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Measuring the relationship and trend analysis among the macro-economic variables (Revenues, per capita income, GDP, and annual budget) in the successive periods of Bangladesh

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ABSTRACT

This study aims to explore the relationship and trend among the macro variables (total revenues, tax revenues, non-tax revenues, direct tax, indirect tax, per capita income, GDP, and annual budget) of Bangladesh in the successive periods. In this study, we used secondary data from the fiscal year 1972-1973 to 2019-2020 from the National Board of Revenues and Ministry of Finance. Chi-Square Test and Durbin Watson Test have been executed in this study. The result of the study revealed that total non-tax revenues, total indirect tax, and annual budget have statistically significant associations with annual GDP, whereas, total direct tax and per capita income have no statistically significant impacts on annual GDP in Bangladesh. The time factors also have an impact on the GDP and government revenue generation. Next, we found that total revenues of the government, total non-tax revenues, total direct tax, and total indirect tax has a significant positive association but per capita income has no impact on revenues of the government. However, government revenues have a significant impact on the annual budget influenced by the time factors. The findings of the study can be used in policy making in raising government revenues in consideration of macro-variables in Bangladesh.

Keywords: GDP, government revenues, tax revenue, per capita income and annual budget.

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1.0 Introduction

Very recently, Bangladesh has graduated from least developed countries to developing countries along with Lao People's Democratic Republic and Nepal for achieving outstanding advancements in health and socioeconomic crisis (CDP, 2021; and UN, 2021). Demographic position, strong readymade garments exports, the flow of foreign remittance, and stable macroeconomic condition have played a strong contribution to poverty reduction and economic growth of Bangladesh and able to draw the attention of the world community and emerged as the fastest-growing economy in the world with a strong stable growth rate (WB, 2022). Bangladesh is a small but densely populated country got independence in 1971 with the lowest per capita GDP, fragile economy, infrastructure, and many more problems but now in the sectors of quality of education, gender equality, reduction of child mortality, improvement in maternal health have been achieved (WB, 2022; Mohajon, 2013). Over the last decades, Bangladesh has improved remarkable progress in human development outcomes, attainment of foremost macroeconomic heads, continuous high economic growth rate, achieving self-sufficiency in food production, substantial lessening in poverty, increase inequality, increases in national savings and investment, advancement in social safety network, reducing malnutrition, progress in the increase in primary education, gender equalization, increase of access to pure drinking water, a revolution in communication technology, enhancing production and consumption of energy (Helal and Hossain, 2013). In development issues, along with Hong Kong, Singapore, South Korea, and, Taiwan, Bangladesh is now considered a rising tiger of Asia and a role model of development for the third world nations (Gerber, 2017; Musa, 2021). Recently, Bangladesh emerged as a lower-middle-income country by continuous progress in GDP, per capita income, employment and remittance, power generation plant, mega projects execution, information technology, high tech park, mobile banking, internet expansion, and E-governance (Bangladesh Rio + 20: 2012; Musa, 2021). A huge amount of funds in the annual budget needs to deploy in ever-increasing development projects and to continue the economic growth of the country (Shill *et al.* 2020; Rahman *et al.* 2020; Mahmud *et al.* 2020) lead to a rapid increase the debt (including the internal and external) burden of the government and annual budget deficit (Mohajon, 2013). Equally, Bangladesh is facing high inflation, government debt, shortage of electricity, poor road network, bridges and ports, natural calamities, accelerating economic growth, unemployment, exchange rate management, deficit budget, negative trade balance, and dependency on interest-bearing debts are major problems in national production and development (Mohajon, 2013; Raihan, 2019; WB, 2022). To match between ever-increasing fund demand and the supply of funds, the government needs to raise internal sources of revenues. Revenues can be raised from both tax revenues and non-tax revenues. Tax revenues can be generated from both direct tax and indirect tax. During the last five decades, the contribution of government revenues, tax revenues, non-tax revenues, direct tax revenues, and indirect tax revenues are rising significantly along with the annual budget and GDP (Shill *et al.* 2020; Rahman *et al.* 2020; Mahmud *et al.* 2020).

