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Fiscal Policy and Growth Nexus: Evidence from BRICS Nations

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KEYWORDS

Fiscal Policy, Economic Growth, Tax to GDP ratio, General govt. Total expenditures (% of GDP) and Current Health Expenditures

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ABSTRACT

The present research studied the link between public revenue and government expenditure with economicgrowthoftheBRICSeconomiesfortheperiod2000-2020.Weusedpaneldataanalysis to examine the relationship of the tax-to-GDP ratio, General Government total expenditures (% of GDP), Current Health Expenditures, inflation, and Education Expenditures with economic growth. The results reveal that Tax to GDP ratio; General Govt. total expenditures (%of GDP) and Current Health Expenditure are significant and positively associated with real GDP. GovernmentRevenueandtotalexpendituredepictapositiveandsignificantassociationwithreal GDP and GDP growth rate

JELCODES: H30,F63,H50,H20,H52, H51**.**

1. INTRODUCTION

The relationship between government revenues and spending with economic growth intrigues researchers worldwide. Prominenteconomists,includingPamba(2021),NuruandGereziher(2021),andAhmadetal.(2020),haveemphasizedthe pivotalsignificanceoffiscalpolicyindeterminingeconomicgrowth.Financialsustainabilitywasemphasizedby Kimetal. (2021) as a fundamental requirement for macroeconomic sustainability. Certain policymakers believe that boosting government spending will stimulate the economy. Cooray (2009) and Dash & Sharma (2008) agreed that government expendituresaideditsexpansion.Ataxincreasecanhelptofundrisinggovernmentspending.SinceAdamSmith,the impact oftheallocationofgeneralgovernmentoperationsoneconomicgrowthhasbeenasourceofheateddiscussionandcuriosity.
However, the available empirical research on this topic is narrow in scope and lacks coherence. Barro (1991), Zhang and Zhang (2004), and Bose et al. (2007) provide substantial evidence that government spending positively affects economic expansion.On thecontrary,thisapproachisopposed by scholars such as OhrlichandKim(2005),Hansson and Henrekson (1994), and Olulu et al. (2014). Landau (1986) also failed to identify a substantial impact of government spending on economic growth.

Theterm"BRIC"asitwaspreviouslyemployedwascoinedin2001byJimO'NeillofGoldmanSachs.In2010,theRepublic ofSouthAfricabecameamemberoftheBRICS,whichoriginallycomprisedBrazil,Russia,India,China,andSouthAfrica. BRICShasgarneredsignificantinternationalattention.(Baffers&Shah;1994;Ewing&Payne;1998forBrazil);(Li,2001; China);(Dhanasekarn,2011;India);and(Nyamongo,Schei,&Schoeman:2007;Ndhiriwe&Gupta:2010;Phiri;2018)are afew of thescholarswhohave contributed to theBRICSliteratureon financialsustenance.Nonetheless,therearen'tmany paneldatastudiesthatexaminehowBRICScountries'fiscalbudgetsareaffected.Additionally,tothebestofourknowledge, there is a dearth of empirical research on the revenue, tax structure, and government spending patterns within the BRICS nations.Theauthorsofthecurrentstudyinvestigatewhethermacroeconomicfactorssuchasgovernmentrevenue,taxes,and expenditure patterns have an impact on the growth of the economy. To provide a pragmatic viewpoint, the present study includes an extensive panel data analysis (PDA) to examine

theeffectofkeyfiscalvariablesontherealGDPandGDPgrowthrateoftheBRICScountries.

In this study, the BRICS economies are chosen to better understand the importance of public tax collections and shifting expenditure patterns. The study's findings and conclusions will support the proposal of new limitations on the revenue and spending patterns that the selected BRICS economies can choose from, considering the importance of fiscal determinants like, Real GDP (RGDP), GDP Growth Rate, tax-to-GDP ratio (GGREV_GDP), General govt. Total expenditures as % of GDP (GGTEXP), Inflation consumer prices (annual %) (INF), Current Health Expenditure (CHE), and General Govt. Expenditures on Education as % of GDP (GEXPEDU).It would be able to identify countries that can sustain growth by examining the impact of fiscal policy on economic growth. It would be helpful to look into the relationship between tax revenue, and development spending with economic growth of the BRICS economies.

