

Macroeconomic Effects of Taxation in Indian Economy: An Empirical Study

*A Thesis Submitted to the University of Hyderabad
in Partial Fulfillment of the Requirements for the Award of*

**DOCTOR OF PHILOSOPHY
IN
ECONOMICS**

**BY
DILLIP KUMAR MUDULI**
(Reg. No. 16SEPH31)



**हैदराबाद विश्वविद्यालय
University of Hyderabad**



**प्रतिष्ठित संस्थान
INSTITUTION OF EMINENCE
राष्ट्रीय अपेक्षाएँ, वैश्विक मानक
National Needs, Global Standards**

School of Economics
University of Hyderabad
Hyderabad, Telangana-500 046
INDIA



DECLARATION

I, **Dillip Kumar Muduli**, hereby declare that the thesis entitled, **“Macroeconomic Effects of Taxation in Indian Economy: An Empirical Study”** submitted by me under the supervision of Prof. N. A. Khan, **School of Economics, University of Hyderabad**, is a bonafide research work which is also free from plagiarism. I also declare that it has not been submitted previously in part or in full to this university or any other university or institutions for the award of any degree or diploma. I hereby agree that my thesis can be deposited in Shodhganga/INFLIBNET.

A report on plagiarism statistics from the University Librarian (IGML) is enclosed.

Date: 08-12-2022

Place: Hyderabad

Dillip Kumar Muduli

Dillip Kumar Muduli

Regd. No. 16SEPH31



CERTIFICATE

This is to certify that the thesis entitled **“Macroeconomic Effects of Taxation in Indian Economy: An Empirical Study”** submitted by Dillip Kumar Muduli, bearing Regd. No. 16SEPH31 in partial fulfillment of the requirements for the award of the Degree of Doctor of Philosophy in the School of Economics, is a bonafide work carried out by him under my supervision and guidance.

This thesis is free from plagiarism and has not been submitted previously in part or in full to this or any other universities and institutions for the award of any degree or diploma.

A part of this thesis has been:

A. Published in the following Publication:

1. NEXUS BETWEEN TAX STRUCTURE AND INCOME INEQUALITY IN INDIA. *Asian Development Policy Review*, Vol. 10, No. 2, 88-105 (Co-Author: Sanjay Kumar Rout and N. A. Khan) (ISSN (Online): 2313-8343)

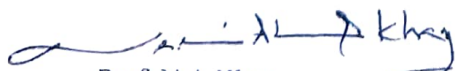
and

B. Presented in the following conferences:

1. “Nexus Between Tax Structure and Income Inequality in India” paper” at International Conference on Contemporary Issues in Economics, 2022 organized by XIM University, Bhubaneswar.
2. “Tax Structure and Economic Growth in General Category States in India: A Panel ARDL Approach” at 55th Annual Conference of The Indian Econometric Society (TIES), 2019 organized by National Institute of Securities Markets, Mumbai.

Further, the student has passed the following courses towards fulfillment of the coursework requirement for PhD.

Course Code	Name	Credits	Pass/Fail
1. SE701	Advanced Economic Theory	4	Pass
2. SE702	Social Accounting and Data base	4	Pass
3. SE703	Research Methodology	4	Pass
4. SE751	Study Area	4	Pass


Prof. N A Khan

Supervisor
SUPERVISOR
SCHOOL OF ECONOMICS
UNIVERSITY OF HYDERABAD
Hyderabad-500 046 (INDIA)


Prof. R. V. Ramana Murthy

Dean of School of Economics
DEAN
SCHOOL OF ECONOMICS
UNIVERSITY OF HYDERABAD
Hyderabad-500 046. (INDIA)

ACKNOWLEDGEMENT

Undertaking this PhD has been a truly life-changing experience for me and it would not have been possible to do without the support and guidance that I received from many people.

To start with, I would like to express my deepest gratitude to my supervisor Prof. Naseer Ahmed Khan for all the support, encouragement, and motivation he gave me during my long PhD journey. This dissertation would have not been completed without his constant guidance and feedback.

I thank Prof. Naresh Kumar Sharma and Prof. Phanindra Goyari for being my doctoral committee members and giving valuable inputs from time to time which have certainly helped in the improvement of my dissertation. My profound sense of gratitude is due to Prof. R. V. Ramana Murthy, Dean, School of Economics, for his kind co-operation. I deeply convey my sincere thanks to Prof. Debashis Acharya, Dr. Prajna Paramita Mishra, Dr. Alok Kumar Mishra, and all the faculty members of our school who directly or indirectly contributed to my research work.

I greatly appreciate the office staff of the School of Economics for providing academic support. I also thank the staff of Indira Gandhi Memorial Library for providing relevant study materials for the dissertation work.

I would also like to say a heartfelt thank you to my parents, sister and brother for always believing in me and encouraging me to follow my dreams and for helping in whatever way they could during this challenging period.

A deep appreciation goes out to the seniors: Nitya bhai, Kali bhai, Pradipta bhai, Bamdev bhai, Debasis bhai, Tapan bhai, Prasanta bhai, Dharendra bhai, Raj bhai, Dinabandhu bhai, Sidheswar bhai, Simpul bhai, Abhay bhai, Ranjit bhai, Kunal bhai, Ajit bhai, Asish bhai, Priyabrata bhai, Joshi bhai, Bhim bhai, Kirti bhai, Mallesh Anna, Subhra bhai, Dhruv bhai, Manas bhai, Hemadri bhai, Gouranga bhai, Dibakar bhai, Susanta bhai, Jagannath bhai, Ranjan bhai, Rashmi di, Sonali di, Rekha di, for their help and encouragements during these years.

I am also very grateful to Trinatha, Anadi, Pitabas, Shailaja, Jyoti, Manamani, Bijay, Suresh, Aniruddha, Prajukta, Malay, Prakash, Dinamani, Sandip, Dhaneswar, Rajendra, Nihar, Jayakrushna, Soutrick, Raturaj, Dhananjay, Pradipta, Shailendra, Kamala, Bandana,

Sachidananda, Sambit, Dhiren, Bijay, Jaga, Jyoti, Kishan, Santanu, Tapaswini, Swayamsikha, and Subhashree Sabnam for their help and encouragement during these years.

I also convey my hearty thanks to Prof. Jayant Kumar Parida, Director of School of Social, Financial & Human Sciences, KIIT Deemed to be University for motivating me to complete my thesis. I also convey my special thanks to all the faculties and students of KSFH, KIIT Deemed to be University.

I am indebted to Sanjay for his invaluable advice and feedback on my research and for always being so supportive of my work.

A very special thank you to my friend Tanmaya, who has been by my side throughout this PhD, boosting my self-confidence every single minute of it. And to Suman and Sourav for being such good friends in the past one year, and making it possible for me to complete what I started.

Dillip Kumar Muduli

CONTENTS

	Page No.
Declaration	I
Certificate	II
Acknowledgement	III-IV
Contents	V-VIII
List of Tables	IX
List of Figures	X
Abbreviations	XI-XII
Chapter-1: Introduction to the Study	1-8
1.1. Introduction	
1.2. Theoretical Background	
1.2.1. Taxation and Economic Growth	
1.2.2. Taxation and Income Inequality	
1.2.3. Taxation and Economic Stability	
1.3. Research Gap	
1.4. Research objectives of the Study	
1.5. Data sources and Methodology of the Study	
1.6. Organization of the Study	
Chapter-2: Indian Tax System	9-19
2.1. Introduction	
2.2. Evolution of the Indian Tax System	
2.2.1. Tax system in Ancient India	
2.2.2. Tax system during Mughal Rule	
2.2.3. Tax system during British Rule	
2.2.4. Tax System of India during the Post-Independence Era	
2.3. Tax Reforms in India	
2.3.1. Tax Reforms Committee of Raja Chelliah	
2.3.2. Rekhi Committee on Indirect Tax Reforms	
2.3.3. Kelkar Committee Report on Tax Reforms	
2.3.4. Goods and Services Tax	

2.4. Trend and Pattern of Tax Revenue in India

2.5. Conclusion

Chapter-3: Taxation and Economic Growth

20-50

3.1. Introduction

3.2. Literature Survey

3.2.1. Personal Income Tax and Economic Growth

3.2.2. Corporate Income Tax and Economic Growth

3.2.3. Consumption Taxes and Economic Growth

3.3. Description of the Data and Variables

3.4. Time series characteristics

3.5. Methodology

3.5.1. Unit Root Tests

3.5.2. ARDL Bounds Testing Approach

3.5.3. Error Correction Mechanism

3.5.4. Model Specification

3.6. Results and Discussions

3.7. Conclusion

Chapter-4: Taxation and Income Inequality

51-80

4.1. Introduction

4.2. Literature Review

4.2.1. Tax Progressivity and Income Inequality

4.2.2. Tax Structure and Income Inequality

4.2.3. Tax-Expenditure Policies and Income Inequality

4.2.4. Tax and Income Inequality in India

4.3. Trends of Income Inequality and Tax Policy in India

4.3.1. Trends of Gini Coefficient and Tax Revenue

4.3.2. Share of Different Income Groups in Pre-tax National Income

4.4. Data, Time Series Characteristics, and Methodology

4.4.1. Data Description

4.4.1.1. Summary Statistics and Correlation Matrix

4.4.2. Time Series Characteristics

- 4.4.2.1. Unit root in Data Series
- 4.4.2.2. Johansen Cointegration Test
- 4.4.3. Methodology
 - 4.4.3.1. Brief Description of Techniques
 - 4.4.3.2. Model Specification
 - 4.4.3.3. Coefficient sign involving theoretical link
 - 4.4.3.4. Estimation Process
- 4.5. Results and Discussion
- 4.6. Robustness Check
- 4.7. Conclusion

Chapter-5: Taxation and Economic Stability

81-98

- 5.1: Introduction
- 5.2. Literature Review
 - 5.2.1. Tax as an Automatic Stabilizer
 - 5.2.1.1. Theoretical Literature
 - 5.2.1.2. Empirical Literature
 - 5.2.2. Taxes as Components of Discretionary Fiscal Policies
 - 5.2.3. Tax Evasion and Economic Stability
- 5.3. Data, Time Series Characteristics, and Methodology
 - 5.3.1. Data Description
 - 5.3.2. Time Series Characteristics
 - 5.3.2.1. Unit root Tests
 - 5.3.3. Methodology
 - 5.3.3.1. ARDL Bounds Testing Approach
 - 5.3.3.2. Error Correction Mechanism
 - 5.3.3.3. ARDL Model Specification
- 5.4. Results and Discussion
- 5.5. Conclusion

Chapter-6: Conclusion and Policy Recommendations

99-103

- 6.1. Summary of the Study
- 6.2. Conclusion

6.3. Policy suggestions	
6.4. Scope for future research	
6.5. Limitations of the study	

References	104-119
-------------------	---------

LIST OF TABLES

Table No	Name of the Table	Page No.
Table 3.1.	Variables and its description	29
Table 3.2.	Descriptive statistics	31
Table 3.3.	Pairwise correlation matrix	32
Table 3.4.	Results of unit root tests	36-37
Table 3.5.	VAR lag order selection criteria	37-38
Table 3.6.	ARDL bounds test results	39
Table 3.7.	Long run and short run coefficients of Model 1	39-40
Table 3.8.	Long run and short run coefficients of Model 2	41-42
Table 3.9.	Long run and short run coefficients of Model 3	43
Table 3.10.	Long run and short run coefficients of Model 4	44-45
Table 3.11.	Results of diagnostic tests	46-47
Table 4.1.	Variable, its definition, and source	61-62
Table 4.2.	Summary of Statistic	64
Table 4.3.	Correlation matrix	65
Table 4.4.	Unit root tests results	66
Table 4.5.	Johansen-cointegration test results	68-70
Table 4.6.	Results from FMOLS Model	75
Table 4.7.	Results from DOLS Model	77
Table 4.8.	Results from CCR Model	78-79
Table 5.1.	Variable and its description	88-89
Table 5.2.	Unit root tests results	92
Table 5.3.	ARDL Bounds Test Result	93
Table 5.4.	Estimated Short-run Coefficients from ARDL Model	93
Table 5.5.	Estimated Long-run Coefficients from ARDL Model	94
Table 5.6.	Result of Diagnostic Tests	96

LIST OF FIGURES

Figure No.	Name of the Figures	Page No.
Figure 2.1.	Trends in Tax-GDP ratio of the central government	15
Figure 2.2.	Share of Direct and Indirect Taxes in Total Tax Revenue	16
Figure 2.3.	Contribution of Different Taxes in Total Tax Revenue	17
Figure 3.1.	Stability Tests for Model 1	47
Figure 3.2.	Stability Tests for Model 2	48
Figure 3.3.	Stability Tests for Model 3	48
Figure 3.4.	Stability Tests for Model 4	49
Figure 4.1.	Trends of Gini coefficient and Tax Revenue	59
Figure 4.2.	Share of different income groups in pre-tax national income	60
Figure 5.1.	Result of CUSUM Test for the stability of model	97
Figure 5.2.	Result of CUSUM-squared Test for the stability of model	97

ABBREVIATIONS

ADF	Augmented Dickey-Fuller
AIC	Akaike Information Criteria
ARDL	Auto Regressive Distributed Lag
BRHAMS	Brazilian Household Microsimulation Model
CC	Counter Cyclical
CCR	Canonical Cointegration Reression
CD	Customs Duty
CEs	Cointegrating Equations
CGST	Central Goods and Services Tax
CIT	Corporate Income Tax
CUSUM	Cumulative Sum of Recursive Residuals
DID	Difference-in-Difference
DOLS	Dynamic Ordinary Least Squares
ECM	Error Correction Model
ECT	Error Correction Term
ED	Excise Duty
ES	Economic Stability
FMOLS	Fully Modified Ordinary Least Squares
FPE	Final Prediction Error
GC	Gini Coefficient
GDP	Gross Domestic Product
GFCE	Government Final Consumption Expenditure
GMM	Generalized Methods of Moments
GST	Goods and Services Tax
HQ	Hannan-Quinn Information Criterion
IMF	International Monetary Fund
INV	Investment
IPFS	Indian Public Finance Statistics
LS	Level of Significance

MOF	Ministry of Finance
MYS	Mean Years of Schooling
OECD	Organization for Economic Cooperation and Development
OLG	Overlapping Generations Model
OLS	Ordinary Least Squares
PCGDPGR	Per Capita Gross Domestic Product
PIT	Personal Income Tax
POPGR	Population Growth Rate
PP	Phillips-Perron
PVAR	Panel Vector Autoregression
R & D	Research and Development
RBI	Reserve Bank of India
SC	Schwarz Information Criterion
SDGs	Sustainable Development Goals
SGST	State Goods and Services Tax
SWIID	Standardized World Income Inequality Database
TAXSIM	Tax Simulation
TDS	Tax Deducted at Source
TMTR	Top Marginal Tax Rate
TRC	Tax Reforms Committee
TTR	Total Tax Revenue
UNDP	United Nations Development Programme
VAR	Vector Autoregressive
VAT	Value Added Tax
VECM	Vector Error Correction Model
WDI	World Development Indicators
WIID	World Income Inequality Database

Chapter-1

Introduction to the Study

1.1. Introduction

The role of the government has evolved over time and can be dated back to the mercantilism period. It was only confined to trade activities for the accumulation of wealth during that period. Later on, the classical school of economic thought assigned the regulatory role to the government for the smooth functioning of the free market mechanism. The functions of the government were restricted to maintaining the rule of law and providing defence, while the free market mechanism governed economic operations. The classical economists, particularly J. B. Say, strongly believed that supply will create its own demand. In other words, each single commodity that is supplied to the market will automatically be demanded. There will be absence of glut of goods and services in the market. However, the propositions of classical school of thought failed in the wake of great depression in 1929 that started in the US and spread worldwide later on. The disastrous effects of that economic ill were felt by the whole world. Halt in production, massive unemployment, acute poverty, etc. were visible everywhere. During this turbulent period, John Maynard Keynes inquired into the causes of great depression and found that lack of effective demand is the sole cause of depression. In a modern economy, Keynes contended, aggregate demand may drop forever, resulting in protracted periods of high unemployment. Owing to high unemployment, the companies would be hesitant to produce the goods. Businesses cut their output as a result, which leads to more job losses. Keynes argued that the national government must dramatically increase spending in order to make up for the loss in consumer and business firm spending if demand is to be successfully generated to fully engage the labour force (Keynes, 1936). As a result, affected economies of the world can be brought back to the right track. Since then, the role and functions of the government have increased manifold. Moreover, a special branch emerged in the field of economics as public sector economics in which the functions of the government were categorized into four such as the allocation function, distribution function, the stabilization function, and the coordination of budget function (Musgrave and Musgrave, 1989).

The government performs those functions through a tool known as fiscal policy. Fiscal policy is defined as, “*changes in government expenditure and taxation designed to influence the pattern and level of economic activity*” (Harvey and Johnson 1971). In a more comprehensive manner, G. K. Shah (1971) defines fiscal policies as “*any decision to change the level, composition, and timing of government expenditure or to vary the burden, structure or frequency of the tax payments*”. So,

fiscal policy basically reflects the tax and expenditure policies of the government that influence the course of economic activities through monetary, regulatory and other devices. Furthermore, compared to monetary policy, fiscal policy is more conducive to direct action, has more noticeable outcomes, and has an immediate effect. Within fiscal policy framework, tax policy is more feasible because it is politically easier to implement than expenditure policy. Also, increasing the share of expenditure in budget reflects the debt service and other costs, restricting the possibility of maintaining the fiscal prudence in the economy. Therefore, these factors explain the emphasis and concerns of the public authorities on tax policies. Specifically, tax policies describe the types of tax that the government imposes, the amount of tax burden, and on whom the tax burden rests. The government always strives for the best tax policy which provides sufficient revenue to the government without creating any distortions. In this regard, Adam Smith advocated four canons of taxation that the government should follow in order to improve the effectiveness and efficiency of its tax policies. The objectives of the tax policy change from time to time and from country to country based on social, political, and economic variables. The objective of the tax policy for a developing country like India should be to raise revenue in an equitable way with as few unintended changes to relative prices and resource allocation as possible (Govinda Rao and Kumar, 2017).

1.2. Theoretical Background

Taxes are as old as civilizations. During 4th century CE, Kalidasa, in his famous work Raghuvamsa wrote, “Just as the sun extracts water from the reservoirs and gives it back in the form of showers, so does the ruler extract tax from his subjects and gives it back to them in the form of prosperity”. Taxes are justified by the necessity of funds for the government to perform its fundamental duties. In other words, the government collects taxes from citizens to fund welfare and development programmes, conventional government functions (defence and enforcing the law), and the provision of public goods to fulfil the needs of the whole population. Money is transferred from the private to the public sectors through taxation. Tax is essential in the sense that what the government provides to its citizens, it must first take away from them. In this connection, Hugh Dalton defines “*A tax is a compulsory contribution imposed by a public authority, irrespective of the exact amount of service rendered to the taxpayer in return and not imposed as a penalty for only legal offenses*”. Indian Taxation Enquiry Committee (1924-25) defines, “*Taxes are*

compulsory contribution made by the member of a community to the governing body of the same towards the common expenditure without any guarantee of a definite measured service in return”.

Therefore, in taxation, no direct quid pro quo policy exists between the taxpayers and the government. Tax income is only used for the general good; it cannot be used for personal gain.

Tax is broadly categorized as direct tax and indirect tax. The same person is subjected to both the impact and the incidence of a direct tax. Here, impact refers to the initial burden of taxation and incidence indicates the ultimate burden of taxation. Direct taxes include income taxes on individuals and businesses, wealth taxes and property taxes. On other hand, indirect tax is a tax in which the impact and incidence of the taxation fall on two different persons. Indirect taxes, such as VAT, sales taxes, the Goods and Services Tax (GST), etc., first place a financial burden on the producers but ultimately pass it on to the consumers.

Taxes in the process of levy to collection may influence the behavior of economic agents, leading to creation of distortions or deadweight loss to the society. In particular, taxes may affect many microeconomic and macroeconomic variables through the mechanism of decisions made by economic agents.

1.2.1. Taxation and Economic growth

Taxation may affect GDP growth rate through the factors like labour supply, physical capital, human capital, and technological development. The amount of labour available in the economy and its average productivity are combined to produce GDP, which is used as a proxy for economic growth. The combination of several factors, including the amount of human and physical capital and the technology accessible to the labour force, determines the productivity of labour.

The effects taxation on physical capital, labour force, human resources, and technology directly translate into lower after-tax returns. The cost of pursuing the above factors would be costlier. A rise in the top marginal tax rate (TMTR) on individual income, for instance, can reduce the labour supply. Because an increase in TMTR will reduce the after-tax returns to labour. Similarly, a rise in effective corporate tax rates discourages the capitalists to invest in physical capital., Because it declines the after-tax return to capital., Higher income tax rates on higher income may reduce the return to investment in human capital., Eventually, it may distort educational decisions leading to lower investment in human capital., According to the neoclassical growth model, growth is fueled

by the accumulation of both human and physical capital., Any tax structure eventually results in an equilibrium capital-labor ratio and average worker education. Any further gains in production per person are solely due to the exogenous rate of technological development. These equilibrium values can only be changed by a change in the tax system, which will only have short-term growth impacts. Hall and Jorgenson (1967) and Lee and Gordon (2005) discovered that low corporation tax rates on new investment raise the stock of physical capital, which leads to economic growth in the short run. However, Trostel (1993) observed that a proportionate income tax had little impact on educational incentives, whereas Heckman et al., (1998) showed that a progressive labour income tax prevents investment in human capital., As a result, the impact of taxes on the investment of human capital remain unclear. A few works on endogenous growth also made an effort to assess how taxes affected economic growth. Barro (1990) did little explanation for the nexus between tax structure and per capita GDP growth. Jones et al., (1993) found that tax growth and welfare effects. Cullen and Gordon (2002) and Gentry and Hubbard (2000) analyzed the effects of taxation on economic growth through entrepreneurial activities.

1.2.2. Taxation and Income Inequality

Significant inequalities in people's decisions to work, save, pursue higher education, and the kind of employment they are ready to accept lead to income inequality. Additionally, it results from stark inequalities in intelligence, inheritance, and luck since some individuals are born intelligent, wealthy, and gifted while others struggle with ignorance, poverty, and inadequate schooling. These disparities show up in a highly skewed distribution of income, and over time, economic inequality between people increases. In this context, the role of taxation in reducing income inequality can be explored by looking into the nature of tax structure. Here, the nature of tax structure refers to progressive and regressive tax structure. A progressive tax system reduces income inequality by imposing more tax burden on richer segment of the population while a regressive tax structure enhances income inequality by imposing more tax burden on poorer section of the population (Kaldor, 1963; IMF, 2014). Many factors affect the degree of progressiveness of tax system. Burman (2013) showed that there would be a very high chance of large progressive taxation if differences in income were attributed to luck. On the other hand, there would be little room for progressive taxation if differences in effort were to be caused by income differences. Musgrave and Thin (1948) formulated various measures of tax progressivity to investigate the effects of tax

progressivity on income distribution. Subsequent literatures also emphasized the role of average tax rate and progressivity on distribution of income (Dalton, 1955; Bracewell-Milnes, 1971; Jakobsson, 1976; Kakwani, 1976). Many empirical studies such as Atkinson and Stiglitz (1976), Nayak and Paul (1989), Aggarwal (1990), Duncan and Peter (2012), Iosifidi and Mylonidis (2016) found that progressive income tax significantly reduces income inequality. In contrast, Cremer et al., (2001), Cimineli et al., (2017), reported that consumption taxes reduce income inequality. In India, the income share of the top 1% population has increased from 11% to 21.7% of total income between the time period 1980-2021 whereas the income share of the bottom 50% has drastically plummeted from 23% to 13.1% of total income between the same time period. Furthermore, top 10% has captured 57% and the middle 40% has shared only 29.7% in 2021. In response to this, the government of India has been introducing many tax reforms which could possibly ameliorate the financial positions of poor people and hence, their standard of living. However, the effectiveness of those tax reforms has not been empirically evaluated.

1.2.3. Taxation and Economic stability

Taxation can be used as a tool to smooth output fluctuations over a business cycle. It can control the forces of expansion and contraction and can thus reduce the variability of output fluctuations. A well-planned tax system might reduce the cyclical changes in the economy (Gilbert, 1942). However, some fiscal policy experts argue that the tax system of any economy is static by its nature and it cannot be sufficiently flexible to be used for reducing cyclical fluctuations. Numerous theoretical and empirical studies have examined how taxes might promote economic stability. Further, under different analytical settings some theoretical studies confirmed that a progressive income tax schedule can serve as an automatic stabilizer by ensuring output stability (Guo and Lansing, 1998; Agell and Dillen, 1994; Kletzer, 2006), while others observed that the higher the progressivity of labor income tax, the more likely the emergence of indeterminacy and endogenous fluctuations in the economy (Kleven and Kreiner, 2003; Ismael, 2011). But Zhiyong An (2018) suggested that taxes act as automatic destabilizers on the supply side, whereas taxes play the traditional role of automatic stabilizers on the demand side. Hence, the net impact of taxes on economic fluctuations is theoretically ambiguous. However, a number of empirical studies observed that progressive tax system can serve as an automatic stabilizer in reducing output

volatility (Pearse, 1962; Auerbach and Feenberg, 2000; Swanepol and Schoeman, 2002; Weller and Rao, 2010; Mattesini and Rossi, 2012; Martinez-Vazquez and Vulovic, 2014)

1.3. Research Gap

Reckoning the nexus between taxes and three key macroeconomic variables such as economic growth, income inequality and economic stability and the possible effects of taxes on those variables, the Indian government along with skill and expertise of fiscal policy analysts have formulated and implemented a series of tax reforms since independence. They have structurally changed the Indian tax system. Many studies are found that particularly envision the tax reforms required for the economic development of India. But no single study even tries to capture the macroeconomic effects of the Indian tax structure. The present study attempts to bridge this gap by empirically analyzing the effects of tax structure on three important macroeconomic indicators.

1.4. Research objectives of the Study

In the above backdrop, three objectives have been designed.

- To explore the effects of tax structure on economic growth.
- To examine the effects of tax structure on income inequality.
- To assess the impact of tax structure on economic stability.

1.5. Data Sources and Methodology of the Study

The present research employs time series datasets collected from various secondary sources. The data sources are the Handbook of statistics on Indian Economy published by RBI, Indian Public Finance Statistics published by the ministry of finance, the government of India, Union Budget documents published by the ministry of finance, the government of India, World Development Indicators published by World Bank, Standardized World Income Inequality Database, United Nations Development Programme, and Barro and Lee Database. As far as methodology is concerned, I have used methodology in accordance with the objectives of the study. Chapter 3 examines the nexus between taxes and economic growth using the ARDL bounds testing methodology. In chapter 4, the effect of tax structure on income inequality is examined using three complex estimating approaches, including FMOLS, DOLS, and CCR. In chapter-5, the ARDL model is employed to investigate the role of taxes in reducing output volatility.

1.6. Organization of the study

The present study contains into six chapters including the introduction and the conclusion chapters. The second chapter describes how the Indian tax system changed from the time before independence to the present. The third chapter examines how India's tax system affects economic growth. The fourth chapter investigates how India's tax system affects income inequality. The fifth chapter examines the role of taxation in mitigating output fluctuations in India. The sixth chapter offers the conclusion and policy suggestions.

Chapter-2

Indian Tax System

2.1. Introduction

Taxation has been one of the vital sources of revenue across the world and so for India. The pace of economic growth and development in India largely depends on its tax structure. Establishing an ideal tax system in a developing nation like India is a challenging task. Because the Indian economy is predominated by the informal sector where a major proportion of the population continues to work (Singh, 2019). All the transactions are made in cash in that sector. Therefore, it is not easy to estimate an appropriate tax base or tax rate with any objective. Further, the volume of tax revenue collected in any country largely depends on its tax administration. The tax administration must effectuate efficiently and effectively to fulfil the intended objectives of the tax policy such as efficient allocation of resources, redistribution of income, and output volatility. Initially, the tax policies of India were utilized as the tools to fulfill a variety of objectives. Those objectives were as follows. First, tax policies were being designed to increase the level of savings. Second, those were intended to correct inequalities arising from an oligopolistic market structure (Bagchi and Nayak, 1994). However, with the passage of time the Indian tax system has changed depending on the development strategies and philosophy of the country (Rao, 2017). It has changed from the narrow-based and complicated one to a broad-based and simple one that has been focusing on revenue productivity while minimizing distortions (Rao, 2005). Still, it lacks higher productivity and efficiency and is in serious need of reform (Rao, 2016).

2.2. Evolution of the Indian Tax System

2.2.1. Tax system in Ancient India

The tax system in ancient India is systematically found in Arthashastra, Raghuvamsa, and Manu Smriti, three great works of Kautilya, Kalidasa, and Manu respectively. The writings of Kautilya and Manu reveal that, in ancient India, the kings levied taxes (both in cash and in-kind) and the local officers collected those taxes. The large proportion of tax income was collected from land, octroi, liquor shops, gambling houses, and dancers of the Kingdom. According to Kautilya and Manu, it was the King's responsibility to design the tax system in such a way that the subjects would not feel the tax burden. The taxes were categorical. The traders and artisans had to pay 20% of their profits in silver or gold as taxes, while the agriculturists were to pay 17%, 12.5%, and 10% of their produce depending upon their circumstances. This reflects that there existed a well-planned

tax system in ancient India. However, Kautilya's Arthashastra dealt with the tax system in an elaborate and planned manner. The tax system in Arthashastra was more or less similar to the modern tax system. It emphasized equity and justice in taxation. According to it, the higher income class were being imposed by higher taxes compared to the lower income class. No tax was being imposed to the sick people. Moreover, the collection and exemptions were being maintained by the tax officials.

2.2.2. Tax system during Mughal Rule

Ain-i-Akbari, the official chronicler of Emperor Akbar provides vivid explanations of the tax system during Mughal rule. His writings also explain tax revenue, other revenues and salaries of public officers. Moreover, the travel accounts of visitors also provide some information about the revenue administration of the Mughal rule. Babur had no tax policies as such in his rule. He used to collect his state revenue by plundering others. However, land revenue was the main source of income for the Mughal rulers while other sources of income came from gifts and Jizya. The tax policies of the Mughals were based on religion. Jizya was imposed to encourage Hindus to convert to Islam. The discriminatory tax policy based on religion adopted by some of the Mughal rulers was responsible for the decline of the Mughal dynasty in India.

2.2.3. Tax system during British Rule

The British tax system in India reflected some features of traditional agricultural economy. The major revenue source of the central government was customs duties. The share of which was 40.51 % of total tax revenue. Income tax was also a vital source of revenue for the central government. The contribution of it was 13.74% of total tax revenue. Income tax had undergone a series of changes such as from the Income Tax Act, 1860 to the Income Tax Investigation Commission, 1947 to meet the changing requirements of government finances and economic policy. The central government also collected some revenue from central excise duties and salt duty. On the other hand, the British Indian provinces collected a major portion of their income from land tax, followed by state excises, stamps duties, and registration duties. The princely states at the time of British India were not a part of the government finance structure. They had their own budgets and own sources of income.

2.2.4. Tax system during the post-independence era

India has a three-tier federal tax structure. List I of the 7th schedule of the constitution of India assigns taxation powers to the central government. The taxation powers of the state governments enshrine in List II of the 7th schedule. The principal sources of revenue for the central government include personal income tax, corporate income tax, excise duties, customs duties, and CGST. The major sources of revenue for the state governments, on the other hand, include agricultural income tax, professional tax, stamp duties, registration fees, and SGST. The revenue-raising powers of urban and rural local governments have been enshrined in the 72nd and 73rd constitutional amendments. Property taxes and octroi are two important sources of revenue for the local governments. However, the local governments possess limited revenue-raising powers, and their expenditure requirements are met by the devolution of revenues from the state governments.

Since independence in 1947, the Indian tax system has undertaken major structural reforms pertaining to both direct and indirect taxes. It has become all-inclusive and intricate over the years. Both direct and indirect taxes have been simplified and rationalized by those structural reforms. And the objective of supplementing revenues and removing irregularities in the tax structure. Besides raising sufficient revenue for developmental, welfare, and administrative activities, the Indian tax system has become an effective instrument for income redistribution and economic stabilization. A series of tax reforms initiated in late years by the central government has carried the Indian tax system much nearer to international tax practices. Tax reforms are a part of the new economic reforms in 1991 to liberalize and globalize the Indian economy. The tax rates of income tax, excise duty, and customs duty have been slashed during post-economic reforms period. This suggests that the conventional belief that high tax rates bring more revenue to the treasury has been refuted. On the other hand, lower tax rates with fewer exemptions and concessions have been established. Direct taxes have been designed in such a manner that these could be able to expand the tax base and moderate tax rates. Further, these taxes could improve the efficiency of tax administration. As a result, distortions in the tax structure could be minimized. In the case of indirect taxation, a fully integrated GST has been implemented on 1st July 2017.

2.3. Tax Reforms in India

2.3.1. Tax Reforms Committee of Raja Chelliah

Under the leadership of Dr. Raja J. Chelliah, the tax reforms committee was established in 1991, and it submitted its report in 1992. Direct and indirect tax changes were advocated. In case of direct taxes, the recommendations were as follows. First, it was recommended that tax rates should be lowered, the gap between the lowest marginal rate and the highest marginal rate should be reduced, and agricultural income should be taxed. Second, the corporate tax rates should be cut down, and there shouldn't be a 10% gap between domestic and foreign companies' tax rates. Third, on the productive assets, there shouldn't be any wealth taxes. Fourth, only non-productive and socially unacceptable assets should be taxed. Fifth, in order to account for indexation, some kind of indexation must be used when computing long-term capital gains. In case of indirect taxes, the recommendations were as follows. First, customs duty should be reduced by eliminating several exclusions and special treatments and the number of tariff rates should be reduced. Second, the regulations and processes governing the valuation of excise duty ought to be made simpler. Third, specific duties should be replaced by ad valorem taxes. Fourth, value-added tax (VAT) should eventually replace the current excise duty at the industrial level. Services ought to be taxed.

2.3.2. Rekhi Committee on Indirect tax reforms

The Rekhi Committee was established in 1992 with K. L. Rekhi as its head. The committee's recommendations were as follows. First, in order to resolve disputes between taxpayers and tax collectors, a tribunal should be formed. Second, it is advisable to form a high-level All India Classification committee involving trade and business leaders. Third, Consignments for import should be cleared in 3 days. Fourth, there should be a second bank to break up the monopoly of one designated bank in each state. Fifth, when the assessee requests a stay, coercive means must not be used to recover the disputed duty amount.

2.3.3. Kelkar committee report on tax reforms

Under the chairmanship of Dr. Vijay Kelkar, a task group on direct and indirect taxes was established in 2002. The Vijay Kelkar committee's recommendations are as follows.

In case of direct taxes, the committee recommended that income tax exemption threshold of Rs. 50,000 must be raised to Rs. 1 lakh. Second, the maximum amount of tax exemption for widows and old persons should be Rs. 1.5 lakhs. Third, a two-tier income tax system with a 20% tax rate for incomes between Rs. 1 lakh and Rs. 4 lakhs and a 30% tax rate for earnings exceeding Rs. 4 lakhs is recommended. Fourth, standard deductions must be eliminated, although a transportation allowance exception is recommended. Fifth, long-term capital gains tax, dividend tax, and wealth tax should all be eliminated. Sixth, income tax shouldn't be subject to any additional fees. Seventh, except for the handicapped, tax incentives for savings and other income must be removed. Eighth, 2% of interest should be waived on housing loans up to Rs. 5 lakh per month. Ninth, there should be no minimum alternative tax and a corporation tax rate of 35% for foreign firms and 30% for domestic enterprises. Tenth, mutual fund short-term capital gains should be subject to a 20% tax. Eleventh, there shouldn't be a distinction made between the business loss and the unabsorbed depreciation.

In case of indirect taxes, the committee made also some recommendations. First, the central value-added tax rate need to be 14%. Second, there should be a comprehensive service tax and a national VAT. Third, exemptions for medicines that save lives, security equipment, and agricultural goods. Fourth, tax exemption for small businesses with annual sales up to Rs. 50 lakhs.

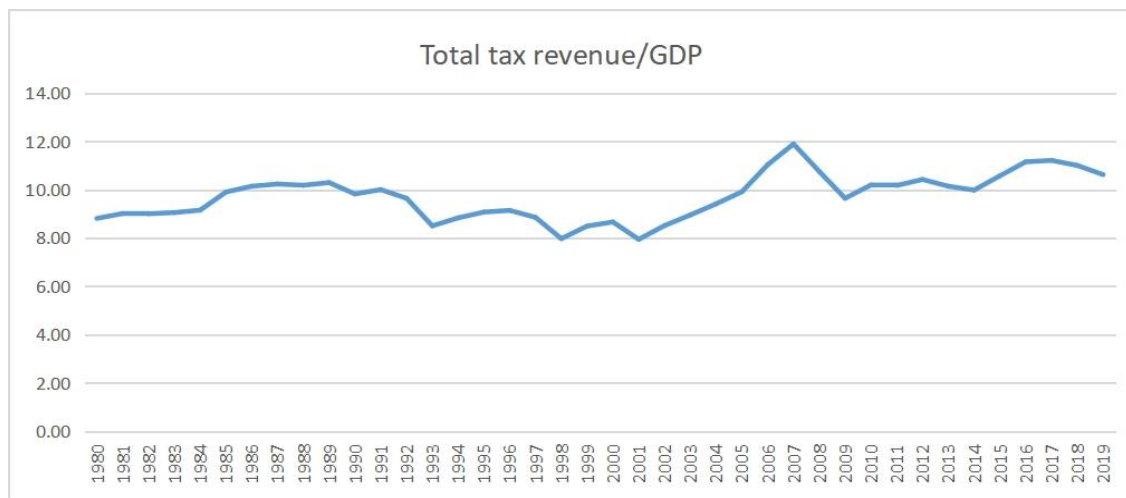
2.3.4. Goods and Services Tax (GST)

The indirect tax system in India underwent a complete transformation thanks to the Goods and Services Tax (GST). The central excise duty, central sales tax, purchase tax, entertainment tax, VAT, services tax, and other indirect taxes have all been replaced by this one in India. On 29th March 2017, the parliament approved the GST act that came into force on 1st July of the same year.

GST is based on the principle of "one nation, one tax" by replacing numerous indirect taxes previously existed. It is designed in such a manner that it would eliminate the cascading effects of tax and curb tax evasion. GST will broaden the base of taxpayers. It will follow online processes for ease of doing business. It will improve logistics and distribution system. It will promote competitive pricing and increase consumption.

