From Tax to TFP: Unraveling the Dynamics of Income Inequality in SAARC Economies

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Abstract

From 1990 to 2021, study examines the dynamic relationship between taxation, total factor productivity (TFP), and income inequality in four SAARC countries: Bangladesh, India, Pakistan, and Sri Lanka. Using panel data analysis, the study investigates the relationship between variations in the GINI coefficient and tax-to-GDP ratios and TFP, taking labor force participation, inflation, and consumption expenditure into account. The findings demonstrate that while taxes and income inequality significantly affect TFP, the effects are different across country because of differences in economic conditions and legal systems. The study deals important new understandings into how socio-economic inequality and fiscal policy affect productivity in South Asian nations.

Keywords: taxation, total factor productivity (TFP), SAARC countries, GINI coefficient

Introduction

Development must be viewed as a targeted solution to the most extreme types of poverty. Malnutrition, illnesses, illiteracy, unemployment, and inequalities must be reduced over time and eventually eliminated in order to achieve development objectives. To lessen poverty, we are instructed to care for the GNP (Gross National Product). Let's turn this around and address poverty because doing so will benefit the GNP. In other words, let's worry more about the GNP's contents than its rate of growth. As a result, the social aspect is focused on poverty. (Mahboob-ul-Haque, 1971). The fiscal state has three recognized functions in the traditional public finance literature (Musgrave, 1959), providing public goods and services, redistributing revenue, and stabilizing the economy. A trade-off between capital, productivity, and growth is widely recognized (Okun, 1975).

Economic growth has become a cause of concern for the policy maker because a sustainable path of growth is detrimental to development, like education, unemployment, health, inflation, and taxation, etc. (Reyes and Useche, 2019). Although, a lot of research has analysed the effective determinants that would be helpful to strengthen the country. Solow (1956) told that labour, and capital, are key elements of growth. The improvement in government expenditures also helps to promote growth and it is evident that government expenditures increase the growth of the country (Ahuja and Pandit, 2020). IMF reports depicted that those countries that have high rates of public spending are seen in western European countries, on the other hand, low government expenditure turns out to be in developing countries. Therefore, taxpayers in advanced countries inquire that the government discloses the cost of tax revenue. Taxes have restrictions, but in case of emergency, they can be increased by demanding directly from the masses, there are many other methods to grow resources, but the government normally uses the taxation system because it is valuable and simple.

One of the public finance problems is inflation as its increasing trend caused inefficiency in the tax system. Degregorio (1993), and Kormendi and Meguire (1985) empirically presented the negative relationship between inflation and long-run growth. In countries where the inflation tax rate is high to public spending, inflation is positively correlated. Inflation reduces growth Levine and Renelt (1992), Fischer et al. (1991).

Fiscal policy is the sort run phenomenon, but Martin Zagler (2003) filled the gap by presenting growth and expenditure relationship. He investigated the effects of government expenditures and revenues on the growth rate of the economy. Where education expenditures and investment have a positive impact. According to him several tax rates directly affect the division of labour and thus thereby modify the innovation-driven long-run growth rate. Marginal tax rates affect the individual’s incentives to earn additional income (Gwartney and Lawson 2006). By using the data of personal income tax of seventy-seven countries, they examined the relationship of marginal tax rate with growth and income inequality. Analyses were made through both marginal tax rate and the rating matrix used in the Economic Freedom of the World (EFW) index, which consider both marginal tax rate and thresh-hold of income. It was noted that a decrease in top marginal tax rates raises economic growth.

Thus, countries with low tax categories had more income inequality than those with high tax cluster countries. Furthermore, countries with high marginal tax rates had also more inequality and vice versa.

Review of Literature

As financing education is the key to development for any county, Blankenau et al. (2007) found that from the spending point of view when these two variables are regressed without controlling taxation there is no significant effect on fiscal factors and show no evidence of funding of public education. And from the revenue side it it's concluded that fiscal policy positively influence growth. When we run the regression without taxes the crowding out effects are considered along with other control variables then found a positive relationship between education expenditure and economic growth. The study by Padda & Akram (2009) investigates the trends in economic growth due to the change in the effects of the tax rate. They concluded that tax policies positively influenced economic growth. Sameti and Rafie (2010) study the mechanism between taxes, and economic growth, using the panel data for East Asian Countries from 1990-2006 and found that growth, government expenditures, taxes on profits, and capital gains reduce income inequality.

