

**The Opportunity Cost of Ratifying Kyoto Protocol:
An Input-Output Analysis for Turkey**

Niaz Ahmed BHUTTO, Selim CAGATAY & Nisar Ahmed SIDDIQUI

Niaz Ahmed Bhutto is an Assistant Professor in the Sukkur Institute of Business Administration, Pakistan.

Selim Cagatay is an Associate Professor in the Economics Department of Akdeniz University, Turkey.

Nisar Ahmed Siddiqui is Director & Professor in the Sukkur Institute of Business Administration, Pakistan.

Addresses:

Niaz Ahmed Bhutto- Sukkur Institute of Business Administration, Airport Road Sukkur 65200 Sindh, Pakistan.

Selim Cagatay- Akdeniz University, Department of Economics, Dumlupinar caddesi, 07058 Antalya, Turkey.

Nisar Ahmed Siddiqui - Sukkur Institute of Business Administration, Airport Road Sukkur 65200 Sindh, Pakistan.

Correspondence address:

Niaz Ahmed Bhutto- Sukkur Institute of Business Administration, Airport Road Sukkur 65200 Sindh, Pakistan.

Fax: +92 (71) 5632465

Email: niazbhutto@gmail.com

Abstract

Turkey is being pressurized by EU and environmental agencies to ratify Kyoto Protocol so as to reduce GHGs emissions from the atmosphere of our earth. The aim of this paper is to test the impact of three different possible targets of Kyoto Protocol that is reduction of GHGs emissions in 2008 on the final demand (GNP), employee's compensation and total and industrial output by using environmental input-output model. This paper finds that given exogenous targets of 95, 110 and 130 percent of GHGs emissions subject to 1998 levels of emissions, Turkey has to decrease final demand, employees' compensation and total output of all sectors by 60, 38 and 17 percent respectively in 2008. This huge cost in terms of economic and social goals derives the attention to renewable energy technologies and may be natural gas substitution partially while Turkey makes her sustainable development strategies and policies.

Key words: Environmental Input-output Model, Green House Gases Emissions, Kyoto Protocol and Economic and Social Cost.

1. Introduction

The Earth has finite resources, its ability to absorb wastes and destructive effluent is limited, its ability to meet the demand for growing number of people is limited and earth is fast approaching to its limits. Current economic practices can not be continued without the risk that global systems will be damaged beyond repair. Today earth is facing serious climate threats which are mainly the outcome of unsustainable production and consumption pattern of human societies. High temperatures, melting of glaciers and ice caps, rise in sea level, floods, droughts, loss of biodiversity, disturbed ecosystem, water contamination, deforestation, desertification, and loss of soil fertility are prominent.

Sustainable development has become a hot agenda to many countries and to international agencies. There is need of change of entire set of policies that promote sustainable development and their enforcement is inevitable for every country now or later in order to safeguard their own future interests. In order to meet the challenges of sustainable development, States of the world decided to establish a new global partnership. Agenda 21 and Kyoto Protocol are the outcomes of such efforts. Agenda 21 recommended that States prepare national reports and communicate the information therein to the Commission on Sustainable Development (CSD).

The problems associated with climate change are being addressed under the United Nations Framework Convention on Climate Change. So far insufficient progress has been made to stabilize greenhouse gas emission levels. However, under its Kyoto Protocol, developed countries have agreed to reduce their collective emissions of six greenhouse gases by 5% of 1990 levels by 2008-2012. In addition, the Protocol encourages joint implementation and emissions trading among developed countries; and cooperation between developed and developing countries under a Clean Development Mechanism.

Turkey is toiling hard to become the member of EU and hence, Turkey faces significant pressure from EU to ratify Kyoto Protocol in order to reduce GHGs emissions assigned by the Kyoto Protocol to its parties for the commitment period of 2008 to 2012.

Turkey has already ratified the United Nations Framework Convention on Climate Change in 2004.

Basing on the above, this paper aims to estimate the cost of ratifying Kyoto Protocol by Turkey in terms of GNP and employees' compensation by using an environmental input-output model. This paper attempts to explain the extent of how much GNP and employee's compensation will decrease when Turkey will meet the different possible targets assigned by Kyoto Protocol. This paper will also recommend the relevant measures and policy tools that help boosting sustainable development without much compromising the economic and social goals of its.