2.4. Trend and Pattern of Tax Revenue in India

Figure 2.1. Trends in Tax-GDP ratio of the central government

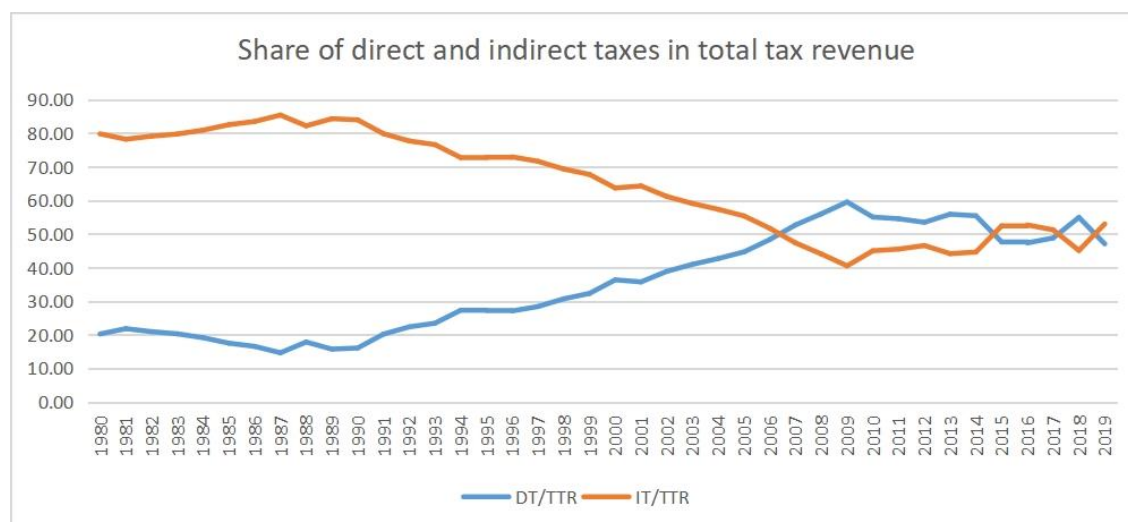


Source: Author's calculation.

Figure 2.1. highlights that tax-GDP ratio has steadily increased due to buoyant economic conditions and accelerated economic growth. In addition to that, higher tariff rates and economic liberalization in the 1980s fueled the tax revenue. The tax-GDP ratio, which was about 8.81 percent in 1980 increased to 10.29 percent in 1989. The economic depression ensuing the severe drought of 1987 caused stagnation in revenues until 1992-93. Thereafter, the tax-GDP ratio deteriorated because of 1991 economic crisis and a series of tax reforms. Generally, it is comprehended that tax-ratio which touched 10.29 percent in 1989, declined thereafter to 8.50 percent in 1993 and gradually recovered to 9.14 percent in 1996. The tax-GDP ratio again fluctuated around 8-9 percent. The tax-GDP ratio drastically increased in the subsequent periods particularly 11.89 percent in 2007, due to attempts made to contain deficit levels. The global financial crisis in 2007-08 reduced the tax-GDP ratio temporarily. However, different measures adopted by the government recovered the tax-GDP ratio from 9.64 percent to 11.21 percent. Indian government finally rolled out the much-debated GST on 1 July 2017. GST is a comprehensive, multi-stage, destination-based tax that subsumed many indirect taxes in India such as service tax, VAT, etc. However, both the central and state governments suffered huge revenue losses from the implementation of GST for a couple of years. As a result, the tax-GDP ratio which was 11.21 percent in 2017 decreased to 10.69 percent in 2019. Moreover, the tax-GDP ratio of India is quite

reasonable as compared to the tax-GDP ratio of other developing countries. However, as far as the developmental needs of the nation are concerned, the tax-GDP ratio of the country is clearly insufficient.

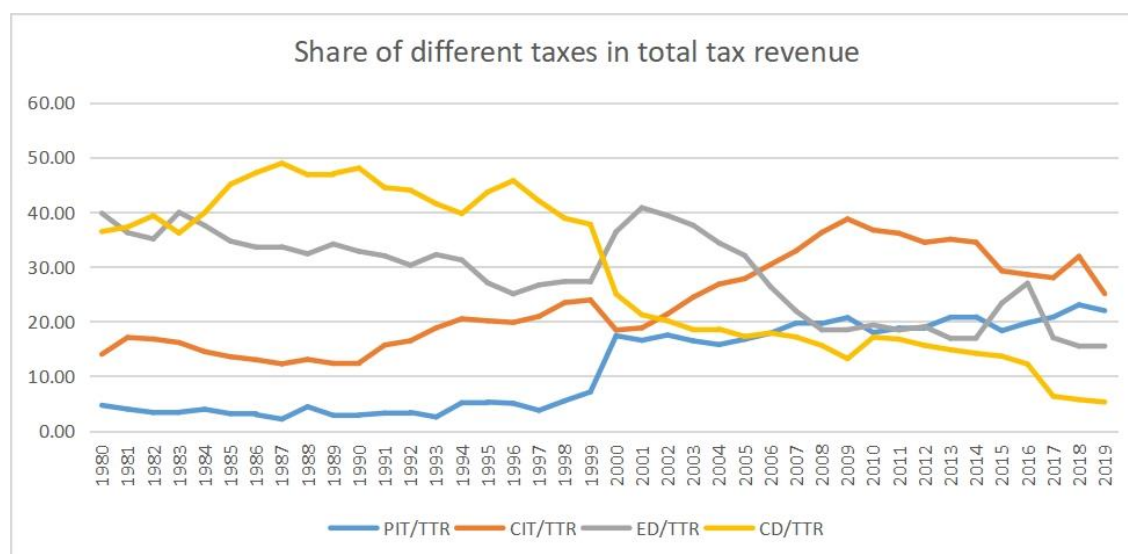
Figure 2.2. Share of Direct and Indirect taxes in Total Tax Revenue



Source: Author's plotting, taking data from RBI

Figure 2.2 shows that the proportion of revenue collected from indirect taxes is significantly higher in comparison to the proportion of revenue collected from direct taxes between 1980 and 2006. In 1980, indirect taxes contributed 80% of total tax revenue while the share of direct taxes was only 20%. However, in 2007, the contribution of revenue from direct taxes surpassed that from indirect taxes in total revenue where its share was around 53% of total tax revenue and the share of indirect taxes was 47%. However, from 2007 onwards, there have been fluctuations in the trends of both direct and indirect taxes. The share of revenue from indirect taxes was more than that from direct taxes because of high tariff rates and high tax rates in union excise duties. The revenue collection from indirect taxes declined and that from direct taxes increased due to reforms by TRC in 1991-92.

Figure 2.3. Contribution of different taxes in total tax revenue



Source: Author's plotting, taking data from RBI

Figure 2.3. displays the contribution of four central government taxes for example PIT, CIT, ED, and CD to the total tax revenue between the period 1980 to 2019. The contribution of two important indirect taxes such as ED and CD in total tax revenue was significantly higher than direct taxes from the early 1980s to the mid-2000s. However, the reverse trend appeared from the mid-2000s to 2019 as CIT and PIT dominated excise duties and customs duties.

During the period 1980-2000, less share of PIT reflects the narrow tax base, a combination of steeply high marginal tax rates and surcharges, and rampant tax evasion. Personal income tax only covers less than 1 percent of the population. However, the decline in marginal tax rates and surcharge in 1997-98, simplification and rationalization of PIT resulted in more contribution to total tax revenue.

A similar case happened to corporate income tax too. The tax rate varied between 45 to 65 percent. Despite having high nominal rates, the effective corporate tax rate was significantly less due to considerable tax preferences including depreciation and tax allowances. Systematic reforms were initiated by Tax Reforms Committee (TRC) in 1991-92 by reducing tax rates and simplifying tax slabs. Resultantly, steep growth in corporate tax revenue took place.

In the early 1980s, excise duties were multifaceted and distortionary. Excise duties were designed with a combination of specific tax and ad valorem tax. Further, it had 24 different rates ranging from 2 percent to 100 percent. However, tax rates of excise duties were reduced by the TRC's recommendations.

The higher share of CD in TTR in the 1980s and 1990s occurred due to a higher tariff rates ranging from 0 to 400 percent. Over one-tenth of imports was being taxed at the rate of 120 percent. The largest decline in the customs duties was certainly anticipated when tariff rates were drastically reduced in the aftermath of external stabilization by a number of tax changes started in the 1990s and early 2000s (Rao, 2005).

2.5. Conclusion

Since economic reforms in 1991, tax experts and policymakers have been attempting to make the Indian tax system simple and transparent tax system. Higher contribution of direct taxes in total tax revenue and larger tax base improved the overall tax collection. According to an analysis of the tax-GDP ratio, the contribution of direct taxes to the government exchequer is increasing, whilst the percentage of indirect taxes in overall tax revenue is declining. This may occur because of the computerization of tax procedures, formalization of the economy, improved TDS coverage, and effective management. Even though most operations have been simplified since being computerized, several of the department's compliance standards remain intricate and time and money intensive. It implies that there is a need for further tax structure modifications, including changes to tax administration. In his 2017 budget address, Finance Minister Arun Jaitley said that “India still does not comply with tax laws. In fact, more than 50 percent all registered companies fail to submit tax returns. The people who possess cars and properties are also paying taxes and filing tax returns, but their number is very less”. The Indian tax system is suffering from low revenue productivity and stagnant tax-GDP ratio. The lack of comprehensive income taxation due to constitutional provisions is reducing the tax base. A wide range of exemptions, deductions, and concessions given to different taxpayers is also narrowing the tax base. However, GST is a landmark reform in the history of the Indian tax system because it replaced a plethora of indirect taxes and made the indirect tax system simple. Though the tax revenue collection from GST was not at all satisfactory for a couple of years due to faulty implementation and operational difficulties, the efforts of various GST councils skyrocketed the gross GST collection subsequently and

reached GST collection of Rs. 1.42 lakh crores in March 2022. However, we can still state that structural tax reforms are required to both boost revenue productivity and enhance the nation's business climate.

Chapter-3

Tax Structure and Economic Growth

3.1. Introduction

Academicians and policymakers in the field of public finance have recently expressed an interest in examining the link between taxation and growth because of the potentiality of taxes to affect economic growth. Being an indispensable part of budgetary activities, taxation may be able to influence GDP growth through many factors like labour supply, human capital, physical capital, total factor productivity, change in price ratios, crowding out of private investment through making financing costlier, etc. (Arnold et al., 2011). Now the question comes into the mind: how does taxation affect economic growth? The economic theory finds an indirect nexus between tax and per capita GDP growth. A reduction in tax rates results in an increase in per capita GDP growth. On the other side, slower GDP growth would result from a rise in tax rates. But the tax system's effectiveness in affecting economic growth depends on both the tax rate and the tax structure (Arnold, 2008).

In a tax system, both tax level and tax structure affect GDP growth. Tax level refers to tax-GDP ratio of the country and tax structure indicates tax revenue collection from different tax variables. However, for two reasons, the impact of tax structure on economic growth is more significant than the impact of tax level. First, the growth implications of tax structure are useful for policy making regardless of change to the tax level. Second, the government tries to change the tax structure to minimize the consequences to the growth (Myles, 2000; Arnold, 2008). Hence the effect of change in tax level without having an understanding of tax structure on GDP growth is inconclusive and incomplete.

The study of tax structure with respect to economic growth is essential if the goal is to explore an overall association between taxation and GDP growth. Because the distinct effects on economic growth may be noticed from different kinds of taxation. For example, the nexus between personal income tax and per capita GDP growth is generally assumed to be negative. Because a rise in personal income tax reduces individuals' disposable income and savings. The increment of the tax rate will encourage the people to prefer less work to leisure (Mendoza et al., 1997) and to engage in tax malpractices such as tax evasion and tax avoidance. Hence, the combined effect of a fall in productivity and tax evasion reduces economic growth. Corporation income tax, further, has an inverse impact on per capita GDP growth (Lee and Gordon, 2005; Arnold, 2008). For the corporate sector, the willingness to invest in physical and human capital, research and development (R&D),

and other forms of innovation increase when the corporate income tax rate reduces, which enhances the firm's profits and capacity to compete in both domestic and international markets. Nevertheless, it also attracts foreign companies to settle down in those countries where low corporate tax is prevalent. All these factors together affect economic growth positively. Comparison between corporate income tax and personal income tax explores a new dimension of the study of analysing the risk-taking appetite of the self-employed individual (Schumpeter, 1942; Gordon and Cullen, 2002). The lower the former to later would encourage self-employed persons to undertake entrepreneurial activities of innovation beneficial to GDP growth. In contrast, consumption taxes like sales tax, excise duty, customs duties, etc. have positive impact on economic growth. Excessive burden on consumers via consumption taxes reduces the burden on labour, capital, and technological progress via lower income taxes, and thereby enhance economic growth (Zipfel and Heinrichs, 2012; Stoilova, 2017). In contrast, some studies such as Munir and Sulatn (2016), and Eugene and Abigail (2016) argued that in short-run, a rise in sales tax instantly raises the price of the product and acts as an incentive for the producers to produce more. But, in long run, it creates distortion in the factor prices and reduces returns to the factors of the production. The impact of tax structure on per capita GDP growth is so unclear and unresolved. Depending on the characteristics of each nation and period of time, it differs from one place and time to another. Thus, the current study uses the Auto Regressive Distributed Lag (ARDL) model developed in order to not only analyse the nexus between tax structure and economic growth, but also to calculate the degree to which various types of taxes have an impact on growth both in the short- and long-term (Pesaran, Shin, and Smith, 1999, 2001). We especially look at how four taxes affect India's economic expansion.

3.2. Literature Review

Many economic theories have diverse opinions on the controversial nexus between tax structure and economic growth and have also put forward different mechanisms by which the former influences later. As per the neoclassical growth models advocated by Solow (1956) and Swan (1956), the changes in the tax rates can bring changes in the intercept of the steady-state growth rate as taxation is taken as the exogenous variable in the growth model. As a result, its influence on the long-term growth rate is only temporary. In contrast to the neoclassical approach, Barro (1990), in his endogenous growth model where fiscal policy is included into the production

function endogenously, observed the persistent and positive influence of the government spending on the marginal productivity of physical capital. Lucas (1988) found that capital tax rates do not change growth rate. Kim (1998) examined the effects of various taxes on the long-run economic growth rate for the US economy and argued for the elimination of all taxes since doing so would boost growth by 0.85%. Mendoza et al (1997) looked at how consumption, physical capital, and human capital marginal tax rates affected economic growth. The model noticed the indirect effect of consumption tax (for instance VAT) on growth with an alteration in capital to labour ratio through changes in labour- leisure choices. In addition, direct effect of taxation of physical and labour supply on GDP growth was predicted in the model. However, the fundamental nexus between tax structure and per capita GDP growth had been neglected by those above studies. Therefore, the present study emphasizes the nexus between tax variables and per capita GDP growth.

3.2.1. Personal income tax and economic growth

Taxes on individual income have a variety of effects on economic growth. Change in marginal tax rates may affect willingness to work for taxpayers. It may affect incentive to save, or take advantage of certain tax preferences (Mendoza et al., 1997; Arnold, 2008; Arnold et al., 2011). First, a rise in the marginal tax rate will reduce people's after-tax income and make them prefer leisure over employment (Chetty, 2012). Second, increase in tax rate will reduce savings of the individuals which in turn, causes low investment, low capital formation, and decline in output growth (Mendoza et al., 1997). Third, increase in marginal tax rate encourages tax evasion which shrinks revenue collection, cuts down quality public spending and hence reduces economic growth (Arnold et al., 2011).

Some studies have sought to examine how labour income taxes affect investments in human capital, which is a key factor in growth. According to Trostel (1993), a constant labour income tax rate has no effect on investments in human capital. Heckman et al., (1998), however, showed that a progressive labour income tax discourages education since the future taxes on additional income more than outweigh the taxes saved while in school in the present.

Numerous empirical research also looked at the effects of personal income tax on GDP growth in addition to theoretical research. Using Leamer's (1983) extreme bounds technique, Widmalm

(2001) explored the connection between taxation and per capita GDP growth rate in 23 OECD nations from 1965 to 1990. She discovered that the average tax rate of a nation does not affect economic growth, demonstrating that there is no connection between tax levels in any nation and economic growth. In contrast, the tax level significantly influences economic growth. Particularly, personal income tax is strongly and adversely correlated with economic growth because it may distort the choice between work and leisure. Similar to this, Arnold (2008) used an error-correction specification to describe the short-run dynamics as he investigated the association between tax variables and GDP growth in 21 OECD nations between 1971 and 2004. He found that personal income taxes retard economic growth. Dackehag and Hansson (2012) examined the impact of personal income tax on GDP growth for 25 rich OECD nations from 1975 to 2010. They employed fixed effects regression to solve the omitted variable bias. They allowed a non-linear association between tax rates and GDP growth since higher tax rates may be more distorting and hence have a negative impact on GDP, whereas lower tax rates may result in more revenue that is used effectively. They found that the link between tax rates and economic growth was nonlinear. Particularly, lower tax rates on personal income encourage economic growth and higher tax rates retard it. Xing (2011) examined how tax policy affected GDP in a panel of 17 OECD nations between 1970 and 2004. He employed a pooled mean group approach for estimation. According to the estimation findings, personal income tax has a long-term, substantial and negative relationship with per capita income. Additionally, this conclusion held true even when alternative samples, independent variables, and time effect specifications were used. Between 1990 and 2009, Canavire-Bacarreza et al., (2013) explored the effects of tax policies on economic growth in a sample of 19 Latin American nations. For individual countries data, they employed the Vector Autoregressive (VAR) approach, and for the panel data analysis, they used the System Generalized Method of Moments (GMM). They found that across most of the Latin American region, personal income tax had no such detrimental effects on economic growth. However, the results from the global sample revealed that increased personal income tax rates might reduce GDP growth rates of Latin American countries. Nantob (2014) used a dynamic panel data set between 2000 and 2012 to explore the impact of taxation on GDP growth in 47 developing nations. In order to deal with endogeneity difficulties, he employed the system GMM estimator. He found that income taxes hinder economic growth. In 14 Indian states from 1991 to 2016, Neog and Gaur (2020) revealed that income tax had a detrimental effect per capita GDP growth. In contrast, Ahmad et al., (2016)

empirically investigated the effect of taxes on GDP growth in Pakistan from 1974 to 2010 using the ARDL bounds test technique and discovered that personal income tax promotes growth. Similar to this, Munir and Sultan (2016) looked at how taxes affected Pakistan's economic growth from 1976 to 2014 and found that personal income tax positively affects growth.

3.2.2. Corporate income tax and economic growth

Corporate income tax indirectly influences economic growth by affecting investment in physical capital. Investment decisions on physical capital mainly depend on the cost of capital. If the return on a capital asset exceeds the cost of capital, a company will invest in it (Mackie III, 2002). Therefore, cutting the cost of capital can increase investment in capital assets, which in turn increases capital creation and economic growth (Rosen, 1985). Due to an investment boom in reaction to the temporarily reduced tax rate, lower corporation tax rates on new investments help to boost short-term economic growth (Jorgenson and Hall, 1967).

The efficacy of corporate income tax depends on responsiveness of investment. And responsiveness of investment depends on change in the cost of capital (Yagan, 2013). Investment, according to Hassett and Hubbard (2002), is very responsive to changes in the cost of capital. Investment in equipment is more responsive to tax changes than investment in buildings (Chirinko, Fazzari, and Meyer, 1999). Tax policy has a big impact on how financially strapped enterprises behave when making investments. This shows that businesses with restricted access to financial markets are more vulnerable to adjustments in the taxation of investments (Zwick and Mahon, 2014; Kaplan and Zingales, 1997). Bond and Xing (2014) examined the nexus between tax and investment in 14 OECD countries and found that tax changes have a strong influence on equipment investment.

Schumpeter (1942) emphasized the significance of entrepreneurial activities and innovation on economic growth. Later on, some studies explored the role of tax policy, particularly corporate income tax in influencing entrepreneurial activities and self-employment. According to Gordon (1988), a lower corporation tax rate in comparison to the personal tax rate fosters business risk-taking. Additionally, Gentry and Hubbard (2000) offered evidence that, to the extent that personal income tax is progressive, taking entrepreneurial risks is discouraged. In addition, Carroll et al., (2000) found that entrepreneurs hire less workers when entrepreneur's marginal tax rate goes up.

Using data from individual income tax returns filed in the US between 1964 and 1993, Cullen and Gordon (2002) examined the effects of tax structure on entrepreneurial activities and found that entrepreneurial risk-taking and self-employment increase when the corporate income tax rate is lower than the personal income tax rate.

Several empirical research examined the nexus between the corporation tax rate and per capita GDP growth. Using the OLS method, Lee and Gordon (2005) looked into the impact of corporation tax rate on per capita GDP growth rate in 70 nations between 1970 and 1997. In regression models, they also took into account a large number of other economic growth factors. They discovered that the corporation tax rate significantly reduces per capita GDP growth. This means that a 10 percent reduction in corporate tax rate can increase GDP growth rate by 1.1 percent. Further, the fixed effects model recommended that the effect is larger because the same tax change can increase the annual growth rate by 1.8 percentage points. Using a stratified sample of firms from the OECD between 1996 and 2004, Schwellnus and Arnold (2008) investigated the effect of corporate tax on productivity and investment. To take advantage of differential impacts on enterprises with varying profitability, they used the difference-in-differences (DID) technique. They found that corporate taxes have a detrimental impact on firm-level production, and that effect holds true regardless of company size or age. For firms catching up to the technological frontier, the adverse effect of corporate tax is particularly apparent. The findings imply that corporate taxes discourage investment by raising the user cost of capital. Similar to this, Vartia (2008) examined how corporate tax rates affected productivity and investment in OECD nations. A rise in the corporation tax rate, according to estimation results, has a detrimental impact on investment due to an increase in user cost of capital. He also discovered that corporation taxes hurt production. In the similar fashion, Arnold (2008) reported that the corporate tax had a considerable negative impact on per capita GDP growth in 21 OECD nations between 1971 and 2004. Ferete and Dhalby (2012) looked at how Canada's provincial tax rates affected economic growth. The findings suggested that a higher corporate income tax rate reduces private investment, which consequently slows down economic growth during 1977-2006. Xing (2011) examined how tax policy affected GDP growth in 17 OECD nations from 1970 to 2004. He employed a pooled mean group approach for estimation. Additionally, he suggested that corporate income tax is negatively related to GDP growth.

3.2.3. Consumption taxes and economic growth

Numerous theoretical studies that explored the effects of consumption taxes on economic growth discovered that these taxes had no distorting effects (Schenone, 1975; Abel and Blanchard, 1983; Itaya, 1991; Rebelo, 1991; Pecorino, 1993). On the other hand, some other studies argued that a consumption tax can distort economic decisions and hence influence economic growth. Hall (1968) compared the growth effects of consumption tax and income tax by using life-cycle hypothesis and found that proportional consumption tax is better than income tax from economic growth point of view. A consumption tax may have a positive or negative impact on effective demand depending on the proportion of poorer families to all households (Matsuzaki, 2003). Because a rise in consumption tax decreases the demand for consumer products and redistributes labour from the manufacturing of goods to research and development activities (Futugami and Doi, 2004). Nishiyama and Smetters (2005) analyzed tax reforms using an overlapping generations model (OLG) with uninsurable wage shocks and longevity risks. They found that switching to a flat consumption tax would get rid of many distortions brought on by a progressive income tax. Chang (2006) discovered that raising the consumption tax improves the steady-state level of capital stock and consumption if consumers acquire capital not just for future consumption but also for social prestige. Using an overlapping generations model, Kaneko and Matsuzaki (2009) investigated how a consumption tax might affect economic growth and discovered that it would have an impact on both capital accumulation and consumption.

Given that excise duties are production taxes, Baker and Brechling (1992) used theoretical models to analyse the effects of excise duties on the pricing behavior of the firm. These models classify a firm's response based on how the market in which it operates is structured and how much competition it faces. They discovered that an increase in excise duty will increase the consumer prices by the precise amount of tax, not more than the tax, in a fully competitive industry with a downward sloping demand curve. This means that when the market contracts in reaction to the first price increase brought on by the tax adjustment, producer prices will decline or, at worst, remain unchanged. Therefore, in perfectly competitive market, tax over-shifting is not possible. However, in imperfect market conditions, market prices rise above the marginal cost. This means that tax over-shifting is possible and the consumer prices will rise by more than the rise in the excise duty. The level of the markup will determine how much of impact excise duty adjustments

have on customers. Market demand elasticity alone determines the markup factor. The degree of tax shifting is therefore greatly influenced by the elasticity of demand. Warren (2008) supported that the shifting of consumption depends on the elasticity of demand and supply. In addition, Boyer and Russel (1995) stated that to the extent the firm is paying the tax regardless of whether it is earning profits or not, a large portion of a consumption tax will pass on to consumers.

Recent empirical studies explored the effect of consumption tax on GDP growth. Widmalm (2001) studied the relationship between consumption taxes and GDP growth in 23 OECD countries between 1965 and 1990 by using extreme bounds analysis and found that consumption tax is growth-enhancing. Similar to this, Arnold (2008) found that consumption tax is growth-friendly when looking at the nexus between tax variables and per capita GDP growth in 21 OECD nations between 1971 and 2004. Canavire-Bacarreza et al., (2013) and Stoilova (2017) also observed the same nexus between consumption taxes and economic growth in a sample of 19 Latin American nations and EU-28 member states respectively.

On the other hand, Xing (2011) examined how the tax system affected GDP growth in a panel of 17 OECD nations from 1970 to 2004. He employed a pooled mean group approach for estimation. He found that the consumption tax is strongly and adversely related to economic growth. Munir and Sultan (2016) investigated how taxes affected Pakistan's economic growth from 1976 to 2014. They found that excise duty negatively affects GDP growth.

From the above discussion, the study made following observations on tax structure and economic growth. First, a negative association exists between personal income tax and economic growth. Second, corporate income tax has a similar negative impact on economic growth. However, consumption taxes have a mixed impact on economic growth as suggested by theoretical and empirical studies. Hence no consistent and conclusive evidence is found with regard to relationship between tax structure and economic growth. Thus, the present study employs annual time series data between 1980 and 2019 and an ARDL bounds testing technique to examine the link between tax structure and per capita GDP growth in the Indian setting.

3.3. Description of the data and variables

The research uses annual time series data from secondary sources collected between 1980 and 2019. The current study employs the GDP per capita growth rate as the dependent variable of the

model, which serves as a proxy for economic growth, to explore the effect of tax structure on per capita GDP growth in India. Personal income tax, corporate income tax, excise duty, and customs duty are the primary independent variables. Investment, population growth rate, and government final consumption expenditure are the control variables. Table 3.1 provides elaborate information on all the variables employed in the model.

Table 3.1. Variables and its description

Variables	Definition	Expected signs	Data Sources
GDP per capita growth rate (Dependent variable)	% Change in GDP per capita		Handbook of Statistics on Indian Economy, RBI
Personal income tax revenue	% Of total tax revenue	-	IPFS, MOF
Corporate income tax revenue	% Of total tax revenue	-	IPFS, MOF
Excise duty	% Of total tax revenue	+/-	IPFS, MOF
Customs duty	% Of total tax revenue	+/-	IPFS, MOF
Investment	% Of GDP	+	Handbook of statistics on Indian Economy, RBI
Population growth rate	% Change in population	+/-	Handbook of Statistics on Indian Economy, RBI
Government final consumption expenditure	% Of GDP	+/-	Handbook of Statistics on Indian Economy, RBI

Source: Author's compilation

Note: IPFS indicates Indian Public Finance Statistics, MOF refers to Ministry of Finance, and RBI indicates Reserve Bank of India.

Except GDP per capita growth rate, all the variables depicted in Table 3.1 are explanatory variables. All the explanatory variables are related to GDP per capita growth rate with different signs. First, Personal income tax is expected to have a negative influence on economic growth because an increase in personal income tax may decline labour supply by reducing after-tax returns to labour, shrink household savings available for domestic investment, and encourage tax evasion. Due to widespread tax evasion, decreased domestic savings, and a decline in labour productivity, personal income tax is negatively related to economic growth (Mendoza et al., 1997; Arnold, 2008; Arnold et al., 2011). Second, corporate income tax is also negatively related to economic growth because a rise in corporate income tax reduces after-tax returns to physical capital and discourages entrepreneurial risk-taking (Rosen, 1985; Cullen and Gordon, 2002). Third, as suggested by theory and empirics, consumption taxes don't possess any consistent relationship with economic growth. Therefore, it is expected that consumption taxes may reduce or increase economic growth (Zipfel and Heinrichs, 2012; Stoilova, 2017). Fourth, investment is predicted to have positive impact on economic growth because higher domestic saving leads to higher investment which ultimately results in higher economic growth in India (Levin & Renelt, 1992; Mankiw et al., 1992; De long & Summers, 1992; Kaushik and Klein, 2008; Jangili, 2011). Fifth, population growth rate may reduce or increase economic growth depending upon the quality of manpower added to labour force. On one hand, higher population growth reduces per capita income (Solow, 1956; Mankiw et al., 1992). On the other hand, increase in population growth rate augments productive labour supply chain and thereby increases economic growth in India (Sethy and Sahoo, 2015). Therefore, the study cannot predict any clear nexus between population growth rate and economic growth. Sixth, government final consumption expenditure may have negative or positive effects on economic growth. Because the classical school of thought suggests that government expenditure financed by public borrowings raises the interest rate that makes credit costlier for private sector, leading to lower investment and lower output. However, some contemporary studies such as Muthu (2017), Sharma et al., (2018), and Barik and Mohanty (2019) found that government expenditure stimulates economic growth in India through crowding-in effect.

3.4. Time series characteristics

Table 3.2. Descriptive Statistics

	lnPCGDPGR	lnPIT	lnCIT	lnED	lnCD	lnINV	lnPOPGR	lnGFCE
Mean	2.42	2.13	3.08	3.30	3.20	3.28	0.54	2.39
Median	2.47	2.36	3.05	3.42	3.40	3.25	0.63	2.39
Maximum	2.92	3.16	3.65	3.70	3.88	3.57	1.04	2.52
Minimum	1.74	0.76	2.50	2.67	1.65	2.96	0.00	2.28
Std. dev.	0.28	0.84	0.36	0.30	0.62	0.16	0.25	0.06
Skewness	-0.73	-0.14	-0.05	-0.57	-0.75	0.09	-0.28	0.19
Kurtosis	3.24	1.25	1.74	-0.57	-0.75	0.09	-0.28	0.19
Jarque-Bera	3.66	5.22	2.65	3.80	3.94	1.37	1.50	1.49
Probability	0.15	0.07	0.26	0.14	0.13	0.50	0.47	0.47
Sum	97.05	85.43	123.31	132.36	128.03	131.36	21.99	95.91
Sum Sq. Dev.	3.09	28.01	5.12	3.61	15.47	1.07	2.56	0.15
Observations	40	40	40	40	40	40	40	40

Source: Author's estimation

It is crucial to examine the features of the sample data before using any regression procedures. Table 3.2. shows the results of descriptive statistics which guide us to use either parametric or non-parametric tests for the estimation. All the series have been converted into logarithm form. The difference between mean and median values of all the variables is very insignificant. Also, standard deviation of all the variables is not large which indicates that all the observations of a particular series clusters around the average value of the series. Apart from positive skewness of LNINV and LNGFCE, all the series are negatively skewed, suggesting that no series is symmetric in nature. Further, LNPCGDPGR possesses leptokurtic curve as its kurtosis value is more than 3 and all the dependent variables possess platykurtic curves as their kurtosis values are less than 3. Lastly, Table 3.2 also depicts that probability value of Jarque-Bera statistics for all series is larger than 0.05. Hence, all series are normally distributed.

Table 3.3. Pairwise correlation matrix

Variables	lnPCGDPGR	lnPIT	lnCIT	lnED	lnCD	lnINV	lnPOPGR	lnGFCE
lnPCGDPGR	1							
								
lnPIT	-0.29 (0.06)	1						
								
lnCIT	-0.01 (0.92)	0.86 (0.00)	1					
								
lnED	-0.02 (0.90)	-0.62 (0.00)	-0.77 (0.00)	1				
								
lnCD	0.31 (0.04)	-0.89 (0.00)	-0.77 (0.00)	0.72 (0.00)	1			
								
lnINV	0.02 (0.90)	0.79 (0.00)	0.86 (0.00)	-0.70 (0.00)	-0.67 (0.00)	1		
								
lnPOPGR	0.21 (0.19)	-0.77 (0.00)	-0.72 (0.00)	0.70 (0.00)	0.84 (0.00)	-0.65 (0.00)	1	
								
lnGFCE	-0.35 (0.02)	-0.22 (0.16)	-0.31 (0.04)	0.18 (0.25)	0.27 (0.09)	-0.10 (0.52)	0.18 (0.25)	1
								

Note: The values in parenthesis represent probability. Source: Author's estimation

Table 3.3. suggests that PIT, CIT, ED, and GFCE are negatively related with PCGDPGR whereas CD, INV, and POPGR are positively associated with PCGDPGR. The correlation coefficient shows that there is no higher degree of correlation exists between all the independent variables and PCGDPGR, proxy for the economic growth. Excluding GFCE, the independent variables have a strong correlation, which might cause multicollinearity issues in the models.

3.5. Methodology

The objective of the current study is to evaluate the long- and short-term impacts of tax structure on per capita GDP growth. The present chapter employs ARDL bounds testing approach developed by Pesaran et al., (2001) for cointegration between economic growth and tax variables along with some control variables due to limitations in traditional cointegration approaches. ARDL method is superior over traditional cointegration methods in many ways. First, ARDL method is

applied to the series which is I (0) or I (1) or combination of both. However, traditional cointegration approach is only applied to the series which is I (1). Second, this method provides robust results for small sample than other methods (Pesaran, 1999). Third, endogeneity issues arising from the estimation of regressors are corrected by ARDL method (Harris and Sollis, 2003).

3.5.1. Unit Root Tests

Usually, stationarity of the series is checked by unit root tests before doing any regression analysis because non-stationary series might cause spurious regression. The ADF and PP tests are employed to test the stationarity of the data.

Dickey and Fuller (1979, 1981) developed a method to test the stationarity of time series data. According to them, unit root test is equivalent to checking for stationarity. Dickey-Fuller is expanded in Augmented Dickey-Fuller (ADF). To remove autocorrelation, lagged dependent variable are included in the ADF test. PP test (1988) is widely used financial time series analysis. The way serial correlation and heteroscedasticity are addressed in the error terms is the main distinction between PP and ADF tests.

3.5.2. ARDL Bounds Testing Approach

By supplying the value of the estimated F-statistics, the ARDL bounds test verifies the cointegration between the dependent variable and a group of explanatory factors. The resulting F-test is then evaluated against the critical value reported by Pesaran et al., (1999, 2001) and Narayan (2005). According to Pesaran et al., (1999, 2001) and Narayan, the explanatory variables' upper bound critical values are designated as I (1) while their lower bound critical values are labelled as I (0). (2005). H_0 is accepted and no cointegration between the variables is established if the estimated F-statistic value is smaller than the value of the lower critical bound. Conversely, if the estimated F-statistic value is greater the value of upper critical bound, then H_0 is rejected and the cointegration between the variables is established. If the value of calculated F-statistics lies within the values of lower and upper bounds, the result is considered inconclusive. The H_0 and H_1 of the F-statistics test are mathematically expressed below.

$$H_0: \beta_i = 0 \text{ for all } i = 1, 2, 3, \dots, n$$

$$H_1: \beta_i = 1 \text{ for all } i = 1, 2, 3, \dots, n$$

Where H_0 is null hypothesis, H_1 is alternative hypothesis, and β_i is the long run coefficients in ARDL model. The null hypothesis suggests that there is no cointegration between dependent and a set of regressors while alternative hypothesis tells just opposite. If the cointegration is established among variables, the next step is to check the long run and short run relationship among variables.

3.5.3. Error Correction Mechanism

Error Correction Model (ECM) is then used to look into the short-run dynamics among variables after ARDL bounds test confirmation of cointegration among variables. Sargan (1964) first proposed and used ECM for determining wage rates in the UK, while Engle and Granger (1987) later popularized the approach. Due to its dynamic short-run disequilibrium, ECM reconciles the cointegrating time series static long-run equilibrium. Following the confirmation of cointegration, the optimal lag order for the variables is chosen using the AIC. The long-run coefficients of the model are estimated after the selection of the optimal lag order. Then ECM calculates error correction term that implies the speed at which the short run disequilibrium is getting adjusted towards long run equilibrium along with a set of regressors.

