Who's Responsible for Climate Change? New Evidence Based on Country-Level Estimates of Climate Debt

Benedict Clements, Sanjeev Gupta, and Jianhong Liu

Abstract

In this paper, we introduce the concept of climate debt and provide country-level estimates through 2035 under a business-as-usual scenario. These estimates can help inform the debate on climate change by providing a clear view of which countries have (until the present) contributed the most to climate change, as well as the likely path for climate debt by country over the next 15 years. We then discuss the implications for carbon emissions if the G-20 countries and EU were to adopt either of the two policy options proposed in recent months: the first by President Biden for the US and the other by the EU for its member countries. The implications for fiscal policy are that beyond the need to keep public debt at sustainable levels, countries will also need to allocate funds for expected increases in pension and health spending associated with aging populations. As a result, there may be little room for new expenditures (such as green infrastructure or subsidies for clean energy) to reduce the growth of climate debt. Countries could turn to the revenue side, in particular greater taxation of energy with carbon taxes. This would have the advantage of reducing emissions while also helping countries to fund spending on green infrastructure.

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CGD Policy Paper 242
November 2021

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The authors would like to thank Ian Mitchell, Mark Plant, and an anonymous reviewer for helpful comments on an earlier draft.

Benedict Clements, Sanjeev Gupta, and Jianhong Liu. 2021. "Who's Responsible for Climate Change? New Evidence Based on Country-level Estimates of Climate Debt." CGD Policy Paper 242. Washington, DC: Center for Global Development. https://www.cgdev.org/publication/whos-responsible-climate-change-new-evidence-based-country-level-estimates-climate-debt

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1. Introduction

Persistent increases in average global temperature, in the absence of mitigation policies, risk catastrophic climate change as well as reduced world GDP per capita (Kahn and others, 2019; Intergovernmental Panel on Climate Change, 2021). In the absence of policy changes, fossil fuel consumption and global CO_2 emissions are projected to rise over the next 15 years, leading to further increases in global temperatures.

In order to avoid the adverse consequences of this "business-as-usual" scenario of increasing global temperatures, a number of countries have pledged to reduce emissions beyond their initial commitments in the 2015 Paris Agreement, including the United States and countries of the European Union.[1] A key issue in these discussions is which countries need to make the most effort to reduce emissions and how to ensure that the burden is shared fairly across countries. This issue is likely to be discussed even in the aftermath of the Glasgow COP 26 summit.

In this context, estimates of emissions by country are an essential first step in calculating the contribution of each country to global warming. These data can then be multiplied by an estimate of the social cost of carbon (per ton of emissions) to estimate adverse effects on the environment. These estimates quantify the negative externality from fossil fuel use and have been incorporated into assessments of energy subsidies (Clements and others, 2013; Coady and others, 2019; Parry, Black, and Vernon, 2021).

This methodology can also be extended to estimates of the cumulative negative externalities from carbon emissions. These cumulative externalities can be conceptualized as the "climate debt" a country owes to the entire globe.

In this paper, we provide, to our knowledge, the first set of country level estimates that incorporate projections of climate debt through 2035 under a business-as-usual scenario. These estimates of the climate debt can help inform the debate on climate change by providing a clear view of which countries have (until the present) contributed the most to climate change, as well as the likely path for climate debt by country over the next 15 years. This can help provide guideposts on which countries need to reduce emissions the most, for example, to cut their cumulative climate debt to a figure viewed as equitable and feasible.[2]

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[1] Under the Paris Agreement in 2015 (COP21), countries agreed to limit global warming to well below 2 degrees relative to pre-industrial levels and aim for 1.5 degrees. Under this Agreement, countries committed to present national plans—known as Nationally Determined Contributions, or 'NDCs'—to reduce their emissions. They agreed that every five years they would come back with updated plans, to be presented at summits, such as the Glasgow COP26 summit this year.

[2] Earlier work on climate debt focused on the high level of emissions of advanced countries relative to the rest of the world and the adverse effects of climate change imposed on developing countries (see Sims, Meyer, and Robbins, 1999; Pickering and Barry, 2012; and Warlenius, 2017). These works did not provide extensive country estimates of climate debt nor estimates based on projected emissions.

Our methodology takes an approach similar to Mitchell, Robinson, and Tahmasebi (2021) and Robinson, Mitchell, and Tahmasebi (2021) to assess climate debt, although their estimates did not incorporate emissions projected for the future. Our estimates reflect recent thinking on the social cost of carbon (Stern and Stiglitz, 2021a) and incorporate yearly adjustments. This implies that the timing of emissions matters, with greater environmental damage from more recent emissions and those projected for future years. Thus, data on emissions alone, and a single price for the cost of carbon, are insufficient to measure each country's contribution to global warming.

Two additional issues arise in curtailing future emissions where the concept of climate debt is relevant. First, advanced economies achieved high levels of per capita incomes when the social cost of carbon emissions was viewed as negligible. In view of increased recognition of the adverse impact of climate change, the social cost of carbon is now seen to be much higher than before and rising, meaning that developing countries will accumulate a larger share of world's climate debt as they develop. In these circumstances, what is an acceptable and fair division of responsibilities among countries going forward to confront climate change?

Second, reducing the future accumulation of climate debt will entail significant resource costs for all country groups, posing a steep challenge for policymakers. This is in part because public debt ratios in all countries have risen since 2018. In the advanced economies, public debt ratio rose by an average of 19 percent of GDP in 2020, in emerging market economies by 9 percent of GDP, and in low-income countries by 6 percent of GDP (IMF, 2021). On top of higher public debt, many advanced and emerging economies must also confront the rising costs of pensions and public health care—the latter particularly in the aftermath of the COVID-19 pandemic.