"What matters for economic growth in Pakistan: fiscal policy or its components?" Ahmad and Wajid (2013) empirically tested the data from 1979-2009 by using the ARDL approach and explored the answer to this question with the help of the endogenous growth model. The results of the study explored that development expenditures are positively related to endogenous growth while discretionary taxes (DT) are negatively and significantly related to endogenous growth.

Six SAARC nations are analyzed in the panel data study from 1990–202. The information was gathered from multiple sources. Along with control variables, the analysis is based on the dynamic link between TFP, tax, and the GINI coefficient. The research methodology and econometric approaches were used in the study to accomplish the intended goals.

Research Methodology

Econometric Methods

The strategy and a way to find the answers to research questions is modelling, a way forward that leads the researcher to do a complete analysis of the research hypotheses and objectives of the study. Techniques, which are performed for regression analysis, are: FE model, RE model & Housman Test after that we will perform the Panel ARDL. Methods such as the Housman test, PMG (Pooled Mean Group), and MG (Mean Group) to determine which of those is the best MG of PMG, basically by using these techniques we will try to find the short run and long run elasticities. For the cross-sectional dependence test Pesaran CSD will be applied to find cross-sectional dependence.

Pooled OLS Regression Analysis

The POLS is defined as

$$Y = \beta 0 + \beta 1X1 + \beta 2X2 + \cdots \ldots \ldots \ldots \ldots \ldots + U_n$$

The parameters $\beta 0, \beta 1, \ldots \ldots \beta n$ of the population regression line are estimated by the fitted values b_0, b_1,.., b_n. To end, is the mean value of the error terms, and Ui represents the error term.

The formula for Yit is $\beta 0 + \beta 1xi1 + \beta 2xi2 + \cdots \ldots \ldots \ldots + \varepsilon i$

Breusch and Pagan LM test.

$y = \alpha + \beta_1 x_1 + \cdots \ldots \ldots \ldots + \beta_n x_n + u_t$

$var(u\acute{}x) = \sigma 2$

$v\sim(u\acute{}x) = \sigma 2 f(x)$

$= \sigma 2(\alpha 0 + \alpha 1x1 + \alpha 2x2 + \cdots \ldots \ldots \ldots \ldots + \alpha pxp)$

For this estimate, the LM test determines if POLS or RE is the best option.

H_o: The best is POLS Regression.

H_i: RE model is greatest.

The Fixed Effect (FE) Model

Each entity has distinct qualities which can influence the predictor variables, which in turn can affect people opinion about a given matter or how a country's taxes, income inequalities or GDP effect. According to FE model, the time-invariant characters are particular to each individual and should not be correlated with other characters of the same individual. The error term and constant for each entity should not be associated with those of the other entities because each entity is unique.

The FE equation is:

$Y_{it} = \beta 1 x_{it} + \alpha_i + U_{it}$ ----------1

Where α_i (i=1…. n) is the unidentified intercept. The Y_{it} is a dependent variable where i = entity and t = time. xit represents, independent variables. $\beta 1$ is the coefficient uit is the error term. In this study eq 1 method is used for the FE model.

Random Effect (RE) Model

It is supposed in the RE model, variation across entities is not correlated with the independent variables: "The main difference between fixed and random effects is whether the unobserved individual effect contains elements that are correlated with the regressed in the model, not whether these effects are stochastic or not" (Greene, 2008, p.183). The condition of RE model is:

$Y_{it} = \beta X_{it} + \alpha_i + u_{it} + \epsilon_{it},$ ----------2

$t = 1, 2, 3 \ldots\ldots, T$

Where x_{it} contain evident variables, who change across entities I, whereas time t & variables that change across entities i & time t do not change. Time-invariant variables can assist as

explanatory variables. As, the entity's error term is not correlated with the independent variable. In this model, we investigate for those unique individual traits that might not have an influence on independent variables. The issue with the RE model is that it occasionally results in bias from omitted variables in the model.