Some international studies investigate the relationship between fiscal indicators and one or two parameters of economic growth.Certain concernspersistdespitetheabundanceofempiricalresearch;thus,theauthorsinvestigated theinfluenceof tax revenues and expenditures on key indicators of economic growth i.e. Real GDP and GDP growth rate. Conducting an extensive examination of the correlation between government tax revenue, development expenditure and their impact on BRICSeconomicgrowthisimperative.Thiswillenableustoanalyzetheimpactoftaxrevenue, GeneralGovernmentTotal Expenditure,currenthealthexpenditure,educationexpenditure,andinflationoneconomicgrowthexpressedasaproportion ofGDP.However,wewishtoinquireastowhetherthetaxsystemcouldserveasapersuasiveinstrumentforthegovernment toensureprudentandtransparentspendingtopromotebettereconomicoutcomes.Incontrasttopriorresearchandtofacilitate a more comprehensive examination, we have incorporated government spending (current health expenditures and General govt. total expenditures as % of GDP) and Inflation at consumer prices (annual %) in our analysis to determine the most effectivemodelforboostingeconomicgrowthandefficiency.TheBRICS economieswillfindtheresultsbeneficialasthey will empower them to select appropriate policies that will stimulate economic growth. The current study adopts a holistic approach by constructing six models in which these variables are interchangeably utilized as endogenous variables. The impact of fiscal indicators on growth has been examined in the past through the utilization of Panel data analyses.

In contrast, the current study uses panel data analysis to scrutinize the effect of fiscal variables on the Real GDP and GDP growth rate of the BRICS economies. Keeping this in mind, the primary goal of the current study is to assess the BRICS countries'governmenttaxstructuresandspendingpatterns.Second,tounderstandtherelationshipbetweenimportantfiscal indicators such as Real GDP, GDP Growth Rate, Tax to GDP ratio, General government total expenditures as a percentage of GDP, Inflation, Current Health Expenditure, and General GovernmentEducation expenditures in BRICS nations' economic growth.

In light of this, the current investigation has been undertaken. The subsequent sections have been applied to the remaining portion. Theempirical literature pertinent to the research area is presented in Section 2. The methodology and data sources are detailed in Section 3. Section 4 pertains to the findings. The discussion and conclusions are presented in Section 5

2. WHATLITERATURESAYS?

Asignificantamountofresearch hasbeen doneto look athowfiscalpolicy variablesaffectmacroeconomicactivitiessuch as the external deficit, inflation, consumption, investment, growth, and exchange rates (Höoppner, 2003; Perotti, 2005; AmanjaandMorrissey2005;Falk,etal.2006;Rezk,2006;Castro,etal.2006;Claus,etal.2006;andKukk,2006).Scholars have been captivated by this subject matter; nevertheless, there exist disparities among nations, economic states, and even time frames designated for investigation.Examining past studies is crucial when analyzing inter-state or inter-country differences. The impact of fiscal policy on the economy has been extensively documented in recent literature, as demonstratedbystudiesbyLongwaneetal.(2018),Al-kasbah(2022),Ahmadetal.(2020),andPamba(2021).Thefindings highlight the ability of fiscal policy to influence economic growth via both macroeconomic and microeconomic channels.

Boseetal.(2007)discoveredthatgovernmentspendingonhealthandeducationisassociatedwithlong-runeconomicgrowth by analyzing disaggregated spending in 30 developing countries from the 1970s to the 1980s. Jawadi, Fredj, et al. (2014) examined the size ofgovernment and economic growth in the BRICcountries from 1990to 2008. Theyrevealed that fiscal policy can be an effective stabilization tool and provide a significant short-term boost to emerging markets. Olulu et al. (2014) examined disaggregated expenditure in Nigeria from 1980 to 2010, focusing on health, education, and public debt. They found that government spending on health is inversely related to economic growth. More emphasis should be placed on educational expenditure. According to Li and Zheng(2017), fiscal decentralizationgreatly enhanced citizens'livelihood expenditure,withcountygovernmentspreferringprojectsdirectlyrelatedtolocalpeople'sexpenditureson publicgoodsover those having spillover effects.

Yihua, Beibei, and Huanhong (2015) emphasize the need for fiscal decentralization for national governments, suggesting thatcounty-levelgovernmentsshouldhavegreaterfinancialresourcesandindependentauthority.HuangandOsborne's2017 study investigates the distributional implications of the BRICS countries' rapid economic growth, revealing that the group has improved the well-being of the impoverished during thelast two decades, with South Africa making the least progress. In this context, China is viewed as the group's superstar.

Gisoreetal.(2014)analyzedspendingonhealth,defense,education,andagricultureinEastAfricabetween1980and2010.