3.5.4. Model Specification

The present study tries to explore the impact of individual tax variables on per capita GDP growth. Accordingly, four models have been designed to show the effects of four tax variables on per capita GDP growth. The model 1 captures the effects of personal income tax on per capita GDP growth. The model 2 depicts the effects of corporate income tax on per capita GDP growth. The impact of excise duties on per capita GDP growth is depicted in the model 3. The model 4 shows the effects of customs duty on per capita GDP growth. Investment, population growth rate, and government final consumption expenditure are the control variables in the four models.

$$PCGDPGR = f(PIT, INV, POPGR, GFCE) \dots\dots\dots \text{Eqn. (1)}$$

$$PCGDPGR = f(CIT, INV, POPGR, GFCE) \dots\dots\dots \text{Eqn. (2)}$$

$$PCGDPGR = f(ED, INV, POPGR, GFCE) \dots\dots\dots \text{Eqn. (3)}$$

$$PCGDPGR = f(CD, INV, POPGR, GFCE) \dots\dots\dots \text{Eqn. (4)}$$

$$\Delta \ln PCGDPGR_t = \alpha_0 + \sum_{t=1}^n \alpha_{1i} \Delta \ln PCGDPGR_{t-i} + \sum_{t=0}^n \alpha_{2i} \Delta \ln PIT_{t-i} + \sum_{t=0}^n \alpha_{3i} \Delta \ln INV_{t-i} + \sum_{t=0}^n \alpha_{4i} \Delta \ln POPGR_{t-i} + \sum_{t=0}^n \alpha_{5i} \Delta \ln GFCE_{t-i} + \beta_1 \ln PCGDPGR_{t-1} + \beta_2 \ln PIT_{t-1} + \beta_3 \ln INV_{t-1} + \beta_4 \ln POPGR_{t-1} + \beta_5 \ln GFCE_{t-1} + \mu_t \quad \text{.....Eqn. (5)}$$

$$\Delta \ln PCGDPGR_t = \alpha_0 + \sum_{t=1}^n \alpha_{1i} \Delta \ln PCGDPGR_{t-i} + \sum_{t=0}^n \alpha_{2i} \Delta \ln CIT_{t-i} + \sum_{t=0}^n \alpha_{3i} \Delta \ln INV_{t-i} + \sum_{t=0}^n \alpha_{4i} \Delta \ln POPGR_{t-i} + \sum_{t=0}^n \alpha_{5i} \Delta \ln GFCE_{t-i} + \beta_1 \ln PCGDPGR_{t-1} + \beta_2 \ln CIT_{t-1} + \beta_3 \ln INV_{t-1} + \beta_4 \ln POPGR_{t-1} + \beta_5 \ln GFCE_{t-1} + \mu_t \quad \text{.....Eqn. (6)}$$

$$\Delta \ln PCGDPGR_t = \alpha_0 + \sum_{t=1}^n \alpha_{1i} \Delta \ln PCGDPGR_{t-i} + \sum_{t=0}^n \alpha_{2i} \Delta \ln ED_{t-i} + \sum_{t=0}^n \alpha_{3i} \Delta \ln INV_{t-i} + \sum_{t=0}^n \alpha_{4i} \Delta \ln POPGR_{t-i} + \sum_{t=0}^n \alpha_{5i} \Delta \ln GFCE_{t-i} + \beta_1 \ln PCGDPGR_{t-1} + \beta_2 \ln ED_{t-1} + \beta_3 \ln INV_{t-1} + \beta_4 \ln POPGR_{t-1} + \beta_5 \ln GFCE_{t-1} + \mu_t \quad \text{.....Eqn. (7)}$$

$$\Delta \ln PCGDPGR_t = \alpha_0 + \sum_{t=1}^n \alpha_{1i} \Delta \ln PCGDPGR_{t-i} + \sum_{t=0}^n \alpha_{2i} \Delta \ln CD_{t-i} + \sum_{t=0}^n \alpha_{3i} \Delta \ln INV_{t-i} + \sum_{t=0}^n \alpha_{4i} \Delta \ln POPGR_{t-i} + \sum_{t=0}^n \alpha_{5i} \Delta \ln GFCE_{t-i} + \beta_1 \ln PCGDPGR_{t-1} + \beta_2 \ln CD_{t-1} + \beta_3 \ln INV_{t-1} + \beta_4 \ln POPGR_{t-1} + \beta_5 \ln GFCE_{t-1} + \mu_t \quad \text{.....Eqn. (8)}$$

From the equation 5 to the equation 8, all the variables are converted into the logarithm form. PCGDPGR stands for real per capita growth rate, PIT represents personal income tax, CIT indicates corporate income tax, ED stands for excise duty, CD denotes customs duty, INV is investment, POPGR expresses population growth rate, GFCE stands for government final consumption expenditure, μ is the error term, and Δ is first difference operator.

Null hypothesis

$$H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$$

Alternative hypothesis

$$H_1: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$$

The optimal lag order has been determined to be one for Model 1, three for Model 2, one for Model 3, and three for Model 4 based on AIC criteria. Thereafter, for investigating short run dynamics, error correction models are specified as under:

$$\Delta \ln PCGDPGR_t = \alpha_0 + \sum_{t=1}^n \alpha_{1i} \Delta \ln PCGDPGR_{t-i} + \sum_{t=0}^n \alpha_{2i} \Delta \ln PIT_{t-i} + \sum_{t=0}^n \alpha_{3i} \Delta \ln INV_{t-i} + \sum_{t=0}^n \alpha_{4i} \Delta \ln POPGR_{t-i} + \sum_{t=0}^n \alpha_{5i} \Delta \ln GFCE_{t-i} + \delta_1 ECT_{t-i} + \mu_t \quad \text{..... (9)}$$

$$\Delta \text{Ln PCGDPGR}_t = \alpha_0 + \sum_{t=1}^n \alpha_{1i} \Delta \text{Ln PCGDPGR}_{t-i} + \sum_{t=0}^n \alpha_{2i} \Delta \text{Ln CIT}_{t-i} + \sum_{t=0}^n \alpha_{3i} \Delta \text{Ln INV}_{t-i} + \sum_{t=0}^n \alpha_{4i} \Delta \text{Ln POPGR}_{t-i} + \sum_{t=0}^n \alpha_{5i} \Delta \text{Ln GFCE}_{t-i} + \delta_2 ECT_{t-i} + \mu_t \dots\dots\dots (10)$$

$$\Delta \text{Ln PCGDPGR}_t = \alpha_0 + \sum_{t=1}^n \alpha_{1i} \Delta \text{Ln PCGDPGR}_{t-i} + \sum_{t=0}^n \alpha_{2i} \Delta \text{Ln ED}_{t-i} + \sum_{t=0}^n \alpha_{3i} \Delta \text{Ln PIT}_{t-i} + \sum_{t=0}^n \alpha_{4i} \Delta \text{Ln INV}_{t-i} + \sum_{t=0}^n \alpha_{5i} \Delta \text{Ln POPGR}_{t-i} + \sum_{t=0}^n \alpha_{6i} \Delta \text{Ln GFCE}_{t-i} + \delta_3 ECT_{t-i} + \mu_t \dots\dots\dots (11)$$

$$\Delta \text{Ln PCGDPGR}_t = \alpha_0 + \sum_{t=1}^n \alpha_{1i} \Delta \text{Ln PCGDPGR}_{t-i} + \sum_{t=0}^n \alpha_{2i} \Delta \text{Ln CD}_{t-i} + \sum_{t=0}^n \alpha_{3i} \Delta \text{Ln INV}_{t-i} + \sum_{t=0}^n \alpha_{4i} \Delta \text{Ln POPGR}_{t-i} + \sum_{t=0}^n \alpha_{5i} \Delta \text{Ln GFCE}_{t-i} + \delta_4 ECT_{t-i} + \mu_t \dots\dots\dots (12)$$

$\delta_1, \delta_2, \delta_3$, and δ_4 in the equations 9, 10, 11, and 12 are the coefficients of ECT_{t-i} and α_i is defined as short run coefficients in equations 9, 10, 11, and 12. ECT_{t-i} is the error correction term suggesting the speed at which the short run dynamics getting corrected to long-run equilibrium. It should have negative sign and significant probability value.

3.6. Results and Discussions

Table 3.4. Results of unit root tests

Regressors	ADF		PP (Adj. t-stat)	
	C	C+T	C	C+T
lnPCGDPGR	-4.388**	-4.216***	-4.436**	-4.275***
lnPIT	-0.904	-2.193	-0.762	-2.116
ΔlnPIT	-8.712***	-8.598***	-8.660***	-8.552***
lnCIT	-1.058	-1.835	-1.089	-1.878
ΔlnCIT	-6.478***	-6.395**	-6.469***	-6.384***
lnED	-0.728	-3.169	-0.806	-2.600
ΔlnED	-5.517***	-5.477***	-5.402***	-5.347***
lnCD	1.534	-0.569	1.076	-0.569
ΔlnCD	-5.277***	-6.192***	-5.271***	-6.195***

lnINV	-2.229	-1.293	-2.206	-1.421
lnINV	-6.753***	-7.034***	-6.784***	-7.032***
lnPOPGR	-0.042	-5.768***	-1.778	-5.791***
lnPOPGR	-8.129***		-20.992***	
lnGFCE	-2.163	-2.383	-2.301	-2.264
lnGFCE	-5.765***	-5.664***	-5.701***	-5.579***

Note: Δ indicates first difference form of the series. All variables have been converted to logarithm form, as shown by Ln. *, **, and *** indicate 10%, 5%, and 1% significance level. C refers to constant and C+T refers to constant plus trend. See the text for other abbreviations. Source: Author's estimation.

The results of ADF and PP tests are shown in table 3.4. It shows that except lnPCGDPGR which is stationary at level, all the variables are stationary at first difference. The results confirm the conditions required for employing ARDL model. Because the ARDL model may be used to examine both the short and long-term relationships among variables if all the variables are integrated of order 0 or 1, or a combination of the two.

Table 3.5. VAR Lag Order Selection Criteria

Focus Variable: lnPIT						
Lag	Logl	LR	FPE	AIC	SC	HQ
0	57.15	NA	6.64e-07	-2.87	-2.69	-2.81
1	153.85	167.27*	8.52e-09*	-7.23*	-6.36*	-6.92*
2	168.16	21.65	9.65e-09	-7.14	-5.57	-6.59
3	180.49	15.98	1.28e-08	-6.94	-4.68	-6.14

Focus Variable: lnCIT						
Lag	Logl	LR	FPE	AIC	SC	HQ
0	100.23	NA	4.00e-09	-5.14	-4.92	-5.07
1	202.42	171.24	6.25e-11	-9.32	-8.01*	-8.85*
2	230.61	39.61*	5.69e-11	-9.49	-7.09	-8.64

3	261.16	34.67	5.21e-11*	-9.79*	-6.30	-8.56
---	--------	-------	-----------	--------	-------	-------

Focus Variable: lnED						
Lag	Logl	LR	FPE	AIC	SC	HQ
0	82.85	NA	6.33e-10	-4.15	-3.89	-4.06
1	221.10	224.19*	2.59e-12*	-9.68*	-7.85*	-9.03*
2	224.92	30.89	5.86e-12	-9.02	-5.62	-7.82
3	284.12	38.14	7.81e-12	-9.19	-4.23	-7.44

Focus Variable: lnCD						
Lag	Logl	LR	FPE	AIC	SC	HQ
0	80.99	NA	1.13e-08	-4.10	-3.89	-4.03
1	195.14	191.27*	9.27e-11*	-8.92	-7.62*	-8.46*
2	218.41	32.70	1.10e-10	-8.83	-6.43	-7.98
3	246.73	32.15	1.14e-10	-9.01	-5.52	-7.78

Note: * indicates lag order chosen by criterion. Source: Author's estimation

After verification of the stationarity of the data series, optimal lag order has been chosen by using different criteria because it lowers residual correlation. The optimal lag order should be selected to overcome parameterization problems (Narayan, 2005; Pesaran, 2001). In order to show the individual effect of four tax variables, we have formulated 4 models and have selected optimal lag order for each of the model. We have taken AIC for the selection of lag order. Table 3.5 suggests that maximum lags for LNPIT, LNCIT, LNED, and LNCD are 1, 3, 1, and 3 respectively as selected by AIC.

Table 3.6. ARDL Bounds Test Results

Model 1			Model 2			Model 3			Model 4		
F-statistic- 6.942			F-statistic- 3.806			F-statistic- 4.402			F-statistic- 5.485		
K=4			K=4			K=4			K=4		
LS	I(0)	I(1)	LS	I(0)	I(1)	LS	I(0)	I(1)	LS	I(0)	I(1)
1%	3.29	4.37	1%	3.29	4.37	1%	3.29	4.37	1%	3.29	4.37
5%	2.56	3.49	5%	2.56	3.49	5%	2.56	3.49	5%	2.56	3.49
10%	2.2	3.09	10%	2.2	3.09	10%	2.2	3.09	10%	2.2	3.09

Note: K refers to number of independent variables and LS represents level of significance. The lower and upper bounds values are used from Pesaran et al., (2001) while comparing the calculated F-statistics values of ARDL model. Source: Author's estimation

Table 3.6. suggests that there exists cointegration between per capita GDP growth and a number of independent variables. All four equations demonstrate the presence of co-integration between per capita GDP growth and independent variables in all models because estimated values of F-statistic of all models are more than critical upper bounds values at significance level of 5%.

Table 3.7. Long-run and short-run coefficients of Model 1 (Ln PIT as independent variable)

Long Run Coefficients				
Regressors	Coefficient	Standard Error	t-statistic	Probability
lnPIT	-0.440***	0.115	-3.799	0.000
lnINV	1.480***	0.415	3.563	0.000
lnPOPGR	-0.209	0.337	-0.620	0.538
lnGFCE	-2.064***	0.812	-2.540	0.014
C	3.566	1.637	2.177	0.305
Short Run Coefficients				

Regressors	Coefficient	Standard Error	t-statistic	Probability
ECT (-1)	-0.694***	0.101	-6.827	0.000
$\Delta \ln \text{PCGDPGR}(-1)$	-0.694***	0.115	-6.021	0.000
$\Delta \ln \text{PIT}$	-0.305*	0.085	-3.578	0.000
$\Delta \ln \text{INV}$	1.028***	0.346	2.972	0.004
$\Delta \ln \text{POPGR}$	-0.145	0.232	-0.625	0.535
$\Delta \ln \text{GFCE}$	-5.091***	0.765	-6.651	0.000
R square	0.601			
F-statistic	10.553***			

Note: * and *** indicate significance level at 10% and 1%. Δ is first difference operator. Source: Author's estimation.

After confirming the existence of long-run association between economic growth and its determinants, Table 3.7. highlights the long-run and short-run effects of personal income tax, investment, population growth rate, and government final consumption expenditure on per capita GDP growth in India. The magnitude of long run elasticity of personal income tax and investment are more than their short run elasticity, while elasticity of government final consumption expenditure is more in short run than in long run. Firstly, personal income tax significantly reducing economic growth in both short and long run. Specifically, 1 percent increase in revenue from personal income tax reduces economic growth by 0.30 and 0.44 percent in short run and long run respectively. This might happen due to distortionary nature of personal income tax. Personal income tax may distort the labour-leisure choice and taxpayers may prefer more leisure in place of labour leading to decline in labour productivity and hence output growth rate (Widmalm, 2001). Further, higher marginal tax rates on higher incomes decline the return to human capital investment, which distorts educational decisions resulting in lower output growth (Koester and Kormendi, 1989). Secondly, the empirical result also reveals that investment significantly and positively affects long-term economic growth. An increase of 1 percent in investment leads to increase per capita GDP growth rate by 1.48 percent. The reason for this is that more domestic saving encourages increased investment, which eventually boosts India's economic growth

(Kaushik and Klein, 2008; Jangili, 2011). Thirdly, long-term economic growth in India is considerably and negatively correlated with government final consumer spending. It claims that 1 percent more spent on final goods and services by the government results in a 2.06 percent decline in per capita GDP growth. Excessive government final consumption expenditure compels the government to resort additional taxation and borrowings, resulting in disincentives and inefficiency (Chen and Feng, 2000; Dowrick, 1996). Further, the classical thought points out that government expenditure financed by public borrowings raises the interest rate that makes credit costlier for private sector, leading to lower investment and lower output (Das, 2004; Das, 2016; Sahu and Panda, 2012; Mohanty, 2018; Sen and Kaya, 2014). However, a few contemporary research like Muthu (2017), Sharma et al., (2018), and Barik and Mohanty (2019) found that government expenditure stimulates economic growth in India through crowding-in effect. Additionally, population growth rate has no significant role in explaining GDP per capita growth in the long-run.

The computed coefficient of ECT is negative and significant indicating that the short-run dynamics of disequilibrium of the co-integrating variables are strongly corrected in the direction of long-run equilibrium. Additionally, this suggests that the long-term link between the aforementioned factors is stable. To achieve long-term equilibrium, the per capita GDP growth rate's short-term disequilibrium is rectified by 69% annually. The R square and F-statistic values also show that the findings of the estimation are reliable.

Table 3.8. Long-run and Short-run coefficients of Model 2 (CIT as independent variable)

Long run Coefficients				
Regressors	Coefficient	Standard Error	t-statistic	Probability
lnCIT	-0.948***	0.409	-2.314	0.026
lnINV	2.460***	0.721	3.410	0.001
lnPOPGR	0.474***	0.309	1.533	0.133
lnGFCE	-3.252***	1.197	-2.716	0.010
C	4.805	2.195	2.188	0.035
Short Run Coefficients				
Regressors	Coefficient	Standard Error	t-statistic	Probability

ECT (-1)	-0.735***	0.144	-5.100	0.000
$\Delta \ln \text{PCGDPGR}(-1)$	0.342	0.128	2.666	0.011
$\Delta \ln \text{PCGDPGR}(-2)$	-0.735**	0.167	-4.398	0.000
$\Delta \ln \text{CIT}$	0.109***	0.346	0.317	0.752
$\Delta \ln \text{CIT}(-1)$	-0.697	0.312	-2.232	0.031
$\Delta \ln \text{INV}$	0.508*	0.743	0.683	0.498
$\Delta \ln \text{INV}(-1)$	-1.777***	0.766	-2.319	0.026
$\Delta \ln \text{POPGR}$	0.348	0.242	1.438	0.159
$\Delta \ln \text{GFCE}$	-4.601***	0.878	-5.237	0.000
$\Delta \ln \text{GFCE}(-1)$	3.669***	0.948	3.867	0.000
R square	0.590			
F-statistic	4.715***			

Note: * and *** indicate significance level at 10% and 1%. Δ is first difference operator. Source: Author's estimation.

Table 3.8. presents the findings of both the short run and long run ARDL coefficients. Corporate income tax is significantly reducing India's per capita GDP growth during the study period. Statistically, 1% increase in revenue from corporate income tax reduces economic growth by 0.94%. Our results align with Lee and Gordon (2005), Arnold (2008), and Ferde and Dahlby (2012). Corporate tax rate can affect economic growth through many channels. An increase in the corporation tax rate may increase the cost of capital and lessen investment incentives, which would be detrimental to economic growth. Further, corporate tax can distort allocation of capital and reduce the productivity of overall investment by providing tax incentives to specific sectors (Myles, 2000; Johansson et al., 2008). In the similar line, corporate tax can have adverse effect on total factor productivity by distorting factor prices and generating inefficiency in resource allocation (Feldstein, 2006). Corporate tax rate can discourage entrepreneurial activities and self-employment motive, thereby reducing creation of new ideas and lowering total factor productivity and economic growth (Gentry and Hubbard, 2000; Cullen and Gordon, 2002; Djankov et al., 2010). In the long run, control variables like investment and population growth rate significantly increases economic growth while government final consumption expenditure significantly reduces

economic growth. Increase in population growth rate augments productive labour supply chain and thereby generate value addition to economic growth in India (Sethy and Sahoo, 2015). Error correction term with a coefficient of -0.73 suggests a very fast convergence to long run equilibrium.

Table 3.9. Long-run and Short-run coefficients of Model 3 (LNED as Independent Variable)

Long Run Coefficients				
Regressors	Coefficient	Standard Error	t-statistic	Probability
lnED	-0.504	0.395	-1.366	0.179
lnINV	-0.033	0.652	-0.051	0.959
lnPOPGR	0.696	0.416	1.671	0.102
lnGFCE	-0.089	1.050	-0.085	0.932
C	4.119	3.170	1.299	0.201
Short Run Coefficients				
Regressors	Coefficient	Standard Error	t-statistic	Probability
ECT (-1)	-0.572***	0.105	-5.444	0.000
ΔlnPCGDPGR	-0.572***	0.120	-4.746	0.000
ΔlnED	-0.861	0.315	-2.732	0.009
ΔlnINV	-0.019***	0.372	-0.051	0.959
ΔlnPOPGR	0.398	0.253	1.574	0.123
ΔlnGFCE	-4.351***	0.835	-5.209	0.000
ΔlnGFCE(-1)	-0.051**	0.602	-0.085	0.932
R square	0.533			
F-statistic	6.700***			

Note: *, **, and *** indicate significance level at 10%, 5%, and 1%. Δ is the first difference operator. Source: Author's estimation

Table 3.9. illustrates the relationship between economic growth and its determinants in the short and long run. It has been demonstrated that both in the short and long run, excise duty has little impact on economic growth. This finding is consistent with previous literature (Schenone, 1975; Abel and Blanchard, 1983). Furthermore, it is seen that economic growth is negatively and significantly affected by investment and government final consumption expenditure. As suggested by ECT, the speed of adjustment of short run disequilibrium to long run equilibrium is 57% per annum.

Table 3.10. Long run and short run coefficients of Model 4 (Ln CD as independent variable)

Long Run Coefficients				
Regressors	Coefficient	Standard Error	t-statistic	Probability
lnCD	0.508***	0.165	3.064	0.003
lnINV	0.874***	0.395	2.208	0.032
lnPOPGR	-0.417	0.414	-1.009	0.318
lnGFCE	-1.991**	0.869	-2.290	0.027
C	2.921	1.665	1.753	0.086
Short Run Coefficients				
Regressors	Coefficient	Standard Error	t-statistic	Probability
ECT (-1)	-0.703***	0.115	-6.068	0.000
ΔlnPCGDPGR(-1)	-0.703***	0.129	-5.443	0.000
ΔlnCD	0.357***	0.134	2.660	0.011
ΔlnINV	1.492**	0.601	2.482	0.023
ΔlnPOPGR	-0.320	0.241	-1.331	0.194

$\Delta \ln \text{GFCE}$	-4.453***	0.802	-5.550	0.000
$\Delta \ln \text{GFCE}(-1)$	2.961	0.831	3.571	0.00
C	2.011	1.891	1.061	0.291
R square	0.554			
F-statistic	8.718***			

Note: *, **, and *** indicate significance level at 10%, 5%, and 1%. Δ is the first difference operator. Source: Author's estimation

Table 3.10. depicts the short and long run relationship between economic growth and customs duty, investment, population growth rate, and government final consumption expenditure. Customs duty is positively and significantly related to per capita GDP growth in the long and short run, respectively, with coefficient values of 0.50 and 0.35. This finding might support the fact that customs duty is primarily levied on imported goods mostly consumed by lower income class people due to their higher marginal propensity to consume as compared to rich people. An increase in customs duty on imported goods, given budget constraint, would shift their consumption choice from imported goods to the domestically produced substitutes. As a result of that, domestic firms are encouraged to produce more and positively contribute to growth. Moreover, a rise in customs duty acts as an incentive for domestic producers to scale up their production. Our results support previous studies such as Wang and Yip (1992), Zipfel and Heinrichs (2012), Stoilova (2017). Higher consumption taxes induce accumulation of domestic capital which promotes economic growth with an efficient public sector (Wang and Yip, 1992). Another mechanism claims that a tax structure that mainly focuses on consumption taxes reduces the distorting effects of taxation by placing less taxes on inputs of production that promote growth, such as labour, capital, and technical advancement (Zipfel & Heinrichs, 2012). Consumption taxes are therefore less likely to cause distortions, such as excise taxes and customs charges. Additionally, it has been found that government final consumption expenditures both short- and long-term have a negative and substantial impact on per capita GDP growth whereas investment is significantly increasing economic growth.

Error correction term with a coefficient of -0.70 suggests very good convergence rate to long run equilibrium. It confirms long run association among the variables.

Table 3.11. Results of Diagnostic Tests

Model 1:	Test	F-statistics	Prob.
	Jarque-Bera Normality Test	2.83	0.24
	BG Serial Correlation LM Test	0.33	0.64
	BPG Heteroscedasticity Test	0.41	0.96
	Ramsey RESET Test	5.02 (1, 30)	0.03
Model 2:	Test	F-statistics	Prob.
	Jarque-Bera Normality Test	0.52	0.76
	BG Serial Correlation LM Test	0.15	0.70
	BPG Heteroscedasticity Test	0.69	0.99
	Ramsey RESET Test	0.79 (1, 17)	0.38
Model 3:	Test	F-statistics	Prob.
	Jarque-Bera Normality Test	2.95	0.22
	BG Serial Correlation LM Test	0.55	0.44
	BPG Heteroscedasticity Test	0.43	0.99
	Ramsey RESET Test	4.59 (1, 26)	0.04
Model 4:	Test	F-statistics	Prob.
	Jarque-Bera Normality Test	0.08	0.95

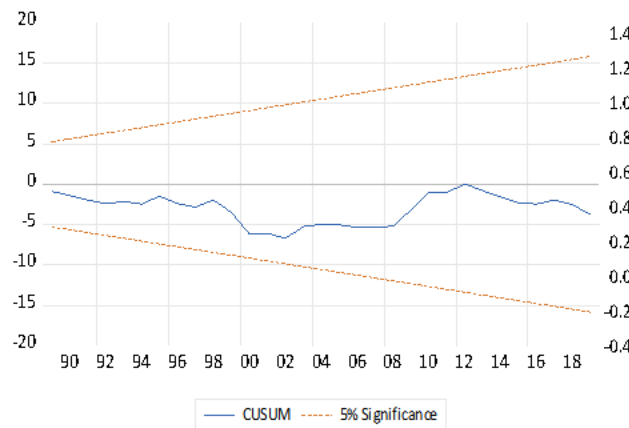
BG Serial Correlation LM Test	0.41	0.56
BPG Heteroscedasticity Test	1.62	0.62
Ramsey RESET Test	0.03 (1, 28)	0.85

Note: Degrees of freedom are mentioned in parenthesis. Source: Author's estimation

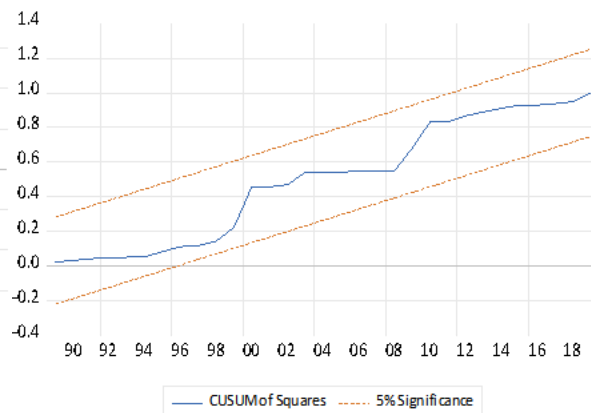
Results of the diagnostic tests are highlighted in Table 3.11. Since the probability values of the Jarque-Bera normality tests are larger than 0.05, it may be concluded that the four models' error terms are normally distributed. Similarly, there are no serial correlation and heteroscedasticity in the models as the probability of Chi-square values of BG serial correlation LM test and BPG heteroscedasticity test are greater than 0.05. Furthermore, Ramsey RESET tests suggest that there are no omitted variables in the models since the probability value is greater than 0.05. Hence, all the models are specified well.

Figure 3.1. Stability Tests for Model 1

CUSUM Test



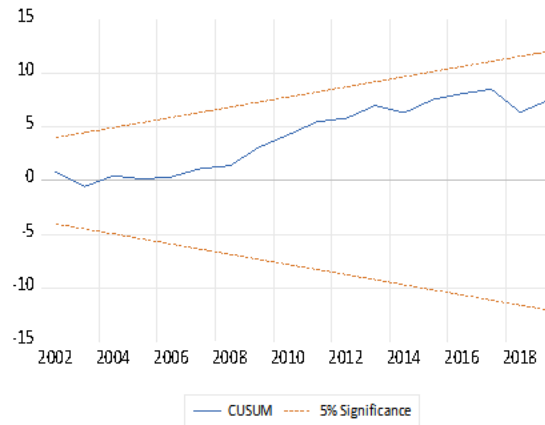
CUSUMSQ Test



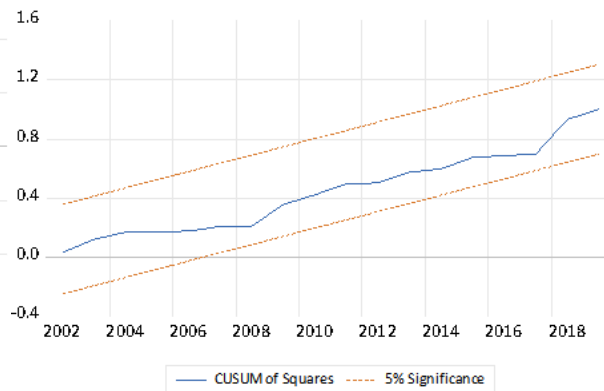
Source: Author's estimation

Figure 3.2. Stability Tests for Model 2

CUSUM Test



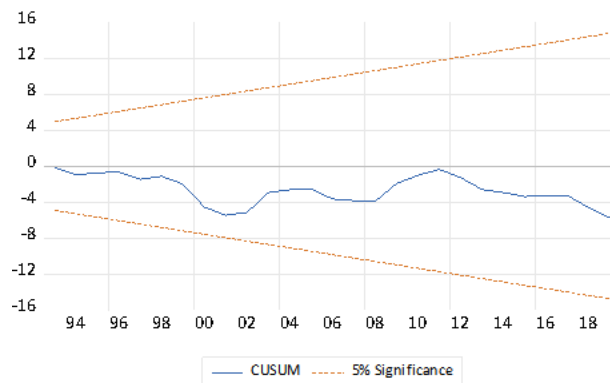
CUSUMSQ Test



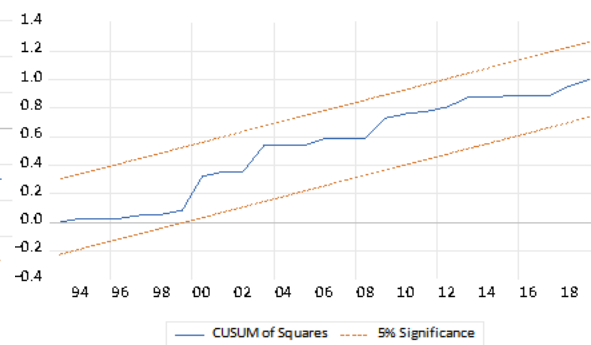
Source: Author's estimation

Figure 3.3. Stability Tests for Model 3

CUSUM Test



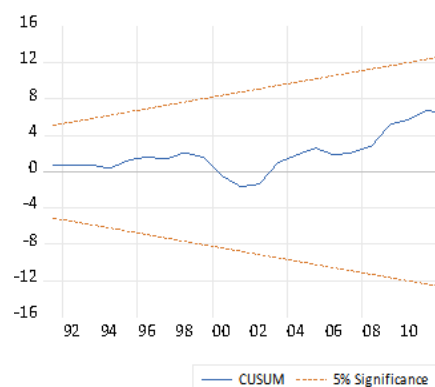
CUSUMSQ Test



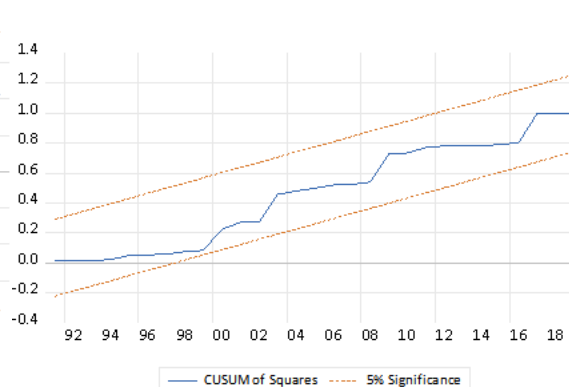
Source: Author's estimation

Figure 3.4. Stability Tests for Model 4

CUMSUM Test



CUSUMSQ Test



Source: Author's estimation

The results of the CUSUM and CUSUM-squared tests developed by Brown et al., (1975) for four models are shown in figures 3.1 through figures 3.8. These two tests are used to determine if the long-term relationship between economic growth and its determinants is stable for each model. The model's residuals are subjected to the tests. The cumulative sum of recursive residuals, which is based on the initial set of n observations, provides the basis for the CUSUM test. It is plotted against the break points and updated iteratively. If the plot of the CUSUM statistics is within the 5% threshold of significance, the estimates are stable. The CUSUM-squared statistics are the same. Plotting the CUSUM and CUSUM-squared statistics for each of the four models reveals that the parameters exhibit the long run stability.

3.7. Conclusion

Nexus between taxation and economic growth has been discussed since recent decades in the domain of public finance. Most of the literature reports that income taxes reduce economic growth whereas consumption taxes enhance economic growth. Conversely, other studies found that consumption taxes are growth-retarding and income taxes are growth-conducive. The previous studies, however, have not explored the nexus between tax structure and growth in India. The present chapter, therefore, attempts to examine relationship between tax structure and economic growth in India by analysing a set of time series variables from 1980 to 2019 with the help of ARDL bounds testing approach. Four models were designed for four tax variables, such as PIT,

CIT, ED, and CD, in order to reflect the individual impact of taxes on per capita GDP growth. First, it was shown that, by distorting the labour market and depressing investments in human capital, personal income tax in India significantly retards per capita growth rate in both the short and long run. Our results find the support of Koester and Kormendi (1989) and Widmalm (2001). Second, the long-term impact of corporate income tax also significantly slows growth. The reason for this is that raising the corporation tax rate can increase the cost of capital, decrease investment incentives, and discourage innovation and entrepreneurship, all of which slow down economic growth. This result aligns with Lee and Gordon (2005), Arnold (2008), and Ferede and Dahlby (2012). Third, excise duty has no effects on per capita GDP growth rate in India during the study period. Fourth, customs duty significantly increases per capita GDP growth during the study period. Higher tax collections from consumption taxes such as customs duty and excise duty means lower tax burden on labour and capital which are main factors of growth. Therefore, consumption tax like custom duty is non-distortionary in nature which reduces burden on labour, capital, and technological progress and thereby growth conducive. This finding is also supported by Wang and Yip (1992), Futugami and Doi (2004), Zipfel and Heinrichs (2012).

The policymakers always face the difficulty to choose between efficiency and equity while designing the tax policies. This indicates that efficiency (economic growth) is neglected while prioritizing equity (income distribution) and vice-versa. The present study finds that progressive taxes like PIT and CIT are distortionary. Thus, they reduce per capita GDP economic growth. In contrast, regressive tax like customs duty is beneficial for growth. As a result, it is recommended that the Indian government should rely more on customs duties in order to encourage economic growth through the use of tax policies. On the other hand, by collecting less revenue through corporate and personal income taxes, the government should lessen the burden on productive elements like human capital, physical capital, and technological advancement. Nonetheless, a conducive business climate should be developed in order to stimulate investment. And unnecessary government expenditure should be curtailed for sustainable growth of the country.

Chapter-4

Tax Structure and Income Inequality

4.1. Introduction

In India, the income shares of the top 1% of income earners has increased from 11% to 21.7% of total income between the time period 1980-2021 whereas the income share of the bottom 50% has drastically plummeted from 23% to 13.1% of total income between the same time period. Furthermore, top 10% has captured 57% and the middle 40% has shared only 29.7% in 2021. According to this statistic, India is the world's second-most unequal country in terms of income inequality, behind South Africa (Mahendra Dev, 2018). The negative effects of the COVID-19 epidemic have further fueled the already-burning flames. Due to COVID-19, the income share of the impoverished group has drastically decreased. The pandemic's adverse economic repercussions are anticipated to have a particularly devastating impact on the lower and middle classes. The most recent reports from Oxfam (2021) and Forbes (2021) support the hypothesis that a pandemic will worsen the distribution of income. The magnitude of deterioration would be significant in India due to India's prolonged suffering in the pandemic.

The high-income inequality might limit economic performance. It might stand as a barrier to accomplishing many sustainable development goals (SDGs). For instance, SDGs such as no poverty, zero hunger, gender equality, decent work and economic growth, and inequality reduction might not be materialized within the stipulated time. It might happen because the purchasing power of the majority low-income class declines in comparison to the minority high-income class and the marginal propensity to consume is relatively lesser in the case of the high-income class and higher in the case of low-income class. Hence, enormous income inequality might weaken economic performance (Stiglitz, 2012). The Sustainable Development Goal 10 (SDG10) affirms that income inequality affects accessibility to factors like health outcomes, food and nutrition, energy, education, water, and sanitation (Sarkodie and Adams, 2020). Therefore, policies are need of the hour for the reduction of income inequality in India. This study is highly significant from a policy perspective.

Rigorous policies are required urgently to ameliorate income distribution in India. Taxation is one of the conventional and direct policies for income redistribution. In this context, our questions: do conventional prescription of taxation affect income inequality in India? Whether taxation improves or worsens income distribution in India? Which tax parameter improves income distribution? The present study address these questions in this analysis. Taxation, being a policy tool, has various

economic objectives, originates, and develops over time. Initially, taxation was designed as an effective weapon to mobilize revenue (Musgrave, 1959). Further, Solow (1956) and Swan (1956) consider taxation as an exogenous variable in their seminal works and showed that changes in tax rates could shift the intercept of the Steady-State growth path. Concerning a significant widening income inequality worldwide, tax policies are designed to improve income distribution.

Taxation can affect income distribution either positively or negatively. However, income distribution may be improved through progressive taxes like the individual and corporate income tax. It ensures a supplementary inclusive process of economic development (Kaldor, 1963). Conversely, regressive taxes (like sales tax, VAT, customs duties, and excise duties) are expected to deteriorate income distribution because of a higher burden on poor individuals (IMF, 2014). However, the effectiveness of taxes varies from country to country. The most debated issue is the tax policy effectiveness on income disparity in developing economies (Bird and Zolt, 2013).

The contribution of taxation affecting income inequality in developing countries is restrained by the hefty informal sector as well as the dearth of appropriate administrative systems (Mahon, 2009). Similarly, Martorano (2016) shows that the taxation in Latin America has limited effect on income inequality because of low average tax revenue (% of GDP), high proportion of indirect taxes in total tax revenue (TTR), lack of ability to tax top income and insignificant contribution of property taxes to TTR. Being a developing country India has been facing vast income inequality from the beginning of liberalization policies in the 1980s. The top 1% and top 10% income earners share 22% and 56% in national income in the country respectively (Chancel and Piketty, 2018). With this context, the study aims to evaluate how India's tax system has affected income inequality between 1980 and 2019.

In the context of India, considering the degree of progressiveness in PIT and examining the redistributive effects of income tax schedules by Atkinson's measure of inequality for 1985-86, Nayak and Paul (1989) showed that a fall in lower and upper marginal tax rate is likely to broaden the base. It also improves the income redistribution than the most progressive tax schedule. Using personal income tax data from 1961-62 to 1983-84, Agarwal (1990) found that an increase in the tax progressivity increases redistributive impact of the tax. To the best of our knowledge, no single study has examined the impact of India's tax system on income inequality in India. Possible effects of tax policies in reducing income inequality in India have not been explored by the previous

studies. With the rising trend of income inequality in India in the mind, the present study is motivated to empirically examine the role of tax structure on income inequality in India.

Considering tax structure, Atkinson and Stiglitz (1976) maintain that equitable income distribution could achieve through income tax alone and consumption taxes not required for income distribution. Garcia-Penalosa and Turnovsky (2011) find an upsurge in income tax and consumption taxes are associated with less output but with high after-tax income equality. Conversely, observing a tax mix model between consumption and income taxes, Cremer et al., (2001) maintain that commodity taxes are beneficial for redistribution.

