MSCI 609 Deliverable 2
Group 9

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2. Introduction and Objective

The objective of the paper is to examine the relationship between carbon dioxide (CO_2) emissions, income and natural factors through the statistical method of regression. Natural factors include the differences in average climate temperatures, the proportion of urban land areas, and the availability of renewable and fossil fuel resources. While many studies have shown the empirical relationship between CO_2 emissions and income, the question to what extent natural factor determines cross-country differences in CO_2 emissions has been somehow neglected, which will be addressed in this paper. The analysis would be mainly based on and compared against 4 Asian countries of different income groups, namely Afghanistan (low-income), Vietnam (lower-middle-income), Thailand (middle-income), and Japan (high-income).

3. Proposed Model

The basic model would be

$$Y = a + b_1x_1 + b_2{x_1}^2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 + b_7x_7 + b_8x_8 + \varepsilon$$

Where

$$Y = logged\ CO_2\ emissions\ per\ capita$$
$$x_1 = logged\ Gross\ Domestic\ Product\ (GDP)\ per\ capita$$
$$x_3 = lowest\ monthly\ average\ temperature$$
$$x_4 = highest\ monthly\ average\ temperature$$
$$x_5 = log\ of\ the\ \%\ of\ total\ land\ area\ impacted\ by\ human\ activities$$
$$x_6 = \%\ of\ renewable\ energy\ sources\ of\ total\ energy\ use$$
$$x_7 = log\ of\ \%\ of\ fossil\ fuel\ consumed$$
$$x_8 = time\ trend$$
$$\varepsilon = error\ term$$

4. Data Table

Variable Name	Unit	Description	Source	Website
CO2 Emission	Metric Tons (ton)	CO2 emissions per capita	The World Bank	https://data.worldbank.org/indicator/EN.ATM.CO2E.PC
GDP	U.S. Dollars (US$)	GDPs per capita	The World Bank	https://data.worldbank.org/indicator/NY.GDP.PCAP.CD
Lowest Average Temperature	Degree Celsius (°C)	Lowest monthly average temperatures	The World Bank	https://climateknowledgeportal.worldbank.org/download-data
Highest Average Temperature	Degree Celsius (°C)	Highest monthly average temperatures	The World Bank	https://climateknowledgeportal.worldbank.org/download-data
Urban Area	Percentage (%)	Percentages of land area impacted by human activities	The World Bank	https://data.worldbank.org/indicator/AG.LND.TOTL.UR.K2
Renewable energy Source	Percentage (%)	Percentages of renewable energy in total energy use	The World Bank	https://data.worldbank.org/indicator/EG.FEC.RNEW.ZS
Fossil Fuel Consumption	Percentage (%)	Percentages of fossil fuel consumed	The World Bank	https://data.worldbank.org/indicator/EG.USE.COMM.FO.ZS