They discovered that spending on health and defense is strongly linked to growth. Reeves et al. (2015) examined the tax burden and government health spending in 89 low- and middle-income countries from 1995 to 2011. They concluded that indirect revenue has a positive effect on public health investment. Jakovljevic (2016) examined global health expenditure andcurrentPPPin12G7andBRICScountriesfrom1995to2013.TheydiscoveredthattheleadingEMEs'shareofmedical healthcarespendinghasconsistentlyincreased.Bebonchu(2018)examinedhealthexpenditure,taxation,andgrowthinU.S. states from 1963 to 2015. They found a positive association. Kaur et al. (2024) discovered a positive relationship between GHE, GDP, and GDP per capita. Increased out-of-pocket charges in BRICS countries indicate a reduction in healthcare funds, limiting medical services for all citizens. They argue that there is a need to focus on healthcare infrastructure.

Ashasbeenobservedthroughpriorliterature,theresultsareconflicting,varied,anddiverse,suggestingthattheissuesrelated to fiscal policy parameters are far from being settled and need to be examined in depth, especially in the case of BRICS nations.

Findingthebestmodeltoimprovegovernmentincome,spendingefficiency,andeconomicgrowthrequiresanunderstanding oftherelationshipbetweenfiscalfactorsandspending.Thus,thepresentresearchwillsupporttheimplementationofgrowth-oriented policies in the BRICS economies. By creating six models that swap out these endogenous variables, this study adopts a comprehensive methodology. Numerous international studies examine fiscal indicators and one or two economic growth parameters. The government tax revenue and Development expenditure must be extensively examined concerning BRICSeconomicgrowth.Theresultsaredivergentandrelated toafewvariables.Itbecomesimportanttopresentaholistic view covering additional variables. We wonder if the tax system could persuade the government to spend wisely and transparentlytoimproveeconomicoutcomes.Itisalsoimportanttofindthebestmodelforeconomicgrowthandefficiency byincludinggovernmentspendinginouranalysis,unlikepreviousresearch.Fewstudiescoversuchalongperiod;hencethe research has been undertaken spanning 2000 to 2020. Our study builds six models using these variables interchangeably as endogenous variables in a holistic approach. The impact of fiscal indicators on growth has earlier been studied using linear ormultipleregressions.Instead,thisstudyusespanel dataanalysistoexaminefiscalvariables'effectsonBRICS'RealGDP and GDP growth rate.

3. RESEARCHMETHODS

:Model

Thisinvestigationemployspaneldataanalysis(PDA)toconstructfixedeffect(FE)andcross-sectionrandomeffect(CSRE) models.Prioranalysisnecessitatestheverificationofvariablestationarity.Intheinitialphase,levelstationarityisexamined. Stationarity and the unit root of the various variables are initially examined at the level; however, the variables exhibited non-stationarity. The majority of tests were stationary upon the first difference. The stationarity of the remaining variables is determined by the second difference. A variety of unit root methodologies have been implemented (Choi, 2001). The stationaryanalysiswasconductedattheone-seconddifference.Panelleastsquareestimationisperformedinthefinalphase togenerateFEandCSREmodels(Zulfikar,2018).Todeterminewhichmodelbestfitsthecurrentdataseriesandcountries, theHausmantestwasapplied.Thestudyspanstheyears2000to2020.TheinformationwasobtainedfromtheWorldBank Database and statistical abstracts of BRICS from multiple years. To conduct a cross-section random unit-root test, the following statistical methods were utilized: Breitung T-statistic, Im, Pesaran, and Shin W-statistic, and ADF-Fisher Chi-squared(LevinLinChu(2002).Theaforementionedexperimentswereconductedwithconstant(withC),andwithconstant and trends (with C&T). The following equations of two models which have been developed by using PDA:

Real GDP= $\alpha+\beta_1$(GGGR_GDP) $+\beta_2$ (GGTEXP) $+\beta_3$ (INF)+ β_4 (CHE) $+\beta_5$(GEXPEDU)……(1)

GDPGrowth=$\alpha+\beta_1$(GGGR_GDP)+β_2(GGTEXP)+β_3(INF)+β_4(CHE)+β_5(GEXPEDU)……(2)

:Data

A thorough investigation was undertaken to identify pertinent and prior research, and the data about the variables were extracted from statistical abstractsof BRICS nations and bythe World Bankdatabase comprising theyears 2000and2020, respectively."Key Factors," i.e. Real GDP (RGDP), GDP Growth Rate, Tax to GDP ratio (GGREV_GDP), General govt. Total expenditures as % of GDP (GGTEXP), Inflation consumer prices (annual %) (INF), Current Health Expenditure (CHE), and, General Govt. Expenditures on Education as % of GDP (GEXPEDU).

