US Economics Analyst

The Economics of Climate Change: A Primer

- Climate change has increasingly drawn the attention of economists in both academic and policymaking circles. In this week's *Analyst* we survey the literature on the economic effects of climate change and possible policy responses.
- Researchers have estimated the welfare effects of climate change due to output loss and monetary damages as well as increased mortality, species loss, and environmental degradation. The empirical evidence suggests that climate change has likely already had a significant impact on economic welfare through a wide range of channels. The estimated welfare impact also tends to vary sharply across geographies and is often highly non-linear in temperature.
- Most of the welfare costs of climate change are likely to come in the distant future. While there is considerable uncertainty over how much temperatures will rise, and how that will affect natural and human systems, growing evidence points to a significant risk of very large welfare losses.
- Economic principles suggest that market-based instruments like a carbon tax can efficiently deal with the negative externalities from carbon emissions. While simple in theory, most countries including the US have not implemented such policies. This likely reflects the global nature of the externality, which encourages free-riding, the highly uncertain welfare costs, and the challenges in choosing how much weight to place on future generations in cost-benefit analysis.
- Analysis from our Energy equity analysts points to many available low-cost opportunities that would reduce emissions. The current cost curve steepens quickly, with rapidly rising costs at higher levels of decarbonization. Nevertheless, dynamic considerations, such as learning-by-doing, knowledge spillovers, and network effects, suggest that many investments that are costly today could still be efficient from a long-run perspective.
- In the short run, the growth effects from decarbonization policies are likely ambiguous, with winners and losers across sectors, and are likely highly dependent on the policy details. Overall, our survey of the literature suggests that policies aimed at curbing emissions could trigger significant shifts and have the potential to raise welfare of current and especially future generations.

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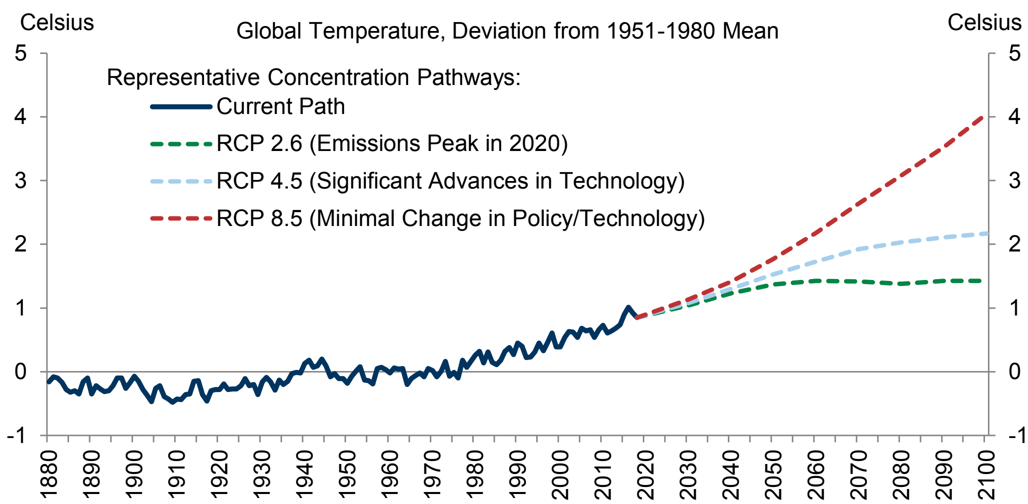
The Economics of Climate Change: A Primer

Climate change has increasingly drawn the attention of economists in both academic and policymaking circles. Recently, over 3,500 economists—including 27 Nobel Laureates and 4 former Fed Chairs—signed a statement supporting a carbon tax in the US, and climate-related issues were the top five most likely long-run global risks according to a survey of participants at the World Economic Forum. These concerns have followed a steady rise in global temperatures over the last five decades, with projections of significant further rises under most emission scenarios from the Intergovernmental Panel on Climate Change (Exhibit 1).