4. Descriptive Statistics

C02 Emission	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Mean	4.09	4.18	4.54	4.59	4.51	4.59	4.68	4.70	4.61	4.58	4.72	4.79	4.77	4.92	4.97	5.02	5.09	5.04	5.01	4.80	4.91	4.83	4.88	4.82	4.78	4.72
Standard Error	0.47	0.50	0.52	0.55	0.54	0.55	0.56	0.59	0.53	0.52	0.55	0.57	0.55	0.55	0.54	0.56	0.57	0.54	0.52	0.49	0.49	0.48	0.49	0.48	0.48	0.48
Median	1.39	1.45	1.83	1.88	1.77	1.92	1.83	1.98	2.04	2.03	2.16	2.27	2.12	2.21	2.20	2.24	2.25	2.28	2.39	2.42	2.49	2.44	2.58	2.63	2.63	2.63
Mode	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Standard Deviation	5.70	6.01	6.58	7.04	6.98	7.12	7.14	7.53	6.87	6.63	7.06	7.29	7.04	7.10	6.99	7.14	7.33	6.95	6.64	6.32	6.35	6.19	6.36	6.14	6.25	6.13
Sample Variance	32.48	36.15	43.28	49.61	48.67	50.70	50.91	56.65	47.15	43.89	49.88	53.11	49.59	50.42	48.84	51.01	53.71	48.28	44.11	39.95	40.27	38.36	40.41	37.73	39.03	37.55
Kurtosis	4.94	8.27	21.38	28.10	26.94	27.36	26.12	35.62	25.00	21.69	22.78	33.54	30.34	24.08	19.54	20.90	23.38	14.66	10.88	10.72	9.05	9.46	10.85	7.87	11.80	11.17
Skewness	2.14	2.55	3.66	4.27	4.19	4.27	4.12	4.87	4.05	3.74	3.91	4.64	4.36	3.89	3.53	3.68	3.88	3.17	2.81	2.82	2.62	2.65	2.82	2.50	2.92	2.87
Range	28.42	36.32	54.60	61.90	60.67	61.87	61.77	70.00	58.70	55.01	58.58	67.28	63.80	60.88	56.98	58.86	62.04	51.91	45.11	41.80	39.02	39.46	42.82	36.34	43.48	41.60
Minimum	0.03	0.01	0.04	0.04	0.02	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.02	0.03	0.02	0.02	0.02	0.02	0.02	0.04	0.05	0.04	0.04	0.04	0.04
Maximum	28.44	36.33	54.64	61.94	60.69	61.91	61.81	70.04	58.75	55.05	58.62	67.31	63.83	60.90	57.01	58.88	62.07	51.93	45.13	41.83	39.06	39.51	42.86	36.39	43.52	41.64
Sum	596.81	615.08	740.56	747.68	739.30	756.65	771.66	775.97	759.84	755.30	778.04	790.97	786.57	811.52	820.85	827.53	840.39	837.39	832.47	796.64	814.49	801.49	809.73	799.98	793.12	769.00
Count	146	147	163	163	164	165	165	165	165	165	165	165	165	165	165	165	165	166	166	166	166	166	166	166	166	163

GDP	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Mean	7588.52	7824.22	7970.34	8131.98	8395.66	8991.06	9365.26	9825.49	10098.60	10458.09	11589.15	11958.77	12285.64	12756.17	13652.91	14349.40	15477.95	16395.58	16922.03	16436.89	16952.10	17660.89	18311.09	18722.85	19064.35	18919.48
Standard Error	832.77	842.03	853.19	854.46	883.77	944.80	972.61	1009.75	1011.40	1022.56	1205.01	1218.69	1241.18	1280.55	1370.32	1396.98	1490.92	1530.03	1541.88	1463.94	1508.11	1581.32	1622.72	1623.48	1613.85	1524.11
Median	4249.96	4574.49	4405.01	4572.16	4558.17	4976.38	5200.39	5387.37	5644.96	5807.82	6100.37	6490.83	6589.97	6876.80	7361.38	7784.79	8514.42	9071.62	9711.37	9819.39	10078.72	10483.87	11164.44	11591.77	12116.94	12089.17
Mode	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Standard Deviation	9923.63	10104.33	10273.81	10359.79	10751.57	11724.66	12069.83	12530.70	12551.10	12730.71	15146.78	15318.65	15650.73	16147.07	17279.10	17615.20	18799.73	19292.93	19503.40	18517.48	19076.26	20002.29	20461.74	20535.56	20413.72	19218.35
Sample Variance	98478477.65	102097438.86	105551118.66	107325313.51	115596257.51	137467729.82	145680788.09	157018467.19	157530172.48	162071064.00	229424870.99	234661092.10	244945260.94	260727757.70	298567191.21	310295291.75	353429759.49	372217021.52	380382677.72	342897144.06	363903534.73	400091513.51	418682706.30	421709091.39	416719907.19	369344819.69
Kurtosis	28.76	24.41	22.25	19.22	18.73	16.05	15.49	15.47	12.76	11.05	12.42	11.71	11.50	10.83	11.16	8.95	8.83	7.75	7.26	7.42	8.84	9.35	9.03	7.94	6.38	3.55
Skewness	4.18	3.86	3.67	3.42	3.36	3.25	3.18	3.15	2.87	2.68	2.98	2.88	2.85	2.80	2.84	2.59	2.56	2.39	2.29	2.26	2.40	2.48	2.44	2.31	2.12	1.73
Range	86935.05	85539.29	85339.32	83537.10	86381.38	89397.00	91583.38	95783.50	92198.06	91252.09	97885.44	98516.15	102956.65	102254.26	113292.31	109286.92	120238.84	122268.32	124374.80	121780.07	131385.08	138676.38	140944.28	137491.66	128348.54	102963.76
Minimum	291.49	308.03	285.59	310.60	324.92	327.49	359.76	396.47	429.81	458.31	478.29	519.27	520.34	503.97	565.04	569.27	598.51	615.23	636.33	644.10	663.05	681.97	690.69	738.48	720.32	787.01
Maximum	87226.54	85847.32	85624.91	83847.70	86706.30	89724.49	91943.14	96179.97	92627.87	91710.39	98363.73	99035.42	103476.99	102758.23	113857.36	109856.20	120837.35	122883.55	125011.14	122424.17	132048.13	139358.35	141634.97	138230.14	129068.87	103750.78
Sum	1077569.31	1126687.20	1155699.35	1195401.72	1242558.17	1384622.81	1442250.48	1513125.11	1555184.86	1621003.64	1831085.95	1889485.77	1953416.63	2028231.60	2170812.58	2281554.28	2460994.60	2606897.58	2707525.21	2629902.97	2712336.07	2825743.01	2911464.02	2995656.37	3050295.96	3008196.59
Count	142	144	145	147	148	154	154	154	154	155	158	158	159	159	159	159	159	159	160	160	160	160	159	160	160	159