Comparing the FE and RE Models using Hausman Test

Now we have the results of two main models RE and FE and we have to decide whether RE is better than FE. This test is used to decide among these models where the acceptance of H_o means random effects is better (Greene 2008, chapter 9). It is employed to determine whether the errors are correlated with regressors. Consider a linear model:

$y = b_1x + e$

in the above equation y is the dependent variable, x is vector of regressors, b is vector of coefficients and e is the error term. According to the model, covariance between an efficient estimator and inefficient estimator is zero. It can also be used to differentiate in panel data, between FE and RE models. While FE is preferred over the alternative since it is at least constant, RE is preferable in this case due to its superior efficiency.

H_0: RE model is better.

H_1: FE model is best.

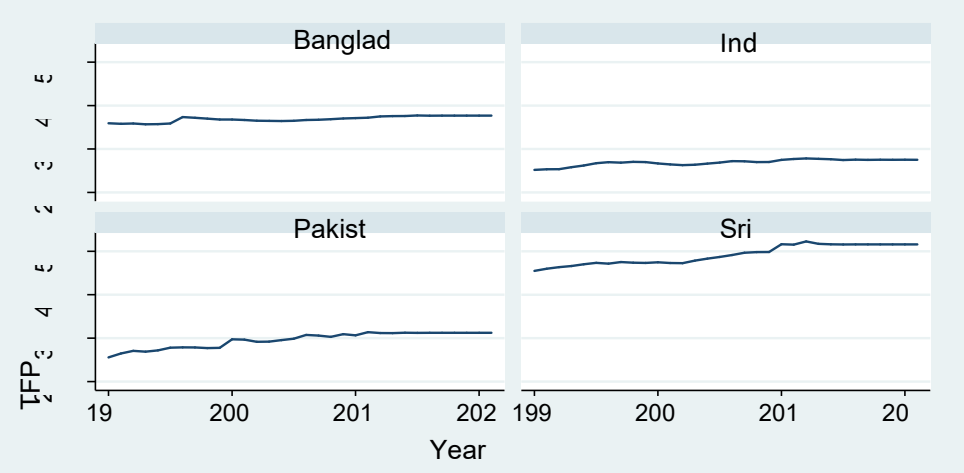
Panel Unit Root Tests

It is essential to check the unit root problem among the variables before applying the econometric technique and also check order of integration. Which tells us, whether the variable is stationary at first difference, possibly will be at the level because the unobserved country-specific effect may exist among the cross-section (Rauf et al., 2018). Similarly, Khan et al. (2019) also recommend the similar test. Thus, we have used two-second generation tests.

1. The Fisher ADF unit root test (Maddala and Wu 1999), and
2. The Fisher PP unit root test.

The second-generation test reports the problem of cross-sectional dependence given by Pesaran (2007).

Figure 1
TFP of SAARC Countries



Source: *trends are estimated from analysed data (Note: 1 Bangladesh, 2 India, 3 Pakistan, 4 Sri Lanka)*

Figure 1 is created on total factor productivity from 1990-21. We see in this figure TFP patterns of four SAARC countries. In SAARC countries total factor productivity is showing a constant time trend without any abrupt change. India is showing a low value and a constant trend which is the lowest in all the four SAARC countries. It has not shown any unexpected changes in its TFP over time. Pakistan is showing a continuous increasing time trend but at a constant rate. Total factor productivity is rising in Pakistan because of the green revolution policy of Pakistan regarding the agriculture sector. Sri Lanka is showing a sharp increasing time trend from 1990-21. It has shown a decreasing and constant trend. Finally, it is seen that in all cross-section trends total factor productivity has an almost constant trend.

The Model and Description of Variables

The econometric model is developed to capture the effect of income inequality and taxes-to-GDP ratio on total factor productivity in the case of four SAARC countries. The functional foam of the model used for the analysis of impact of income inequality and taxes on total factor productivity is as follows:

TFP = f (GINI, Tax, Inflation, Consumption expenditure, Labour) ----------1

The equation foam is as follows. Thus, I and t represents cross-section and time respectively.

$$LNTFP_{it} = \beta_0 + \beta_1 LNGINI_{it} + \beta_2 LNTAX_{it} + \beta_3 LNINF_{it} + \beta_4 LNCEXP_{it} + \beta_5 LNLAB_{it} + U_t$$

----------2

Table 1
Variables and description

Variables	Definition	Sources
LNTFP	Natural Log of Total factor productivity.	ESOP
LNTAX	Natural Log of Total Tax Revenue as % of GDP	ICTD-2021
LNGINI	Natural Log of GINI coefficient.	WIID
LNINF	Natural Log of inflation.	WDI
LNLAB	Natural Log of the total labour force.	WDI
LNCEXP	Natural Log of total consumption expenditure.	WDI

Source: World Development Indicators, World income inequality database, International Conference on Information and Communication Technologies and Development

Statistical Summary

The descriptive statistics of all the variables for six nations are displayed in Table 2 below.

