

India Studies in Business and Economics

Barun Deb Pal  
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Sanjib Pohit  
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# GHG Emissions and Economic Growth

A Computable General Equilibrium  
Model Based Analysis for India

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# India Studies in Business and Economics

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# Preface

We decided to get this book published to help the larger audience make sense of the discussion on climate change and its implications for economic growth in India. Issues linking climate change and economic growth are now at the centre of discussions regarding climate friendly development strategies which are increasingly becoming a necessity rather than an option for late-industrialising countries like India. This book contributes to this discussion by systematically analysing the relationships between economic growth and GHG emissions in India with explicit reference to all major economic sectors. Although the science of the impact of climate change on earth and its inhabitants is moving rapidly in the direction of certainty and precision, lack of clarity on how emerging economies can manage their developmental imperatives in the face of pressing carbon constraints with judicious policy interventions persists. Whether a global carbon price will help incentivising developmental actors to choose low-carbon growth strategies is still an open and debatable issue. Many suggest carbon tax at the border or nationally implemented under sovereign national fiscal regimes. Suggestions for benchmarking-monitoring-reporting-verification of all activities by best practices are also on the table. So, it is quite a complex issue for anybody to try to resolve without detailed knowledge and information on pros and cons of each of the alternative interventions and institutional arrangements suggested. Moreover, the impact of climate change is all pervading. It is not confined to one single activity or sector but extends to each and every economic activity and sector and to people of all socioeconomic groups.

Our joint effort in this area began in 2006 when India's Ministry of Environment and Forest, gave a small research grant to National Council of Applied Economic Research (NCAER) and Jadavpur University (with the former and latter being then the institutions of affiliation for the first three authors and the fourth author respectively), to provide them with knowledge and analytical support on India's GHG emissions profile. The necessity and inevitability of pooling multiple expertises to get this empirical investigation accomplished brought all of us together with the lead author of the book also availing the opportunity to find an interesting and relevant research topic for his Ph.D. work which he eventually completed by virtue of hard labour and patience to our great pleasure.

This book estimates latest Social Accounting Matrix (SAM) for India. It provides a very important database describing the complete circular flow of income and input-output transactions among the sectors of the economy. Striking novelty of the book lies in the fact that for the first time to the best of our knowledge, a SAM for Indian economy has been prepared with environmental indicators and detailed methodology is also presented in the book. The environmental social accounting matrix (ESAM) based analysis has been included in the book to show direct and indirect linkage between economic growth and GHG emissions.

The work we present here goes beyond SAM and applies computable general equilibrium (CGE) modelling to conduct climate change policy analysis and simulations. The analysis is an important contribution in the current debate around carbon tax and its possible impacts on macroeconomic growth. Knowledge sharing by Dr. Pradipto Ghosh on CGE modelling as applied to climate change issues needs special mention.

During the course of this detailed work we received help from a number of excellent people in various forms. Administrative support from Prof. Binay Kumar Pattanayak, Director ISEC, Director General of NCAER, Dr. Shashanka Bhide, senior research councilor, NCAER, Dr. Anushree Sinha, Senior Fellow, NCAER, Mr. N. J. Sebastian, Former Secretary and Librarian, NCAER; and Dr. Nandita Bhattacharyya of Faculty of Arts, Staff members of Department of Economics-Jadavpur University, made the progress of the work smooth. Comments and academic advice received from Prof. Pradeep Biswas, CSIR-NISTADS, Prof. Rajashree Majumder, University of Burdwan, Prof. M. R. Naryana, ISEC, Prof. K. V. Raju, ISEC, Prof. Meenakshi Rajeev, ISEC, and Mrs. B. P. Vani, ISEC needs special acknowledgement. Study material collected by NCAER library staff, from Dr. Maniparna Shyam Roy, and Dr. Duke Ghose of Global Change Programme of Jadavpur University were immensely useful. Lastly, we thank for never ending family support for each one of us.