This paper is organized as follows. In section 2, we first estimate the cumulative and per capita carbon emissions for as many countries for which data are available, beginning in 1959, and project them until 2035. The estimates are presented for advanced, emerging and low-income countries and disaggregated for the major current and future emitters. Section 3 presents corresponding estimates for annual climate externalities and climate debt. The purpose of this exercise is to show the changing relative shares of climate debt for key countries in the future. In the following section (4), we discuss the implications for carbon emissions if the G-20 countries were to adopt either of the two policy options proposed in recent months: the first by President Biden for the US and the other by the EU for its member countries. Section 5 discusses implications for fiscal policy, and Section 6 concludes the main body of the paper. Finally, an appendix with figures for climate debt as a share of GDP and climate debt per capita are provided for all 131 countries included in the study.

2. Cumulative and per capita carbon emissions, 1959–2035

Global historical CO_2 emissions, available from Ritchie and Roser (2017), indicate a cumulative total of 1,520 gigatons as of end 2018.[3] For some countries, the data extend as far back as 1751. In order to capture as large a number of countries as possible for both our starting date and projections, we limit our sample to emissions beginning in 1959, which allows us to include 131 countries. In absolute terms, global CO_2 emissions from 1959 to 2018 amounted to 1,259 gigatons, or about 83 percent of historical global emissions. These estimates capture CO_2 emissions from both the burning of fossil fuels and those arising from cement production. We estimate projections for CO_2 emissions for 2019–2035 on the basis of country level projections for greenhouse gases from the IMF's Fiscal Affairs Department, which follow the methodology described in the IMF's Fiscal Monitor (IMF, 2019). Future emissions are estimated under a "business-as-usual" scenario, which is grounded on data on energy consumption by product in 2018 and projected economic growth. Thus, the projections do not assume any further reforms that alter the composition of energy consumption (for example, due to future implementation of commitments under the Paris Climate Accords). Based on this business-as-usual scenario, our projections suggest that CO_2 emissions during 2019–2035 will add another 711 gigatons to the global total—a more than 50 percent increase relative to that accumulated until 2018.

There has yet to emerge a consensus on a fair division of responsibilities among countries in reducing carbon emissions. One perspective is that countries responsible for the highest level of emissions (in absolute terms) should take the greatest action. From this perspective, the greatest emitter has been the United States (US), which over the 1959–2018 period, accounted for 41percent of cumulative global emissions. While the US and other advanced economies were the biggest emitters in the past, emerging economies, such as China and India, account for an increasing share of new emissions, fueled in part by high rates of economic growth. Incorporating projections for cumulative emissions through 2035, the largest three emitters are projected to be the US (20 percent), China (23 percent), and India (5 percent).

Emissions can also be assessed on a per capita basis, which more populous countries (such as China and India) can argue puts the debate in the proper context (Figures 1 and 2). Not surprisingly, the advanced economies have generated the highest CO_2 emissions per capita since the 1950s, although emissions began to decline in the early 2000s. Under a business-as-usual scenario, advanced economy emissions are projected to show a modest increase by 2035. Per capita emissions by low-income countries will rise by 2035 with growing income but will still be just one-fourth and one-tenth of those of emerging market and advanced economies, respectively.

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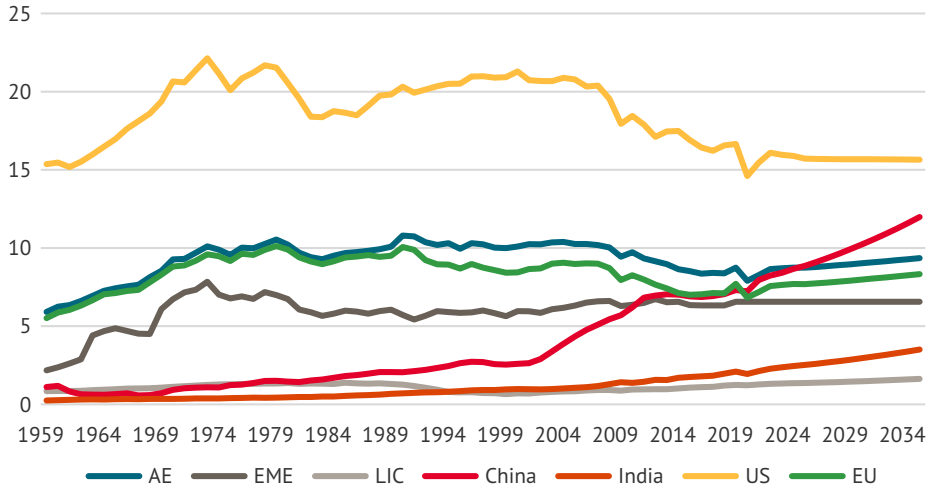
[3] The analysis in this paper covers CO_2 emissions produced by the use of fossil fuels and production of cement and does not cover all greenhouse gases (such as methane). We also exclude CO_2 emissions from changes in land use (see Evans, 2021), given the difficulty in projecting these emissions going forward. For 2018, changes in land use accounted for 13.1 percent of the cumulative total of global CO_2 emissions.

The US stands out as the leading emitter on an annual per capita basis. China has experienced sharp increases in annual emissions per capita since 2000 and is expected to exceed the advanced economy average in 2025. CO_2 emissions per capita have risen in India and Russia, as well as in some other emerging market countries (not shown in the figure). On a cumulative basis, CO_2 emissions per capita were greatest in the US during 1959–2018, which are twice those of the average in advanced economies, 7 times that of China, and 24 times that of India (Figure 2). Although the US's CO_2 annual emission per capita displays a downward trend going forward during 2019–2035, its cumulative sum of CO_2 emissions per capita will still exceed that of all countries in the globe (Figure 3).

Figure 1. Annual CO_2 emissions per capita (ton), 1959–2035



Notes: Advanced economies (AE) include the United States; emerging market economies include China and India.