Table 2
Summary Statistics

	LNTAX	LNGINI	LNTFP	LNINF	LNLFT	LNCEXP
Mean	2.387781	0.558220	1.242239	1.915633	17.79573	2.186240
Median	2.433128	0.552229	1.208098	1.938730	17.75857	2.333346
Maximum	2.916656	0.633618	1.653801	3.116378	19.99491	2.868530
Minimum	1.593819	0.460675	0.923266	0.696728	15.75014	1.399519
Std. Dev.	0.318809	0.038975	0.236656	0.500640	1.423950	0.350193

Source: Author's estimation

Stationarity Test

The ADF and Fisher PP tests are used to test for stationarity at constant and linear trends. No variable is integrated of second order, and all the variables are stationary at the level of first difference. The variables exhibiting varying degrees of integration are displayed in Table 3.

Table 3
Stationarity analysis

Series	Augmented Dicky-Fuller Test Statistics			
	Constant		Constant, Linear trend	
	Level	Fist Diff	Level	Fist Diff
LNGINI	24.558**	36.664*	37.702*	23.552*
LNTAX	11.124	69.503*	9.817	51.09*
LNINF	29.38*	110.75*	23.59*	89.28*
LNLAB	24.42*	22.69*	4.13	21.89**
LNCEXP	22.78*	67.99*	14.92	51.72*
LNTFP	9.38	40.76*	8.49	40.76*
	PP Test Statistic			
	Constant		Constant, Linear trend	
	Level	Fist Diff	Level	Fist Diff
LNGINI	12.299	37.748*	21.244**	33.736*
LNTAX	15.260	133.26*	14.695	240.31*
LNINF	37.11*	158.76*	30.84*	464.93*
LNLAB	45.84*	101.57*	5.57	114.662*

LNCEXP	19.66*	114.47*	10.61	99.00*
LNTFP	22.28*	72.96*	6.50	72.98*

Source: estimation

Estimation of Results

Step-by-step estimation was carried out. Firstly, the regression analysis involving (POLS), (FE) and (RE) conducted. Secondly, Brush-Pagan LM test was used to choose between POLS and RE. Thirdly, Hausman test was used to choose between FE or RE? Lastly, both the mean group and the pooled mean group were used to determine the short- and long-term elasticities, and the Hausman test was used to determine which of those should be reported.

The POLS Results for Total Factor Productivity as Dependent Variables

Pooled OLS regression is the result of ordinary least squares regression without the use of dummy variables. It makes the assumption that slopes and interceptions are constant and thus there are no country-specific impacts. Here apply Pooled OLS with dependent variables total factor productivity with other different independent variables like GINI, tax, inflation, consumption expenditure, and labour, etc. were used. The statistics stretched from 1990 to 2021 for four SAARC countries. First, we used the Brush-Pagan LM test to determine which of POLS and Random Effect was the best. Here, β_0 is the intercept, β_1, β_2, β_3, β_4, and β_5 are slope coefficients and U_t is the error term. All the variables were used in Natural log foam. The model fits as results are stated in Table 4. The significance level was taken to be 5 percent. The Prob. (F) is 0.0000 and R-Squared is 0.86 (86% variation) in the dependent variable is explained by independent variables which is a good fit. Estimates of the slope coefficients of other independent variables, such as the GINI, taxes-to-GDP ratio, inflation, consumption expenditure, and labor, were found to be.287, -.015, -.3, and -.154, respectively, while the constant term displays the model's intercept term with a value of 3.524. Thus, all the variables are significant except inflation. The overall significance of the model is demonstrated by the good R-squared and the probability value of the F-statistics. The table also displays t-values, p-values, and individual standard errors. The GINI coefficient's positive and significant sign indicates that total productivity factors will rise by.812 percent for every 1% increase in income inequality. The sign of taxes-to-GDP ratio is positive and significant which shows that if there is 1 percent increase in taxes-to-GDP there will be a .287 percent increase in total factor productivity. The impact of inflation is negative and insignificant. The effect of consumption expenditure is found to be negative and significant on total factor productivity which means that if consumption expenditure rises by 1 percent the total factor productivity will decline by -.303 percent. The sign of labour force is negative and significant which shows that if there is 1 percent increase in the labour force there will be 0.154 percent increase in total factor productivity.