What has driven us and kept us together until we finished this book is the genuine wish to advance the knowledge on the subject and deep concern for saving our planet and ourselves from extinction if global warming remains unchecked.

Last but not least, the results expressed in this book are those of the authors and are not attributable to the institute/organization to which they belong.

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# Abbreviations

AEEI	Autonomous energy efficiency improvement
AGRIM	Agriculture, growth and redistribution of income model
ANFI	Aggregate non-factor input
ASI	Annual Survey of Industries
CAB	Current account balance
CDM	Clean development management
CE	Compensation to employees
CES	Constant elasticity of substitution
CET	Constant elasticity of transformation
CGE	Computable general equilibrium
COP	Conference of the parties
CO <sub>2</sub> EQ	Carbon equivalent
ESAM	Environmental social accounting matrix
FDI	Foreign direct investment
GAMS	General algebraic modelling systems
GCMs	General circulation models
GDP	Gross domestic product
GEF	Global Environment Facility
GVA	Gross value added
HYV	High-yielding variety
IO	Input output
KgOE	Kg of oil equivalent
LES	Linear expenditure system
LFPR	Labour force participation rate
MBI	Market-based instruments
MoEF	Ministry of Environment and Forests
NAMEA	National Accounting Matrix for Environmental Accounting
NAS	National accounts statistics
NATCOM	National communication
NCAER	National Council of Applied Economic Research
NHPCL	National Hydro Power Corporation Limited
NPCIL	Nuclear Power Corporation of India Limited

NSSO	National Sample Survey Organization
NVA	Net value added
OS	Operating surplus
PCE	Per capita emission
PFCE	Private final consumption expenditure
PPP	Purchasing power parity
PPM	Parts per million
PPB	Parts per billion
SAM	Social accounting matrix
SDA	Structural decomposition analysis
SGM	Second generation model
TERI	The Energy and Resource Institute
TFPG	Total factor productivity growth
TL	Translog
UNFCCC	United Nations Framework Convention on Climate Change
US\$	US dollar

# List of Figures

<b>Fig. 4.1</b>	Sector-specific shares in gross domestic product .....	59
<b>Fig. 5.1</b>	Observed changes in GHG emissions. ....	67
<b>Fig. 5.2</b>	Factor-wise GHG emissions change. ....	69
<b>Fig. 6.1</b>	Flow of conventional commodities, factors, payments, and transfer in the economy .....	74
<b>Fig. 6.2</b>	The production nesting. <i>QQ</i> composite output, <i>CES</i> constant elasticity of substitution, <i>QD</i> domestic sales, <i>QM</i> final imports, <i>QX</i> gross domestic output, <i>QE</i> domestic exports, <i>AEN</i> aggregate of energy inputs, <i>MAT</i> aggregate materials, <i>CET</i> constant elasticity of transformation. ....	77
<b>Fig. 7.1</b>	Growth rate of GDP, labor force, and foreign savings. ....	96
<b>Fig. 7.2</b>	Growth rate of energy use (percentage). ....	98
<b>Fig. 7.3</b>	Energy intensity (KgOE/US\$ of GDP in PPP). ....	99
<b>Fig. 7.4</b>	CO <sub>2</sub> EQ emission intensity (grams/US\$ of GDP in PPP). ....	100
<b>Fig. 7.5</b>	Per capita CO <sub>2</sub> EQ emission (tons per capita). ....	101
<b>Fig. 7.6</b>	GDP in policy scenarios (US\$ billion of GDP in PPP). ....	105
<b>Fig. 7.7</b>	CO <sub>2</sub> EQ emission in policy scenarios 1a, 1b, 1c, 1d (million tons). ....	107
<b>Fig. 7.8</b>	Per capita CO <sub>2</sub> EQ emission in policy scenarios 1a, 1b, 1c, 1d (tons/person). ....	110
<b>Fig. 7.9</b>	GDP in policy scenarios 2a, 2b, 2c, 2d (US\$ billion of GDP in PPP). ....	111
<b>Fig. 7.10</b>	CO <sub>2</sub> EQ emission in policy scenarios 2a, 2b, 2c, 2d (million tons). ....	114
<b>Fig. 7.11</b>	Per capita CO <sub>2</sub> EQ emission in policy scenarios 2a, 2b, 2c, 2d (tons/person). ....	117