From the above theoretical background, the present chapter examines the effect of the tax variables on income distribution in India. The objectives of the study are established using yearly data from 1980 to 2019 and a variety of time series followed by econometric techniques. Firstly, ADF and PP unit root tests were employed to confirm the stationarity feature of the data. Secondly, application of the Johansen cointegration test reinforced the long-run association among variables. Thirdly, FMOLS and DOLS used to investigate the objectives of the study, these popular models has been popularly resolves seriel correlation, endogeneity and small sample bias within a regression framework. Finally, to test the consistency of the results, the study applied the Canonical Cointegration Regression (CCR).

4.2. Literature Review

This section reviews both empirical and theoretical literature in various subsections.

4.2.1. Tax progressivity and income inequality

A tax structure is progressive if the average tax rate rises with an increase in income before tax (Jakobsson, 1976). The study of income tax progression and income distribution dates back to Musgrave and Thin (1948). They provided various measures of progressivity through which income distribution can take place. However, they failed to distinguish between the influence of change in progressivity and average tax rates on income distribution. Therefore, Kakwani (1997) considered this issue and showed that reduction in income distribution depends on tax progressivity and average tax rate.

Recent studies have also explored at how tax progressivity affects income inequality. For instance, Burman (2013) looked at how much tax progressivity the US federal tax system should have in order to minimize income inequality. He found that numerous aspects that cause inequality and the cost of taxation are the determinants for an appropriate level of tax progressivity. On the one hand, there is little foundation for progressive taxation if the differences in income are caused by the variation in the effort, thrift or occupation. On the other hand, if variations in luck or rent-seeking cause the differences in income, there should be a highly progressive income tax system.

Similarly, Duncan and Peter (2016) found that progressive personal income significantly reduces observed inequality and actual inequality. However, the effect is more marginal in the case of observed inequality than actual inequality. In addition, they found that the tax progressivity effect is stronger in more developed democratic institutions than weaker legal institutions; even though the effect can be positive in weak institutions. They added that it would be more successful if income changes were represented at the top rather than the bottom of the income scale in order to reflect changes in progressivity. However, Lambert (1993) argues that progressive taxation could not reduce income inequality alone; rather, income taxes that contain non-income attributes can reduce overall income inequality. Therefore, this study prescribes certain conditions which should be fulfilled to reduce overall inequality. These conditions are: (1) every member of one class is more affluent than any member of the other, (2) the members of this more affluent class are all taxed at higher average rates than others, and (3) the tax does not induce any reversal in the income parade.

4.2.2. Tax structure and income inequality

The study of tax structure on income inequality traces back to Musgrave (1959), who discussed how welfare and distribution change when one tax is substituted for another. However, Atkinson and Stiglitz (1976) provided the first formal model involving tax structure and found that income tax can reduce income inequality. There is no need for consumption taxes. Conversely, Cremer et al., (2001) inspected the tax mix model between income tax and commodity taxes. They found that commodity taxes are positively related to income redistribution.

The impact of tax structure on income inequality was examined in some recent empirical research. In their study, Losifidi and Mylonidis (2016) examined the effects of tax rates on income inequality

in OECD nations. They discovered the minimal redistributive impact of single tax rates. And only the labor tax significantly worsens inequality. According to the study, relative tax rates have a somewhat greater redistributive impact than a single tax rate. Specifically, the larger the tax burden on labour than on capital and the higher the burden on consumption than on capital, the greater the income inequality. The intensification of the labour to consumption taxes ratio leads to aggravation of income equality.

Using the PVAR model, Cimineli et al., (2019) found that the impact of general indirect taxes is greater than that of personal income tax in reducing income inequality through the channel of labour force participation. Considering 18 Latin American economies, Martorano (2018) studied the taxation-income inequality association during 1990-2015. He investigated the possible effects of different tax instruments and other control variables on income inequality. The study found that recent tax changes in the early 2000s worsened income inequality. Specifically, the increasing share of direct taxes in total tax revenue improved the tax system's progressivity and reduced income inequality. Nevertheless, the effectiveness of the tax policy in reducing income inequality was not satisfactory for various reasons, such as the low tax to GDP ratio, the inability of the governments to raise effective top tax rates and the less share of property taxes to TTR in Latin America.

4.2.3. Tax-expenditure policies and income inequality

Taxation on its own cannot sufficiently reduce income inequality. The powerful force of income inequality can be offset with the combined effort of progressive taxation and redistributive expenditures. By increasing the tax rate on top income earners, progressive taxation reduces income inequality, and by providing more transfer payments to the poor, redistributive expenditure increases the disposable income of the poor and reduces income inequality. Aaron (2015) suggested that an increase in the tax rate on wealthy Americans as well as prudent expansion in public spending would reduce income inequality in the US. Using the Brazilian Household Microsimulation Model (BRHAMS), Immervoll et al., (2006) found that tax-benefit systems successfully reduce income inequality in Brazil. Ivaskaite-Tamosiune et al., (2018) found that tax reforms adopted in Latvia in 2017 had limited effect on income inequality. However, the study predicted that if pursued further, the reform of the minimum income scheme can reduce inequality.

Heisz and Murphy (2016) examined the impact of taxes and transfers on income inequality in Canada from 1976 to 2011 and found that the tax and transfer system significantly reduced the increase in market income inequality. Using observational microdata across 22 OECD countries for the 1922-2013 period, Guillaud et al., (2017) found that a combination of taxation and transfers reduced income inequality. Hanni et al., (2015) examined the effect of personal income tax and transfer payments on income disparity in 17 Latin American countries. They found that the Gini coefficient was reduced by 61% due to public cash transfers, and the remaining 39% was due to personal income and social security measures. The impact of taxes and public expenditures on income inequality was also examined by Martinez-Vazquez et al., (2012) for a panel of 150 economies. They maintained that the distribution of income is significantly influenced by both taxation and public expenditures. Income taxes considerably reduce income inequality, and its impact increases the greater the degree of progressivity.

4.2.4. Tax and income inequality in India

A number of studies examined the potency of the Indian tax system in the context of redistribution of income. To check the degree of progressivity, Nayak and Paul (1989) investigated India's personal income tax structure for 1985-86. They also examined the redistributive impact of mathematically designed income tax schedules using Atkinson's measure of inequality. They found that India's personal income tax (PIT) structure is progressive. Nevertheless, the PIT covers less than 1% of the population, which is the main difficulty of redistribution. They suggested that a reduction in lower marginal tax rate and upper marginal tax rate was likely to broaden the base. Thus, the actual tax redistribution schedules may be larger than the most progressive tax schedule. If the government wants to pursue a revenue-neutral policy, it cannot afford meagre tax rates at the lower income scale.

Agarwal (1990) examined the effect of personal income tax on income distribution by empirically isolating income inequality from the impact of tax progressivity and tax level. He used the Gini index and Atkinson's measure of inequality to measure income redistribution. The OLS method was used to study the redistributive effect of tax instruments and income inequality. It showed that income inequality significantly affects the redistributive impact of the tax.

This confirmed that tax progressivity in the form of personal income tax has more potential than other taxes to reduce income inequality across countries and time. The extant literature also suggested that a combination of taxes and transfers could reduce income inequality more effectively. However, Swagel and Boruchowicz (2017) assessed the tax policies and other measures aimed at income redistribution in the US and found that tax policies cannot effectively reduce income inequality. Redistributive transfers are likely to have a modest effect on income disparity. Nonetheless, they believed that measures aimed at improving individual incentives for work could substantially increase both before-tax and after-tax incomes at the bottom of the income distribution scale.

Although a significant amount of prior literature is associated with taxation and income inequality, it nevertheless remains unclear how India's tax structure affects its income distribution. Reviewing the literature, the present study confirmed that no single study investigates the tax structure effect on income inequality in India. The empirical ambiguity involving the relationship between taxes and income distribution increases the difficulty to adopting and implementing appropriate policies. Hence, the study tries to fill this important gap in the literature from policies perspective.

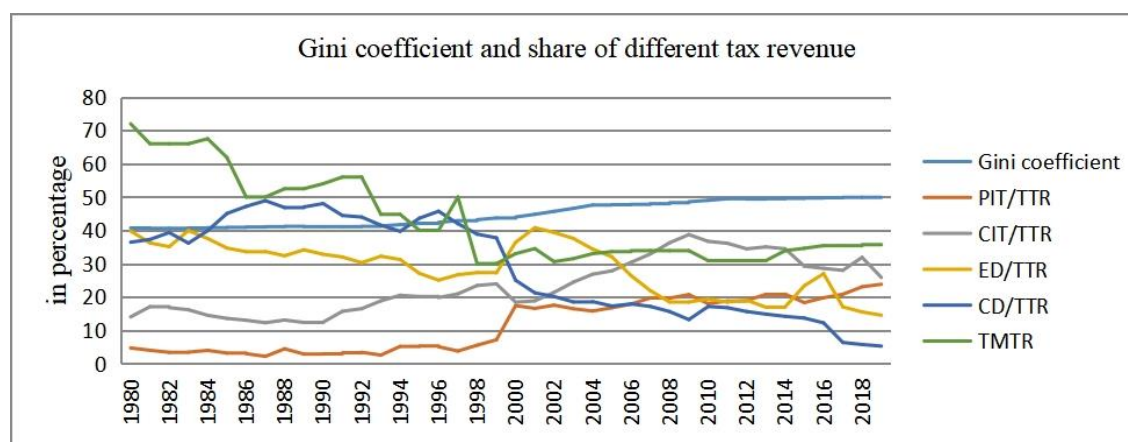
4.3. Trends of Income Inequality and Tax Policy in India

In India, income inequality between rich and poor has been considerably widening year after year and has reached a historically high level. India is the second-most unequal nation in the world in terms of income inequality. (Mahendra Dev, 2018). The income shares of top 1% and 10% are 21.7% and 57%, respectively, of national income in 2021 (World Inequality Report, 2022). The top 22% have accumulated the biggest percentage of national income ever since the Indian Income Tax was first implemented in 1922. Less than 21% of total income was amassed by the top 1% of earners in the late 1930s, 6% in the early 1980s, and again, 21.7% in 2021. The poorest 50% of earners saw 28% of the overall rise in income from 1951 to 1980, and their income increased more quickly than the average while the income of the top 0.1% decreased (Chancel and Piketty, 2017). This decrease in income inequality can be attributed to Nehru and Indira Gandhi's socialist policies. This includes highly progressive taxation in which the top marginal tax rate touched record high levels (up to 97.5%) in the early 1970s.

However, income inequality widened when Rajiv Gandhi initiated a plethora of liberalization policies during the latter phase of the 1980s (Banerjee and Piketty, 2005). The progressivity of personal income tax reduced significantly. As a result, the top 0.1% group captured 12% of total growth and the bottom 50% captured only 11% of growth, while the top 1% accrued 29% of total growth while the middle 40% only 23% of growth over the period of 1980-2015 (Chancel and Piketty, 2017).

4.3.1. Trends of Gini coefficient and tax revenue

Fig. 4.1. Trend of Gini coefficient and tax revenue



Source: Author's plotting, considering data from SWIID database and Indian Public Finance Statistics.

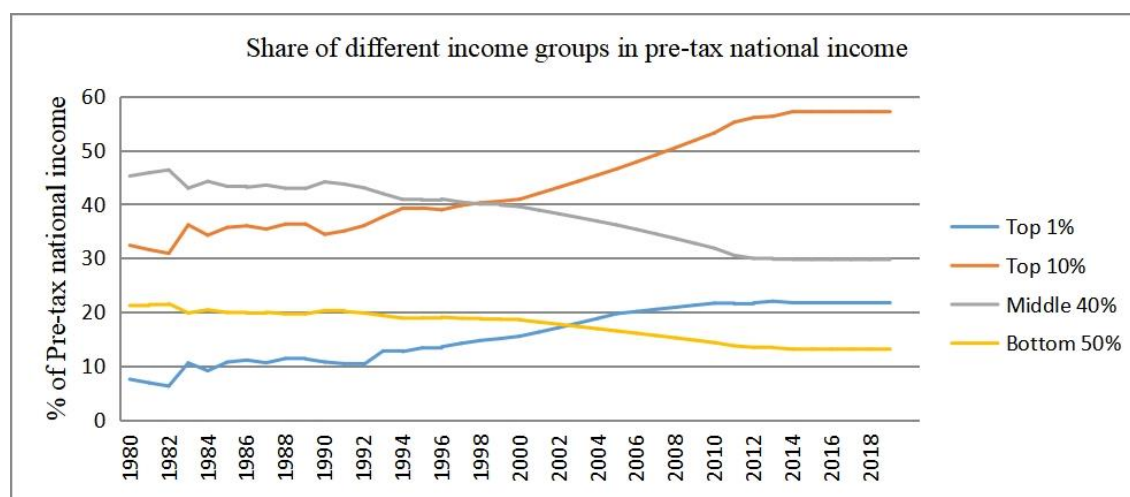
Note: "Gini disp indicates the Gini coefficient of household disposable income. PIT/TTR indicates the personal income tax as a % of total tax revenue, and CIT/TTR refers to the corporate income tax as a % of total tax revenue. ED/TTR is the exercise duty as % of total tax revenue, CD/TTR refers to custom duty as % of total tax revenue, and TMTR refers to top marginal tax rate including cess and surcharges".

Figure 4.1. demonstrates that between 1980 and the middle of the 2000s, the contribution of indirect tax revenue predominated over the share of direct tax revenue to the total tax revenue. It implies that government collected more tax revenue from consumption taxes than labour and capital taxes. In taxation theory, more burden on consumption taxes creates less distortion and

beneficial for economic growth but detrimental for income distribution because of regressive nature of consumption taxes (Zipfel and Heinrichs, 2012). There always exists a trade-off between efficiency and equity in taxation. Therefore, income inequality was high during that time period. Figure 4.1 also depicts that despite of higher top marginal tax rate; the ratio of personal income tax revenue to total tax revenue was low during the period of 1980-2000. This suggests that the progressivity of personal income tax is sapped by several basic infirmities such as narrow tax base, exemptions and deductions; exclusion of unrealized capital gains, income splitting etc. Thus, the potency of personal income tax in reducing income inequality deteriorated. Moreover, a drastic fall in TMTR from 72% in 1980 to 30.6% in 2002 worsened income inequality in India. However, tax structure is partially responsible for widening income inequality. A plethora of major economic reforms implemented between mid-1980s to 1991 fuelled economic growth in the post-reform period (1993-94 to 2004-05). And that economic growth was characterized by rise in self-employment and stagnant wage employment, which enhanced income inequality among the workers (Chandrasekhar and Ghosh, 2007).

4.3.2. Share of different income groups in pre-tax national income

Fig. 4.2. Share of different income groups in Pre-tax National income



Source: Author's plotting, taking data from World Inequality Database (2018).

Fig. 4.2. highlights the share of different income groups in pre-tax national income. It depicts that the share of the top 1% of income earners and the top 10% of income earners in national income

steadily increased over the period 1980-2019. In contrast, the share of middle 40% income earners and bottom 50% income earners in fiscal income continuously declined over the same period. The income of top 1% income earners increased three times from 7.54% in 1980 to 21.73% in 2019. Similarly, the share of top 10% income earners in national income increases from 32.36% in 1980 to 57.13% in 2019. However, the share of national income accruing to the middle 40% earners which was 45.20% in 1980 shrinks substantially to 29.74% in 2019. Further, the share of bottom 50% income group falls from 21.21% in 1980 to 13.13% in 2019. This clearly reveals the extent and severity of income inequality in India.

4.4. Data, time series characteristics, and methodology

4.4.1. Data Description

The present study collected data from various sources for empirical analysis of interest. The variables and its definitions are enumerated in the table 4.1.

Table 4.1. Variable, its definition, and source

Variable	Definition	Source
<i><u>Dependent variable</u></i>		
Gini_disp_se	Estimate of Gini index of inequality in equivalized (square root scale) household disposable (post-tax, post-transfer) income, using Luxembourg Income Study data as the standard.	SWIID version 9.0
<i><u>Main independent variable</u></i>		
Top Marginal Tax Rate including cess and Surcharge (TMTR_C&S)	Marginal tax rate applies to top income tax bracket including cess and surcharge	Union Budget documents

Personal Income Tax (PIT)	The ratio of PIT to total tax revenue (TTR)	IPFS
Corporate Income Tax (CIT)	The ratio of CIT to TTR	IPFS
Excise Duty (ED)	The ratio of ED to TTR	IPFS
<i><u>Additional independent variable (i.e., Control variable)</u></i>		
GDP per capita (GDP_PC)	GDP per capita (constant 2010 US\$)	RBI
GDP per capita Square (GDP_PCS)	GDP per capita (constant 2010 US\$) square	GDP_PC converted to GDP_PCS
Mean Years of Schooling (MYS)	The average number of years of education received by people ages 25 and older (UNDP).	UNDP, Barro and Lee database

Source: Author's compilation. Note: SWIID indicates standardized world income inequality database, IPFS indicates Indian Public Finance Statistics, MOF is the Ministry of Finance, UNDP stands for United Nation Development Programme, and RBI indicates Reserve Bank of India.

For the dependent variable, the present study consider the standardised Gini coefficient of household disposable income (post-tax, post-transfer) and denoted as Gini_disp_se. For main independent variables, the study uses five tax variables (denoted as tax structure) viz; top marginal tax rate including cess & surcharge (TMTR_C&S), personal income tax (PIT) as a % of total tax

revenue (TTR) (PIT/TTR), corporate income tax (CIT) as a % of TTR (CIT/TTR), excise duty (ED) as a % of TTR (ED/TTR), and customs duty (CD) as a % of TTR (CD/TTR). To circumvent model misspecification, we use additional independent variables such as GDP per capita (GDP_PC), GDP_PC Square (GDP_PCS), and mean years of schooling (MYS). The study considers GDP per capita and its square due to Kuznets hypothesis. Table 1 demonstrates the detail regarding variables, their definition and sources.

Gini coefficient shows the mean income difference between all pairs over twice the mean income in the population. If Gini coefficient (GC) is 0, then all income is distributed equally among the population. If GC is 1, then all income is concentrated in one person. Similarly, If GC takes a value from 1 to 100 (which is considered in SWIID data), it reflects the same interpretation as GC between 0 and 1. The GC has been widely used and is most popular among researchers. The income GC data were extracted from the SWIID Version 9.0, created by Solt (2016). The SWIID data is more reliable and maximizes comparability for the larger possible sample of economies and years (Santiago et al., 2019; Cevik and Correa-Caro, 2015; Jaumotte et al., 2008) than any other databases such as WID, WIID, and World Bank. Hence, SWIID motivates its use.

The study uses four tax ratios: PIT/TTR , CIT/TTR , ED/TTR , and CD/TTR to establish the tax structure of India. The data on these four tax ratios are extracted from Indian Public Finance Statistics (IPFS) published by MOF, GOI. The top marginal income tax rate (TMTR) is conventionally used as a parameter of personal income tax progressivity. Progressivity of personal income tax increases with a rise in the TMTR. The TMTR was drawn from union budget documents of the government of India between 1980 and 2019. GDP per capita, as well as GDP per capita square, computed from the data on GDP at constant price and population extracted from RBI. Education has been an important variable to influence income inequality. So, the study takes mean years of schooling (MYS) as a proxy for education. MYS data is taken from both UNDP and Barro and Lee databases due to data unavailability in any one source. MYS data between 1980 and 1990 is drawn from Barro and Lee database. The missing data in MYS between 1980 and 1990 is filled by the annual average growth rate of MYS between 1980 and 1990. Further, MYS data between 1990 and 2019 is extracted from the UNDP database.

4.4.1.1. Summary statistic and correlation matrix

GDP per capita (GDP PC) has the greatest mean, median, maximum, minimum, and standard deviation values of all the variables, as shown in Table 2. In contrast, the mean, median, and maximum/minimum standard deviation values for Gini_disp_se are the lowest. All the variables are normally distributed as demonstrated by Jarque-Bera statistic and its corresponding P-values. All P-values are more than 0.05. The number of observations in each series is 40.

Table 4.2. Summary of statistic

	Gini_disp_se	TMTR_	PIT/TTR	CIT/TTR	ED/TTR	CD/TTR	GDP_PC	MYS
	C&S							
Mean	1.402	42.901	11.501	23.276	28.566	28.899	47779.54	4.149
Median	1.400	35.550	11.442	21.149	30.755	30.577	38575.29	4.300
Maximum	1.800	72.000	23.797	38.725	40.790	48.909	108620.0	6.500
Minimum	0.800	30.000	2.152	12.254	14.503	5.232	19776.87	1.870
Std. Dev.	0.174	12.881	7.852	8.243	7.895	14.496	26483.26	1.468
Skewness	0.200	0.829	0.080	0.316	-0.273	-0.068	0.900	0.021
Kurtosis	2.474	2.315	1.205	1.797	1.815	1.414	2.591	1.793
Jarque-Bera	0.729	5.367	5.411	3.077	2.836	4.223	5.686	2.430
P-Value	0.694	0.068	0.066	0.214	0.242	0.121	0.0582	0.296
Observations	40	40	40	40	40	40	40	40

Source: Author's estimation

The correlation matrix (represented in Table 3) reports that TMTR, tax ratios viz; PIT/TTR, CIT/TTR, ED/TTR, and MYS are negatively associated with Gini coefficient. CD/TTR and GDP per capita increase income inequality. The correlation coefficient indicates that there isn't a high correlation between the Gini coefficient with any other relevant variables. However, there is a high correlation among the explanatory factors. The high correlation between explanatory variables reflects the potential multicollinearity problem in the models. To avoid the possible multicollinearity problems, first, we use sophisticated models for estimation that correct this issue. Second, we use a single tax variable in a model and estimate five different models. Our phenomenon of estimation involving sophisticated econometrics tools solves the potential multicollinearity problem in models.

Table 4.3. Correlation matrix

Correlation (t-Statistic) [Probability]	TMTR_C							
	Gini_disp_se	&S	PIT_TTR	CIT_TTR	ED_TTR	CD_TTR	GDP_PC	MYS
Gini_disp_se	1.000							

TMTR_C&S	-0.370 (2.459) [0.018]	1.000 ----- -----						
PIT/TTR	-0.088 (-0.545) [0.588]	-0.763 (-7.280) [0.000]	1.000 ----- -----					
CIT/TTR	-0.195 (-1.226) [0.227]	-0.748 (-6.950) [0.000]	0.848 (9.870) [0.000]	1.000 ----- -----				
ED/TTR	-0.110 (-0.687) [0.496]	0.569 (4.269) [0.000]	-0.626 (-4.950) [0.000]	-0.791 (-7.985) [0.000]	1.000 ----- -----			
CD/TTR	0.009 (0.005) [0.995]	0.678 (5.699) [0.000]	-0.975 (-27.482) [0.000]	-0.837 (-9.465) [0.000]	0.591 (4.520) [0.000]	1.000 ----- -----		
GDP_PC	0.255 (1.628) [0.111]	-0.651 (-5.289) [0.000]	0.873 (11.087) [0.000]	0.781 (7.712) [0.000]	-0.808 (-8.467) [0.000]	-0.880 (-11.453) [0.000]	1.000 ----- -----	
MYS	-0.0019 (-0.012) [0.990]	-0.842 (-9.645) [0.000]	0.921 (14.655) [0.000]	0.847 (9.832) [0.000]	-0.757 (-7.163) [0.000]	-0.896 (-12.477) [0.000]	0.940 (17.025) [0.000]	1.000 ----- -----

Source: Author's estimation. Note: for abbreviation see the text.

4.4.2. Time series characteristics

Time series data set to confront two significant issues, such as stationarity of series and cointegration among variables. Addressing both issues help to select appropriate econometrics techniques and thereby, provide unbiased, consistent, and accurate results. The study is proceeding with these two features of the time series as follows.

4.4.2.1. Unit root in data series.

Table 4.4. Unit root tests results

Variable	ADF TEST		PP TEST	
	C	C+T	C	C+T
lnGini_disp_se	-2.273	-0.696	-2.266	-1.975
ΔlnGini_disp_se	-3.300**	-6.747***	-8.154***	-8.269***
lnTMTR_C&S	-2.063	-2.195	-2.082	-2.195
ΔlnTMTR_C&S	-7.601***	-6.382***	-8.155***	-11.923***
lnPIT/TTR	-0.699	-2.730	-0.579	-2.715
ΔlnPIT/TTR	-7.664***	-7.579***	-7.790***	-7.691***
lnCIT/TTR	-1.240	-1.202	-1.280	-1.420
ΔlnCIT/TTR	-4.932***	-4.874***	-4.932***	-4.874***
lnED/TTR	-0.788	-2.832	-0.891	-2.303
ΔlnED/TTR	-4.933***	-4.929***	-4.809***	-4.808***
lnCD/TTR	1.491	-1.330	1.380	-1.330
ΔlnCD/TTR	-5.020***	-5.617***	-5.015***	-5.618***
lnGDP pc	2.914	-1.306	3.299	-1.277
ΔlnGDP pc	-4.619***	-5.679***	-4.593***	-5.666***
lnMYS	-2.488	-0.871	-4.990	-0.287
ΔlnMYS	-5.162***	-5.889***	-5.147***	-9.723***

Source: Author's estimation. Notes: ** and *** denote the level of significance at 5%, and 1%, respectively. Here, C stands for constant, and C+T indicates the constant plus trend.

First, if there is a non-stationarity issue (unit root problem) in time series, without appropriate techniques, it may produce biased and inefficient estimators, leading to a misleading interpretation of empirical results. So, the study uses ADF and PP tests to find the unit root in the series. Conducting unit root tests assist researchers to employ the appropriate empirical tools that provide unbiased results. Some literature documents for a small sample, ADF performs much better (Arltova and Fedorova 2016). The study conducted both the techniques incorporating constant (C) as well as a constant plus trend (C+T). Results are shown in Table 4. The unit root results from both tests (ADF & PP) document that all series are stationary at the first difference. It implies series are I (1) order of integration. It indicates series are nonstationary at the level and stationary at the first difference. The first difference stationary data set also reflects the possible cointegration among variables (Engle and Granger, 1987). Hence, next, we deal with the cointegration test.

4.4.2.2. Johansen cointegration test

The present study employs the Johansen cointegration test to confirm the cointegrating nature among variables. Johansen Cointegration test specification rests on a summary result with different assumptions involving selecting optimum lags and deterministic terms (i.e., intercept and trend) in the models. The number of models hinges on tax variables. Here it considers five different tax variables based on their importance for income redistribution. So, the study runs five models incorporating five tax variables. All five models have been considered for the cointegration test. Schwarz information criterion (SIC) is employed to navigate optimum lags in the cointegration test. Summary results involving SIC of Johansen cointegration test suggest using two lags with linear intercept and trend for the 1st, 4th, and 5th models, one lag with quadratic intercept and trend for the 2nd model, and one lag with linear intercept and trend for the 3rd model.

Johansen (1988) cointegration test is a popular and widely used test. The cointegration results reflect that the variables under each model are cointegrated. It demonstrates the presence of a long-run association among variables of interest. Table 5 represents the Johansen cointegration test. The Trace and maximum eigenvalue statistics rejected the null hypothesis: no cointegration and accepted the alternative hypothesis: the presence of cointegration among variables of interest in all models. Precisely, trace and maximum eigenvalue demonstrate at least one cointegrating equation in each model. It implies the presence of a long-run association between tax variables as well income distribution in India.

Table 4.5. Johansen-cointegration test results.

1st model				
Trace statistics				
Hypothesized				
No. of CE(s).	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.766	122.512	88.803	0.000
At most 1 *	0.610	68.758	63.876	0.018
At most 2	0.382	33.833	42.915	0.296
At most 3	0.242	16.017	25.872	0.491
At most 4	0.143	5.727	12.517	0.495
Maximum Eigenvalue statistics				
No. of CE(s).	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.7660	53.753	38.331	0.000
At most 1 *	0.6108	34.924	32.118	0.022
At most 2	0.3821	17.816	25.823	0.391
At most 3	0.2427	10.290	19.387	0.587
At most 4	0.143	5.727	12.517	0.495
2nd model				
Trace statistics				
No. of CE(s).	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.692	100.258	79.341	0.000
At most 1 *	0.592	55.392	55.245	0.048
At most 2	0.289	21.324	35.010	0.620
At most 3	0.192	8.317	18.397	0.650
At most 4	0.004	0.188	3.841	0.664
Maximum Eigenvalue statistics				
No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.692	44.866	37.163	0.005
At most 1 *	0.592	34.067	30.815	0.019
At most 2	0.289	13.006	24.252	0.677

At most 3	0.1925	8.129	17.147	0.588
At most 4	0.0049	0.188	3.841	0.664
3rd model				
Trace statistics				
No. of CE(s).	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.696	120.327	88.803	0.000
At most 1 *	0.621	75.021	63.876	0.004
At most 2	0.376	38.104	42.915	0.139
At most 3	0.316	20.128	25.872	0.219
At most 4	0.138	5.649	12.517	0.506
Maximum Eigenvalue statistics				
No. of CE(s).	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.696	45.305	38.331	0.006
At most 1 *	0.621	36.917	32.118	0.012
At most 2	0.376	17.975	25.823	0.379
At most 3	0.316	14.478	19.387	0.223
At most 4	0.138	5.649	12.517	0.506
4th model				
Trace statistics				
No. of CE(s).	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.796	137.310	88.803	0.000
At most 1 *	0.597	78.468	63.876	0.001
At most 2 *	0.510	44.754	42.915	0.032
At most 3	0.289	18.324	25.872	0.322
At most 4	0.142	5.680	12.517	0.502
Maximum Eigenvalue statistics				
No. of CE(s).	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.796	58.842	38.331	0.000
At most 1 *	0.597	33.713	32.118	0.031
At most 2 *	0.510	26.430	25.823	0.041

At most 3	0.289	12.644	19.387	0.357
At most 4	0.142	5.680	12.517	0.502
5th model				
Trace statistics				
No. of CE(s).	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.7839	128.391	88.803	0.000
At most 1 *	0.5423	71.700	63.876	0.009
At most 2	0.3810	42.780	42.915	0.051
At most 3	0.3498	25.030	25.872	0.063
At most 4	0.2180	9.098	12.517	0.174
Maximum Eigenvalue statistics				
No. of CE(s).	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.783	56.690	38.331	0.000
At most 1	0.542	28.920	32.118	0.117
At most 2	0.381	17.749	25.823	0.396
At most 3	0.349	15.932	19.387	0.148
At most 4	0.2180	9.098	12.517	0.174

*Denotes rejection of the hypothesis at the 0.05 level. **MacKinnon-Haug-Michelis (1999) p-values.

Finally, the cointegrating technique appears to be an effective tool to assess the impact of the tax structure on income inequality in India, according to the unit root and Johansen cointegration tests. Thus, the present analysis considers cointegrating models such as FMOLS, DOLS, and CCR, which are time-series techniques to examine our interest.

4.4.3. Methodology

4.4.3.1. Brief description of techniques

The unit root, as well as cointegration test results, recommend using cointegrating models. Thus, here the study uses sophisticated econometric methods like FMOLS DOLS, and CCR. These methods will avoid omitted variables, endogeneity, and reverse causality problems. These techniques practically yield better results than the traditional OLS estimators, as they correct serial

correlation and endogeneity problems. The FMOLS, DOLS, and CCR models determine the long-run relationship by employing a single cointegrating vector. All three models are fully efficient techniques. Note that the CCR model is used to confirm the consistency and robustness of our results.

Phillips and Hansen (1990) employed semi-parametric method to circumvent the issue produced by “the long-run correlation between the cointegrating equation and stochastic regressors innovations”. This method is known as Fully Modified Ordinary Least Square (FMOLS). It provides an asymptotically unbiased and efficient estimator letting for the standard Wald test involving asymptotic Chi-square statistical inference (Hansen, 1992). Like FMOLS, Park (1992) proposed a similar model known as Canonical Cointegration regression (CCR). CCR employs stationary conversion of the data to obtain the least square estimate to eliminate the long-run reliance between cointegrating equation as well as stochastic regressor shocks. The CCR conversion asymptotically removes endogeneity produced via the long-run cointegrating equation’s correlation and regressor shocks (Lee and XUAN, 2019). If estimators are systematically corrected, the asymptotic property is not disturbed by endogeneity or serial correlation (Montalvo, 1995).

Finally, Stock and Watson (1993) introduce an easy method to establish asymptotically efficient estimators which can remove the reverse causality in a cointegrating framework. This approach is known as the Dynamic Ordinary Least Square (DOLS) model. They consider leads and lags in the framework that eliminates asymptotically any possible bias resulting from endogeneity problems or serial correlation (Montalvo, 1995). Therefore, FMOLS, CCR and DOLS provide efficient estimators. Because these methods correct small sample bias, simultaneity bias, endogeneity problem and serial correlation in the models. However, for example, Montalvo (1995) maintain that the DOLS model performs steadily better than the FMOLS and CCR methods. Overall, the study is motivated and used these three models to provide a consistent and robust outcome. FMOLS, CCR, and DOLS models are suitable and appropriate for this small sample analysis.

4.4.3.2. Model specification

To investigate the relationship between tax structure as well as income inequality in India, the study uses the following equations. The specified equations are presented in Eq. 1, 2, 3, 4, and 5.

Where Gini_disp_se stands for the measure of income inequality. TMTR_C&S stands for top marginal tax rate including cess and surcharge; PIT is the personal income tax (%TTR). CIT is the corporate income tax (%TTR), and ED is the excise duty (%TTR). CD represents custom duty (%TTR). GDP_PC is the GDP per capita reflecting a lower economic development. GDP_PCS is the GDP per capita square representing a higher economic development. MYS is reflecting the mean years of schooling, and ln demonstrates the natural log. All data series has been converted into log forms.

$$\begin{aligned} \ln Gini_disp_se_t &= \beta_0 + \beta_1 \ln TMTR_C\&S_t + \beta_2 \ln GDP_PC_t + \beta_3 \ln GDP_PCS_t + \beta_4 \ln MYS_t \\ &+ \varepsilon_t \dots (1) \end{aligned}$$

$$\begin{aligned} \ln Gini_disp_se_t &= \beta_0 + \beta_1 \ln PIT_t + \beta_2 \ln GDP_PC_t + \beta_3 \ln GDP_PCS_t + \beta_4 \ln MYS_t \\ &+ \varepsilon_t \dots (2) \end{aligned}$$

$$\begin{aligned} \ln Gini_disp_se_t &= \beta_0 + \beta_1 \ln CIT_t + \beta_2 \ln GDP_PC_t + \beta_3 \ln GDP_PCS_t + \beta_4 \ln MYS_t \\ &+ \varepsilon_t \dots (3) \end{aligned}$$

$$\begin{aligned} \ln Gini_disp_se_t &= \beta_0 + \beta_1 \ln ED_t + \beta_2 \ln GDP_PC_t + \beta_3 \ln GDP_PCS_t + \beta_4 \ln MYS_t \\ &+ \varepsilon_t \dots (4) \end{aligned}$$

$$\begin{aligned} \ln Gini_disp_se_t &= \beta_0 + \beta_1 \ln CD_t + \beta_2 \ln GDP_PC_t + \beta_3 \ln GDP_PCS_t + \beta_4 \ln MYS_t + \\ &\varepsilon_t \dots (5) \end{aligned}$$

Where, β_0 is the intercept, β_1 to β_4 are the slope coefficients, and ε_t is the stochastic error term. FMOLS, DOLS, and CCR models have been estimated under Eq. 1, 2, 3, 4, and 5. To reduce the influence of outliers in our time series data, the study transforms all the variables into natural logarithmic form, represented by ln. The same number of control variables is used in each equation.

4.4.3.3. Coefficient sign involving theoretical link

The main variable of Interest: The TMTR is a measure of progressivity of personal income tax. More the TMTR, more burden will fall on the high-income class and less burden will fall on

the low-income class. Thus, less will be income inequality. Hence, we predict that $\beta_1 < 0$ in Eq. 1. As this study inspects the tax structure effect on income inequality, our variables of interest are individual tax instruments. Personal income tax (PIT) is generally a progressive tax because the tax burden is more on the high-income class relative to the low-income class. So, the more the revenue raised from personal income tax, the less will be income inequality. Hence, it assumed that $\beta_1 < 0$ in Eq. 2. Corporate income tax (CIT) is believed that corporate income tax is a progressive tax if the tax falls on capital income earners. However, in open economies, easy accessibility of capital from domestic and international markets shifts corporate tax burden on labour income. Since labour income recipients naturally have lower average incomes than capital income recipients, CIT leads to higher income inequality (Harberger, 1995). Thus, we predict that $\beta_1 > 0$ in Eq. 3. Excise duty (ED) is expected to have positively related to income inequality. Hence, this study assumed that $\beta_1 > 0$ in Eq. 4. Finally, customs duty (CD) is positively related to income inequality due to its regressive nature. So, we assumed that $\beta_1 > 0$ in Eq. 5.

Control variables of interest: here the study have used some control variables in models, and hence, determining their sign is also important. However, the sign of the control variable may vary with regions. We are only assigning signs based on the general view that extant literature provides. Kuznets (1955) speculated that inequality intensifies first and then declines after a certain point owing to rise in per capita income. To capture the Kuznets hypothesis, the study has used GDP per capita (GDP_PC) representing a low economic development and GDP per capita square (GDP_PCS) indicating a higher economic development. If $\beta_2 > 0$ and $\beta_3 < 0$, then, an inverted-U-shaped or Kuznets hypothesis holds.

Human capital also affects income distribution. The enriched and skilled human capital may reduce income inequality (Coady and Dizioli, 2018). Thus, mean years of schooling (MYS) was used to capture the effect of human capital. It assumed that $\beta_4 < 0$, indicating that MYS is reducing income inequality. However, education is poorly distributed in India and thus sign of β_4 maybe reverse. Control variables remain the same in all equations, and thus, the sign of the coefficients concerning control variables take the same interpretation.

4.4.3.4. Estimation process

All variables are I (1), which is another point that suggests using cointegrating models such as FMOLS, CCR, and DOLS. The study estimate the equations mentioned above using EViews 12. For optimum lag selection, the study used Akaike Information criteria (AIC) for estimations. Notably, the long-run covariance is vital involving time series conclusion viz; heteroskedasticity and autocorrelation consistent (HAC) standard error. Long run covariance is popularly used for non-stationary time series analysis under FMOLS, CCR, and DOLS framework. To estimate long-run covariance under FMOLS and CCR framework, we consider Prewhitening with optimum lag selected by AIC and Bartlett Kernel, Newey-West fixed bandwidth of 4.0000. The study estimated the DOLS model with fixed lead and lag specification instead of letting AIC select lead and lag. This limitation is due to few observations in each data series, which prevent us from considering AIC for selecting lead and lag. The study used one lead and one lag for the estimation of the DOLS model. The study also incorporated HAC standard error and covariance estimated by Prewhitening with optimum lag one and Bartlet Kernel, Newey-West fixed bandwidth of 4.0000 under the framework of DOLS.