Table1:IndependentandDependentVariables

Abbreviation	Variables	CalculationFormula	Variables	Expected Sign
RGDP	RealGDP	NominalGDP/Deflator*100	Dependent	
GDPGrowth	GDPgrowthrate	$GDP_{Present}$–GDP_{Past}/GDP_{Past}*100	Dependent	

GGREV_GDP	TaxtoGDPratio	TaxtoGDPratioTRofthenation during the period/ GDP of the nation	Independent	Positive
GGTEXP	General Govt. Total Expenditure (%ofGDP)		Independent	Positive
INF	Inflation consumer prices (annual %)	Rate of Inflation= CPI_{X+1}-CPI_X/ CPI_X*100	Independent	Positive
CHE	Current Health Expenditure	CHE/GDP	Independent	Negative
GEXPEDU	General Govt. Total Expenditures on Education(%of GDP)	GGTEE=Totalgovt.expenditurefor a given level of education / Total government expenditures *100	Independent	Positive

Source:Developedbyauthors.

:EstimationTechniques

Theresearchemployspaneldataanalysis(PDA)duetoitscapabilityofregulatingtime-varyingvariables.Paneldataanalysis considers the heterogeneity of the economy, firm, or organization. PDA enables the application of variables across various levels of analysis to facilitate hierarchical modeling (Reyna, 2007). Within the panel unit root-testing framework, there are two generations of tests. The first generation of tests assumes that cross-section units are cross-section ally independent, whereasthe secondgenerationofpanelunitroottestsrelaxesthisassumptionandallowsforcross-sectionaldependence.In this study, we used the first generation; the second generation could not be performed in case of unbalanced data. We have already used three techniques, i.e., simple OLS estimation, fixed effect, and cross-section random effect model.

Fixed Effect Model (FE): PDA with FE issuggested whenvariables diverge over time.FE revealstherelationshipbetween anation'sororganization'sdependentvariableanditspredictors(Reyna,2007).ApplicationofFEpre-supposesthatfactors occurring within a particular nation or entity have the potential to affect the predictors or dependent variable and must be constrained. To investigate the true relationship, FE eliminates the influence of time-invariant descriptions (Stock and Watson, 2003; Kohler and Kreuter, 2009).FE model is assessed by:

Yit=αi+β1Xit+e…..... 3

a) αi(i=1….n)isintercept(norganization/country-specificintercept).
b) Yit:endogenousvariable(DV);i=entity&t=time.
c) Xit:predictors.
d) β1:coefficientpredictors
e) e:errorterm
a)

Cross-Section Random Effect Model (CSRE): CSRE operates under the assumption that the observed deviations in organizationsandeconomiesareunrelatedtotheexogenousvariablesorpredictorsincorporatedinthemodel(Reyna,2007). The fundamental distinction between FE and RE is whether the effect is stochastic or whether variables are associated (Greene, 2008).

Therandomeffectsmodelis:Yit=+α+βXit+uit+εit…..... 4

a) α: Constant
b) Yit:dependentvariable
c) β:coefficientpredictors
d) uit=Betweencorporation/economyerrorterm
e) εit=withinentryerror

4. RESULTS

:DescriptiveStatistics

Thedescriptivestatisticsforfiveindependentandtwodependentvariablesaredepictedin Table2 RealGDP(RGDP),GDP GrowthRate,Tax-to-GDPratio(GGREV_GDP),andGeneralgovt.Totalexpendituresas%ofGDP(GGTEXP),Inflation

consumerprices(annual%)(INF),CurrentHealthExpenditure(CHE),and,GeneralGovt.ExpendituresonEducation as% of GDP (GEXPEDU).

Accordingtothestandarddeviationsofthevariousindependentvariables,allofthesevariablesarevolatileduringthestudy period of 2000-2019. The test developed by Jarque and Bera (1987) confirms the existence of normality (Bowman and Shenton1975).Kurtosis(±3)andskewness(±1)werebothsatisfactoryvalues(Sekaran,2006).TheJarqueandBeratesttests passedforeveryvariable.Theconsistencyofthedataseriesforbothdependentvariablesisdemonstratedbytheirrespective standard deviations.

Table-2:DescriptiveStatistics

	Real GDP	**GDP Growth**	**GGREV_GDP**	**GGTEXP**	**GGTEXP**	**INF**	**CHE**	**GEXPEDU**
Mean	8.203	4.468	27.163	30.628	30.628	5.982	5.416	4.289
Median	8.580	4.555	26.492	29.628	29.628	5.184	5.066	4.077
Maximum	9.279	14.231	37.527	47.001	47.001	21.477	9.629	6.320
Minimum	6.630	-7.800	13.422	16.268	16.268	-0.732	2.936	2.220
Std. Deviation	0.874	4.039	7.036	6.594	6.594	4.035	1.730	0.984
Skewness	-0.267	-0.534	-0.111	0.053	0.053	1.382	0.970	0.221
Kurtosis	1.409	3.590	1.600	2.658	2.658	5.718	3.006	2.614
Jarque-Bara	12.321	6.579	8.792	2.561	2.561	65.734	16.469	2.049
Probability	0.002*	0.037*	0.012**	0.048**	0.048**	0.0001***	0.000***	0.471
Sum	861.304	469.135	2852.078	3215.895	3215.895	628.069	568.646	450.375
Sum Sq.-Dev	79.494	1696.483	5148.231	4521.358	4521.358	1693.564	311.330	100.600
Observations	105	105	105	105	105	105	105	105