Exhibit 1: Global Temperatures Are Rising, and Are Projected to Rise Considerably Further Under Most Plausible Scenarios



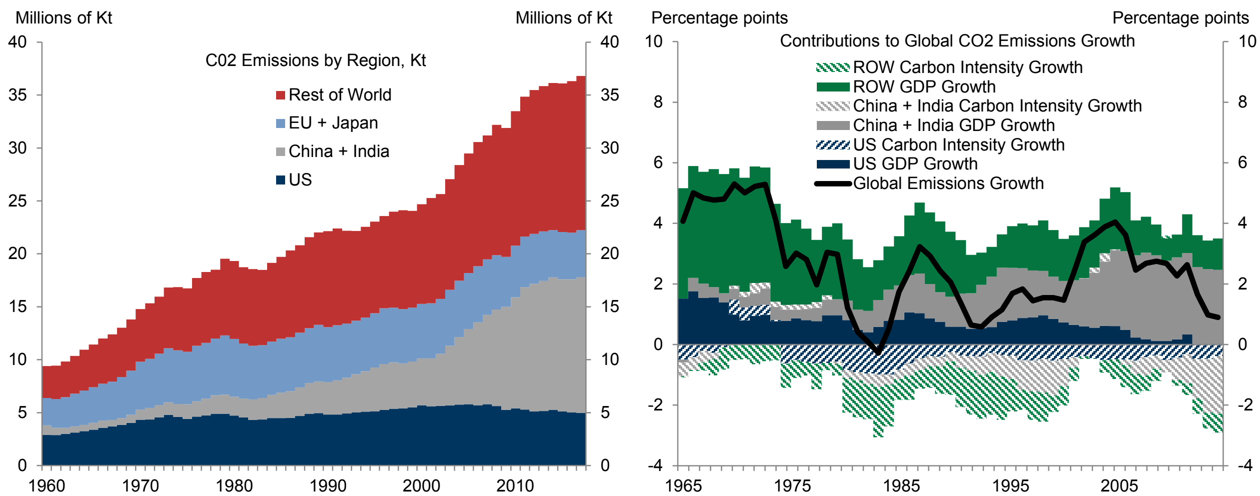
Source: Goddard Institute for Space Studies, Intergovernmental Panel on Climate Change, Goldman Sachs Global Investment Research

Scientists strongly agree that human emissions of greenhouse gases, especially carbon dioxide, have played a large role in the rise in global temperatures. While US carbon emissions have started to edge lower, the US continues to produce nearly 15% of global emissions,[1] and global carbon emissions have continued to rise (Exhibit 2, LHS). This rise reflects output growth that has outpaced the decline in carbon intensity,[2] particularly in emerging economies (Exhibit 2, RHS), and even stabilization in global net emissions would not prevent further increases in the concentration of greenhouse gases and therefore temperature levels. In this week's *Analyst* we survey the economics of climate change, discussing the link between climate change, economic growth, and welfare, as well as the public policy response in theory and practice.

1 This is particularly true when looking at carbon emissions per capita.

2 Defined here as carbon emissions per unit of output.

Exhibit 2: Global Carbon Emissions Have Continued to Rise as Global Output Growth Has Outpaced the Decline in Carbon Intensity



Source: World Bank, Ritchie and Roser (2017), Goldman Sachs Global Investment Research

Surveying the Evidence on Welfare Effects from Climate Change

A key challenge in the economics of climate change is assessing welfare effects. Welfare effects include not only output losses and monetary damages, but effects from climate change that are not fully captured by any market measure, such as increased mortality, species loss, and environmental degradation. While there is no clear-cut way to quantify the welfare losses, economists have constructed methods for estimating monetized equivalents to facilitate comparison and to estimate a "social cost of carbon" for cost-benefit analysis.[3]

Exhibit 3 shows examples of recent academic studies of the welfare impact of climate change at the micro-level thus far. While the list is far from comprehensive, these studies have identified a wide range of channels, such as increased frequency of storms, lower crop yields in agriculture, lower productivity in manufacturing, and higher crime and mortality through which climate change can lower welfare. Many studies find non-linearities where the welfare costs from rising temperatures become very large at higher temperature levels, for instance through lower agricultural or manufacturing productivity, higher outmigration, or lower subjective happiness.

[3] For instance, economists have relied on estimates on the value of a statistical life and estimates of the economic cost of crime.

Exhibit 3: Researchers Have Identified Multiple Channels Through Which Climate Change Affects Welfare

