**Macroeconomic and Carbon Simulations**

1. **Model Setting for Proposed Simulations**

* Version/Build - 20C/180
* Specification - Linear
* Fiscal Policy Module - Deficit determined endogenously and spending is exogenous
* Sector Specific Taxes Module - Include sector-specific taxes with exogenous revenue from those taxes (RVGS), which must be set via a shock file.

1. **Running Proposed Simulations**

To run the proposed simulations, complete the following steps.

1. Delete the csv and python files associated with the example simulations from the “simulations” and “python” folders of 20C/180.
2. Upload the csv and python files associated with the proposed simulations in [\\arc\dfs\unix\ofs\research2\FSCC\G-Cubed\_model\Experiments](file:///\\arc\dfs\unix\ofs\research2\FSCC\G-Cubed_model\Experiments) to the “simulations” and “python” folders of 20C/180.
3. Delete model\_constants.py from the “python” folder of 20C/180.
4. Upload model\_constants.py associated with the proposed simulations in [\\arc\dfs\unix\ofs\research2\FSCC\G-Cubed\_model\Experiments](file:///\\arc\dfs\unix\ofs\research2\FSCC\G-Cubed_model\Experiments) to the “python” folder of 20C/180.
5. 20C/180 is set to be linear with “Closure: Deficit determined endogenously while spending is exogenous” and “Include sector-specific taxes with exogenous revenue from those taxes (RVGS)”. To ensure the setting of the model, users could first delete all the files in the “sym” folder except the two files with the sym extension and re-process the main sym file, ggg-20C-180.sym.
6. Run “run\_fast\_baseline.py” in the “python” folder.
7. Run “share\_baseline\_projections\_with\_experiments.py” in the “python” folder.
8. Run the scripts for the proposed simulations.
9. Delete the results files from Codespace.
10. **Macroeconomic Simulations**

* Experiment\_1 (Household Confidence) - RISW, risk premium for human wealth, is 4% in database.csv for all countries. RISH is risk premium shock for human wealth. We shock RISH in the US by +4% (i.e., doubling RISW) starting 2025, which leads to decreases in household wealth and consumption.

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* Experiment\_2 (Country Risk Premium) - 1 percentage point increase in the exchange rate risk premium (EXCR) for the USA.

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* Experiment\_3 (Trade War without Retaliation) – US imposes tariffs on all imports starting from 2025. We shock US TIM (multilateral tariff rates) by +20% for all countries except China. For China, we shock US TIM by +60%.

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* Experiment\_4 (Trade War with Retaliation) – US imposes tariffs on all imports starting from 2025. Trading partners retaliate with same tariffs.

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1. **Climate Simulations**

**3.1. Productivity shocks**

* Experiment\_5 (Transitory TFP Shock) – SHY is shock to total factor productivity by sector and region. Given that acute physical risk could result in temporary disruptions, we shock SHY in all US sectors by -2% in 2025.

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* Experiment\_6 (Permanent TFP Shock) - Given that chronic physical risk (e.g., temperature increases, sea level rises) could result in permanent decreases in productivity, we shock SHY in all US sectors by -1% per year from 2025 to 2150.

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* Experiment\_7 (Renewable Technology) - SHY in the US renewable sectors (including Nuclear generation of electricity, Wind generation of electricity, Solar generation of electricity, and Hydroelectric generation of electricity) is shocked by +10% per year from 2025 to 2150.

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A graph showing the price of the stock market

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**3.2. Carbon tax shocks**

**3.2.1 Carbon revenue going into consolidated government revenue**

***Note that the python scripts for the two simulations in 3.2.1 differ from those for other simulations, as we need to compute carbon tax outside the model.***

* Experiment\_8 (Legislation-based Tax) – [H.R.5744](https://www.congress.gov/bill/118th-congress/house-bill/5744), introduced in September 2023, would impose a rising fee on the carbon content of fossil fuels that emit greenhouse gases into the atmosphere. The fee would start at $15 per metric ton of carbon dioxide equivalent in 2023 and increase by $10 (nominal) each year. To simulate the impact, we shock TCPS (nominal sector tax on CO2). Assuming that legislation use the target inflation rate of 2.5% to calculate the annual increase, the increase then would be $10 × 1.025 = $10.25. As such, under this scenario, TCPS in the US is set to $15 + 10.25 + 10.25 = $35.5 in 2025 and then increases by $10.25 each year until 2050.