Table 4
Results of The POLS Regression Model with Total Factor Productivity as a Dependent

Variable.					
Variables.	Coefficient.	SE	t-value	p-value	Comment.
LNGINI	.812	.237	3.42	0.001	Significant
LNTAX	.287	.044	6.46	0.002	Significant
LNINF	-.015	.017	-0.91	0.366	insignificant
LNEXP	-.3	.036	-8.28	0.003	Significant
LNLAB	-.154	.006	-23.65	0.002	Significant
Constant	3.524	.188	18.77	0.004	Significant
Number of obs	128				
R^2	0.86				
F-test	158.41				
Prob > F	0.000				
Source: Author's estimation					

The Random Effects Model

The GINI coefficient, the model's dependent variable, is calculated for various independent variables between 1990 and 2021. Table 5 displays the outcomes of the RE model estimation. There are 128 observations in all. The p-value is 0.0000, and the predicted Wald chi-square statistic value is 176. For tax, GDP, total factor productivity, corruption, population, and consumer expenditure, the slope coefficients are.034, -.022,.158,.043,.012, and -.146, respectively, whereas the intercept is 0.034. Now most independent variables are significant and values and signs are consistent with the results of POLS, R-squared values within, between and overall are 0.46, 0.99, and 0.59, respectively. In this case, the Wald chi-square test also helps us determine whether or not RE is appropriate. The chi-square value in this instance is 135 and the p-value is 0.000, indicating that the Ho cannot be accepted and that the RE model is not the most effective.

Table 5
Results of The Random Effects Model with Total Factor Productivity as a Dependent Variable.

Variables.	Coefficient	Standard Error	p-value
LNGINI	.812	.237	0.001*
LNTAX	.287	.044	0.003*
LNINF	-.015	.017	0.365
LNEXP	-.303	.036	0.002*
LNLAB	-.154	.006	0.003*
Constant	3.524	.188	0.001*
Wald Chi-square	794.654		
Prob > chi2	0.000		
R^2 between	0.95		
R^2 overall	0.86		
Source: Author's estimation			

For Random effects use the BP-LM test.

We can determine which of the POLS and Random Effect models is most suited for estimating and future prediction by using the BP LM test for RE. The POLS model is the best, according to H_0, and random effects are the best, according to H_1. The outcomes of the model with total factor production as the dependent variable are shown in Table 6. The chi-square value and p-value is 0.0000 and 0.9876 respectively, which clearly state that we cannot reject the H_0 so, Pooled OLS is the best for estimation.

Table 6
Results of B-P test for RE

Variable	Statistics	Sd=Sqrt(var)
LNTFP	0.0560061	0.236656
E	0.0003083	0.01758
U	0	0
Chi-bar2 = 0.9767		
Source: Author's estimation		

Hausman Test for Decision about PMG and MG

Table 7 displays the Hausman test results for the model's independent variables. According to the Hausman test hypothesis, there is no statistical difference between the PMG and MG models.

H_0: PMG is the best.

H_1: MG is the best.

Since the p-value is greater than 0.10 at the ten percent significance level, we have chosen to adopt the PMG approach. So, it is impossible to reject Ho. Thus, the model supports PMG.

Table 7
Results of Hausman Test

Description.	Coefficient.
Chi-square test value	5.21
p-value	.391
Source: Author's estimation	

Estimation of PMG (Pooled Mean Group)

PMG estimators are used for dynamic heterogeneous panels to check the long-run equilibrium between variables. The PMG is a transitional method between dynamic FE and MG. It is possible to get the interaction between the results by employing both short-term and long-term results. The cointegration link between non-stationary variables serves as the basis

for the long-term interactions between the variables. The contribution of Pesaran et al. (1999) is the maximum likelihood PMG estimators that fit into ARDL.