2. Methodology & Data

An input-output model can be used to find-out the environmental discharges in an economy, for example Leontief (1970) extended the input-output model which includes the environmental pollution and abatement activities. Input-output analysis measures the magnitudes of direct and indirect variation in total production caused by changes in the final demand. In input-output model, total output is:

$$X = Ax + Y \quad (1)$$

where X is the vector of total output of sectors, Ax is matrix of the intermediate demand of sectors and Y is vector of the final demand of sectors. A is the matrix of technical coefficients $[a_{ij}]$ which is found by:

$$a_{ij} = \frac{x_{ij}}{X_j} \quad (2)$$

where x_{ij} is the sale of i th sector to sector j and X_j is the total outlay of sector j .

Rearrange the equation (1) by taking intermediate demand term to the left of equation (1).

$$X - Ax = Y \quad (3)$$

Simplifying the equation (3)

$$X(I - A) = Y \quad (4)$$

To incorporate environment into input-output analysis, following equation is introduced

$$E_i = \hat{R}_i X \quad (5)$$

Where E_i represents the vector of total environmental effects of category i , \hat{R}_i is a diagonal matrix of discharges of type i , per monetary unit of sector's output.

$$X = \frac{E_i}{\hat{R}_i} \quad (6)$$

Put the value of X in equation (4):

$$Y = (I - A)\hat{R}_i^{-1}E_i \quad (7)$$

By using equation (7) Y can be solved given the exogenous environmental discharges of type i .

Three sources of data have been used in this paper. Growth rates are taken from Turkish Institute of Statistics and State Planning Organization. Whereas, agriculture focused input-output table and agriculture focused environmental input-output table of Turkey for the year 1998 have been taken from the Bhutto (2007).

3. Policy Analysis

From the immense pressure of EU and other OECD countries, if Turkey ratifies the Kyoto Protocol, what will be the possible impacts of such change on the growing economy of Turkey is the central investigation of this paper. Under the article 3 and paragraph 1 of Kyoto Protocol, Turkey has to reduce anthropogenic carbon dioxide equivalent of the GHGs emissions by at least 5 percent below 1990 levels of GHGs emissions in the commitment period 2008 to 2012. In paragraph 5 of same article, flexibility is given regarding the base year other than 1990 for the countries whose economies are under the process of transition to market economies subject to the approval of Conference of Parties and Turkey comes under the category of such countries.

In this policy scenario, it is assumed that the base year will be 1998 and therefore no significant change in industry-wise production technology is assumed till the commitment period 2008. The respective values of GNP (final demand), employee's compensation and total output of all sectors (intermediate and final demand) for three targets – 95, 110 and 130 percent of GHGs emissions levels subject to base year of 1998 are investigated.

To obtain final demand (GNP) for all 33 sectors of agriculture focused input-output table for the year 2008, actual and projected growth rates of different sectors have been used. The growth rates are given in Table 1 and Table 2.

<insert Table 1 and Table 2>

The employee's compensation and total output of all sectors are calculated by using simply Leontief Inverse method. Based on projected final demand for the year 2008, GHGs emissions are also estimated using the following environmental input-output model.

As it is given in equation (3):

$$X - Ax = Y \quad (3)$$

$$X(I - A) = Y \quad (8)$$

$$X = (I - A)^{-1}Y \quad (9)$$

From equation (5):

$$E_i = \hat{R}_i X \quad (5)$$

Insert the value of X from equation (9) into equation (5)

$$E_i = \hat{R}_i (I - A)^{-1} Y \quad (10)$$

Results of GHGs emissions under Kyoto Protocol targets and projected final demand for the year 2008 are given in Table 3 and Table 4¹. The results of GHGs emissions based upon the final demand projection for the year 2008 are quite alarming, GHGs emissions of inter-industries increase to 50.23 percent subject to 1998 inter-industries emissions in which energy, manufacturing and transport sectors are major contributors. If we look from the other aspect, the individual sector's percentage increment in GHGs emissions subject to 1998 year's individual sector's level, then manufacture of tobacco products sector tops the list with 58.2 % rise from 1998 emissions level, manufacture of bakery products comes second with 58.09 %, energy sector 54.72%, transport sector 50.44% and agriculture sectors on average 42%.