Lowest Avg. Temp.	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Mean	13.08	12.76	12.84	12.83	12.88	12.93	12.58	13.11	13.31	13.33	13.05	12.88	12.98	12.97	13.22	13.02	12.74	13.21	12.90	13.17	13.12	13.09	12.48	13.25	13.60	13.77
Standard Error	0.95	0.98	0.92	0.95	0.97	0.96	1.00	0.95	0.97	0.92	0.95	0.98	0.98	0.98	0.97	0.97	0.99	0.94	0.96	0.96	1.01	0.97	1.02	0.96	0.94	0.91
Median	18.11	18.13	17.58	17.84	18.16	18.33	17.95	18.30	18.69	18.57	17.89	18.28	18.16	17.86	18.23	18.41	18.40	17.84	17.67	18.21	18.80	18.26	18.01	17.99	18.40	18.52
Mode	-	-	-	-	-	-	27.20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Standard Deviation	12.39	12.71	11.98	12.35	12.67	12.57	13.01	12.42	12.61	12.05	12.32	12.73	12.83	12.80	12.59	12.62	12.95	12.31	12.54	12.46	13.15	12.71	13.31	12.46	12.22	11.87
Sample Variance	153.52	161.61	143.46	152.61	160.45	158.10	169.16	154.35	158.97	145.09	151.83	162.05	164.59	163.89	158.39	159.39	167.77	151.46	157.17	155.31	173.00	161.50	177.20	155.15	149.33	140.83
Kurtosis	0.10	-0.36	-0.11	-0.04	0.09	-0.20	-0.34	-0.26	-0.11	-0.08	-0.13	-0.27	-0.25	-0.32	-0.20	-0.31	-0.57	-0.19	0.09	-0.18	-0.37	-0.10	-0.51	-0.24	0.14	0.02
Skewness	-0.85	-0.77	-0.75	-0.82	-0.90	-0.81	-0.81	-0.79	-0.84	-0.84	-0.79	-0.81	-0.81	-0.80	-0.81	-0.79	-0.75	-0.80	-0.88	-0.80	-0.84	-0.86	-0.77	-0.81	-0.91	-0.82
Range	58.28	55.19	57.35	58.06	58.30	58.11	54.48	55.98	56.11	55.23	56.31	57.50	58.09	56.05	56.37	53.11	54.00	55.36	57.08	57.75	54.73	54.52	55.04	55.08	56.38	55.87
Minimum	-30.15	-26.94	-29.91	-30.86	-30.14	-30.28	-27.10	-28.02	-28.31	-27.32	-28.29	-29.38	-29.66	-28.08	-28.01	-25.10	-26.14	-27.23	-29.02	-29.55	-26.77	-26.72	-27.04	-27.25	-28.58	-27.87
Maximum	28.13	28.25	27.45	27.20	28.16	27.83	27.37	27.96	27.80	27.91	28.03	28.13	28.43	27.97	28.36	28.01	27.86	28.13	28.06	28.20	27.96	27.80	28.00	27.83	27.80	28.00
Sum	2223.63	2169.57	2183.37	2181.82	2189.64	2197.34	2138.24	2228.55	2262.28	2266.53	2218.04	2189.41	2206.46	2205.74	2248.11	2213.77	2165.55	2246.07	2193.48	2238.10	2230.23	2225.67	2120.95	2252.18	2311.67	2340.59
Count	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170