Source:Author'scalculationswithE-views.[***pvalue<0.01,**pvalue<0.05;*pvalue<0.10]

Table 2 depicts the statistics of unit roots applying multiple techniques. According to LLC, all except IMMU, IMR, TFR, and OPE were stationary at 1st difference (p:<0.05).As per Breitung T-stat, all variables except for PGR and TFR were stationary (p>0.05). Im Pearson and Shin W-Stat test results suggest only population growth is not stationary. For ADF FisherChi-square&Phillip-perron(PP)allvariablesi.e.GGREV_GDP,GGTEXP,INF,CHE,andGEXPEDU arefoundto be stationary with constant intents. At 1st difference, the stationarity condition was satisfied.

Table3:UnitRootatFirstDifference

	RealGDP	GDP Growth	GGREV_GDP	GGTEXP	INF	CHE	GEXPEDU
LLC							
None	-1.530 (0.629)	-7.445 (0.000)***	-6.1982 (0.000)***	-5.495 (0.000)***	-9.813 (0.0000)***	-6.996 (0.000)***	
WithC	-2.489 (0.0064)**	-2.940 (0.0016)**	-3.4318 (0.0003)**	-2.373 (0.0088)**	-7.970 (0.000)***	-4.694 (0.000)***	-3.187 (0.0007)**

WithC&T	-4.380 (0.000)***	-3.862 (0.0001)***	-3.3869 (0.0004)**	-1.497 (0.0671)*	-6.785 (0.000)***	-5.170 (0.000)***	-2.524 (0.0058)**
BreitungT-stat							
WithC							
WithC&T	-2.411 (0.0079)**	1.514 (0.9351)	-0.866 (0.1932)	1.550 (0.9394)	-3.781 (0.0001)**	-3.908 (0.000)***	-2.252 (0.0121)**
Im,PesaranandShinW-stat							
None							
WithC	-1.604 (0.0543)	-3.923 (0.000)***	-3.1879 (0.0007)**	-3.827 (0.0001)***	-6.744 (0.000)***	-4.226 (0.000)***	-4.824 (0.000)***
WithC&T	-2.157 (0.0155)**	-3.217 (0.0006)**	-2.227 (0.0130)**	-2.120 (0.0170)**	-5.268 (0.000)***	-4.046 (0.000)***	-3.961 (0.000)***
ADF-FisherChi-square							
None	17.222 (0.0696)*	58.649 (0.000)***	54.0123 (0.000)***	42.865 (0.000)***	79.184 (0.000)***	59.913 (0.000)***	
WithC	19.349 (0.0360)**	34.837 (0.0001)**	29.095 (0.0012)*	33.106 (0.0003)**	58.816 (0.000)***	36.679 (0.0001)***	42.436 (0.000)***
WithC&T	20.283 (0.0267)**	27.976 (0.0018)**	21.319 (0.0190)**	20.334 (0.262)	43.110 (0.000)***	33.886 (0.0002)**	33.971 (0.0002)**
PP							
None	21.856 (0.0159)**	84.538 (0.000)***	69.4373 (0.000)***	54.835 (0.000)***	102.881 (0.000)***	85.923 (0.000)***	
WithC	27.116 (0.0025)**	145.375 (0.000)***	41.5363 (0.000)***		91.778 (0.000)***	67.528 (0.000)***	68.170 (0.000)***
WithC&T	37.156 (0.0001)***	62.318 (0.000)***	35.244 (0.0001)***	23.976 (0.0077)**	70.736 (0.000)***	71.607 (0.000)***	61.0560 (0.000)***

[***pvalue<0.01,**pvalue<0.05;*pvalue<0.10][ComputationwithE-viewsv12]

Panel unit root tests of the first generation are used to examine the stationarity of data series of different variables. Table 3 reportstheresultsoffirst-generationtestsbyassumingthatthereisnocross-sectionaldependenceamongtheBRICSnations. Results of various tests used of the first generation demonstrate that data series of all the variables are stationary at first difference.Sincethep-valueofallthevariablesiseitherlessthan0.01or0.05whichmeansthedataseriesarestationaryat firstdifference.After applyingfirstgeneration unitroottestsnextstep wasto check crosssection dependence.Soin the next stage, CDS is checked by applying three techniques.

