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Budget Model

Analysis of Carbon Emission Reductions in Build Back America

Summary: Build Back Better (BBB) Act allocates about $550 billion to climate change policies. Provisions that are funded with user fees can grow the economy while deficit financing can shrink the economy.

Key Points

- Provisions in the Build Back Better Act that reduce carbon emissions through natural resource management are typically the most cost-effective of the plan's approaches to reduce carbon.

- Efficiency improvements, building weatherization, and electric vehicle subsidies are some of the least cost-efficient approaches to carbon abatement today. Improving technology and a greater use of renewables will change the cost of using these approaches to reduce carbon emissions.

- Financing the climate investments in the Build Back Better Act with additional deficits would increase government debt by 1.4 percent and reduce GDP by 0.1 percent in 2040. However, using user fees to finance these investments increases GDP by 0.1 percent in 2040.

Introduction

To address climate change issues, the Build Back Better (BBB) Act allocates about $550 billion to carbon abatement and climate change policies. Table 1 lists the provisions in the BBB Act currently being considered by the Senate. The largest climate investments are $325 billion in clean energy tax credits. In addition to the tax credits, the Act calls for investments of $56 billion in clean electricity generation, $32 billion in transportation investments, about $50 billion for forestry and agriculture, and smaller amounts in a variety of other climate-change and carbon-abatement projects.

Table 1. BBB Provisions for Climate Investment

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BBB Provisions on Climate Investment	Amount (in Billions)
Clean Energy Tax Credits	$325
Greenhouse Gas Reduction Fund	$30
Civilian Climate Corps	$19
Environmental Justice	$16
Clean Buildings	$14
Clean Transportation	$32
Clean Electricity	$56
Industrial Decarbonization	$4
State, Tribal & Local Climate Leadership	$4
Climate-Smart Agriculture	$22
Healthy Forests and Land Conservation	$28

Static Costs of Carbon Abatement

Table 2 shows cost estimates for carbon abatement in the BBB Act per ton based on categories originally outlined by Gillingham and Stock (2018). These costs are *static* estimates, meaning that these estimates do not consider how changing conditions, behavior, or technology may vary over time. (By contrast, *dynamic* effects incorporate how consumers and businesses may change their behaviors and how prices change in response to these policies.) We use two values for each of these categories: a *mid-cost estimate*, which is in the middle of the range of estimates provided by Gillingham and Stock, and a *low-cost estimate*, which is at the bottom of the range. The low-cost estimate implies that more carbon is reduced per dollar spent.

Table 2. Types of Policies and Static Carbon Abatement Cost Estimates

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Policy Category	Amount (in Billions)	Low-Cost Estimate ($2017/ton CO2e)	Mid-Cost Estimate ($2017/ton CO2e)
Weatherization Assistance Program	$87	$350	$350
Energy Efficiency Programs	$68	$250	$275
Solar PV Subsidies	$54	$140	$1,120
Deducated Battery Electric Vehicle Subsidies	$27	$350	$495
Reforestation	$22	$1	$6
Biodiesel	$15	$150	$285
Livestock Management Policies	$13	$71	$71
Renewable Fuel Subsidies	$12	$100	$100
Low Carbon Fuel Standard	$9	$100	$1,500
Agricultural Emissions Policies	$9	$50	$58
Soil Management	$6	$57	$57
Uncategorized	$151	$50	$100

Note: These numbers do not add up to the values in Table 1 because several provisions are either public infrastructure investments or do not directly abate carbon and are not included.
Categorization and abatement cost estimates from Gillingham and Stock (2018).

As shown in Table 2, the Build Back Better plan calls for about $87 billion for weatherization assistance, which is improving buildings and structures to be more energy efficient. At about $350 per ton of carbon abated according to a recent study by Fowlie et al. (2018), weatherization is a comparatively cost-inefficient approach to abating carbon emissions.

Holland et al. (2016) show that in many places such as the U.S. Midwest, which still depend on coal for electricity generation, electric vehicle subsidies may increase total carbon emissions. By contrast, the same vehicles decrease carbon emissions in states such as California and Texas that boast a larger share of renewables. Averaging these values across all states leads to a relatively high cost for abating carbon emissions.

By contrast, some of the most cost-efficient methods to reduce carbon include natural resource management programs such as forestation efforts ($22 billion), agricultural emissions policies ($9 billion), and soil management ($6 billion). A fair number of the provisions, particularly those that emphasize the development of renewable energy, do not fit easily into any category. In this case, we assume a *mid-cost estimate* of $100 per ton of carbon and a *low-cost estimate* of carbon of $50 per ton, broadly in line with estimates of the value of wind power subsidies.

We use these numbers to estimate the total amount of carbon abated each year from the BBB Act. U.S. government estimates, supported by a range of research, that the social cost of carbon is about $51 per ton, with a range from about $14 to $152 per ton. In our main analysis, we assume that the benefits of carbon abatement are about $50 per ton (which accrues at a rate of $1 per year), and we use a value of $150 per ton (which accrues at a rate of $3 per year) for alternate analyses. We assume that the benefits of carbon abatement are reflected through productivity increases, as opposed to alternate assumptions that the benefits are social welfare enhancing. Under this assumption, the reduction in climate change makes workers and capital more productive.

In addition to directly abating carbon, the BBB Act provides about $81 billion for public infrastructure. Although this money does not directly reduce carbon, public infrastructure investment provides productivity benefits using the same approach PWBM used in previous analyses.