Figure 2. Cumulative CO_2 emissions per capita (ton), 1959–2018

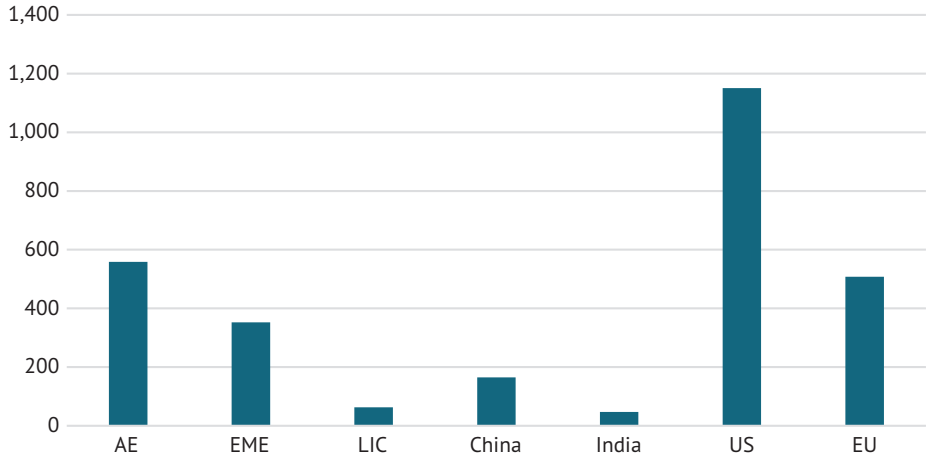
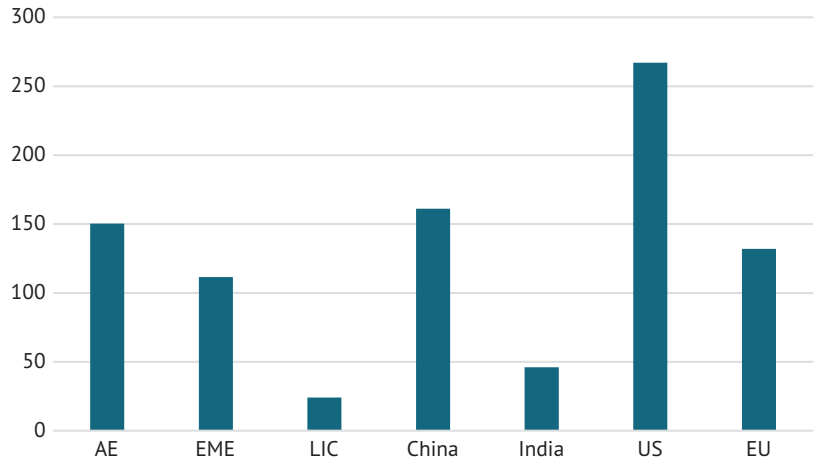


Figure 3. Cumulative CO_2 emissions per capita (ton) projection, 2019–2035



3. Annual climate externalities and the climate debt, 1959–1935

From the standpoint of fiscal policy, these CO_2 emissions, which adversely affect the world's well-being, are a negative externality—that is, a cost imposed by the consumption of certain forms of energy and goods by a country on the entire globe. At present, countries do not bear the full cost of these externalities. As argued in this paper, the cumulative sum of these liabilities presented above can be viewed as a "climate debt" a country owes to the global community. Although there is yet no obligation for countries to recognize this climate debt, debates regarding the appropriate sharing of the burden to reduce emissions will surely consider how much damage to the environment has been inflicted by different countries. At the same time, addressing this climate debt will be a challenge for countries as they face the fiscal constraints posed by the build-up of public debt in the post-COVID period and rising fiscal obligations stemming from aging populations.

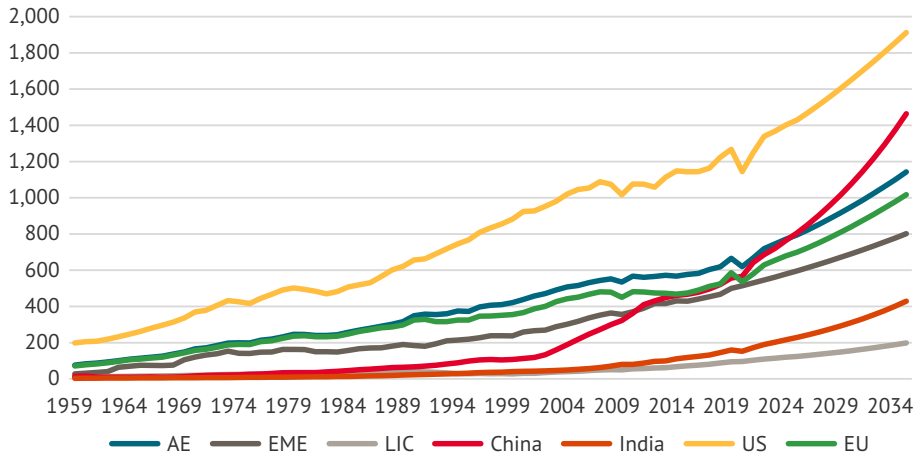
Annual climate externalities are estimated on the basis of the quantity of CO_2 emissions and the social cost of carbon (SCC) for that year. Estimates of the SCC vary widely, although climate models generally indicate that the damages from emissions rise over time (Coady and others, 2019). There is considerable controversy regarding the appropriate method for determining the SCC. More recently, it has been argued that the SCC should not be based on integrated assessment models—which are highly sensitive to model assumptions—but on estimates of the SCC needed to meet goals for stabilizing global temperature increases. In this context, Stern and Stiglitz (2021a, 2021b) have argued in favor of adopting a SCC in the upper end of the range of $50–$100 per ton of CO_2 emissions (at 2015 prices) for the year 2030.[4] This was the upper bound price for SCC by the high-level commission they chaired in

[4] This was also the upper end of the High-Level Commission on Carbon Prices (2017) chaired by Stiglitz and Stern. See also Robinson, Mitchell, and Tahmasebi (2021) for a discussion on the SCC.