# List of Tables

<b>Table 2.1</b>	A schematic social accounting matrix (SAM) for India. ....	15
<b>Table 2.2</b>	Stylized facts of social accounting matrices (SAMs) of India. ....	16
<b>Table 2.3</b>	Mapping between social accounting matrix (SAM) sectors and sectors of input-output (IO) table. ....	18
<b>Table 2.4</b>	Description of economic agents. ....	19
<b>Table 2.5</b>	Mapping between social accounting matrix (SAM) sectors and National Sample Survey Organization (NSSO) items. ....	26
<b>Table 3.1</b>	Schematic structure of environmentally extended social accounting matrix. ....	32
<b>Table 3.2</b>	Mapping between environmentally extended social accounting matrix (ESAM) sector and sector of Indian Network on Climate Change Assessment (INCCA) report. ....	35
<b>Table 3.3</b>	Wastewater generation in Indian industry. ....	37
<b>Table 3.4</b>	Direct pollution coefficient matrix 2006–2007 (unit tons/lakh of output). ....	40
<b>Table 4.1</b>	Schematic structure of social accounting matrix (SAM). ....	45
<b>Table 4.2</b>	Impact of sectoral growth on primary energy use for the production. ....	49
<b>Table 4.3</b>	Impact of output growth on greenhouse gas (GHG) emissions (tons/lakhs of rupees of output). ....	53
<b>Table 4.4</b>	Sectorwise share of employment and labor intensity (2006–2007). ....	56
<b>Table 4.5</b>	Impact of employment change on GHG emissions. ....	58
<b>Table 4.6</b>	Energy cost per unit of labor employed (energy in rupee value/labor). ....	58
<b>Table 4.7</b>	Sector-specific share in gross domestic product at factor cost. ....	59
<b>Table 5.1</b>	Mapping between 2006–2007 IO sectors and the 1994–1995 IO sectors ....	66
<b>Table 5.2</b>	Observed changes in GHG emissions (thousand tons) ....	67
<b>Table 5.3</b>	Factor for which GHG emissions changes in India (unit thousand tons). ....	69

<b>Table 5.4</b>	Change in emission intensity, technical coefficients, and consumption share between 1994–1995 and 2006–2007 . . . . .	70
<b>Table 6.1</b>	Time Series of Exogenous Variables . . . . .	92
<b>Table 7.1</b>	Macro variables in the reference scenario. . . . .	97
<b>Table 7.2</b>	Primary energy use under the assumption of Total Factor Productivity Growth (TFPG)=3 and AEEI=3. . . . .	98
<b>Table 7.3</b>	Total CO <sub>2</sub> EQ emissions in the reference scenario (Million tons). . . . .	100
<b>Table 7.4</b>	The policy scenarios. . . . .	102
<b>Table 7.5</b>	GDP in policy scenarios 1a, 1b, 1c, 1d (US\$ billion of GDP in PPP). . . . .	104
<b>Table 7.6</b>	Change in GDP and energy use in policy scenarios 1a, 1b, 1c, 1d (with respect to reference scenario; %). . . . .	106
<b>Table 7.7</b>	Energy intensity in policy scenarios 1a, 1b, 1c, 1d (KgOE/US\$ of GDP in PPP). . . . .	107
<b>Table 7.8</b>	CO <sub>2</sub> EQ emission in policy scenarios 1a, 1b, 1c, 1d (Million tons). . . . .	108
<b>Table 7.9</b>	Change in GDP and CO <sub>2</sub> EQ emission in policy scenarios 1a, 1b, 1c, 1d (with respect to reference scenario). . . . .	109
<b>Table 7.10</b>	CO <sub>2</sub> EQ emission intensity policy scenarios 1a, 1b, 1c, 1d (grams/US\$ GDP in PPP). . . . .	110
<b>Table 7.11</b>	Per capita CO <sub>2</sub> EQ emission in policy scenarios 1a, 1b, 1c, 1d (Million tons per capita). . . . .	111
<b>Table 7.12</b>	GDP in policy scenarios 2a, 2b, 2c, 2d (US\$ GDP in PPP). . . . .	112
<b>Table 7.13</b>	Change in GDP and energy use in policy scenarios 2a, 2b, 2c, 2d (with respect to reference scenario) (Percentage). . . . .	113
<b>Table 7.14</b>	Energy intensity in policy scenarios 2a, 2b, 2c, 2d (KgOE/US \$ of GDP in PPP). . . . .	114
<b>Table 7.15</b>	CO <sub>2</sub> EQ emission in policy scenarios 2a, 2b, 2c, 2d (million tons). . . . .	115
<b>Table 7.16</b>	Change in GDP and CO <sub>2</sub> EQ emission in policy scenarios 2a, 2b, 2c, 2d (with respect to reference scenario). . . . .	116
<b>Table 7.17</b>	CO <sub>2</sub> EQ emission intensity in policy scenarios 2a, 2b, 2c, 2d (grams/US\$ GDP in PPP). . . . .	117
<b>Table 7.18</b>	Per capita CO <sub>2</sub> EQ emission in policy scenarios 2a, 2b, 2c, 2d (tons per capita). . . . .	118