Empirical Evidence on the Welfare Effects from Climate Change by Sector			
Sector/Channel	**Study**	**Key Finding/Description of Channel**	**Direct Output effect?**
Agriculture	Moore, Baldos, Hertel & Diaz (2017)	A 2□C increase in the global temperature vs.1995-2005 baseline lowers major crop yields by 10-30%.	Yes (negative)
Manufacturing (productivity)	Zhang, Deschenes, Meng, Zhang (2018)	A day with temperature above 90◦F (26◦C) decreases China plants' output and TFP by around 0.5%, relative to a day with temperature between 50-60◦F (i.e. 21-26◦C).	Yes (negative)
Energy	Aufhammer (2018)	Rising temperature increases electricity consumption (e.g. summer AC) but lowers natural gas demand (e.g. winter heating) in California.	Yes (ambiguous)
Storms	Hsiang and Jina (2014)	Tropical cyclones persistenly depress growth rates for 15 years with a 7% cumulative decline in per capita income after 20 years.	Yes (negative, at least in study)
Sea-level rise	NA	Houses, offices, plants and infrastructure could be chronically inundated.	Yes (ambiguous)
Mortality	Deschenes and Greenstone (2011)	Under a "business as usual" scenario, climate change will increase the US annual mortality rate by about 1% by 2100 (and boost annnual residential energy consumption by 20-25%, corresponding to 0.1% of GDP.)	Mostly no
Migration	Bohra-Mishra, Oppenheimer, Hsiang (2014)	Above 25 □C, a rise in temperature is related to an increase in outmigration in India.	No
Crime and conflict	Burke, Hsiang, Miguel (2015)	A 1σ increase in temperature increases the frequency of interpersonal conflict (e.g. domestic violence, murder, road rage) by 2.4% and of intergroup conflict (e.g. riots, land invasions, civil war, coups) by 11.3%.	No
Temparement/ happiness	Baylis (2015)	An increase in the temperature from 70◦F to 80◦F (i.e. 21◦C to 26◦C) lowers happiness as much as a switch from Sunday to Monday does.	No
Species and forestry loss	NA	Climate change leads to a loss of species and forests.	No

Source: Goldman Sachs Global Investment Research

One particularly salient channel has been the increased frequency of storms and other large natural disasters and rising damages over the last several decades, both in the US and globally.[4] Natural disasters have two important, but generally offsetting, effects on economic activity.[5] At first, the disaster itself leads to a loss of business activity; as the disruptions ease, activity picks up again and damaged houses and other property are rebuilt. While under a typical scenario the long-run output loss may be small, several studies and anecdotal evidence suggest that local output may not fully recover for very large disasters.[6] In such a case the welfare costs may be considerably larger, in addition to the major welfare costs from mortality and distress from those affected, as well as the destruction of wealth.

While the micro-level studies deepen our understanding of the various channels, their large number and potential overlap (e.g. climate change lowers agricultural output, which in turn boosts outmigration) complicate the calculation of aggregate welfare costs. Researchers have therefore also looked at the relationship between climate change and growth at the country and region level. An influential study using historical temperature fluctuations across countries has found that higher temperatures have likely already weighed on aggregate growth in poor countries, through lower agricultural output, industrial output and political stability.[7]

4 Andrew Boak, Bill Zu, and William Nixon, "The Macro Impact of the Bushfire Crisis," Australia and New Zealand Economics Analyst, 6 January 2020.

5 See Spencer Hill, "Hurricane Handbook: Natural Disasters and Economic Data," US Economics Analyst, 9 September 2017 and Jan Hatzius, Sven Jari Stehn, and Shuyan Wu, "The Economic Effects of Hurricane Sandy," US Economics Analyst, 2 November 2012.

6 See Solomon Hsiang and Amir Jina, "The Causal Effect of Environmental Catastrophe on Long-Run Economic Growth: Evidence from 6,700 Cyclones," NBER Working Paper, 2014. For example in the United States, employment in New Orleans has not recovered since Hurricane Katrina, and population projections suggest permanent output loss in Puerto Rico. The level of insurance coverage in an economy leads to very different paths of recovery from climate-related disasters, as shown in recent instances of hurricanes across different US states and Caribbean islands.

7 Melissa Dell, Benjamin Jones and Benjamin Olken, "Temperature Shocks and Economic Growth: Evidence from the Last Half Century," American Economic Journal: Macroeconomics, 2012.

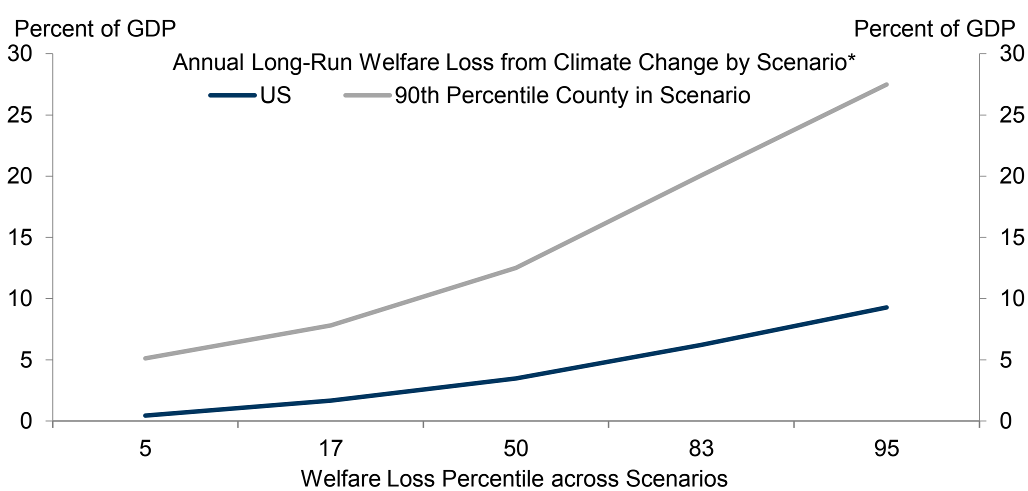
Taken together, these studies suggest that climate change has already significantly impacted economic welfare in many sectors and geographies.