2017. We base our forward-looking estimates on this upper bound price. For the years before 2030, we assume that the SCC changes by 3 percent annually in real terms as argued by IMF staff (Coady and others 2019).[5] On this basis, we present both forward-looking estimates of SCC of emissions as well as for 1959–2018. The SCC that we assume for each year, in 2018 prices, can be found in Appendix Table 1.

Figure 4 provides an estimate of annual CO_2 climate externalities per capita over 1959–2035 by country group—advanced, emerging market, and low-income countries—as well as for the US, China, and India. Similar to the results in Figure 1, the US and other advanced economies generate relatively higher climate externalities. These externalities fell somewhat in 2020, reflecting the impact of COVID-19 on economic activity, but are projected to resume an upward trajectory with the easing of the pandemic in advanced economies. China's annual climate externalities are rising rapidly and will surpass the advanced economy level in 2025. The rise in externalities across most country groups occurs despite the relatively flat trajectory for emissions per capita (Figure 1) and reflects our assumption of a rise in the SCC over time. This underscores the need for immediate action from the global community to sharply reduce carbon emissions, as freezing annual emissions at their current level will still lead to accelerating climate damage.

Figure 4. Annual climate externalities per capita (USD), 1959–2035



[5] Parry, Black, and Vernon (2021) use a similar approach by adjusting the SCC by $1.5 per year. As noted in Robinson, Mitchell, and Tahmasebi (2021), the SCC rises over time if the marginal economic damage from new emissions also rises as economic systems absorb greater and greater climate change. The work of the Intergovernmental Panel on Climate Change Working Group (2021) is supportive of the view that the economic costs of climate change are exponential, rather than linear.

Figure 5. Cumulative climate debt per capita (USD), 1959–2018

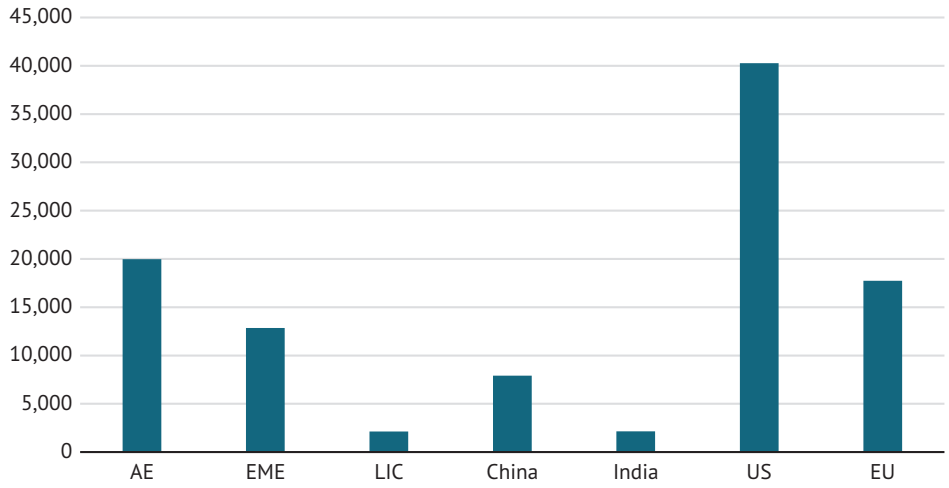
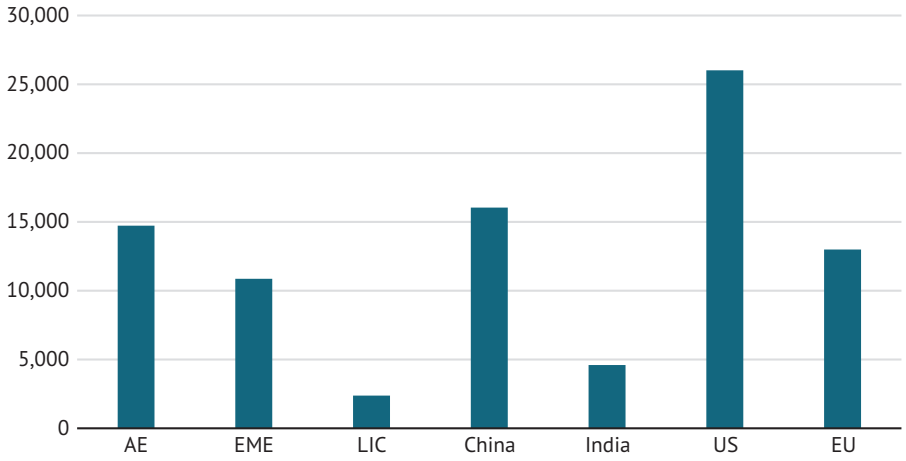


Figure 6. Climate debt per capita (USD) projection, 2019–2035



The climate debt can be calculated by aggregating annual climate externalities. Climate debt for 1959–2018, on a per capita basis, is sizeable in the US and China (Figure 5).[6] Looking forward, large increase in climate debt per capita will also be racked up during 2019–2035 under a business-as-usual scenario (Figure 6). What is most striking is the large increase in climate debt in absolute terms—some 70 trillion dollars, far exceeding the climate debt accumulated in the past 60 years (Figures 7 and 8). These results underscore the message that a business-as-usual scenario will result in an acceleration of climate change, even if carbon emissions are kept relatively flat.

[6] Climate debt for individual countries up to 2035 as a share of GDP is available in Appendix Table 2. Appendix Table 3 gives the cumulative per capita climate debt in the G-20.