An equation of error correction term improves the economic meaning, whether the model is converging towards the equilibrium? There are three key factors related to PMG which are necessary to be clarified. First, all variables should have their stationarity checked, and none of them should belong to I (2). Similarly, whether series are integrated at I (0) and I(1) or at the mixed cointegration level, PMG is more suitable than ARDL (Kim et al., 2010). Second, PMG employs an error correction term that ought to be considerable and negative, indicating that the model is moving closer to the long-term equilibrium path. Thirdly, the MG and PMG are the most effective methods for estimating a heterogeneous panel of this kind when the cross-section N is less than time T.

We are projecting that four SAARC nations, which are interdependent on one another within the same regional bloc because of commerce, geography, weather, and monetary and fiscal policies. Because each nation has its own unique affects and characteristics, thus, the long-term results are likely to be consistent, but the short-term results may vary. As a result, there's a likelihood that there are institutional and economic variations by nation. Below is an ARDL model based on ECM. Therefore, the PMG econometric technique for panel data is selected for the best analysis. Table 8 displays the PMG results.

$$(lntfp)_{it} = \alpha_0 + \sum_{i=1}^{n} \alpha_{i2}\, lntp_{i,t-1} + \sum_{i=0}^{n} \beta_{i2}\, lngini_{i,t-1} + \sum_{i=0}^{n} \gamma_{i2}\, lntax_{i,t-1} + \sum_{i=0}^{n} \delta_{i2}\, lninf_{i,t-1} + \sum_{i=0}^{n} \varepsilon_{i2}\, lncap_{i,t-1} + \sum_{i=0}^{n} \epsilon_{i2}\, lnlab_{i,t-1} + \cup_{it}$$

----------3

Equations above and below illustrate the long-term and short-term relationships, respectively. Here α_{i2}, β_{i2}, γ_{i2}, δ_{i2}, ε_{i2}, ϵ_{i2} are the long run coefficients and U_{it} is an error term and the equation is estimated for an ARDL (1,0,0,0,0,0) model. Similarly, in equation 4, α_{i2}, β_{i2}, γ_{i2}, δ_{i2}, ε_{i2}, ϵ_{i2} are the short run coefficients having θ as an error correction term, i represents cross-sections, and 't' represents time.

$$(\Delta lntfp)_{it} = \alpha_1 + \sum_{i=1}^{n} \alpha_{i2}\, \Delta lntfp_{i,t-1} + \sum_{i=0}^{n} \beta_{i2}\, \Delta lngini_{i,t-1} + \sum_{i=0}^{n} \gamma_{i2}\, \Delta lntax_{i,t-1} + \sum_{i=0}^{n} \delta_{i2}\, \Delta lninf_{i,t-1} + \sum_{i=0}^{n} \varepsilon_{i2}\, \Delta lncap_{i,t-1} + \sum_{i=0}^{n} \epsilon_{i2}\, \Delta lnlab_{i,t-1} + \sum_{i=0}^{n} \theta\, ECT_{i,t-1} + \cup_{it}$$

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Table 8

Long-run & Short-run Results

Dependent Variable: Total factor productivity

Long-run Estimations (Based on PMG)				
Variables.	Coefficient.	SE.	Z	p-value.
LNGINI	-0.113	0.094	-1.200	0.232
LNTAX	0.013	0.031	0.400	0.686
LNINF	0.018	0.005	3.280	0.001*
LNEXP	-0.104	0.018	-5.790	0.000*
LNLAB	0.185	0.009	19.590	0.000*
Short-run estimation (Based on PMG)				
Variables.	Coefficient.	SE.	Z	p-value.
ECM (-1)	-0.320	0.177	-1.810	0.071**
Δ LNGINI	-0.370	0.222	-1.670	0.095**
Δ LNTAX	-0.003	0.009	-0.360	0.717
Δ LNINF	-0.007	0.004	-2.040	0.041**
Δ LNEXP	-0.013	0.013	-1.000	0.315
Δ LNLAB	-0.007	0.054	-0.130	0.893
Constant	-0.638	0.355	-1.800	0.072**
Source: Author's estimation				