Projecting the Welfare Effects of Climate Change

An even harder challenge for researchers is estimating the impacts of future climate change. There is considerable uncertainty in how much temperatures will rise, and even more uncertainty in how that will affect human and natural systems. Scientists are particularly worried about potential nonlinear effects, such as "tipping points" that lead to sudden and large changes in physical systems, but these are inherently hard to predict. The ability of humans to adapt is also important to take into account: for example, if temperatures rise, this will likely lead to more air conditioning usage, limiting the rise in mortality and the productivity loss but also leading to more electricity consumption.[8]

The large uncertainty and different assumptions made by researchers have led to a wide range of estimates of the welfare effects of long-run climate change. A recent study by Hsiang et al. uses meta-analysis of many empirical studies to estimate future economic damages from climate change in the US assuming only a minimal policy response.[9] This analysis finds a large right tail in the distribution of potential welfare losses across simulations and large heterogeneity in estimated welfare losses by region, with the South and coastal regions disproportionately affected (Exhibit 4). While such estimates will always be highly uncertain, these studies taken together underscore the risk of potentially very large long-run welfare effects.

Exhibit 4: Studies Suggest Significant Heterogeneity in Welfare Losses Across Regions, as Well as Large Right Tails



*From the Hsiang et al (2017) meta-study which simulates welfare losses in 2080-2099 under the Representative Concentration Pathway 8.5 ("Minimal Change in Policy/Technology").

[8] Maximilian Auffhamer, "Quantifying Economic Damages from Climate Change," Journal of Economic Perspectives, 2018.

[9] Solomon Hsiang, Robert Kopp, Amir Jina et al.,"Estimating economic damage from climate change in the United States," Science, 2017.

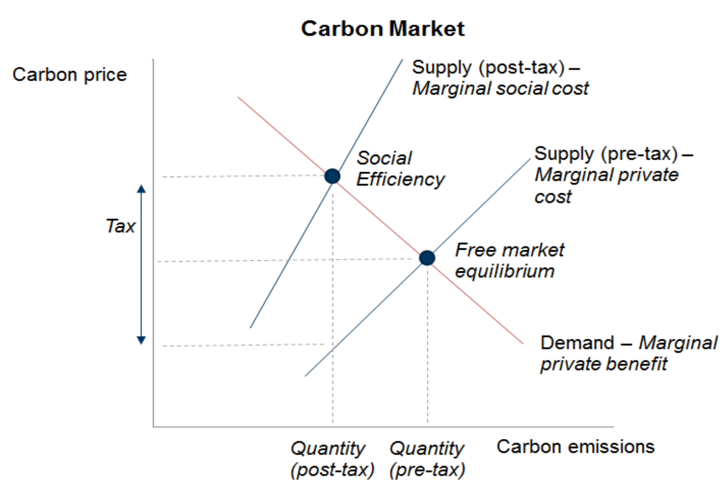
Decarbonization Policy: Theory and Practice

Given the growing evidence of the link between emissions, climate change, and welfare, how should economic policy effectively deal with the issue? Scientists have focused on three potential strategies to slow climate change: abatement (reducing emissions), carbon removal and storage, and geoengineering (e.g. offsetting global warming by increasing the reflectivity of the earth). Because cost-effective carbon removal and geoengineering technologies still appear a ways off, most experts see abatement as the only realistic option at this point.[10]

From an economics perspective, the rationale for abatement is that greenhouse gas emissions are a negative externality. Firms and individuals do not fully internalize the effect of their emissions on broader society, and thus the social cost of emissions exceeds the private cost, which leads to excessive emissions. The economics of externalities offers a clear solution to this problem: increase the price of emitting carbon until social and private costs are aligned.