Both China and the US will continue to account for a large share of the new climate debt, but China will account for an increasing share, rising to 33 percent of the global total. India's share will rise by 4 percentage points and the US's share will decrease by 8 percentage points.

Figure 7. Cumulative climate debt (billions), 1959–2018

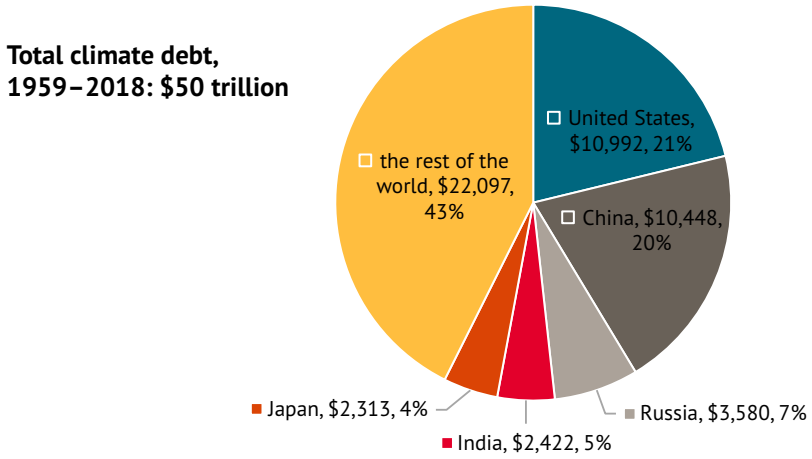
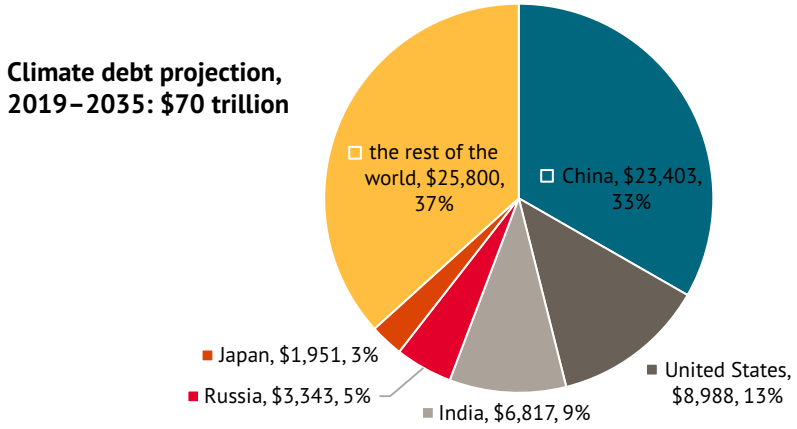


Figure 8. Climate debt projection (billions), 2019–2035



The climate debt is also very large relative to other liabilities of government. Climate debt accumulated through 2018 equals about 72 percent of GDP (unweighted average) in the G-20 (Table 1). Looking forward to 2035, cumulative climate debt will soar to 166 percent of GDP under the business-as-usual scenario, close to double the G-20 average of public debt of 88 percent of GDP in 2020.

Table 1. Cumulative climate debt and fiscal indicators (*Percent of GDP*), G20[1] countries

	Climate Debt, 1959–2018	General Government Gross Debt 2020	Climate Debt Projection (no action scenario), 2019–2035	NPV of Pension Spending Increases, 2020–2035[2]	NPV of Health Care Spending Increases, 2020–2035[3]
Average	**72**	**88**	**94**	**13**	**12**
Argentina	58	103	63	9	4
Australia	47	61	54	9	12
Brazil	34	99	43	46	n/a
Canada	61	118	56	9	13
China	76	67	169	28	7
France	30	114	24	6	13
Germany	49	69	34	13	9
India	89	90	251	9	2
Indonesia	58	37	121	2	2
Italy	40	156	27	20	9
Japan	47	256	39	–15	21
Korea	46	49	71	20	23
Mexico	63	61	65	6	5
Russia	215	19	201	35	6
Saudi Arabia	89	32	141	23	6
South Africa	208	77	230	4	6
Turkey	60	37	123	5	7
United Kingdom	40	104	21	4	17
United States	53	127	44	15	54

Sources: Authors' calculations using CO_2 historical emission data from Ritchie and Roser (2017); emissions projections from the IMF's Fiscal Affairs Department; and the IMF Fiscal Monitor, April 2021.

[1] Ratios to GDP are based on 2018 prices to ensure the comparability of climate debt figures for 2018 and 2035. The exception is gross debt to GDP in 2020, which is based on 2020 prices.

[2,3] NPV of pension and health care spending increases are estimated based on projected increases in spending from 2020 to 2030 from the IMF Fiscal Monitor, April 2021. A discount rate for future increases as a share of GDP of 1 percent per year is used.

4. Policy action scenarios: Biden and EU plans

The above analysis showed that in the absence of a policy change, climate debt will continue to grow at a rapid pace in the next 15 years. In order to assess the impact of potential plans to curb emissions and their likely impact on climate debt, we assess two proposals from large CO_2 emitters to contain CO_2 emissions. The first, by US President Biden, proposes to reduce US emissions to 50 percent of their 2005 levels by 2030. We estimate the implications for CO_2 emissions if all G20 countries were to follow Biden plan. The second proposal that we study was recently announced by the EU to reduce emissions by 55 percent (relative to their level in 1990) by 2030.