All of the short- and long-term variables are expressed as natural logarithms in order to get the results in the form of elasticities. Table 8 presents the PMG model's results, which indicate that the GINI coefficient has a negative but negligible long-term influence. Since corruption is a prominent problem in SAARC nations, it is used in conjunction with other factors. According to its estimation, it has a slight but favorable effect on income inequality. Revenue from taxes has a positive but negligible effect on GDP. Total factor productivity is positively and significantly impacted by inflation, meaning that a 1% increase in inflation will result in a 0.018 increase in total factor productivity. consumer spending has a negative and significant effect on total factor productivity; a 1% increase in consumer expenditure would result in a 0.104% decrease in TFP. TFP is positively and significantly impacted by labor, meaning that a 1 percent increase in labor will result in a 0.185% rise in total factor productivity. Most of the variables are significant in the long run and signs of all the variables are as per expectation. In the short term, inflation is also important, and the estimate of the GINI coefficient is considerable and consistent with the long-term results of the constant term. The model is moving closer to the long-run equilibrium path since the error correction term is negative and large. With these relevant independent variables, it is discovered that there is an annual convergence of 32.11% from short-run to long-run equilibrium, and the ECM coefficient value is observed to support the theory (with a negative sign). It is consistent with the long-term results since the short-term effects of the taxes-to-GDP ratio, total factor productivity, and consumption spending are found to be considerable.

Cointegration Result by Westerlund

Using the panel cointegration technique, we have taken into account the cointegration among the variables with the basic time component and allow for variability. The Westerlund ECM panel cointegration test was used for this. The findings of four statistics (Gt, Ga, Pt, and Pa) are displayed in Table 9. The test statistics are Ga and Gt. The weighted average of each separately determined t-ratio serves as the starting point for these statistics. Therefore, the rejection of H0 should be interpreted as proof that at least one cross-sectional unit is cointegrated. The statistics for the Pa and Pt tests combine data from every cross-sectional unit. Therefore, rejection of H0 should be interpreted as proof of cointegration for the entire panel. The Westerlund test's hypothesis states that there is no panel cointegration. The panel's overall cointegration is demonstrated by the first two Gt and Ga tests. In contrast, Pt and Pa are used to test the cointegration of at least one unit. Four tests demonstrate that the panel is cointegrated, and the results reject H_0 and accept H_1

Table 9
Cointegration Result by Westerlund

Statistics.	Value.	z-value.	p-value.
Gt	-2.059	0.275	0.0002*
Ga	-1.559	2.468	0.6667
Pt	-3.157	0.496	0.0001*
Pa	-1.028	1.761	0.0001*

Source: Author's estimation

Causality Analysis

The Dumitrescu-Hurlin (DH) causality test finds the existence of causality among the variables. It tests whether there is any causality running between total factor productivity and its determinants in four SAARC countries? Table 8.10 shows the results of causality test, and it is seen that there is one-way causality from Labour force to GINI coefficient. Consumption expenditures have a one-way causal relationship with inflation, the GINI coefficient, and total factor productivity. It is also found that one-way causality runs from inflation to consumption expenditure. Two-way causality is found between taxes-to-GDP ratio and labour force; GINI coefficient and total factor productivity; inflation and total factor productivity; and taxes-to-GDP ratio and GINI coefficient. Maximum number of variables have shown one-way causality while, some have shown two-way causality. Conversely, no causality is originated between TFP and labour force; inflation and labour force; consumption expenditure and inflation; taxes-to-GDP ratio and TFP; inflation and GINI coefficient; consumption expenditure and taxes-to-GDP.

Table 10
Results of Dumitrescu-Hurlin causality

Null Hypothesis: Ho	z-stat.	p-value.	Inference.
LNTFP ⇏ LNLFT	0.53255	0.5943	No causality exists.
LNLFT ⇏ LNTFP	0.55033	0.5821	
LNGINI ⇏ LNLFT	-0.29171	0.7705	One-way causality exists.
LNLFT ⇏ LNGINI	4.14264	0.0000	
LNINF ⇏ LNLFT	-0.59867	0.5494	No causality exists.