Gross domestic product is considered one of the determinants of economic growth for countries (Kira, 2013). Development in health, education, crime, economic growth, and poverty reduction can be hindered by the discrepancy in the growth of GDP per capita income within a country. For maintaining stable inflation, the government needs to increase taxes and reduce government expenditures (Jain et al. 2015). Government and household expenditure and exports have direct influences on GDP growth along with increases in oil prices, power shortage, and political instabilities (Kira, 2013). GDP has a statistically significant long-run relationship with annual budget revenues (Belullo and Duzman, 2011) and budget revenues are collected and generated from tax, non-tax, direct, and indirect tax revenues leading to enhance per capita income of a country (Shill *et al.* 2020; Rahman *et al.* 2020; Mahmud *et al.* 2020). Government revenues generation has a positive association with the annual GDP of a country (Rosoui, 2015) and Government revenues generation has a positive association with government expenditure. If government expenditure is higher than government revenues generation leads to a budget deficit (Kaka, 2020) and that is happening in Bangladesh now. During the last five decades, total annual budget, total revenues, total tax revenues, total non-tax revenues, total direct tax, total indirect tax, total GDP, and per capita income has been increased rapidly with few fluctuations but we have no idea about the association of GDP with the total annual budget, total revenues, total tax revenues, total non-tax revenues, total direct tax, total indirect tax, and per capita income. Association of total revenues with total tax revenues, total non-tax revenues, total direct tax, total indirect tax, and per capita income. Finally, the association of the annual budget with total revenues. These studies stated the following objective:

i. Measuring the relationship and trend analysis among the macro-economic variables (revenues, per capita income, GDP, and annual budget) in the successive periods of Bangladesh.