Highest Avg. Temp.	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Mean	24.18	24.23	24.29	24.17	23.84	24.21	24.16	23.89	24.38	24.25	24.07	24.15	24.57	23.93	24.26	24.04	24.06	23.97	24.24	24.45	24.28	24.35	25.04	24.24	24.42	24.39
Standard Error	0.45	0.46	0.45	0.45	0.47	0.46	0.43	0.45	0.45	0.45	0.43	0.44	0.44	0.44	0.43	0.43	0.47	0.47	0.46	0.46	0.45	0.44	0.44	0.46	0.45	0.46
Median	25.70	25.75	25.67	25.74	25.46	25.86	25.64	25.41	25.92	25.73	25.38	25.49	26.12	25.25	25.69	25.48	25.67	25.67	25.86	26.10	25.89	25.87	26.54	25.73	25.82	25.91
Mode	-	-	-	26.42	-	-	-	-	-	-	23.71	-	-	-	-	-	28.40	-	-	-	26.00	-	-	-	-	-
Standard Deviation	5.87	5.97	5.86	5.82	6.18	5.96	5.66	5.86	5.84	5.92	5.64	5.72	5.77	5.74	5.63	5.63	6.07	6.16	6.01	6.01	5.91	5.70	5.77	5.96	5.82	5.95
Sample Variance	34.48	35.69	34.31	33.84	38.14	35.57	32.03	34.29	34.10	35.06	31.86	32.67	33.28	32.95	31.75	31.72	36.87	37.97	36.10	36.10	34.97	32.49	33.27	35.54	33.91	35.40
Kurtosis	1.80	1.72	2.68	2.72	1.53	1.96	2.68	2.11	2.23	2.44	2.55	3.18	2.73	2.23	2.76	2.55	1.61	1.24	2.10	1.99	2.07	2.55	3.36	1.58	2.36	2.44
Skewness	-0.93	-0.97	-1.05	-1.09	-0.93	-0.99	-1.08	-0.99	-1.00	-1.04	-1.00	-1.14	-1.04	-0.97	-1.02	-1.01	-0.91	-0.88	-1.01	-0.93	-0.95	-0.99	-1.15	-0.84	-1.00	-1.02
Range	38.73	38.96	40.84	39.99	39.74	39.57	38.59	39.43	39.12	39.99	38.73	39.96	40.05	38.58	39.40	38.74	39.46	38.61	39.61	40.45	39.72	39.06	40.61	39.05	39.19	40.71
Minimum	-2.51	-2.10	-3.87	-4.18	-3.22	-3.07	-2.89	-3.32	-3.42	-4.02	-2.73	-4.43	-3.73	-2.99	-3.16	-3.32	-3.12	-2.66	-3.41	-3.45	-3.15	-3.28	-4.09	-2.47	-3.11	-3.88
Maximum	36.22	36.85	36.97	35.81	36.52	36.50	35.69	36.11	35.69	35.98	36.01	35.53	36.31	35.59	36.25	35.42	36.35	35.94	36.20	37.00	36.57	35.78	36.52	36.58	36.09	36.83
Sum	4109.96	4118.56	4128.88	4108.31	4052.68	4114.89	4107.55	4061.06	4144.42	4122.29	4092.26	4105.86	4176.63	4067.61	4124.48	4087.25	4089.35	4074.77	4121.46	4156.09	4127.39	4140.09	4256.83	4121.41	4151.32	4147.15
Count	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170