<insert Table 3 and Table 4>

If the economy of Turkey follows its growth pattern, then the GHGs emissions would increase to almost 60, 38 and 17 percent in 2008 with the projected final demand as compared to 95, 110 and 130 percent targets of Kyoto Protocol subject to the base year of 1998 level respectively. In order to reach the targets mentioned above Turkey has to reduce final demand through its different macroeconomic policies. These targets cost the

¹ Sectoral GHGs emissions are given in Appendices 2-5.

Turkey reduce final demand, employee's compensation and total output of all sectors by almost 60, 37 and 16 percent respectively. These results are given in Table 5 and Table 6.

<insert Table 5 and Table 6>

Conclusion and Recommendations

Sustainable development has become an urgent need in today's world. Extreme weathers and global warming are the main concerns that have raised the seriousness of the collective action of both the developed and the developing countries to combat these problems. From the environmental perspective, the increased consumption of fossil fuels raises the problems of climate change, acid rain, damage to eco-system from the extraction of fossil fuels and impact of oil spills on marine eco-system.

These serious problems drew the attention of almost all the developed countries and some developing countries and ultimately brought some progress in bringing the nations of the world together on common platform and paved the way for the formation of UNFCCC and Kyoto Protocol. As Turkey is already Annex I Party to UNFCCC, she faces huge pressure from EU and OECD countries to ratify Kyoto Protocol. If Turkey becomes the member of Kyoto Protocol, then Turkey has to reduce anthropogenic carbon dioxide equivalent of the GHGs emissions by at least 5 percent below 1990 levels of GHGs emissions in the commitment period 2008 to 2012.

This research finds that the results of GHGs emissions based upon the final demand projection for the year 2008 are quite alarming, GHGs emissions of inter-industries increase to 50.23 percent subject to 1998 inter-industries emissions in which energy, manufacturing and transport sectors are major contributors. Turkey has to reduce GNP by almost 60, 38, and 17 percent and consequently similar changes in total sectoral output and compensation of employees under the assigned targets of 95, 110 and 130 percent of GHGs emissions respectively, subject to 1998 levels emissions till 2008.

The opportunity costs of implementation of Kyoto Protocol targets are very high to be imposed in terms of economic and social goals of Turkey. Shifting to natural gas use in the industries that have relatively high shares in total emissions may be a solution as natural gas produces much less emissions compared to others. However, in that case, the rising import bill and its impact on trade account and on production cost has to be taken into account as Turkey is a big net-importer in natural gas. In addition, net natural gas exporter countries have the price setting power and have the freedom to totally or partially restrict supply, as seen in the previous years. In Turkey, the share of renewable energy in total energy production is very less; Turkey has to take very crucial steps to develop and boost renewable energy sources as they are totally environmental friendly technologies. Turkey has to develop new set of policies by considering the above recommendations that will lead the Turkey to meet the Kyoto Protocol targets without getting much cost in economic and social goals of sustainable development.

References

Bhutto, A.N., 2007. Building Environmental Input-Output Model for Turkey with Special Focus on Agri-Food Sectors. Unpublished Ph.D. dissertation, Hacettepe University, Department of Economics, Ankara, Turkey.

IPCC, 2006. "2006 IPCC Guidelines for National Greenhouse Gas Inventories." Available at: <http://www.ipcc-nggip.iges.or.jp>

Leontief W., 1970. The Dynamic Inverse. In A. P. Carter and A. Brody (Editors), Contributions to Input-Output Analysis. North-Holland, Amsterdam, pp. 17-46.

Leontief W., 1986. "Input-output Economics"; Oxford University Press; 2nd Edition; New York.

Miller R. E. and P. D. Blair, 1985. "Input-output Analysis - Foundations and Extensions." Prentice-Hall, New Jersey.

State Planning Organization. <http://www.dpt.gov.tr/>

TUIK, 2004. Turkish Institute of Statistics, Input Output Table for 1998 (electronic publication), Ankara.

Turkish Institute of Statistics (TURKSTAT). <http://www.tuik.gov.tr>

UNFCCC. <http://unfccc.int/2860.php>

UNFCCC, 1998. "Kyoto Protocol to the United Nations Framework Convention on Climate Change."