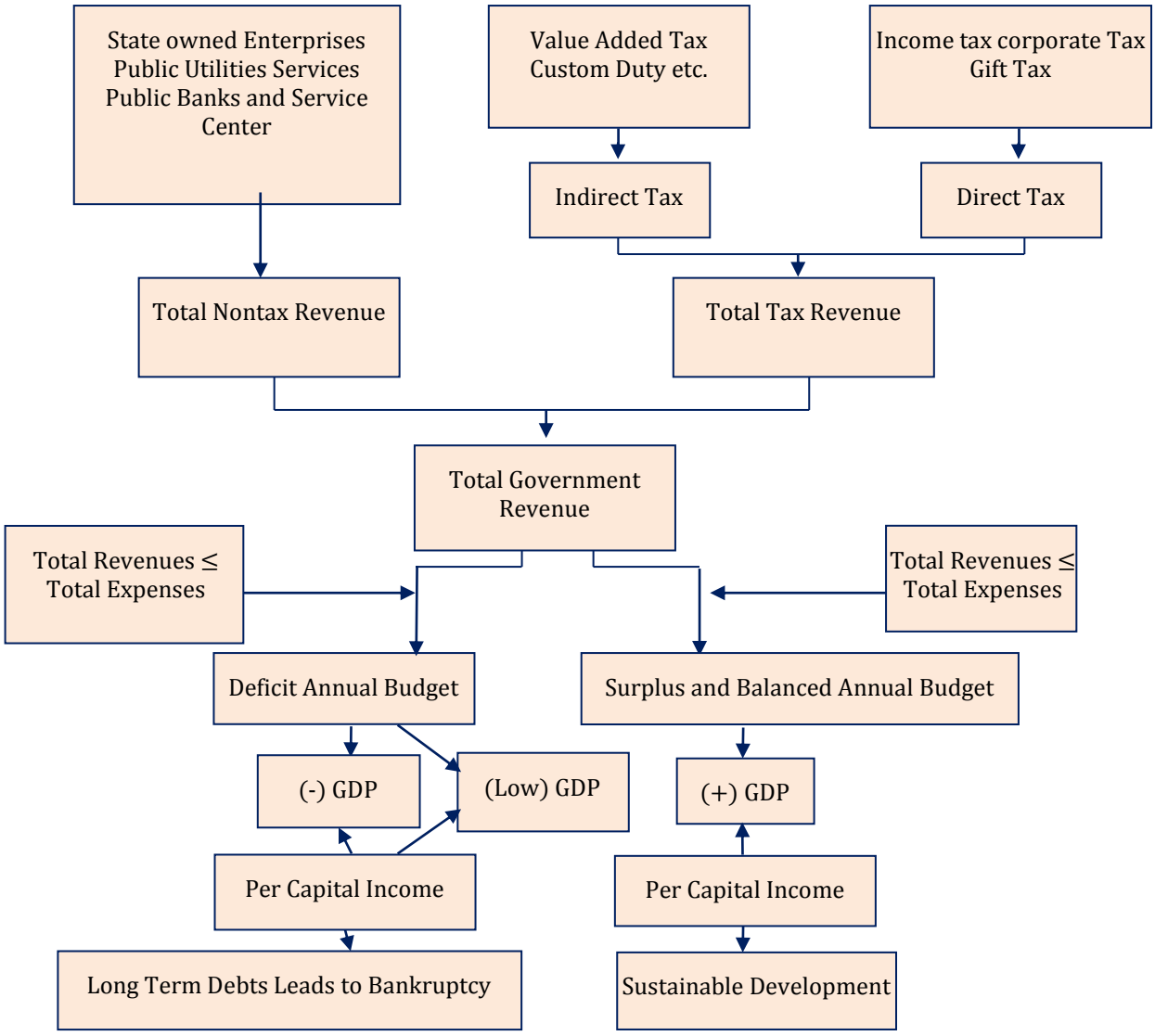

Figure 1. Ultimate Consequences of Government Revenues Generations

2.0 Literature review

Government revenues basically collected from tax sources and non-tax sources. Tax revenues are derived mainly from two sources namely direct tax and indirect tax. An example of direct tax is income tax and an example of indirect tax is VAT, supplementary tax, turnover tax, etc. Non-tax revenue has been considered as the second-largest source of revenue in Bangladesh after-tax revenues (Bangladesh Bank, 2018). Different sources of income and fees levied on income from financial assets, public goods are termed as non-tax revenue (Mourre and Reut, 2017).

2.1 Government revenues and developments in Bangladesh

In order to reduce the budget deficiency, the government finances funds from domestic and foreign sources. In comparison between domestic and foreign sources, the government intends to rely on domestic sources as it is less costly and focuses to extend the more internal sources (Sadekin et al., 2020). There is a relationship between government tax revenues and government spending and the government intends to generate enough tax revenues for government expenditures (Kaka, 2020).

2.2 Government revenues from a global perspective

Indirect tax plays a significant contribution to government tax revenues collection in India and corporate tax is the major source of direct tax collection (Gupta and Sharma, 2021). Direct and indirect taxes are now not only the main sources of government revenues but also an important factor in the modern macroeconomic (Brautigam, 2002). The development of a country largely depends on the trends of collection and changes, proper realization, and continuity of this source of income, which accounts for more than 80% of the government's revenue (Ortiz-Ospina and Roser, 2016).

2.3 Association among the Variables

The direct tax has a substantial and adverse association with the economic growth of Bangladesh but indirect tax has a positive association with the economic growth of Bangladesh. Between direct and indirect tax sources in total tax revenues, direct tax has a considerable and beneficial impact on total tax revenue (Hakim, 2020). There is a strong and positive association between financial inclusion and tax revenues (Oz-Yalaman, 2019). There is a strong endogenous association in the short run among institutional quality, government expenditure, tax revenue, and economic growth (Arvin et al., 2021). Indirect tax has a negative relation with GDP. To attain the county's socio-economic stability, a revised tax policy is required (Hosen, 2019). Tax revenues, direct tax, and indirect tax have a positive influence on Nigeria's economy (Ogundana et al., 2017). Rising corruption, inflation, and political instability lead to a decline the tax collections whereas trade openness and real per capita income increase tax collections (Amin et al., 2014). In Vietnam, the indirect tax has a beneficial impact and promotes economic progress, but the direct tax has an intangible consequence on economic progress (Nguyen, 2019). There is a lack of sufficient attention to identifying potential sources of revenues collection in Bangladesh (Miti et al., 2018).

From the literature review, several studies show that total government revenues, tax revenues, non-tax, direct and indirect tax are associated with economic growth, annual GDP, per capita income, and economic growth. Several studies examined the factors affecting the trends of total government revenues, tax revenues, and non-tax, direct and indirect. Many studies showed positive and negative associations among the variables. But we have no actual scenarios of Bangladesh's perspective from the fiscal year 1972-1973 to 2020-2021, to address this issue, by this motivation, we have embarked this study.