Urban Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Mean	13.45	13.48	13.46	13.46	13.46	13.46	13.46	13.46	13.46	13.46	13.81	13.81	13.80	13.78	13.77	13.77	13.76	13.75	13.74	13.74	13.74	13.74	13.73	13.73	13.73	13.73
Standard Error	1.92	1.89	1.89	1.89	1.89	1.89	1.89	1.89	1.89	1.89	1.87	1.87	1.87	1.87	1.87	1.86	1.86	1.86	1.86	1.86	1.86	1.86	1.85	1.85	1.85	1.85
Median	4.65	4.74	4.74	4.74	4.74	4.74	4.74	4.74	4.74	4.74	5.18	5.18	5.18	5.18	5.18	5.18	5.18	5.18	5.18	5.18	5.18	5.18	5.18	5.18	5.18	5.18
Mode	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Standard Deviation	22.10	21.96	21.91	21.91	21.91	21.91	21.91	21.91	21.91	21.91	21.93	21.93	21.92	21.86	21.83	21.81	21.80	21.78	21.75	21.75	21.74	21.72	21.71	21.71	21.70	21.69
Sample Variance	488.44	482.25	480.08	480.08	480.08	480.08	480.08	480.08	480.02	480.02	481.11	481.11	480.44	477.96	476.76	475.85	475.26	474.27	472.86	472.87	472.48	471.86	471.42	471.32	471.02	470.49
Kurtosis	6.14	6.22	6.23	6.23	6.23	6.23	6.23	6.23	6.23	6.23	5.91	5.91	5.90	5.90	5.91	5.92	5.91	5.92	5.93	5.93	5.93	5.93	5.94	5.93	5.94	5.94
Skewness	2.56	2.57	2.57	2.57	2.57	2.57	2.57	2.57	2.57	2.57	2.49	2.49	2.49	2.49	2.49	2.49	2.49	2.49	2.49	2.49	2.49	2.49	2.49	2.49	2.49	2.49
Range	97.75	97.75	97.75	97.75	97.75	97.75	97.75	97.75	97.75	97.75	97.75	97.75	97.75	97.75	97.75	97.75	97.75	97.75	97.75	97.75	97.75	97.75	97.75	97.75	97.75	97.75
Minimum	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Maximum	97.76	97.76	97.76	97.76	97.76	97.76	97.76	97.76	97.76	97.76	97.76	97.76	97.76	97.76	97.76	97.76	97.76	97.76	97.76	97.76	97.76	97.76	97.76	97.76	97.76	97.76
Sum	1789.05	1819.32	1817.05	1817.03	1817.04	1817.04	1817.04	1817.04	1817.50	1817.51	1891.38	1891.40	1890.95	1888.40	1887.11	1886.11	1885.53	1884.43	1882.91	1882.93	1882.47	1881.75	1881.56	1881.50	1881.21	1880.58
Count	133	135	135	135	135	135	135	135	135	135	137	137	137	137	137	137	137	137	137	137	137	137	137	137	137	137