4.5. Results and discussion

Table 4.6. displays the outcomes of employing the FMOLS method in five different equations associated with TMTR and four tax ratios as explanatory variables. As per the hypothesis, all the main explanatory variables of interest show expected signs with income inequality measured by the Gini coefficient. It indicates that TMTR_C&S, PIT/TTR and CIT/TTR show a negative association with Gini coefficient. ED/TTR and CD/TTR show a positive association with Gini coefficient. For example, the 2nd column in Table 4.6 displays that the coefficient of TMTR_C&S is -0.10. This suggests that a 1 percent increase in TMTR reduces income inequality by 0.10 percent. This may happen because an increase in TMTR declines after-tax income of the higher-income groups (Sammartino, 2017). The results are consistent with Aaron (2015) and Gale et al., (2015).

Table 4.6. Result from FMOLS model

Dependent variable: lnGini_disp_se					
Model: Fully Modified Least Squares (FMOLS)					
Variable	Coefficient (t-statistic) [P-value]	Coefficient (t-statistic) [P-value]	Coefficient (t-statistic) [P-value]	Coefficient (t-statistic) [P-value]	Coefficient (t-statistic) [P-value]
	(1 st)	(2 nd)	(3 rd)	(4 th)	(5 th)
lnTax structure	-0.100*** (-3.477) [0.001]	-0.004 (-0.496) [0.622]	-0.014 (-0.500) [0.620]	0.002 (0.124) [0.901]	0.036*** (3.474) [0.001]
	<i>TMTR_C&S</i>	<i>PIT/TTR</i>	<i>CIT/TTR</i>	<i>ED/TTR</i>	<i>CD/TTR</i>
lnGDP_PC	-14.781*** (-21.900) [0.000]	-7.132*** (-10.790) [0.000]	-7.639*** (-6.676) [0.000]	-6.865*** (-9.369) [0.000]	-7.988*** (-15.863) [0.000]
lnGDP_PCS	0.674*** (22.480) [0.000]	0.326*** (11.241) [0.000]	0.347*** (6.926) [0.000]	0.311*** (9.687) [0.000]	0.367*** (16.435) [0.000]
lnMYS	0.431*** (8.192) [0.000]	0.208*** (3.872) [0.000]	0.295*** (3.311) [0.0022]	0.269*** (4.049) [0.000]	0.226*** (5.227) [0.000]
C	80.711*** (21.33) [0.000]	38.752*** (10.558) [0.000]	41.653*** (6.593) [0.000]	37.469*** (9.177) [0.000]	43.049*** (15.550) [0.000]
R-square	0.385	0.665	0.667	0.697	0.694

Source: Author's estimation. Note: *** represents significance at a 1% level.

The customs duty's impact on income inequality is presented in the first row of the 6th column in Table 4.6. The coefficient of CD is 0.036, suggesting that a 1 percent increase in the CD aggravates income inequality by 0.036 percent. CD is regressive by nature. Therefore, a higher CD increases income inequality since those who are poorer spend a greater proportion of their income on consumption than those who are wealthier and are responsible for a greater share of the responsibilities associated with CD (IMF, 2014).

Though PIT, CIT, and ED have shown expected signs as per the hypothesis, they do not affect income inequality significantly. It concludes that though PIT and CIT can reduce income inequality, they do not affect income inequality significantly during the study period. Similarly, though excise duty increases income inequality due to its regressive nature, it does not affect income inequality during the study period.

Apart from our variable of interest, we consider some control variables in the model and hence, determining their relationship with income inequality is also essential. The result shows evidence that Kuznets hypothesis does not prevail for the Indian economy. It explains that the nexus of Indian economic development and inequality follow the sequence that India is experiencing decreasing inequality at a lower economic development and increasing inequality at a higher economic development significantly, as shown by GDP_PC and GDP_PCS in Table 4.6. All models produce similar results. The sign of GDP per capita is negative whereas the sign of GDP per capita square is positive. Both the signs are statistically significant. It implies that income inequality declines at a low level of development and increases income inequality at a higher economic development.

Furthermore, mean years of schooling (MYS) implies that more education leads to more income inequality in India. It shows that 80% of the population receives a significantly poor quality of education in India and only top-income classes provide better quality education to their son and daughters. Considering the number of factors such as rural-urban, gender, various states, different cast groups, and finally poor and rich, it is crystal clear that some receive poor quality education compared to their counterparts. Therefore, education attainment inequality is one of the causes behind rising income inequality in India. Nevertheless, the FMOLS model suggests that explanatory variables poorly explain dependent variables as indicated by R^2 . Therefore, we are proceeding with more efficient models such as DOLS. According to Montalvo (1995), FMOLS is less efficient than DOLS.

Table 4.7. Results from DOLS Model

Dependent variable: lnGini_disp_se					
Model: Dynamic Least Squares (DOLS)					
Variable	Coefficient (t-statistic) [P-value]	Coefficient (t-statistic) [P-value]	Coefficient (t-statistic) [P-value]	Coefficient (t-statistic) [P-value]	Coefficient (t-statistic) [P-value]
	(1 st)	(2 nd)	(3 rd)	(4 th)	(5 th)
lnTax structure	-0.207*** (-2.795) [0.011]	-0.011 (-0.756) [0.458]	-0.014 (-0.410) [0.685]	-0.016 (-0.580) 0.568	0.083*** (2.913) [0.008]
	<i>TMTR_C&S</i>	<i>PIT/TTR</i>	<i>CIT/TTR</i>	<i>ED/TTR</i>	<i>CD/TTR</i>
lnGDP_PC	-9.515*** (-5.769) [0.000]	-6.797*** (-2.775) [0.011]	-6.454*** (-4.679) [0.000]	-7.647*** (-11.735) [0.000]	-7.368** (2.543) [0.0193]
lnGDP_PCS	0.428*** (5.818) [0.000]	0.308*** (2.775) [0.011]	0.291*** (4.710) [0.000]	0.346*** (12.157) [0.000]	0.335*** (2.573) [0.018]
lnMYS	0.275** (2.350) [0.029]	0.276 (1.821) [0.083]	0.317*** (3.557) [0.002]	0.321*** (5.207) [0.000]	0.283 (1.479) 0.1547
C	53.058*** (5.764) [0.000]	37.051*** (2.790) [0.011]	35.318*** (4.702) (0.000)	41.701*** (11.190) 0.000	39.735** (2.513) [0.020]
R-square	0.830	0.7997	0.837	0.888	0.842647

Source: Author's estimation.

Note: ***, and ** represents significance at 1%, and 5% level, respectively.

Table 4.7. demonstrates the results obtained from the estimated DOLS model. Except for excise duty, the DOLS model provides similar results as obtained from the FMOLS model. There exist two fundamental differences in results from two different models. First, the DOLS model provides a higher magnitude relationship between independent variables used as well as income inequality (dependent variable). Second, values in each equation are high in the DOLS model compared to the FMOLS model, reflecting that the model is well specified. It shows so because the DOLS

model considers one lag and one lead. Besides the coefficient of excise duty, the sign of each coefficient remains the same in both models (see Tables 4.6 and 4.7). It demonstrates that our results are not biased with the small explanatory power of independent variables under the FMOLS model. We used one lead and one lag to estimate the DOLS model, which specifies well for our data set. There is no significant difference in results from two different models, such as FMOLS and DOLS.

4.6. Robustness check

The main result and discussion section debated the empirical results obtained from two models viz; FMOLS and DOLS. Except for the coefficient sign of excise duty, both models provide consistent results in terms of their coefficient sign. However, the DOLS model demonstrates a higher magnitude relationship between income inequality and tax variables than the FMOLS model. This discrepancy between the two models compels us to check further the consistency and robustness of these results using the CCR model. The results obtained from CCR is presented in Table 4.8.

CCR estimation results are very similar to those of DOLS. However, the CCR model shows a lower magnitude relationship between income inequality and all explanatory variables. All other stories remain unchanged. Moreover, all three models demonstrate that TMTR reduces income inequality significantly, whereas CD increases income inequality significantly. The impact of PIT, CIT and ED on income distribution remains insignificant in India. As a result, it also confirmed the non-existence of the Kuznets hypothesis in the country. Additionally, human capital increases income inequality in India. Finally, the results of this study are robust with alternative modelling.

Table 4.8. Results from CCR Model

Dependent variable: lnGini_disp_se					
Model: Canonical Cointegrating Regression (CCR)					
Variable	Coefficient (t-statistic) [P-value]	Coefficient (t-statistic) [P-value]	Coefficient (t-statistic) [P-value]	Coefficient (t-statistic) [P-value]	Coefficient (t-statistic) [P-value]
	(1 st)	(2 nd)	(3 rd)	(4 th)	(5 th)
lnTax structure	-0.090***	-0.004	-0.001	-0.005	0.024***

	(-2.609)	(-0.541)	(-0.044)	(-0.264)	(2.762)
	[0.013]	[0.591]	[0.964]	[0.793]	[0.009]
	<i>TMTR_C&S</i>	<i>PIT/TTR</i>	<i>CIT/TTR</i>	<i>ED/TTR</i>	<i>CD/TTR</i>
lnGDP_PC	-7.931***	-5.640***	-6.919***	-6.820***	-6.599***
	(-11.948)	(-8.499)	(-4.575)	(-10.290)	(-17.045)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
lnGDP_PCS	0.359***	0.258***	0.313***	0.309***	0.302***
	(12.341)	(8.999)	(4.752)	(10.954)	(18.056)
	[0.000]	[0.000]	0.000	[0.000]	[0.000]
lnMYS	0.257***	0.162***	0.271**	0.266***	0.216478
	(4.526)	(2.745)	(2.321)	(3.873)	5.655596
	[0.000]	[0.009]	[0.026]	[0.000]	0.0000
C	43.693***	30.593***	37.788***	37.282***	35.659***
	(11.627)	(8.249)	(4.515)	(9.814)	(16.471)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
R-square	0.663	0.628	0.675	0.697	0.711

Source: Author's estimation.

Note: ***, and ** represents significance at 1%, and 5% level, respectively.

4.7. Conclusion

Income inequality was high in India even before the Covid-19 pandemic. The pernicious effects of Covid-19 fueled the flames. Additionally, it lowers the amount of income that is held by socially excluded groups. The high level of income inequality may cause to deterioration of human development and economic growth in the country. Hence, rigorous macroeconomic policies are urgently required to ameliorate income distribution. Taxation is one of the conventional and direct policies to bring about income redistribution. In this context, the present study sought to answer the following questions. Do conventional prescriptions of taxation affect income inequality in India? Does taxation improve or worsen income distribution in India? Which tax parameter improves income distribution? This analysis has addressed these questions. To the best of our knowledge, no previous study focusing on India has looked at how taxation affects income inequality. On the above background, the present study carefully examined the impact of five tax variables on income inequality in India.

Using a time-series dataset from 1980 to 2019 and employing robust time-series techniques viz; FMOLS, DOLS, and CCR, we have estimated the relationship between individual tax instruments and Gini coefficient. The empirical exercises have shown that the TMTR reduces the gap between rich and poor, whereas CD does the opposite. The results confirm that PIT, CIT and ED do not significantly affect income inequality. Thus, the conventional prescription of using taxation to redistribute of income in India only works if TMTR increases and no other taxes significantly reduce income inequality. Moreover, Kuznets's hypothesis was shown not to hold in the case of India. Finally, results also corroborate that mean years of schooling increases income inequality in India. These results support the present study's hypothesis that India's top marginal tax rate (TMTR) can lower income inequality. The Indian government should think about a progressive tax structure which can increase the redistributive effect of progressive taxes. The government should reduce consumption taxes like excise duty and customs duty on the poor while increasing taxes on the wealthy through a progressive personal income tax.

Moreover, the findings demonstrate that better income distribution occurs when current economic development—as indicated by GDP per capita—increases. As a result, the Indian government should implement thorough macroeconomic policies to promote equitable growth and enhance income distribution. A rise in income inequality can be ascribed to the unequal distribution of high-quality education, as demonstrated by human capital as measured by mean years of education. Therefore, ensuring that everyone has access to high-quality education is crucial for India's sustained economic growth as well as the elimination of socioeconomic disparity. The present study has only taken into account the long run association between tax instruments and income inequality. The short-run nexus between tax variables and income inequality has been neglected in the current study. The short-run association between tax instruments and income inequality can be explored by future research.

Chapter-5

Tax Structure and Economic Stability

5.1. Introduction

The people of the 21st century is conscious of the economic situation than ever before. Any minor changes in economic indicators like employment, productivity, or price level, which would have gone unnoticed in earlier generations, are closely followed by laymen as well as experts in the current generation. This sensitivity to the recession and boom phenomena is a sign of greater public understanding of the necessity for and desirability of economic advancement (Burns, 1969). The business cycle has a greater impact on the economy and on the lives and fortunes of individuals as well. For example, great depression of 1929 and financial crisis of 2007-2008 had huge bad effects on the world economy. The great depression had a massive impact on the world economy and on the Indian economy as well. The financial system failed, unemployment rose to the highest level, international prices crashed and international trade collapsed due to the great depression. The great depression had a great impact on Indian trade as the Indian economy mainly depended upon trade. However, the 2008 financial crisis had no such massive impact on the Indian economy because of its less share of exports and the tight monetary policies of RBI. Conversely, the Indian economy experienced its boom phase from 2003 to 2008 until it was punctured by the financial crisis of 2008. The annual economic growth rate was close to 9%. That was a cyclical boom fueled by private corporate investment, financed by rising domestic savings, and topped by unprecedented foreign capital inflows (Nagaraj, 2013). Thus, the Indian economy has gone through a cyclical path over a period of time.

In the light of the above facts, the policymakers have been trying and resorting to many policies which could mitigate the cyclical fluctuations in the business cycle. Conventionally, it is believed that monetary policy is an effective tool to control cyclical fluctuations and bring economic stability. Both nominal and real variables are impacted by monetary policy in the short and medium term. However, in the long run, only nominal variables are affected by monetary policy (Svensson, 2003; Duskobilov, 2005; Feridun et al., 2005; Vanhoose, 2008; Stein, 2011).

John Maynard Keynes was the first economist to recognise and establish the significance of fiscal policies in economic activity in the wake of the great depression in 1929. He, in his magnum opus titled “The General Theory of Employment, Interest, and Money” prescribed those economic fluctuations could be effectively solved through the traditional aggregate demand mechanism. Friedman (1948) and Herfindahl (1957) also propose some fiscal policies to mitigate cyclical

fluctuations. According to King and Rebelo (1990), fiscal policies significantly influence GDP growth rates of the isolated economies. Schultz (1981) found that fiscal policies affect private incentives for the production of physical and human capital. Lee and Sung (2007) find that fiscal policies are effective in reducing economic fluctuations. The government uses counter-cyclical fiscal policies to control output fluctuations. The government of any country has two fiscal instruments such as taxation and public spending through which it controls output volatility. This study exclusively focuses on the role of taxes as automatic stabilizers or as part of any discretionary fiscal policies in mitigating output volatility.

Taxation has many economic effects. In other words, Taxes can never be economically neutral. It has its effects on resource allocation, growth, distribution, and stabilization. Taxation could be a reinforcing factor during a cumulative growth. It may make the forces of deflation and contraction stronger. A well-designed tax structure, however, may mitigate rather than exacerbate cyclical variations. It might help to prevent the expansion to limits which will avoid the creation of significant imbalance, and, after the contraction has started, it may help to shorten and delay the recession (Gilbert, 1942).

Some economists contend that because the tax system is static by nature, it cannot be sufficiently elastic or flexible to be used to control the business cycle or promote economic stability. Further, they suggest that stability can be achieved through public spending. Much research has not been done regarding such a tax system which could be adapted to changing economic conditions and used as a counterweight to unbalancing forces. Therefore, the nature and operation of forces that cause inflation and depression must be taken into account when designing the character and composition of a tax system meant to foster economic stability. No tax system could be able to regulate cyclical variations unless and until the dynamics that work at the turning points of a business cycle are grasped by the tax planners.

Therefore, the present study attempts to assess the role of taxation in bringing stability in the Indian economy.

5.2. Literature Review

The relationship between taxes and economic stability have been extensively studied in the literature. Taxes, either being the automatic stabilizers or being the components of discretionary

fiscal policy, influence the business cycles. This section has been categorized into two parts. The first part explains the role of taxes as being automatic stabilizers in mitigating output fluctuations, and the second part evaluates the importance of taxes as being components of the discretionary fiscal policies.

5.2.1. Tax as an automatic stabilizer

Tax serves as an automatic stabilizer. A progressive income tax system imposes a large tax burden during an expansion and a lighter tax burden during a recession because an expansion brings taxpayers into higher tax slabs and lowers their average tax rates, while a recession has the opposite effect. This built-in flexibility in the progressive tax system leads to economic stability through two channels. Firstly, when the disposable income is more stable, then consumption and investment are also stable. Secondly, when the taxes distort the labour market, lower tax rates during recession and higher tax rates during expansion encourage employees to switch out hours worked from one period to the next, resulting in reduced volatility in the number of hours worked (Alessandrini, 2021).

5.2.1.1. Theoretical literature

A substantial amount of theoretical literature investigates the function of a progressive tax as an automatic stabilizer and presents various findings about this function.

Guo and Lansing (1998) found that an income tax which is progressive in nature, schedule may function as an automated stabilizer. A flat or regressive tax system, however, makes an economy more vulnerable to volatility. Progressive taxation, according to Agell and Dillen (1994), will make businesses more prone to price changes, meaning less volatility in production and welfare. Kletzer (2006) found that progressive labour income tax reduces output volatility in the presence of flexible wages and prices.

However, numerous studies show that progressive income taxes act as an automatic destabilizer that magnifies growth variations and thereby destabilizes the economy, in stark contrast to the Keynesian stabilization mechanism. Gou and Harrison (2001) demonstrated that an economy with a flat or progressive tax policy is more susceptible to indeterminacy and sunspot fluctuations while a regressive tax policy can stabilize the economy. Employing the New-Keynesian model, Kleven and Kreiner (2003) found that taxes destabilize the economy by increasing both wage and price

rigidity. ISMAEL (2011) investigated the stability effects of a two-period overlapping generations model with a progressive labor income tax and finds that progressive labour income tax acts as an automatic destabilizer because the higher the progressivity of labor income tax, the more likely the emergence of indeterminacy and endogenous fluctuations in the economy. Chen and Guo (2014) studied the stabilizing impact of progressive income tax and discovered that increasing the progressivity of the income tax may cause the economy to become unstable. In a one-sector AK model of endogenous growth, Chen and Guo (2016) studied the link between progressive income tax and output stability. They found that under progressive income tax, the economy shows equilibrium indeterminacy and belief-driven aggregate volatility. Chen, Hu, and Mino (2016) estimated the stabilization effects of non-linear income tax in small open economies with an endogenous growth model and found that under an exogenously given world interest rate, the progressive tax generates equilibrium indeterminacy whereas regressive tax establishes equilibrium determinacy. Zhiyong An (2018) investigated how taxes affect aggregate price stickiness of the New Keynesian model and finds that taxes make prices more sticky overall. The findings imply that taxes play the usual function of automatic stabilizers on the demand side while acting as automatic destabilizers on the supply side. The net effect of taxes on economic fluctuations is therefore hypothetically unclear. A linearly progressive income tax, according to Chen (2019), causes instability in the Barro endogenous growth model (1990). Chen (2021) showed that progressive income taxation destabilizes the economy. Progressive income tax does not act as an automatic stabilizer.

5.2.1.2. Empirical literature

In line with the Keynesian approach, Pearse's (1962) estimated the British income tax system and found that the stabilizing effect of the tax system is more, when the tax yield flexibility and the marginal propensity to consume are higher. Auerbach and Feenberg (2000) analysed the automatic stabilizer role of US tax system using the TAXSIM model between 1962 and 1995. They discovered that automatic stabilizer function of US tax system hasn't changed much, despite many modifications. According to their estimate, individual federal taxes may be able to partially offset up to 8% of GDP's early shocks. The paper contends that the progressive income tax's conventional impact on aggregate demand and its impact on labour supply both have the potential to stabilize production. Swanepol and Schoeman (2002) found that South Africa's tax system serves as an

automatic stabilizer role because of the significant nexus between tax revenue and the output gap. Weller and Singleton's (2004) argues that progressive taxation through income distribution might reduce production volatility because a more equitable income distribution may help to stabilize domestic demand. Mattesini and Rossi (2012) empirically examine the importance of progressive labour income tax in the standard new Keynesian model in 24 OECD countries and find that progressive labour income tax acts as an automatic stabilizer by reducing both output and inflation volatility. Igbinovia and Igbinovia (2020) using the VECM technique, examined the effect of value-added tax (VAT) on inflation, output and interest rate in Nigeria and found that VAT could stabilize the economy because it does not drive fluctuations in macroeconomic variables. Weller and Rao (2010) looked at the nexus between progressive taxation and economic stability using data from 1981 to 2002. They found that the potential to implement counter cyclical fiscal measures, which in turn significantly contribute to economic stability, is provided by progressive taxation. They also found no evidence on the bad impact of progressive taxation on the output stability. However, they found that both the quantity of government spending and capital mobility limit the ability to increase progressiveness. Jorge Martinez-Vazquez and Violeta Vulovic (2014) examined the impact of Latin America's direct to indirect tax ratio on the macroeconomic stability. They regressed the direct to indirect tax ratio, which indicates the effect of automatic stabilizers, on the standard deviation of GDP growth rate. They estimated the data using a random-effects model. Their estimation results suggested that the ratio is significantly reducing economic volatility for emerging countries. This ratio does not serve as an automatic stabilizer in the case of Latin America.

According to past studies, a progressive income tax may not always act as a stabilizer. However, empirical evidence explains that progressive income tax reduces economic fluctuations by acting as an automatic stabilizer.

5.2.2. Taxes as components of discretionary fiscal policy

Taxes being the ingredients of any budgetary policies could smooth the output variability and bring the economic stability. For instance, a large slash in the corporate tax rate is aimed to induce both domestic and foreign investors to undertake new investments, and in turn, to move the economy out of the recession trap. On the other hand, the government deliberately reduces its spending on the welfare projects that presumably would have increased aggregate demand in order to avoid

demand-pull inflation. There are innumerable studies that attempted to examine the operational efficacy of budgetary policies in order to mitigate output fluctuations. Numerous studies have found an indirect relationship between output volatility and the government size. Using a Real Business Cycle Model Gali (1994) established that, between 1960 and 1990, the size of the government is correlated with decreased production volatility in 22 OECD nations. According to Kniesner and Ziliak (2002), changes made in the federal tax system lowered US consumption stability by around 50%. Romer and Romer (2007) studied the effects of legislatively mandated tax changes on macroeconomic variables and revealed that production is significantly affected by tax increases. The baseline model predicted that an exogenous tax rate increase of one percentage point causes a real GDP decrease of about three percentage points. Mertens and Ravn (2012) examined the impact of the tax obligation changes in the United States and found that tax cuts that have been proposed but not yet implemented lead to contractions in production, investment, and hours worked while raising real wages. Contrarily, tax reductions that are really put into place—regardless of when they happen—have expansionary impacts on production, consumption, investment, hours worked, and real wages. The US economic cycle is significantly influenced by tax shocks, and anticipatory effects have been significant over various business cycle events. Using a five-variable vector autoregression (VAR) methodology, Hayo and Uhl (2014) explored the short-term macroeconomic consequences of legislative tax increases in Germany. According to the VAR results, a 1 percent rise in the tax-to-GDP ratio leads to a 2.4 percent decrease in production. These findings show that the output is significantly and statistically affected by the tax change. In a monetary union made up of two fundamentally different countries with supply function distortions, Menguy (2014) observed that in the presence of demand shocks, higher tax rates are output stabilizing but in the presence of supply shocks, higher tax rates are output destabilizing. As a result, tax rate reductions typically result in increased economic stabilization.

5.2.3. Tax Evasion and Economic Stability

Literature reports that tax evasion negatively affects economic stability because more tax evasion results in less tax revenue suggesting that the government may confront budget deficiency which prevents the government to implement the projects aimed at growth and welfare. In addition, increased illegal activities can trigger a recession and raise investment uncertainty and risk by lowering the legal GDP. Therefore, tax evasion makes the economy unstable.

Mehrara and Tavakoliyan (2015) explored the association between economic stability, tax evasion, and tax rates for OECD countries between 1990 and 2013 and found that taxes and output volatility have a dominant negative relationship. Estimation findings also indicated a positive and significant nexus between tax ratio and output stability. They also found negative and significant relationship between tax evasion and tax revenue. Using data from 1990 to 2013, Mehrara and Farhani (2016) evaluated the effects of tax revenue and tax evasion on economic stability in 29 OECD nations. They employed panel fixed effect models and pooled OLS to evaluate how tax evasion affects the economic stability. They discovered a U-shaped relationship between tax evasion and the income tax rate. Initially, a rise in tax rate leads to lessen tax evasion. However, subsequent rise in tax rate tends to increase tax evasion after a certain point. The study also finds that high tax revenue improves economic stability whereas high tax evasion worsens economic stability.

According to the aforementioned literature review, there aren't many studies that specifically address India's tax system and its impact on economic stability. Due to the far wider breadth of this study and its unique use of time series data, it will undoubtedly fill a gap in the literature and have significant policy consequences.

5.3. Data, Time Series Characteristics, and Methodology

5.3.1. Data description

The present study uses secondary data from 1980 to 2019 collected from various sources for establishing the present objective. The data sources are the Handbook of Statistics for Indian Economy, RBI, World development indicators, World Bank, Indian Public Finance Statistics, ministry of finance and Union Budget Documents. Table 5.1 enumerates the data and its source.

Table 5.1. Variables and its description

Variable	Definition	Source
<i><u>Dependent variable</u></i>		
Economic stability	The growth rate of GDP relative to the standard deviation of growth.	RBI, India

Main independent variable

Top Marginal Tax Rate including cess and Surcharge (TMTR_C&S)	Marginal tax rate applies to top income tax bracket including cess and surcharge	Union Budget documents, MOF, India
Corporate Income Tax Rate (CIT)	The highest effective rate for corporate income for domestic companies	WDI, World Bank
Excise Duty (ED)	The ratio of ED to TTR	IPFS, MOF, India
Customs Duty (CD)	The ratio of CD to TTR	IPFS, MOF, India

Additional independent variables (i.e., Control variables)

Tax/GDP ratio	The ratio of tax to GDP	IPFS, MOF
Tax evasion	The ratio of currency in circulation to time deposits	RBI, India
Countercyclicalities	$\text{Growth} + \frac{\sigma_g}{\sigma_f} \text{fiscal balance}$	RBI, India
Investment	Gross fixed capital formation	RBI, India

Source: Author's compilation

Note: IPFS indicates Indian Public Finance Statistics, MOF is the Ministry of Finance, WDI indicates World Development Indicators, and RBI indicates Reserve Bank of India.

5.3.2. Time series characteristics

5.3.2.1. Unit root tests

Before employing the OLS technique for estimation, it is critical to examine that the time series data are stationary. The ADF test and PP test are used in this study to determine whether the data are stationary or not.

Dickey and Fuller (1979, 1981) developed a method to test the stationarity of time series data. According to them, unit root test is equivalent to checking for stationarity. Dickey-Fuller is expanded in Augmented Dickey-Fuller (ADF). To remove autocorrelation, lagged dependent variable are included in the ADF test. PP test (1988) is widely used financial time series analysis. The way serial correlation and heteroscedasticity are addressed in the error terms is the main distinction between PP and ADF tests.

5.3.3. Methodology

5.3.3.1. ARDL bounds testing approach

By supplying the value of the estimated F-statistics, the ARDL bounds test verifies the cointegration between the dependent variable and a group of explanatory factors. The resulting F-test is then evaluated against the critical value reported by Pesaran et al., (1999, 2001) and Narayan (2005). According to Pesaran et al., (1999, 2001) and Narayan, the explanatory variables' upper bound critical values are designated as $I(1)$ while their lower bound critical values are labelled as $I(0)$. (2005). The null hypothesis is accepted and no long-term link between the variables is established if the estimated F-statistic value is smaller than the value of the lower critical bound. In contrast, if the estimated F-statistic value exceeds the value of upper critical bound, then null hypothesis is rejected and the cointegration between the variables is established. If the value of calculated F-statistics lies within the values of lower and upper bounds, the result is considered inconclusive.

5.3.3.2. Error Correction Mechanism

Error Correction Model (ECM) is then used to look into the short-run dynamics among variables after ARDL bounds test confirmation of cointegration among variables. Sargan (1964) first proposed and used ECM for determining wage rates in the UK, while Engle and Granger (1987) later popularized the approach. Due to its dynamic short-run disequilibrium, ECM reconciles the cointegrating time series static long-run equilibrium. Following the confirmation of cointegration, the optimal lag order for the variables is chosen using the Akaike Information Criteria (AIC). After the selection of the optimal lag order, the long-run coefficients of the model are estimated and then ECM calculates error correction term that implies the speed of adjustment of short run disequilibrium towards long run equilibrium along with a set of regressors.

5.3.3.3. ARDL Model Specification

Once the long-run association between the variables is determined, The ARDL model then estimates the long-run coefficients from the equation.

Economic stability = (Top marginal tax rate, corporate tax rate, excise duty, customs duty, tax evasion, counter cyclical, investment, and tax-GDP ratio)

ARDL equation

$$\begin{aligned} \ln ES_t = & \alpha_0 + \sum_{i=1}^{k_1} \beta_{1i} \Delta \ln ES_{t-i} + \sum_{i=1}^{k_2} \beta_{2i} \Delta \ln TMTR_{t-i} + \sum_{i=1}^{k_3} \beta_{3i} \Delta \ln CTR_{t-i} + \sum_{i=1}^{k_4} \beta_{4i} \Delta \ln ED_{t-i} + \\ & \sum_{i=1}^{k_5} \beta_{5i} \Delta \ln CD_{t-i} + \sum_{i=1}^{k_6} \beta_{6i} \Delta \ln \frac{CU}{M_2}_{t-i} + \sum_{i=1}^{k_7} \beta_{7i} \Delta \ln CC_{t-i} + \sum_{i=1}^{k_8} \beta_{8i} \Delta \ln INV_{t-i} + \sum_{i=1}^{k_9} \beta_{9i} \Delta \ln TAX/ \\ & GDP_{t-i} + \delta_1 \ln ES_{t-1} + \delta_2 \ln TMTR_{t-1} + \delta_3 \ln CTR_{t-1} + \delta_4 \ln ED_{t-1} + \delta_5 \ln CD_{t-1} + \delta_6 \ln \frac{CU}{M_2}_{t-1} + \delta_7 \ln CC_{t-1} + \\ & \delta_8 \ln INV_{t-1} + \delta_9 \ln TAX/GDP_{t-1} + \theta ECT_t + \mu_{1t} \end{aligned}$$

Null hypothesis

$$H_0: \delta_i = 0, \quad \text{for } i = 1, 2, 3 \dots$$

Alternative hypothesis

$H_1: \delta_i \neq 0, \text{ for } i=1, 2, 3 \dots$

5.4. Results and Discussion

Table 5.2. Unit root tests results

Variables	ADF Test		PP Test	
	C	C+T	C	C+T
lnES	-5.489***	-6.024***	-5.511***	-6.309***
ln(TAX/GDP)	-1.796	-2.031	-1.796	-2.031
Δln(TAX/GDP)	-5.317***	-5.242***	-5.250***	-5.163***
lnTMTR	-2.063	-2.195	-2.082	-2.195
ΔlnTMTR	-7.601***	-6.382***	-8.155***	-11.923***
lnCTR	-1.477	-2.744	-1.609	-2.627
ΔlnCTR	-7.821***	-7.820***	-8.664***	-18.126***
ln(ED/TTR)	-0.932	-2.955	-1.065	-2.359
Δln(ED/TTR)	-5.357***	-5.341***	-4.728***	-4.695***
ln(CD/TTR)	1.457	-1.356	1.353	-1.356
Δln(CD/TTR)	-5.054***	-5.643***	-5.049***	-5.644***
ln(CU/M2)	-1.694	-3.650**	-1.801	-3.495*
Δln(CU/M2)	-8.244***		-9.031***	
ln(INV/GDP)	-0.619	-2.032	-0.606	-2.219
Δln(INV/GDP)	-6.675***	-6.581***	-6.657***	-6.566***
lnCC	-5.480***	-5.717***	-5.480***	-5.705***

Note: ***, ** and * represent 1%, 5% and 10% level of significance respectively. Source: Authors estimation.

Table 5.2. displays the results of ADF and PP tests. Apart from economic stability and countercyclicality, which are stationary at level, both the ADF and PP tests indicate that all of the variables are stationary at first difference. This satisfies the criteria to use the ARDL model.

Table 5.3. ARDL Bounds Test Result

Test statistic	Value	K
F-statistic	4.525917	8
Level of significance	I0 Bound	I1 Bound
10%	1.95	3.06
5%	2.22	3.39
1%	2.79	4.1

Source: Author's estimation

Table 5.3. suggests that there is cointegration between economic stability and its independent variables. Because estimated F-statistic value is higher than critical upper bounds values at 5% level of significance Pesaran et al., (2001).

Table 5.4. Estimated short run coefficients from ARDL Model

Regressors	Coefficient	Std. error	t-statistic
lnTMTR	-0.792158***	0.148431	-5.336882
lnCTR	1.511543***	0.439250	3.441188
lnEDR	-0.574098**	0.251185	-2.285561
lnCDR	0.133245**	0.053825	2.475532
ln(CU/M2)	-0.542129*	0.282440	-1.919445
lnCC	0.671377***	0.091561	7.332533
LnINV	1.296167	1.065825	1.216117
lnTAX/GDP	3.388083***	0.799542	4.237530
ECT (-1)	-1.244328***	0.113590	-10.954601

Source: Author's estimation

Table 5.4. displays the short run relationship between economic stability and its determinants. ECT (-1) is negative and significant suggesting that disequilibrium in the short-run dynamics of the cointegrating variables is getting corrected towards long-run equilibrium at a speed of 124 percent each year. This indicates an explosive and oscillatory convergence of the underlying series. The

results also suggest that while corporate tax rate, customs duty, countercyclicality, and tax-GDP ratio are significantly improving output stability in the short-run while top marginal tax rate, excise duty, and tax evasion are significantly deteriorating output stability.

Table 5.5. Estimated long-run coefficients from ARDL Model

Regressors	Coefficient	Std. error	t-statistic
lnTMTR	-0.636615***	0.153782	-4.139736
lnCTR	1.214746***	0.341635	3.555684
ln(ED/TTR)	-0.461372**	0.189086	-2.440012
ln(CD/TTR)	0.107082**	0.045550	2.350857
ln(CU/M2)	-0.435680*	0.234552	-1.857498
lnCC	0.539550***	0.113335	4.760654
lnINV	0.047163	0.482270	0.097793
Ln(TAX/GDP)	-0.591897	0.485754	-1.218513
C	0.561173	0.809306	0.693401
R square	0.674		
F-statistic	8.734***		

Note: ***, **, and * represent 1%, 5%, and 10% significance levels respectively. Source: Author's estimation

Table 5.5. shows the long run nexus between economic stability and its determinants. The results show that TMTR, a measure of progressivity of personal income tax, makes the economy more fluctuating in the long run. Because 1 percentage point rise in TMTR reduces the output stability by 0.63 percentage points. This may occur because more progressive taxes could reduce economic growth by lowering the incentives for investment and the creation of human capital. The amount of domestic savings available for domestic investment might be declined by a more progressive tax structure. This may result in greater capital costs, which would stop the production and expansion of physical capital (Weller and Rao, 2010).

Corporate tax rate, which is also a progressivity measure of corporate income tax improves the economic stability significantly as suggested by the coefficient of corporate tax rate. The economic stability improves by 1.10 percentage points for 1 percentage point rise in the corporation tax rate.

This is due to the fact that the household ownership of corporate stock is highly concentrated among high-income individuals, who are extremely unlikely to experience liquidity constraints and whose marginal propensity to consume is comparably lower than low-income individuals. As a result, the corporate tax rate would have a negligible effect on total consumption expenditure (Auerbach and Hassett, 1991). Because India is a home of poor and middle-income class people whose marginal propensity to consume is very high. The consumption baskets of those people mostly contain the necessary goods and services. Changes in corporate income tax rate do not significantly affect the prices of those necessary goods and services. Thus, changes in corporate tax rate may not generate fluctuations in aggregate consumption expenditure and hence, in output fluctuations. In addition to that, structural economic reforms in 1991 created flexible and forward-looking capital markets in India. As a result, the accessibility to both domestic and foreign capital markets for the corporate sector became easy. Therefore, temporary corporate tax rate changes may have little effect on the long-term incentive to invest.

Excise duty is significantly negative with coefficient of -0.46, suggesting that 1 percentage point rise in excise duty worsens output volatility by 0.46 percentage points. This is due to the fact that in early 1980s, excise duty was very complex and distortionary in which rates were varying from 2 percent to 100 percent. High tax rates might reduce the incentives to invest by the producers. Hence, economic growth and economic stability might be reduced consequently.

Customs duty has positive and significant effect on economic stability in the long-run. In the long-run, 1 percent increase in customs duty results in 0.10 percent improvement in economic stability. This is due to the fact that India's tariff structure was very complicated between 1980s and 1990s. The range of customs duties was spanning from 0 to 400 percent. Thereafter from early 1990s, customs duties were declined sharply due to a series of tax reforms. A steep customs duty structure might reduce import spending and in turn might stimulate aggregate demand for domestically produced goods and also increase exports demand. Thus, domestic producers will be encouraged to undertake more investment which will increase economic growth and improve output stability.

Tax evasion reduces the economic stability significantly in the long run. It states that 1 percent increase in tax evasion worsens output stability by 0.43 percent. The increase in the size of underground economy declines reported taxable income, suggesting that the government may face budget deficit. Furthermore, higher illegal activities can bring out recession and increase the

uncertainty and risk of investment by reducing the legal GDP. Therefore, more the size of tax evasion, more the economy is unstable (Mehrra and Tavakoliyan, 2015; Mehrra and Farahani, 2016).