Table4:Cross-SectionDependenceTest

Test	Statistics	d.f	Prob.
Breusch-PeganLM	54.55954	10	0.0000***
Pesaranscaled LM	9.963817		0.0000***

PesaranCD	7.07		0.0000***

Source:Authors'calculationswithEviews-12

Table 4 reports the results of cross-section-dependent tests.The null hypothesis of CSD states that no cross-section dependence (correlation) residual exists. In the present case, all three tests' p-values are less than 0.05, which means we cannotacceptthenullhypothesis andthereiscross-sectiondependenceamongdifferentcountries.Thenextstepistoapply second-generation unit root tests to check the stationarity of different variables.

Table5:PanelUnitrootsecondgenerationtests

Test	Real GDP	GDP Growth	CHE Constant	GEXPED	GEZPEDU	GGR%GDP	GGTEXP	INF
BaiandNg WithC								
PooledStat.	3.634 (0.000)	2.048 (0.040)	-1.846 (0.064)	3.089 (0.002)	2.992 (0.002)	3.148 (0.001)	2.857 (0.004)	9.279 (0.000)
Pesaran CIPS WithC								
CIPS-TStat.	-2.556 (<0.05)	2.786 (<0.01)	-2.358 (<0.05)	-2.372 (<0.05)	-2.372 (<0.05)	-3.094 (<0.01)	-1.344 (>=0.10)	-2.492 (<0.05)
Truncated T Stat.	2.556 (<0.05)	2.7868 (<0.01)	-2.358 (<0.05)	-2.346 (<0.05)	-2.346 (<0.05)	-3.094 (<0.01)	-1.344 (>=0.10)	-2.492 (<0.05)

Source:Authors'calculationswithEviews12

After checking the cross-section dependence, we applied second-generation unit root tests, as second-generation unit root tests assume there are no cross-sectional dependence tests. Two tests are applied: Bai and Ng (Panic) and Pesaran CIPS. Resultsofbothtestsdemonstratethatthereisnounitrootandthatthedataseriesofthegivenvariableisstationaryaccording to second-generation tests as the associated p-value of either pooled statistics or t-statistics is less than 0.05. However, GGTEP'sdataseriesisstationaryasperBaiandNgbutnotasperPesaranCIPS.However,itisassumedstationaryaccording to the Bai and Ng test (table 5).

Table6:ModelEstimationwithReal GDP

	Model1 WithoutFEandCSRE		Model2 FixedEffect		Model3 Cross-SectionRandomEffect	
	Coeff.	TStat (p-value)	Coeff.	TStat (p-value)	Coeff.	TStat (p-value)
GGREV_GDP	0.011716	4.05521 (0.0001)***	0.008406	4.2179 (0.0001)***	0.00855	4.2551 (0.0001)***
GGTEXP	-0.005759	-2.67529 (0.0093)**	-0.007461	-5.13007 (0.000)***	-0.007380	-5.0253 (0.000)***
INF	-0.00100	0.8222 (0.4137)	-0.000983	-1.21780 (0.2276)	-0.000984	-1.20623 (0.2317)
CHE	-4.00	-1.9147 (0.0596)*	-3.02	-2.1497 (0.0352)**	-3.07	-2.1615 (0.0340)**

GEXPEDU	0.004276	0.41014 (0.6829)	0.007513	1.0809 (0.2836)	0.00735	1.04763 (0.2984)
R^2	0.3097		0.71488		0.4481	
Adj.R^2	0.26112		0.67658		0.4092	
Durbin-Watson	0.6083		1.3409		1.26039	
F-Value	6.37179		18.6658		11.5294	

[***pvalue<0.01,**pvalue<0.05;*pvalue<0.10][ComputationwithE-viewsv12]