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A graph of energy consumption

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* Experiment\_9 (Social Cost of Carbon) - The U.S. Environmental Protection Agency (EPA) issued an [update](https://www.epa.gov/system/files/documents/2023-12/epa_scghg_2023_report_final.pdf) of the social cost of greenhouse gases (SC-GHG) in 2023. The values increase over time and vary by the discount rate used to compute the present value of damages in the future. Taking the mid-value of discount rates, two percent, the SC-GHG grows from $190 (in 2020 dollars per metric ton of CO2) in 2020 to $310 in 2050. EPA reports the values in 10-year time steps. Assuming that EPA use the target inflation rate of 2.5% to inflate SC-GHG, we first inflate and SC-GHG. Then we interpolate SC-GHG to annual carbon prices and shock TCPS accordingly.

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A graph of energy consumption

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**3.2.2 Carbon revenue recycled to households as direct transfers**

***Note that the python scripts for the two simulations in 3.2.2 differ from those for other simulations, as we need to recycle carbon tax revenue into direct transfers.***

* Experiment\_10 (Legislation-based Tax) – Under this scenario, TCPS in the US is set to $15 + 10.25 + 10.25 = $35.5 in 2025 and then increases by $10.25 each year until 2050.

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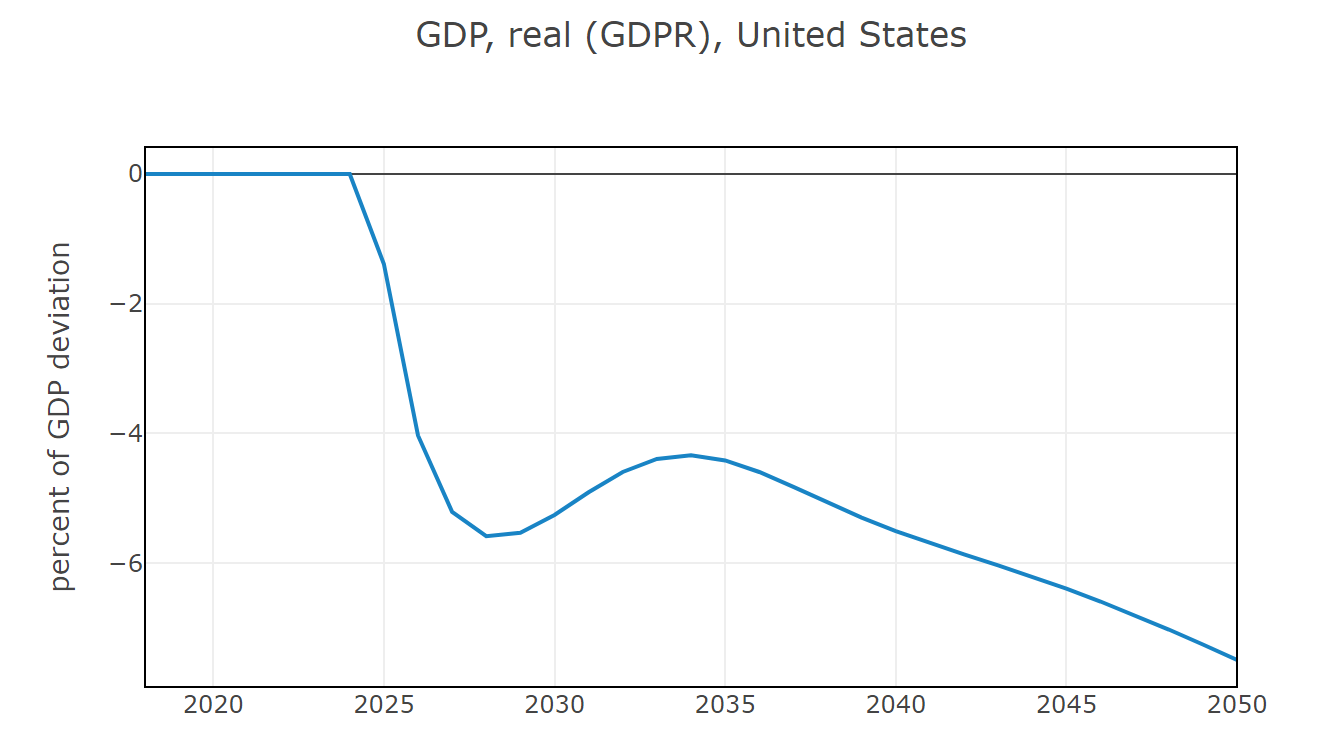
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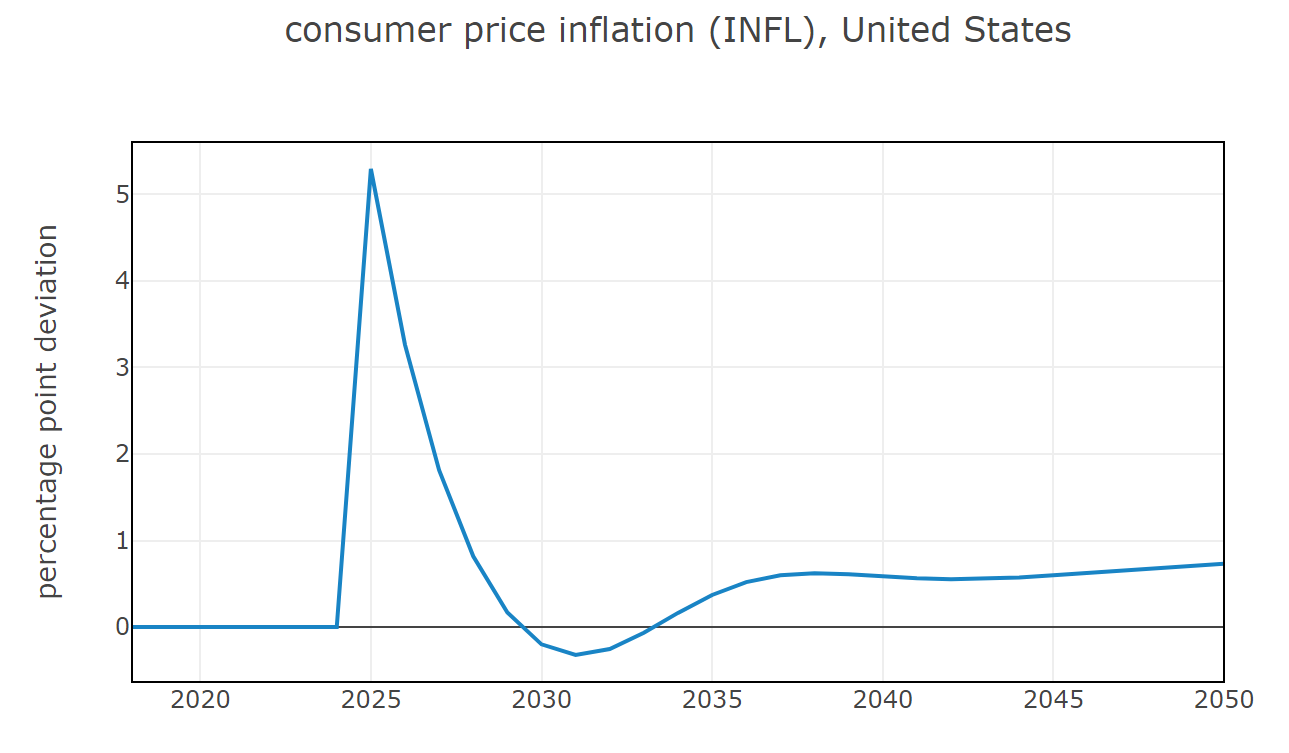
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* Experiment\_11 (Social Cost of Carbon) - We first inflate and SC-GHG. Then we interpolate SC-GHG to annual carbon prices and shock TCPS accordingly.





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