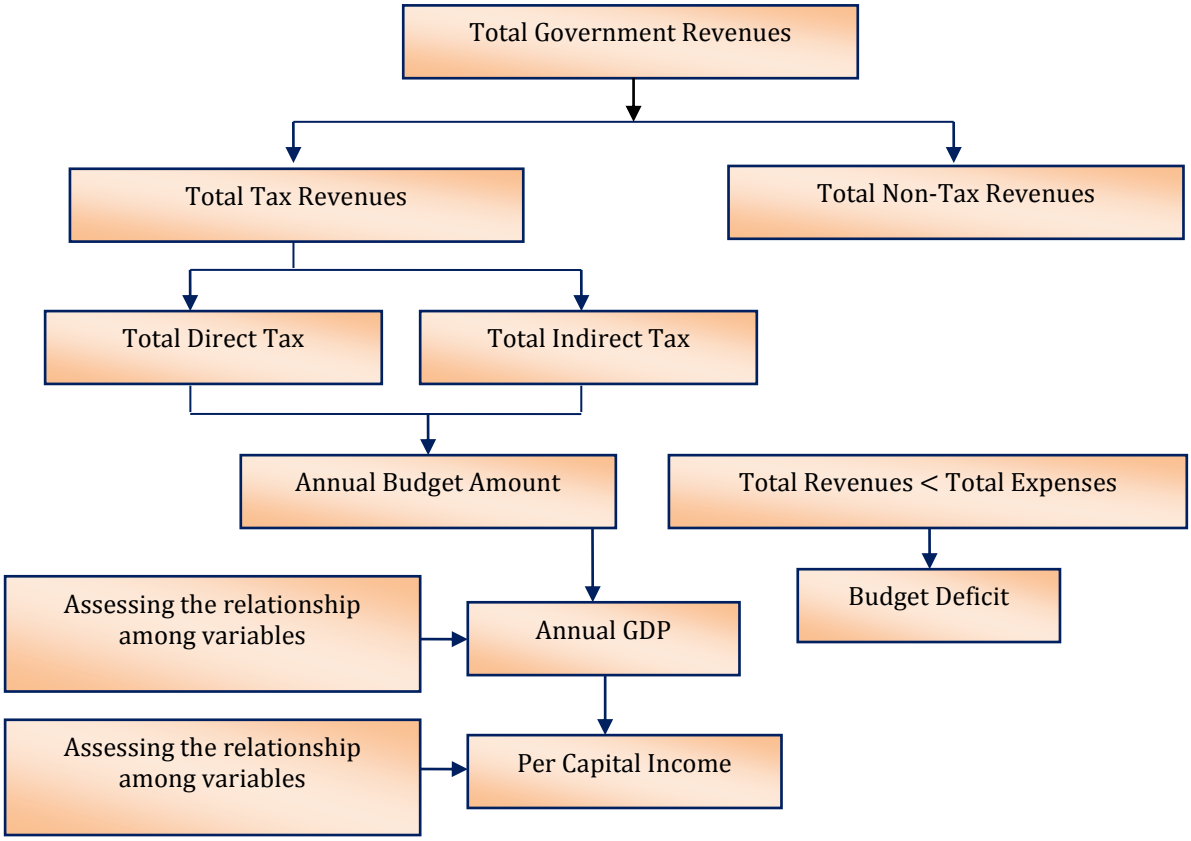

Figure 2. Overall Summery of the Study

3.0 Methodology

3.1 Dataset

Dataset constitutes the data of annual budget, total governments revenues, total tax revenues, total non-tax revenues, total direct tax revenues, total indirect tax revenues, annual GDP, per capita income, and annual budget of Bangladesh from the fiscal year 1972-1973 to 2019-2020, collected from National Board of Revenues (NBR), ministry of finance people's republic of Bangladesh. All the values are taken in billion Tk.

3.2 Analysis type

This study is inferential analysis. Data analysis was conducted through SPSS.

3.3 Model specification

Following linear multiple regression models have been applied to know the explanatory variables on GDP.

$$GDPi = \beta_0 + TR_i\,\beta_1 + TTR_i\,\beta_2 + TNR_i\,\beta_2 + TDT_i\,\beta_3 + TIT_i\,\beta_4 + PCI_i\,\beta_5 + AB_i\,\beta_6 + \varepsilon \quad (1)$$

$$TR_i = \alpha_0 + TTR_i\alpha_1 + TNR_i\alpha_2 + TDT_i\alpha_3 + TIT_i\,\alpha_4 + PCI_i\,\alpha_5 + \varepsilon \quad (2)$$

$$ABi = \gamma_0 + TR_i\,\boldsymbol{\gamma_1} + \varepsilon \quad (3)$$

Where,

GDP:	Gross Domestic Product	TDT:	Total Direct Tax
TR:	Total Revenues	TIT:	Total Indirect Tax
TTR:	Total Tax Revenues	PCI:	Per Capita Income
TNR:	Total Nontax Revenues	AB:	Annual Budget
ε:	Error Term		