Table 6 presents PDA results with 3 models: 1 without FE & CSRE; 2 with fixed effects; and 3-cross-section random estimation.ThedependentvariableisrealGDP.Thefindingsofmodel1(withoutFE&CSREusingrealGDPasdependent variables reflect that the variables: i) Tax to GDP ratio, ii) General govt. Total expenditures (%of GDP) and iii) Current Health Expenditures are significant and positively associated with real GDP. General government revenue/ GDP and GGTEXP variables arefoundto besignificant(p<0.01).The inferencedrawn isthat thegeneral governmentrevenue/GDP helps to boost economic growth through its positive influence on GDP. CHE is also significant (p-value <0.05). A positive association of Current health expenditures with real GDP suggests that a high current expenditure rate will lead to higher GDP for BRICS countries. In the case of model 2 (fixed effect model) and model 3 (cross-section random effect model) using real GDP as a dependent variable reflects that: Tax/GDP, General govt. Total expenditures (%of GDP) and Current Health Expenditures are significant and positively associated with real GDP.GGREV_GDP and GGTEXP are significant (p<0.01) and CHE is significant at a 5% level (p-value <0.05).FE model demonstrates a good fit model. For example, ANOVA results for the model suggest that F-value (18.6658; pp<0.01). The adjusted R^2 value is 0.7148 which means our model explains 71.48% of the variation in real GDP explained by predictors. The Durbin-Watson is 1.3409 suggesting no auto-correlation.

Table7:ModelEstimationwithRealGDPGrowth

	Model4 WithoutFEandCSRE		Model5 FixedAffect		Model6 Cross-SectionRandomAffect	
	Coeff.	TStat (p-value)	Coeff.	TStat (p-value)	Coeff.	TStat (p-value)
GGREV_GDP	0.82233	3.3087 (0.0015)**	0.7789	2.9320 (0.0046)**	0.8223	3.2275 (0.0019)**
GGTEXP	-0.96333	-5.2023 (0.000)***	-0.9731	-5.0198 (0.000)***	-0.9633	-5.0745 (0.000)***
INF	-0.2328	-2.2196 (0.0296)**	-0.23416	-2.1763 (0.0331)**	-0.2328	-2.1651 (0.0337)**
CHE	-1.04	-0.05776 (0.9541)	-1.41	-0.0750 (0.9404)	-1.04	-0.05634 (0.9552)
GEXPEDU	-0.4699	-0.5240 (0.6019)	-0.4160	-0.4490 (0.6549)	-0.4699	-0.5111 (0.6108)
R^2	0.3635		0.3687		0.3635	
Adj.R^2	0.3187		0.2840		0.3187	
Durbin-Watson	2.7112		2.7443		2.7112	
F-Value	8.1118		4.3495		8.1118	

TestSummary	Variables	Chi-Square	Chi-Squared.f	Prob
HausmanTest	RealGDP	74.506	5	0.000*
	GDPGrowth Rate	35.109	5	0.000*

[pvalue<0.01,**pvalue<0.05;*pvalue<0.10][ComputationwithE-viewsv12]***

Table 7 presents PDA models: 4 (without fixed and cross-section random effect); 5 with fixed effects; and 6 -cross-section random estimation.Thedependentvariableisreal GDP.Thefindingsofmodel6.1 (withoutFEand CSRE) using realGDP asdependentvariablesreflectthatthevariables:TaxtoGDPratio;Generalgovt.Totalexpenditures(%ofGDP)andCurrent Health Expenditures are significant and positively associated with real GDP.GGREV_GDP and GGTEXP are significant (p<0.01). General govt. Revenue/GDP is positively related to GDP growth and thus augments economic growth. However, Inflation in consumer prices (annual %) is significant too (p-value <0.05). This demonstrates its positive association with GDP growth. In the case of model 5(FE) and model 6(CSRE) using real GDP as a dependent variable highlightsthat:Tax to GDP ratio, General govt. Total expenditures (%of GDP) and Current Health Expenditures are significant and positively associated with real GDP.GGREV_GDP and GGTEXP variables are found to be significant at (p<0.01) and Inflation consumer prices (annual %) are significant too (p-value <0.05). FE model demonstrates a good fit model. For example, ANOVA results for the model suggest that F-value (8.1118) is significant (p<0.01). The adj.R^2 value is 0.3187.It means our model explains 31.87% of the variation in GDP growth. The Durbin-Watson ratio is also close to 2 (i.e. 2.712) which means there is no problem with autocorrelation.

The Hausman test was performed for real GDP and GDP growth. In the case of real GDP as the experimental variable, the value of Chi-Square statistics is 74.506 (p-value<0.05). This indicates that the FE model is a good fit (Hausman, J., 1978) withrealGDPasthedependentvariableandwithselectedpredictors. InthesecondcaseGDPgrowthrate,theHausmantest suggests that the model's associated Chi-Square (35.109; p :< 0.05). Thus,the FE model is the best suited in comparison with the CSRE model. Thus, the results suggest that the FE model is more suitable with both GDP; as well as GDP/Capita as dependent variables. In other words, for BRICS, the time-variant effect is better than CSRE.