The socially optimal solution can be achieved by a carbon tax—in which the tax rate is the monetized marginal external cost of emissions—or by putting a regulatory limit on the amount of emissions and allowing market trading in a cap-and-trade system (Exhibit 5). Both policies raise the price of emissions to correct for the externality, and use market forces to induce firms to move to low-carbon technologies and to provide incentives to further develop new low-carbon technologies. Studies of the behavioral responses to such policies that have been implemented thus far have found a significant decline in emissions in response to higher carbon prices.[11]

Exhibit 5: Economic Principles Suggest Taxing Emissions to Correct for Their Negative Externalities



Source: Goldman Sachs Global Investment Research

While simple in theory, most countries including the US have not implemented such

[10] See William Nordhaus, "Climate Change: The Ultimate Challenge for Economics," American Economic Review, 2019.

[11] See for example Julius Andersson, "Carbon Taxes and CO2 Emissions: Sweden as a Case Study," American Economic Journal: Economic Policy, forthcoming, and Jean-Thomas Bernard and Maral Kichian, "The Long and Short Run Effects of British Columbia's Carbon Tax on Diesel Demand," Energy Policy, 2019.

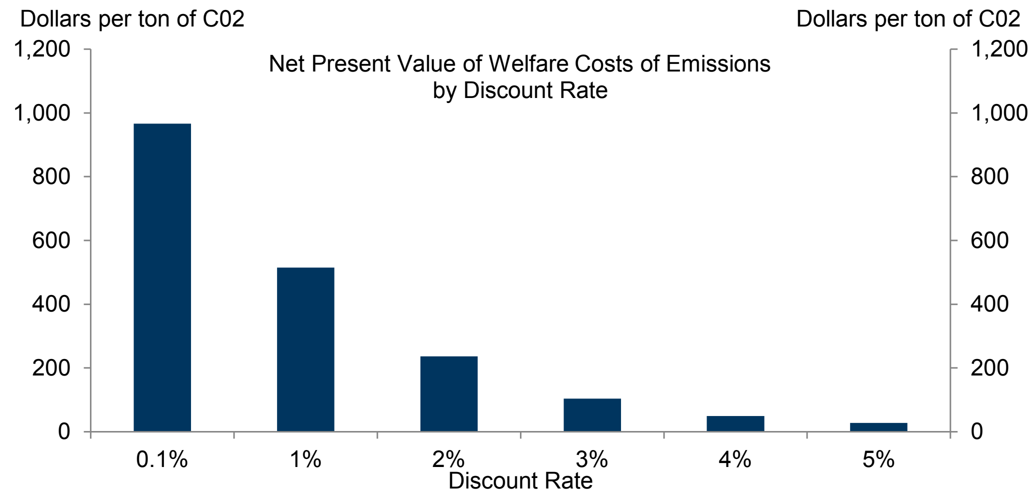
policies, likely reflecting several challenges of applying these approaches in practice. First, the externality is global, and thus requires global cooperation; there is no legal mechanism that can prevent countries from free-riding on policies aimed at curbing emissions.[12] Second, welfare costs are both highly uncertain and hard to measure, as illustrated earlier. Third, a large share of the costs of climate change is likely to come in the distant future, making any assessment of climate change policies highly sensitive to the choice of the discount rate. A higher discount rate implies that a gradual ramping up of policy is appropriate, while a low discount rate implies that mitigation efforts should be more front-loaded.

The question of what discount rate to use has become central in the economics debate on climate change. Exhibit 6 shows the net present value (NPV) of welfare costs of emissions for different discount rates, for a given estimate of annual welfare costs from William Nordhaus's widely used model. Several studies have suggested using very low discount rates—close to zero—based on the idea that it is ethically wrong to heavily discount the costs to future generations. Many economists suggest that market discount rates are more appropriate, as they reflect the opportunity cost of foregoing other investments.[13] However, the possibility of future catastrophes and uncertainty over when climate change might have a large adverse effect are forces that suggest once again that the appropriate discount rate should be lower than for other assets. While this debate is ongoing, most economists agree that the appropriate discount rate is unlikely to be very high, suggesting that policies aimed at mitigating emissions are likely welfare enhancing from a NPV perspective.

[12] One proposal to enforce global cooperation suggested by William Nordhaus is a "climate club," in which members agree to put a price on carbon and to tax imported goods from non-member countries. The lack of a "carbon border tax" has also made existing proposals unpopular with unions, as energy intensive industries move abroad, leading to carbon leakage.

[13] Even if future generations are weighted equally to current generations, an argument for using market discount rates is that future generations would potentially benefit more from other investments that increase the capital stock and increase consumption in the future. See Gary Becker, Kevin Murphy, and Robert Topel, "On the Economics of Climate Policy".