# Appendix

<b>Appendix A:</b> Description of 130 Sectors of 2006–2007 IO Tables . . . . .	123
<b>Appendix B:</b> The Social Accounting Matrix of India 2006–2007 (₹ lakh). . .	125
<b>Appendix C:</b> Environmental Social Accounting Matrix of India 2006–2007 (₹ Lakhs for Monetary Transaction and Others in Physical Units) . . . . .	137
<b>Appendix D:</b> SAM Multiplier Matrix for India for the Year 2006–2007 . . .	158
<b>Appendix E:</b> The description of 60 sectors of 1994–1995 IO Tables. . . . .	170
<b>Appendix F:</b> 35 Sectors Input–Output Tables of 1994–1995 (₹ Lakhs). . . .	171



# Contents

<b>1</b>	<b>Economic Growth and Greenhouse Gas (GHG) Emissions: Policy Perspective from Past Indian Studies .....</b>	<b>1</b>
1.1	Climate Change and Economic Growth: Global Context .....	2
1.2	Climate Change and Economic Growth: Indian Context .....	2
1.3	Past Studies .....	4
1.4	Study Goals .....	8
1.5	Framework for Assessment .....	8
1.6	Scheme and Scope of This Study .....	10
	References.....	10
<b>2</b>	<b>Social Accounting Matrix of India: Concepts and Construction.....</b>	<b>13</b>
2.1	Concept and Structure of SAM .....	13
2.2	Purpose of Constructing SAM .....	14
2.3	Methodology of Construction of SAM .....	19
2.3.1	Expansion of Electricity Sector (Hydro, Non-hydro, and Nuclear) .....	19
2.3.2	Construction of Biomass Sector .....	20
2.3.3	Disaggregation of “Services Incidental to Transport” Sectors .....	21
2.3.4	Aggregation of IO Table .....	22
2.3.5	Extension of IO Table to SAM .....	22
2.3.6	Construction of Tax Account (Direct and Indirect Taxes) .....	28
2.3.7	Construction of Capital Account .....	28
2.3.8	Treatment of Foreign Trade .....	28
2.4	The SAM for India 2006–2007 .....	29
	References.....	30
<b>3</b>	<b>Environmentally Extended Social Accounting Matrix of India: Definition and Construction Methodology .....</b>	<b>31</b>
3.1	The Framework and Methodology .....	31
3.2	Estimation of Environmental Data .....	34
3.2.1	Estimation of Generation of Damaging Substances .....	34