Renewable energy Source	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Mean	35.00	35.11	34.95	35.12	35.14	35.23	34.94	34.48	34.17	34.18	34.42	33.83	33.82	33.43	33.26	33.13	32.82	32.26	32.41	32.40	32.27	31.95	31.89	32.17	32.12	31.93
Standard Error	2.64	2.63	2.59	2.58	2.56	2.54	2.51	2.49	2.47	2.46	2.44	2.43	2.43	2.41	2.41	2.42	2.42	2.37	2.38	2.36	2.32	2.29	2.26	2.24	2.22	2.20
Median	24.51	24.71	25.24	26.19	25.41	27.27	26.87	25.80	25.94	27.46	26.47	25.48	24.59	22.58	22.22	22.12	21.97	21.57	20.92	22.42	21.77	22.35	23.05	23.09	24.33	23.70
Mode	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Standard Deviation	33.34	33.31	33.18	32.99	32.77	32.66	32.28	31.99	31.74	31.60	31.55	31.45	31.43	31.13	31.16	31.27	31.27	30.78	30.78	30.56	30.11	29.69	29.32	29.16	28.87	28.66
Sample Variance	1111.30	1109.59	1101.10	1088.32	1073.60	1066.58	1041.78	1023.38	1007.70	998.39	995.46	989.31	987.78	968.88	970.88	977.68	977.73	947.61	947.68	933.91	906.77	881.63	859.62	850.24	833.45	821.31
Kurtosis	-1.20	-1.19	-1.16	-1.14	-1.13	-1.14	-1.12	-1.09	-1.04	-1.05	-1.07	-1.01	-1.00	-0.96	-0.94	-0.94	-0.93	-0.82	-0.84	-0.80	-0.79	-0.78	-0.79	-0.77	-0.77	-0.72
Skewness	0.55	0.55	0.56	0.57	0.56	0.55	0.56	0.58	0.61	0.59	0.59	0.63	0.63	0.65	0.67	0.68	0.69	0.74	0.73	0.75	0.74	0.75	0.73	0.72	0.72	0.75
Range	98.16	98.30	98.23	98.17	98.12	98.14	98.09	97.92	97.60	97.30	97.16	97.26	97.26	97.02	97.27	97.29	96.86	96.89	96.85	96.92	96.76	96.59	93.96	94.23	94.60	95.68
Minimum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Maximum	98.16	98.30	98.23	98.17	98.12	98.14	98.09	97.92	97.60	97.30	97.16	97.26	97.26	97.02	97.27	97.29	96.86	96.89	96.85	96.92	96.76	96.59	93.96	94.23	94.60	95.68
Sum	5564.44	5617.52	5731.40	5760.18	5762.85	5813.60	5764.33	5688.80	5638.43	5639.08	5748.51	5650.32	5647.17	5583.15	5554.77	5532.93	5480.85	5419.94	5445.17	5442.45	5420.97	5368.35	5389.61	5436.94	5428.71	5396.72
Count	159	160	164	164	164	165	165	165	165	165	167	167	167	167	167	167	167	168	168	168	168	168	169	169	169	169

Fossil Fuel Consumption	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Mean	55.67	66.23	66.30	65.93	65.46	66.26	66.23	66.68	67.13	67.09	66.51	67.15	66.32	67.20	55.63	55.44	55.52	56.67	67.69	67.23	66.63	67.54	66.91	67.04	67.75	69.62
Standard Error	3.19	2.79	2.77	2.75	2.75	2.69	2.66	2.65	2.62	2.60	2.60	2.58	2.60	2.58	3.02	3.03	3.04	3.01	2.55	2.54	2.55	2.50	2.45	2.46	2.40	3.94
Median	64.34	74.48	75.43	73.43	71.70	72.88	73.24	75.85	76.14	75.71	75.05	75.63	73.20	75.23	64.95	65.00	66.81	67.00	75.18	74.17	74.30	74.82	73.67	72.71	73.58	76.45
Mode	0.00	-	-	-	-	100.00	100.00	100.00	-	100.00	100.00	-	-	-	0.00	0.00	0.00	0.00	-	-	-	-	-	100.00	-	-
Standard Deviation	36.67	29.26	29.45	29.10	28.96	28.87	28.54	28.39	28.07	27.75	27.98	27.94	27.91	27.88	35.71	35.76	35.79	35.86	27.61	27.48	27.20	27.04	26.43	26.70	25.72	22.28
Sample Variance	1344.49	856.29	867.47	846.88	838.62	833.61	814.57	805.80	787.65	770.11	782.93	780.39	779.19	777.57	1274.86	1278.55	1280.77	1285.77	762.55	755.17	739.81	731.21	698.60	712.79	661.32	496.62
Kurtosis	-1.41	-0.80	-0.79	-0.73	-0.71	-0.75	-0.79	-0.77	-0.67	-0.66	-0.73	-0.67	-0.73	-0.69	-1.32	-1.34	-1.34	-1.29	-0.55	-0.62	-0.65	-0.61	-0.60	-0.62	-0.48	1.28
Skewness	-0.36	-0.66	-0.66	-0.67	-0.67	-0.67	-0.63	-0.67	-0.70	-0.70	-0.68	-0.70	-0.66	-0.70	-0.42	-0.42	-0.43	-0.47	-0.77	-0.72	-0.72	-0.74	-0.72	-0.71	-0.75	-1.32
Range	100.00	96.60	97.76	97.26	96.94	96.66	96.49	96.69	96.67	96.77	96.57	95.87	95.81	95.60	100.00	100.00	100.00	100.00	95.09	95.14	95.42	95.43	94.92	94.21	93.43	86.09
Minimum	0.00	3.40	2.24	2.74	3.05	3.34	3.51	3.31	3.33	3.23	3.43	4.13	4.19	4.40	0.00	0.00	0.00	0.00	4.91	4.86	4.58	4.57	5.01	5.79	6.57	11.29
Maximum	100.00	100.00	100.00	100.00	99.98	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	99.93	100.00	100.00	97.38
Sum	7348.17	7284.78	7492.32	7384.72	7266.16	7620.24	7616.01	7668.51	7720.02	7648.67	7715.14	7856.10	7626.65	7861.87	7788.61	7705.69	7717.00	8047.29	7919.38	7865.95	7595.73	7902.39	7761.29	7910.25	7790.77	2227.73
Count	132	110	113	112	111	115	115	115	115	114	116	117	115	117	140	139	139	142	117	117	114	117	116	118	115	32