Model for growth calculation

Average growth of GDP, $G_{GDP} = (\sum \frac{Y_t^{GDP} - Y_{t-1}^{GDP}}{Y_{t-1}^{GDP}})/n$

Average growth of TR, $G_{TR} = (\sum \frac{Y_t^{TR} - Y_{t-1}^{TR}}{Y_{t-1}^{TR}})/n$

Average growth of TTR, $G_{TTR} = (\sum \frac{Y_t^{TTR} - Y_{t-1}^{TTR}}{Y_{t-1}^{TTR}})/n$

Average growth of TNR, $G_{TNR} = (\sum \frac{Y_t^{TNR} - Y_{t-1}^{TNR}}{Y_{t-1}^{TNR}})/n$

Average growth of $G_{TDT} = (\sum \frac{Y_t^{TDT} - Y_{t-1}^{TDT}}{Y_{t-1}^{TDT}})/n$ TDT,

Average growth of TIT, $G_{TIT} = (\sum \frac{Y_t^{TIT} - Y_{t-1}^{TIT}}{Y_{t-1}^{TIT}})/n$

Average growth of PCI, $G_{PCI} = (\sum \frac{Y_t^{PCI} - Y_{t-1}^{PCI}}{Y_{t-1}^{PCI}})/n$

3.4 Hypotheses

H1: There is significant impact of TR, TTR, TNR, TDT, TIT, PCI, and AB on GDP.
H2: There is significant impact of TTR, TNR, TDT, TIT, and PCI on TR.
H3: There is significant impact of TR on AB.

3.5 The applied test in this study:

To get the validity of the results of the objective 1, 2 and 3, following tests have been used.

3.5.1 Chi Square Test

Chi-square tests have been used in the determination of the source of results for more than a hundred years (Sharpe, 2015). In research, the examination of cross-classified category data is very common and the chi-square test of Karl Pearson's family is one of the most utilized statistical analyses of the association of categorical variables (Franke and Christie, 2012; Ugoni and Walker, 1995). When experimental frequencies are compared with theoretical frequencies based on hypotheses, the chi-square test is widely applicable (Tallarida and Murray, 1987). In order to get valid results, we are using the chi-square test in this study.

$$\chi^2 = \sum \frac{(O-E)^2}{E}$$

where, O = observed value (actual value) and E = expected value

3.5.2 Durbin Watson Test

For the test of autocorrelation of a first-order in regression analysis, the Durbin Watson is mostly used. For the normal distribution of a large sample, the Durbin Watson test can be used and able to bring better results (Akter, 2014). The Durbin Watson test is one of the most powerful simple tests against first-order autocorrelation (White, 1992). When observations are missing in introgression models, the Durbin Watson test is used for serial correlation of errors (Dufour and Dagenais, 1985). As this study dealt with large data and required knowing autocorrelation among the variables in relation to timing effects, we are embarked to use this test.

$$d = \frac{\sum_{i=2}^{n}(e_i - e_{i-1})^2}{\sum_{i=1}^{n} e_i^2}$$

where i is the number of observations.

Total analysis of the study will be divided into three parts. First one is correlation findings, second one is trends analysis and third one is statistical test. All results of the study are showed in different graphs, plots and charts.

3.6 Methodological flowchart

In this study, we early pictured the summary of this study in figure 2. Furthermore, this study also focusing analyzed processes to reach the findings.