Appendix-1

Table 1. Sectoral Real Growth Rates

Year	1999	2000	2001	2002	2003	2004
Agriculture	-5.6	3.8	-6.0	7.5	-2.4	2.0
Industry	-5.1	6.2	-7.4	9.1	7.8	9.4
Services	-6.7	7.0	-11.3	7.5	6.9	11.8

Source: TURKSTAT (Various Years).

Table 2. Real Growth Rates²

Year	2005	2006	2007	2008
Growth Rates	7.6	7.0	7.0	7.0

Source: TURKSTAT and SPO (Various Years).

Table 3. Inter-industries GHGs Emissions in tones (1998 base year)

Kyoto Targets	CO2	N2O	CH4	CO	SOx	NOx	NMVOC
95	177120425.60	1791.50	4094.60	1946952.84	2020758.89	743688.82	358073.66
110	205086808.59	2074.37	4741.12	2254366.45	2339826.08	861113.37	414611.60
130	242375319.24	2451.53	5603.14	2664251.26	2765249.00	1017679.43	489995.53
Projected	Emissions estimations for 2008						
Y based	285995819.26	2901.38	6579.67	3082194.49	3268373.80	1190235.85	566821.45

Source: Author's calculations

Table 4. Percentage Change of GHGs Emissions in 2008 in Comparison with Kyoto Targets

Kyoto Targets	CO2	N2O	CH4	CO	SOx	NOx	NMVOC
95	61.47	61.95	60.69	58.31	61.74	60.04	58.30
110	39.45	39.87	38.78	36.72	39.68	38.22	36.71
130	18.00	18.35	17.43	15.69	18.19	16.96	15.68

Source: Author's calculations

² Till third quarter of 2006, the average growth rate was 7, so 7 is assumed for the whole year; growth rates for 2007 and 2008 are (targets) projected in the 9th Development Plan 2007-2013.

Table 5. Final Demand, Employees Income and Total Output (Billions TL)

Under Kyoto Targets	Final Demand (Y)	Employees Income	Total Output Xi
95	65183391	12234165	100818938
110	75475505	14165875	116737718
130	89198324	16741489	137962758
Based upon Growth Rates ³	Estimations for 2008		
	103656435	19425650	160751210

Source: Author's calculations

Table 6. Percentage Change of Final Demand, Employees Income and Total Output in 2008 in Comparison with Kyoto Targets

Under Kyoto Targets	Final Demand (Y)	Employees Income	Total Output Xi
95	-59.02	-58.78	-59.45
110	-37.34	-37.13	-37.70
130	-16.21	-16.03	-16.52

Source: Author's calculations

³ Till 2006 actual real growth rates are used, after that projected real growth rates mentioned in the table 6.6.

Appendix-2
GHGs Emissions 1998 (in 1000 tones)