Countercyclical index has positive and significant effect in influencing economic stability in the long-run. The result suggests that 1 percent rise in countercyclical index results in 0.54 percent improvement in economic stability. Countercyclical index is constructed to test the impact of countercyclical fiscal policies on output volatility through aggregate demand mechanism. The effectiveness of countercyclical fiscal policies depends not only on its size but also in its composition, i.e., relative importance of tax versus government expenditure. Theory depicts that government expenditure has more immediate and direct impact on aggregate demand than tax. However, Jha et al., (2010) find that in 10 developing Asian economies including India, impact of deficit-financed tax cuts is more than that of deficit spending in stimulating economic activity. Weller and Rao (2010) also suggest that countercyclical fiscal policies affect positively to economic stability by boosting aggregate demand.

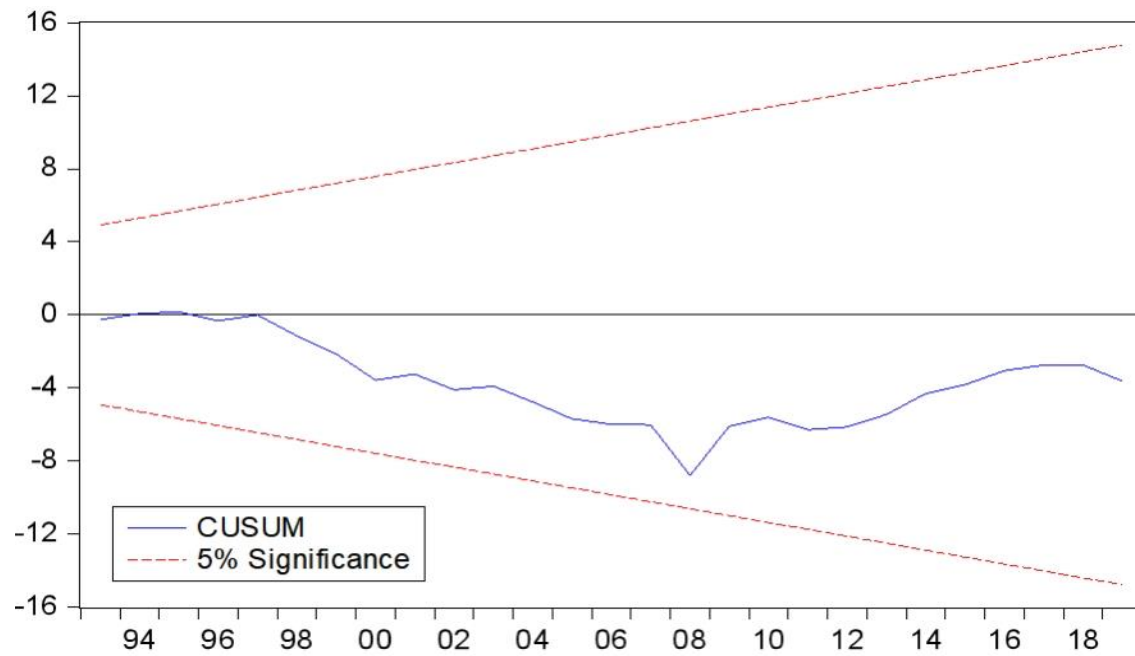
Table 5.6. Results of diagnostic tests

Test	Chi-squared value	P-value
BG Serial Correlation LM test	0.579396	0.3565
BPG Heteroscedasticity test	1.433095	0.1914

Source: Author's estimation

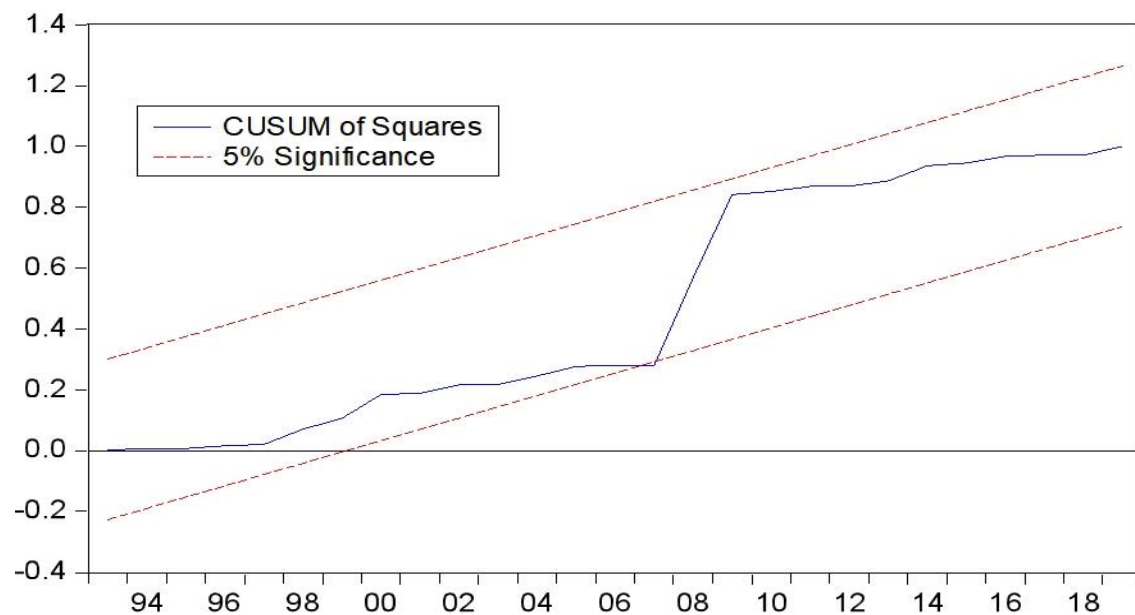
Table 5.6. shows that the estimated model is free from serial correlation and heteroscedasticity problems because the probability values of the serial correlation LM test and the heteroscedasticity test are both greater than 0.05.

Figure 5.1. Result of CUSUM test for the stability of model



Source: Author's estimation

Figure 5.2. Result of CUSUM -squared test for the stability of model



Source: Author's estimation

Figures 5.1. and 5.2. show the results of stability tests such as CUSUM and CUSUM-squared tests. The estimations are stable if the plot of the CUSUM statistics is within the 5% threshold of significance. The same holds for the squared recursive residual-based CUSUM-squared statistics. Plotting of the CUSUM and CUSUM-squared statistics suggests the stability of the estimated model.

5.5. Conclusion

The present chapter explored the nexus between tax variables and output stability in India between 1980 and 2019. The ARDL bounds test approach was used for investigating the short and long run nexus between output stability and its determinants. Before employing ARDL model, ARDL bounds testing approach was conducted to check the cointegration between economic stability and tax variables and some control variables as well. After the estimation, the study found three conclusions. First, top marginal tax rate, excise duty and tax evasion deteriorate economic stability in India during the study period in both short run and long run. Second, corporate tax rate, customs duty and countercyclicality improve economic stability in India. Third, investment and tax-GDP ratio have no significant impact on output stability in the long run. The possible interpretations are offered for this result. This finding is consistent with Weller and Rao (2010), Mehrara and Tavakoliyan, (2015) and Mehrara and Farahani (2016).

The present chapter provides some policy suggestions on the basis of the above findings. First, the Indian government should lower top marginal tax rate and excise duty which are detrimental for the economic stability. Second, the tax administration of the country must be strict in its approach so that tax compliance can be adhered and tax evasion can be minimized. Third, the government should design corporate tax and customs duty in such a manner that can improve the stabilization function. Fourth, counter cyclical fiscal policies should be implemented.

Chapter-6

Summary, Conclusion and Scope for Future Research

6.1. Summary of the Study

With the passage of time, the importance of tax has evolved in accordance with the requirements of the nation. The role of taxation has not been confined with being an important source of revenue for the government's treasury. The modern tax system is being designed with a view to perform many functions such as production, distribution, and stabilization. Hence, taxation has effects on production of goods and services, distribution of income and stabilization of the economic growth. On the above background, the present research examines the nexus between tax structure and three important macroeconomic variables such as economic growth, income inequality and economic stability in India.

The third chapter investigates the effects of tax structure on per capita GDP growth in India from 1980 to 2019. The first chapter uses ARDL bounds testing approach to study the short run and long run nexus between tax variables and economic growth. The findings suggest that personal income tax significantly reduces per capita GDP growth in India by distorting the labour market and reducing spending in education. Our results find the support of Koester and Kormendi (1989) and Widmalm (2001). Similarly, corporate income tax also significantly reduces growth rate in the long run. The explanation for that is a rise in corporate tax rate raises the cost of capital and reduces the incentives to invest and it also discourages entrepreneurial activities and innovation which retards economic growth. This result aligns with Lee and Gordon (2005), Arnold (2008), and Ferede and Dahlby (2012). Excise duty is not significantly related to per capita GDP growth rate in India during the study period. Customs duty significantly enhancing economic growth during the study period. Higher tax collections from consumption taxes such as customs duty and excise duty means lower tax burden on labour and capital which are main factors of growth. Therefore, consumption tax like custom duty is non-distortionary in nature which reduces burden on labour, capital, and technological progress and thereby growth conducive. This finding is also supported by Wang and Yip (1992), Futugami and Doi (2004), Zipfel and Heinrichs (2012). Investment positively affects economic growth because higher domestic saving leads to higher investment which ultimately results in higher per capita GDP growth in India. This finding is in line with Kaushik and Klein (2008) and Jangili (2011). In the long-run, government expenditure is significantly reducing economic growth in India. It states that a 1% rise in government final

consumption expenditure leads to 2.06% fall in per capita GDP growth. This finding is supported by Jaben and Shah (2016) and Sakthivel and Yadav (2007).

The fourth chapter examines the effects of tax variables on income inequality in India. In fact, this is the first empirical study in the Indian context which examines the effects of taxes on income inequality. We use annual time-series data set between 1980 and 2019 and employ robust time-series econometric methods viz. FMOLS, DOLS, and CCR to estimate the association between individual tax instruments and income inequality. The results from empirical estimation suggest that TMTR, a measure of progressivity for personal income tax, reduces income inequality significantly. The TMTR decreases income inequality by 0.10% for every 1% increase. This finding is consistent with Aaron (2015) and Gale et al., (2015). Also, customs duty worsens income inequality significantly in India during the study period. Income inequality is worsened by 0.036 percent for every 1 percent rise in customs duty. This result supports the findings of IMF (2014). Although other tax instruments such as PIT, CIT, and ED show negative sign with income inequality, their relationship with later is not statistically significant. GDP per capita which is a control variable in our model, is significantly reducing income inequality indicating that initial level of economic development reduces income inequality significantly. Furthermore, GDP per capita squared, a proxy for higher level of economic development aggravates income inequality. Thus, this finding suggests that Kuznets hypothesis does not hold in India during the study period. Another control variable, mean years of schooling has positive impact on income inequality, suggesting more education causes more income inequality. This may happen due to educational attainment inequality.

The fifth chapter examines the effects of tax structure on economic stability in India during the period of 1980-2019. An empirical exercise was conducted to observe whether the tax variables have any impact on economic stability or not. ARDL bounds testing approach was employed to investigate the short-run and long-run relationship between economic stability and its determinants. Before employing ARDL model, unit root tests and ARDL bounds test were conducted to check the stationarity and cointegration between economic stability and all independent variables respectively. After the estimation process, the study found that top marginal tax rate, excise duty and tax evasion worsen economic stability in India. Three possible explanations are offered for this result. This finding is supported by Weller and Rao (2010),

Mehrara and Tavakoliyan, (2015) and Mehrara and Farahani (2016). On the contrary, corporate tax rate, customs duty and counter cyclicalities improve economic stability during the study period in India. Additionally, the tax-GDP ratio and investment have no significant impact on economic stability.

6.2. Conclusion

Chapter 3 finds that PIT and CIT are significantly reducing per capita GDP growth whereas customs duty significantly stimulating economic growth. Further, private investment is significantly increasing economic growth. Chapter 4 suggests that an increase in top marginal tax rate significantly reduces income inequality in India. On the other hand, customs duty aggravates income inequality in India. Chapter 5 reveals that top marginal tax rate, excise duty and tax evasion significantly reduces economic stability in India. In contrast, corporate tax rate, customs duty and counter cyclicalities have improved economic stability in India during the study period.

6.3. Policy suggestions

The present study suggests that in order to increase per capita GDP growth by the help of tax policies, the government of India should rely more on customs duty because it will increase saving and investment. On the other hand, by taking in less money through corporate and personal income taxes, the government should lessen the burden on productive elements like human capital, physical capital, and technological advancement. India should switch from a regressive tax structure to a progressive tax structure by increasing TMTR and lowering CD in order to increase the redistributive effect of progressive taxes. To promote stabilization of the economy, the government should impose more corporate tax and customs duty in place of personal income tax and excise duty.

6.4. Scope for future research

The present research does not address the mechanisms through which different tax instruments affect per capita GDP growth, income inequality and economic stability. Although used methods like ARDL bounds testing approach, FMOLS, DOLS and CCR are there to estimate the long run relationship between variables, they do not capture the process through which the independent

variable affects the dependent variable. By using better econometric approaches, some future research may try to evaluate how the tax system affects three different economic indicators.

6.5. Limitations of the study

Although the present study attempts to examine the association between tax structure and per capita GDP growth, it is not free from limitations. Those limitations are enumerated below. First, for checking the effects of tax structure on per capita GDP growth, several other methods can be used. Second, the study uses TMTR as the progressivity measure of the personal income tax. However, for better estimation of the impact of personal income tax on income inequality, different progressivity measures can be used. Third, ARDL model has been used to explore the impact of tax structure on output stability. Better methods can be used to examine that relationship.

REFERENCES

- Aaron, H. J. (2015). Can taxing the rich reduce inequality? You bet it can! Economic studies, Brookings institution.
- Agell, J., & Dillen, M. (1994). Macroeconomic externalities. Are Pigouvian taxes the answer? *Journal of Public Economics*, 53(1), 111–126.
- Aggarwal, P. K. (1990). An empirical analysis of the redistributive impact of the personal income tax: A case study of India. Working paper no. 7. National Institute of Public Finance and Policy, New Delhi.
- Ahmad, S., Sial, M., & Ahmad, N. (2016). Taxes and Economic Growth: An Empirical Analysis of Pakistan. *European Law Review*, 5(502), 16-19.
- Alessandrini, D. (2021). Progressive Taxation and Economic Stability. *The Scandinavian Journal of Economics*, 123(2), 422-452.
- Arltova, M., & Fedorova, D. (2016). Selection of unit root test on the basis of length of the time series and value of AR (1) parameter. *Statistika-Statistics and Economy Journal*, 96(3), 47-64.
- Arnold, J. M., Brys, B., Heady, C., Johansson, A., Schweltnus, C., & Vartia, R. (2011). Tax Policy for Economic Recovery and Growth. *The Economic Journal*, 121(550), F59-F80.
- Arnold, J. (2008). Do Tax Structures Affect Aggregate Economic Growth?: Empirical Evidence from a Panel of OECD Countries. OECD, Economics Department. Paris: OECD Publishing.
- Atkinson, A. B., & Stiglitz, J. E. (1976). The design of tax structure: Direct versus indirect taxation. *Journal of Public Economics*, 6, 55-75.

- Auerbach, A. J., & Hassett, K. (1991). Corporate Savings and Shareholder Consumption in D. Bernheim and J. Shoven, eds., *National Saving and Economic Performance*, Chicago: University of Chicago Press, 75-98.
- Auerbach, A. J. (1996). Measuring the Impact of Tax Reform. *National Tax Journal*, 49(4), 665-673.
- Auerbach, A. J., & Feenberg, D. R. (2000). The Significance of Federal Taxes as Automatic Stabilizers. *Journal of Economic Perspectives*, 14(3), 37-56.
- Bagchi, A., & Nayak, P. (1994). A Survey of Public Finance and the Planning Process: The Indian Experience in A. Bagchi and N. Stern (eds.), *Tax Policy and Planning in Developing Countries*. Delhi, Oxford, and New York: Oxford University Press.
- Banerjee, A., & Piketty, T. (2005). Top Indian incomes, 1922-2000. *The World Bank Economic Review*, 19(1), 1-20.
- Barro, R. J. (1990). Government spending in a simple model of endogenous growth. *Journal of Political Economy*, 98(S5), S103–S125.
- Barro, R. J. (1995). Education and economic growth.
- Bidisha, S. H., Abdullah, S. M., Siddiqua, S., & Islam, M. M. (2020). How does dependency ratio affect economic growth in the long run? Evidence from selected Asian countries. *The Journal of Developing Areas*, 54(2),
- Bird, R. M. and E. M. Zolt (2013). Taxation and inequality in the Americas: Changing the fiscal contract? International Center for Public Policy Working paper series. Paper No. 50. Andrew Young School of Policy Studies, Georgia State University, GA.
- Blomstrom, M., Lipsey, R. E., & Zejan, M. (1996). Is fixed investment the key to economic growth? *The Quarterly Journal of Economics*, 111(1), 269-276.

- Boskin, M. J. (1988). Tax Policy and Economic Growth: Lessons From the 1980s. *The Journal of Economic Perspectives*, 2(4), 71-97.
- Brown, R. L., Durbin, J., & Evans, J. M. (1975). Techniques for Testing the Constancy of Regression Relationships over Time. *Journal of the Royal Statistical Society. Series B (Methodological)*, 37(2), 149-192.
- Burman, L. E. (2013). Taxes and inequality. *Tax Law Review*, 66, 563-592.
- Burns, A. F. (1969). Progress Towards Economic Stability. In. *The Business cycle in a Changing World* (pp. 101-128). National Bureau of Economic Research.
- Cevik, S., & Correa-Caro C. (2015). Growing (un) equal: fiscal policy and income inequality in China and BRIC+. *Journal of the Asia Pacific Economy*, 25(4), 1-20.
- Chancel, L. & Piketty, T. (2019). Indian income inequality, 1922-2015: From British Raj to Billionaire Raj? *Review of Income and Wealth*, 65(S1), S33-S62.
- Chancel, L., Piketty, T., Saez, E., Zucman, G. et al. (2022). *World Inequality Report 2022*, World Inequality Lab.
- Chen, S. H., & Guo, J. T. (2014). Progressive taxation and macroeconomic (in) stability with utility-generating government spending. *Journal of Macroeconomics*, 42, 174-183.
- Chen, S. H., & Guo, J. T. (2016). Progressive taxation, endogenous growth, and macroeconomic (in) stability. *Bulletin of Economic Research*, 68(S1), 20-27.
- Chen, S. H. (2019). On economic growth and automatic stabilizers under linearly progressive income taxation. *Journal of Macroeconomics*, 60(c), 378-395.
- Chen, S. H. (2021). Progressive taxation and Macroeconomics (in) stability Under household Heterogeneity. *Macroeconomic Dynamics*, 1-32.

- Cimineli, G., E., Giuliadori, E. M., & Merola, R. (2019). The composition effects of tax-based consolidations on income inequality. *European Journal of Political Economy*, 57, 107-124.
- Coady, D., & Dizioli, A. (2018). Income inequality and education revisited: persistence, endogeneity, and heterogeneity. *Applied Economics*, 50(2), 2747-2761.
- Cremer, H., Pestieau, P., & Rochet J. C. (2001). Direct versus indirect taxation: the design of the tax structure revisited. *International Economic Review*, 42(3), 781-799.
- Gentry, W. M., & Hubbard, R. G. (2000). Tax policy and entrepreneurial entry. *American Economic Review*, 90(2), 283-287.
- Gordon, R. H., & Cullen, J. B. (2002). Taxes and entrepreneurial activity: Theory and evidence for the US.
- Cummins, J., Hassett, K. A., & Oliner, S. D. (1997). Investment Behavior, Observable Expectations, and Internal Funds. *The American Economic Review*, 96(3), 796-810.
- Delong, J. B., & Summers, L. (1992). Equipment investment and economic growth: How strong is the nexus? *Brookings papers on economic activity*, 23(2), 157-212.
- Dickey, D. A., & Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with a unit root, *Journal of the American Statistical Association*, 74(366), 427-431.
- Dickey, D. A., & Fuller, W. A. (1981). Likelihood Ratio Statistics for Autoregressive time series with a unit root. *Econometrica*, 49(4), 1057-1072.
- Duncan, D., & Peter, K. S. (2016). Unequal inequalities: Do progressive taxes reduce income inequality? *International Tax and Public Finance*, 23(4), 762-783.
- Duskobilov, U. (2017). Impact of Economic Regulation through Monetary Policy: Impact Analysis of Monetary Policy Tools on Economic Stability in Uzbekistan. *International Journal of Innovation and Economic Development*, 3(5), 65-69.

- Eichhorn, W., Funke, H., & Richter, W. F. (1984). Tax progression and inequality of income distribution. *Journal of Mathematical Economics*, 13(2), 127-131.
- Engle, R. F., & Granger, C. W. J. (1987). Cointegration and error correction: Representation, estimation, and testing. *Econometrica*, 55, 251-276.
- Fazzari, S. M., Hubbard, R. G., & Petersen, B. C. (1988). Financing Constraints and Corporate Investment. *Brookings Papers on Economic Activity*, 1, 141-95.
- Ferede, E., & Dahlby, B. (2012). The Impact of Tax Cuts on Economic Growth: Evidence from the Canadian Provinces. *National Tax Journal*, 65(3), 563-594.
- Feridun, M., Folawewo, A., & Osinubi, T. (2005). Monetary policy and macroeconomic instability in Nigeria: a rational expectation approach. *Applied Econometrics and Economic Development*, 5(2), 69-90.
- Forbes report (2021) Retrieved from <https://www.forbes.com/billionaires/>
- Friedman, M. (1948). A Monetary and Fiscal Framework for Economic Stability. *American Economic Review*, 38(3), 245- 264.
- Gale, W. G., Kearney M. S., & Orszag, P. R. (2015). Would a significant increase in the top income tax rate substantially alters income inequality? *Economic studies*, Brookings institution.
- Gali, J. (1994). Government size and macroeconomic stability. *European Economic Review*, 38(1), 117-132.
- Garcia-Penalosa, C., & Turnovsky, S. J. (2011). Taxation and income distribution dynamics in a neoclassical growth model. *Journal of Money, Credit and Banking*, 43, 1543-1577.
- Gilbert, D. W. (1942). Taxation and Economic Stability. *The Quarterly Journal of Economics*, 56(3), 406-429.

- Gilchrist, S., & Himmelberg, C. P. (1999). Investment: Fundamentals and Finance. NBER Macroeconomics Annual, 13, 223-62.
- Gordon, R. H., & Cullen, J. B. (2002). Taxes and Entrepreneurial Activity: Theory and Evidence for the U.S. NBER Working Paper No. 9015. National Bureau of Economic Research, Inc.
- Rao, M. G. (2005). Tax system reform in India: Achievements and challenges ahead. Journal of Asian Economics, 16(6), 993-1011.
- Rao, M. G., & Kumar, S. (2017). Envisioning Tax Policy for Accelerated Development in India. NIPFP. New Delhi: NIPFP Working Paper Series.
- Granger, C. W. J. (1981). Some properties of time series data and their use in econometric model specification. Journal of Econometrics, 16(1), 121-130.
- Guillaud, E., Olckers, M., & Zemmour, M. (2017). Four levers of redistribution: The impact of tax and transfer systems on inequality reduction.
- Guo, J. T., & Lansing, K. J. (1998). Indeterminacy and Stabilization Policy. Journal of Economic Theory, 82(2), 481-490.
- Guo, J. T., & Harrison, S. G. (2001). Tax Policy and Stability in a Model with Sector-Specific Externalities. Review of Economic Dynamics, 4(1), 75-89.
- Hall, R. E., & Jorgenson, D. W. (1967). Tax policy and investment behavior. The American Economic Review, 57(3), 391-414.
- Han, H. L., & Ogaki, M. (1997). Consumption, income and cointegration. International Review of Economics & Finance, 6(2), 107–117.
- Hanni, M., Martner, R., Podesta, A. (2015). The redistributive potential of taxation in Latin America. CEPAL review, 116, 7-26.

- Hansen, B. E. (1992). Tests for parameter instability in regressions with I (1) processes. *Journal of Business and Economic Statistics*, 10(3), 321-335.
- Harvey, J., & Johnson, M. (1971). *Introduction to Macro-economics*, Macmillan student edition.
- Hayo, B., & Uhl, M. (2014). The macroeconomic effects of legislated tax changes in Germany. *Oxford Economic Papers*, 66(2), 397-418.
- Heckman, J. J., Lochner, L., & Taber, C. R. (1998). General equilibrium treatment effects: A study of tuition policy.
- Helms, L. J. (1985). The Effect of State and Local Taxes on Economic Growth: A Time-Series--Cross-Section Approach. *The Review of Economics and Statistics*, 67(4), 574-582.
- Heisz, A., & Murphy, B. (2016). The role of taxes and transfers in reducing income inequality. *Income inequality: The Canadian story*. Institute for Research on Public Policy and Canadian Market and Skills Researcher Network. 435-477.
- Herfindahl, O. C., (1957). Tax Policy for Stability and Growth. *The American Economic Review*, 47 (2), 139-144.
- Huang, WH., Lin, YJ., & Lee, HF. (2019). Impact of population and workforce aging on economic growth: case study of Taiwan, *Sustainability*, 11(22), 1-23.
- Igbinovia, I. M., & Igbinovia, E. L. (2020). Does Value-Added Tax cause economic instability? Evidence from Nigeria. *Journal of Academic Research in Economics*, 12(3), 480-493.
- Immervoll, H., Levy, H., Nogueira, J. R., Donoghue, C. O., & de Siqueira, R. B. (2006). The impact of Brazil's tax-benefit system on inequality and poverty. IZA discussion papers. No. 2114. Institute for the Study of Labour (IZA), Bonn.
- International Monetary Fund (2014). Fiscal policy and income inequality (Staff policy paper, fiscal affairs department). Washington D.C.

- Iosifidi, M., & Mylonidis, N. (2016). Relative effective taxation and income inequality: Evidence from OECD countries. *Journal of European Social Policy*, 27(1), 57-76.
- Ismael, M. (2011). Progressive income taxes and macroeconomic instability. Munich personal RePEc archive. MPRA paper no. 49917. <https://mpra.ub.uni-muenchen.de/49917/>.
- Ivaskaite-Tamosiune, V., Maestri, V., Malzubris, J., Poissonnier, A., & Vandeplas, A. (2018). The effect of taxes and benefits reforms on poverty and inequality in Latvia. Economic brief 039. European Commission.
- Jakobsson, U. (1976). On the measurement of the degree of progression. *Journal of Public Economics*, 5(1-2), 61-168.
- Jaumotte, F., & Papageorgiou, S. C. L. (2008). Rising Income Inequality: Technology, or Trade and Financial Globalization?' IMF WP 8, 185.
- Jha, S., Mallick, S. K., Park, D., & Quising, P. (2010). Effectiveness of Countercyclical Fiscal Policy: Time-Series Evidence from Developing Asia. ADB Economics Working Paper Series 211. Asian Development Bank.
- Johansen, S. (1988). Statistical analysis of cointegration vectors. *Journal of economic dynamics and control*, 12(2-3), 231-254.
- Jones, L. E., Manuelli, R. E., & Rossi, P. E. (1993). Optimal taxation in models of endogenous growth. *Journal of Political economy*, 101(3), 485-517.
- Journard, I., Pisu, M., & Bloch, D. (2012). Tackling income inequality: The role of taxes and transfers, *OECD Journal: Economic Studies*, 37-70.
- Kakwani, N. C. (1977). Measurement of tax progression: An international comparison. *The Economic Journal*, 87, 71-80.
- Kaldor, N. (1963). Will underdeveloped countries learn to tax? *Foreign Affairs*, 41, 410-419.

- Kaplan, S. N., & Zingales, L. (1997). Do Investment-Cash Flow Sensitivities Provide Useful Measures of Financing Constraints? *Quarterly Journal of Economics*, 112(1), 169-215.
- Keynes, J. M. (1936). *The General Theory of Employment, Interest and Money*. Macmillan and company, London.
- Kim, S. J. (1998). Growth effect of taxes in an endogenous growth model: to what extent do taxes affect economic growth? *Journal of Economic Dynamics and Control*, 23(1), 125-158.
- King, R. G., & Rebelo, S. (1990). Public policy and economic growth: Developing neoclassical implications. NBER working paper series, working paper no. 3338, National Bureau of Economic Research, Cambridge, MA.
- Kleven, H. J., & Kreiner, C. T., (2003). The role of taxes as automatic stabilizers in New Keynesian economics. *Journal of Public Economics*, 87(5), 1123-1136.
- Kletzer, K. (2006). Taxes and stabilization in contemporary macroeconomic models. *International Tax and Public Finance*, 13(4), 351-371.
- Kniesner, T. J., & Ziliak, J. P. (2002). Tax Reform and Automatic Stabilization. *American Economic Review*, 92(3), 590-612.
- Kuznets, S. (1955). Economic growth and income inequality. *The American Economic Review*, 45(1), 1-28.
- Lam, D. (1986). The dynamics of population growth, differential fertility, and inequality. *The American Economic Review*, 76(5), 1103-1116.
- Lambert, P. J. (1993). Inequality reduction through the income tax. *Economica*, 60, 357-365.
- Lee, Y. & Gordon, R. (2005). Tax structure and economic growth. *Journal of Public Economics*, 89(5-6), 1027–1043.

- Lee, Y., & Sung, T. (2007). Fiscal Policy, Business Cycles, and Economic Stabilization: Evidence from Industrialized and Developing Countries. *Fiscal Studies*, 28(4), 437-462.
- Lee, J. W., & XUAN, Y. (2019). Effects of technology and innovation management and total factor productivity on the economic growth of China. *The Journal of Asian Finance, Economics, and Business*, 6(2), 63-73.
- Levin, R., & Renelt, D. (1992). A sensitivity analysis of cross-country growth regressions. *American Economic Review*, 82(4), 942-963.
- Lucas, R. E. (1990). Why doesn't capital flow from rich to poor countries? *American Economic Review*, 80(2), 92-96.
- Mackinnon, R. I., (1973). *Money and capital in economic development*. The Brookings institution press, Washington, DC.
- Mahendra Dev, S. (2018). Inequality, employment and public policy. Working paper No. 2018 003 Indira Gandhi Institute of Development Research, Mumbai.
- Mahon, J. (2009). Tax Reforms and income distribution in Latin America, prepared for delivery at the XXVIII congress of the Latin American Studies Association, Rio de Janeiro, 11-14 June 2009.
- Mankiw, N. G., Romer, D., & Weil, D. N. (1992). A contribution to the empirics of economic growth. *The Quarterly Journal of Economics*, 107(2), 407-437.
- Marsden, K. (1983). Link between Taxes and Economic Growth Some empirical evidences. The World Bank. Washington, D.C.: The World Bank staff working papers, No. 605, 21-25.
- Martinez-Vazquez, J., Moreno-Dodson, B., & Vulovic, V. (2012). The impact of tax and expenditure policies on income distribution: Evidence from a large panel of countries. International Center for Public Policy Working Paper 12-25, Andrew Young School of Policy Studies, Georgia state university, GA.

- Martinez-Vazquez, J., & Vulovic, V. (2014). Tax structure in Latin America: its impact on the real economy. *Revista de Economía Mundial*, 37, 41-73.
- Martorano, B. (2018). Taxation and inequality in developing countries: Lessons from the recent experience of Latin America. *Journal of International Development*, 30(2), 256-273.
- Mattesini, F., & Rossi, L. (2012). Monetary Policy and Automatic Stabilizers: The Role of Progressive Taxation. *Journal of Money, Credit and Banking*, 44(5), 825-862.
- Mehrara, M., & Tavakoliyan, H. (2015). Tax Evasion, Tax Rate, and Economic Stability. *World Scientific News*, 4, 56-70.
- Mehrara, M., & Farahani, Y. G. (2016). The study of the effects of tax evasion and tax revenues on economic stabilities in OECD countries. *World Scientific News*, 33, 43-55.
- Mendoza*, E. G., Milesi-Ferretti, G. M., & Asea, P. (1997). On the ineffectiveness of tax policy in altering long-run growth: Harberger's super neutrality conjecture. *Journal of Public Economics*, 66(1), 99-126.
- Menguy, S. (2014). Taxation Rates and Stabilization in the Framework of Supply-side Distortions. *International Economic Journal*, 28(1), 95-120.
- Mertens, K., & Ravn, M. O. (2012). Empirical Evidence on the Aggregate Effects of Anticipated and Unanticipated US Tax Policy Shocks. *American Economic Journal: Economic Policy*, 4(2), 145-181.
- Montalvo, J. G. (1995). Comparing cointegrating regression estimators: Some additional Monte Carlo results. *Economics letters*, 48 (3-4), 229-234.
- Musgrave, R. A., & Thin, T. (1948). Income tax progression, 1929-48. *Journal of Political Economy*, 56, 498-514.
- Musgrave, R. A. (1959). *The Theory of Public Finance*. Mcgraw hill, New York.

- Musgrave, R. A., & Musgrave, P. B. (1989). *Public Finance in Theory and Practice*, Fifth edition, McGraw hill international editions.
- Myles, G. D. (2000). Taxation and Economic Growth. *Fiscal Studies*, 21(1), 141-168.
- Nagaraj, R. (2013). India's Dream Run 2003-2008: Understanding the Boom and its Aftermath. *Economic & Political Weekly*, XLVIII (20), 39-51.
- Nayak, P. B., & S, Paul. (1989). Personal income tax in India: Alternative structures and their redistributive effects. *Economic and Political Weekly*, 24, 2779-2783.
- Narayan, P. K. (2005). The saving and investment nexus for China: evidence from cointegration tests, *Applied Economics*, 37(17), 1979-1990.
- Oxfam report (2021) *The Inequality Virus - Global Report*.
- Padda, I. Ul. Haq., & Akram, N. (2010). The Impact of Tax Policies on Economic Growth: Evidence from South-Asian Economies. *The Pakistan Development Review*, 48(4), 961-971.
- Park, J. Y. (1992). Canonical Cointegrating Regressions. *Econometrica*, 60, 119-143.
- Park, D., & Shin, K. (2011). Impact of population aging on Asia's future growth. ADB economics working paper series No. 281. Asian Development Bank.
- Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, 16(3), 289-326.
- Pearse, P. H. (1962). Automatic Stabilization and the British Taxes on Income. *The Review of Economic Studies*, 29(2), 124-139.
- Phillips, Peter C. B., & Perron, P. (1988). Testing for a unit root in time series regression. *Biometrika*, 75(2), 335-346.

- Phillips, P. C., & Hansen, B. E. (1990). Statistical inference in instrumental variables regression with I (1) Processes. *The Review of Economic Studies*, 57(1), 99-125.
- Rao, B. B. (2006). Time series econometrics of growth: a guide for applied economists. Munich Personal RePEc Archive (MPRA) No. 1547, University of the South Pacific, Suva
- Richard, K., Bleaney, M. F., & Gemmell, N. (1999). Fiscal policy and growth: evidence from OECD countries, *Journal of Public Economics*, 74(2), 171-190.
- Roy, W. B., & Bird, R. B. (2008). Tax Policy in Developing Countries: Looking Back—and Forward. *National Tax Journal*, 61(2), 279-301.
- Sajid, G., & Sarfaraz, M. (2008). Savings and economic growth in Pakistan: An issue of causality. *Pakistan Economic and Social Review*. 46(1). 17-36.
- Sammartino, F. (2017). Taxes and Income Inequality. Tax policy center, Urban Institute and Brookings Institution.
- Sargan, J. D. (1964). Wages and prices in the United Kingdom: A study in econometric methodology. In: Hart, P. E., Mills, G. and Whitacker, J. K., Eds., *Econometric analysis for national economic planning*, Butterworths, London, 34-36.
- Santiago, R., Fuinhas, J. A., & Marques, A. C. (2019). Income inequality, globalization, and economic growth: a panel vector autoregressive approach for Latin American countries. *The Extended Energy-Growth Nexus*, 57-96.
- Sarkodie, S. A., & Adams, S. (2020). Electricity access, human development index, governance and income inequality in Sub-Saharan Africa. *Energy Reports*, 6, 455-466.
- Schultz, T. (1981). *Investing in People: The Economics of Population Quality*. Berkeley, University of California Press.
- Schumpeter, J. A. (1942). *Socialism, capitalism and democracy*. Harper and Brothers.

- Shaw, E. (1973). *Financial deepening in economic development*, Oxford university press, New York.
- Shrestha, M. B., & Bhatta, G. R. (2018). Selecting appropriate methodological framework for time series data analysis. *The Journal of Finance and Data Science*, 4(2), 71-89.
- Singh, P. (2019). *Tax Revenue in India: Trends and Issues*. Working paper 448, The Institute for Social and Economic Change, Bangalore.
- Skinner, E. (1996). Taxation and economic growth. *National Tax Journal*, 49(4), 617-642.
- Solow, R. M. (1956). A contribution to the theory of economic growth. *Quarterly Journal of Economics*, 70(1), 65–94.
- Stein Jeremy. C. (2003). *Monetary policy as financial stability regulation*. Working paper series. Working Paper No. 16883. NBER, Cambridge, MA.
- Stiglitz, J. E. (2012). Macroeconomic fluctuations, inequality and human development. *Journal of Human Development and Capabilities*, 13(1), 31-58.
- Stock, J. H., & Watson, M. (1993). A Simple Estimator of Cointegrating Vectors in Higher Order Integrated Systems. *Econometrica*, 61(4), 783-820.
- Stoilova, D. (2017). Tax structure and economic growth: Evidence from the European Union. *Contaduría y administración*, 62(3), 1041-1057.
- Svensson Lars. E. O. (2003). *Monetary policy and real stabilization*. Working paper series. Working Paper No. 9486. NBER, Cambridge, MA.
- Swan, T. (1956). Economic growth and capital accumulation. *Economic Record*, 32(2), 334–361.
- Swagel, P., & Boruchowicz, C. (2017). *Policies to address income inequality and increase economic opportunities for low-income families*. Mercatus Research, Mercatus centre at George Mason University, Arlington, VA.