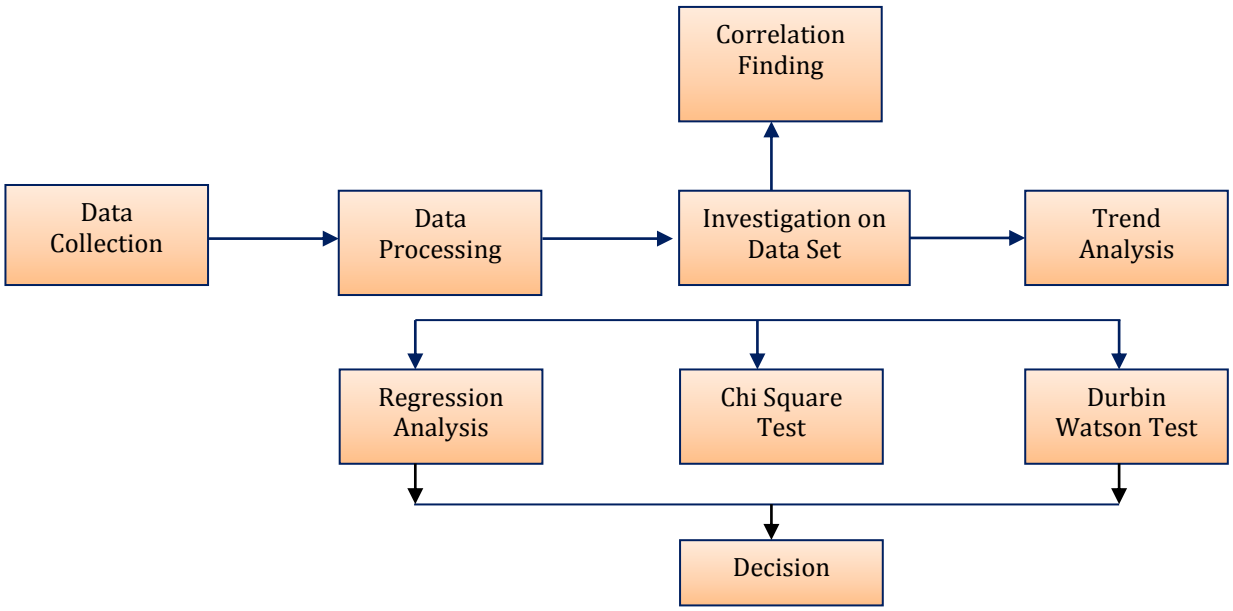

Figure 3. Overview of data analysis process

The description of the variables is given below.

3.6.1 Annual budget

It is the annual summary of total revenues and income of the country for a specific period of time normally for the fiscal year and it is considered a significant instrument for state fiscal policy.

3.6.2 Total revenues

Government revenues are generated from both tax sources and nontax sources. Government revenues are used basically for government spending and it is considered an important part of state fiscal policy (Carroll, 2009; Hayes, 2021; Atkinson and Stiglitz, 1976).

3.6.3 Total tax revenues

Tax revenues are one type of public revenue, that is paid by citizens of the country to live in a civilized society without expecting any direct benefits (Shill *et al.* 2020; Rahman *et al.* 2020; Mahmud *et al.* 2020). Government tax revenue collections are basically based on two structures, direct and indirect taxes (Atkinson & Stiglitz, 1976). Examples of Tax Revenues are corporate tax, personal tax, customs duty, value-added tax, and services tax (Shill *et al.* 2020; Rahman *et al.* 2020; Mahmud *et al.* 2020).

3.6.4 Total non-tax revenues

Total Direct Tax: government revenues generations from the sources except taxed are termed as non-tax revenues such as income from public enterprises and property, income from the forest, and civil works (Shill *et al.* 2020; Rahman *et al.* 2020; Mahmud *et al.* 2020). Direct tax is paid by the persons on which it has been imposed and cannot transfer the tax liability to the third parties such as income tax and land revenues (Shill *et al.* 2020; Rahman *et al.* 2020; Mahmud *et al.* 2020). Direct taxes are largely levied on natural people (individuals) and are often based on the taxpayer's capacity to pay as assessed by income, consumption, or net worth. The sources of income tax may be divided into seven categories: Salaries, Interest on securities, Earnings from the personal property or real estate, Earnings from agriculture, earnings from business or profession, capital gains, and earnings from other sources (SUPRO, 2017).

3.6.5 Total indirect tax

In indirect tax the ultimate tax liability can be transferred to third parties basically it is imposed on sales or purchase of any goods and services rather than any personal services such as customs duty and value-added tax (Shill *et al.* 2020; Rahman *et al.* 2020; Mahmud *et al.* 2020).

3.6.6 Total annual GDP

The annual GDP of a country can be calculated by considering consumption, investment, government spending, exports, and imports of a country within a specific period of time. In other words, annual GDP measures the monetary value of final goods and services by subtracting the production in a country in a given period from the final users' amount.

GDP = Consumption + Investment + Gov't Spending + (Exports - Imports)

3.6.7 Per capita income

The amount of money earned per person in a given period in a specific region or geographical location to measure the standards of living is per capita income (Hunter and Markusen, 1986).