Sectors	CO2	N2O	CH4	CO	SOx	NOx	NMVOc
Growing of cereals and other crops n.e.c.	3345.56	0.0235	0.1222	23.9775	30.578	30.559	4.819
Wheat	660.17	0.0046	0.0241	4.7314	6.034	6.030	0.951
Maize	115.34	0.0008	0.0042	0.8266	1.054	1.054	0.166
Sunflower	145.43	0.0010	0.0053	1.0423	1.329	1.328	0.209
Cotton	89.94	0.0006	0.0033	0.6446	0.822	0.822	0.130
Growing of vegetables, horticultural specialties and nursery products	122.29	0.0009	0.0045	0.8764	1.118	1.117	0.176
Growing of fruit, nuts, beverage and spice crops	130.20	0.0009	0.0048	0.9331	1.190	1.189	0.188
Farming of animals	41.87	0.0003	0.0015	0.3007	0.382	0.382	0.060
Agricultural and animal husbandry service activities, except veterinary activities	11.50	0.0001	0.0004	0.0824	0.105	0.105	0.017
Forestry, logging and related service activities	174.87	0.0019	0.0042	2.2715	2.227	0.946	0.295
Fishing	369.01	0.0027	0.0131	2.8221	3.483	3.257	0.539
Mining and quarrying [08-12]	970.81	0.0069	0.0351	0.1527	8.943	2.730	0.070
Production, processing and preserving of meat and meat products	74.55	0.0007	0.0015	0.0658	1.020	0.205	0.010
Processing and preserving of fish and fish products	7.97	0.0000	0.0001	0.0037	0.076	0.019	0.001
Processing and preserving of fruit and vegetables	143.85	0.0011	0.0054	0.0216	1.277	0.372	0.009
Manufacture of vegetable and animal oils and fats	324.34	0.0034	0.0068	0.2830	4.064	0.907	0.044
Manufacture of dairy products	57.55	0.0005	0.0021	0.0140	0.563	0.150	0.004
Manufacture of grain mill products, starches and starch products	5.22	0.0000	0.0002	0.0007	0.047	0.014	0.000
Manufacture of prepared animal feeds	5.25	0.0001	0.0001	0.0069	0.092	0.015	0.001
Manufacture of bakery products	86.27	0.0003	0.0020	0.0366	0.565	0.221	0.007
Manufacture of sugar	2444.74	0.0316	0.0363	2.9900	36.032	7.120	0.419
Manufacture of cocoa, chocolate, sugar confert.& other food products n.e.c.	643.48	0.0065	0.0154	0.4985	5.977	1.798	0.082
Manufacture of alcoholic, soft drinks and mineral waters[23-24]	144.37	0.0010	0.0049	0.0332	1.136	0.376	0.010
Manufacture of tobacco products	41.84	0.0003	0.0014	0.0117	0.303	0.112	0.003
Manufacture of textiles [26-32]	2334.60	0.0135	0.0584	1.1464	15.256	6.212	0.216
Wood, furniture, paper, publishing [33-37, 67]	2569.66	0.0192	0.0916	0.6293	22.285	6.868	0.193
Manufacture of fertilizers, pesticides, other agro-chemicals, paints, and varnishes [40-41]	2001.75	0.0083	0.0488	0.8817	7.234	5.355	0.171
Manufacture of coke, refined petroleum prod, basic chemicals, rubber, plastics, glass, ceramic prod., non-metallic minerals, etc. [38-39, 42-49]	19053.87	0.1719	0.4730	12.0256	196.546	50.024	2.095
Manufacture of ferrous, non-ferrous metals, various machinery, vehicles, etc. [50-66, 68]	18983.49	0.2302	0.3072	21.6770	180.115	55.079	3.094
Energy production and distribution [69-70]	84171.95	0.9904	1.5016	18.0471	1144.228	245.396	4.917
Water and Construction [71-72]	3156.53	0.0210	0.1090	0.7926	26.633	8.762	0.250
Transport [73, 78-81]	32764.54	0.2334	1.1729	1851.8286	301.267	331.402	347.603
Services [74-77, 82-97]	11249.75	0.1082	0.2485	99.7687	125.134	12.903	10.171
PrC	41683.77	0.5028	0.7200	569.4289	580.912	45.603	57.393
Pb C	6768.60	0.0501	0.1995	22.9420	60.226	8.532	2.490
Goods and services exports	5189.82	0.0365	0.1886	1.9379	47.424	7.272	0.411
Total	240084.75	2.4753	5.4182	2643.7328	2815.676	844.237	437.213