- Swanepol, J.A. & Schoeman, N. (2002). Countercyclical fiscal policy in South Africa: Role and Impact of automatic fiscal stabilizers. *South African Journal of Economic and Management Sciences (SAJEMS)*, 6(4), 802-822.
- Tanzi, V. & Zee, H. H. (2000). Tax Policy for Emerging Markets: Developing Countries. *National Tax Journal*, 53(2), 299-322.
- Tobin, J. (1965). Money and economic growth. *Econometrica*, 33(4), 671-684.
- Trostel, P. A. (1993). The effect of taxation on human capital. *Journal of political Economy*, 101(2), 327-350.
- Turnovsky, S. J. (2000). Fiscal policy, elastic labor supply, and endogenous growth. *Journal of Monetary Economics*, 45(1), 185-210.
- VanHoose, David. D. (2008). Bank Capital Regulation, Economic Stability, and Monetary Policy: What Does the Academic Literature Tell Us? *Atlantic Economic Journal*. 36(1), 1-14.
- Yay, G., Taştan, H., & Oktayer, A. (2016). Globalization, economic freedom, and wage inequality: A panel data analysis. *Panoeconomicus*, 63(5), 581-601.
- Wang, P., & Yip, C. K. (1992). Taxation and Economic Growth: The Case of Taiwan. *American Journal of Economics and Sociology, Inc.*, 51(3), 317-331.
- Weller, C. E., & Singleton, L. (2004). Political Freedom, External Stabilization, and Financial Stability. *International Review of Applied Economics*, 18(1), 43-61.
- Weller, C. E., & Rao, M. (2010). Progressive tax policy and economic stability. *Journal of Economic Issues*, 44(3), 629-659.
- Widwalm, F. (2001). Tax structure and growth: Are some taxes better than others? *Public Choice*, 107(3-4), 199-219.

Wooldridge, J. M. (2001). Applications of generalized method of moments estimation. *Journal of Economic perspectives*, 15(4), 87-100.

World of Work Report 2008 (2008). Income inequalities in the age of financial globalization, International Institute for Labour Studies, Geneva.

Zhiyong, An. (2019). Taxation, Aggregate Price Stickiness, and Economic Fluctuations. [https://ntanet.org › wp-content › uploads › 2019/03](https://ntanet.org/wp-content/uploads/2019/03).

Zipfel, F., Heinrichs, C., Böttcher, B., AG, D. B., Hoffmann, R., & Speyer, B. (2012). The impact of tax systems on economic growth in Europe. An overview. Deutsche Bank.

NEXUS BETWEEN TAX STRUCTURE AND INCOME INEQUALITY IN INDIA



Dillip Kumar Muduli^{1*}

Sanjay Kumar Rout²

N. A. Khan³

^{1,2}School of Economics, University of Hyderabad, Telangana, India.

¹Email: dillipmuduli6@gmail.com Tel: +919398310478

²Email: drkhan58@gmail.com Tel: +919573605245

³Centre for Development Studies, Thiruvananthapuram, Kerala, India.

³Email: sanjayrout1992@gmail.com Tel: +918848338987



(+ Corresponding author)

ABSTRACT

Article History

Received: 10 February 2022

Revised: 1 April 2022

Accepted: 15 April 2022

Published: 6 May 2022

Keywords

Tax structure
Income inequality
FMOLS
CCR
DOLS
India.

JEL Classification

H21; D63; C32.

This study empirically examines the long-run effect of tax structure on income inequality in India. It considers annual time-series data from 1980 to 2019. The unit root and Johansen cointegration tests substantiate a long-run relationship between tax variables and income inequality. We employ Fully Modified OLS (FMOLS) and Dynamic OLS (DOLS) techniques for the baseline analysis. For a robustness check, we utilize the Canonical Cointegration Regression (CCR) technique. The results show that the top marginal tax rate (TMTR) reduces income inequality, whereas customs duty (CD) significantly increases income inequality. Personal income tax (PIT), corporate income tax (CIT), and excise duty (ED) have no significant association with income inequality. In addition, GDP per capita significantly reduces income inequality, whereas GDP per capita squared aggravates income inequality, reflecting the absence of the Kuznets hypothesis in India. Human capital measured by mean years of schooling (MYS) also significantly worsens income inequality. Our results suggest that the Indian government should increase TMTR and reduce customs duty (CD) in order to improve income distribution.

Contribution/ Originality: An analysis of the effect of tax structure on income inequality in India has not been previously explored in the literature. Thus, this examination of the long-run effect of tax structure on income inequality in India, employing sophisticated time-series techniques, contributes significantly to the literature from a policy perspective.

1. INTRODUCTION

In India, the income share of the top 1% of the population increased from 11% to 21.7% of total income between 1980 and 2021, whereas in the same period, the income share of the bottom 50% drastically plummeted from 23% to 13.1% of total income. Furthermore, in 2021, the top 10% captured 57% and the middle 40% shared only 29.7% (Chancel, Piketty, Saez, & Zucman, 2022). This fact establishes India as the second most unequal nation on earth in terms of income inequality, after South Africa (Mahendra, 2018). In addition, the impact of the Covid-19 pandemic has added fuel to the fire. The pandemic significantly reduced the share of income held by marginalized sections of society. Given the widespread negative economic outcome of the pandemic, the poor and middle classes are likely to be severely hit. A recent report by Oxfam (2021) confirms that the pandemic will deteriorate income distribution. The magnitude of deterioration could be significant in India due to India's prolonged suffering in the pandemic.

The high income inequality might limit economic performance and stand as a barrier to accomplishing many sustainable development goals (SDGs). For instance, SDGs such as no poverty, zero hunger, gender equality, decent work and economic growth, and inequality reduction may not be realized within the stipulated time. This might happen because the purchasing power of the majority low-income class has declined in comparison to the minority high-income class, and the marginal propensity to consume (MPC) is relatively higher for the low-income class than the high-income class. Hence, severe income inequality might weaken economic performance (Stiglitz, 2012). Sustainable Development Goal 10 (SDG10) affirms that income inequality affects accessibility to factors like healthcare, food and nutrition, energy, education, water, and sanitation (Sarkodie & Adams, 2020). Therefore, policies are urgently needed to reduce the income inequality in India. This study is highly significant from a policy perspective.

Rigorous policies are urgently required to ameliorate income distribution in India. Taxation is a conventional and direct policy to achieve income redistribution. In this context, this study addresses the questions: Do conventional prescriptions of taxation affect income inequality in India? Does taxation improve or worsen income distribution in India? Which tax parameter improves income distribution? Taxation, as a policy tool, has various economic objectives and develops over time. Initially, taxation was designed as an effective means of mobilizing revenue (Musgrave, 1959). Furthermore, Solow (1956) and Swan (1956) considered taxation to be an exogenous variable in their seminal works and showed that changes in tax rates could shift the intercept of the Steady-State growth path. In light of a significantly widening income inequality worldwide, tax policies are designed to improve income distribution.

Taxation can affect income distribution either positively or negatively. Progressive taxes, such as individual income tax and corporate income tax, can ameliorate income distribution. They ensure a supplementary inclusive process of economic development (Kaldor, 1963). Conversely, regressive taxes such as sales tax, VAT, customs duties, and excise duties are expected to deteriorate income distribution because of the higher burden they place on poor individuals. However, the effectiveness of taxes varies from country to country. The most debated issue is the effectiveness of tax policy in addressing income disparity in developing economies (Bird & Zolt, 2013).

The effect of taxation on income inequality in developing countries is restrained by the considerable informal sector and the dearth of appropriate administrative systems (Mahon, 2009). Similarly, Martorano (2016) revealed the limited effect of taxation on income disparity through low average tax revenue (% of GDP), a higher segment of indirect taxes in total tax revenue (TTR), a lack of ability to tax top incomes, and an insignificant contribution of property taxes to TTR in Latin America. As a developing country, India has faced vast income inequality since the beginning of liberalization policies in the 1980s. The top 1% of income earners' share of the national income is 22%, while the top 10% earn 56% (Chancel & Piketty, 2019). It is against this background that we attempt to assess the role of tax structure in affecting income inequality in India for the period 1980-2019.

In the Indian context, considering the degree of progressivity in PIT and examining the redistributive effects of income tax schedules by Atkinson's measure of inequality for 1985-86, Nayak and Paul (1989) showed that a fall in marginal tax rate at the lower as well as the upper end of the income scale is likely to broaden the base. It also improves income redistribution more than the most progressive tax schedule. Using personal income tax data from 1961-62 to 1983-84, Aggarwal (1990) claimed, using OLS regression, that given the income distribution, a rise (fall) in the tax level or tax progressivity increases (decreases) the redistributive impact of the tax. To the best of our knowledge, no single analysis has scrutinized the effect of tax structure on income inequality in India. This gap constitutes a substantial barricade to identifying the most promising tax policies for reducing inequality. With income inequality increasing, this gap motivates us to empirically investigate the effect of tax structure on income inequality in India from a policy perspective.

Considering tax structure, Atkinson and Stiglitz (1976) maintained that equitable income distribution could be achieved through income tax alone and consumption taxes were not required for income distribution. García-

Peñalosa and Turnovsky (2011) found that an increase in both income tax and consumption tax is associated with lower output but with high after-tax income equality. Conversely, observing a tax mix model of consumption and income taxes, Cremer, Pestieau, and Rochet (2001) maintained that commodity taxes are beneficial for redistribution.

Based on this theoretical background, the present paper investigates the impact of tax structure on income inequality in India. The study employs annual data from 1980 to 2019 and various time-series econometric techniques to meet its objectives. First, we employ the Augmented Dickey-Fuller (ADF) and Phillip-Perron (PP) unit root tests to confirm the stationarity of the data. Second, the application of the Johansen cointegration test reinforced the long-run association among the variables. Third, we used FMOLS and DOLS to investigate our objectives. These models are known for their power to mitigate small sample bias, endogeneity, and serial correlation problems in a regression framework. Finally, we used the Canonical Cointegration Regression (CCR) to check the consistency of the results.

Results from time-series techniques show that the top marginal tax rate (TMTR) reduces income inequality, whereas Customs Duty (CD) increases income inequality significantly. However, Corporate Income Tax (CIT) and Excise Duty (ED) do not affect income inequality significantly in India. In addition, GDP per capita significantly reduces income inequality, whereas GDP per capita squared aggravates income inequality, reflecting the absence of the Kuznets hypothesis in India. Human capital measured by mean years of schooling (MYS) also significantly worsens income inequality.

With these findings, our study contributes significantly to the literature. First, to the best of our knowledge, we are the first to examine the effect of tax structure on income inequality in India. Second, if series are stationary at the first difference, then variables may be cointegrated in the model. The fundamental issues concern non-stationarity in data series, which produce potential spurious correlation and endogeneity problems (Engle & Granger, 1987). Using conventional methods, in this case, may provide misleading and unreliable results. Therefore, to circumvent such issues, we used sophisticated time-series techniques, including FMOLS, DOLS, and CCR. These models remove small sample bias, spurious correlation, and endogeneity problems, thus producing reliable results. Third, other variables affect income inequality; therefore, we used three important control variables to avoid model misspecification problems. Fourth, unlike other studies that considered a single tax rate, we used overall tax structure to provide a complete picture of the impact of tax on income inequality. Finally, our results are consistent with the alternative modeling.

This paper is organized as follows. Section 2 reviews the previous literature on the link between tax and income inequality. Section 3 provides the data sources and estimation methods employed for the investigation and determines the sign of coefficients based on the theoretical groundwork. Section 4 contains empirical results and their discussion. Section 5 provides the results of the robustness check. Lastly, Section 6 concludes with policy implications.

2. LITERATURE SURVEY

This section reviews both empirical and theoretical literature in various subsections.

2.1. Tax Progressivity and Income Inequality

A tax structure is progressive if the average tax rate rises with an increase in income before tax (Jackobsson, 1976). The study of income tax progression and income distribution dates back to Musgrave and Thin (1948). They provided various measures of progressivity through which income distribution can take place. However, they failed to distinguish between the effects of changes in progressivity and those of average tax rates on income distribution. Therefore, Kakwani (1977) considered this issue and showed that a reduction in income distribution depends on both tax progressivity and the average tax rate.

Recent studies have also examined the effect of tax progressivity on income disparity. For instance, [Burman \(2013\)](#) tried to determine the appropriate level of tax progressivity in the federal tax system to reduce income inequality in the US. He found that the numerous factors that cause inequality and the cost of taxation are the determinants of an appropriate level of tax progressivity. On the one hand, there is little foundation for progressive taxation if the differences in income are caused by variations in effort, thrift, or occupation. On the other hand, if variations in luck or rent-seeking cause differences in income, there should be a highly progressive income tax system.

Similarly, employing various progressivity measures over the period 1981-2005, [Duncan and Peter \(2016\)](#) maintained that personal income tax progressivity significantly reduces observed inequality and actual inequality. However, the effect is more marginal in the case of observed inequality than actual inequality. In addition, they found that the tax progressivity effect is stronger in more developed democratic institutions than in weaker legal institutions, even though the effect can be positive in weak institutions. They also suggested that it would be more effective if changes in progressivity were reflected at the top rather than at the bottom of the income scale. However, [Lambert \(1993\)](#) argued that progressive taxation by itself cannot reduce income inequality; rather, income taxes that contain non-income attributes can reduce overall income inequality. Therefore, this study prescribes certain conditions which should be fulfilled to reduce overall inequality. These conditions are: (1) every member of one class is more affluent than any member of the other; (2) the members of this more affluent class are all taxed at a higher average rate than the others; (3) the tax does not induce any reversal in the income parade.

2.2. Tax Structure and Income Inequality

The study of the impact of tax structure on income inequality traces back to [Musgrave \(1959\)](#), who discussed how welfare and distribution change when one tax is substituted for another. However, [Atkinson and Stiglitz \(1976\)](#) provided the first formal model involving tax structure and found that income tax can reduce income inequality. There is no need for consumption taxes. Conversely, [Cremer et al. \(2001\)](#) inspected the tax mix model between income tax and commodity taxes. They found that commodity taxes are positively related to income redistribution.

Some recent empirical studies have analyzed the effect of tax structure on income inequality. [Iosifidi and Mylonidis \(2017\)](#) examined the effect of labor, consumption, and capital tax rates on income disparity in the OECD. They found that the redistributive effect of the single tax rate is modest. Only labor tax has a significant negative effect on inequality. The study suggested that the redistributive power of relative tax rates is more significant than that of the single tax rate. Specifically, the larger the tax burden on labor than on capital and the higher the burden on consumption than on capital, the greater the income inequality. The intensification of the labor to consumption taxes ratio leads to an aggravation of income equality.

Using the PVAR model, [Ciminelli, Ernst, Merola, and Giuliadori \(2019\)](#) examined the composition effects of tax-based consolidations on income inequality in 16 OECD countries from 1978 to 2012. The study found that the impact of general indirect taxes is greater than that of personal income tax in reducing income inequality through the channel of labor force participation. Finally, considering 18 Latin American economies, [Martorano \(2018\)](#) studied the taxation-income inequality association from 1990 to 2015. He investigated the possible effects of different tax instruments and other control variables on income inequality. The study found that recent tax changes in the early 2000s reduced income inequality. Specifically, the increasing share of direct taxes to TTR compared to that of indirect taxes to TTR promoted the tax system's progressivity and contributed to the reduction of inequality. Nevertheless, the tax policy's effectiveness in reducing income inequality was not satisfactory for various reasons, such as the low tax to GDP ratio, the inability of the governments to raise effective top tax rates, and the low contribution of property taxes to TTR in Latin America.

2.3. Tax-Expenditure Policies and Income Inequality

Taxation on its own cannot sufficiently reduce income inequality. The powerful force of income inequality can be offset by the combined effort of progressive taxation and redistributive expenditure. By increasing the tax rate on top income earners, progressive taxation reduces income inequality, and by providing more transfer payments to the poor, redistributive expenditure increases the disposable income of the poor and reduces income inequality. Aaron (2015) suggested that an increase in the tax rate on wealthy Americans as well as prudent expansion of public spending would reduce income inequality in the US. Using the Brazilian Household Microsimulation Model (BRHAMS), Immervoll, Levy, Nogueira, O' Donoghue, and De Siqueira (2006) found that tax-benefit systems successfully reduce income inequality in Brazil. Ivaškaitė-Tamošiūnė, Maestri, Malzubris, Poissonnier, and Vandeplas (2018) found that tax reforms adopted in Latvia in 2017 had a limited effect on income inequality. However, the study predicted that if pursued further, the reform of the minimum income scheme could reduce inequality.

Heisz and Murphy (2016) examined the effects of taxes and transfers on income inequality in Canada from 1976 to 2011 and found that the tax and transfer system significantly reduced the increase in market income inequality. Using observational microdata across 22 OECD countries for the 1922-2013 period, Guillaud, Olckers, and Zemmour (2017) found that a combination of taxation and transfers reduced income inequality. Hanni, Martner, and Podesta (2015) examined the effect of personal income tax and transfer payments on income disparity in 17 Latin American countries. They found that the Gini coefficient was reduced by 61% due to public cash transfers, and the remaining 39% was due to personal income as well as social security contributions. Similarly, Martinez-Vazquez, Moreno-Dodson, and Vulovic (2012) explored the effect of taxes and public expenditure on income inequality for a panel of 150 economies. They maintained that both taxes and public expenditure have a significant impact on income distribution. Specifically, income tax significantly reduces income inequality, and its impact increases the greater the degree of progressivity.

2.4. Tax and Income Inequality in India

To check the degree of progressivity, Nayak and Paul (1989) investigated India's personal income tax structure for 1985-86. They also examined the redistributive impact of mathematically designed income tax schedules using Atkinson's measure of inequality. They found that India's personal income tax (PIT) structure is progressive, particularly when comparing the distribution of pre-tax and post-tax income. Nevertheless, the PIT covers less than 1% of the population, which is the main difficulty of redistribution. They suggested that a decline in marginal tax rate at the lower as well as the upper end of the income scale was likely to broaden the base. Thus, the actual tax redistribution schedules may be larger than the most progressive tax schedule. If the government wants to pursue a revenue-neutral policy, it cannot afford meager tax rates at the lower end of the income scale.

Aggarwal (1990) analyzed the effect of personal income tax on income distribution by empirically isolating income inequality from the effect of tax progressivity and tax level. He used the Gini index and Atkinson's measure of inequality to measure income redistribution. The OLS method was used to study the redistributive effect of tax instruments and income inequality. It showed that income inequality significantly affects the redistributive impact of the tax. For a given tax structure, a rise (fall) in income inequality increases (decreases) the redistributive impact of the tax. Similarly, given a level of income inequality, a rise (fall) in the tax level or tax progressivity increases (decreases) the redistributive impact of the tax.

This confirmed that tax progressivity in the form of personal income tax has more potential than other taxes to reduce income inequality across countries and time. The extant literature also suggests that a combination of taxes and transfers could reduce income inequality more effectively. However, Swagel and Boruchowicz (2017) assessed the tax policies and other measures aimed at income redistribution in the US and found that tax policies cannot effectively reduce income inequality. Redistributive transfers are likely to have a modest effect on income disparity.

Nonetheless, they believed that measures aimed at improving individual incentives for work could substantially increase both before- and after-tax incomes at the bottom of the income distribution scale.

Although a significant amount of prior literature is associated with taxation and income inequality, it nevertheless remains unclear how India's tax structure affects its income distribution. Reviewing the literature, we confirmed that no single study has investigated the effect of tax structure on income inequality in India. The empirical ambiguity involving the relationship between taxes and income distribution increases the difficulty of adopting and implementing appropriate policies. Hence, our study tries to fill this important gap in the literature from a policy perspective.

3. DATA, TIME SERIES CHARACTERISTICS, AND METHODS

3.1. Data

The present study involves data collected from various sources for empirical analysis. For the dependent variable, we consider the standardized Gini coefficient of household disposable income (post-tax, post-transfer), denoted as Gini_disp_se. For the main independent variables, we use five tax variables (denoted as tax structure): top marginal tax rate including cess and surcharge (TMTR_C&S), personal income tax (PIT) as a % of total tax revenue (TTR) (PIT/TTR), corporate income tax (CIT) as a % of TTR (CIT/TTR), excise duty (ED) as a % of TTR (ED/TTR), and customs duty (CD) as a % of TTR (CD/TTR). To circumvent model misspecification, we use additional independent variables, such as GDP per capita (GDP_PC), GDP_PC squared (GDP_PCS), and mean years of schooling (MYS). We consider GDP per capita and its square to test the Kuznets hypothesis. Table 1 provides details of the variables, their definitions, and sources.

Table 1. Variables, definitions, and sources.

Variable	Definition	Source
Dependent variable		
Gini_disp_se	Estimate of Gini index of inequality in equivalized (square root scale) household disposable (post-tax, post-transfer) income, using Luxembourg Income Study data as the standard.	SWIID version 9.0
Main independent variables		
Top Marginal Tax Rate including cess and surcharge (TMTR_C&S) Personal Income Tax (PIT)	Marginal tax rate applies to top income tax bracket including cess and surcharge. The ratio of PIT to total tax revenue (TTR).	Union Budget documents, MOF, India IPFS, MOF, India IPFS, MOF, India
Corporate Income Tax (CIT)	The ratio of CIT to TTR	IPFS, MOF, India
Excise Duty (ED)	The ratio of ED to TTR	IPFS, MOF, India
Customs Duty (CD)	The ratio of CD to TTR	IPFS, MOF, India
Additional independent variables (Control variables)		
GDP per capita (GDP_PC)	GDP per capita (constant 2010 US\$)	RBI
GDP per capita squared (GDP_PCS)	GDP per capita (constant 2010 US\$) squared	We converted GDP_PC to GDP_PCS
Mean Years of Schooling (MYS)	The average number of years of education received by people ages 25 and older (UNDP).	UNDP, Barro and Lee database

Note: SWIID indicates the standardized world income inequality database, IPFS indicates Indian Public Finance Statistics, MOF is the Ministry of Finance, UNDP stands for the United Nation Development Programme, and RBI indicates the Reserve Bank of India.

The Gini coefficient shows the mean income difference between all pairs over twice the mean income in the population. If the Gini coefficient (GC) is 0, then all income is distributed equally among the population. If GC is 1, then all income is concentrated in one person. Similarly, if GC takes a value from 1 to 100 (as it does in the SWIID data), it reflects the same interpretation as a GC of between 0 and 1. The GC has been widely used among

researchers. The income GC data were extracted from the SWIID¹ version 9.0, created by Solt (2016). The SWIID data is very reliable and maximizes comparability for the largest possible sample of economies and years (Cevik & Correa-Caro, 2015; Jaumotte & Papageorgiou, 2008; Santiago, Fuinhas, & Marques, 2019) compared to any other database such as WID, WIID (UNU-WIDER), or World Bank. Hence, SWIID is used in this study.

We use four tax ratios – PIT/TTR, CIT/TTR, ED/TTR, and CD/TTR – to establish the tax structure of India. The data on these four tax ratios are extracted from the Indian Public Finance Statistics (IPFS) published by MOF,² GOI.³ The top marginal income tax rate (TMTR) is conventionally used as a parameter of personal income tax progressivity. Progressivity of personal income tax increases with a rise in the TMTR. The TMTR data were drawn from union budget documents of the government of India between 1980 and 2019. GDP per capita, as well as GDP per capita squared, were computed from the data on GDP at constant price and population extracted from RBI. Education has been noted as an important variable that influences income inequality. So we took mean years of schooling (MYS) as a proxy for education. MYS data was taken from both UNDP and Barro and Lee databases due to data unavailability from any one source. MYS data from 1980 to 1990 was drawn from the Barro and Lee database. The missing MYS data between 1980 and 1990 was filled by the annual average growth rate of MYS between 1980 and 1990. Furthermore, MYS data for 1990 to 2019 was extracted from the UNDP database.

3.1.1. Summary Statistics and Correlation Matrix

Table 2 shows that among all the variables, GDP per capita (GDP_PC) has the highest mean, median, maximum, minimum, and standard deviation values. Conversely, Gini_disp_se has the lowest mean, median, maximum, minimum, and standard deviation values. All the variables are normally distributed as demonstrated by the Jarque-Bera statistic and its corresponding p-values. All p-values are more than 0.05. The total observations in each series are 40.

Table 2. Summary statistics.

Variable	Gini_disp_se	TMTR_C&S	PIT/TTR	CIT/TTR	ED/TTR	CD/TTR	GDP_PC	MYS
Mean	1.402	42.901	11.501	23.276	28.566	28.899	47779.54	4.149
Median	1.400	35.550	11.442	21.149	30.755	30.577	38575.29	4.300
Maximum	1.800	72.000	23.797	38.725	40.790	48.909	108620.0	6.500
Minimum	0.800	30.000	2.152	12.254	14.503	5.232	19776.87	1.870
Std. Dev.	0.174	12.881	7.852	8.243	7.895	14.496	26483.26	1.468
Skewness	0.200	0.829	0.080	0.316	-0.273	-0.068	0.900	0.021
Kurtosis	2.474	2.315	1.205	1.797	1.815	1.414	2.591	1.793
Jarque-Bera	0.729	5.367	5.411	3.077	2.836	4.223	5.686	2.430
P-Value	0.694	0.068	0.066	0.214	0.242	0.121	0.0582	0.296
Observations	40	40	40	40	40	40	40	40

The correlation matrix (represented in Table 3) reveals that TMTR, the tax ratios PIT/TTR, CIT/TTR, ED/TTR, and MYS are negatively associated with the Gini coefficient. CD/TTR and GDP per capita are positively associated with the Gini coefficient. The correlation coefficient suggests the absence of a high degree of correlation between the Gini coefficient and all other variables of interest. Nevertheless, a high degree of correlation exists among the explanatory variables. The high degree of correlation between the explanatory variables reflects a potential multicollinearity problem in the models. To avoid the multicollinearity problem, first, we use sophisticated models of estimation that correct for this issue. Second, we use a single tax variable in a model and estimate five

¹ Standardized World Income Inequality Database (SWIID).

² Ministry of Finance (MOF).

³ The Government of India (GOI).

different models. Our method of estimation involving sophisticated econometrics tools solves the potential multicollinearity problem in the models.

3.2. Time Series Characteristics

Time series data is subject to two significant issues: stationarity of series and cointegration among variables. To address both issues, it helps to select appropriate econometrics techniques and thereby provide unbiased, consistent, and accurate results. We are proceeding with the two time series features detailed below.

Table 3. Correlation matrix.

Variable	Gini_disp_se	TMTR_C&S	PIT_TTR	CIT_TTR	ED_TTR	CD_TTR	GDP_PC	MYS
Gini_disp_se	1.000 ----- -----							
TMTR_C&S	-0.370 (2.459) [0.018]	1.000 ----- -----						
PIT/TTR	-0.088 (-0.545) [0.588]	-0.763 (-7.280) [0.000]	1.000 ----- -----					
CIT/TTR	-0.195 (-1.226) [0.227]	-0.748 (-6.950) [0.000]	0.848 (9.870) [0.000]	1.000 ----- -----				
ED/TTR	-0.110 (-0.687) [0.496]	0.569 (4.269) [0.000]	-0.626 (-4.950) [0.000]	-0.791 (-7.985) [0.000]	1.000 ----- -----			
CD/TTR	0.009 (0.005) [0.995]	0.678 (5.699) [0.000]	-0.975 (-27.482) [0.000]	-0.837 (-9.465) [0.000]	0.591 (4.520) [0.000]	1.000 ----- -----		
GDP_PC	0.255 (1.628) [0.111]	-0.651 (-5.289) [0.000]	0.873 (11.087) [0.000]	0.781 (7.712) [0.000]	-0.808 (-8.467) [0.000]	-0.880 (-11.453) [0.000]	1.000 ----- -----	
MYS	-0.0019 (-0.012) [0.990]	-0.842 (-9.645) [0.000]	0.921 (14.655) [0.000]	0.847 (9.832) [0.000]	-0.757 (-7.163) [0.000]	-0.896 (-12.477) [0.000]	0.940 (17.025) [0.000]	1.000 ----- -----

Note: For abbreviations, see the text. The values in the square brackets and parentheses represent p-values and t-statistics, respectively.

Table 4. Unit root results.

Variable	ADF TEST		PP TEST	
	C	C+T	C	C+T
lnGini_disp_se	-2.273	-0.696	-2.266	-1.975
ΔlnGini_disp_se	-3.300**	-6.747***	-8.154***	-8.269***
lnTMTR_C&S	-2.063	-2.195	-2.082	-2.195
ΔlnTMTR_C&S	-7.601***	-6.382***	-8.155***	-11.923***
lnPIT/TTR	-0.699	-2.730	-0.579	-2.715
ΔlnPIT/TTR	-7.664***	-7.579***	-7.790***	-7.691***
lnCIT/TTR	-1.240	-1.202	-1.280	-1.420
ΔlnCIT/TTR	-4.932***	-4.874***	-4.932***	-4.874***
lnED/TTR	-0.788	-2.832	-0.891	-2.303
ΔlnED/TTR	-4.933***	-4.929***	-4.809***	-4.808***
lnCD/TTR	1.491	-1.330	1.380	-1.330
ΔlnCD/TTR	-5.020***	-5.617***	-5.015***	-5.618***
lnGDP pc	2.914	-1.306	3.299	-1.277
ΔlnGDP pc	-4.619***	-5.679***	-4.593***	-5.666***
lnMYS	-2.488	-0.871	-4.990	-0.287
ΔlnMYS	-5.162***	-5.889***	-5.147***	-9.723***

Notes: ** and *** denote the level of significance at 5%, and 1%, respectively. Here, C stands for constant, and C+T indicates the constant plus trend.

3.2.1. Unit Root in Data Series

First, if there is a non-stationarity issue (unit root problem) in the time series, without appropriate techniques, it may produce biased and inefficient estimators, leading to a misleading interpretation of the empirical results. So, we use Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests to find unit roots in the series. Conducting unit root tests helps researchers employ the appropriate empirical tools that provide unbiased results. Some literature has reported that for a small sample, ADF performs much better (Arltova & Fedorova, 2016). We conducted both techniques, incorporating a constant (C) as well as a constant plus trend (C+T). The results are shown in Table 4. The unit root results from both tests (ADF & PP) document that all series are stationary at the first difference. It implies the series are $I(1)$ order of integration. It indicates the series are nonstationary at level and stationary at first difference. The first difference stationary data set also reflects the possible cointegration among variables (Engle & Granger, 1987). Hence, next, we deal with the cointegration test.

3.2.2. Johanson Cointegration Test

We employ the Johanson cointegration test to corroborate the cointegrating nature among the variables. The Johanson Cointegration test specification rests on a summary result with different assumptions involving the selection of optimum lags and deterministic terms (i.e., intercept and trend) in the models. The number of models hinges on tax variables. We consider five different tax variables based on their importance to income redistribution. So, we run five models incorporating the five tax variables. All five models have been considered in the cointegration test. Schwarz information criteria (SIC) are employed to navigate optimum lags in the cointegration test. Summary results involving SIC of the Johanson cointegration test suggest using two lags with linear intercept and trend for the 1st, 4th, and 5th models, one lag with quadratic intercept and trend for the 2nd model, and one lag with linear intercept and trend for the 3rd model.

Johansen's (1988) cointegration test is popular and widely used. The cointegration results reflect that the variables under each model are cointegrated. It demonstrates the presence of a long-run association among variables of interest. Table 5 shows the results of the Johanson cointegration test. The trace and maximum eigenvalue statistics reject the null hypothesis (no cointegration) and accepted the alternative hypothesis: the presence of cointegration among variables of interest in all models. Specifically, trace and maximum eigenvalue demonstrate at least one cointegrating equation in each model. It implies the presence of a long-run association between tax variables and income distribution in India.

Finally, we conclude that the unit root and Johanson cointegration tests suggest that the cointegrating technique appears to be an appropriate method to evaluate the effect of tax structure on income inequality in India. Thus, the present analysis considers cointegrating models such as FMOLS, DOLS, and CCR to be time-series techniques appropriate for examining our research question.

4. METHODS

4.1. Brief Description of Techniques

The unit root and cointegration test results recommend the use of cointegrating models. Thus, we make use of sophisticated estimation techniques to circumvent omitted variables, unit root, and reverse causality problems by employing FMOLS, DOLS, and CCR. These techniques yield better results than the traditional OLS estimators, as they correct serial correlation and endogeneity problems. The FMOLS, DOLS, and CCR models determine the long-run relationship by employing a single cointegrating vector. All three models are fully efficient techniques. Note that the CCR model is used to confirm the consistency of our results.

Table 5. Johansen-cointegration test results.

1st model				
Trace statistics				
Hypothesized No. of CE(s).	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.766	122.512	88.803	0.000
At most 1 *	0.610	68.758	63.876	0.018
At most 2	0.382	33.833	42.915	0.296
At most 3	0.242	16.017	25.872	0.491
At most 4	0.143	5.727	12.517	0.495
Maximum Eigenvalue statistics				
No. of CE(s).	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.7660	53.753	38.331	0.000
At most 1 *	0.6108	34.924	32.118	0.022
At most 2	0.3821	17.816	25.823	0.391
At most 3	0.2427	10.290	19.387	0.587
At most 4	0.143	5.727	12.517	0.495
2nd model				
Trace statistics				
No. of CE(s).	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.692	100.258	79.341	0.000
At most 1 *	0.592	55.392	55.245	0.048
At most 2	0.289	21.324	35.010	0.620
At most 3	0.192	8.317	18.397	0.650
At most 4	0.004	0.188	3.841	0.664
Maximum Eigenvalue statistics				
No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.692	44.866	37.163	0.005
At most 1 *	0.592	34.067	30.815	0.019
At most 2	0.289	13.006	24.252	0.677
At most 3	0.1925	8.129	17.147	0.588
At most 4	0.0049	0.188	3.841	0.664
3rd model				
Trace statistics				
No. of CE(s).	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.696	120.327	88.803	0.000
At most 1 *	0.621	75.021	63.876	0.004
At most 2	0.376	38.104	42.915	0.139
At most 3	0.316	20.128	25.872	0.219
At most 4	0.138	5.649	12.517	0.506
Maximum Eigenvalue statistics				
No. of CE(s).	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.696	45.305	38.331	0.006
At most 1 *	0.621	36.917	32.118	0.012
At most 2	0.376	17.975	25.823	0.379
At most 3	0.316	14.478	19.387	0.223
At most 4	0.138	5.649	12.517	0.506
4th model				
Trace statistics				
No. of CE(s).	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.796	137.310	88.803	0.000
At most 1 *	0.597	78.468	63.876	0.001
At most 2 *	0.510	44.754	42.915	0.032
At most 3	0.289	18.324	25.872	0.322
At most 4	0.142	5.680	12.517	0.502
Maximum Eigenvalue statistics				
No. of CE(s).	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.796	58.842	38.331	0.000
At most 1 *	0.597	33.713	32.118	0.031
At most 2 *	0.510	26.430	25.823	0.041
At most 3	0.289	12.644	19.387	0.357
At most 4	0.142	5.680	12.517	0.502
5th model				
Trace statistics				
No. of CE(s).	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.7839	128.391	88.803	0.000
At most 1 *	0.5423	71.700	63.876	0.009
At most 2	0.3810	42.780	42.915	0.051

At most 3	0.3498	25.030	25.872	0.063
At most 4	0.2180	9.098	12.517	0.174
Maximum Eigenvalue statistics				
No. of CE(s).	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.783	56.690	38.331	0.000
At most 1	0.542	28.920	32.118	0.117
At most 2	0.381	17.749	25.823	0.396
At most 3	0.349	15.932	19.387	0.148
At most 4	0.2180	9.098	12.517	0.174

Note: * Denotes rejection of the hypothesis at the 0.05 level.

**MacKinnon-Haug-Michelis p-values.

Phillips and Hansen (1990) used semi-parametric correction to circumvent the issue produced by the long-run correlation between the cointegrating equation and stochastic regressors innovations. This Phillips and Hansen method is known as Fully Modified Ordinary Least Squares (FMOLS). It provides an asymptotically unbiased and efficient estimator letting for the standard Wald test involving asymptotic Chi-square statistical inference (Hansen, 1992). Similar to FMOLS, Park (1992) proposed a model known as Canonical Cointegration Regression (CCR). CCR employs stationary conversion of the data to attain the least square estimate to remove the long-run reliance between cointegrating equations as well as stochastic regressor shocks. The CCR conversion asymptotically removes endogeneity produced via the long-run cointegrating equation's correlation and regressor shocks (Lee & Xuan, 2019). If estimators are systematically corrected, the asymptotic property is not disturbed by endogeneity or serial correlation (Montalvo, 1995).

Finally, Stock and Watson (1993) introduced an easy method for establishing asymptotically efficient estimators that can remove the reverse causality in a cointegrating framework. This approach is known as the Dynamic Ordinary Least Squares (DOLS) model. They consider leads and lags in the framework that asymptotically eliminate any possible bias resulting from endogeneity problems or serial correlation (Montalvo, 1995). Therefore, FMOLS, CCR, and DOLS provide efficient estimators that correct small sample bias, simultaneity bias, endogeneity problems, and serial correlation in the model. However, Montalvo (1995), among others, maintained that the DOLS model performs steadily better than the FMOLS and CCR methods. Overall, we are convinced that the use of these three models will provide a consistent and robust outcome. FMOLS, CCR, and DOLS models are suitable and appropriate for this small sample analysis.

4.2. Model Specification

To investigate the relationship between tax structure and income inequality in India, we use the following equations. The specified equations are presented in Equations 1, 2, 3, 4, and 5. Where Gini_disp_se stands for the measure of income inequality; TMTR_C&S stands for top marginal tax rate including cess and surcharge; PIT is the personal income tax (%TTR); CIT is the corporate income tax (%TTR); ED is the excise duty (%TTR); CD represents custom duty (%TTR); GDP_PC is the GDP per capita, reflecting a lower economic development; GDP_PCS is the GDP per capita squared, representing a higher economic development; MYS reflects the mean years of schooling, and ln represents the natural log. All data series have been converted into log forms.

$$\ln Gini_disp_se_t = \beta_0 + \beta_1 \ln TMTR_C\&S_t + \beta_2 \ln GDP_PC_t + \beta_3 \ln GDP_PCS_t + \beta_4 \ln MYS_t + \varepsilon_t \quad (1)$$

$$\ln Gini_disp_se_t = \beta_0 + \beta_1 \ln PIT_t + \beta_2 \ln GDP_PC_t + \beta_3 \ln GDP_PCS_t + \beta_4 \ln MYS_t + \varepsilon_t \quad (2)$$

$$\ln Gini_disp_se_t = \beta_0 + \beta_1 \ln CIT_t + \beta_2 \ln GDP_PC_t + \beta_3 \ln GDP_PCS_t + \beta_4 \ln MYS_t + \varepsilon_t \quad (3)$$

$$\ln Gini_disp_se_t = \beta_0 + \beta_1 \ln ED_t + \beta_2 \ln GDP_PC_t + \beta_3 \ln GDP_PCS_t + \beta_4 \ln MYS_t + \varepsilon_t \quad (4)$$

$$\ln Gini_disp_se_t = \beta_0 + \beta_1 \ln CD_t + \beta_2 \ln GDP_PC_t + \beta_3 \ln GDP_PCS_t + \beta_4 \ln MYS_t + \varepsilon_t \quad (5)$$

Where β_0 is the intercept, β_1 to β_4 are the coefficients of slope parameters, and ε_t is the stochastic error term. FMOLS, DOLS, and CCR models are estimated in Equations 1, 2, 3, 4, and 5. To reduce the influence of outliers in

our time series data, we transform all the variables into a natural logarithmic form, represented by $\ln$. The same number of control variables is used in each equation.