LNLFT ⇎ LNINF	1.15762	0.2740	
LNTAX ⇎ LNLFT	1.64653	0.0997	Two ay causality exist.
LNLFT ⇎ LNTAX	2.83707	0.0046	
LNEXP ⇎ LNLFT	0.26889	0.7880	No causality exists.
LNLFT ⇎ LNEXP	0.93532	0.3496	
LNGINI ⇎ LNTFP	2.11022	0.0348	Two-way causality exists.
LNTFP ⇎ LNGINI	3.83950	0.0001	
LINF ⇎ LNTFP	3.07314	0.0021	Two-way causality exists.
LNTFP ⇎ LNINF	2.49730	0.0125	
LNTAX ⇎ LNTFP	0.57514	0.5652	No causality exists.
LNTFP ⇎ LNTAX	-0.59140	0.5543	
LNEXP ⇎ LNTFP	2.77844	0.0055	One-way causality exists.
LNTFP ⇎ LNEXP	0.27878	0.7804	
LNINF ⇎ LNGINI	1.11818	0.2635	No causality exists.
LNGINI ⇎ LNINF	0.49171	0.6229	
LNTAX ⇎ LNGINI	3.27918	0.0010	Two-way causality exists.
LNGINI ⇎ LNTAX	1.87466	0.0608	
LNEXP ⇎ LNGINI	2.14715	0.0318	One way causality exists.
LNGINI ⇎ LNEXP	1.06046	0.2889	
LNTAX ⇎ LNINF	0.81469	0.41153	One way causality exists.
LNINF ⇎ LNTAX	1.49954	0.1037	
LNEXP ⇎ LNINF	0.08452	0.9326	One way causality exists.
LNINF ⇎ LNEXP	1.42710	0.1053	
LNEXP ⇎ LNTAX	-1.00552	0.3146	No causality exists.
LNTAX ⇎ LNEXP	0.84579	0.3977	
Source: Author's estimation			

Diagnostic Analysis

Table 11
Results of the Diagnostic Tests

Robustness Analysis	Vif	Prob	Remarks
Slope heterogeneity Yamagata	------	0.2446	No slope heterogeneity
Breusch-Pagan Cook-Weisberg test	------	0.8709	No Heterogeneity
Multicollinearity	1.98	-------	No Multicollinearity
Pesaran's cross-sectional Dependence	------	0.338	No cross-sectional dependence
Source: Author's estimation			

Conclusion and Recommendations

The present study aims to explore the relationship between taxation, economic growth, and inequality, the impact is measured by an examination of panel data covering the years 1990–21. The variable of TFP which is the main novelty of our thesis. Firstly, the effect of income inequality on TFP was found to be negative. The effect of tax was found to be negative. In

the short run labour force augmented the TFP. The ECT was found to be negative and significant which meant that the model was converging towards the long-run equilibrium path. Mostly obtained results support the theoretical background and expectations. Recent studies as well as our study have explored the connection between inequality and economic growth. In a paper, Barro (2000) made the case that inequality inhibits growth in developing nations while fostering it in wealthy ones. Our research, taken in conjunction with numerous recent studies, came to the same conclusion: The impact of inequality on growth is detrimental. The ambition to eliminate or lessen economic disparity is commonly linked to the political left worldwide. The idea that economic inequality erodes social cohesiveness and feeds social unrest, undermining society overall, is the main justification for reduction. This is supported by evidence and makes sense, at least for small, in-person gatherings of people.

Alberto Alesina and Robert MacCulloch (2004) found that while inequality harms happiness in Europe, it does not have such an effect in the United States. There is also the claim that political inequality always follows economic inequality, which exacerbates the problem. The key distinction between the findings of different researchers essentially has to do with the relative weighting of each effect and the location of the ideal balance point. Both sides generally agree that the causes of economic inequality are based on non-economic differences (such as race, gender, etc.) should be reduced. There is a great deal of disagreement over how to achieve this minimization. The amount of empirical literature, however, that focuses on how inequality affects the rate of productivity growth is small but growing. Similar to those on the growing nexus, empirical studies on the inequality-productivity nexus have yielded conflicting results. While some studies by Dipietro (2014) reported a negative relationship, others showed positive outcomes regarding the impact of inequality on productivity Mahy et al. (2011). Additionally, our findings show that TFP is negatively and statistically significantly impacted by rising income inequality in SAARC countries. The natural negative link between growth and inequality, which is primarily caused by political instability, is what causes the negative relationship between inequality and growth. In other words, the negative effects of inequality demonstrate how political unrest brought on by income inequality hurts productivity and economic growth. These results imply that the negative effects of income inequality on productivity and growth in neighbouring regions are more than just an intuitive theory; rather, they seem to be a fundamental reality of economic phenomena that essentially connects the negative effects of income inequality with TFP.

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