Source: Author's Calculations

Appendix-3

95 Percent of 1998 Levels of GHGs Emissions in Tones

Sectors	CO2	N2O	CH4	CO	SOx	NOx	NMVOC
Growing of cereals and other crops n.e.c.	3178281.95	22.33	116.13	22778.58	29048.85	29031.52	4578.05
Wheat	627157.23	4.41	22.91	4494.80	5732.09	5728.67	903.37
Maize	109572.00	0.77	4.00	785.30	1001.47	1000.87	157.83
Sunflower	138158.34	0.97	5.05	990.17	1262.74	1261.99	199.01
Cotton	85442.83	0.60	3.12	612.36	780.93	780.46	123.07
Growing of vegetables, horticultural specialties and nursery products	116173.13	0.82	4.24	832.63	1061.79	1061.15	167.34
Growing of fruit, nuts, beverage and spice crops	123689.48	0.87	4.52	886.48	1130.50	1129.82	178.16
Farming of animals	39780.40	0.28	1.45	285.70	363.34	362.84	57.22
Agricultural and animal husbandry service activities, except veterinary activities	10926.16	0.08	0.40	78.31	99.86	99.80	15.74
Forestry, logging and related service activities	166123.29	1.77	4.04	2157.88	2115.24	899.01	280.33
Fishing	350557.69	2.57	12.46	2680.95	3308.84	3094.58	512.24
Mining and quarrying [08-12]	922265.55	6.55	33.37	145.05	8495.93	2593.72	66.23
Production, processing and preserving of meat and meat products	70825.17	0.70	1.38	62.54	969.47	195.12	9.55
Processing and preserving of fish and fish products	7575.22	0.01	0.13	3.51	72.18	18.11	0.60
Processing and preserving of fruit and vegetables	136653.58	1.02	5.14	20.48	1212.73	353.10	8.99
Manufacture of vegetable and animal oils and fats	308122.01	3.20	6.50	268.90	3860.69	862.01	41.74
Manufacture of dairy products	54669.26	0.43	1.95	13.30	534.48	142.85	4.10
Manufacture of grain mill products, starches and starch products	4955.00	0.04	0.19	0.65	45.11	12.85	0.32
Manufacture of prepared animal feeds	4990.13	0.07	0.07	6.58	87.43	14.66	0.91
Manufacture of bakery products	81960.40	0.32	1.91	34.75	536.76	210.03	6.73
Manufacture of sugar	2322504.70	29.99	34.48	2840.53	34229.96	6763.63	398.16
Manufacture of cocoa, chocolate, sugar confert.& other food products n.e.c.	611308.37	6.21	14.61	473.61	5678.57	1707.84	77.46
Manufacture of alcoholic, soft drinks and mineral waters[23-24]	137147.40	0.93	4.70	31.57	1079.07	357.16	9.82
Manufacture of tobacco products	39750.50	0.25	1.30	11.14	287.96	106.17	3.02
Manufacture of textiles [26-32]	2217867.51	12.82	55.47	1089.05	14492.77	5901.06	205.47
Wood, furniture, paper, publishing [33-37, 67]	2441179.04	18.21	87.02	597.85	21170.71	6524.57	183.50
Manufacture of fertilizers, pesticides, other agro-chemicals, paints, and varnishes [40-41]	1901665.21	7.87	46.40	837.59	6871.90	5086.99	162.70
Manufacture of coke, refined petroleum prod, basic chemicals, rubber, plastics, glass, ceramic prod., non-metallic minerals, etc. [38-39, 42-49]	18101176.45	163.30	449.39	11424.33	186718.80	47522.55	1989.78
Manufacture of ferrous, non-ferrous metals, various machinery, vehicles, etc. [50-66, 68]	18034311.38	218.66	291.82	20593.13	171109.71	52324.83	2938.92
Energy production and distribution [69-70]	79963352.54	940.90	1426.57	17144.77	1087016.60	233126.15	4670.87
Water and Construction [71-72]	2998701.46	19.99	103.56	752.93	25301.20	8324.33	237.04
Transport [73, 78-81]	31126315.43	221.77	1114.30	1759237.14	286203.67	314832.05	330222.91
Services [74-77, 82-97]	10687266.78	102.79	236.04	94780.30	118877.54	12258.32	9662.50
PrC	39599584.28	477.67	684.03	540957.41	551866.05	43322.72	54523.16
Pb C	6430170.77	47.60	189.54	21794.94	57214.78	8105.28	2365.76
Goods and services exports	4930331.90	34.71	179.16	1840.98	45052.84	6908.70	390.14
Total	228080512.55	2351.49	5147.33	2511546.18	2674892.55	802025.52	415352.71

Source: Author's Calculations.