4.3. Coefficient Sign Involving Theoretical Link

The main variable of interest: The TMTR is a measure of progressivity of personal income tax. The higher the TMTR, the greater will be the burden on the high-income class and the lower the burden will be on the low-income class. Thus, income inequality will be reduced. Hence, we predict that $\beta_1 < 0$ in Equation 1. As this study inspects the tax structure's effect on income inequality, our variables of interest are individual tax instruments. Personal income tax (PIT) is generally a progressive tax because the tax burden is greater on the high-income class than on the low-income class. So, the more revenue that is raised from personal income tax, the lower income inequality will be. Hence, it assumed that $\beta_1 < 0$ in Equation 2. Corporate income tax (CIT) is believed to be a progressive tax if the tax falls on capital income earners. However, in open economies, easy and seamless movement of capital from one country to another country shifts the corporate tax burden to labor income. Since labor income recipients naturally have lower average incomes than capital income recipients, CIT leads to higher income inequality (Harberger, 1995). Thus, we predict that $\beta_1 > / < 0$ in Eq. 3. Excise duty (ED) is expected to have a positive effect on income inequality. Hence, this study assumed that $\beta_1 > 0$ in Eq. 4. Finally, customs duty (CD) is positively related to income inequality due to its regressive nature. So, we assume that $\beta_1 > 0$ in Equation 5.

Control variables of interest: We have used some control variables in the models; hence, determining their sign is also important. However, the sign of the control variable may vary with the region. We only assign signs based on the general view provided by the extant literature. Kuznets (1955) speculated that inequality intensifies first and then declines after a certain point, owing to economic development. This pattern of income inequality relating to economic development over time is referred to as the Kuznets Inverted-U hypothesis. To capture the Kuznets hypothesis, we used GDP per capita (GDP_PC) to represent a low level of economic development and GDP per capita squared (GDP_PCS) to indicate a higher level of economic development. If $\beta_2 > 0$ and $\beta_3 < 0$, then an inverted-U-shaped or Kuznets hypothesis holds.

Human capital significantly affects income inequality. If the level of human capital increases, the study expects that it may influence income inequality, as the distribution of income depends on the level and distribution of schooling in the population (Coady & Dizioli, 2018). Thus, we used mean years of schooling (MYS) to capture human capital. It assumed that $\beta_4 < 0$, indicating that MYS reduces income inequality. However, education is poorly distributed in India, and thus the sign of β_4 may be reversed. The control variables remain the same in all equations; thus, the signs of the coefficients for the control variables take the same interpretation.

4.4. Estimation Process

All variables are $I(1)$, which is another point that suggests the use of cointegrating models such as FMOLS, CCR, and DOLS. We estimate the equations mentioned above using EViews 9. For optimum lag selection, we used Akaike Information Criteria (AIC) for estimations. Notably, the long-run covariance is vital, involving time-series conclusions on heteroskedasticity and autocorrelation consistent (HAC) standard error. Long-run covariance is often used for non-stationary time-series analysis under FMOLS, CCR, and DOLS frameworks. To estimate long-run covariance under FMOLS and CCR frameworks, we consider prewhitening with optimum lag selected by AIC and a Bartlett Kernel, Newey-West fixed bandwidth of 4.0000. We estimate the DOLS model with a fixed lead and lag specification instead of letting AIC select lead and lag. This limitation is due to the low number of observations in each data series, which prevent us from considering AIC for lead and lag selection. We used one lead and one lag for the estimation of the DOLS model. We also incorporate HAC standard error and covariance estimated by prewhitening with optimum lag one and a Bartlett Kernel, Newey-West fixed bandwidth of 4.0000 under the DOLS framework. The empirical results are presented in the following section.

5. RESULTS AND DISCUSSION

Table 6 displays the outcomes of the FMOLS method in five different equations associated with the top marginal tax rate and four tax ratios as explanatory variables. As per the hypothesis, all the main explanatory variables of interest show the expected signs in relation to income inequality as measured by the Gini coefficient. The results indicate that TMTR_C&S, PIT/TTR, and CIT/TTR have a negative association with the Gini coefficient.

Table 6. The results of the FMOLS model.

Dependent Variable: lnGini_disp_se					
Model: Fully Modified Least Squares (FMOLS)					
Variable	Coefficient (t-statistic) [P-value]	Coefficient (t-statistic) [P-value]	Coefficient (t-statistic) [P-value]	Coefficient (t-statistic) [P-value]	Coefficient (t-statistic) [P-value]
(1st)	(2nd)	(3rd)	(4th)	(5th)	(6th)
lnTax structure	-0.100*** (-3.477) [0.001] <i>TMTR_C&S</i>	-0.004 (-0.496) [0.622] <i>PIT/TTR</i>	-0.014 (-0.500) [0.620] <i>CIT/TTR</i>	0.002 (0.124) [0.901] <i>ED/TTR</i>	0.036*** (3.474) [0.001] <i>CD/TTR</i>
lnGDP_PC	-14.781*** (-21.900) [0.000]	-7.132*** (-10.790) [0.000]	-7.639*** (-6.676) [0.000]	-6.865*** (-9.369) [0.000]	-7.988*** (-15.863) [0.000]
lnGDP_PCS	0.674*** (22.480) [0.000]	0.326*** (11.241) [0.000]	0.347*** (6.926) [0.000]	0.311*** (9.687) [0.000]	0.367*** (16.435) [0.000]
lnMYS	0.431*** (8.192) [0.000]	0.208*** (3.872) [0.000]	0.295*** (3.311) [0.0022]	0.269*** (4.049) [0.000]	0.226*** (5.227) [0.000]
C	80.711*** (21.33) [0.000]	38.752*** (10.558) [0.000]	41.653*** (6.593) [0.000]	37.469*** (9.177) [0.000]	43.049*** (15.550) [0.000]
R-square	0.385	0.665	0.667	0.697	0.694

Note: *** represents significance at the 1% level.

ED/TTR and CD/TTR show a positive association with the Gini coefficient. For example, the 2nd column in Table 6 shows that the coefficient of TMTR_C&S is -0.100, reflecting that a 1% increase in TMTR reduces income inequality by 0.100%. When TMTR increases, the after-tax income of the top income groups declines comparatively more than that of low-income groups (Sammartino, 2017). Our results are consistent with Aaron (2015) and Gale, Kearney, and Orszag (2015).

The impact of customs duty on income inequality is presented in the first row of the 6th column in Table 6. The coefficient of CD is 0.036, suggesting that a 1% increase in the share of CD in total tax revenue (TTR) increases income inequality by 0.036%. CD is regressive by nature. Hence, a higher CD raises income inequality because more impoverished individuals spend more of their income on consumption than the more affluent section of society and bear a relatively higher CD burden.

Though PIT, CIT, and ED all show the expected signs as per the hypothesis, they do not affect income inequality significantly. It can be concluded that although PIT and CIT can reduce income inequality, they did not affect income inequality significantly during the study period. Similarly, though excise duty increases income inequality due to its regressive nature, it did not affect income inequality during the study period.

Apart from our variable of interest, we consider certain control variables in the model; hence, determining their relationship to income inequality is also essential. The result shows that Kuznets's hypothesis does not prevail for the Indian economy. It demonstrates that the nexus of Indian economic development and inequality is characterized by decreased inequality at a lower level of economic development and significantly increasing inequality at a higher level of economic development, as shown by GDP_PC and GDP_PCS in Table 6. All models produce similar

results. The signs of GDP per capita and GDP per capita squared are negative and positive, respectively. Both signs are statistically significant. This implies that income inequality declines at a low level of development and increases at a higher level of economic development. Furthermore, human capital as measured by mean years of schooling (MYS) implies that higher levels of education lead to increased income inequality in India. This is because 80% of the population receives a poor quality of education in India. Only the top income classes are able to provide a high-quality education to their sons and daughters. Considering the number of factors involved, such as rural-urban, gender, geographical region, cast group, and finally economic status, it is clear that some receive a poor quality of education compared to their counterparts. Therefore, education attainment inequality can be considered one of the causes of rising income inequality in India. Nevertheless, the FMOLS model suggests that the explanatory variables poorly explain the dependent variables, as indicated by R^2 . Therefore, we proceed to test more efficient models, such as DOLS. According to Montalvo (1995), FMOLS is less efficient than DOLS.

Table 7 demonstrates the results obtained from the estimated DOLS model. Except for excise duty, the DOLS model provides results similar to those obtained from the FMOLS model. However, there are two fundamental differences in the results of the two models. First, the DOLS model provides a higher magnitude relationship between the independent variables used and income inequality (dependent variable). Second, the values in each equation are high in the DOLS model compared to the FMOLS model, indicating that the model is well specified. This is apparent because the DOLS model considers one lag and one lead. Aside from the coefficient of excise duty, the sign of each coefficient is the same in both models (see Tables 6 and 7). This demonstrates that our results are not biased due to the small explanatory power of independent variables under the FMOLS model. We used one lead and one lag to estimate the DOLS model, which specifies well for our data set. There is no significant difference in the results of the FMOLS and DOLS models.

Table 7. Results of DOLS.

Dependent variable: ln Gini disp _{se} Model: Dynamic Least Squares (DOLS)					
Variable	Coefficient (t-statistic) [P-value]	Coefficient (t-statistic) [P-value]	Coefficient (t-statistic) [P-value]	Coefficient (t-statistic) [P-value]	Coefficient (t-statistic) [P-value]
(1 st)	(2 nd)	(3 rd)	(4 th)	(5 th)	(6 th)
lnTax structure	-0.207*** (-2.795) [0.011] <i>TMTR_C&S</i>	-0.011 (-0.756) [0.458] <i>PIT/TTR</i>	-0.014 (-0.410) [0.685] <i>CIT/TTR</i>	-0.016 (-0.580) 0.568 <i>ED/TTR</i>	0.083*** (2.913) [0.008] <i>CD/TTR</i>
lnGDP_PC	-9.515*** (-5.769) [0.000]	-6.797*** (-2.775) [0.011]	-6.454*** (-4.679) [0.000]	-7.647*** (-11.735) [0.000]	-7.368** (2.543) [0.0193]
lnGDP_PCS	0.428*** (5.818) [0.000]	0.308*** (2.775) [0.011]	0.291*** (4.710) [0.000]	0.346*** (12.157) [0.000]	0.335*** (2.573) [0.018]
ln MYS	0.275** (2.350) [0.029]	0.276 (1.821) [0.083]	0.317*** (3.557) [0.002]	0.321*** (5.207) [0.000]	0.283 (1.479) 0.1547
C	53.058*** (5.764) [0.000]	37.051*** (2.790) [0.011]	35.318*** (4.702) (0.000)	41.701*** (11.190) 0.000	39.735** (2.513) [0.020]
R-square	0.830	0.7997	0.837	0.888	0.842647

Note: *** and ** represent significance at the 1% and 5% level, respectively.

6. ROBUSTNESS CHECK

The main results and discussion section presented the empirical results obtained from two models: FMOLS and DOLS. Except for the coefficient sign of excise duty, the two models provide consistent results in terms of their coefficient signs. However, the DOLS model demonstrates a higher magnitude relationship between income

inequality and tax variables than the FMOLS model. This discrepancy between the two models compels us to further check the consistency and robustness of the results using the CCR model. The results obtained from CCR are presented in Table 8. The CCR estimation results are very similar to those of DOLS. However, the CCR model shows a lower magnitude relationship between income inequality and all explanatory variables. All other results remain unchanged. All three models demonstrate that the top marginal tax rate (TMTR) reduces income inequality significantly, whereas CD increases income inequality significantly. The impacts of PIT, CIT, and ED on income distribution remain insignificant in India. The results also confirmed that Kuznets' hypothesis does not hold in India. Furthermore, increased human capital aggravates income inequality in India. Finally, our results are robust with alternative modeling.

Table 8. Results of the CCR model.

Dependent Variable: $\ln\text{Gini_disp_se}$ Model: Canonical Cointegrating Regression (CCR).					
Variable	Coefficient (t-statistic) [P-value]	Coefficient (t-statistic) [P-value]	Coefficient (t-statistic) [P-value]	Coefficient (t-statistic) [P-value]	Coefficient (t-statistic) [P-value]
(1 st)	(2 nd)	(3 rd)	(4 th)	(5 th)	(6 th)
$\ln\text{Tax structure}$	-0.090*** (-2.609) [0.013] <i>TMTR_C&S</i>	-0.004 (-0.541) [0.591] <i>PIT/TTR</i>	-0.001 (-0.044) [0.964] <i>CIT/TTR</i>	-0.005 (-0.264) [0.793] <i>ED/TTR</i>	0.024*** (2.762) [0.009] <i>CD/TTR</i>
$\ln\text{GDP_PC}$	-7.931*** (-11.948) [0.000]	-5.640*** (-8.499) [0.000]	-6.919*** (-4.575) [0.000]	-6.820*** (-10.290) [0.000]	-6.599*** (-17.045) [0.000]
$\ln\text{GDP_PCS}$	0.359*** (12.341) [0.000]	0.258*** (8.999) [0.000]	0.313*** (4.752) 0.000	0.309*** (10.954) [0.000]	0.302*** (18.056) [0.000]
$\ln\text{MYS}$	0.257*** (4.526) [0.000]	0.162*** (2.745) [0.009]	0.271** (2.321) [0.026]	0.266*** (3.873) [0.000]	0.216478 (5.655596) 0.0000
C	43.693*** (11.627) [0.000]	30.593*** (8.249) [0.000]	37.788*** (4.515) [0.000]	37.282*** (9.814) [0.000]	35.659*** (16.471) [0.000]
R-square	0.663	0.628	0.675	0.697	0.711

Note: *** and ** represents significance at the 1% and 5% level, respectively.

7. CONCLUSION

Even before the Covid-19 pandemic, income inequality was high in India. The pernicious impact of Covid-19 added fuel to the fire by causing a reduction in the share of income held by marginalized sections of society. The high level of income inequality may lead to a substantial loss of human development and economic performance in India. Hence, rigorous macroeconomic policies are urgently required to ameliorate income distribution in India. Taxation is one of the conventional and direct policies to bring about income redistribution. In this context, we sought to answer the following questions. Do conventional prescriptions of taxation affect income inequality in India? Does taxation improve or worsen income distribution in India? Which tax parameter improves income distribution? This analysis has addressed these questions. To the best of our knowledge, no single analysis involving India has previously examined the effects of tax structure on income inequality. Against this background, the present study has scrutinized the effects of tax structure on income inequality in the Indian context.

Using a time-series dataset from 1980 to 2019 and employing the robust time-series techniques of FMOLS, DOLS, and CCR, we have estimated the relationship between individual tax instruments and income inequality as measured by the standardized Gini coefficient of household disposable income. The empirical exercises have shown that the TMTR reduces income inequality, whereas CD significantly aggravates income inequality in India. The results confirm that PIT, CIT, and ED do not significantly affect income inequality. Thus, the conventional

prescription of using taxation to redistribute income in India only works if TMTR increases and no other taxes significantly increase income inequality. Moreover, Kuznets' hypothesis was shown not to hold in the case of India. Finally, the results also corroborate that human capital increases income inequality in India. Given these findings, the present study suggests that increasing the top marginal tax rate (TMTR) can reduce income inequality in India. To promote the redistributive effect of potential taxation, the Indian government needs to switch from a regressive tax structure to a progressive tax structure by increasing TMTR and reducing CD. The government should balance tax revenue receipts by imposing higher taxes on the rich through progressive personal income tax and lower taxes on the poor by cutting consumption taxes such as excise duty and customs duty.

Moreover, the results show that a rise in current economic development, as measured in GDP per capita, improves income distribution. Thus, the Government of India should adopt comprehensive macroeconomic policies that encourage inclusive growth and improve income distribution. Human capital captured by mean years of schooling shows that an increase in income inequality can be attributed to the unequal distribution of quality education. Therefore, quality education for all is the need of the hour, not only to reduce income inequality but also to benefit sustainable economic growth in India. The present analysis has only considered the long-run relationship between tax variables and income inequality and has ignored the short-run relationship between the two. Future research could consider the short-run relationship between tax variables and income inequality in India.

Funding: This study received no specific financial support.

Competing Interests: The authors declare that they have no competing interests.

Authors' Contributions: All authors contributed equally to the conception and design of the study.

REFERENCES

- Aaron, H. (2015). *Can taxing the rich reduce inequality? You bet it can*: Economic Studies at The Brookings Institution.
- Aggarwal, P. K. (1990). An empirical analysis of redistributive impact of the personal income tax: A case study of India. Working Paper No. 7. National Institute of Public Finance and Policy, New Delhi.
- Arltova, M., & Fedorova, D. (2016). Selection of unit root test on the basis of length of the time series and value of AR (1) parameter. *Statistika-Statistics and Economy Journal*, 96(3), 47-64.
- Atkinson, A. B., & Stiglitz, J. (1976). The design of tax structure: Direct versus indirect taxation. *Journal of Public Economics*, 6(1-2), 55-75. Available at: [https://doi.org/10.1016/0047-2727\(76\)90041-4](https://doi.org/10.1016/0047-2727(76)90041-4).
- Bird, R. M., & Zolt, E. M. (2013). Taxation and inequality in the Americas: Changing the fiscal contract? International center for public policy working paper series. Paper No. 50. Andrew Young School of Policy Studies, Georgia State University, GA.
- Burman, L. E. (2013). Taxes and inequality. *Tax Law Review*, 66, 563-592.
- Cevik, S., & Correa-Caro, C. (2015). Growing (un) equal: Fiscal policy and income inequality in China and BRIC+. *Journal of the Asia Pacific Economy*, 25(4), 634-653. Available at: <https://doi.org/10.1080/13547860.2019.1699985>.
- Chancel, L., Piketty, T., Saez, E., & Zucman, G. (2022). World inequality report 2022: World inequality lab. Retrieved from: <https://bibliotecadigital.ccb.org.co/handle/11520/27510>.
- Chancel, L., & Piketty, T. (2019). Indian income inequality, 1922-2015: From British Raj to Billionaire Raj? *Review of Income and Wealth*, 65, S33-S62. Available at: <https://doi.org/10.1111/roiw.12439>.
- Ciminelli, G., Ernst, E., Merola, R., & Giuliodori, M. (2019). The composition effects of tax-based consolidation on income inequality. *European Journal of Political Economy*, 57, 107-124. Available at: <https://doi.org/10.1016/j.ejpoleco.2018.08.009>.
- Coady, D., & Dizioli, A. (2018). Income inequality and education revisited: Persistence, endogeneity and heterogeneity. *Applied Economics*, 50(25), 2747-2761. Available at: <https://doi.org/10.1080/00036846.2017.1406659>.
- Cremer, H., Pestieau, P., & Rochet, J.-C. (2001). Direct versus indirect taxation: The design of the tax structure revisited. *International Economic Review*, 42(3), 781-800. Available at: <https://doi.org/10.1111/1468-2354.00133>.

- Duncan, D., & Peter, S. K. (2016). Unequal inequalities: Do progressive taxes reduce income inequality? *International Tax and Public Finance*, 23(4), 762-783. Available at: <https://doi.org/10.1007/s10797-016-9412-5>.
- Engle, R. F., & Granger, C. W. J. (1987). Co-integration and error correction: Representation, estimation, and testing. *Econometrica*, 55(2), 251-276. Available at: <https://doi.org/10.2307/1913236>.
- Gale, W. G., Kearney, M. S., & Orszag, P. R. (2015). Would a significant increase in the top income tax rate substantially alter income inequality? *Economic Studies at Brookings*, 3(7), 1-4.
- García-Peñalosa, C., & Turnovsky, S. J. (2011). Taxation and income distribution dynamics in a neoclassical growth model. *Journal of Money, Credit and Banking*, 43(8), 1543-1577. Available at: <https://doi.org/10.1111/j.1538-4616.2011.00458.x>.
- Guillaud, E., Olckers, M., & Zemmour, M. (2017). Four levers of redistribution: The impact of tax and transfer systems on inequality reduction.
- Hanni, M., Martner, R., & Podesta, A. (2015). The redistributive potential of taxation in Latin America. *CEPAL Review*, 16, 7-26. Available at: <http://dx.doi.org/10.18356/4bfdcb5d-en>.
- Hansen, B. E. (1992). Tests for parameter instability in regressions with I(1) processes. *Journal of Business and Economic Statistics*, 10(3), 321-335. Available at: <https://doi.org/10.1080/07350015.1992.10509908>.
- Harberger, A. C. (1995). The ABCs of corporation tax incidence: Insights into the open-economy case. *Tax Policy and Economic Growth*, 51-73.
- Heisz, A., & Murphy, B. (2016). The role of taxes and transfers in reducing income inequality. *Income Inequality: The Canadian Story*, 5, 435-477.
- Immervoll, H., Levy, H., Nogueira, J. R., O' Donoghue, C., & De Siqueira, R. B. (2006). The impact of Brazil's tax-benefit system on inequality and poverty. IZA Discussion Papers. No. 2114. Institute for the Study of Labour (IZA), Bonn.
- Iosifidi, M., & Mylonidis, N. (2017). Relative effective taxation and income inequality: Evidence from OECD countries. *Journal of European Social Policy*, 27(1), 57-76. Available at: <https://doi.org/10.1177/0958928716672182>.
- Ivaškaitė-Tamošiūnė, V., Maestri, V., Malzubris, J., Poissonnier, A., & Vandeplas, A. (2018). The effect of taxes and benefits reforms on poverty and inequality in Latvia. Directorate General Economic and Financial Affairs (DG ECFIN), European commission, ECONOMIC BRIEF 039. Retrieved from: https://ec.europa.eu/info/sites/default/files/economy-finance/eb039_en.pdf.
- Jackobsson, U. (1976). On the measurement of the degree of progression. *Journal of Public Economics*, 5(1-2), 161-168. Available at: [https://doi.org/10.1016/0047-2727\(76\)90066-9](https://doi.org/10.1016/0047-2727(76)90066-9).
- Jaumotte, F., & Papageorgiou, S. C. L. (2008). Rising income inequality: Technology, or trade and financial globalization? *IMF WP*, 8, 185.
- Johansen, S. (1988). Statistical analysis of cointegration vectors. *Journal of Economic Dynamics and Control*, 12(2-3), 231-254. Available at: [https://doi.org/10.1016/0165-1889\(88\)90041-3](https://doi.org/10.1016/0165-1889(88)90041-3).
- Kakwani, N. C. (1977). Measurement of tax progressivity: An international comparison. *The Economic Journal*, 87(345), 71-80. Available at: <https://doi.org/10.2307/2231833>.
- Kaldor, N. (1963). Will underdeveloped countries learn to tax? *Foreign Affairs*, 41, 410-419. Available at: <https://doi.org/10.2307/20029626>.
- Kuznets, S. (1955). Economic growth and income inequality. *The American Economic*, 45(1), 1-28.
- Lambert, P. J. (1993). Inequality reduction through the income tax. *Economica*, 60(239), 357-365. Available at: <https://doi.org/10.2307/2554857>.
- Lee, J. W., & Xuan, Y. (2019). Effects of technology and innovation management and total factor productivity on the economic growth of China. *The Journal of Asian Finance, Economics, and Business*, 6(2), 63-73. Available at: <http://dx.doi.org/10.13106/jafeb.2019.vol6.no2.63>.
- Mahendra, D. S. (2018). Inequality, employment and public policy. Working Paper No. 2018-003 Indira Gandhi Institute of Development Research, Mumbai.

- Mahon, J. (2009). *Tax reforms and income distribution in Latin America*. Paper presented at the XXVIII Congress of the Latin American Studies Association, Rio De Janeiro, 11-14 June 2009.
- Martinez-Vazquez, J., Moreno-Dodson, B., & Vulovic, V. (2012). The impact of tax and expenditure policies on income distribution: Evidence from a large panel of countries. International Center for Public Policy Working Paper No.12-25, Andrew Young School of Policy Studies, Georgia state University, GA.
- Martorano, B. (2016). Taxation and inequality in developing countries: Lessons from the recent experience of Latin America. WIDER Working Paper 2016/98. Retrieved from: <http://dx.doi.org/10.35188/UNU-WIDER/2016/142-0>.
- Martorano, B. (2018). Taxation and inequality in developing countries: Lessons from the recent experience of Latin America. *Journal of International Development*, 30(2), 256-273. Available at: <http://dx.doi.org/10.1002/jid.3350>.
- Montalvo, J. G. (1995). Comparing cointegrating regression estimators: Some additional Monte Carlo results. *Economics Letters*, 48(3-4), 229-234. Available at: [https://doi.org/10.1016/0165-1765\(94\)00632-c](https://doi.org/10.1016/0165-1765(94)00632-c).
- Musgrave, R. A. (1959). *The theory of public finance*. New York: McGraw Hill.
- Musgrave, R. A., & Thin, T. (1948). Income tax progression, 1929-48. *Journal of Political Economy*, 56(6), 498-514. Available at: <https://doi.org/10.1086/256742>.
- Nayak, P. B., & Paul, S. (1989). Personal income tax in India: Alternative structures and their redistributive effects. *Economic and Political Weekly*, 24, 2779-2783.
- Oxfam, R. (2021). The inequality virus - global report. Retrieved from: <https://oxfamilibrary.openrepository.com/bitstream/handle/10546/621149/bp-the-inequality-virus-summ-250121-en.pdf>.
- Park, J. (1992). Canonical cointegrating regressions. *Econometrica*, 60(1), 119-143. Available at: <https://doi.org/10.2307/2951679>.
- Phillips, P. C., & Hansen, B. E. (1990). Statistical inference in instrumental variables regression with I (1) processes. *The Review of Economic Studies*, 57(1), 99-125. Available at: <https://doi.org/10.2307/2297545>.
- Sammartino, F. (2017). Taxes and income inequality, tax policy center: Urban Institute and Brookings Institution. Retrieved from: https://www.taxpolicycenter.org/sites/default/files/publication/138871/salt_3.pdf.
- Santiago, R., Fuinhas, J. A., & Marques, A. C. (2019). Income inequality, globalization, and economic growth: A panel vector autoregressive approach for Latin American countries. The extended energy-growth nexus. *Theory and Empirical Applications*, 57-96. Available at: <https://doi.org/10.1016/B978-0-12-815719-0.00003-6>.
- Sarkodie, S. A., & Adams, S. (2020). Electricity access, human development index, governance and income inequality in Sub-Saharan Africa. *Energy Reports*, 6, 455-466. Available at: <https://doi.org/10.1016/j.egyr.2020.02.009>.
- Solow, R. M. (1956). A contribution to the theory of economic growth. *The Quarterly Journal of Economics*, 70(1), 65-94.
- Solt, F. (2016). The standardized world income inequality database. *Social Science Quarterly*, 97(5), 1267-1281. Available at: <https://doi.org/10.1111/ssqu.12295>.
- Stiglitz, J. E. (2012). Macroeconomic fluctuations, inequality and human development. *Journal of Human Development and Capabilities*, 13(1), 31-58. Available at: <http://dx.doi.org/10.1080/19452829.2011.643098>.
- Stock, J. H., & Watson, M. W. (1993). A simple estimator of cointegrating vectors in higher order integrated systems. *Econometrica*, 61(4), 783-820. Available at: <https://doi.org/10.2307/2951763>.
- Swagel, P., & Boruchowicz, C. (2017). Policies to address income inequality and increase economic opportunities for low-income families: George Mason University, Mercatus Center. Retrieved from: <https://utahpolicy.com/wp-content/uploads/2019/06/mercatus-swagel-tax-inequality-v1.pdf>.
- Swan, T. W. (1956). Economic growth and capital accumulation. *Economic Record*, 32(2), 334-361.

Views and opinions expressed in this article are the views and opinions of the author(s), Asian Development Policy Review shall not be responsible or answerable for any loss, damage or liability etc. caused in relation to/arising out of the use of the content.

Certificate



55th Annual Conference of The Indian Econometric Society (TIES)

Mumbai School of Economics & Public Policy, University of Mumbai & National Institute of Securities Markets

8th, 9th and 10th January, 2019

This is to certify that Dillip Kumar Muduli

*has presented a paper titled TAX STRUCTURE AND ECONOMIC GROWTH IN GENERAL CATEGORY STATES IN INDIA: A
PANAL ARDAL APPROACH*

Co-authored with Nityasundar Manik

*at the 55th Annual Conference of The Indian Econometric Society (TIES) held during 8-10 January, 2019 at the NISM Campus,
Patalganga.*

A blue ink signature of Dr. Neeraj Hatekar.

Dr. Neeraj Hatekar

Local Organizing Secretary

A blue ink signature of Dr. Latha Chari.

Dr. Latha Chari

Local Organizing Secretary

A blue ink signature of Dr. K. Shanmugan.

Dr. K. Shanmugan

Convener, Programme Committee, TIES



**International Conference on Contemporary Issues in Economics
(ICCIE 2022)**



Certificate of Presentation

**This is to certify that
Mr. Dillip K. Muduli**

University of Hyderabad

presented a paper titled

Nexus Between Tax Structure and Income Inequality in India.

**at "International Conference on Contemporary Issues in Economics" organized by XIM
University in association with Indian Council of Social Science Research held on 4th, 5th &
7th February 2022**

Tanmoy Das
Mahamitra Das

Conference Coordinators

[Signature]
Director, ERC, ICSSR

[Signature]
Registrar, XIM University

Macroeconomic Effects of Taxation in Indian Economy: An Empirical Study

by Dillip Kumar Muduli

Submission date: 07-Dec-2022 11:40AM (UTC+0530)

Submission ID: 1974033451

File name: Dillip_Kumar_Muduli.pdf (2.1M)

Word count: 31053

Character count: 161943

Macroeconomic Effects of Taxation in Indian Economy: An Empirical Study

ORIGINALITY REPORT

28%
SIMILARITY INDEX

26%
INTERNET SOURCES

9%
PUBLICATIONS

3%
STUDENT PAPERS

PRIMARY SOURCES

Overall Similarity Index = 28 - 19 = 9% 7/12/22

1 archive.aessweb.com
Internet Source

This publication is by the student

2 store.ectap.ro
Internet Source

3 Submitted to University of Durham
Student Paper

4 www.econ.cmu.ac.th
Internet Source

5 Deepak Kumar Behera, Umakant Dash.
"Short-Run and Long-Run Income Elasticity of
Healthcare Expenditure in India: Role of
Domestic Revenue and Public Debt", Research
Square, 2020
Publication

6 Metri Favez Mdanat, Manhal Shotar, Ghazi
Samawi, Jean Mulot, Talah S. Arabiyat,
Mohammed A. Alzyadat. "Tax structure and
economic growth in Jordan, 1980-2015",
EuroMed Journal of Business, 2018
Publication

*AKH K hary
(Supervised)*

7	irepos.unijos.edu.ng Internet Source	<1 %
8	Submitted to University of Hyderabad, Hyderabad Student Paper	<1 %
9	Submitted to Higher Education Commission Pakistan Student Paper	<1 %
10	mpra.ub.uni-muenchen.de Internet Source	<1 %
11	Submitted to Asia Pacific University College of Technology and Innovation (UCTI) Student Paper	<1 %
12	Mohamed Ariff, Yeah Kim Leng (Eds). "Malaysia's Taxation System: Contemporary Practices, Issues and Future Direction", Malaysia's Taxation System, 2020 Publication	<1 %
13	Yadawananda Neog, Achal Kumar Gaur. "Tax structure and economic growth in India: insights from ARDL model", Indian Growth and Development Review, 2020 Publication	<1 %
14	vital.seals.ac.za:8080 Internet Source	<1 %
15	wiredspace.wits.ac.za	

<1 %

16

Ruba A. Aljarallah, Andrew Angus. "Dilemma of Natural Resource Abundance: A Case Study of Kuwait", SAGE Open, 2020

Publication

<1 %

17

"Current Issues in the Economy and Finance of India", Springer Science and Business Media LLC, 2018

Publication

<1 %

18

Submitted to Universiti Putra Malaysia

Student Paper

<1 %

19

oer.sau.edu.ng

Internet Source

<1 %

20

Varsha S. Kulkarni, Raghav Gaiha. "Beyond Piketty: A new perspective on poverty and inequality in India", Journal of Policy Modeling, 2021

Publication

<1 %

21

Submitted to Deakin University

Student Paper

<1 %

22

Tax Policy in the Nordic Countries, 1998.

Publication

<1 %

23

dspace.cuni.cz

Internet Source

<1 %

24	waifem-cbp.org Internet Source	<1 %
25	Turgut Tursoy, Faisal Faisal. "Validity of F-H hypothesis in small isolated island economy: an application of the combined cointegration approach", Asia-Pacific Journal of Accounting & Economics, 2017 Publication	<1 %
26	www.jetir.org Internet Source	<1 %
27	Submitted to University of Lancaster Student Paper	<1 %
28	ebin.pub Internet Source	<1 %
29	Arjun Kumar Dahal. "Tax-to-GDP Ratio and the Relation of Tax Revenue with GDP: Nepalese Perspective", Researcher: A Research Journal of Culture and Society, 2020 Publication	<1 %
30	www.ijrbi.in Internet Source	<1 %
31	Chung Tin Fah. "Designing Malaysia's Tax Structure to Achieve Higher Income Country", International Journal of Accounting and Financial Reporting, 2019 Publication	<1 %

32	Dr. Md. Iqbal Hossain, Dr. Mohammad Nayeem Abdullah. "Tax Structure and Its Relationship with Economic Growth – Bangladesh Context", Business Perspective Review, 2022 Publication	<1 %
33	Katarzyna Bilicka. "Are financing constraints binding for investment? Evidence from a natural experiment", Journal of Economic Behavior & Organization, 2020 Publication	<1 %
34	jurnal.ugm.ac.id Internet Source	<1 %
35	uir.unisa.ac.za Internet Source	<1 %
36	www.econstor.eu Internet Source	<1 %
37	Lira P. Sekantsi, Sayed Timuno. "Electricity Consumption in Botswana: the Role of Financial Development, Industrialisation and Urbanization", Review of Economic and Business Studies, 2017 Publication	<1 %
38	razyane.ir Internet Source	<1 %
39	www.macrothink.org Internet Source	

<1 %

40

Guo, J.T.. "Tax Policy and Stability in a Model with Sector-Specific Externalities", Review of Economic Dynamics, 200101

Publication

<1 %

41

Submitted to Sankalchand Patel University

Student Paper

<1 %

42

books.mec.biz

Internet Source

<1 %

43

Submitted to University of the West Indies

Student Paper

<1 %

44

etd.aau.edu.et

Internet Source

<1 %

45

Bowser, D.M.. "Guatemala: The economic burden of illness and health system implications", Health policy, 201105

Publication

<1 %

46

Submitted to The University of Manchester

Student Paper

<1 %

47

ir.jkuat.ac.ke

Internet Source

<1 %

48

saudijournals.com

Internet Source

<1 %

49

Karel Mertens, Morten O Ravn. "The Dynamic Effects of Personal and Corporate Income Tax Changes in the United States", American Economic Review, 2013

Publication

<1 %

50

Liton Chandra Voumik, Md. Hasanur Rahman, Md. Shaddam Hossain. "Investigating the subsistence of Environmental Kuznets Curve in the midst of economic development, population, and energy consumption in Bangladesh: imminent of ARDL model", Heliyon, 2022

Publication

<1 %

51

digital.sandiego.edu

Internet Source

<1 %

52

hdl.handle.net

Internet Source

<1 %

53

researchdirect.uws.edu.au

Internet Source

<1 %

54

Desislava Stoilova. "Tax structure and economic growth: Evidence from the European Union", Contaduría y Administración, 2017

Publication

<1 %

55

Submitted to University of Sydney

Student Paper

<1 %

56	cdn1.byjus.com Internet Source	<1 %
57	dokumen.pub Internet Source	<1 %
58	ia801608.us.archive.org Internet Source	<1 %
59	purehost.bath.ac.uk Internet Source	<1 %
60	Adire Simon Deng, Lucy Rono, Jane Sang. "Heuristics and the Performance of Financial Institutions in South Sudan", Modern Economy, 2020 Publication	<1 %
61	Gamze Öz Yalaman. "The Relationship Between Corporate Tax Rate and Economic Growth During the Global Financial Crisis: Evidence from a Panel VAR", European Journal of Government and Economics, 2019 Publication	<1 %
62	Liu, Yongzheng, and Jorge Martinez-Vazquez. "Growth-Inequality Tradeoff in the Design of Tax Structure: Evidence from a Large Panel of Countries : Growth-Inequality Tradeoff in Tax Design", Pacific Economic Review, 2015. Publication	<1 %

- | | | |
|----|--|------|
| 63 | Nwedeh Chukwuemeka Cosmas, Isaac Chitedze, Khaldoon A. Mourad. "An econometric analysis of the macroeconomic determinants of carbon dioxide emissions in Nigeria", Science of The Total Environment, 2019
Publication | <1 % |
| 64 | Submitted to University of Bradford
Student Paper | <1 % |
| 65 | Submitted to University of Hertfordshire
Student Paper | <1 % |
| 66 | docplayer.net
Internet Source | <1 % |
| 67 | etheses.whiterose.ac.uk
Internet Source | <1 % |
| 68 | www.ccsenet.org
Internet Source | <1 % |
| 69 | www.iosrjournals.org
Internet Source | <1 % |
| 70 | "Inequality, Poverty and Development in India", Springer Science and Business Media LLC, 2017
Publication | <1 % |
| 71 | Bruno Martorano. "Taxation and Inequality in Developing Countries: Lessons from the | <1 % |

Recent Experience of Latin America", Journal of International Development, 2018

Publication

72

Submitted to Birkbeck College

Student Paper

<1 %

73

Submitted to Eiffel Corporation

Student Paper

<1 %

74

Norman Gemmell, Joey Au. "Government size, fiscal policy and the level and growth of output: a review of recent evidence", Journal of the Asia Pacific Economy, 2013

Publication

<1 %

75

Submitted to Universiti Malaysia Perlis

Student Paper

<1 %

76

cpd.org.bd

Internet Source

<1 %

77

journals.francoangeli.it

Internet Source

<1 %

78

www.scholink.org

Internet Source

<1 %

Exclude quotes On

Exclude matches

< 14 words

Exclude bibliography On