Adding Dynamic Climate Effects

In response to BBB Act direct investments, the price of these investments may change and therefore significantly affect consumer and business behavior. In this case, federal aid may change the price of climate investments. For example, some subsidies and programs lower the price of climate investments, causing individuals and businesses to invest more in carbon abatement. In this case, the amount of carbon abated for every dollar of federal climate investment would increase. Some of this might be offset, however, as higher demand may drive up the price of providing these goods, at least in the short run. For example, high demand for electric vehicles may cause supply shortages of critical components and thereby increase the cost of new vehicles.

In many cases, the investments themselves induce a positive feedback loop in which the technology falls in price over time in response to the investment, spurring additional investment. One such feedback loop was observed for solar panels, whose prices have decreased rapidly over the last two decades. One study shows how subsidies can impact solar panel manufacturers' willingness to invest to improve their products. Another study highlights how expanding the market for solar allowed companies to invest in larger and more efficient facilities, allowing them to produce solar panels more cheaply.

In some cases, we expect economic conditions to change, which will change the value of these investments over time. Currently, subsidizing electric vehicles is an inefficient way of reducing carbon emissions, and these subsidies may cost as much as $350 to $640 per ton of carbon. The benefits from electric vehicle subsidies are likely to increase in the future as a greater share of electricity generation comes from renewable sources.

For the same reason, investments in energy efficiency may become less effective over time. As more of the grid transitions to renewable sources, carbon abatement from more efficient appliances and building design becomes more expensive. Each dollar spent on improving energy efficiency becomes less effective at reducing carbon emissions because more of the energy saved comes from renewable sources.

Finally, climate change investments made today may exclude future, more efficient investments in carbon abatement. Gillingham and Huang (2018) evaluate the effects of inexpensive natural gas. Investment in natural gas facilities lowers carbon emissions today, but these investments today may delay future investments in clean technologies.

Macroeconomic Effects of Climate Investment

Table 3a. Economic Effects of Deficit-Financed Climate Investment (Social Cost of Carbon at $50/ton)

Percent Change from Baseline

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Year	GDP	Capital Stock	Hourly Wage	Hours Worked	Government Debt
2031	-0.1	-0.2	-0.1	0.0	1.3
2040	-0.1	-0.3	-0.1	0.0	1.4
2050	-0.1	-0.4	-0.1	0.0	1.2

Table 3a shows the macroeconomic effects of the climate investment package in the BBB Act if it were funded with additional government borrowing, using a $50/ton social cost of carbon and *mid-cost* carbon abatement. In this case, higher output leads to lower government debt. Lower government debt *crowds-in* additional productive capital, which leads to higher GDP.

However, the additional government borrowing leads to higher government debt and greater crowd-out of productive private capital. Less productive private capital makes workers less productive, which leads to lower wages and lower GDP. Combing these two effects leads to an increase in government debt of 1.4 and 1.2 percent in 2040 and 2050, respectively. This higher debt crowds out private capital, which decreases by 0.3 and 0.4 percent in the same years. Lower capital leads to a 0.1 percent decrease in wages and GDP in both years.

Table 3b. Economic Effects of Climate Investment Financed with Lump-Sum Taxes (Social Cost of Carbon at $50/ton)

Percent Change from Baseline

DOWNLOAD DATA

Year	GDP	Capital Stock	Hourly Wage	Hours Worked	Government Debt
2031	0.0	0.0	-0.2	0.2	-0.1
2040	0.0	0.0	0.0	0.0	-0.1
2050	0.0	0.0	0.0	0.0	-0.1

In Table 3b we assume that these investments are funded with lump sum taxes or similar fees. In this case, there is no effect on the government budget before economic feedback. In this case, GDP increases by a small amount, which leads to slightly higher tax revenues. Higher revenues over time lead to a small decline in government debt, which falls by 0.1 percent in 2040 and 2050. The changes in hours worked, wages, and capital are close to unchanged in both 2040 and 2050.

Table 4a. Economic Effects of Deficit-Financed Climate Investment (Social Cost of Carbon at $150/ton)

Percent Change from Baseline

DOWNLOAD DATA

Year	GDP	Capital Stock	Hourly Wage	Hours Worked	Government Debt
2031	-0.1	-0.2	-0.1	0.0	1.3
2040	-0.1	-0.3	-0.1	0.0	1.4
2050	-0.1	-0.4	-0.1	0.0	1.1

Additionally, we consider a scenario with *low-cost* carbon abatement and a $150/ton social value of carbon. In Table 4a we show the results from this scenario in which the climate investments are deficit financed. The results are similar, although government debt increases by only 1.1 percent in 2050, compared with a 1.2 percent increase in government debt in the scenario with *mid-cost* carbon abatement and a social value of carbon of $50/ton.

Table 4b. Economic Effects of Climate Investment Financed with Lump-Sum Taxes (Social Cost of Carbon at $150/ton)

Percent Change from Baseline

DOWNLOAD DATA

Year	GDP	Capital Stock	Hourly Wage	Hours Worked	Government Debt
2031	0.1	0.0	-0.2	0.2	-0.1
2040	0.0	0.0	0.0	0.0	-0.1
2050	0.1	0.1	0.1	0.0	-0.1

Table 4b reports the results from the *low-cost* carbon abatement and social value of carbon of $150/ton when the policy is financed with lump-sum taxes or fees. In this case, GDP and private capital will increase by 0.1 percent in 2050. Higher private capital makes workers more productive and leads to higher wages, which also increases by 0.1 percent in 2050. Government debt decreases by 0.1 percent on account of the higher incomes, which leads to greater revenue.

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