4.0 Result and discussion

In our methodology section, we have set equation that is the model of the study. In case of model (1), we find that the adjusted R^2 is .999 that indicates all of the variables are explained properly.

Table 1.

Impact of explanatory variable as on dependent variable (GDP) in respect of model-1.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	291.195	111.327		2.616	.012
	TNR	9.880	1.618	.154	6.107	.000
	TDT	-.612	1.475	-.017	-.415	.681
	TIT	7.178	2.067	.408	3.472	.001
	PCI	-84.890	42.855	-.045	-1.981	.054
	AB	2.825	.525	.495	5.378	.000

a. Dependent Variable: TGDP

In table 1, unstandardized B and standardized Beta for TDT and PCI are negative which means total direct tax and per capita income has no impact on total GDP, whereas, the p of total nontax revenues, total indirect tax, and the annual budget is less than of 0.05 that means total non-tax revenues, total indirect tax, and annual budget have statistically significant impacts on total GDP.

Table 2.

Measurement of Chi Square value of model-1.

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1728.000[a]	1692	.266
Likelihood Ratio	337.997	1692	1.000
N of Valid Cases	48		

Table 2 inject that; since the calculated value is less than the tabulated value of 6.134 at a 5% level of significance at 1 degree of freedom the null hypothesis is rejected and the alternative hypothesis is accepted as there is the significant impact of TR, TTR, TNR, TDT, TIT, PCI, and AB on GDP.

4.1 Durbin Watson test

Table 3.

Durbin Watson Test's value in model-1.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.810[a]	.656	.649	4367.79598	.055

a. Predictors: (Constant), FY
b. Dependent Variable: TGDP

Table 3, that show the value of R, R2, adjusted R2, and the value of the Durbin Watson Test are 0.810, 0.656, .649, and .055 respectively. As the calculated value of the Durbin Watson Test is less than the tabulated value, so null hypothesis is rejected and the alternative hypothesis is accepted as there is a significant impact of TR, TTR, TNR, TDT, TIT, PCI, and AB on GDP.

We find that the value of adjusted R2 is 1.00 in the case of the model (2), which is indicated that all of the variables are explained properly.

Table 4.

Impact of explanatory variable as on dependent variable (TR) in respect of model-2.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
2	(Constant)	.015	.046		.324	.747
	TNR	1.000	.001	.156	1220.257	.000
	TDT	1.000	.001	.282	1204.920	.000
	TIT	1.000	.000	.569	2039.722	.000
	PCI	.002	.012	.000	.135	.893
	(Constant)	.015	.046		.324	.747

a. DependentVariable: TR

From table 4, the p-value of TNR, TDT, TIT is 0.000 which is less than 0.05 and leads to rejecting the null hypothesis and accepting the alternative hypotheses meaning total nontax revenues, total direct tax revenues, and total indirect tax revenues have statistically significant impacts on total revenues, while, p of total PCI is 0.893 which is greater than of 0.05 which indicates per capita income has no statistically significant impacts on total revenues.

Table 5.

Measurement of Chi Square value of model-2.

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1728.000[a]	1692	.266
Likelihood Ratio	337.997	1692	1.000
N of Valid Cases	48		

From table 5, depicts the calculated value is 0.266 which is less than the tabulated value of 6.134 at a 5% level of significance at 1 degree of freedom. These findings lead to rejecting the null hypothesis and accepting the alternative hypotheses as TTR, TNR, TDT, TIT, and PCI have statistically significant impacts on TR.

4.2 Durbin Watson test

Table 6.

Durbin Watson Test's value in model-2.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
2	.820[a]	.673	.666	426.23707	.036

a. Predictors: (Constant), FY
b. Dependent Variable: TR

Here, the value of R, R2, adjusted R2, and Durbin Watson Test are derived from table 6 as .820, .673, .666, and 0.036 respectively. Here the calculated value of the Durbin Watson Test is less than the tabulated value which leads to rejecting null hypotheses and accepting the alternative. So TTR, TNR, TDT, TIT and PCI are seismically associated with TR along with timing effects.

From the model (3) summary, we came to know that the value of R2 is 0.985 which indicated that all variables of this model are explained properly.