Appendix-4

110 Percent of 1998 Levels of GHGs Emissions in Tones

Sectors	CO2	N2O	CH4	CO	SOx	NOx	NMVOc
Growing of cereals and other crops n.e.c.	3680115.95	25.86	134.46	26375.20	33635.51	33615.45	5300.90
Wheat	726182.05	5.10	26.53	5204.51	6637.16	6633.20	1046.00
Maize	126872.84	0.89	4.64	909.29	1159.59	1158.90	182.75
Sunflower	159972.82	1.12	5.84	1146.52	1462.12	1461.25	230.43
Cotton	98933.80	0.70	3.61	709.05	904.23	903.70	142.51
Growing of vegetables, horticultural specialties and nursery products	134516.25	0.95	4.91	964.09	1229.45	1228.70	193.76
Growing of fruit, nuts, beverage and spice crops	143219.39	1.01	5.23	1026.45	1309.00	1308.22	206.30
Farming of animals	46061.51	0.32	1.68	330.81	420.70	420.13	66.26
Agricultural and animal husbandry service activities, except veterinary activities	12651.34	0.09	0.46	90.67	115.63	115.56	18.22
Forestry, logging and related service activities	192353.29	2.04	4.67	2498.60	2449.23	1040.96	324.60
Fishing	405908.90	2.97	14.42	3104.26	3831.28	3583.19	593.12
Mining and quarrying [08-12]	1067886.43	7.59	38.64	167.95	9837.39	3003.26	76.69
Production, processing and preserving of meat and meat products	82008.10	0.81	1.60	72.42	1122.54	225.93	11.05
Processing and preserving of fish and fish products	8771.31	0.02	0.15	4.06	83.58	20.97	0.69
Processing and preserving of fruit and vegetables	158230.47	1.18	5.95	23.71	1404.21	408.85	10.40
Manufacture of vegetable and animal oils and fats	356772.85	3.71	7.52	311.35	4470.27	998.12	48.33
Manufacture of dairy products	63301.25	0.50	2.26	15.40	618.87	165.40	4.74
Manufacture of grain mill products, starches and starch products	5737.37	0.04	0.22	0.75	52.23	14.88	0.37
Manufacture of prepared animal feeds	5778.05	0.08	0.08	7.62	101.23	16.97	1.05
Manufacture of bakery products	94901.52	0.37	2.21	40.24	621.51	243.20	7.79
Manufacture of sugar	2689215.97	34.73	39.92	3289.04	39634.69	7831.57	461.03
Manufacture of cocoa, chocolate, sugar confert.& other food products n.e.c.	707830.74	7.19	16.91	548.39	6575.18	1977.49	89.69
Manufacture of alcoholic, soft drinks and mineral waters[23-24]	158802.25	1.07	5.44	36.55	1249.45	413.55	11.37
Manufacture of tobacco products	46026.89	0.29	1.51	12.90	333.43	122.93	3.50
Manufacture of textiles [26-32]	2568057.12	14.85	64.23	1261.00	16781.10	6832.81	237.91
Wood, furniture, paper, publishing [33-37, 67]	2826628.36	21.09	100.76	692.25	24513.46	7554.77	212.48
Manufacture of fertilizers, pesticides, other agro-chemicals, paints, and varnishes [40-41]	2201928.14	9.12	53.73	969.84	7956.94	5890.20	188.39
Manufacture of coke, refined petroleum prod, basic chemicals, rubber, plastics, glass, ceramic prod., non-metallic minerals, etc. [38-39, 42-49]	20959256.95	189.08	520.35	13228.17	216200.71	55026.11	2303.95
Manufacture of ferrous, non-ferrous metals, various machinery, vehicles, etc. [50-66, 68]	20881834.23	253.18	337.90	23844.67	198127.03	60586.65	3402.96
Energy production and distribution [69-70]	92589145.04	1089.46	1651.81	19851.84	1258650.80	269935.54	5408.38
Water and Construction [71-72]	3472180.64	23.15	119.92	871.81	29296.13	9638.70	274.46
Transport [73, 78-81]	36040996.82	256.79	1290.24	2037011.42	331393.72	364542.37	382363.37
Services [74-77, 82-97]	12374729.95	119.02	273.31	109745.61	137647.68	14193.84	11188.15
PrC	45852150.21	553.09	792.03	626371.74	639002.79	50163.15	63132.08
Pb C	7445460.89	55.12	219.47	25236.25	66248.69	9385.06	2739.30
Goods and services exports	5708805.36	40.19	207.44	2131.67	52166.45	7999.55	451.74
Total	264093225.06	2722.78	5960.06	2908106.10	3097244.01	928661.12	480934.72

Source: Author's Calculations.