Theresidualcross-sectiondependencetestwascheckedusingBreuschandPagan's(1980)proposedLMstatistic.Theresults of Breusch–Pagan LM statistics is 3.02 (p: 0.13). The results suggest that there is no issue of Heteroscedasticity.

5. CONCLUSIONANDDISCUSSION

The results have witnessed an ongoing evolution of the receipt of revenues and allocation of expenditure in BRICS economies.Inthecaseofmodels1-3,realGDPwasthedependentvariable.ThefindingsofPDAdepictthatmodel1(without FE & CSRE using real GDP as dependent variables reflect the variables: i) Tax to GDP ratio, ii) General govt. Total expenditures (%of GDP) and iii) Current Health Expenditures are significant and positively associated with real GDP. Generalgovernmentrevenue/GDPandGGTEXPvariablesarefoundtobesignificant(p<0.01).Theinferencedrawnisthat the general government revenue/GDP helps to boost economic growth through its positive influence on GDP. CHE is also significant(p-value<0.05).ApositiveassociationofCurrenthealthexpenditureswithrealGDPsuggeststhatahighcurrent expenditureratewillleadtohigherGDPforBRICScountries.Ifweconsiderheterogeneityacrosscountriesi.e.fixedeffect model, then three variables out of five are found to be significant (i.e. GGREV_GDP, GGTEXP, and CHE). Whereas if heterogeneity is taken accidentally and the time-variant effect is more prevalent than and fixed effect, is considered, then four variables are found to be significant (three variables i.e. Government Revenues to % of GDP, General Govt. Total Expenditurestothe%ofGDPandCurrentHealthExpenditures)andarepositivelyrelatedwithrealGDP.Theseresultsare consistentwithpreviousstudies;i.e.Gaber(2009),Ocran(2011),andM'AmanjaandMorrissey(2015),thussupportingthat public investment stimulates the economy's growth.

Models4-6arebasedonGDPgrowthasthedependentvariable.Thefindingsofmodel4(withoutFEandCSRE)usingreal GDP as dependent variables reflect that the variables: Tax to GDP ratio; General govt. Total expenditures (%of GDP) and Current Health Expenditures are significant and positively associated with real GDP.GGREV_GDP and GGTEXP are significant(p<0.01).Generalgovt.Revenue/GDPispositivelyrelatedtoGDPgrowthandthusaugmentseconomicgrowth.
However, Inflation in consumer prices (annual %) is significant too (p-value <0.05). This demonstrates its positive association with GDP growth. In the case of model 5 (FE) and model 6 (CSRE) using real GDP as a dependent variable highlights that: Tax to GDP ratio, General govt. Total expenditures (%of GDP) and Current Health Expenditures are significant and positively associated with real GDP.GGREV_GDP and GGTEXP variables are found to be significant at (p<0.01) and Inflation consumer prices (annual %) are significant too (p-value <0.05). Empirical findings of CSRE Revenue/GDP emerge as an important predictor along with the government's total expenditures it demonstrates a positive linkwithGDPgrowthrate.Further,theHausmantestconfirmsthattheFEmodelisbetterthanCSRE.FEmodeldemonstrates a good fit model.

Whenwediscusstherelationshipbetweentaxcollections,governmentspending,andgrowth,somewell-knowneconomists illustrate similar findings. Tax revenue has a strong and considerable impact on government health spending, according to Lora and Olivera (2007). Bose and associates (2007) Long-term economic growth and government spending on health and education are related. Gisore et al. (2014) Spending on health & defense is significantly linked with growth. Reeves et al. (2015) indirect revenue has a positive impact on public health investment.Bebonchu (2018) Growth and public health spendingarepositivelycorrelated.Tendenguetal(2022)foundthatgrowthandgovernmentcapitalspendingarepositively correlated.

The present research gauged the effectiveness of fiscal indicators on growth in BRICS through panel data analysis. The results suggest a need to invest in the fiscal system with a focus on social welfare and infrastructure to augment economic growth.Theresultsindicatethatthebudgetoutlayoneducationandhealthcarewillhelpstimulatethegrowthoftheeconomy. This calls for policies to increase their outlay in BRICS.

6. LIMITATIONSOFTHESTUDYANDFUTUREAREASOFRESEARCH

The study limitations emerge from the data and assumptions of the methodology used in the study. In this study, an effort has been made to examine whether fiscal indicators stimulate growth in BRICS Nations. Though the novelty of the paper lies in using PDA for BRICS and coming out with important results, still the paper has some limitations.One limitation is thisstudy has taken a few variables. In the future additionalhealth indicators may beusedfor deeper analysis. Moreover, a country-wise analysis may be undertaken to examine which fiscal indicators are important for which BRICS nations. The study in the future can also be extended to other emerging economies.

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