If G20 countries adopted their own versions of the "Biden plan" and started steady implementation in 2021 through 2030, emissions per capita would fall relative to the "business-as-usual" scenario, although with variation across countries (Figure 9). The greatest reductions, in percentage terms, would be India by 80 percent; China by 55 percent; the US by 38 percent; and other G20 countries by 50 percent on average. The reform scenario assumes a smooth reduction in emissions and would thus require a mix of policy actions that achieve some decreases in emissions now (through measures such as carbon pricing, which would raise the price of energy and reduce consumption immediately), and policies that might only reduce emissions later (for example, building capacity to produce green energy, which could take years to reduce emissions). Figure 10 shows annual climate externalities per capita under a Biden-like plan, and Figure 11 shows similar estimates under the EU plan.

The different rates of decline in emissions across countries, relative to the baseline, suggests that some countries would likely view a decline in emissions relative to 2005 levels as an unfair starting point. In particular, developing countries that experienced rapid increases in economic growth since 2005—and, concomitantly, emissions—will have to make much greater reductions to come back to 2005 levels of emissions than the advanced economies. In addition, advanced economies like the US, that are already at high levels of emissions per capita, would still be at high levels after the implementation of a global Biden plan. These equity issues suggest that, in the end, the targeted reduction in emissions would need to be lower for developing countries to ensure that a global plan posed a fair burden across countries.

Figure 9. CO_2 emission per capita (tons) under Biden-like plan, 1959–2030

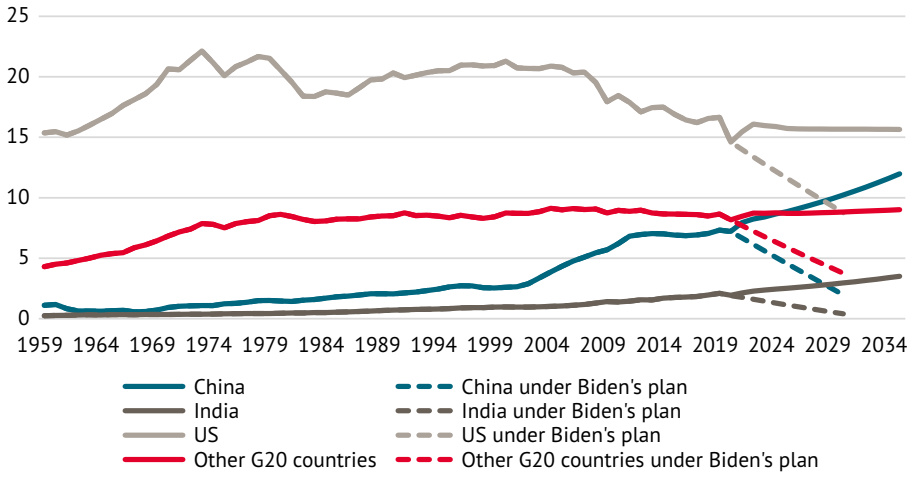


Figure 10. Annual climate externalities per capita (USD) under Biden-like plan, 1959–2030

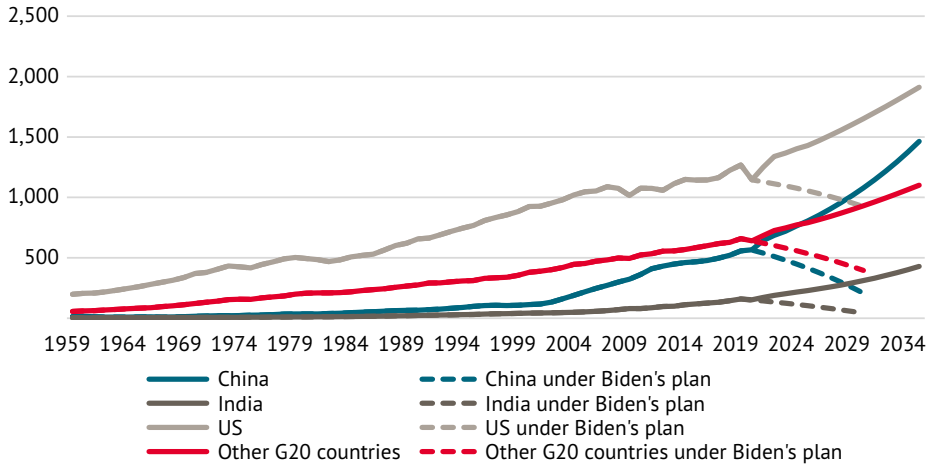
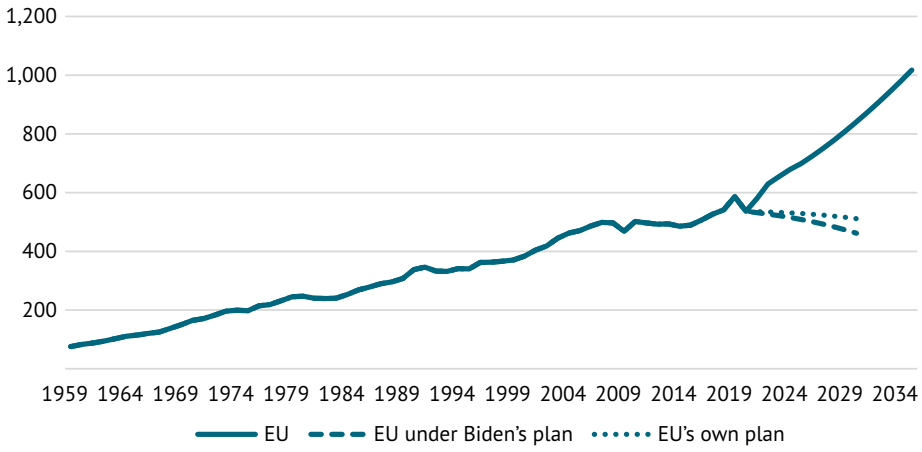
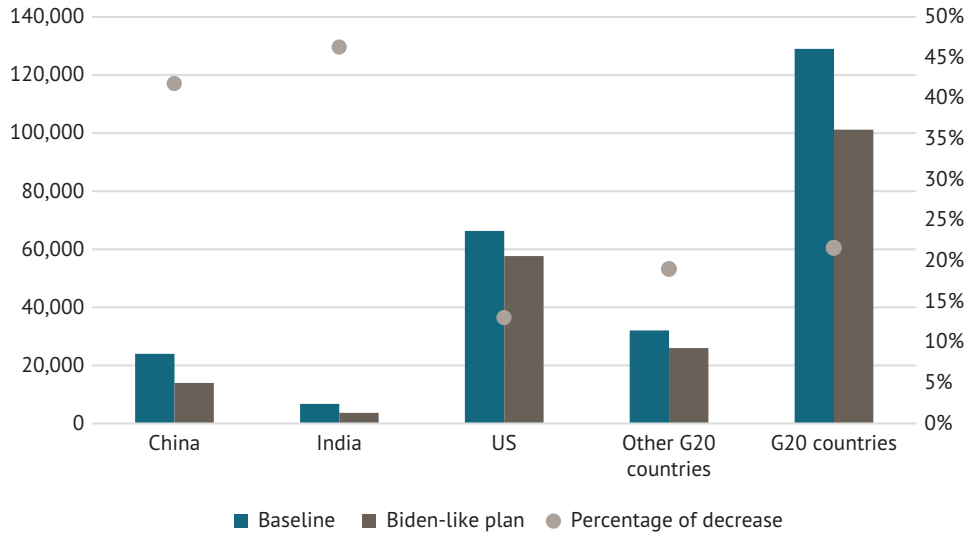