Appendix-5

130 Percent of 1998 Levels of GHGs Emissions in Tones

Sectors	CO2	N2O	CH4	CO	SOx	NOx	NMVOc
Growing of cereals and other crops n.e.c.	4349227.94	30.56	158.91	31170.69	39751.06	39727.35	6264.70
Wheat	858215.15	6.03	31.36	6150.78	7843.91	7839.23	1236.19
Maize	149940.63	1.05	5.48	1074.62	1370.43	1369.61	215.98
Sunflower	189058.78	1.33	6.91	1354.97	1727.96	1726.93	272.32
Cotton	116921.77	0.82	4.27	837.97	1068.64	1068.00	168.42
Growing of vegetables, horticultural specialties and nursery products	158973.75	1.12	5.81	1139.38	1452.98	1452.10	228.99
Growing of fruit, nuts, beverage and spice crops	169259.28	1.19	6.18	1213.07	1547.00	1546.07	243.80
Farming of animals	54436.33	0.38	1.98	390.95	497.20	496.51	78.30
Agricultural and animal husbandry service activities, except veterinary activities	14951.58	0.11	0.55	107.16	136.65	136.57	21.54
Forestry, logging and related service activities	227326.61	2.42	5.52	2952.89	2894.54	1230.22	383.61
Fishing	479710.52	3.51	17.05	3668.67	4527.88	4234.68	700.96
Mining and quarrying [08-12]	1262047.60	8.97	45.67	198.49	11626.01	3549.30	90.64
Production, processing and preserving of meat and meat products	96918.66	0.96	1.89	85.59	1326.64	267.01	13.06
Processing and preserving of fish and fish products	10366.09	0.02	0.17	4.80	98.78	24.78	0.82
Processing and preserving of fruit and vegetables	186999.64	1.39	7.03	28.02	1659.52	483.19	12.30
Manufacture of vegetable and animal oils and fats	421640.64	4.38	8.89	367.96	5283.04	1179.59	57.11
Manufacture of dairy products	74810.57	0.59	2.67	18.20	731.39	195.48	5.61
Manufacture of grain mill products, starches and starch products	6780.53	0.05	0.26	0.88	61.73	17.59	0.44
Manufacture of prepared animal feeds	6828.60	0.10	0.09	9.01	119.64	20.06	1.24
Manufacture of bakery products	112156.34	0.44	2.61	47.56	734.52	287.41	9.20
Manufacture of sugar	3178164.33	41.04	47.18	3887.04	46840.99	9255.50	544.85
Manufacture of cocoa, chocolate, sugar confert. & other food products n.e.c.	836527.24	8.50	19.99	648.10	7770.67	2337.04	106.00
Manufacture of alcoholic, soft drinks and mineral waters[23-24]	187675.39	1.27	6.43	43.20	1476.63	488.74	13.44
Manufacture of tobacco products	54395.42	0.34	1.78	15.25	394.05	145.29	4.14
Manufacture of textiles [26-32]	3034976.60	17.55	75.91	1490.28	19832.21	8075.14	281.17
Wood, furniture, paper, publishing [33-37, 67]	3340560.79	24.92	119.08	818.12	28970.45	8928.36	251.11
Manufacture of fertilizers, pesticides, other agro-chemicals, paints, and varnishes [40-41]	2602278.71	10.77	63.49	1146.17	9403.66	6961.15	222.64
Manufacture of coke, refined petroleum prod, basic chemicals, rubber, plastics, glass, ceramic prod., non-metallic minerals, etc. [38-39, 42-49]	24770030.94	223.46	614.95	15633.29	255509.93	65030.86	2722.85
Manufacture of ferrous, non-ferrous metals, various machinery, vehicles, etc. [50-66, 68]	24678531.36	299.22	399.34	28180.07	234150.13	71602.40	4021.68
Energy production and distribution [69-70]	109423535.05	1287.55	1952.14	23461.26	1487496.40	319014.73	6391.72
Water and Construction [71-72]	4103486.21	27.36	141.72	1030.33	34622.70	11391.19	324.37
Transport [73, 78-81]	42593905.33	303.48	1524.82	2407377.14	391647.13	430822.80	451883.99
Services [74-77, 82-97]	14624680.85	140.66	323.00	129699.36	162674.53	16774.54	13222.36
PrC	54188904.80	653.66	936.04	740257.51	755185.12	59283.72	74610.64
Pb C	8799181.06	65.14	259.37	29824.66	78293.91	11091.43	3237.35
Goods and services exports	6746769.97	47.50	245.16	2519.24	61651.26	9454.01	533.87
Total	312110175.07	3217.83	7043.71	3436852.67	3660379.29	1097508.60	568377.39

Source: Author's Calculations.