Exhibit 6: The NPV of Welfare Costs of Emissions Is Highly Sensitive to the Discount Rate



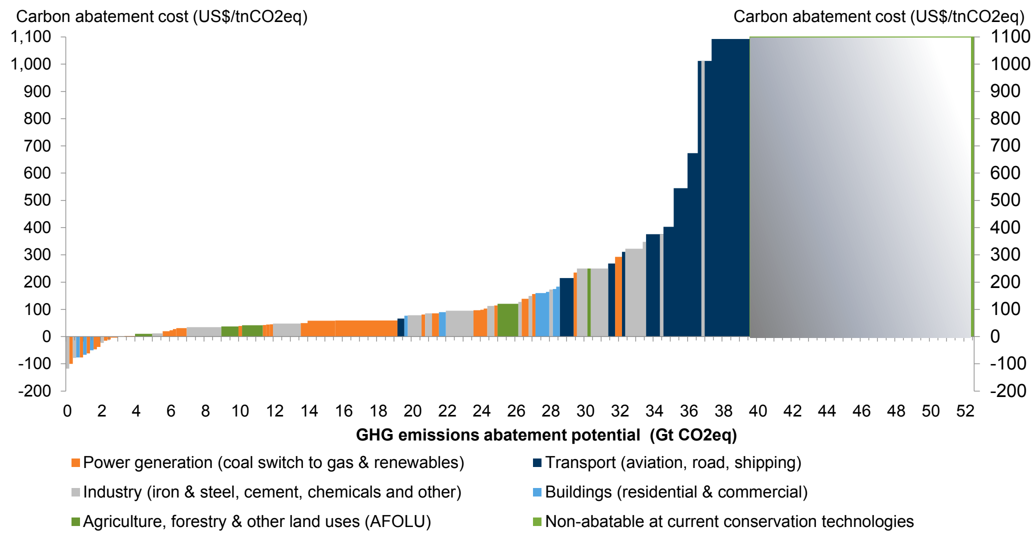
Note: Based on Nordhaus (2019) and equal to the optimal carbon price in standard economic models.

Source: Nordhaus (2019), Goldman Sachs Global Investment Research

How might decarbonization policies work in practice? Based on research by our Energy equity research analysts,[14] Exhibit 7 shows an estimate of a marginal abatement cost curve, which shows the marginal costs of achieving a given reduction in emissions by sorting investment opportunities from lowest to highest cost. These estimates show many available low-cost opportunities, including "free lunches" that would both reduce costs *and* emissions. Such measures for example include switching from coal to gas and renewable solar energy in power generation, efficiency gains in recycling, and increased industrial and building efficiency. A carbon tax would likely further incentivize the use of other low-cost decarbonization opportunities, by making the parts of the abatement curve below the carbon tax cost-effective.

[14] Michele Della Vigna et al., "Carbonomics: The Future of Energy in the Age of Climate Change, " 11 December 2019.

Exhibit 7: The Cost Curve of Decarbonization Shows Many Low-Cost Investment Opportunities, but Quickly Becomes Steep



Source: Goldman Sachs Global Investment Research

The cost curve quickly becomes steep, with rapidly rising costs at higher levels of decarbonization. However, it is important to note that marginal cost curves are static, and miss the important dynamic effects of potentially reducing costs in the future.[15] Technological investment undertaken today can lead to gains in production efficiency, stimulate learning-by-doing, and allow for more technological improvements. Network effects may also develop: for example, purchases of electric vehicles today could stimulate demand for more charging stations, which would in turn lower the future operating cost of electric vehicles. Such dynamic effects are important in determining which investments are most cost effective in the long run.[16] These dynamic considerations may also provide a rationale to complement carbon taxes with (temporary) research subsidies to redirect innovation towards clean technologies.[17]

The Growth Effects of Decarbonization Policies

What are the growth implications of decarbonization policies? There appears to be little evidence on the economic growth effects of carbon taxes or cap and trade systems. In contrast, several studies of US environmental regulation have found negative effects on the productivity, output and earnings of targeted firms, industries and workers (Exhibit 8). However, the effects of decarbonization policies on economy-wide activity are more ambiguous for three reasons.

[15] Kenneth Gillingham and James Stock, "The Cost of Reducing Greenhouse Gas Emissions," Journal of Economic Perspectives, 2018.

[16] These dynamic considerations are one reason why some seemingly cost-effective ways of reducing emissions, such as moving from coal to gas, may not be efficient in the long run if there is path dependence.

[17] Daron Acemoglu, Ufuk Akcigit, Douglas Hanley and William Kerr, "Transition to Clean Technology", Journal of Political Economy, 2016.