Figure 11. Annual climate externalities per capita (USD) under EU plan, 1959–2030



How much would these reductions in emissions put a dent in aggregate climate debt? Figure 12 indicates the cumulative climate debt per capita in 2035 under a Biden-like plan compared with the baseline. Two important results emerge from this analysis. First, climate debt would decline by a modest amount—in the US and G-20 as a whole, by only 20 percent, on average. China and India, however, would experience sharp declines of 42 percent and 46 percent, respectively. In the US, climate debt would remain at remarkably high levels—$57,666 per capita. Second, the climate debt per capita of the advanced economies would remain far higher than those of other countries, including China and India. These results suggest that current proposals to reduce emissions in the advanced economies are insufficiently ambitious to contain climate change. They also are likely to be perceived as unfair to emerging and developing economies, given their much lower levels of cumulative climate debt.

Figure 12. Cumulative climate debt per capita (USD) and percentage of decrease under Biden-like plan, 1959–2035



5. Fiscal policy actions to reduce climate debt

Government taxation and spending policies are a potent tool for taming the growth of climate debt. At the same time, countries face constraints in pursuing climate action because of the impact of the pandemic on their economies and the steep increases in public debt. Beyond the need to keep public debt at sustainable levels—which will require countries to reduce their budget deficits—countries will also need to allocate funds for expected increases in pension and health spending associated with aging populations. In the G-20, for example, the cumulative increase in spending for these programs is expected to rise by 25 percent over 2020–35 (Table 1).

An important implication of these fiscal pressures is that there may be little room for new expenditures (such as green infrastructure or subsidies for clean energy) to reduce the growth of climate debt. What is the alternative? Countries could turn to the revenue side, in particular greater taxation of energy with carbon taxes (Clements, and others, 2013).

This would have the advantage of reducing emissions while also helping countries to fund spending on green infrastructure.

Carbon taxation will need to be accompanied by complementary fiscal policies to offset their burden on low-income households. In developing economies, carbon taxation is generally found to be progressive, hitting upper-income groups more than others (Dorband and others, 2019).[7] Nonetheless, to garner political support for reforms, lower and middle-income groups will need to be compensated for higher energy costs. In advanced economies, energy taxes can be regressive. Policies that recycle some of these carbon revenues for well targeted spending, however, can lead to a policy package that reduces inequality (IMF, 2019).

6. Conclusions

Climate debt from CO_2 emissions is large and unevenly spread across the world's economies. In the advanced economies, the climate debt accumulated up to 2018 equaled about US $20,000 per person, some 2 times that of emerging economies and 10 times that of low-income economies. Among the biggest emitters, climate debt per capita is the highest in the United States and 5 times as high as that of China (and 19 times as high as that of India). While fiscal policy will face constraints going forward, the large size of the climate debt, and the disparities in climate debt by countries, portends contentious discussions on what constitutes a country's fair burden in slowing climate change and the level of assistance that should be given to developing countries to aid this effort. The cumulative climate debt of the US in 2035, for example, is projected to equal about 97 percent of GDP, compared to its annual official development aid of 0.2 percent of GNI. Climate debt per capita is projected to be much higher in the advanced economies than in developing economies, even under the reform proposals of the Biden administration in the US and the European Union. This implies that additional effort by advanced economies, or substantially higher financial assistance to developing countries, may be needed to achieve a fair burden in the fight against climate change.

[7] As countries develop and the poor and middle classes expand their consumption of electricity and fuels, energy taxation is likely to become less progressive.

