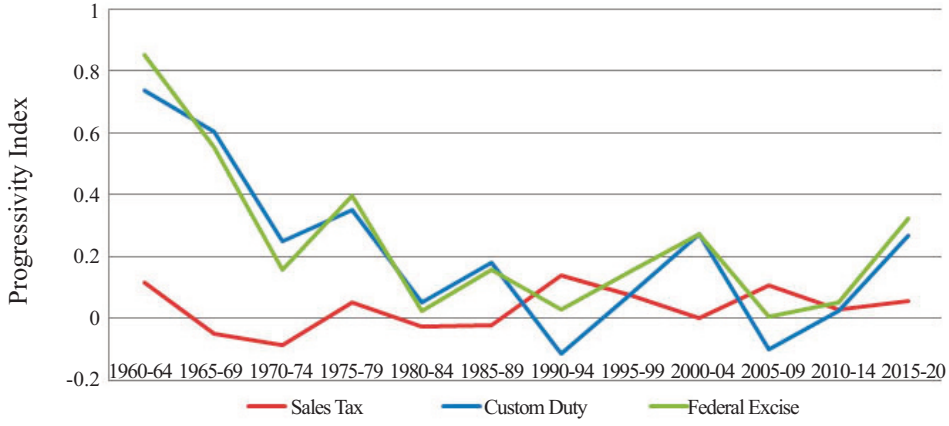

FIGURE 3

Progressivity Trend of Direct taxes, Indirect Taxes and Total Federal Taxes

VI. Conclusion

Tax structure and policy design have important implications for redistribution. The primary objective of any tax system is to raise revenue, redistribute income and encourage/discourage certain activities through tax provisions [Karingi and Wanjala (2005)]. The structure should be adequate and equitable. It should be fair for all groups of society. Progressivity and regressivity of the tax structure are the underlying concepts of equity. In a progressive structure, the upper segment of the society pays more share in relation to the lower segment; the reverse is true for a regressive structure. Income tax is the classic example of progressive taxes, while sales tax is assumed to be regressive. However, some government imposes a rate of zero tax on basic commodities to make the system pro-poor. Therefore, the measurement of the tax structure is essential to determine its influence on other variables.

The present study has applied the methodology of Kakinaka and Pereira (2006) by extending and decomposing the index into the subcomponents of the taxes. The proposed index satisfies a number of desirable properties, including additivity, inclusiveness, unit independence, monotonicity, homogeneity, transfer principle and the principle of addition. The study reveals the tax structure of Pakistan using time series data of 60 years, i.e. from 1960 to 2020. Broadly, the tax structure of Pakistan is classified into direct and indirect taxes. The share of indirect taxes in total taxes remained high throughout the entire period of analysis. According to Asian Development Bank (2018), Pakistan is among the few countries (Bangladesh, Cambodia, Kyrgyzstan, and Nepal) having a proportion of indirect taxes around and above 60 per cent; therefore, indirect taxes dominate the tax structure.

The results show that the overall tax system of Pakistan remained progressive for the entire period of consideration. However, the progressivity has declined over the years. Moreover, 'other direct taxes' are found to be more progressive as compared to income tax. 'other direct taxes' mainly include Corporate Assets Tax (CAT), Capital Value Tax (CVT), Workers' Welfare Fund (WWF) and wealth tax. In order to increase revenue collection, the focus should be given to enhancing the shares of these taxes. The fact cannot be ignored that corporate taxation is suffering from ill-design policies and widespread corruption [Bukhari and Haq (2020)]. Appropriate tax collection is not possible without a strong enforcement apparatus. Therefore, it is a dire need of time to introduce such a hierarchy that should be friendly in educating and guiding the entities to fulfil their tax obligations. Among the three major components of indirect taxes, sales tax is relatively more progressive as compared to federal excise and customs duty. The progressivity of indirect taxes can be increased by imposing higher-than-standard rates on luxuries. Excise taxes can be made progressive if levied on items considered luxuries. Pakistan follows multiple tax bases, and diversifying tax rates with respect to different commodities can influence the degree of progressivity. In the bottom line, in order to increase the revenue collection to meet ever-increasing government expenditure, the structure should be made more progressive. Share of direct taxes should be enhanced in the total federal revenue receipts. Furthermore, revenue collection should also be increased by stimulating economic activities.

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