README for The Timing Versus Allocation Trade-off in Politically Constrained Climate Policies

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Data Availability Statement for "The Timing Versus Allocation Trade-off in Politically Constrained Climate Policies"

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This directory contains a set of codes that reproduces all of the figures and analysis carried out in: *The Timing Versus Allocation Trade-off in Politically Constrained Climate Policies* by Bauer, Hallegatte, and McIsaac.

To cite our working paper that uses these codes: Bauer, A. M., S. Hallegatte, F. McIsaac. *The Timing Versus Allocation Trade-off in Politically Constrained Climate Policies*. World Bank Policy Research Working Paper Series, No. 10971, The World Bank, Washington DC, 2024.

All of the data used in our study is taken and/or interpreted from publically available publications and reports. Raw data is used to calibrate the numerical model. Individual numbers used in the simulations can be found in the `codes/data/cal/` files for each simulation. All values are taken from the following papers or reports:

- Data for the remaining carbon budget and its uncertainty is taken from Friedlingstein *et al.*, *Earth System Science Data*, 2023.
- Marginal investment cost data is taken from Bauer *et al.*, World Bank Policy Research Working Paper No. 10473, 2024.
- Capital depreciation rates are taken from Philibert, C., 2007, see Figure 8. The capital depreciation rate is the inverse of the capital lifetime.
- The social discount rate is taken from Drupp *et al.*, 2018, their median estimate.
- The transient climate response to emissions is taken from Dvorak *et al.*, 2022, their median estimate.

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Reproduction code package for "The Timing Versus Allocation Trade-off in Politically Constrained Climate Policies"

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General package overview

This set of codes reproduces all of the figures and analysis carried out in *The Timing Versus Allocation Trade-off in Politically Constrained Climate Policies*.

The codes directory

Each code is assigned a number corresponding to the figure it creates. Here is the full table for the figures:

Figure Desired	Code to Run	Notes
Figure 1: Change in decarbonization date for each sector in each policy suite	`01_decabonization_date.sh`	-
Figure 2: Carbon price indices for politically and non-politically challenged groups in each policy suite	`02_carbon_price_indices.sh`	-
Figure 3: Breakdown of investment paths: value of emissions reductions, forgone opportunity effect, and long-term value of abatement capital	`03_path_breakdown.sh`	-
Figure 4: Optimal path of investment for every sector in each policy suite	`04_optimal_paths.sh`	-
Figure 5: Sectoral cost indices in each political economy policy suite	`05_sectoral_cost_indices.sh`	-
Figure 6: Aggregate cost implications of delay in each policy suite	`06_aggregate_cost.sh`	-
Figure 7: Relative policy cost after delaying each sector by 5 or 10 years, organized by their sectoral characteristics	`07_sectoral_characteristics.sh`	-
Figure 8: Paths of emissions and temperature rise for different policy suites	`08_timing_of_damages.sh`	-

The are also two additional files: - `run_all.sh` will run all the analytic calculations once, create all the figures, and then run the final files to print out all of the quoted calculations

and tables in the paper. - `quoted_numbers.sh` will print all of the quoted figures and tables in the paper.

You should consider using the `.yml` file provided in this directory to establish a virtual python environment that should include all of the necessary dependencies for the code to run smoothly. I recommend using `conda` or its improved version, `mamba` to do this.

How to run the code

To run the codes, simply navigate to the `codes` directory and run the numbered code to recreate the desired figure. If you want to run the program `script_name`, you may need to execute:

```
    chmod +x script_name
```

to grant execution permissions (hence the `+x`) to the script you want to run.

As an example, if you want to recreate Figure 1 which shows our calibration of the marginal abatement cost curves, you would simply run:

```
./04_optimal_paths.sh
```

Notice the first bit of the above program name, `04_optimal_paths.sh`, matches the figure number we wanted to create, Figure 1.

All figures will be deposited into the `codes/figs` folder. To run indiviudal simulations, you can run any of the files in `simulation_mains`, and to make individual figures, you can run any file in the `figure_mains` folder. **Note:** You should run all scripts from the `codes` directory. As an example, let's say you want to run the `analytic_calcs_2base.py` file in the `ar6_17` calibration, but not save the output. Then in your command line, you'd use:

```
python simulation_mains/analytic_calcs_2base.py ar6_17 1
```

Note: You should be operating in the Python environment provided at the head directory. Without it, I make no guarantees any of this will run on your machine (and even then, well, mileage may vary…).

Other notes

The hardware of the original author is a 2023 MacBook Pro with an M2 Pro Chip and 16 GB of RAM.

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