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Appendix

Table A.1. Social cost of carbon (2018 prices)

Year	Social Cost of Carbon (2018 prices)
1950	10
1951	10
1952	11
1953	11
1954	11
1955	11
1956	12
1957	12
1958	13
1959	13
1960	13
1961	14
1962	14
1963	15
1964	15
1965	15
1966	16
1967	16
1968	17
1969	17
1970	18
1971	18
1972	19
1973	20
1974	20
1975	21
1976	21
1977	22
1978	23
1979	23
1980	24
1981	25
1982	26
1983	26
1984	27
1985	28
1986	29
1987	30
1988	30
1989	31
1990	32
1991	33

Year	Social Cost of Carbon (2018 prices)
1992	34
1993	35
1994	36
1995	37
1996	39
1997	40
1998	41
1999	42
2000	43
2001	45
2002	46
2003	47
2004	49
2005	50
2006	52
2007	53
2008	55
2009	57
2010	58
2011	60
2012	62
2013	64
2014	66
2015	68
2016	70
2017	72
2018	74
2019	76
2020	78
2021	81
2022	83
2023	86
2024	88
2025	91
2026	94
2027	96
2028	99
2029	102
2030	105
2031	109
2032	112
2033	115
2034	119
2035	122

Table A.2. Cumulative climate debt (percent of GDP), 131 countries

	Country	Climate Debt, 1959–2018	Climate Debt Projection (business-as-usual scenario), 2019–2035
1	Albania	62	66
2	Algeria	111	153
3	Angola	33	58
4	Argentina	58	63
5	Armenia	137	117
6	Australia	47	54
7	Austria	29	25
8	Azerbaijan	168	141
9	Bahrain	102	154
10	Bangladesh	26	101
11	Belarus	257	194
12	Belgium	44	33
13	Benin	39	115
14	Bolivia	57	102
15	Bosnia and Herzegovina	165	209
16	Botswana	37	71
17	Brazil	34	43
18	Brunei Darussalam	90	103
19	Bulgaria	181	125
20	Cambodia	27	105
21	Cameroon	23	43
22	Canada	61	56
23	Chile	37	52
24	China	76	169
25	Colombia	39	63
26	Congo, Democratic Republic of the	11	10
27	Congo, Republic of	25	42
28	Costa Rica	18	26
29	Côte d'Ivoire	22	35
30	Croatia	64	52
31	Cyprus	49	49
32	Czech Republic	113	79
33	Denmark	30	18
34	Dominican Republic	38	60
35	Ecuador	48	64
36	Egypt	110	206
37	El Salvador	38	48
38	Eritrea	43	65
39	Estonia	135	108
40	Ethiopia	14	46

	Country	Climate Debt, 1959–2018	Climate Debt Projection (business-as-usual scenario), 2019–2035
41	Finland	40	29
42	France	30	24
43	Gabon	58	63
44	Georgia	147	161
45	Germany	48	34
46	Ghana	25	55
47	Greece	74	62
48	Guatemala	25	51
49	Haiti	34	51
50	Honduras	48	78
51	Hungary	82	59
52	Iceland	22	30
53	India	89	251
54	Indonesia	58	121
55	Iran	181	307
56	Iraq	85	147
57	Ireland	19	19
58	Israel	27	40
59	Italy	40	27
60	Jamaica	106	86
61	Japan	47	39
62	Jordan	73	110
63	Kazakhstan	242	393
64	Kenya	21	47
65	Korea	46	71
66	Kuwait	87	113
67	Kyrgyz Republic	278	256
68	Lao P.D.R.	38	284
69	Latvia	62	36
70	Lithuania	73	45
71	Luxembourg	31	21
72	Macedonia, FYR	163	112
73	Malaysia	77	146
74	Malta	27	20
75	Mexico	63	65
76	Moldova	220	92
77	Mongolia	213	530
78	Montenegro, Rep. of	66	69
79	Morocco	65	106
80	Mozambique	42	167
81	Myanmar	33	105

	Country	Climate Debt, 1959–2018	Climate Debt Projection (business-as-usual scenario), 2019–2035
82	Namibia	28	66
83	Nepal	23	74
84	Netherlands	37	33
85	New Zealand	30	38
86	Nicaragua	55	75
87	Niger	16	37
88	Nigeria	41	53
89	Norway	19	19
90	Oman	76	161
91	Pakistan	73	163
92	Panama	20	28
93	Paraguay	19	55
94	Peru	31	45
95	Philippines	40	87
96	Poland	123	102
97	Portugal	40	35
98	Qatar	54	116
99	Romania	101	56
100	Russia	215	201
101	Rwanda	12	27
102	Saudi Arabia	89	141
103	Senegal	45	120
104	Serbia	187	188
105	Singapore	22	21
106	Slovak Republic	88	66
107	Slovenia	56	48
108	South Africa	208	230
109	South Sudan	38	74
110	Spain	37	31
111	Sri Lanka	24	57
112	Sudan	53	107
113	Suriname	111	89
114	Sweden	22	24
115	Switzerland	12	8
116	Tajikistan	142	204
117	Tanzania	19	49
118	Thailand	68	112
119	Togo	60	129
120	Trinidad and Tobago	252	337
121	Tunisia	97	139
122	Turkey	60	123

	Country	Climate Debt, 1959–2018	Climate Debt Projection (business-as-usual scenario), 2019–2035
123	Turkmenistan	241	465
124	Uganda	14	39
125	Ukraine	634	367
126	United Arab Emirates	53	91
127	United Kingdom	40	21
128	United States	53	44
129	Uruguay	20	24
130	Uzbekistan	437	451
131	Vietnam	55	173

Table A.3. Cumulative per capita climate debt in G-20

	Country	Cumulative Climate Debt Per Capita, 1959–2018	Cumulative Climate Debt Projection Per Capita, 2019–2035
1	Argentina	8,306	6,769
2	Australia	34,508	27,915
3	Brazil	3,656	3,673
4	Canada	34,869	23,841
5	China	7,917	16,042
6	France	14,404	9,943
7	Germany	23,980	16,112
8	India	2,140	4,593
9	Indonesia	2,689	4,286
10	Italy	14,309	9,395
11	Japan	18,576	15,989
12	Korea	16,643	23,881
13	Mexico	7,891	5,748
14	Russia	25,121	23,247
15	Saudi Arabia	31,055	28,950
16	South Africa	17,868	13,175
17	Turkey	7,051	10,812
18	United Kingdom	19,149	8,740
19	United States	40,266	26,021