5. Use of Data

All data is collected from the World Bank DataBank to maintain consistency. The data is consisted of a panel covering 25 years (1991-2015) on 170 countries across the globe.

CO_2 emissions per capita, forming the dependent variable, is based on the data from Carbon Dioxide Information Analysis Center (CDIAC). CO_2 emissions are those stemming from the burning of fossil fuels and the manufacture of cement. They include CO_2 produced during consumption of solid, liquid, and gas fuels and gas flaring.

Income, as one of the independent variables, is based on the data from World Bank National Accounts and OECD National Accounts. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. GDP per capita is obtained by diving GDP by mid-year population. Higher income countries would have greater emissions to sustain economic development and activities, and vice versa.

The lowest and highest monthly average temperatures are based on the data from World Bank Climate Change Knowledge Portal (CCKP). The temperatures are the average of temperatures of a month, which are then compared against each other within the year to identify the lowest and the highest of the year. It is expected that cold countries would have greater heating demands while hot countries would have greater cooling demands. Cold countries and hot countries would therefore have higher CO_2 emissions.

The percentage of urban areas is based on the data from CIESIN Urban-Rural Population and Land Area Estimates and the Food and Agriculture Organization. The urban area is computed on a combination of population counts, settlement points, and the presence of nighttime lights. The numbers are then divided by the country total land area to obtain the percentage. Countries with less urban areas are sparsely inhabited and have higher transportation demands to move goods and people over long distances. Higher transportation demands would have higher emissions, and vice versa.

The percentage of renewable energy in total energy use is based on the data from World Bank Sustainable Energy for All (SE4ALL). Renewable resources encompass hydroelectric, geothermal, solar and wind resources as well as “fuel and waste”, which comprise biomass and animal products, gas/liquids from biomass, industrial waste, and municipal waste. It is expected that countries that have access to domestic renewable energy resources would have lower emissions than countries that lack such resources.

The percentage of fossil fuel consumed is based on the data from IEA Statistics. Fossil fuel comprises coal, oil, petroleum, and natural gas products. The higher the consumption, the fewer the reserve, vice versa. Countries that have fewer fossil fuel reserves should have lower CO_2 emissions than countries that are rich in such reserves. This is for two reasons: First, because of the emissions generated in the extraction and possibly the transport and processing of such resources. Second, because of countries that lacked major domestic fossil fuel reserves have had strong incentives to develop in a less fossil fuel intensive way to cut down on energy import costs.

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