Table 7.
Impact of explanatory variable as on dependent variable (AB) in respect of model-3.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
3	(Constant)	-52.329	27.879		-1.877	.067
	TR	1.739	.032	.993	55.172	.000
	a. Dependent Variable: AB					

Table 7 is indicating that the p-value is .0000 which is less than 0.05 and leads to rejecting the null hypothesis and accepting the alternative hypothesis as on annual budget, total revenue has statistically significant impacts.

Table 8.
Measurement of Chi Square value of model-3.

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1728.000[a]	1692	.266
Likelihood Ratio	337.997	1692	1.000
N of Valid Cases	48		

Table 8 stated that the calculated value is .266 which is less than the tabulated value of 6.134 at a 5% level of significance at 1 degree of freedom. Furthermore, findings embarked to reject the null hypotheses and accept the alternatives hypotheses.

4.3 Durbin Watson Test

Table 9.
Durbin Watson Test's value in model-3.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
3	.782[a]	.611	.602	815.26796	.051
a. Predictors: (Constant), FY					
b. Dependent Variable: AB					

Here, Table 9 show that the value of R, R2, adjusted R2, and Durbin Watson Test are .809,.655,.648, and 0.054 respectively. As the calculated value of the Durbin Watson Test is less than the tabulated value, so null hypothesis is rejected and the alternative hypothesis is accepted as there is the significant impact of TR on AB along with timing effects.

Trends of Economic Variables:

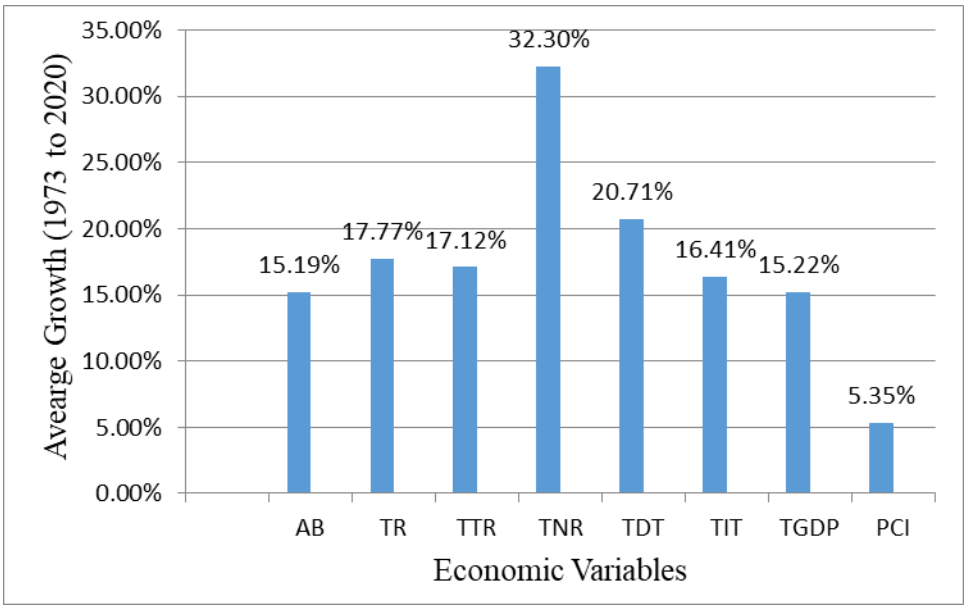

Figure 4. Trends of Economic Variables

Above figure shows the average growth percentages of economic variables from 1973 to 2020. During this time frame average percentage of annual budget, total revenue, total tax revenue, total non-tax revenues, total direct tax, total indirect tax, total GDP and per capita income was 15.19%, 17.77%, 17.12%, 32.30%, 20.71%, 16.41%, 15.22% and 5.35% respectively. Highest average growth was attained by total non-tax revenues whereas lowest by per capita income.

5.0 Conclusion and policy implication

From 1972 to 2020 Bangladesh have an appreciable and noticeable improvement almost in every context. As government budget and government revenues increase comparing to the past records whereas an increase is also noticeable in unemployment, inflation and foreign debt also. Meanwhile external loan also increases in the past decades which is liable for the higher bankruptcy rate, thus it's a learning for us if we could raise more internal funds specifically from direct tax, indirect tax revenues and non-tax revenues it will be helpful for us to sustain in long run and to decrease bankruptcy rate. The findings of this study will work as a guideline in policy making of Bangladesh in considering macro-economic variables. Results of this study will also assist in finding out the ways in reducing long term external debt and long-term interest-bearing debt which will help to achieve sustainable development goal.

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