Exhibit 8: Economic Research Finds Mostly Negative Effects on Activity in Targeted Sectors from US Environmental Regulation

Review of Literature on Impact of Environmental Regulation		
Study	**Impact on Growth/Jobs**	**Finding**
Berman and Bui (2001)	Postive	Local regulations imposed large costs, boosted productivity, but had no employment effects.
Greenstone (2002)	Negative	Highly regulated counties lost 590k jobs vs. lowly regulated counties over 15 years.
Keller and Levinson (2002)	Negative	Abatements costs modestly reduce foreign direct investment in polluting industries.
Hanna (2010)	Negative	US regulation increased foreign output of polluting industries by 9% in 33 years.
Greenstone, List, Syverson (2010)	Negative	Stricter standards lowered productivity by 5% and cost $21bn per year.
Walker (2013)	Negative	Workers in regulated plants lost $9 billion in cumulative earnings.

Source: Goldman Sachs Global Investment Research

First, abatement in the polluting industries also requires both capital investment and the hiring of additional workers. Second, workers and firms typically shift to other often cleaner production or innovation activities (or less regulated areas). A recent study finds that higher fuel taxes indeed induce auto firms to redirect technical change towards clean innovation.[18][19] Third, the policy details and fiscal picture also matter. For instance, the short-term growth effects from a carbon tax are likely to be more positive when the receipts are rebated to households through carbon dividends or spent/invested by the government. Similarly, deficit-funded public investment in green technology is likely more positive for short-term growth than stricter regulations.

Analysis from our European economists also suggests that efforts to mitigate emissions come with transition costs but need not damage economy-wide growth. Compiling data on 21 sectors within 29 countries, they find that environmental regulation tends to weigh on relative output and employment growth in carbon-heavy industries but stimulates fixed investment, with some sectors shrinking and others expanding. Overall, they document only a weak correlation between decarbonization and GDP growth at the national level.[20]

We note once again, however, that short-term growth is not equivalent to welfare. Overall, our survey of the literature suggests that policies aimed at curbing emissions could trigger significant shifts in the economy and have the potential to raise welfare of current and especially future generations.

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[18] Philippe Aghion et al, "Carbon Taxes, Path Dependency and Directed Technical Change: Evidence from the Auto Industry," Journal of Political Economy, 2016.

[19] The net short-term growth effect from reallocating workers and capital from a polluting to a green sector may be somewhat negative if the former is more productive from a narrow GDP perspective.

[20] Adrian Paul and Silvia Ardagna, "Going Green" European Economics Analyst, 7 June 2019.

The US Economic and Financial Outlook

Forecast Changes

Our Q4 GDP tracking estimate declined by 0.2% this week to +1.9%.

THE US ECONOMIC AND FINANCIAL OUTLOOK
(% change on previous period, annualized, except where noted)

	2017	2018	2019	2020	2021	2022	2023	2019				2020			
			(f)	(f)	(f)	(f)	(f)	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
OUTPUT AND SPENDING															
Real GDP	2.4	2.9	2.3	2.2	2.4	2.1	1.8	3.1	2.0	2.1	1.9	2.0	2.6	2.5	2.5
Real GDP (Q4/Q4)	2.8	2.5	2.3	2.4	2.3	2.0	1.7	--	--	--	--	--	--	--	--
Consumer Expenditure	2.6	3.0	2.6	2.5	2.4	2.2	1.9	1.1	4.6	3.1	1.7	2.2	2.5	2.6	2.6
Residential Fixed Investment	3.5	-1.5	-1.7	3.3	3.6	3.0	2.2	-1.1	-2.9	4.6	3.0	4.0	4.0	4.0	2.0
Business Fixed Investment	4.4	6.4	2.2	1.4	4.0	3.6	2.9	4.4	-1.0	-2.3	-0.1	2.1	3.0	3.9	3.9
Structures	4.7	4.1	-4.5	-6.4	0.5	2.0	1.7	4.0	-11.1	-9.9	-11.2	-6.0	-4.0	0.0	0.0
Equipment	4.7	6.8	1.5	1.7	4.0	3.4	2.7	-0.1	0.8	-3.8	-0.5	3.0	4.0	4.0	4.0
Intellectual Property Products	3.6	7.4	7.8	6.0	6.0	4.7	3.7	10.9	3.6	4.6	7.5	6.0	6.0	6.0	6.0
Federal Government	0.8	2.9	3.5	2.5	0.2	0.0	0.0	2.2	8.3	3.3	2.5	2.5	2.5	0.0	0.0
State & Local Government	0.6	1.0	1.6	1.5	1.5	1.2	1.0	3.4	2.7	0.7	1.6	1.5	1.5	1.5	1.5
Net Exports ($bn, '09)	-850	-920	-957	-949	-1,005	-1,046	-1,057	-944	-981	-990	-912	-924	-946	-958	-967
Inventory Investment ($bn, '09)	32	48	68	29	51	55	55	116	69	69	16	10	30	35	40
Industrial Production, Mfg.	2.0	2.3	-0.2	0.3	1.6	1.3	0.9	-1.9	-3.2	0.9	-1.0	0.2	1.3	1.6	1.7
HOUSING MARKET															
Housing Starts (units, thous)	1,209	1,250	1,298	1,334	1,348	1,367	--	1,213	1,256	1,282	1,441	1,334	1,335	1,329	1,338
New Home Sales (units, thous)	617	615	679	701	707	717	--	669	661	699	685	714	691	693	707
Existing Home Sales (units, thous)	5,531	5,341	5,340	5,472	5,523	5,576	--	5,207	5,287	5,427	5,439	5,452	5,465	5,478	5,491
Case-Shiller Home Prices (%yoy)*	6.2	4.1	3.3	3.0	2.2	2.1	2.3	3.0	3.0	3.1	3.3	3.4	3.4	3.2	3.0
INFLATION (% ch, yr/yr)															
Consumer Price Index (CPI)	2.1	2.4	1.8	2.2	2.1	2.3	2.3	1.6	1.8	1.8	2.0	2.4	2.1	2.1	2.0
Core CPI	1.8	2.1	2.2	2.3	2.4	2.4	2.5	2.1	2.1	2.3	2.3	2.3	2.3	2.2	2.2
Core PCE**	1.6	2.0	1.6	1.9	2.0	2.1	2.2	1.6	1.6	1.7	1.6	1.9	1.9	1.8	1.9
LABOR MARKET															
Unemployment Rate (%)	4.4	3.9	3.7	3.3	3.1	3.1	3.0	3.9	3.6	3.6	3.5	3.4	3.3	3.2	3.2
U6 Underemployment Rate (%)	8.5	7.7	7.2	6.4	6.2	6.2	6.1	7.5	7.3	7.0	6.8	6.5	6.5	6.4	6.4
Payrolls (thous, monthly rate)	180	221	179	155	125	113	100	206	146	172	191	170	160	150	140
GOVERNMENT FINANCE															
Federal Budget (FY, $bn)	-666	-779	-984	-1,025	-1,050	-1,200	-1,250	--	--	--	--	--	--	--	--
FINANCIAL INDICATORS															
FF Target Range (Bottom-Top, %)^	1.25-1.5	2.25-2.5	1.5-1.75	1.5-1.75	2.0-2.25	2.5-2.75	2.5-2.75	2.25-2.5	2.25-2.5	1.75-2.0	1.5-1.75	1.5-1.75	1.5-1.75	1.5-1.75	1.5-1.75
10-Year Treasury Note^	2.40	2.69	1.92	2.25	2.30	2.35	2.35	2.41	2.00	1.68	1.92	2.00	2.05	2.15	2.25
Euro (€/$)^	1.20	1.15	1.12	1.15	1.17	1.20	1.22	1.12	1.14	1.09	1.12	1.11	1.12	1.14	1.15
Yen ($/¥)^	113	110	109	105	104	102	101	111	108	108	109	110	108	106	105

* Weighted average of metro-level HPIs for 381 metro cities where the weights are dollar values of housing stock reported in the American Community Survey.
** PCE = Personal consumption expenditures. ^ Denotes end of period.
Note: Published figures in bold.

Source: Goldman Sachs Global Investment Research

Economic Releases

		Time		Estimate		
Date		(EST)	Indicator	GS	Consensus	Last Report
Wed	**Jan 22**	9:00	FHFA House Price Index (Nov)	n.a.	+0.3%	+0.2%
		10:00	**Existing Home Sales (Dec)**	**+2.5%**	**+1.5%**	**-1.7%**
Thu	**Jan 23**	**8:30**	**Initial Jobless Claims**	**220,000**	**214,000**	**204,000**
		8:30	Continuing Claims	n.a.	n.a.	1,767,000
		10:00	Leading Indicators (Dec)	n.a.	-0.2%	Flat
		11:00	Kansas City Fed Survey (Jan)	n.a.	n.a.	-8

Source: Goldman Sachs Global Investment Research

Disclosure Appendix

Reg AC

We, Jan Hatzius, Alec Phillips, David Mericle, Spencer Hill, CFA, Daan Struyven, David Choi, Blake Taylor and Ronnie Walker, hereby certify that all of the views expressed in this report accurately reflect our personal views, which have not been influenced by considerations of the firm's business or client relationships.

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